2013 STATE OF THE WATERSHED

Nine Mile Run
Watershed Association

> Perhaps the most striking opportunity for a large park is the valley of Nine Mile Run. Its long meadows of varying width would make ideal play fields; the stream, when it is freed from sewage, will be an attractive and interesting element in the landscape; the wooded slopes on either side give ample opportunity for enjoyment of the forest, for shaded walks, and cool resting places.
>
> - Frederick Law Olmstead, Jr. 1910

In 2006, Olmsted's vision for the Nine Mile Run Valley moved one step closer to becoming a reality with the completion of the Nine Mile Run Aquatic Ecosystem Restoration. Sponsored by the U.S. Army Corps of Engineers, and the City of Pittsburgh, a $7.7 million, 3-year project restored the 2.2 miles of open stream. Designed to ameliorate years of neglect and degradation, this project reconfigured the stream channel, reconstructed the stream bed, created wetlands and floodplains, and enhanced and expanded habitat with an abundance of native trees, shrubs, wildflowers, and grasses.

Since the restoration was completed, the visual changes in the Nine Mile Run valley continue to delight visitors to Frick Park. But the visual changes and progress are only one part of the complete story. Other changes can only be examined through scientific inquiry.

Nine Mile Run Watershed Association (NMRWA) staff and the scientists and researchers on the NMRWA Monitoring Committee have collectively contributed thousands of hours of expertise and work, collecting and analyzing data to look at changes in the stream and riparian areas.

Every two years, NMRWA presents a summary of ongoing scientific research conducted on the Nine Mile Run Aquatic Ecosystem Restoration - the State of the Watershed Report. This 2013 report is the 4th biennial report - three previous reports were published in 2007, 2009, and 2011.

The 2013 report covers data collected during 2011 and 2012, and represents the most recent findings on:

— **Fish**
— **Benthic Macroinvertebrates**
— **Bacteria**
— **Urban Forestry**

Some data that are collected by staff and/or Monitoring Committee members are left out of this report, such as information on pH, metals, and nitrogen deposition.

Please contact our office if you'd like more information on these parameters.

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WHAT IS A WATERSHED AND WHERE IS NINE MILE RUN?

A watershed is an area of land where all precipitation that falls on it drains to the same waterbody. Geographer John Wesley Powell put it best when he said that a watershed is:

"that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community."

Watersheds come in all shapes and sizes. They cross borough, county, state, and national boundaries. Everyone lives in a watershed.

The Nine Mile Run watershed is a 6.5 square mile watershed found in Pittsburgh's East End. It covers portions of the City of Pittsburgh, Wilkinsburg, Swissvale, and Edgewood Boroughs.

Nine Mile Run flows into the Monongahela River, which flows into the Ohio River, and eventually the Mississippi River. This means the Nine Mile Run watershed is a small part of the Mississippi River watershed - the largest watershed in North America!

Figure 1. Location of the Nine Mile Run watershed relative to the region's three rivers, the City of Pittsburgh, & Allegheny County.

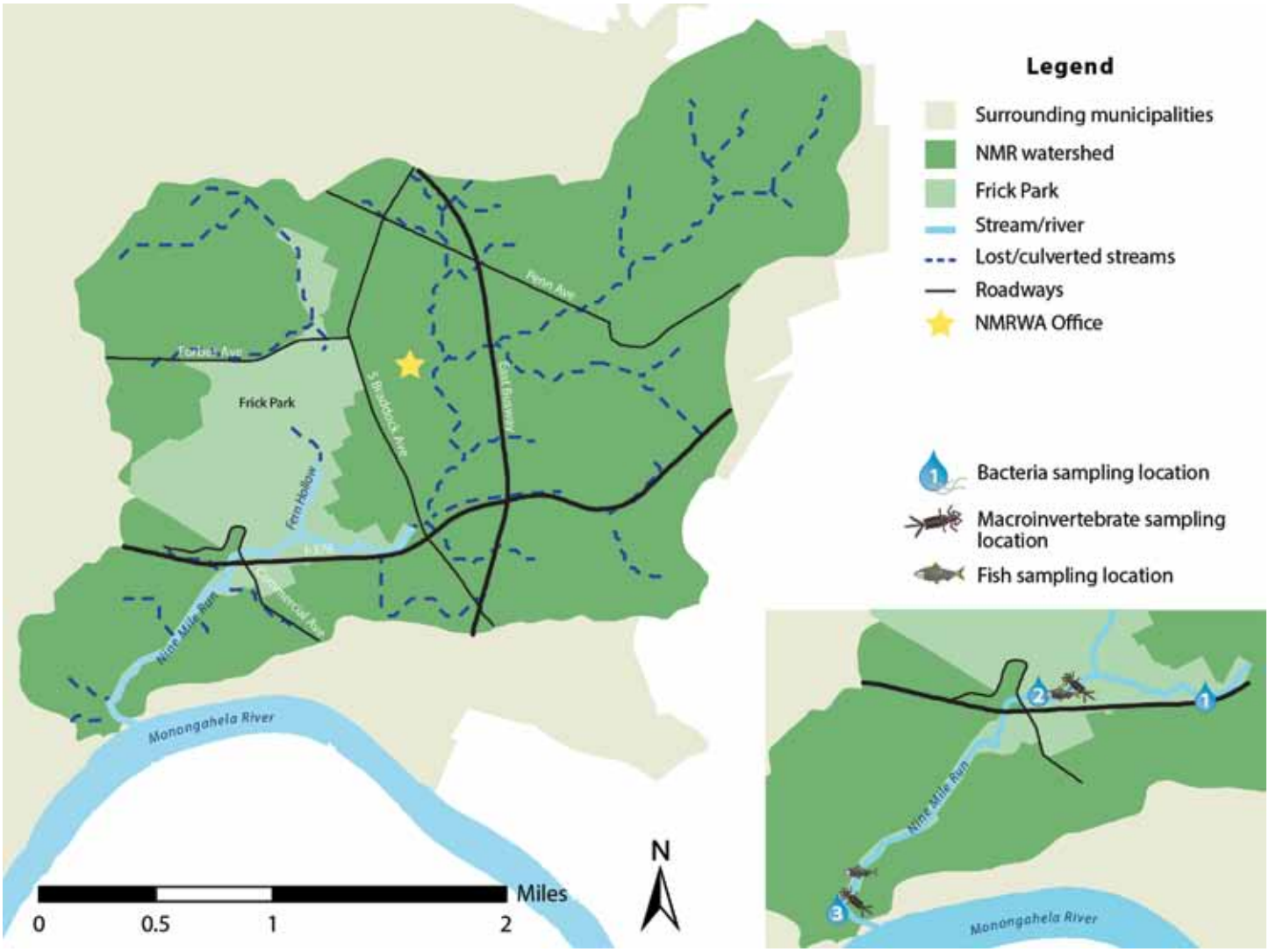

Figure 2. View of the Nine Mile Run watershed & some identifying features, including Frick Park & major roadways. The inset graphic shows the sampling locations discussed in later sections of this report.

FISH

The purpose NMRWA's monitoring program is to assess the impacts of the restoration as well as various ongoing efforts (e.g., installation of rain barrels and rain gardens to reduce wet weather sewage pollution) on the aquatic ecosystem of Nine Mile Run.

Fish are key indicators of stream health for a variety of reasons, including the fact that their entire lifecycle (typically 2-10 years) occurs in the water. This makes them valuable for assessing both short and long-term water quality conditions.

However, simply knowing whether or not fish live in the stream is not enough; we also need information about the presence, condition, numbers, and species of fish, since different species vary in their tolerance to pollution.

Sampling Method

Fish are collected with a battery powered, direct current backpack electrofishing unit (Smith-Root LR-24) using 300 volts with variable amperage. The backpack unit is used to stun fish that are then collected using nets. The netted fish are kept alive in five gallon buckets until they can be measured and weighed.

Species of abundant smaller fish are length ranged, separated into size groups, and weighed. Lengths to the nearest millimeter (mm) and weights to the nearest tenth of a gram (g) are recorded.

Except for specimens that are collected by the University of Pittsburgh for laboratory tissue analysis for metals, all fish are released back into the stream after processing.

Results

Prior to the restoration, an extremely stressed and limited fishery existed in Nine Mile Run. Compared with previous surveys, zero fish were found by the Pennsylvania Fish and Boat Commission in 1990 and only 19 fish were collected from the entire stream by the U.S. Army Corps of Engineers in 1999.

Post-restoration, in 2006, the entire stream was electro-fished. The numbers showed some improvement – a total of 116 fish comprising seven different species were collected – but still, only 0.04 fish/meter were found in the entire stream!

Luckily, in the coming years, improvements in number of fish were marked – to the point that it was no longer possible to sample the entire stream in one day! During 2011 and 2012, sampling occurred at two different sections of the stream. Please see Figure 2 for the sampling locations, and Figure 3 to see the change in fish population at the upper Nine Mile Run sampling station between 2006 and 2012.

Overall, the resident fish population in Nine Mile Run has improved dramatically over the past seven years. Some less pollution tolerant species such as black and golden redhorse, channel and common shiner, rock and spotted bass, brook silverside, and banded killifish were found in the stream for the first time in 2011.

However, it is important to note that many of the new species found at the lower sampling location near the mouth of Nine Mile Run are likely transient from the Monongahela River and are not full time residents. In contrast, the fish community of the upper reaches of Nine Mile Run remains overwhelmingly dominated by a now very abundant but still limited assemblage of resident pollution tolerant headwater species (e.g., blacknose dace, creek chub, white sucker, and green sunfish).

This could be due to continued poor water quality conditions in the upper portion of Nine Mile Run, and/or because of physical barriers in the stream to fish movement around Commercial Street.

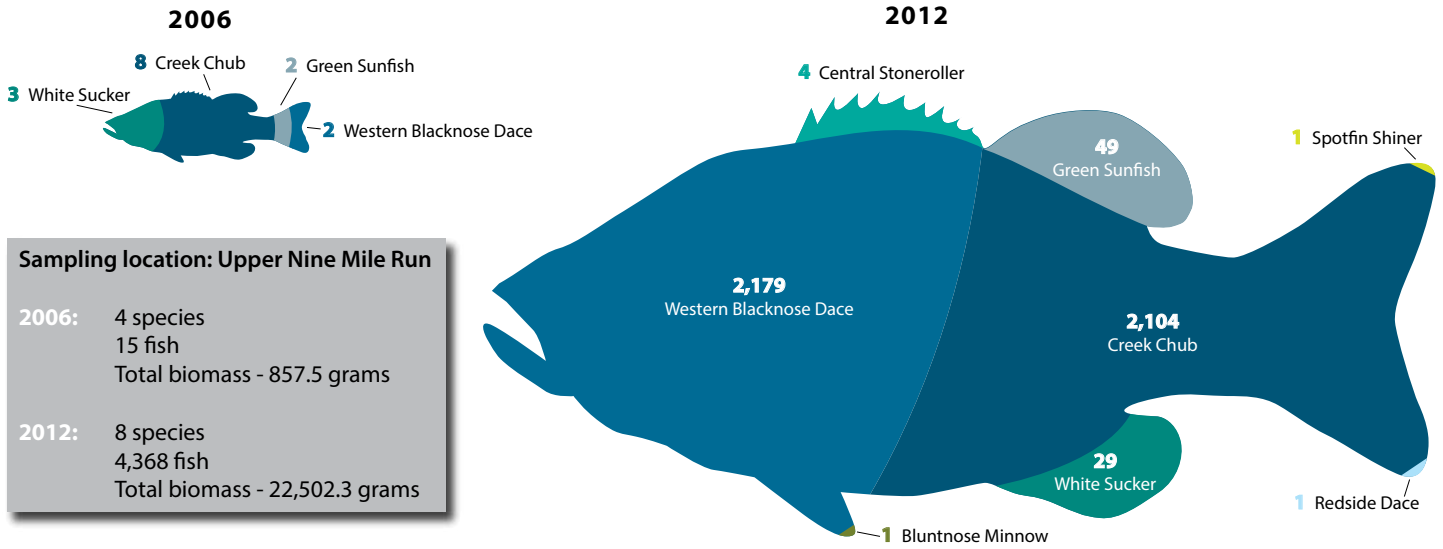

Figure 3. Since completion of the restoration, drastic improvements have been seen in the fish population in upper Nine Mile Run - including an increase from 15 fish in 2006 to more than 4,000 in 2012! However, the majority of these fish are pollution tolerant, so there are still water quality improvements to be made in the stream.

BENTHIC MACROINVERTEBRATES

Clean and healthy streams are full of aquatic life. If you turn over a rock and stir up the sediment in a stream, you will often find tiny creatures called benthic macroinvertebrates. These are freshwater organisms that live in and on the stream bottom. The abundance and diversity of these organisms are good indicators of local stream health because they have limited mobility (compared to fish) and they respond quickly to pollutants and other environmental stressors.

Typically, macroinvertebrates will settle in areas most suitable for their survival – therefore providing a simple method to assess water quality in a stream. Since macroinvertebrates differ in their ability to tolerate pollution, if the macroinvertebrate population in a stream consists exclusively of pollution tolerant species, you can assume poor water quality conditions.

Sampling method

Invertebrate samples have been collected each summer since 2000. Three samples are collected each year (typically during June, July, and August) at two different locations in the stream (see Figure 2).

Samples are collected using a Surber Sampler, which is a one foot square metal frame with a net attached to one side. The sampler is set on the bottom of the stream with the net pointing downstream and stream sediment is kicked into the screen. The net is then checked for invertebrates that have been washed into it.

Because the stream is variable in width, a transect line perpendicular to the banks is established at each sampling location, and two or three samples are collected along it (depending on the width of the stream).

The collected invertebrates are taken back to a lab at Chatham University and are live-sorted.

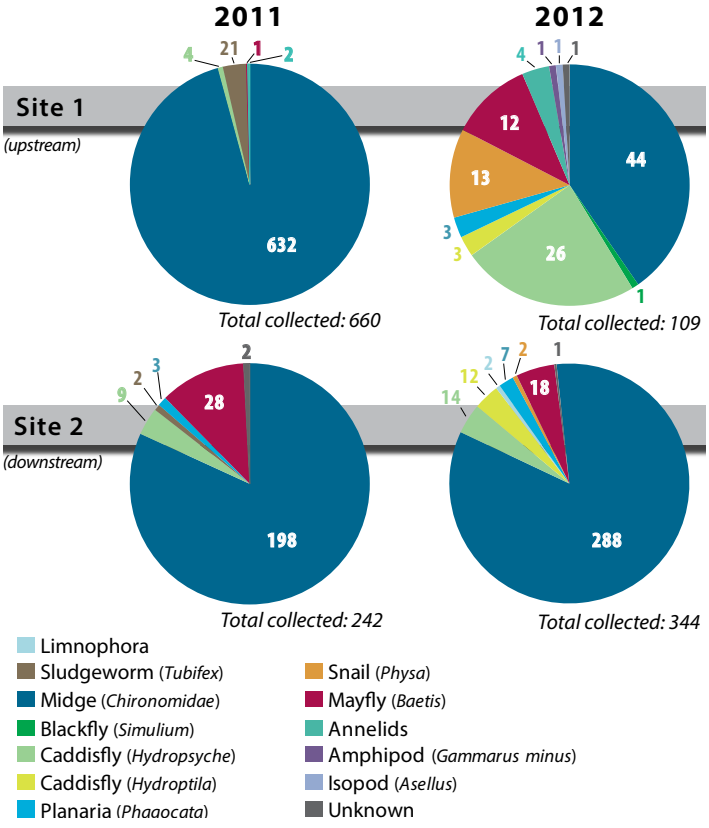

Figure 4. These piecharts show the number & types of macroinvertebrates found at each sampling location in 2011 & 2012. Midges are the dominant species found at both locations during both years.

Results

Macro invertebrate sampling done before the Nine Mile Run Aquatic Ecosystem Restoration revealed limited populations that were dominated by pollution tolerant midges. Other species were rare, comprising less than 5% of the total number of organisms collected. However, with the completion of the restoration in 2006, a more stable and diverse environment for aquatic organisms has been created.

Over a dozen different species have been collected throughout the sampling period 2000-2012. During 2011 and 2012, the number of organisms collected from each site was highly variable - with the highest number of macroinvertebrates collected during 2011 from Site 1 (660) and the lowest number from that same site in 2012 (109). See Figure 4 for a breakdown of the number and types of macrovertebrates found at each site during 2011 and 2012.

There are any number of reasons for variability in the number of macroinvertebrates collected on any given day (e.g., recent rainfall that has swept the organisms downstream), but overall, there is evidence of increased diversity and balance in the invertebrate population in Nine Mile Run since the restoration. In addition, the data indicate a modest increase in organisms that have colonized and are completing their life cycle in the stream.

It is encouraging that another species of caddisfly seems to have become established at both sampling sites. Midges, *Hydropsyche* caddisflies, mayflies, and planaria have been present fairly consistently since the restoration and the addition of two new species, *Hydroptila* caddisflies and snails, would seem to indicate a slow but steady increase in diversity.

However, macroinvertebrates have not increased in number as dramatically as fish. One plausible explanation for this is that as the number of fish in the stream has increased, the fish have begun to consume increasing numbers of invertebrates. Many species of fish feed partially or largely on invertebrates. More research needs to be done to test this hypothesis .

It should be noted that, because a relatively small area of the stream is sampled, rare or extremely mobile organisms may be missed. In addition, since sampling is limited to riffles (rocky areas in the stream), benthic macro-invertebrates that normally inhabit pools may not be represented.

BACTERIA

Bacteria and viruses occur naturally in fresh water systems and are also commonly found in the intestines of humans and animals. Most are harmless to humans and animals, but some are pathogenic and can cause illness. Pathogens can come from the feces of humans, pets, and wildlife. In addition to the possible health risk associated with the presence of elevated levels of pathogens, they can also cause cloudy water and unpleasant odors.

Since it is difficult, time-consuming, and expensive to test directly for the presence of a large variety of pathogens, water is usually tested for the presence of indicator bacteria instead. Indicator bacteria, such as the two types that NMRWA measures, *E. coli* and fecal coliforms, can come from similar sources as pathogens, so the presence of these bacteria indicate that harmful pathogens may also be present.

Escherichia coli (*E. coli*) is a species of fecal coliform bacteria that is specific to fecal material from humans and other warm-blooded animals. EPA recommends E. coli as the best indicator of health risk from water contact in recreational waters.

Fecal coliforms are a subset of total coliforms, which are a group of bacteria that are widespread in nature. Fecal coliforms are more fecal-specific in origin, and were the recommended primary bacteria indicator for recreational waters until relatively recently, when the EPA began recommending *E. coli* as a better indicator of health risk from recreational contact. However, fecal coliforms are still being used in many states as their primary health risk indicator bacteria.

Sampling Method

Bacterial sampling in Nine Mile Run was conducted on a quarterly basis during 2011 and 2012. Grab samples were taken from the edge of the stream at three locations (NM-1, NM-2, and NM-3, see Figure 2), stored on ice, and immediately taken to the Allegheny County Sanitary Authority (ALCOSAN) laboratory for processing and analysis.

Results

As has been the case since NMRWA began monitoring bacteria levels in 2007, both *E. coli* and fecal coliform counts exceeded the EPA standards on nearly every sampling date.

(Due to space constraints, only *E. coli* sampling results are presented in this report, but fecal coliform data are consistent with *E. coli* results.)

High *E. coli* counts are always detected at Site 1, the sampling location closest to the main outfall culvert off of Braddock Avenue, but, for the first time, as seen in Figure 6 below, some of the *E. coli* samples collected at Sites 2 and 3 during 2012 did not exceed the EPA limit of 235 cfu/100 mL.

This is encouraging, but a couple of samples does not equal a trend. Urban streams often have pollution problems due to excess stormwater flows, but the ongoing extremely high bacteria levels seen in Nine Mile Run, especially during wet weather events, are likely a result of direct sewage discharge from combined sewer overflows (CSOs) and residential downspouts illegally connected to sanitary sewers.

There is still a lot of progress to be made in terms of reducing bacteria inputs to Nine Mile Run, particularly with respect to direct sewage discharges.

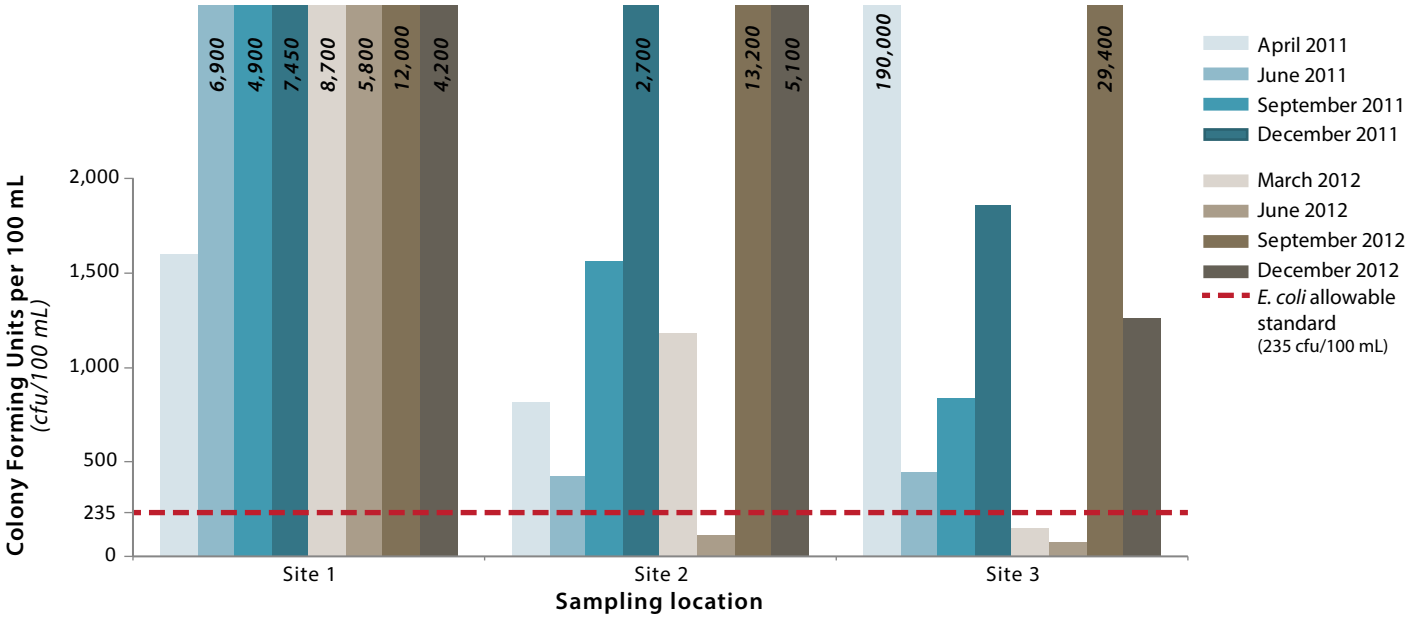

Figure 5. Nearly 90% of *E. coli* samples collected during 2011 & 2012 exceeded the EPA limit of 235 cfu/100 mL. This is not surprising, as Nine Mile Run is an urban stream, but the extremely high counts are likely indicative of continued direct discharges of sewage into the stream from aging or improperly connected sewer infrastructure.

URBAN FORESTRY

Trees are a fundamental part of a healthy community. They clean the air, reduce utility costs, raise property values, and provide valuable habitat for birds, insects, and other small animals, but that's not all...

Mature trees also intercept and absorb thousands of gallons of rain and stormwater runoff each year, helping to prevent erosion, flooding, and sewage overflows. This makes them a key part of a resilient Nine Mile Run watershed.

Since its inception, the NMRWA GreenLinks program has planted more than 800 trees in the Boroughs of Wilkinsburg, Swissvale, Edgewood, and in the City of Pittsburgh. Once mature, these trees will not only help to protect the health of Nine Mile Run by absorbing tens of thousands of gallons of stormwater runoff annually, but will also enhance the quality of life for residents throughout the watershed for all the reasons listed above!

The majority of trees planted in 2011 and 2012 were a part of NMRWA's Wilkinsburg TreeVitalize Project: Rooted in Wilkinsburg – 500 Tree Initiative. Beginning in Fall 2011, the goal of the project was to plant 500 street trees in Wilkinsburg over a two year period. Funding for this project was received through the Pennsylvania Infrastructure Investment Authority, and NMRWA's project partners were TreeVitalize, the Borough of Wilkinsburg, and the Wilkinsburg Community Development Corporation.

Before beginning a large project like the Wilkinsburg TreeVitalize Project, it is important to have a clear picture of the trees that already exist in our watershed. One way to get an idea of the existing tree canopy in an area is to conduct an urban tree canopy (UTC) assessment.

The UTC assessment protocols use Geographic Information Systems to analyze high resolution land cover imagery and classify it into different surface features, such as tree canopy (defined as the layer of tree leaves and branches that cover the ground when viewed from above), water, buildings, roads, etc.

With these surface features identified, it is possible to extrapolate the existing percentage of tree canopy coverage per parcel. This allows us to identify areas where trees are sparse so that we can focus tree planting efforts in those locations.

In 2006, NMRWA partnered with the University of Vermont's (UVM) Spatial Analysis Lab and the USDA Forest Service's Northern Research station to conduct a UTC assessment of the Nine Mile Run watershed based on 2005 imagery. The Northeastern Area State and Private Forestry funded this project.

In 2011, an assessment was conducted on imagery collected in 2010 throughout all of Allegheny County by UVM and the USDA Forest Service, funded by a partnership of the County, Tree Pittsburgh, and the PA Department of Conservation and Natural Resources. This data, shared with us by Tree Pittsburgh, shows an overall increase of approximately 4% in tree canopy cover across the watershed between 2005 and 2010.

Moving foward, we are interested in finding a funding partner that will enable us to conduct another UTC analysis in 2015 to see the changes brought about by the Wilkinsburg TreeVitalize Project and our other tree planting and tree care efforts!

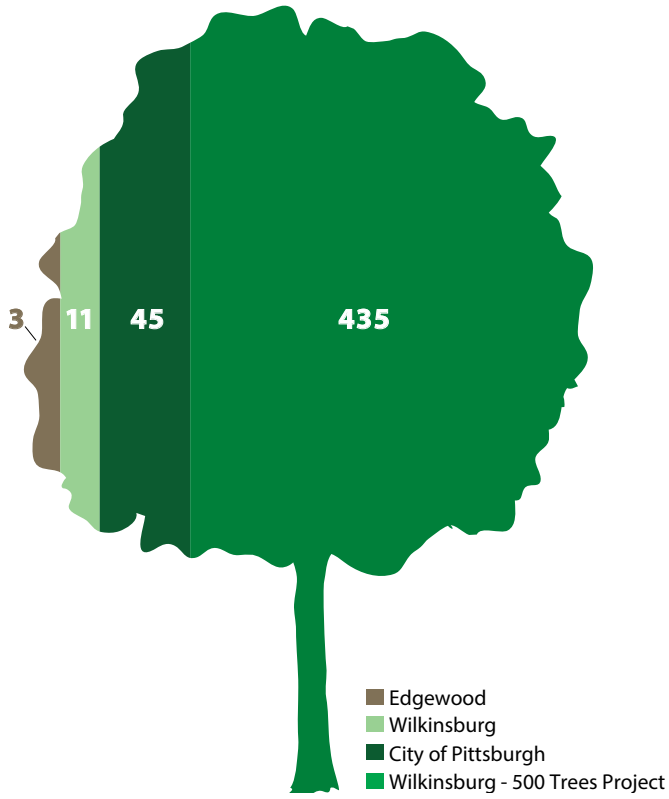

Figure 6. NMRWA planted 494 trees in the watershed during 2011 & 2012, the majority of which were planted in Wilkinsburg as a part of the Wilkinsburg TreeVitalize Project.

Figure 7. NMRWA staff members Maeve Rafferty & Alicia Donner demonstrate proper planting techniques during a Wilkinsburg TreeVitalize Project tree planting event in the Wilkinsburg Borough parking lot during May 2012. (Photo: NMRWA)

THANK YOU

We would like to thank the Nine Mile Run Watershed Association Monitoring Committee for guidance in developing our monitoring program and for their collection and analysis of data:

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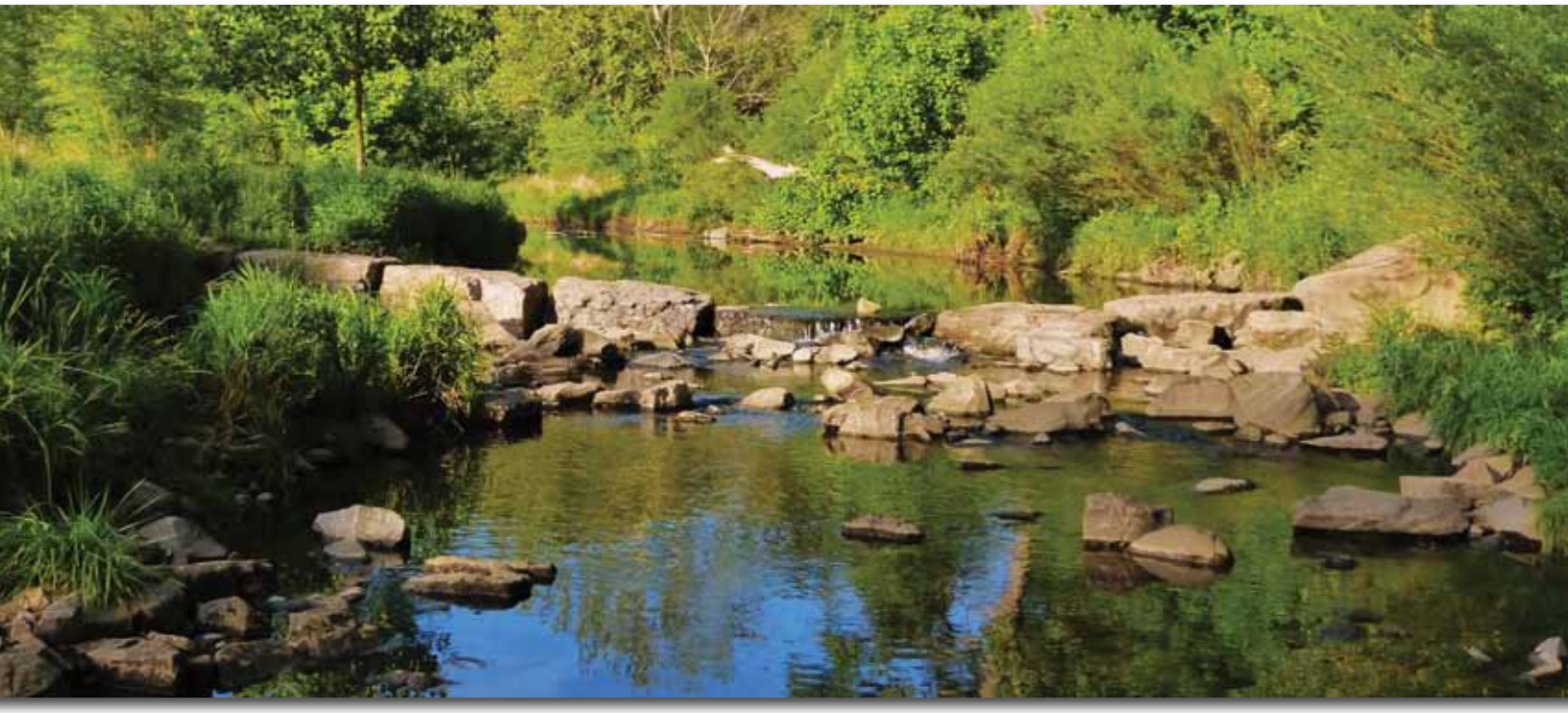

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