How Is the Water? 2012

Sewage Contamination in the Hudson River Estuary 2006 - 2011

RIVERKEEPER®
NY's clean water advocate

RIVERKEEPER®
NY's clean water advocate

Tracy Brown, Author and Principal Researcher
John Lipscomb, Project Design & Direction

© 2012 Riverkeeper, Inc.

Cover photo by Paul Bastin, "Kids swimming in Red Hook, Brooklyn"

How Is the Water? 2012

Sewage Contamination in the Hudson River Estuary

2006 - 2011

Table of Contents

Executive Summary

Since 2006 Riverkeeper has been measuring the Hudson River for the primary indicator of safe recreational water quality - sewage contamination levels. We have found highly variable degrees of sewage contamination, with some locations showing acceptably low levels almost every time we sample and other locations showing unacceptably high levels more than 50% of the times we sample.

The need for consistent, high frequency water quality testing at all Hudson River public access points is clear. This testing needs to happen on the community level, in every city, town and county where people are getting in the water.

Along the 155-mile-long Hudson River Estuary only nine locations north of New York City are currently tested for sewage by local authorities, and only four locations are recognized as official swimming areas. From the Riverkeeper patrol boat we see the public getting in the water in every stretch of the river, from dozens of shoreline access points and from boats. We need to start managing the Hudson River Estuary as the recreational destination it has become.

SUMMARY OF OUR KEY FINDINGS

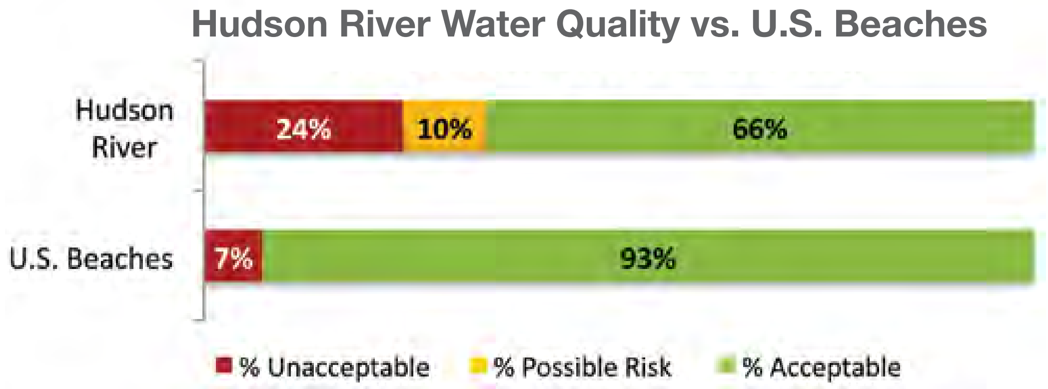
1. **Water quality varies location by location.**
2. **Water quality varies over time.**
3. **Sites vary in both the degree (how high is the sewage concentration), and the frequency (how often does it occur) of contamination.**
4. **Wet weather is a common trigger of sewage contamination.**
5. **Sewage contamination is often higher near the shoreline and at the confluence of tributaries.**

Exposure to disease-causing pathogens in sewage can lead to short-term and chronic illnesses. Some populations, including children, the elderly and people with compromised immune systems, are more likely than others to suffer illness and death from waterborne diseases.[1] The greater the degree of contamination, the greater the health risks.

There are 9 communities on the Hudson River Estuary that still have combined sewer systems that release large pulses of raw and partially treated sewage during and after rain. Our data have also identified tributaries that deliver large pulses of sewage to our shorelines in wet weather and sometimes dry. New York State's current Water Quality Standards, which require only the use of a weighted average called a geometric mean on the Hudson, mask the risks posed by these large sewage pulses that are common in the river, particularly after rain storms.[2] Riverkeeper is calling on New York to update our current Recreational Water Quality Standards to make them more protective of public health and more effective in reaching our shared goal of a swimmable Hudson River.

Clean, swimmable water is critical for the future economic health of our region. When viewed as a whole, 24% of our samples failed U.S. Environmental Protection Agency (EPA) guidelines for safe swimming.[3] By comparison, water quality samples collected at beaches nationwide (including ocean, bay and Great Lakes beaches) failed the EPA safe swimming standard 7% of the times sampled over the same time period.[4]

Riverkeeper's data show that sewage pollution tends to remain localized near the source. Contamination levels are generally highest at the shoreline and during and after rainfall. **Communities with persistent sewage contamination along their shorelines need to assess their local water quality, track down the sources of sewage contamination and eliminate them**. The sources of sewage pollution will vary by community but the elimination of those sources has the same result everywhere—better water quality and safer conditions for recreation.



Hudson River water quality compared with beach water quality nationwide, 2006 – 2011

Another critical component to reducing sewage pollution is renewed investment in our wastewater infrastructure. Since the 1980s federal funds for state infrastructure needs have all but dried up. Riverkeeper calls on Congress to renew this critical source of funding, but until it does, our state and local leaders need to find new ways to fund the maintenance of our sewage infrastructure. The New York State Department of Environmental Conservation (DEC) has published reports on this growing crisis and has estimated a price tag of $36 billion over the next 20 years to address our state's wastewater infrastructure needs.[5]

The DEC's ability to protect our water is also dependent on state funding. During the budget shortfalls of the past few years, DEC suffered disproportionately large cuts to its budget and staff compared with other state agencies.[6] Laws, plans and permits are only effective when they are enforced. Riverkeeper and our coalition of clean water advocates are calling for the reinstatement of cut DEC positions and budget sufficient to fully enforce existing laws and protect New York's water.

Riverkeeper has been working on behalf of the public for increased safe recreational access to the Hudson River for decades. Through our Water Quality Program we work in partnership with the public in communities throughout the Estuary to identify and eliminate local sources of sewage pollution. The Action Agenda in this report describes specific steps that citizens and communities can take to improve their local water quality.

We are committed to continue studying the patterns of sewage contamination in the Hudson, sharing that information with the public and working toward the elimination of this hazardous pollutant.

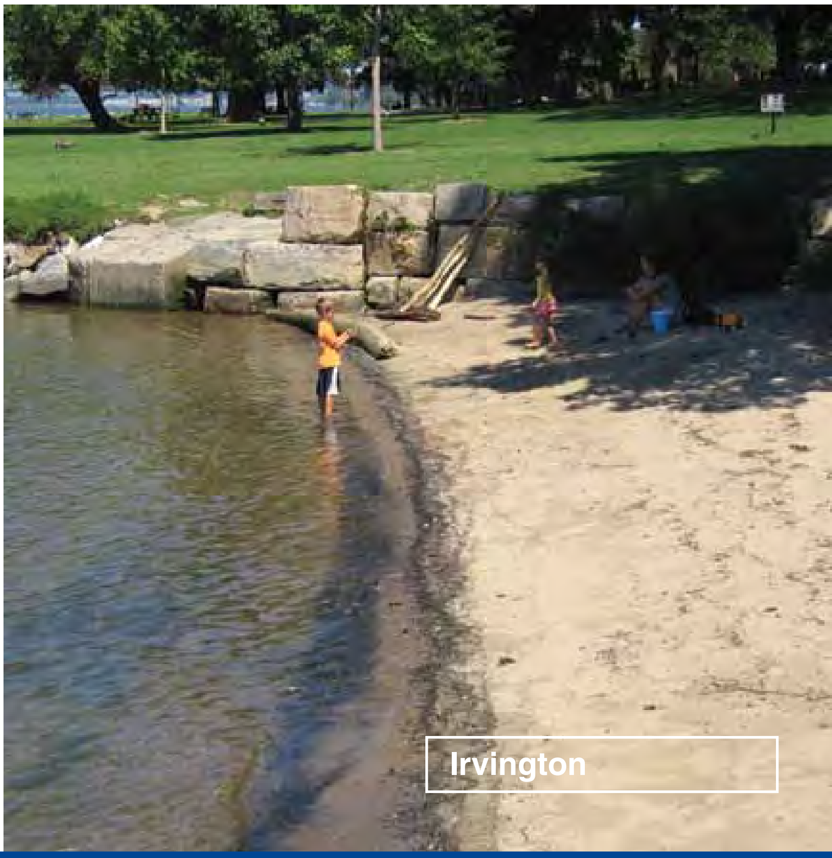
RIVERKEEPER'S ACTION AGENDA

1. **Reinvest in Wastewater Infrastructure**
2. **Enforce Existing Water Quality Protection Laws**
3. **Improve NY State Water Quality Standards**
4. **Engage Citizens in Local Solutions**
5. **Start Frequent Water Quality Monitoring & Prediction**
6. **Notify the Public of Sewage Contamination**

In this report we update the patterns of sewage contamination we have documented in the Hudson River Estuary and expand our Action Agenda for addressing this problem.

In the Hudson Valley, a trip to the river should never lead to a trip to the emergency room. If we invest in our wastewater infrastructure, measure contaminant levels, alert the public to potential risks and take the other measures described in the Action Agenda on page 28, we can make swimming and boating on the Hudson safer and more enjoyable, and continue to support the growth of recreational and economic activity along our river.


Raw sewage and stormwater flowing into the Hudson from a combined sewer overflow (CSO) pipe



Clockwise from top left: kids swimming at a kayak launch site in Brooklyn; boaters and swimmers at the popular unofficial beach at Little Stony Point; a family cooling off at Matthiessen Park in Irvington; cliff diving in Garrison

How Is the Water?

Swimming in the Hudson

There are a number of factors that go into determining whether water is safe for swimming, such as currents, temperature, underwater hazards, turbidity, toxins and bacterial content. One of the most important factors is pollution from raw or partially treated sewage that can carry toxins and disease-causing pathogens.

The majority of beach closings and advisories in the United States are due to high levels of sewage contamination.[7]

Although the entire 155-mile-long Hudson River Estuary is used for swimming, there is currently insufficient testing, or modeling and prediction, of water quality to properly answer the question, "Is it safe to swim?" Riverkeeper's Water Quality Study, which consists of monthly sampling at 74 fixed locations, is not intended to replace government testing or to tell the public when it's safe to swim. Instead our sampling program is designed to 1) raise awareness for the need for more regular, localized, water quality monitoring and reporting along the Hudson shoreline; 2) provide insight into the factors influencing local water quality; 3) identify contamination hot spots; and 4) engage citizens in solutions that eliminate pollution sources and improve water quality.

Of the ten counties on the Hudson River Estuary, only four test for sewage contamination at their shorelines. That testing is limited in scope and frequency, and none of those counties report their findings to the public.[8]

New York City has been collecting water quality data on New York Harbor since 1909. The NYC Department of Environmental Protection (DEP) publishes its findings once a year in the form of an annual summary report, and in 2012 started to post the individual sample results online.[9] Riverkeeper applauds the DEP's decision to make its water quality data more readily available to the public. We would like to see similar sampling programs conducted by government agencies along the entire length of the Hudson River.

Despite the lack of critical data for most regions of the River, the New York State Department of Environmental Conservation (DEC) has classified Hudson River waters from north of the Bronx Borough line all the way to the northern end of Columbia County as acceptable for swimming. Without adequate data it is impossible to properly protect public health or the health of the River. We hope that our program, the information in this report, and the public's response to our data, provide evidence of the value of water quality sampling programs and lead to increased governmental sampling, enhancements to infrastructure, and improvements in Hudson water quality.

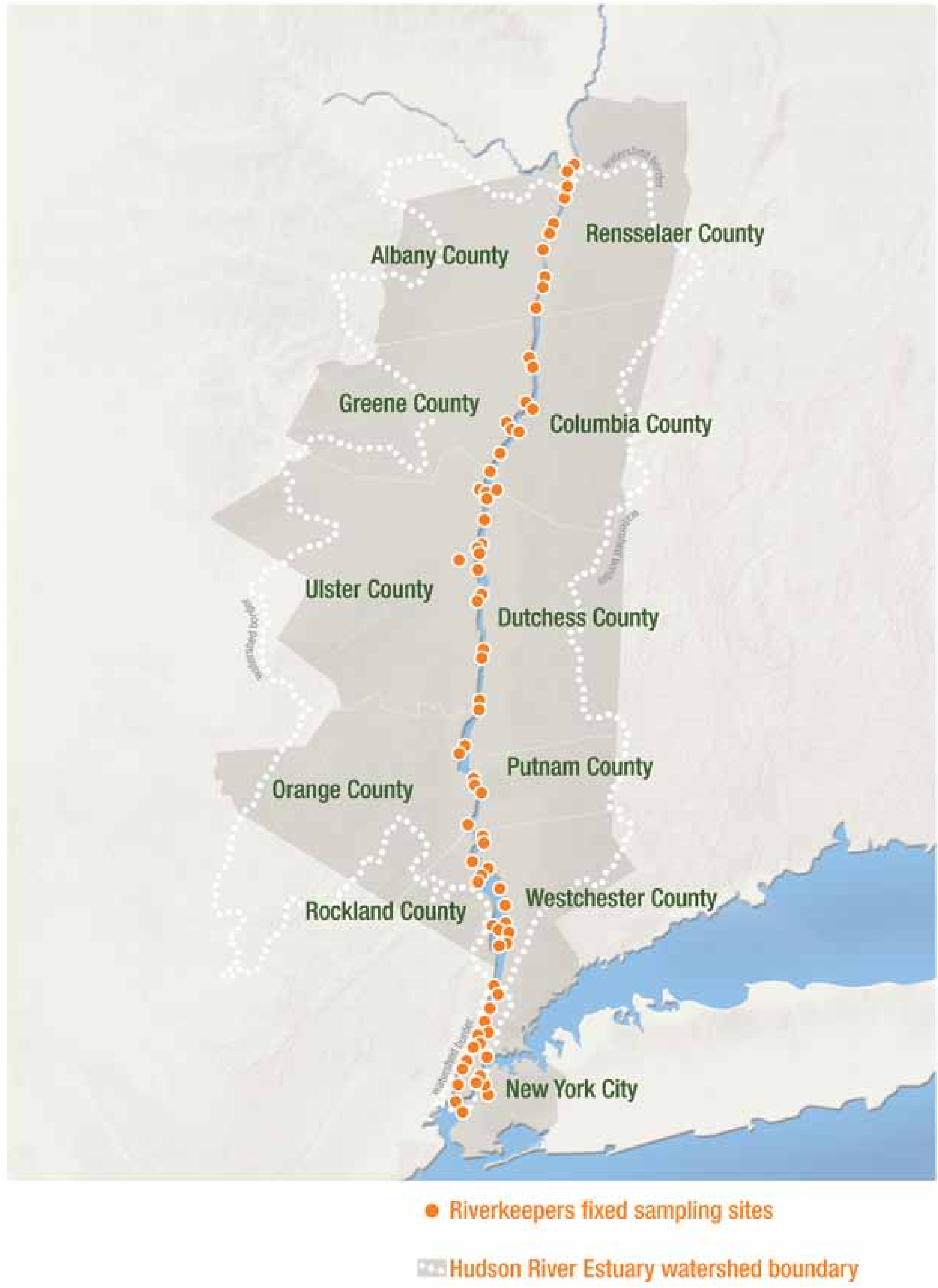
[For a summary of Other Pollutants in the Hudson River see **Appendix I**]

[For more on Waterborne Illnesses and Human Health see **Appendix II**]

Hundreds of people participate in open swim events in the Hudson River every summer like the popular "Swim for Life" across Tappan Zee Bay.

County Monitoring & State Water Classifications

Riverkeeper's 74 Water Quality Monitoring Sites



Riverkeeper's Water Quality Study

Riverkeeper, along with our academic science partners, started the Water Quality Program in 2006, with a focus on testing for sewage contamination in the River and sharing this information with the public. Other important variables that relate to water quality, such as temperature, salinity, turbidity, chlorophyll, and oxygen concentrations are also measured and shared with the public.

We sample at 74 fixed Hudson River locations, once a month, from May through October. The Riverkeeper patrol boat, the *R. Ian Fletcher*, is equipped with a mobile lab that allows us to collect, process and incubate the samples onboard. It takes five days to travel the 155 miles of river and collect and process all the samples each month.

Our sampling sites fall into four categories: mid-channel, near-shore, tributaries, and Sewage Treatment Plant (STP) outfalls. The last three categories all occur in close proximity to the shoreline, but are distinguished by their potential connection to sources of sewage contamination. It is also worth noting that the majority of our sites, including examples from all four categories, are used by the public for recreation. In addition to our fixed sites, we conduct exploratory sampling at a variety of locations to investigate specific events and problem areas.

Working with local citizen groups and individuals, Riverkeeper also coordinates sampling on 160 miles of tributaries in the Hudson Valley. The results of those studies are not included here but will be featured in a future report.

Our Science Partners

Riverkeeper's Water Quality Program is conducted in collaboration with scientists from Columbia University's Lamont-Doherty Earth Observatory and Queens College, City University of New York. Our Co-Principal Investigators, Gregory O'Mullan, Ph.D. and Andrew Juhl, Ph.D., contribute their expertise in environmental microbiology and oceanography to the project. They developed our testing protocol and oversee our field sampling, environmental sensor measurements and microbiological data analyses.[10]

Measuring Sewage Contamination

Riverkeeper tests for sewage-indicating microbes of the genus *Enterococcus* ("Entero"). It is the only group of microbes recommended by the Environmental Protection Agency (EPA) for use as sewage indicators in both salt and fresh water. The Hudson River Estuary contains salt, fresh and brackish (mixed) water.

It currently takes 24 hours to process each sample and quantify its level of Entero. Research is underway to develop a rapid testing methodology that can provide close to real-time results. Riverkeeper follows these scientific developments for future consideration.

Sharing Data with the Public

To distribute our water quality data to the public we have created an online database at www.riverkeeper.org/water-quality/locations that is updated within days of our monthly sampling patrols. This website is our primary means of disseminating data to the public and is a resource that we encourage the public to explore frequently during the recreational season. We also publish periodic water quality updates based on sampling patrols that are available as an opt-in e-letter and as PDFs on our website. In addition to online publishing, we offer live presentations about our water quality findings at conferences and community events, and to agencies involved in water quality management.

Sign up to receive our periodic e-letter updates about Hudson River Water Quality: www.riverkeeper.org/get-involved/stay-informed

What do the numbers mean?

Riverkeeper bases our assessment of water quality on the Environmental Protection Agency (EPA) federal guidelines for safe recreational water quality, which are as follows.[11]

Federal Water Quality Guidelines

Federal Salt or Brackish Water Guidelines:

- Acceptable= Entero cell counts under 35/100ml
- Unacceptable= Entero cell counts over 104/100ml
- Unacceptable= Entero cell counts between 35/100ml and 104/100ml if sustained over time (5 or more samples calculated with a Geometric Mean)

Federal Freshwater Guidelines:

- Acceptable= Entero cell counts under 33/100ml
- Unacceptable= Entero cell counts over 61/100ml
- Unacceptable= Entero cell counts between 33/100ml and 61/100ml if sustained over time (5 or more samples calculated with a Geometric Mean)

Acceptable Illness Rates

Unacceptable water is based on an illness rate of 19 or more illnesses per 1,000 swimmers in salt water, and 8 or more illnesses per 1,000 swimmers in fresh water. The concentration of *Enterococci* (the "Entero cell count") has been correlated to the occurrence of swimming related illnesses.

Riverkeeper's Water Quality Rating

Riverkeeper Salt or Brackish Water Rating: We apply this standard to our sampling sites from NY Harbor, in the south, up to and including Peekskill (northern Westchester and Rockland County) in the north.

- Acceptable= Entero cell counts under 35/100ml
- Unacceptable= Entero cell counts over 104/100ml
- Possible Risk*= Entero cell counts between 35/100ml and 104/100ml

Riverkeeper Freshwater Rating: We apply this standard to our sampling sites from Fort Montgomery (southern Putnam and Orange County) north to Waterford.

- Acceptable= Entero cell counts under 33/100ml
- Unacceptable= Entero cell counts over 61/100ml
- Possible Risk*= Entero cell counts between 33/100ml and 61/100ml

*Riverkeeper notes a "Possible Risk" category to identify water quality that passes EPA's single sample standard but if sustained over time would fail EPA's geometric mean guidelines for safe swimming. ("Geometric Mean" is a method for calculating average bacteria concentrations that dampens the effect of very high or very low values—a type of weighted average.)

[Learn about **New York's Recreational Water Quality Standards** and how we can improve them in our **Action Agenda** on page 28]

Our Water Quality Findings

Riverkeeper has processed more than 2,000 water quality samples from the Hudson River since the program launched in 2006. Based on that number of samples, and the expert analyses of our science partners, we are able to identify patterns of sewage contamination in the Hudson River. Although we have found evidence of sewage contamination at every one of our 74 testing locations, the levels of contamination vary enormously over time and by location.

Summary of our key findings and their significance:

1. Water quality varies location by location. It is primarily a local problem with local solutions.

2. Water quality varies over time. Frequent sampling is important and the causes of the variability must be understood so that water quality can be accurately predicted and sources of pollution eliminated.

3. Sites vary in the level, or degree, as well as the frequency of contamination. When assessing water quality at any location it is important to consider BOTH:

- The level of the contamination (how high is the Entero count), because the higher the Entero count the greater the chance of getting sick.
- The frequency of contamination (how often does it occur), because the more frequent the contamination the more opportunities there are for exposure.

4. Wet weather is a common trigger of sewage contamination. Green and grey infrastructure solutions are needed to reduce Combined Sewer Overflows and contaminants in stormwater runoff.

5. Sewage contamination is often higher near the shoreline where it enters the River and it can be diluted before it reaches the deeper mid-channel. Monitoring programs must include sampling along the shoreline where most human contact occurs.

6. Tributaries are the most frequently contaminated category of sites that we test. Local studies must be conducted to understand and address the sewage contamination in our community streams, creeks and rivers.

HELPFUL TERMINOLOGY

Chlorophyll: The green pigment in plants that allows them to photosynthesize. Found in algae and other surface water phytoplankton.

Enterococcus ("Entero"): A sewage indicating bacteria that lives in the intestines of humans and other warm-blooded animals. [See page 9 for information on how Entero is used to assess water quality]

Pathogens: Any disease-producing agent, especially a virus, bacterium, or other microorganism.

Predictive models: Creating a model to predict the probability of an outcome.

Salinity: The level of dissolved salt in a body of water.

Sewage indicator: Any measurable quantity that points to an input of sewage into a body of water.

Tributary: A stream or river that flows into a main stem, or primary downstream portion, of a river. Tributaries do not flow directly into the ocean.

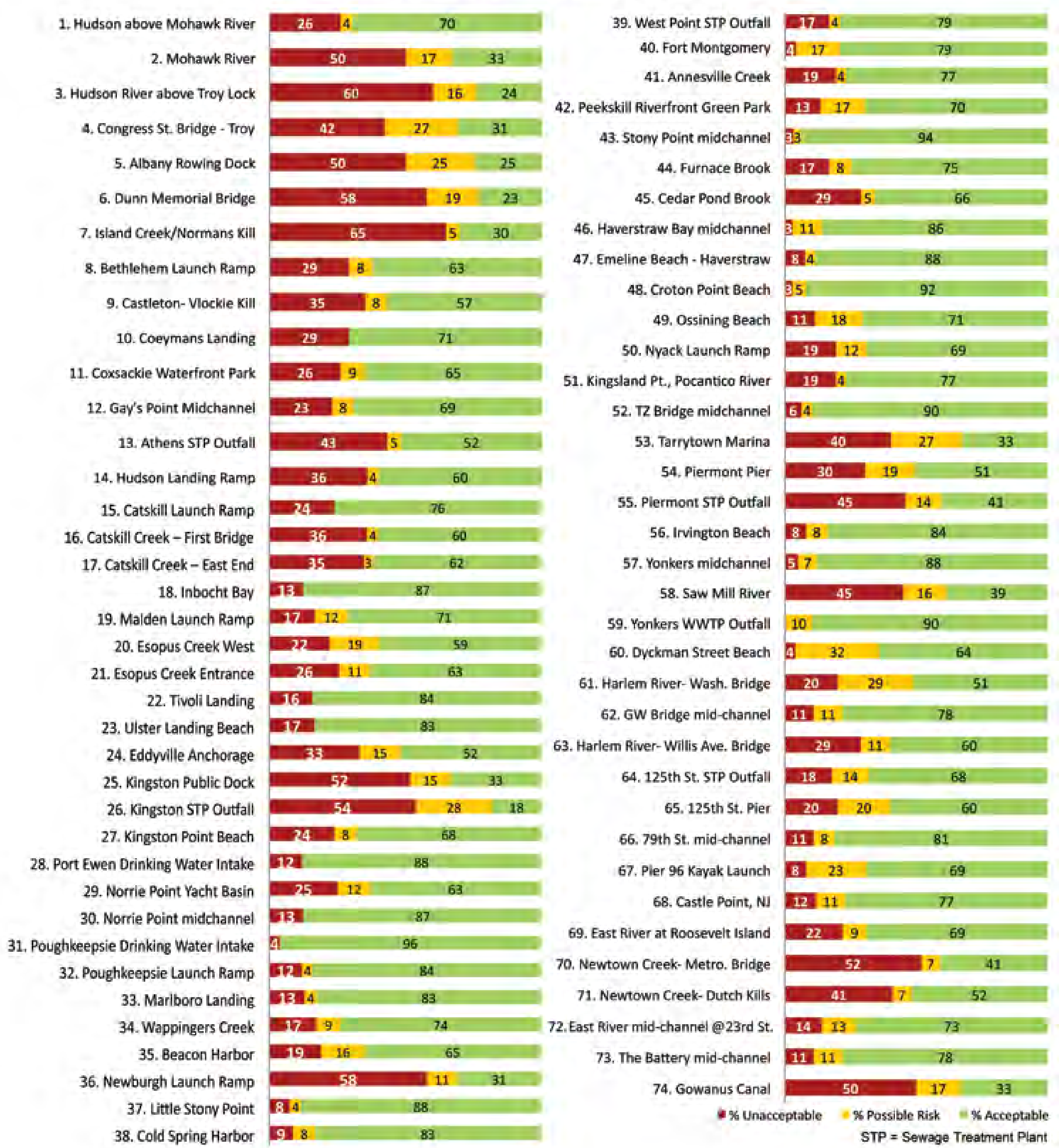
Turbidity: A measure of the suspended solids in a solution, and an indicator of water quality.

Wastewater: Water that has been mixed with waste due to human activity.

Watershed: The geographical area drained by a river and all of its tributaries.

Riverkeeper's 74 Fixed Hudson River Sampling Sites

Percent of Samples Unacceptable, Possible Risk, Acceptable



FINDING: Sewage Impacts Are Localized

Typically sewage contamination in the Hudson is localized. For example, our May 2012 sampling patrol was during a dry weather spell and we found better than average water quality, with only 12% of samples showing unacceptable results. However, in the Capital District we had three sites that failed that month – at the Dunn Memorial Bridge in Albany (187/100ml), above the Troy Lock (96/100ml) and the confluence of the Mohawk River in Waterford (238/100ml). These sites fail 50% or more of the times we sample them. The sample sites in between these locations did not fail.

It is also interesting to note that only 300 yards from the failed Mohawk River site, at our station in the Hudson just above the confluence with the Mohawk, the water was acceptable with a low count of 11/100ml. This shows that it really does matter where you get in the water and where you sample it. It also suggests that most water quality problems occur due to local sources of pollution. The good news is that local problems have local solutions. Once a source is identified, local action can fix it and water quality will improve.

FINDING: Water Quality Can Vary Greatly at a Single Location Over Time

We have found many examples of locations that have high variability of sewage contamination due to wet weather. Locations near Combined Sewer Overflow outfalls can show extreme fluctuations in water quality due to the volume and intensity of those discharges. However, at other locations we find variable water quality that is not connected solely with wet weather. For example, at our Saw Mill River site on the Yonkers waterfront, the public comes into contact with water that can have high or low levels of sewage contamination whether the weather is wet or dry.

This pattern of change over time at a single location means that sampling must occur frequently in order to identify the range of contamination at a site and to help identify potential causes and sources. It is also important to understand the factors that influence the level of contamination. Riverkeeper encourages the public to check our online database frequently during the recreational season to explore recent conditions where they use the river.

FINDING: Sites Vary in Both Degree and Frequency of Contamination

When assessing water quality it is important to consider both the frequency of failure (percent of samples that fail EPA safe-swimming guidelines) and the degree of failure (maximum level of contamination). There are sites in our study that are often contaminated but the degree of contamination does not go much higher than acceptable levels. Then there are sites that are contaminated less frequently but the degree of contamination is much higher and therefore poses a larger public health risk if people enter the water on the wrong day.

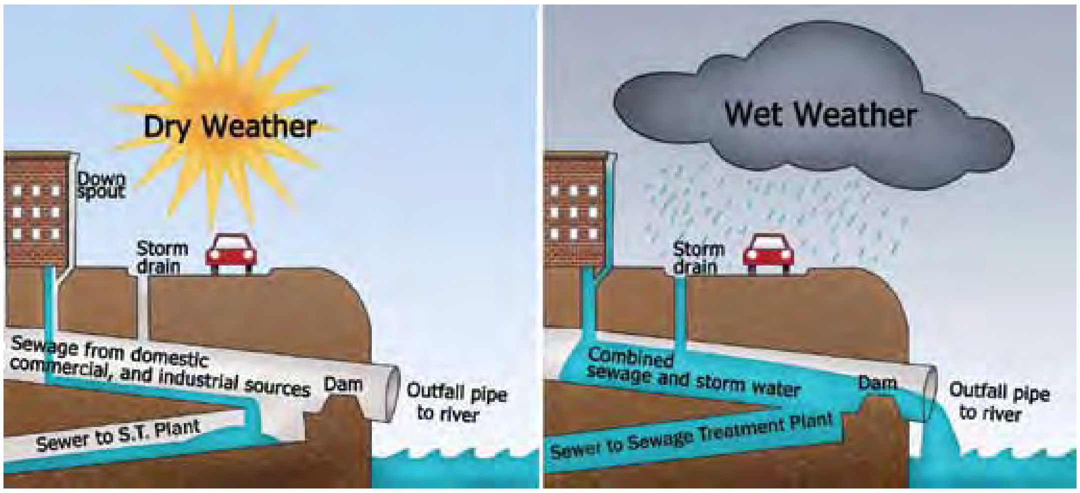
The public launch ramp in Nyack and the shoreline of Kingsland Point Park across the river in Sleepy Hollow demonstrate this contrast. At both locations, 19% of our samples have failed EPA guidelines; however, Kingsland Point Park has a much higher degree of contamination overall with a maximum count of >24,196/100ml, compared with a maximum count of 663/100ml at the Nyack launch ramp. Therefore it is reasonable to conclude that Kingsland Point Park has poorer water quality overall than the Nyack launch ramp. People need to become more aware of the conditions that trigger these concentrated pulses of sewage contamination.

When managing the Hudson it is critical that both the degree of contamination and the frequency of failure be considered.

[See the Regional Maps on pages 20-23 for a listing of **Maximum** and **Minimum Entero counts** by location]

Municipal Sewage Systems

Combined Sewer System: one pipe for sewage and stormwater

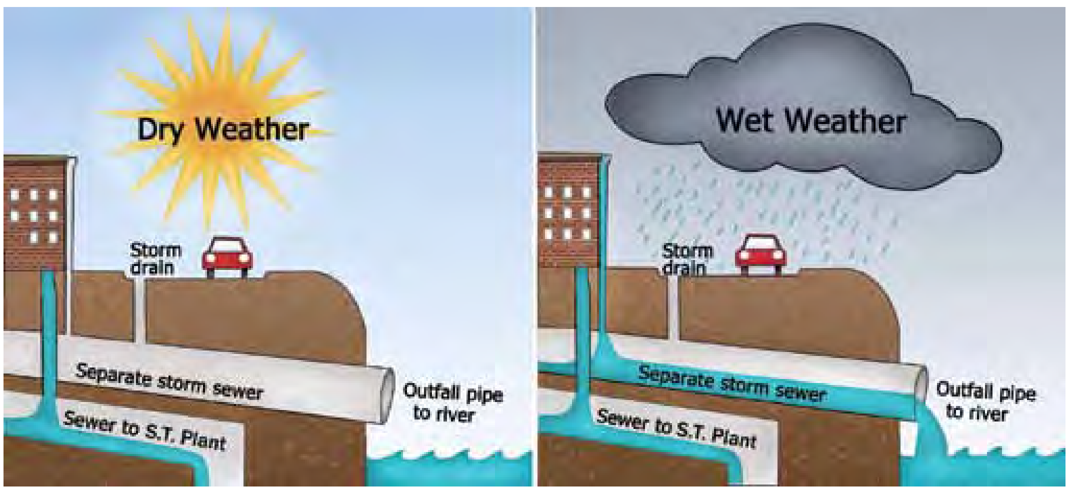


What are Combined Sewer Overflows (CSOs)?

CSOs are remnants of the country's early infrastructure. In the past, communities built sewer systems to collect both stormwater runoff and sanitary sewage in the same pipe. During dry weather, these "combined sewer systems" transport wastewater directly to the sewage treatment plant. In periods of rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, lakes, or estuaries. Combined sewer overflows (CSOs) contain not only stormwater but also untreated human and industrial waste, toxic materials, and debris. This is a major water pollution concern for cities with combined sewer systems. CSOs are among the major sources responsible for beach closings, shellfishing restrictions, and other water body impairments.

- U.S. Environmental Protection Agency

Sanitary Sewage System: separate pipes for sewage and stormwater



What are Sanitary Sewer Overflows (SSOs)?

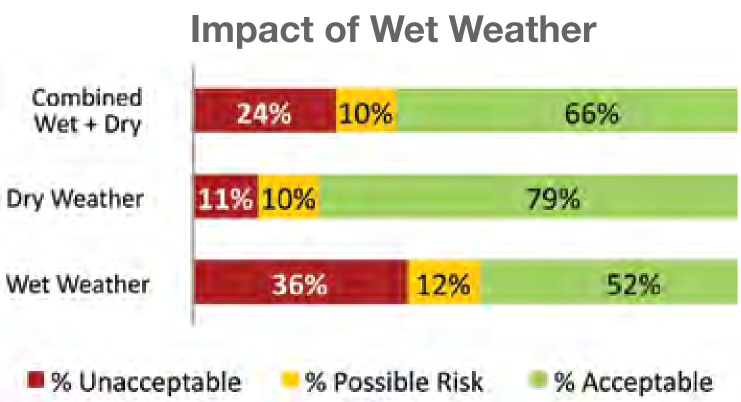
Properly designed, operated, and maintained sanitary sewer systems are meant to collect and transport all of the sewage that flows into them to a publicly owned treatment works (STP). However, occasional unintentional discharges of raw sewage from municipal sanitary sewers occur in almost every system. These types of discharges are called sanitary sewer overflows (SSOs). SSOs have a variety of causes, including but not limited to blockages, line breaks, sewer defects that allow storm water and groundwater to overload the system, lapses in sewer system operation and maintenance, power failures, inadequate sewer design and vandalism.

- U.S. Environmental Protection Agency

FINDING: Wet Weather Is a Common Trigger of Sewage Overflows

During and shortly after rainfall the frequency of unacceptable Entero counts increases in all the regions and at all the types of sites where we sample, though not at every individual location. Overall the percent of samples that were unacceptable increased from 11% in dry weather to 36% in wet weather—a threefold increase.

There are several sources that can contribute to rain-related sewage contamination. One contributor is sewage-contaminated groundwater entering streams, brooks and rivers. Another contributor is rain-triggered overflows from our sewage infrastructure. These overflows fall into two categories—Combined Sewer Overflows (CSOs), which happen by design, and Sanitary Sewer Overflows (SSOs), which are the result of faulty or overloaded sewer systems.



Wet weather is classified as more than 0.25 inches of rain in the three days prior to sampling

Together these rain-triggered overflows dump tens of billions of gallons of combined sewage and stormwater into the Hudson River each year. **Until the CSO problem is solved we will continue to have periods of unsafe water quality.**

Reducing Wet Weather Overflows

In communities where impervious surfaces (i.e. roads, rooftops and parking lots) are plentiful, like New York City, as little as ¼ inch of rain can trigger a sewage overflow. When stormwater and snowmelt run off the hard surfaces in our built environment they carry an assortment of contaminants into our waterways such as oil, road salts, litter and animal waste.

COMMUNITIES WITH COMBINED SEWER SYSTEMS THAT DISCHARGE INTO THE HUDSON RIVER ESTUARY

Listed by number of outfalls

- **New York City: 460**
- **Capital District*: 92**
- **New Jersey side of NY Harbor: over 40**
- **Yonkers: 26**
- **Newburgh: 12**
- **City of Hudson: 10**
- **Kingston: 7**
- **Poughkeepsie: 6**
- **Catskill: 6**

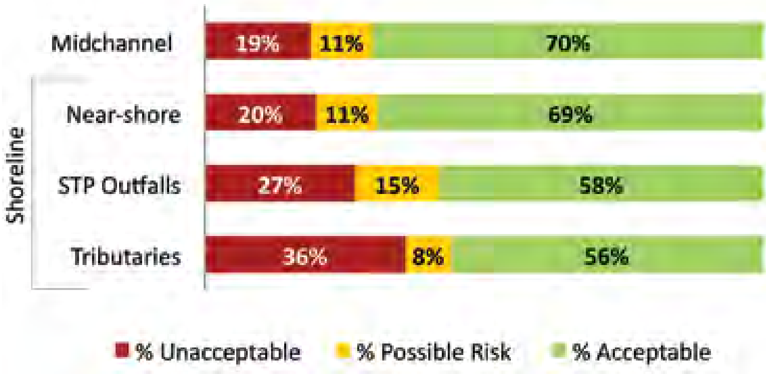
*** The Capital District includes Albany, Cohoes, Green Island, Rensselaer, Troy and Watervliet**

There are two approaches to reducing wet weather overflows—grey infrastructure and green infrastructure projects.

Grey infrastructure refers to traditional built solutions such as separating Combined Sewage Systems by laying new pipes, or building holding tanks to temporarily divert overflows from waterways. Green infrastructure refers to the use of natural landscapes, and/or engineered systems that mimic natural landscapes, to collect and divert stormwater, reduce flooding and improve water quality. Green infrastructure projects, such as greenways, wetlands, and rain gardens, reduce the amount of water that enters our storm drains and sewer systems, reducing the volume and frequency of sewage overflows. It is a cost-effective approach to improving water quality that has added benefits including recharging groundwater, reducing the urban heat effect and improving air quality.

[See the **Action Agenda** for examples of **Green Infrastructure Projects** in the Hudson Valley on page 33]

Types of Sites



FINDING: Contamination Is Highest at the Shoreline and Near Tributaries

To better understand the locations and sources of sewage contamination we have grouped our 74 sampling sites into four categories: mid-channel, near-shore, tributaries, and sewage treatment plant (STP) outfalls. The last three categories all occur in close proximity to the shoreline while the mid-channel sites occur in deep water and are physically removed from shoreline inputs. Tributaries and STPs are distinguished from the near-shore category by their connection to unique sources of potential contamination. However, if we want to consider the conditions that occur along the waters edge, where people come into the most contact with the river, we must consider all three as shoreline categories.

Water quality at the shoreline sites is worse than mid-channel water quality. This is because the shoreline is where sewage typically enters the river. The mid-channel also tends to be the deepest and fastest moving part of the river, so dilution, mixing and the self-flushing power of our tidal river have the greatest impact there.

As mentioned earlier, we find acceptable water quality at many shoreline sites the majority of the times we have sampled. However, some shoreline sites are heavily laden with sewage at times, while others have a consistent low-level sewage signal whenever we test.

[See the **Variable Shoreline Findings** in the Regional Maps on pages 20-23]

Riverkeeper's Tributary Sites

It appears that many of the streams, brooks and creeks that run through our communities are more polluted with sewage than the Hudson River, and as such, they are a source of pollution to the Hudson and our shorelines.

Because contamination tends to be highest along the shoreline, all monitoring programs should include sampling along the shoreline. Currently the New York City Department of Environmental Protection sampling program occurs primarily at mid-channel, a factor that would result in under-estimation of sewage levels in the river at shoreline public access points. Shoreline locations are also where the public is most interested in understanding conditions.

Tributary Water Quality

The unexpected bad news is the high frequency of sewage contamination entering the Hudson from our tributaries. Our study contains 16 standard tributary sites; most are tidewater sites where we sample Hudson River water at the confluence with a tributary.

At these tributary sites, 36% of our samples were unacceptable. We have found that some streams and brooks in our communities can be chronic sources of sewage contamination—meaning that they are a source of sewage contamination for the shoreline and the river no matter what the weather. When it rains, even more sewage enters the Hudson from tributaries. Our study found a fourfold increase in the frequency of unacceptable samples at our tributary sites after wet weather.

So what is happening in our community streams, brooks and creeks? Individual tributary studies are needed to answer this question, and the answers will likely vary by waterway and watershed. Sewage could be entering our local waters from any number of sources including contaminated groundwater from failing septic systems and chronic leaks from sewer pipes; illegal sewage hook-ups; or agricultural sources. In wet weather add contaminated overflowing municipal sewer systems and treatment plants to that list.

The Riverkeeper Water Quality Program is currently looking more closely at contamination in our tributaries. We are partnering with the public on sewage mini-studies on Sparkill Creek, the Pocantico River, Rondout Creek, Wallkill River, Esopus Creek and Catskill Creek. These sampling sites are up in the tributary watersheds above the influence of the Hudson.

Our preliminary sampling data indicates some very high Entero counts in wet weather and intermittent high counts in dry weather. It appears that many of the streams, brooks and creeks that run through our communities are more polluted with sewage than the Hudson River, and as such, they are a source of pollution to the Hudson and our shorelines.

Sewage Treatment Plant Effluent

Sewage Treatment Plant (STP) outfalls, where the treated wastewater from the plant (the effluent) enters the river, are on average more frequently unacceptable than the rest of the river. But this doesn't tell the full story because we get a wide variety of results at the STP outfalls. Some of the outfalls, like the ones at Kingston and the combined Orangetown and South Rockland County STP at Piermont Pier, have high variability in test results, ranging from acceptable single digit Entero counts to highs exceeding the upper limit of our testing system.

Other plants, like the Westchester Plant in Yonkers, have consistently low Entero counts at their outfalls. That is encouraging, however the infrastructure that feeds the treatment plants can fail to get the sewage to the plant, especially during wet weather. Combined Sewer Overflows (CSOs), Sanitary Sewer Overflows (SSOs) and infrastructure breaks are some other ways in which sewage treatment plants fail to properly treat the sewage in their systems.

Regional Views & Site Data

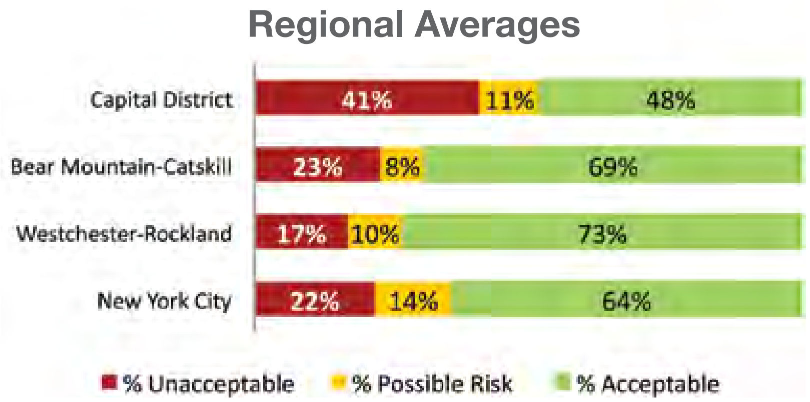
For a regional perspective we have divided our sampling sites into four geographic groups—the Capital District, Bear Mountain to Catskill, Westchester and Rockland Counties, and New York City. All four regions suffer from intermittent sewage contamination to varying degrees.

It may surprise some to see New York City, with 8 million residents, achieving better water quality than the Capital District, which has closer to 1 million residents. Both regions have Combined Sewer Systems and suffer from massive CSO discharges in wet weather. New York City dumps an estimated 27 billion gallons of combined sewage and stormwater into New York Harbor each year from its 460 CSO outfalls.[12] The Capital District dumps an estimated 1.2 billion gallons of combined sewage and wastewater into the Hudson each year from the 92 CSO outfalls from the communities of Albany, Cohoes, Green Island, Rensselaer, Troy and Watervliet.[13]

The critical difference between the Capital District and New York City is that the three sewage treatment plants serving the Capital District *do not use disinfection*. So in the Capital District the rain-triggered CSOs provide a spike of contamination on top of a chronically sewage-laden section of the estuary.

The Clean Water Act (CWA) requires disinfection at sewage treatment plants, but by issuing special permits ("SPDES" permits), New York State has allowed Albany and the Capital District to stay out of compliance with the CWA for 40 years. The lack of disinfection at those plants is one reason our Capital has the highest sewage contamination frequency in the Hudson River Estuary.

In recent years the DEC finally required the Capital District to develop a Long Term Control Plan for its CSOs.[14] The draft plan currently under review includes adding seasonal disinfection at the three sewage treatment plants in this region, a step in the right direction. However, the plan falls short on other measures needed to bring the region's water quality up to the conditions found in the rest of the Estuary.

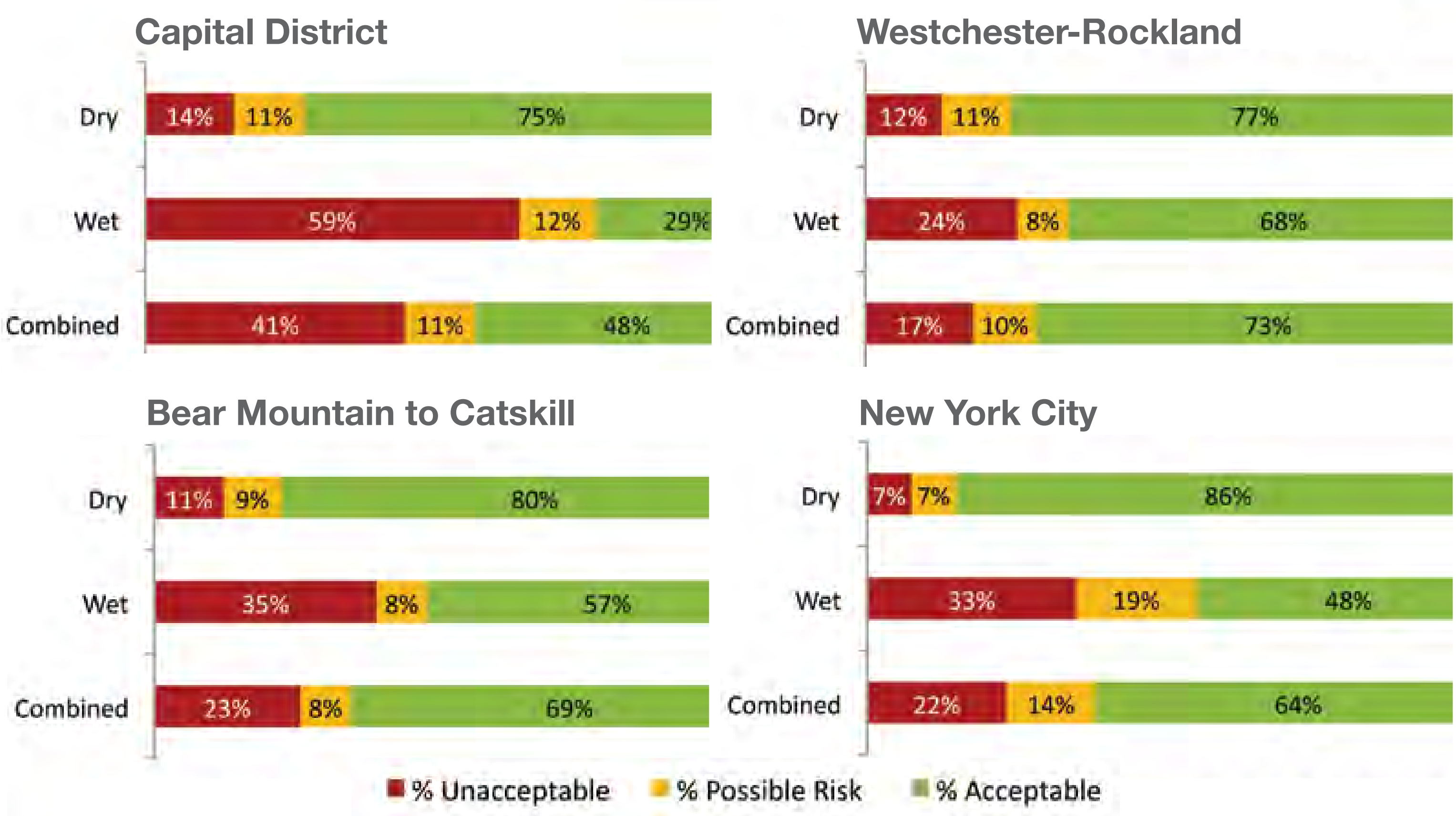


In the mid-Hudson we find the more densely populated Westchester and Rockland region has lower sewage contamination levels than the more sparsely populated region to the north that spans from Bear Mountain Bridge to Catskill. Based on our preliminary findings we believe this difference may be attributed to the higher number of tributaries in the Bear Mountain-Catskill region and the large watersheds that influence the health of those tributaries. Our findings indicate that these tributaries increase contamination at nearby shoreline sites with high spikes of contamination in wet weather.

When we view the data categorized as wet weather and dry weather samples the picture for each region becomes clearer. It is important to note that all regions include some older towns and cities with combined sewage systems and CSOs; however, the volume of combined stormwater and sewage that each community releases varies greatly, and CSOs are not the only source of wet weather sewage contamination.

Riverkeeper defines wet weather as at least 1/4 inch of cumulative rainfall in the three days prior to sample collection. By this standard 49% of our samples were "wet weather" samples and 51% were "dry weather" samples.

Weather Impacts by Region



Wet weather is classified as more than 0.25 inches of rain in the three days prior to sampling.

Westchester-Rockland has the lowest variability between dry and wet weather conditions of all the regions with a doubling of unacceptable water quality counts following wet weather. The region has the best overall water quality, based on percentage of samples that were acceptable, due to this relatively low spike of contamination during wet weather. However, there is also a lot of variability in this region. It is home to some of the best sites in our study and some of the worst.

New York City has the best water quality in dry weather showing that consistent investment in maintaining and updating sewage infrastructure really does lead to good water quality. When it is dry, New York City's 14 sewage treatment plants can handle the demands of its 8 million customers. On some dry weather sampling patrols we find acceptable and/or possible risk water quality at 100% of our NYC sampling sites. *This does not mean that it is safe to swim at all of these locations*. As mentioned earlier there are other factors to consider before getting into the water. Still, with some notable exceptions, NYC residents can feel good about their dry weather sewage levels.

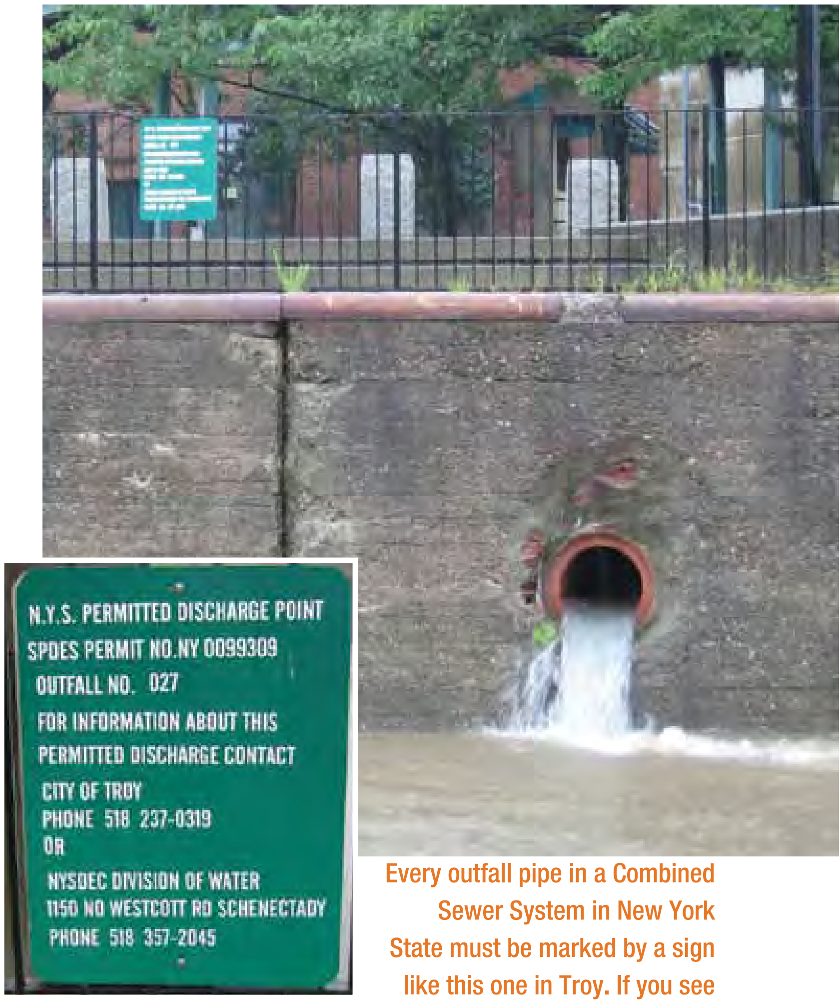
When it rains, this picture can change quickly and dramatically. On our rainy patrol of October 12, 2010, *none* of the sites around NYC were acceptable, and the three sites on Newtown Creek and the Gowanus Canal hit the limit (>24,196/100 ml) of our sampling system indicating very high concentrations of sewage.[15]

New York City is working to reduce the amount of stormwater getting into its combined sewer system with an investment in green infrastructure. In March 2012, New York City entered into a CSO Consent Order with New York State DEC that will lead to $187 million in spending over the next three years, and $2.4 billion over 18 years to reduce the flow of sewage into city waterways. Riverkeeper lobbied for the significant reductions in sewage overflows, citizen enforcement provisions and investment in green infrastructure that made it into the final agreement. Money invested in green infrastructure projects leads to improved water quality and has been shown to be a cost effective way to reduce the volume and frequency of CSOs.[16]

The Bear Mountain to Catskills region has a similar frequency of wet weather sewage contamination as New York City but identifying the sources of that contamination is more challenging. The region has five communities with combined sewer systems that together have 41 CSO outfalls, but that is only a fraction of the number and volume of CSOs in New York City.

The Bear Mountain to Catskill region is also home to seven of our 16 tributary sampling sites on tributaries that are delivering water to the Hudson from a vast watershed. Riverkeeper is conducting four tributary studies in the region—on Catskill Creek, Esopus Creek, Rondout Creek and Wallkill River—in hopes of getting a better understanding of the influence of these tributaries and their watersheds.

In all the regions of the Hudson River Estuary, Riverkeeper is working with local groups to identify and reduce or eliminate sources of sewage pollution. We review and comment on CSO Long Term Control Plans and Sewage Treatment Plant permits. We sample area tributaries in partnership with local citizens. We investigate, report on and notify the public about illicit and accidental discharges.



Every outfall pipe in a Combined Sewer System in New York State must be marked by a sign like this one in Troy. If you see a marked outfall flowing in dry weather call the phone number on the sign and report it.

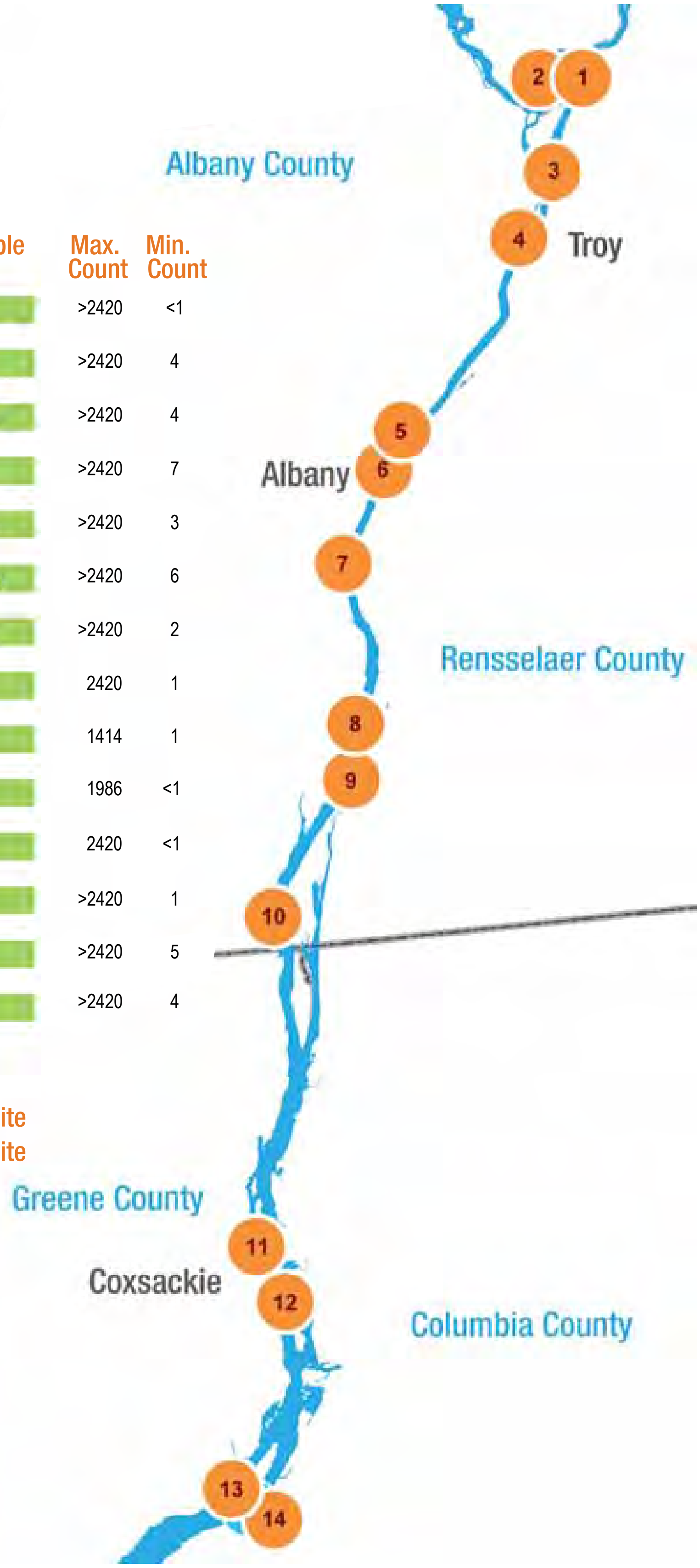
The Riverkeeper patrol boat where the water quality sampling and incubation takes place.

Capital District
[Hudson Launch Ramp to the Mohawk River]

Site Name	% Unacceptable	% Possible Risk	% Acceptable	Max. Count	Min. Count
1. Hudson above Mohawk River	26	4	70	>2420	<1
2. Mohawk River	50	17	33	>2420	4
3. Hudson River above Troy Lock	60	16	24	>2420	4
4. Congress St. Bridge - Troy	42	27	31	>2420	7
5. Albany Rowing Dock	50	25	25	>2420	3
6. Dunn Memorial Bridge	58	19	23	>2420	6
7. Island Creek/Normans Kill	65	5	30	>2420	2
8. Bethlehem Launch Ramp	29	8	63	2420	1
9. Castleton–Vlockie Kill	35	8	57	1414	1
10. Coeymans Landing	29		71	1986	<1
11. Coxsackie Waterfront Park	26	9	65	2420	<1
12. Gay's Point Midchannel	23	8	69	>2420	1
13. Athens STP Outfall	43	5	52	>2420	5
14. Hudson Landing Ramp	36	4	60	>2420	4

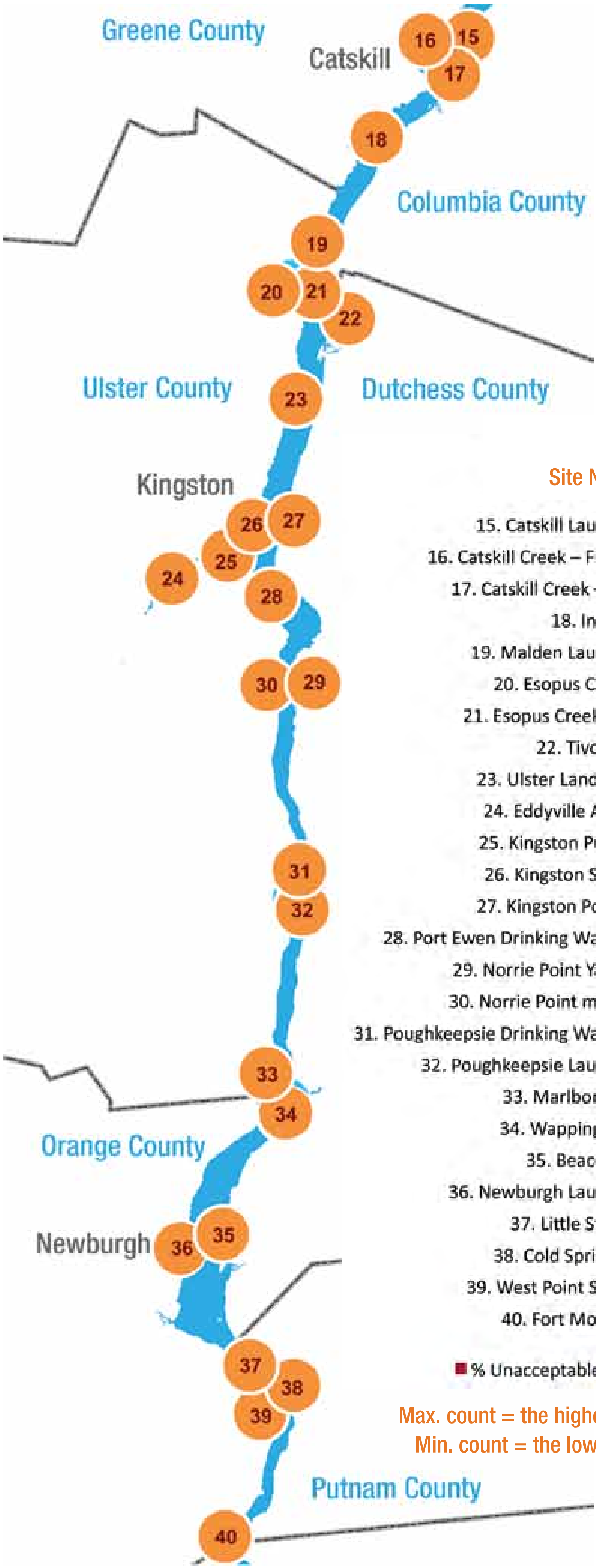
Percentage of Unacceptable/Acceptable: ■ % Unacceptable ■ % Possible Risk ■ % Acceptable

Max. count = the highest Enterococcus count we recorded at this site
Min. count = the lowest Enterococcus count we recorded at this site



Bear Mountain to Catskill

[Fort Montgomery to Catskill]



Site Name	% Unacceptable	% Possible Risk	% Acceptable	Max. Count	Min. Count
15. Catskill Launch Ramp	24		76	>2420	<1
16. Catskill Creek – First Bridge	36	4	60	>2420	<1
17. Catskill Creek – East End	35	3	62	>2420	1
18. Inbocht Bay	13		87	>2420	1
19. Malden Launch Ramp	17	12	71	1986	1
20. Esopus Creek West	22	19	59	>2420	<1
21. Esopus Creek Entrance	26	11	63	>2420	<1
22. Tivoli Landing	16		84	>2420	<1
23. Ulster Landing Beach	17		83	>2420	<1
24. Eddyville Anchorage	33	15	52	>2420	1
25. Kingston Public Dock	52	15	33	>2420	5
26. Kingston STP Outfall	54	28	18	>2420	4
27. Kingston Point Beach	24	8	68	219	<1
28. Port Ewen Drinking Water Intake	12		88	1733	<1
29. Norrie Point Yacht Basin	25	12	63	>2420	1
30. Norrie Point midchannel	13		87	1203	<1
31. Poughkeepsie Drinking Water Intake	4		96	76	1
32. Poughkeepsie Launch Ramp	12	4	84	78	3
33. Marlboro Landing	13	4	83	>2420	1
34. Wappingers Creek	17	9	74	411	1
35. Beacon Harbor	19	16	65	816	<1
36. Newburgh Launch Ramp	58	11	31	>2420	1
37. Little Stony Point	8	4	88	166	<1
38. Cold Spring Harbor	9	8	83	184	<1
39. West Point STP Outfall	17	4	79	291	<1
40. Fort Montgomery	4	17	79	219	<1

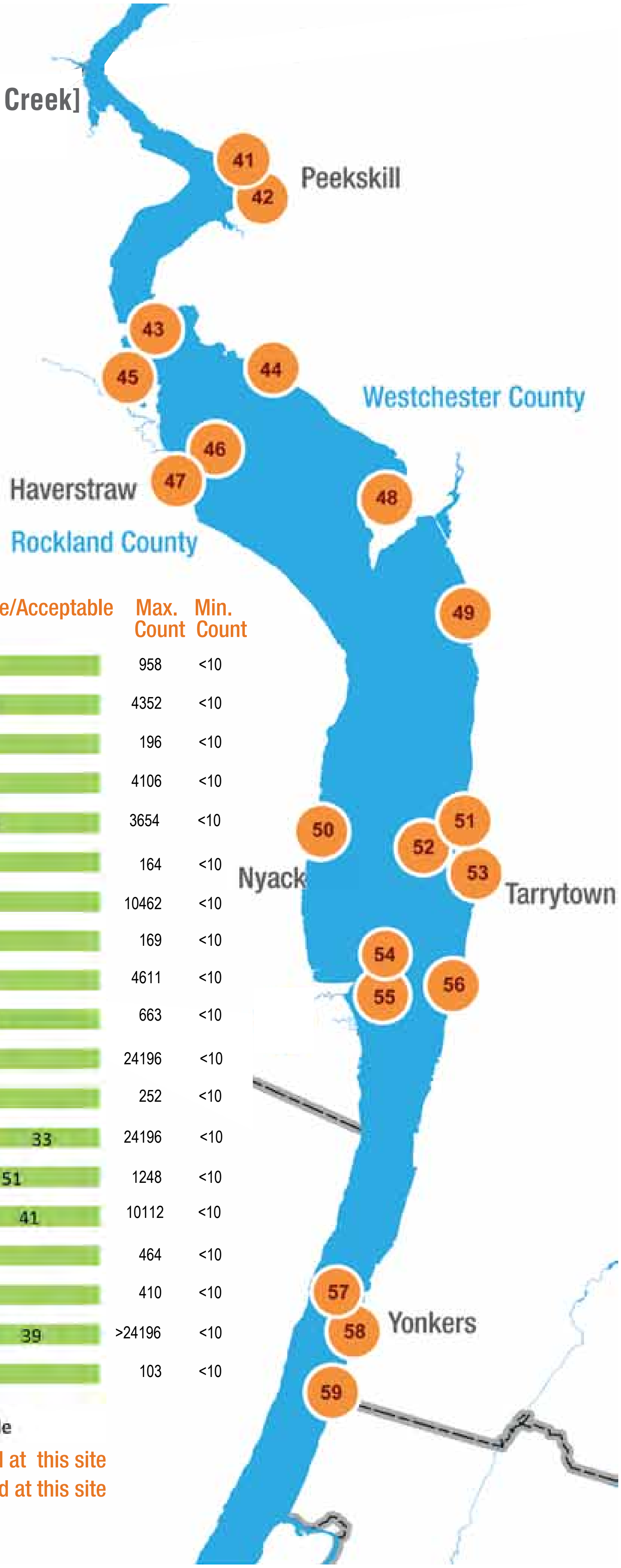
Percentage of Unacceptable/Acceptable: % Unacceptable, % Possible Risk, % Acceptable

Max. count = the highest Enterococcus count we recorded at this site

Min. count = the lowest Enterococcus count we recorded at this site

Westchester-Rockland

[Westchester STP at Yonkers to Annesville Creek]



Site Name	% Unacceptable	% Possible Risk	% Acceptable	Max. Count	Min. Count
41. Annesville Creek	19	4	77	958	<10
42. Peekskill Riverfront Green Park	13	17	70	4352	<10
43. Stony Point midchannel	3	3	94	196	<10
44. Furnace Brook	17	8	75	4106	<10
45. Cedar Pond Brook	29	5	66	3654	<10
46. Haverstraw Bay midchannel	3	11	86	164	<10
47. Emeline Beach - Haverstraw	8	4	88	10462	<10
48. Croton Point Beach	3	5	92	169	<10
49. Ossining Beach	11	18	71	4611	<10
50. Nyack Launch Ramp	19	12	69	663	<10
51. Kingsland Pt. Park, Pocantico River	19	4	77	24196	<10
52. TZ Bridge midchannel	6	4	90	252	<10
53. Tarrytown Marina	40	27	33	24196	<10
54. Piermont Pier	30	19	51	1248	<10
55. Piermont STP Outfall	45	14	41	10112	<10
56. Irvington Beach	8	8	84	464	<10
57. Yonkers midchannel	5	7	88	410	<10
58. Saw Mill River	45	16	39	>24196	<10
59. Yonkers WWTP Outfall		10	90	103	<10

Percentage of Unacceptable/Acceptable: ■ % Unacceptable ■ % Possible Risk ■ % Acceptable

Max. count = the highest Enterococcus count we recorded at this site
Min. count = the lowest Enterococcus count we recorded at this site

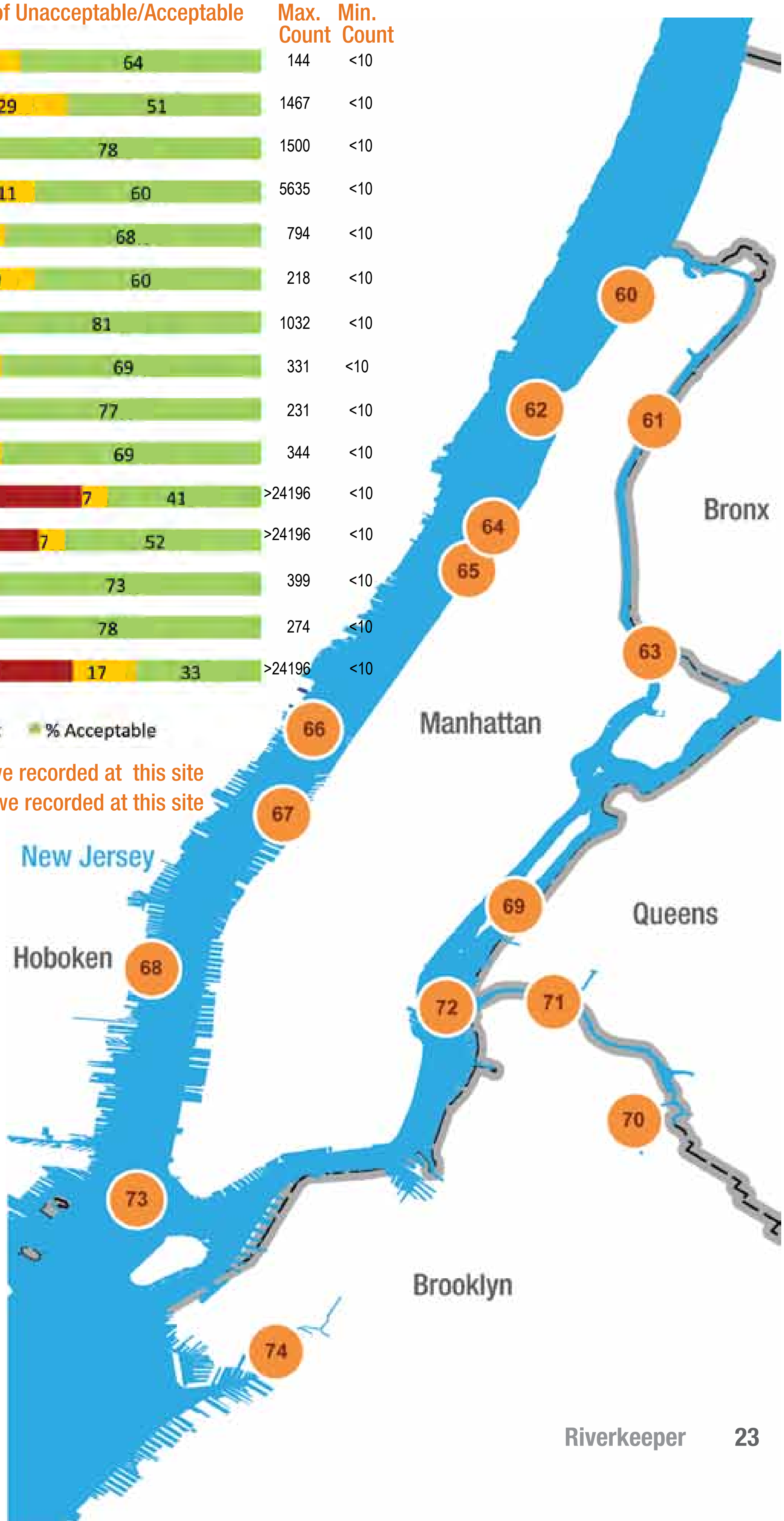
New York City
[Gowanus Canal to Dyckman Street Beach]

Site Name	% Unacceptable	% Possible Risk	% Acceptable	Max. Count	Min. Count
60. Dyckman Street Beach	4	32	64	144	<10
61.Harlem River- Wash. Ave. Bridge	20	29	51	1467	<10
62. GW Bridge midchannel	11	11	78	1500	<10
63. Harlem River- Willis Ave. Bridge	29	11	60	5635	<10
64. 125th St. STP Outfall	18	14	68	794	<10
65. 125th St. Pier	20	20	60	218	<10
66. 79th St. midchannel	11	8	81	1032	<10
67. Pier 96 Kayak Launch	8	23	69	331	<10
68. Castle Point, NJ	12	11	77	231	<10
69. East River at Roosevelt Island	22	9	69	344	<10
70. Newtown Creek- Metro. Bridge	52	7	41	>24196	<10
71. Newtown Creek- Dutch Kills	41	7	52	>24196	<10
72. East River midchannel, 23rd St.	14	13	73	399	<10
73. The Battery midchannel	11	11	78	274	<10
74. Gowanus Canal	50	17	33	>24196	<10

Percentage of Unacceptable/Acceptable

% Unacceptable % Possible Risk % Acceptable

Max. count = the highest Enterococcus count we recorded at this site
Min. count = the lowest Enterococcus count we recorded at this site

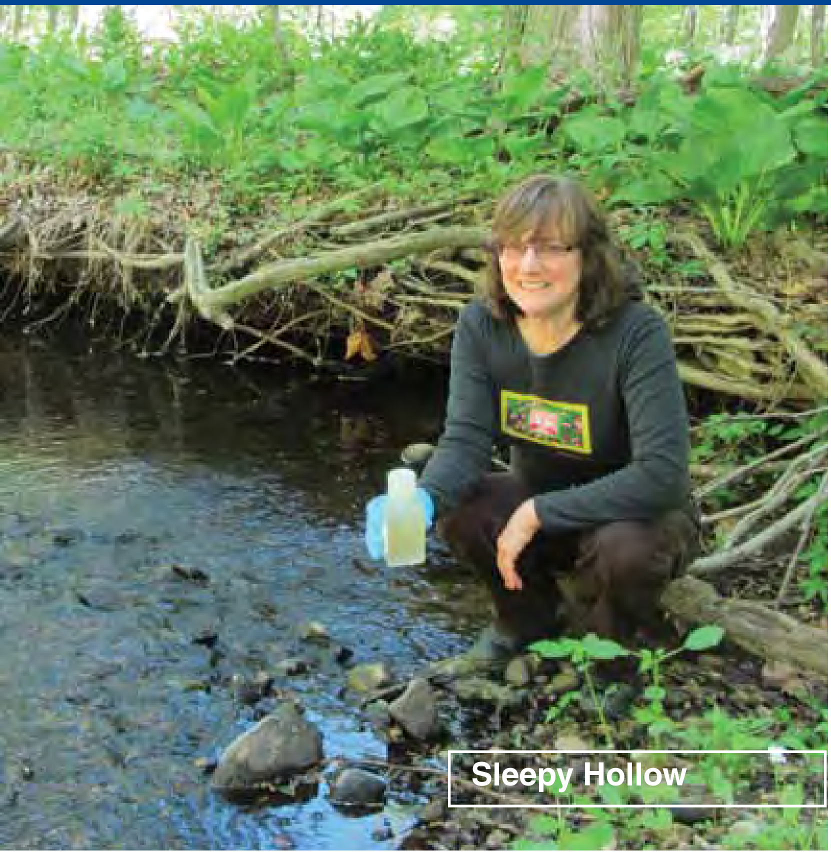


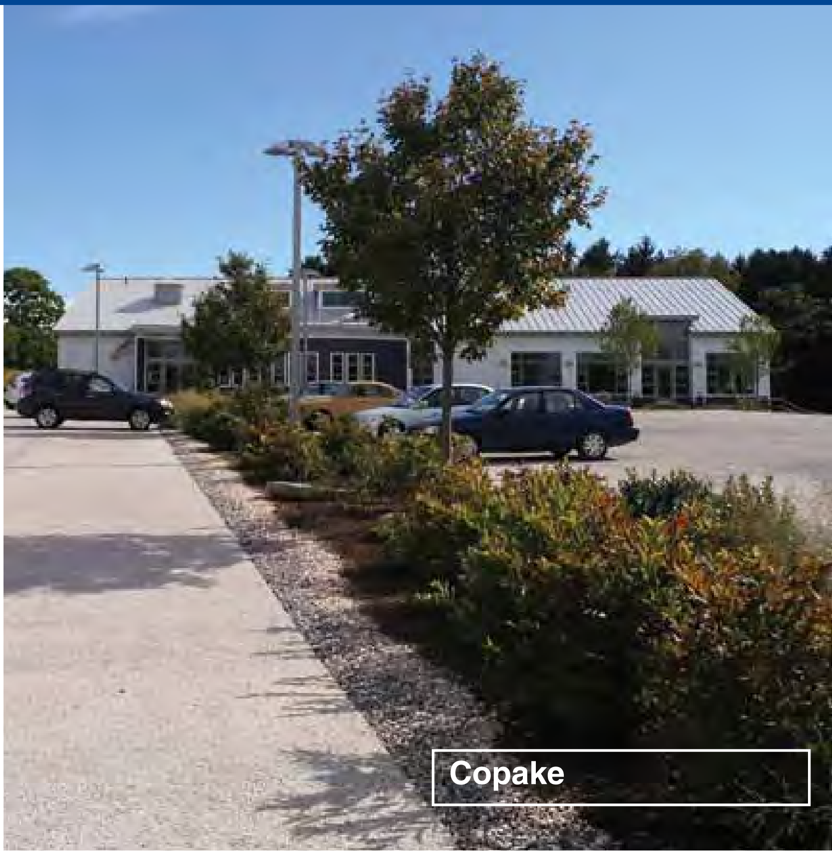
Standard Sampling Sites: North to South

Map #	Name	Description
1	Hudson above Mohawk River	The Hudson River, above the lock at Troy, is no longer part of the estuary. This site has boating, recreational and subsistence fishing and occasional swimming.
2	Mohawk River	Site is below the last Erie Canal lock. It has boating, recreational and subsistence fishing from boats and the shore. There is also occasional swimming.
3	Hudson River above Troy Lock	Site has boating and fishing. The Waterford drinking water intake is in the vicinity.
4	Congress Street Bridge	Site has boating and recreational and subsistence fishing from boats and shore.
5	Albany Rowing Dock	The rowing dock has team rowing, boating and fishing.
6	Dunn Memorial Bridge	In the heart of the port of Albany, contact includes team rowing and swimming from boats. The site also has fishing from shore and from boats.
7	Island Creek/Normans Kill	The two creeks enter the Hudson at this sampling site. There are no facilities, but there is boating through the industrial portion of the Port of Albany.
8	Bethlehem Launch Ramp	The area around the launch ramp has boating and fishing from boat and shore.
9	Castleton, Vlockie Kill	Near the mouth of Vlockie Kill this site has boating and fishing from boats and shore.
10	Coeymans Landing	At a village park, this site has a fishing pier, a marina and a launch ramp for kayaks.
11	Coxsackie Waterfront Park	The park at Coxsackie has an unofficial beach, a launch ramp and a fishing area. Boating and casual water contact occur here.
12	Gay's Point mid-channel	A state park with camping, boating and swimming is directly east of this sample site. It is a relatively undeveloped portion of the estuary.
13	Athens Sewage Treatment Plant Outfall	The Athens Sewage Treatment Plant Outfall is in close proximity to the village water-front, which has boating from small marinas, kayaking and fishing.
14	Hudson Launch Ramp	The launch ramp and boat club at Hudson host kayaking, fishing and boating. There is swimming in the area.
15	Catskill Creek, First Bridge	Near the first bridge over the Catskill Creek, there are marinas, boat traffic and fishing. There is swimming in the vicinity.
16	Catskill Creek, East End	Near the entrance of Catskill Creek, this site has boating, fishing and swimming.
17	Catskill Launch Ramp	The Launch Ramp has casual water contact from boats and fishing.
18	Inbocht Bay	This sampling site has boating and fishing.
19	Malden Launch Ramp	There is a sewage treatment plant outfall near this public launch ramp, which has fishing and casual water contact from boats and jet skis.
20	Esopus Creek West	This site has boating, occasional swimming and fishing. There is a sewage treatment plant outfall nearby to the west.
21	Esopus Creek Entrance	Just in from the lighthouse, there is boating and occasional swimming and fishing.
22	Tivoli Landing	There is an unofficial kayak launch from the rocky shore, as well as boating and fishing.
23	Ulster Landing Beach	This official beach has water contact from swimming and kayaking, as well as some fishing in the vicinity.
24	Eddyville Anchorage	Site in Rondout Creek is heavily used for boating, rafting, swimming, fishing.
25	Kingston Public Dock	Town docks of Kingston and West Strand Park host a marina, boating and fishing on Rondout Creek. There is a combined sewer overflow (CSO) at the site.
26	Kingston Sewage Treatment Plant Outfall	The sewage treatment plant discharges into Rondout Creek at Kingston. Rondout Creek is heavily used for boating, tubing, team rowing, kayaking and fishing.
27	Kingston Point Beach	This official beach has swimming, fishing from the shoreline, kayaking and boating in the vicinity.

Map #	Name	Description
28	Port Ewen drinking water intake	Drinking water intake at Port Ewen is used by a number of communities. Use of the area includes fishing (boats and shore), boating and swimming.
29	Norrie Point Yacht Basin	The yacht basin is located at the mouth of a small tributary. There is boating and fishing.
30	Norrie Point mid-channel	Deep-water site has boating and fishing.
31	Poughkeepsie drinking water intake	Area has boating, team rowing and fishing. The Hudson River drinking water intake is nearby.
32	Poughkeepsie Launch Ramp	Site has a launch ramp, boating, fishing and some swimming from boats.
33	Marlboro Landing	Landing at Marlboro has a marina, as well as kayaking, fishing and swimming from boats. There is a tributary in close proximity.
34	Wappingers Creek	This sample site has swimming from recreational boats, kayaking and fishing.
35	Beacon Harbor	Beacon Harbor sampling site has boating and fishing. There is a seasonal public "river pool" to the north and a storm drain overflow in the vicinity.
36	Newburgh Launch Ramp	Area is heavily used for boating and jet skis, with team rowing and fishing in the vicinity. Next to the ramp is a combined sewer overflow (CSO) and a few hundred yards south is a sewage treatment plant outfall.
37	Little Stony Point	An unofficial swimming beach. There is also boating and fishing.
38	Cold Spring Harbor	The town docks of Cold Spring host a fishing pier, a yacht club and a village waterfront where fishing and boating are popular.
39	West Point Sewage Treatment Plant Outfall	Area is used for boating, team rowing and fishing.
40	Fort Montgomery	Site has boat traffic, fishing and kayaking. A small sewage treatment plant discharges here as well.
41	Annesville Creek	Annesville Creek is a tributary near Peekskill that is popular with kayakers.
42	Peekskill Riverfront Green Park	At site there is a launch ramp, boating and fishing. Swimming at the beach nearby is prohibited but casual contact with the water has been observed.
43	Stony Point mid-channel	Deep-water sampling site has boating and fishing.
44	Cedar Pond Brook	Cedar Pond Brook is a tributary that has boating and fishing.
45	Emeline Beach	Swimming at the beach at Emeline Park is prohibited, yet casual contact with the water has been observed. The site has shore-based fishing, kayaking and boating.
46	Furnace Brook	The Hudson, off Furnace Brook, has recreational and subsistence fishing, as well as kayaking and swimming from boats.
47	Haverstraw Bay mid-channel	Near the ship channel in Haverstraw Bay, this deep-water sampling site has boating and fishing.
48	Croton Point Beach	Croton Point Park has a designated public swimming beach, operated by Westchester County. There is also a high volume of boating and fishing.
49	Ossining Beach	Swimming at Ossining beach is prohibited, yet casual contact with the water has been observed. The beach is immediately north of a sewage treatment plant outfall. There is fishing and boating at this site.
50	Nyack Launch Ramp	Public launch ramp is adjacent to a waterfront park, village marina and private boat club. There is boating and jet skiing, as well as fishing and some swimming.

Map #	Name	Description
51	Kingsland Point Park, Pocantico River	Public park in Sleepy Hollow once had a public swimming beach but swimming is now prohibited. A small private beach and boat club are immediately north of this site. Sites uses include boating, fishing and occasional swimming.
52	Tappan Zee Bridge mid-channel	Deep-water site at the Tappan Zee Bridge has boating and fishing.
53	Tarrytown Marina	Large marina has boating and fishing.
54	Piermont Pier	Piermont Pier is used heavily for recreational and subsistence fishing and crabbing. There is also boating.
55	Piermont Sewage Treatment Plant Outfall	There are two sewage treatment plant outfalls at this sampling site. Use includes boating and fishing.
56	Irvington Beach	This beach is located between a boat club and a village park. The site has kayaking, casual water contact, boating and fishing. There's a combined sewer outflow (CSO) approximately 100 yards to the south.
57	Yonkers mid-channel	This deep-water site has boating and fishing.
58	Saw Mill River	The Sawmill River enters the Hudson at Yonkers. There is boating, recreational and subsistence fishing in this area.
59	Yonkers Sewage Treatment Plant Outfall	This wastewater treatment plant treats sewage from much of Westchester County. The area has boating and fishing.
60	Dyckman St. Beach	Inwood Hill Park has fishing, team rowing, boating and casual water contact at the beach. There is a combined sewer overflow (CSO) under the pier.
61	Harlem River, Washington Ave. Bridge	The Harlem River is an industrial waterway connecting the Hudson with the East River. Contact includes boating, jet skiing and fishing from the shore. There is increasing activity from community and college crew teams.
62	GW Bridge mid-channel	Deep-water sample site at the George Washington Bridge has boating, jet-skiing and occasional swim events.
63	Harlem River, Willis Ave. Bridge	The Harlem River is an industrial waterway, connecting the Hudson with the East River. Contact includes boating, jet skiing and fishing from the shore.
64	125th St. Sewage Treatment Plant Outfall	Wastewater treatment plant is located at Riverbank State Park in Harlem. There is boating and fishing in the area.
65	125th St. Pier	The Pier at 125th St. is a new access point for recreational and subsistence fishing. There is a NYC combined sewer overflow (CSO) immediately to the south.
66	79th St. mid-channel	Deep-water sample site off 79th St. has boating and occasional swim events.
67	Pier 96 Kayak Launch	Kayak launch is in the vicinity of NYC combined sewer overflows (CSOs).
68	Castle Point, NJ	Sample site is located at the HRECOS research buoy of the Stevens Institute of Technology in Hoboken, New Jersey.
69	East River at Roosevelt Island	Site has boating, fishing and occasional swim events.
70	Newtown Creek, Metro. Bridge	Newtown Creek is an industrial waterway and a tributary of the East River.
71	Newtown Creek, Dutch Kills	Newtown Creek at Dutch Kills is a tributary where subsistence fishing, as well as increasing kayak activity has been observed.
72	East River mid-channel 23rd St.	Deep-water sampling site around 23rd St. has mostly transitory boat traffic.
73	The Battery mid-channel	Deep-water sample site has boat traffic and occasional swim events.
74	Gowanus Canal	The Gowanus Canal is an industrial waterway with limited dockage for recreational boats and some kayaking and canoeing.





Clockwise from top left: **Citizen collecting a sample on the Pocantico River; "Green Infrastructure" projects at the Roeliff Jansen Community Library in Copake; Riverkeeper staff and citizens selecting sites for water quality studies on Rondout Creek and Wallkill River; an overflowing STP outfall in Moodna Creek**

Action Agenda:
Improving our Water Quality

There are many actions that we can all take to improve water quality in the Hudson River and elsewhere. Here are six priority solutions that Riverkeeper and our coalition of clean water advocates are currently focusing on:

1. **Reinvest** in Wastewater Infrastructure
2. **Enforce** Existing Water Quality Protection Laws
3. **Improve** NY State Water Quality Standards
4. **Engage** Citizens in Local Solutions
5. **Start** Frequent Water Quality Monitoring & Prediction
6. **Notify** the Public of Sewage Contamination

Riverkeeper sampling at the Westchester County Sewage Treatment Plant in Yonkers

Reinvest in Wastewater Infrastructure Upgrades

Addressing the Source of the Problem

The early gains in water quality that were achieved in the 1970s after the passage of the Clean Water Act (CWA) are now at risk of being lost because our federal, state and local governments have not continued to maintain and update our wastewater infrastructure.

According to the DEC's 2008 report, "Wastewater Infrastructure Needs of New York," many wastewater facilities in NY are past their expected useful lives. Maintenance and upgrades at these facilities are far behind where they need to be to keep up with increasing demand. Statewide, more than 30% of these facilities are in excess of 60 years old, though they were designed to only last 30 to 40 years.[17]

Our state and federal governments need to provide new funding mechanisms for our wastewater infrastructure. Our state agencies and elected officials acknowledge that clean water and efficient wastewater treatment are essential for the future economic health of the Hudson Valley, but our leaders have yet to step up and tackle this growing crisis.

Over the last 20 years federal funding for wastewater infrastructure has been reduced by 70%.


The public beach at Croton Point Park in Croton-on-Hudson

"The importance of modern, reliable, and efficient wastewater treatment systems is self-evident. The health of our communities, the protection of our waterbodies, and the prospects for future economic growth and development, are linked to our ability to maintain, and as necessary, upgrade these facilities. As described in this report, however, aged systems are failing, and municipalities do not have the funds to adequately repair and replace the necessary infrastructure. There is no disputing that the cost of ensuring proper wastewater treatment is larger than what local governments and the state can address on their own. Clearly, there is a compelling need for a sustainable wastewater infrastructure funding program, yet no mechanism presently exists for that funding, and the federal government has largely turned its back on the needs of the states and local governments for this purpose."

– NYS DEC Infrastructure Workgroup from *Wastewater Infrastructure Needs of New York*

Enforce Existing Water Quality Protection Laws

Using the Tools at Hand

In New York State we have yet to muster the political will to use the Clean Water Act to its full effect as an enforcement tool. The law includes the stated goals of achieving swimmable and fishable rivers that are free of pollution discharges by 1985 across the country. And yet in New York State, through good economic times and bad, we have issued thousands of permits allowing businesses and municipalities to continue discharging pollutants into our waters.

Of the 42 sewage treatment plants on the Hudson Estuary 14 have been out of compliance for more than 3 years.

There were 14 sewage treatment plants on the Hudson River that had been out of compliance with their permits for more than three years at the time of publishing—in Albany, Troy, Rensselaer, Poughkeepsie, Yonkers, and New York City.[18] This sad state of affairs will not change until the public and our elected officials call on the DEC to fully enforce the laws that regulate our wastewater systems, requiring private and municipal plants to come into compliance with the CWA.

New York needs a well-funded and properly staffed Department of Environmental Conservation with public and political support to enforce the Clean Water Act and other regulations that protect our water and public health.

Notify the Public of Sewage Contamination

The Sewage Right to Know Law

The key to turning the tide of sewage contamination in the Hudson is public awareness. If we don't know about sewage releases—planned, accidental or chronic—we can't make an informed decision about where and when we get in the water. And we can't push for change.

The Sewage Pollution Right to Know Act requires public notification within four hours of the discharge of raw or partially treated sewage.

In 2011 and into early 2012, Riverkeeper worked with our New York State representatives to draft and pass the Sewage Pollution Right to Know Act. The effort had widespread support from our membership, the public and a coalition of 25 groups representing waterways and communities across New York State.[19] Governor Cuomo signed the legislation into law in August of 2012 and it is scheduled to go into effect on May 1, 2013.[20]

The Sewage Pollution Right to Know Act requires our Publicly Owned Wastewater Treatment Plants and the public sewer systems that feed into those plants to notify the public within four hours of discharges of raw or partially treated sewage into our waterways, including CSO releases. Notification will happen via local news outlets and the website of the DEC.

In addition, the DEC will produce a statewide Sewage Discharge Report each year that will document annual discharges and remedial responses taken. This report will provide New Yorkers with a much-needed road map showing where our sewage infrastructure is failing with greatest frequency.

Boys who were swimming in the Hudson near the North River Treatment Plant in Harlem on July 21, 2011, during the 250 million gallon sewage release, after we told them to get out of the water.

This CSO outfall discharges raw sewage and stormwater into the lower Rondout Creek, a popular swimming spot in Kingston. After the Sewage Right to Know law goes into effect in 2013, the sewage treatment plant that bypasses to this outfall will have to notify the public when they discharge.

The law does not cover privately owned Wastewater Treatment Plants and chronic sewage contamination that is not linked to an identified discharge point. Riverkeeper will continue our work to ensure that the public is notified where and when sewage is discharged into the Hudson River. We will track the enforcement of the Sewage Pollution Right to Know Act to ensure that it is fully implemented and work on future amendments to the law to strengthen and expand it.

Start Frequent Water Quality Monitoring and Predictive Modeling

We Can't Manage What We Don't Measure

When you ask the people swimming at the many access points along the river if the water is safe, you'll often hear "If it wasn't safe, they wouldn't let us swim in it." This false assumption is putting people at risk of contracting a waterborne illness, with the possibility of serious long-term health consequences.

People who enjoy swimming in the Hudson deserve the same protection as their neighbors swimming in the Long Island Sound and the Atlantic Ocean. At those locations local governments or health departments regularly test water quality, and close beaches when they either fail to meet EPA guidelines for safe swimming or are expected to fail based on historical data and modeling.

High frequency sampling should be the standard for all Hudson River swimming areas. But sampling alone isn't enough. Because the standard tests for sewage contamination require an incubation of 24 hours, it's important to develop a *predictive water quality model* for each location.

A good predictive model can take into account various factors, including correlation between rainfall and sewage/pathogen levels, flow rates and water quality of nearby tributaries, turbidity and algae. Combining these factors with historic and ongoing water quality data, our government agencies can make real-time water quality predictions for the Hudson River, anticipating unacceptable swimming conditions and protecting public health.[21]

Consistent, frequent sampling, combined with predictive water quality modeling, should be the standard for all Hudson River beaches.

Riverkeeper sampling after the North River Plant fire and sewage release, NYC, July 2011

Improve New York State Water Quality Standards

Weighted Averages Don't Tell Us Where and When It's Safe to Swim

Currently New York State evaluates Hudson River water quality using an average called a "geometric mean." This approach to averaging greatly reduces the influence of extremes (very high or low microbial counts). While a geometric mean is a useful indicator of long-term trends in water quality, it doesn't accurately represent the extreme spikes of sewage contamination, so it isn't the best tool for protecting bathers from day-to-day conditions.

This is why the EPA "single sample maximum" for acceptable water quality, as outlined in the federal BEACH Act, is recommended for use in recreation waters nationwide and should be employed on the Hudson River Estuary. EPA considers the single sample maximum level to be "especially important for beaches and other recreation waters that are infrequently monitored or prone to short-term spikes in bacteria concentrations, e.g., water that may be affected by combined sewer overflow outfalls."[22]

The Hudson River fits this description well. As our data demonstrate, the Hudson is prone to periodic spikes in *Enterococci* concentrations and is impacted heavily by combined sewer overflows. Therefore, Riverkeeper urges New York State to update our state Recreational Water Quality Standards and to adopt the EPA recommended single sample maximum for the Hudson River in addition to the geometric mean standard.

We are also calling on the DEC to extend the jurisdiction of the BEACH Act to include Hudson River beaches and to recognize the EPA preferred sewage indicator *Enterococcus* for water quality testing and assessment.

Riverkeeper urges New York State to update our state Recreational Water Quality Standards and to adopt the EPA recommended single sample maximum for the Hudson River in addition to the geometric mean standard.

Engage Citizens in Local Solutions

When Riverkeeper started to post the findings of our Water Quality Testing Program, we were concerned that the public might be discouraged or disgusted and turn its back on the Hudson. Instead, as people realize that water quality is a local issue, they're becoming involved in finding local solutions.

Riverkeeper is fortunate to be working with many committed individuals and groups concerned about water quality—including in 2012, 60 volunteers testing 160 miles of six Hudson River tributaries. Here are some examples of how local communities and interested individuals can get involved.

Citizen Scientists Take Action

In 2010 Riverkeeper found sewage contamination in the Esopus Creek in Ulster County. Motivated by these unacceptable samples, a resident contacted us and started a sewage-contamination study on the Esopus, using local residents to collect samples and the Riverkeeper Water Quality Program to incubate them and QA/QC the data.

Using that collaboration as a pilot study, we now have similar citizen science efforts underway in five counties, on six tributaries—the Sparkill Creek, Pocantico River, Wallkill River, Rondout Creek, Catskill Creek and Esopus Creek. In New York City we are collaborating with the NYC Water Trail Association and the River Project on a citizen-led study that engages residents in weekly water quality sampling at public access points all around the city.

Our citizen science partners are using this data to find and stop illicit sewage discharges, drive investment in their wastewater infrastructure, and notify their local communities about water quality conditions.[23]

Green Infrastructure Cleans Water

Green infrastructure is a system of natural landscapes and engineered systems that mimic natural systems, working together to collect and divert stormwater, keeping it out of the storm drains, sewers and waterways. Green infrastructure projects large and small can alleviate pressure on strained sewer systems and divert stormwater from CSOs, reducing the volume of sewage overflows and urban runoff entering our waters. Citizens can work with their local governments to promote the development of green infrastructure solutions in their communities.[24]

Green Infrastructure Projects in the Hudson Valley

Vegetated Swale in the Village of Greenwood Lake. Swales are natural drainage paths or vegetated channels used to transport water instead of storm sewers or concrete channels. They allow for the filtering of pollutants and infiltration of runoff into groundwater.

Rain Garden at the Kingston Library. The roof leaders on this building were connected to the city sanitary sewer system, carrying roof runoff to the Kingston Sewage Treatment Plant and contributing to combined sewer overflows. Now the runoff is absorbed by the rain garden.

Green Roof at Marist College. Green roofs are layers of soil and vegetation installed on rooftops that capture runoff. They absorb rainwater, provide insulation and help lower urban air temperatures.

Rain Garden at the Mt. Pleasant Highway Garage. Rain gardens manage and treat stormwater by filtering runoff through soil and vegetation within a shallow depression.

Water Conservation - a Simple, Affordable Solution

Individuals, towns and businesses can further reduce the pressure on their sewer system by reducing water use. After all, it's not only sewage that flows through our wastewater treatment plants, it's also the water from our sinks, showers and in some instances our storm drains and basement sump pumps. **Individuals and businesses need to be educated on the importance of water conservation even in non-drought situations, improve their water usage habits and implement long-term solutions such as low flow sinks and toilets and grey water systems.**

Riverkeeper is fortunate to be working with many committed individuals and groups concerned about water quality—including in 2012, 60 volunteers testing 160 miles of six Hudson River tributaries.

Maintaining Our Septic Fields

According to the DEC about 25% of New York businesses and residents use onsite sewage treatment systems such as septic tanks and fields.[25] When installed and maintained properly they are an effective and economical wastewater treatment system. However improper installation, the overuse of both small and large systems, an increase in the number of systems per acre, and the widespread lack of proper maintenance has turned these systems into a significant water quality problem, earning them a place on the DEC's "Top 10 Water Quality Issues in NYS" list.[26]

Currently New York State lacks the laws needed to require the inspection and maintenance of private septic systems. As a result, counties are starting to address the problem with regulations such as the pump-out rule that Westchester County put into effect in March of 2011. More counties need to follow suit and all businesses and homeowners who have septic systems need to do the right thing and conduct regular maintenance.

A young citizen sampler in the Pocantico River in Sleepy Hollow

Conclusion

Forty years ago citizens across America rose up and demanded that our federal government take decisive action to reclaim and clean up our water and air. As a result of that groundswell of activism we have the Clean Water Act and the Clean Air Act, arguably the two most important environmental laws in our country. Thanks to these laws and the tireless work of countless activists on behalf of the Hudson, we can now have this conversation about safe swimming in the Hudson, a conversation many people did not think we would ever have.

The public that lives on and visits the Hudson today must expect and demand swimmable water quality in order to achieve it. We can use the data available to us to find the good swimming spots and get in. More important, we can use the available data to identify problem areas and get to work cleaning them up.

Riverkeeper will continue to sample, study, collaborate and advocate on behalf of clean, healthy Hudson River water. Our communities and government agencies need to gather more data, develop models and share what we know as efficiently and widely as possible. Together we can achieve a truly swimmable Hudson River.

Join Riverkeeper and Support the Water Quality Program

Achieving and maintaining clean water in today's world requires measurement, notification, smart planning and investing, good water use habits and vigilance. Riverkeeper is committed to continuing our Water Quality Study on the Hudson as well as expanding our efforts to engage and increase the number of capable water quality advocates in our communities.

We encourage you to join this movement! Become a Riverkeeper member today and sign up to receive our e-letters.

- ☐ **Become** a Riverkeeper Member
- ☐ **Sign up** for our e-letters and stay informed
- ☐ **View** our online water quality database
- ☐ **View** our archive of water quality reports

www.riverkeeper.org

Riverkeeper
20 Secor Rd.
Ossining, NY 10562
info@riverkeeper.org
1-800-21-RIVER

The data page for our sampling site at the Kingston Public Dock. This and all other data pages can be viewed at: www.riverkeeper.org/water-quality/locations

Appendix I: Other Pollutants in the Hudson River

Sewage is just one of the pollutants found in the Hudson River Estuary. As the pollutant most frequently linked to waterborne illnesses it is the focus of Riverkeeper's Water Quality Program and Swimmable River Campaign.

Other pollutants found in the Hudson include PCBs, radioactive contaminants such as tritium and strontium-90, nutrients such as nitrogen and phosphorus, heavy metals and a variety of toxins. Some of the toxins in the Hudson come from our wastewater treatment plants, which also treat water from industrial facilities and factories in river communities. Other toxins come from our bodies and homes, via wastewater. These are the byproducts of the medicines, beauty care products, household cleaners, disinfectants, insecticides and other products we use, many of which are not efficiently removed with current wastewater treatment technology and therefore end up in the river.

Our water quality study, and this report, address only sewage pollution.

Appendix II: Waterborne Illnesses and Human Health

Most waterborne disease-causing microorganisms are found in human and animal fecal waste. A small drop of fecal matter can contain millions of microorganisms of many types, some of which are disease-causing pathogens. Exposure to the microbial pathogens found in sewage can lead to short-term and chronic illnesses.[27]

The most common types of waterborne illnesses are short-term gastrointestinal infections that cause stomachaches and/or diarrhea. The elderly, children, pregnant women, and people with compromised immune systems are at greater risk of contracting chronic illnesses from sewage-contaminated water.

A survey by the Center for Disease Control reported over 4,000 documented illnesses from recreational waters in the U.S. in 2005-2006.[28] However this number is assumed to be low because waterborne illnesses are notoriously underreported. People often associate the most common ailments, stomach and digestive system problems, with what they ate for lunch instead of contact with water. Still, reports of illness resulting from swimming are on the rise.

.

Acute and Chronic Health Effects Associated with Waterborne Pathogens

TYPE	AGENT	ACUTE EFFECTS	CHRONIC OR ULTIMATE EFFECTS
BACTERIA	*E. coli O157:H7*	Diarrhea	Adults: death (thrombocytopenia)
	Legionella pneumoniae	Fever, pneumonia	Elderly: death
	Helicobacter pylori	Gastritis	Ulcers and stomach cancer
	Vibrio cholerae	Diarrhea	Death
	Vibrio vulnificus	Skin & tissue infection	Death in those with liver disorders or problems
	Campylobacter	Diarrhea	Death: Guillain-Barré syndrome
	Salmonella	Diarrhea	Reactive arthritis
	Yersinia	Diarrhea	Reactive arthritis
	Shigella	Diarrhea	Reactive arthritis
	Cyanobacteria (blue-green algae) and their toxins	Diarrhea	Potential cancer
	Leptospirosis	Fever, headache, chills, muscle aches, vomiting	Weil's Disease, death (not common)
	Aeromonas hydrophila	Diarrhea	
PARASITES	*Giardia lamblia*	Diarrhea	Failure to thrive, severe hypothyroidism, lactose intolerance, chronic joint pain
	Cryptosporidium	Diarrhea	Death in immune-compromised host
	Toxoplasma gondii	Newborn syndrome, Hearing and visual loss, Mental retardation, Diarrhea	Dementia and/or seizures
	Acanthamoeba	Eye infections	
	Microsporidia, (Entero-cytozoon & Septata)	Diarrhea	
VIRUSES	*Hepatitis viruses*	Liver infection	Liver failure
	Adenoviruses	Eye infections, diarrhea	
	Caliciviruses, small round structured viruses, Norwalk virus	Diarrhea	
	Coxsackieviruses	Encephalitis, aseptic meningitis, diarrhea, respiratory disease	Heart disease (Myocarditis), reactive insulin-dependent diabetes
	Echoviruses	Aseptic meningitis	

Source: Centers for Disease Control and Prevention.
Emerging Infectious Diseases, vol. 3, no. 4, Oct-Dec 1997.

Acknowledgments

The extensive field research underlying this report is being conducted by:

John Lipscomb, *Boat Captain*
Riverkeeper, Inc. (www.riverkeeper.org)

Dr. Andrew Juhl, *Lamont Associate Research Professor* **Lamont-Doherty Earth Observatory of Columbia University** (www.ldeo.columbia.edu)

Dr. Gregory O'Mullan, *Assistant Professor*
Queens College, City University of New York (www.qc.cuny.edu)

Carol Knudson, *Research Assistant*
Lamont-Doherty Earth Observatory of Columbia University

Riverkeeper wishes to acknowledge the following individuals for their contributions:

Tracy Brown, *author*

John Lipscomb, Dr. Andrew Juhl, Dr. Gregory O'Mullan, *editors*

John Mickelson, *Geospatial Imaging*

Tim Thayer, **Eyebuzz Design**, *Design and Layout*

Photography provided courtesy of:

Paul Bastin, cover photo and Brooklyn photo page 4

Emily Vail and the Hudson River Estuary Program at DEC for all the Green Infrastructure project photos and descriptions on pages 27 (Copake) and page 33

All the other photographs in this report were taken by Riverkeeper staff John Lipscomb, Tracy Brown and Rob Friedman

Riverkeeper thanks our funders:

Funding for the 2007-2010 data collection for this ongoing collaborative project between Riverkeeper, Lamont-Doherty Earth Observatory and Queens College was provided by a grant from the Wallace Research Foundation. We are extremely grateful to have benefited from the foundation's generosity in launching Riverkeeper's Water Quality Program.

For their ongoing support of this and other important Riverkeeper projects we would like to thank the Austen-Stokes Ancient Americas Foundation and the Kowitz Family Foundation.

Riverkeeper also wishes to thank the Brinson Foundation (www.brinsonfoundation.org), Lamont-Doherty Earth Observatory (www.ldeo.columbia.edu) and the Columbia Earth Microbiology Initiative (www.ldeo.columbia.edu/emi) for providing critical funding to purchase necessary equipment and collect data for the 2006-2007 pilot study, and their continuing support.

Riverkeeper is thankful to our members without whom our work would not be possible.

Riverkeeper is an independent environmental organization dedicated to protecting the Hudson River, and its tributaries, and the New York City drinking water supply. Riverkeeper is a founding member of the Waterkeeper Alliance (www.waterkeeper.org) an international organization that works with over 180 Waterkeepers to protect waterways around the globe.

© Riverkeeper Inc., November 2012

Terms for Use of Data and Report Content:

If you use Riverkeeper data as background or ancillary information for any presentation, publication, website, or educational product, please include proper acknowledgement:

"Riverkeeper data collected by O'Mullan GD, Juhl AR, and Lipscomb J, available at www.riverkeeper.org/water-quality. Partial Funding provided by Riverkeeper, Lamont Doherty Earth Observatory of Columbia University, and CUNY Queens College."

If you would like to use the Riverkeeper data as an integral contribution to any publication or educational product, please contact us to discuss potential collaboration and appropriate determination of authorship: tbrown@riverkeeper.org or info@riverkeeper.org.

Endnotes

1. Rose, J.B., et al., "Microbial Pollutants in Our Nation's Waters: Environmental and Public Health Issues." American Society for Microbiology, Washington, D.C., 1999.
2. Geometric Mean is a method for calculating average bacteria concentrations that greatly reduces the influence of very high or very low values—it is a type of weighted average, or mean, that indicates the central tendency of a set of numbers.
3. Riverkeeper bases our assessment of acceptable water quality on EPA's federal guidelines for recreational water quality outlined in the 2000 Beaches Environmental Assessment and Coastal Health (BEACH) Act. See page 9 for the numeric guidelines.
4. Dorfman, M. and K.S. Rosselot. "Testing the Waters: A Guide to Water Quality at Vacation Beaches." Natural Resources Defense Council, 20 November 2012 <www.nrdc.org/water/oceans/ttw/default.asp>.
5. "A Gathering Storm - New York Wastewater Infrastructure in Crisis." New York State Department of Environmental Conservation. 20 November 2012 <www.dec.ny.gov/chemical/48803.html>.
6. Schnapf, L. "Leaked NYSDEC Memo Illustrates Dire Consequences of Budget Cuts." Common Ground. 19 January 2012 <commonground.edrnet.com/posts/8aad9611fd>.
7. Dorfman, M., and K.S. Rosselot.
8. Riverkeeper survey of county water quality testing in the Hudson River Estuary, March 2012.
9. New York Harbor water quality data is available online at <www.nyc.gov/html/dep/html/harborwater/harbor_water_sampling_results.shtml>, New York Harbor water quality reports are available online at <www.nyc.gov/html/dep/html/news/hwqs.shtml>.
10. For more information on our science partners visit <www.riverkeeper.org/water-quality/hudson/our-partners/>.
11. At the time of publication EPA issued an update to the federal Recreational Water Quality Criteria. Riverkeeper's Water Quality Program is reviewing the new criteria and will adjust our rating system to reflect the new criteria in early 2013.
12. "NYC Green Infrastructure Plan: A Sustainable Strategy For Clean Waterways." New York City Department of Environmental Protection, New York, NY, 2010 p. 8.
13. R. Ferraro, Director, Capital District Regional Planning Commission, personal communication, July 5, 2011.
14. A CSO Long Term Control Plan (LTCP) consists of a comprehensive evaluation of long term solutions to reduce CSOs and improve water quality in receiving waterways and waterbodies. The goal of the LTCP is to identify appropriate CSO controls necessary to achieve waterbody-specific water quality standards, consistent with EPA's Federal CSO Policy and subsequent guidance.
15. 2,420 is the maximum Entero count per 100ml obtained with a standard sample. 24,196 is the maximum Entero count per 100ml obtained with a dilution sample. All samples above 2,420 are dilution samples. The precise Entero count of any sample listed as greater than (>) is not known.
16. "Sustainable Raindrops: Cleaning New York Harbor by Greening the Urban Landscape." Riverkeeper, Ossining, NY 2008.
17. "Wastewater Infrastructure Needs of New York." New York State Department of Environmental Conservation. Albany, NY. 2008 <www.dec.ny.gov/docs/water_pdf/infrastructurerpt.pdf>.
18. Updated information on permit violations and compliance are available online at <www.epa-echo.gov/echo/>.

19. Riverkeeper and Citizens Campaign for the Environment collaborated on the drafting and passage of the Sewage Right to Know Law. Coalition members that actively supported this campaign include- Alliance for the Great Lakes, Buffalo Niagara Riverkeeper, Clean Ocean Action, Clearwater, Environmental Advocates of NY, Hackensack Riverkeeper, Hudson River Watertrail Association, Natural Resources Defense Council , Newtown Creek Alliance, New York City Watertrail Association, NY League of Conservation Voters, Inc., NY/NJ Baykeeper, Operation Splash, Peconic Baykeeper, Scenic Hudson, Inc., Sierra Club Atlantic Chapter, Sludge Stoppers Task Force, Surfrider, S.W.I.M. Coalition, Lake George Waterkeeper, The Fund for Lake George, The River Project, Upper St. Lawrence Riverkeeper, and the Waterkeeper Alliance.

20. Read the NY State Sewage Pollution Right to Know law #A10585A-2011 <open.nysenate.gov/legislation/bill/A10585-2011>.

21. Predictive water quality models for the Hudson would not be unusual; New York State is already using predictive models to manage beaches on the Atlantic Ocean and the Long Island Sound. Those beaches are covered by the federal BEACH Act but Hudson River beaches are not.

22. "Water Quality Standards for Coastal Recreation Waters: Using Single Sample Maximum Values in State Water Quality Standards." Office of Water, United State Environmental Protection Agency. Washington, DC. August 2006.

23. There are other approaches and techniques for monitoring local waterways and improving water quality. Some counties facilitate stream-monitoring programs in their communities, as do some parks and nature centers. The Hudson River Estuary Program at the DEC offers a number of programs that support watershed and tributary health such as tree planting for bank restoration and eel and amphibian monitoring.

24. See more examples of green infrastructure (GI) projects in the Hudson Valley and learn about how to initiate GI projects in your community at the DEC website <www.dec.ny.gov/lands/58930.html>.

25. "Inadequate Onsite Wastewater Treatment." New York State Department of Environmental Conservation. 20 November 2012. <www.dec.ny.gov/chemical/69653.html>.

26. "Top 10 Water Quality Issues in NYS." New York Department of Environmental Conservation. 20 November 2012 <www.dec.ny.gov/chemical/69240.html>.

27. Rose, J.B., et al.

28. Yoder, J., et al., "Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water Use and Other Aquatic Facility-Associated Health Events." Center for Disease Control, Washington D.C., 2008.

RIVERKEEPER®

NY's clean water advocate

www.riverkeeper.org

RIVERKEEPER
NY's clean water advocate
20 Secor Road
Ossining, NY 10562

Nonprofit Org.
US Postage
PAID
White Plains, NY
Permit No. 2429