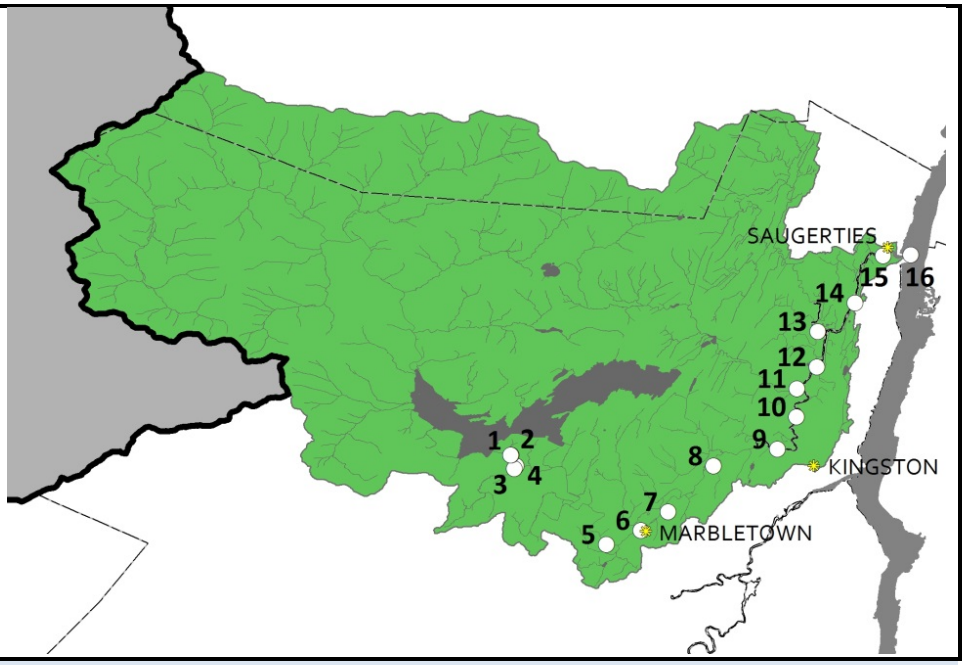
RIVERKEEPER
NY's clean water advocate

COMMUNITY WATER QUALITY MONITORING RESULTS

ESOPUS CREEK
2010-2016



OVERVIEW

Riverkeeper and our Esopus Creek watershed partners have been testing the water for the fecal-indicator bacteria *Enterococcus* ("Entero") since 2010. Sources of fecal contamination may include sewage infrastructure failures, sewer overflows, inadequate sewage treatment, septic system failures, agricultural runoff, urban runoff, and wildlife.

Samples were collected monthly (approx. May to October) at 16 watershed locations by local residents and processed by Riverkeeper. A total of 402 samples have been analyzed since 2010. This water quality monitoring study is designed to learn about broad trends. The data can help inform choices about recreation in the creek, but cannot predict future water quality at any particular time and place. To see all the results visit www.riverkeeper.org/water-quality/citizen-data/esopus-creek.

WATERSHED SNAPSHOT

These results are for non-tidal sites only.

As measured against the Environmental Protection Agency's recommended Beach Action Value for safe swimming:

33%
of Esopus Creek samples failed.

After rainy weather:

43%
of Esopus Creek samples failed.

As measured against the EPA's recommended geometric mean (a weighted average) criterion for safe swimming:

EPA GM threshold	Esopus Creek GM
30	36
cells/100 mL	cells/100 mL

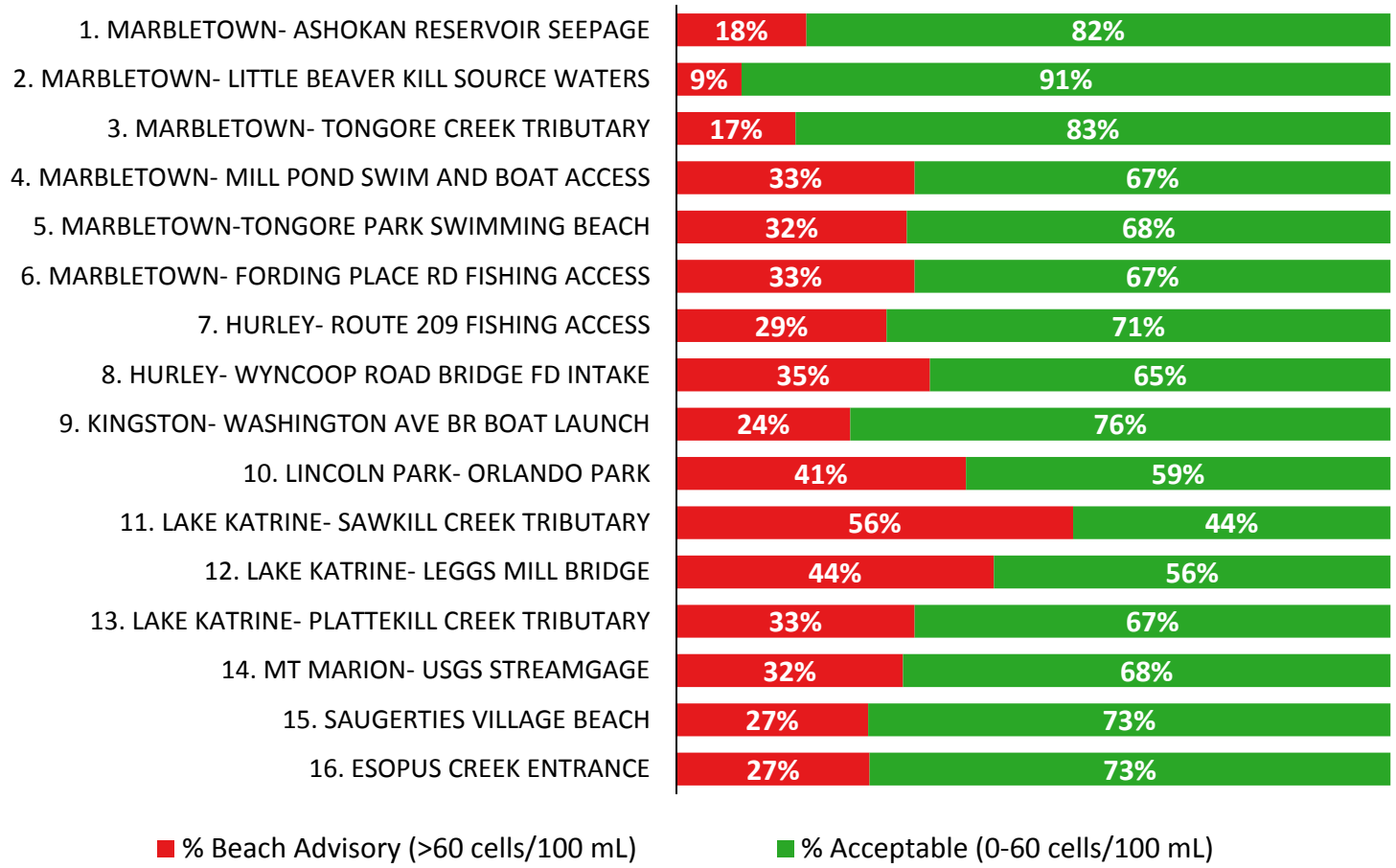
3 Best Sites	3 Worst Sites
• Marbletown- Little Beaver Kill (#2) • Marbletown- Tongore Creek (#3) • Marbletown- Mill Pond swim & boat access (#4)	• Lake Katrine- Sawkill Creek tributary (#11) • Hurley- Route 209 fishing access (#7) • Lincoln Park- Orlando Park (#10)

DAY-TO-DAY WATER QUALITY

Riverkeeper assesses water quality using the EPA's science-based 2012 Recreational Water Quality Criteria, which define recommended concentrations of Entero per 100 ml of water ("Entero count") consistent with "primary contact recreation." This includes swimming, bathing, water play by children and other activities where ingestion of water or full immersion of the body is likely.

In this figure, the red bar shows the percentage of samples at each sampling site that have exceeded an Entero count of 60, the EPA-recommended Beach Action Value. Above this level, the EPA recommends public notification, and possible temporary beach closure.

PERCENTAGE OF ESOPUS CREEK SAMPLES EXCEEDING EPA'S BEACH ACTION VALUE, 2010-2016



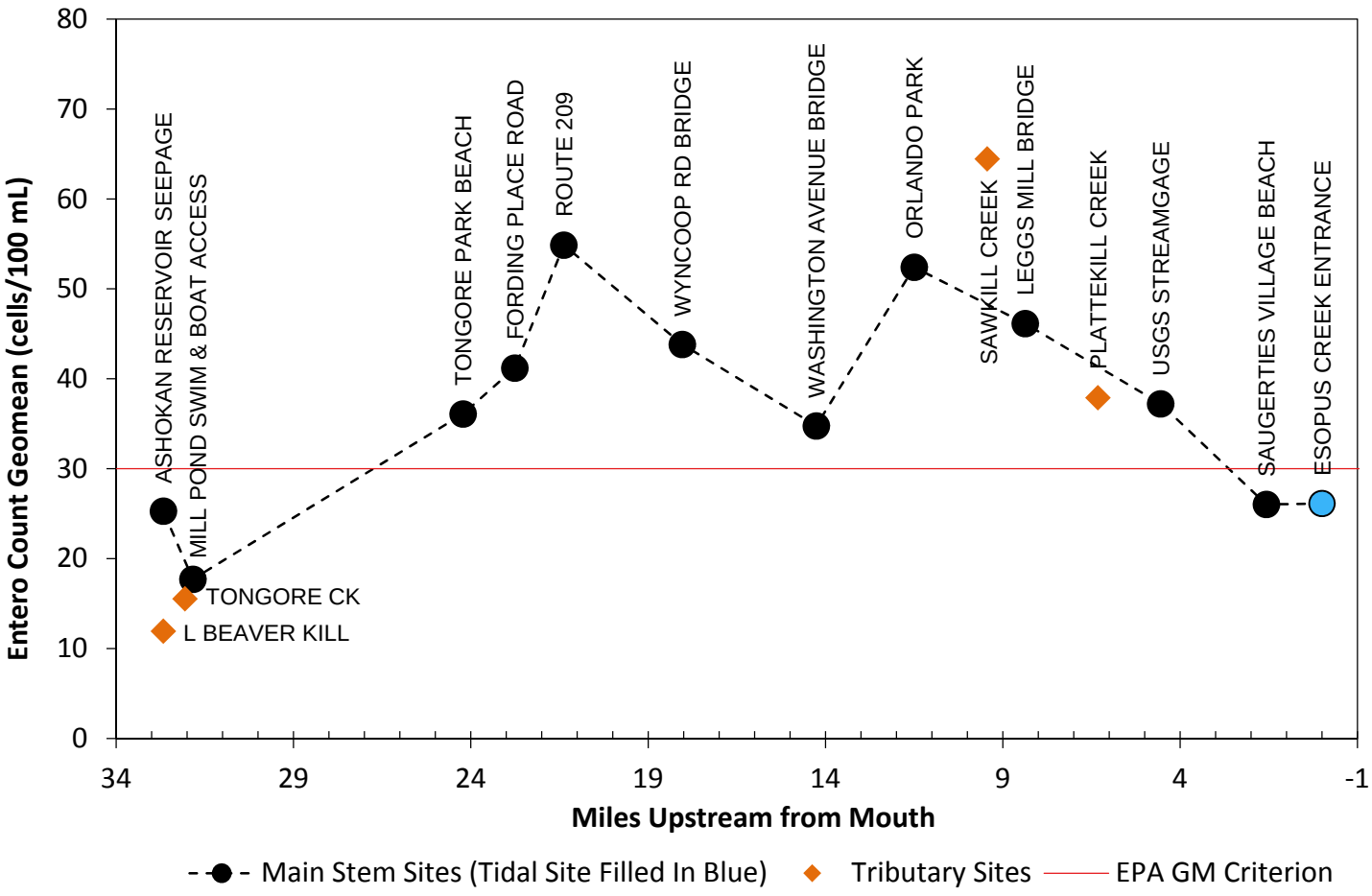
WHAT DO THESE RESULTS MEAN?

Comparing sample results to the BAV gives information about day-to-day water quality. Water quality was suitable for swimming and other primary contact in many of the Esopus samples we tested. Water quality was best just below the Ashokan Reservoir, and was worst in the area just downstream of Kingston.

WATER QUALITY OVER TIME

The Geometric Mean (GM) describes the maximum allowable average Entero count to protect swimmers' health, as measured over time at any given location. Water at a site with a high GM has a high average level of contamination. To avoid exposure to chronic contamination, the GM, a weighted average, should not exceed 30. EPA recommends weekly sampling. Over time, monthly sampling should reveal similar information. If a site's GM exceeds 30, steps should be taken to reduce contamination.

GEOMETRIC MEANS AT ESOPUS CREEK SAMPLING LOCATIONS, 2010-2016



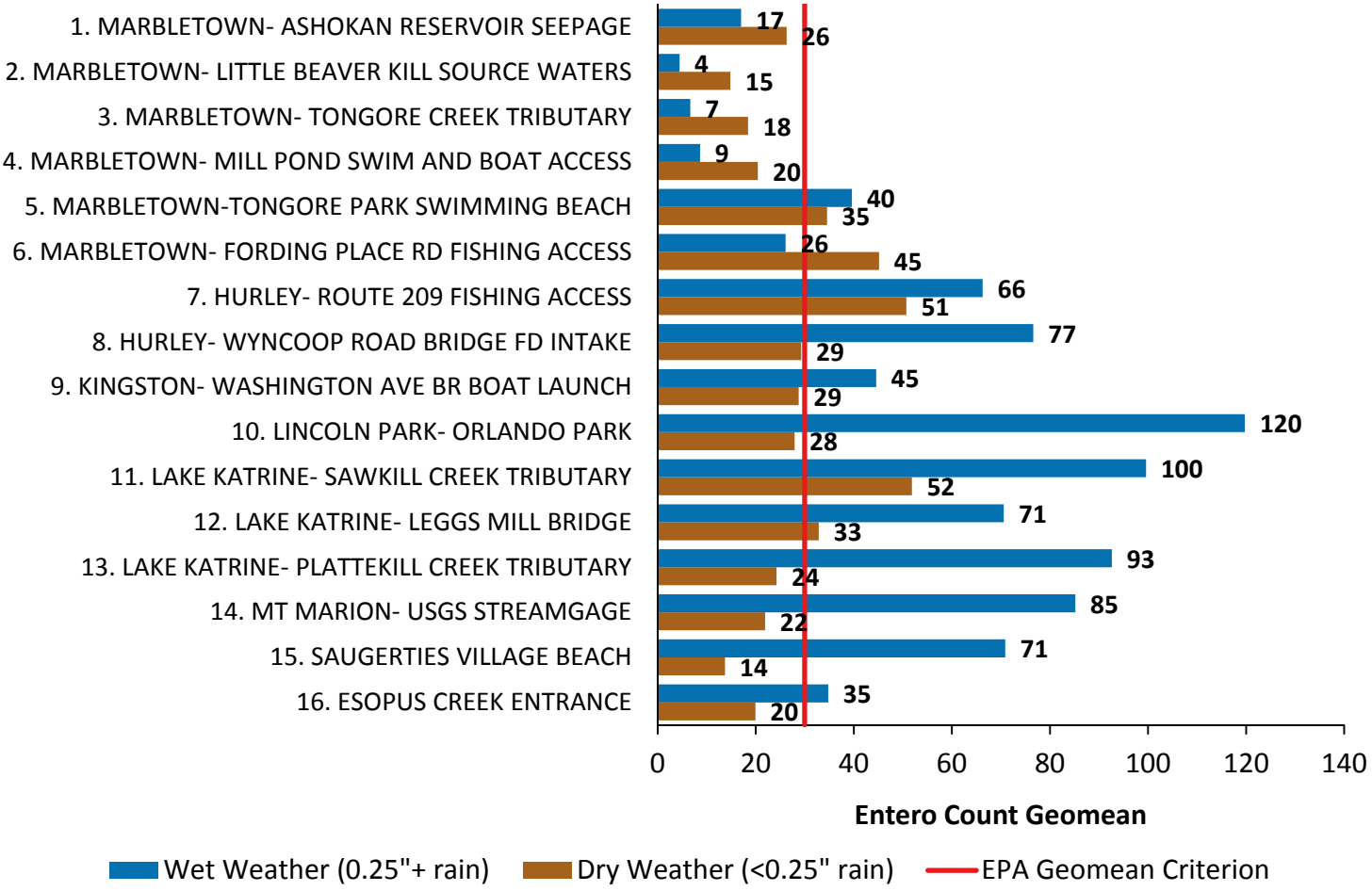
WHAT DO THESE RESULTS MEAN?

The average water quality at Esopus Creek sampling sites varied from source to mouth. At two recreation areas—Mill Pond in Marbletown and the Village Beach in Saugerties—approximately one-third of samples were unsafe for swimming at the time we sampled (BAV results, page 2), but long-term average water quality was below EPA's GM threshold (this page). This means that contamination problems are sporadic, not chronic. The worst contamination occurred at Route 209 fishing access in Hurley, and Orlando Park in Lincoln Park, and long-term problems are also evident elsewhere.

HOW DOES STORMWATER AFFECT WATER QUALITY?

In combined sewer systems, heavy rains trigger releases of untreated sewage directly into waterways. Even in systems where stormwater and wastewater are separated by design, leaks and cross-connections lead to stormwater infiltration into the wastewater system. The increased flows lead to infrastructure failures during storms. Stormwater runoff from streets, feedlots and farms, and areas with failed septic systems can also deliver fecal contamination to streams. This figure shows Entero GMs after dry (less than 0.25 inches of rain in the 4 days leading up to sampling) and rainy weather (0.25 inches or more).

GEOMETRIC MEANS IN ESOPUS CREEK DURING WET AND DRY WEATHER, 2010-2016



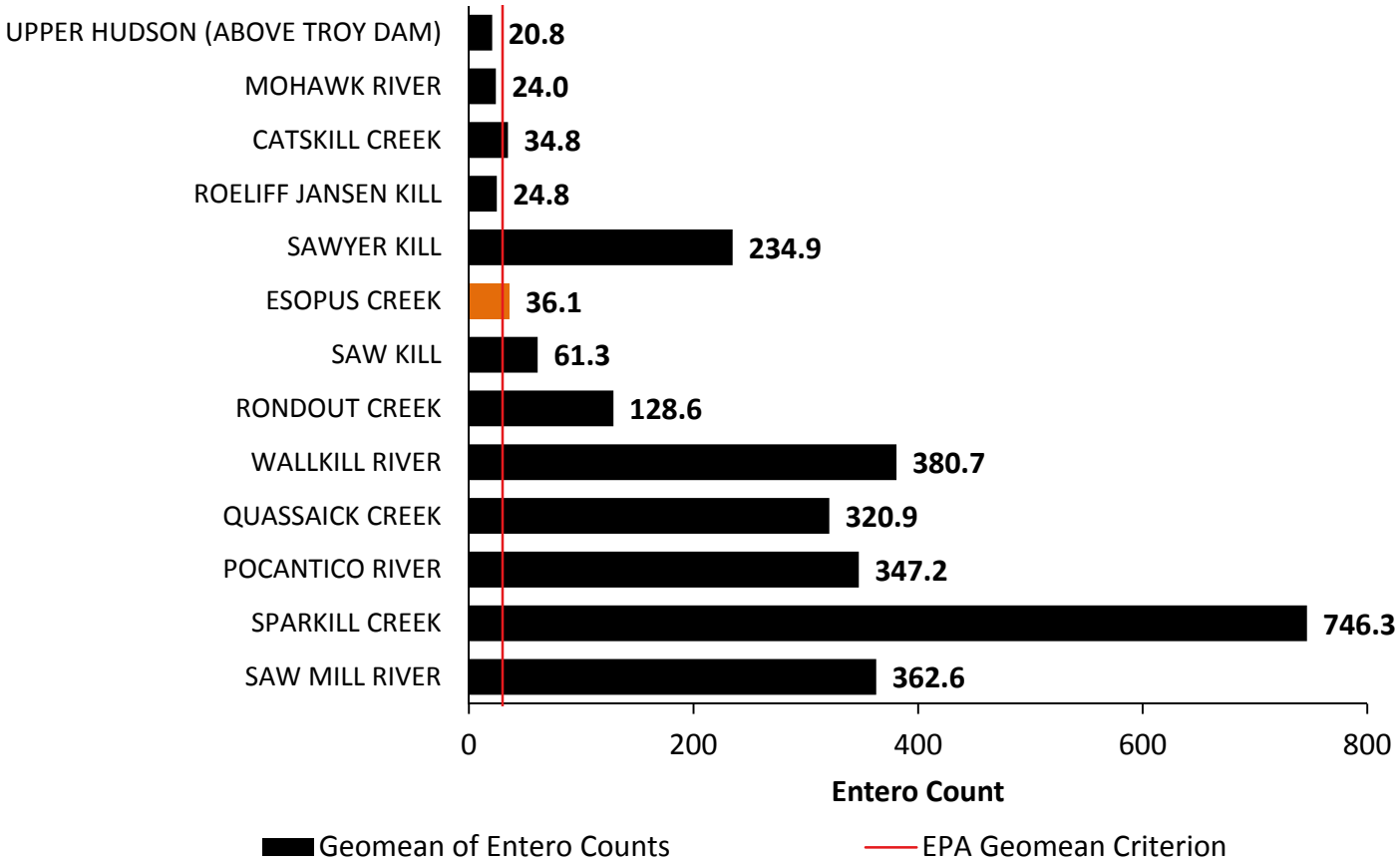
WHAT DO THESE RESULTS MEAN?

If there were no rain, many more sites in the Esopus Creek watershed would meet EPA safe-swimming criteria. However, rainfall greatly increases Entero counts at sites through Hurley, Kingston and Saugerties. Reducing stormwater-related contamination would improve overall water quality. Sites with the largest difference between dry and wet weather water quality are places where stormwater controls would have the biggest impact on fecal contamination.

HOW DOES THE ESOPUS COMPARE WITH OTHER HUDSON TRIBUTARIES?

Overall, our sampling data shows that water quality in tributaries is worse than in the Hudson River Estuary, and that tributaries are contamination sources to the Hudson. Average water quality varies among tributary watersheds. The figure below shows the Geometric Mean (weighted long-term average) of all sample results for all non-tidal sites within each watershed studied to date. Date ranges vary.

GEOMETRIC MEANS OF ALL NON-TIDAL SITES IN ALL TRIBUTARIES SAMPLED, 2010-2016



All samples were processed by Riverkeeper except as follows. Mohawk River and Upper Hudson samples processed by SUNY Cobleskill and Riverkeeper. Roeliff Jansen Kill and Saw Kill samples processed by Bard Water Lab. Quassaick Creek samples processed by EnviroTest. Pocantico River (2016), Sparkill Creek (2016), and Saw Mill River samples processed by The Sarah Lawrence College Center for the Urban River at Beczak.

When comparing among all watersheds sampled, Esopus Creek ranks:

5th	5th	2nd
best in terms of **Overall GM**	best in terms of **Dry Weather GM**	best in terms of **Rain Response**

WHAT DO THESE RESULTS MEAN?

The Esopus Creek has one of the lowest levels of contamination (as measured by the weighted average of samples, the GM) that Riverkeeper and partners have measured. Several sites meet EPA's GM criterion for long-term water quality (see figure on page 3), although fairly frequent day-to-day problems need to be remediated. Since swimmers experience current conditions, not average ones, recreation areas should be priorities for improvement. Where contamination is present in dry weather, sources should be identified. Actions to reduce stormwater runoff could lead to substantial improvement, and should be a long-term priority.

COMMUNITY SCIENCE HAS IMPACT

In 2015, Riverkeeper submitted community monitoring data to the NYS DEC, to ensure that it factored into the state's water quality assessment and regulation. These data will help DEC determine where to target its routine monitoring of diverse water quality parameters, set to take place in the Hudson Valley in 2017-2018. The community science data also resulted in new listings of fecal contamination in the statewide water quality inventory, with more listings yet to be released. These updates will give affected municipalities more competitive standing for when applying for federal and state water quality improvement grants. Riverkeeper's data and advocacy contributed to the establishment of the NY Water Grants program, which has allocated $400 million for community infrastructure grants available since 2015.

WHAT YOU CAN DO

Riverkeeper's water quality sampling program relies on scores of samplers to collect water samples. But the data is only a starting point. Documenting problems is the first step, but solutions require many people working locally. You can organize stream walks, test water flowing from outfalls, contact those responsible for our infrastructure, and spread the word. Reach out to your local municipality, or work with your CAC/ECC or watershed group. Riverkeeper has resources for support, but we need your help!

NEXT STEPS FOR RIVERKEEPER

In 2016, Riverkeeper sampled or supported 16 tributary and shoreline sampling projects, in addition to our longstanding Hudson River Estuary monitoring project. With our organizational partners, we sampled 411 locations over 795 river miles, from Lake Tear of the Clouds to NY Harbor. In addition to Entero, we and our partners measured experimental wastewater tracers (sucralose and caffeine); pharmaceuticals, pesticides and industrial compounds; and parameters related to wastewater pollution, like nutrients and dissolved oxygen. In 2017, Riverkeeper will continue working with our network to monitor water quality in even more streams, and will collaborate with researchers and regulators on several Entero source tracking projects. This work is made possible by many funders, including the New York State Environmental Protection Fund through the Hudson River Estuary Program of NYSDEC.

For more information visit www.riverkeeper.org/water-quality/citizen-data