Sewage Overflows in Pennsylvania's Capital

Harrisburg's chronic releases of sewage mixed with stormwater are an example of PA's failure to address water quality

ENVIRONMENTAL INTEGRITY PROJECT

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THE ENVIRONMENTAL INTEGRITY PROJECT

The Environmental Integrity Project (http://www.environmentalintegrity.org) is a nonpartisan, nonprofit organization established in March of 2002 by former EPA enforcement attorneys to advocate for effective enforcement of environmental laws. EIP has three goals: 1) to provide objective analyses of how the failure to enforce or implement environmental laws increases pollution and affects public health; 2) to hold federal and state agencies, as well as individual corporations, accountable for failing to enforce or comply with environmental laws; and 3) to help local communities obtain the protection of environmental laws.

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PHOTOS:

Cover: Photo of sewer along the Susquehanna River in Harrisburg by Tom Pelton. Other photos: Tom Pelton, EIP and Wikimedia Commons.

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Executive Summary

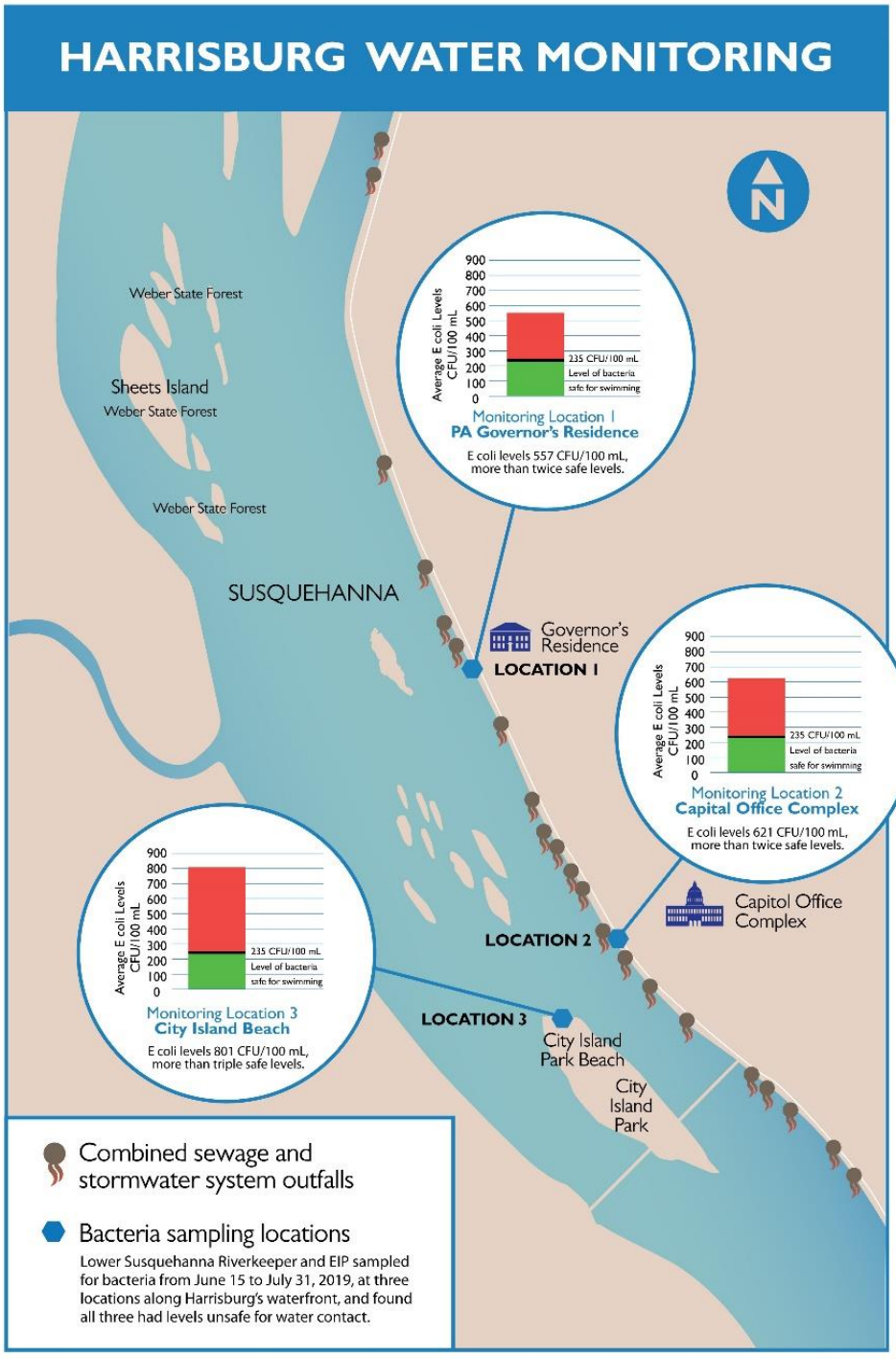
Among Chesapeake Bay region states, Pennsylvania is both the largest source of water pollution[1] and the state that has done the least to achieve regional goals for restoring the health of the nation's largest estuary, according to the Environmental Protection Agency.[2] But the Keystone State's impact on downstream neighbors is less relevant to Pennsylvania residents than the reality of the chronic contamination of local waterways that the Commonwealth's citizens can no longer enjoy for swimming, fishing, and other forms of recreation.

A politically significant example in is the state capital, Harrisburg, which last year released almost 1.4 billion gallons of mixed sewage and stormwater, a near record, into the Susquehanna River, the Bay's largest tributary, according to a report from Capital Region Water.[3] Harrisburg boasts a beautiful waterfront park, riverwalk, and public beach. But water sampling by the Environmental Integrity Project and Lower Susquehanna Riverkeeper in the summer of 2019 found *E coli* bacteria levels along the city's waterfront averaging almost three times higher than would be safe for swimming or water-contact recreation.[4] Of the 60 water samples analyzed from June 15 to July 31, 2019, almost half (29) violated health standards. Seven samples showed *E coli* levels more than 10 times safe levels, including on City Island Park beach, and along the riverwalk just downstream from outfalls leading from the Governor's Residence and the Capitol Office Complex.

The underlying problem is Harrisburg's neglected and antiquated sewer system, which combines sewage and stormwater and intentionally pipes raw human feces and urine directly into local rivers and streams whenever it rains. Harrisburg has one of the largest of 31 combined sewage and stormwater systems in Pennsylvania's section of the Chesapeake Bay watershed.[5] That is more than triple the number of cities with these primitive sewer systems in any other state in the Bay region. Overall, Pennsylvania's cities and towns with combined sewer and stormwater systems release an average of 26 billion gallons of mixed sewage and stormwater into local waterways in a typical

Lower Susquehanna Riverkeeper Ted Evgeniadis taking a water sample at City Island Park beach in Harrisburg. Sampling found levels of fecal bacteria several times higher than would be safe for water contact.

year, according to EPA.[6] This waste contains, depending on estimates, between 1.3 million and 2.6 million pounds of nitrogen and 220,000 and 278,000 pounds of phosphorus annually.[7] In a typical year, Harrisburg and the six surrounding suburbs served by the Capital Region Water authority release about 789 million gallons of mixed sewage and stormwater into the Susquehanna River, according to reports by the Capital Region Water.[8] In 2017, the amount released was 899 million gallons.[9]



This is only a small portion of Pennsylvania's pollution entering the Bay. But the sewage contains pathogens that have a major impact on local water quality and can make people sick if they come into contact with it. According to EPA, raw sewage harbors viruses, bacteria, worms, and protozoa, and can cause diseases in people including stomach flu, respiratory infections, and potentially life-threatening illnesses such as dysentery and Hepatitis B.[10] The nitrogen and phosphorus in the waste also contribute to algal blooms and low-oxygen dead-zones that harm fish and other aquatic life.

In response to chronic violations of the federal Clean Water Act, the Pennsylvania Department of

Environmental Protection (DEP) and EPA in 2015 signed a consent decree with Harrisburg's water authority meant to address the sewage issue.[11] However, the agreement was only a "partial" consent decree – meaning it did not fully solve the problem.[12] Since then, DEP and EPA have taken a passive approach with Harrisburg, failing to penalize about 80 percent (105 of 131) of the self-reported sewage discharge violations by Capital Region Water from 2015 through 2018, according to DEP records.[13]

The 2015 sewage agreement did not impose any penalties on Harrisburg or any requirements that the local water authority close any sewage outfalls, or invest in underground storage tanks to contain overflows during rains. This made the Harrisburg consent decree unlike sewage control agreements EPA signed with other regional cities with antiquated pipes that mix sewage and stormwater, such as Scranton, Pa., Washington D.C., and Arlington, Va. Harrisburg's agreement does not require the city to stop all sewage releases by a certain date, or conduct any testing for bacteria along the city's waterfront to make sure pollution control efforts work. Instead, Harrisburg's agreement requires its Capital Region Water authority to merely develop a long-term plan to reduce (but not eliminate) combined sewage overflows.

Children often play along the waterfront at Harrisburg's City Island Park beach, even though the water is closed because of high bacteria levels. Tyler Lowery, 26, said he's frustrated that his children can't swim because of all the pollution. "I swam here when I was a child. It'd be nice if my kids could swim here, too."

The Capital Region Water authority's plan,[14] released in 2018, proposes that Harrisburg area ratepayers pay $315 million over 20 years to improve the maintenance of the existing combined sewage and stormwater pipes, upgrade a pumping plant, improve outfall regulation devices, as well as plant trees and rain gardens and create other "green infrastructure" to help soak up rainwater.[15] In theory, the results are supposed to reduce the amount of sewage mixed with stormwater flowing into the Susquehanna River by a little more than half, from an average of about 800 million gallons a year now, down to at least 332 million gallons annually.[16] It is unclear whether Harrisburg's plan will work, however, or whether it will be enough to reduce bacteria levels to the point that Harrisburg's waterfront will be "swimmable" again, which is what the federal Clean Water Act requires. If the plan falls short, area residents may end up paying too much for a solution that doesn't fix the problem.

There is no question that "green infrastructure" should be seen as an important part of any city's efforts to control its stormwater runoff pollution. Capital Region Water should be applauded for incorporating more trees, green roofs, and rain gardens into its plans for Harrisburg. However, "green infrastructure" is a necessary but not sufficient step. Planting

trees and installing rain gardens should be done in addition to, and not as a complete substitution for, fixing the underlying problem of pipes that are designed to funnel human waste directly into public waterways. All local residents would enjoy an expansion of parks and green spaces in Harrisburg. But the city's plan should be designed to achieve explicit water quality goals that include eliminating dangerous bacteria levels that make the Susquehanna unsafe for swimming and water-contact recreation. A greening of the urban landscape should not be a replacement for improvements to infrastructure and regular bacteria monitoring along the waterfront to make sure that pollution control activities actually work, and that bacteria concentrations in the river actually decline.

The continued sewage overflows in Harrisburg – and the state's failure to fix the problem – are symbolic of a larger failure of Pennsylvania's elected officials to address water quality problems. This is because the overflows include untreated human waste from the Governor's Residence, located on the banks of the Susquehanna, and from the nearby Pennsylvania State Capitol Complex. One outfall immediately downstream from the Governor's Residence, for example, overflowed into the Susquehanna River 64 times last year – more than once a week – releasing more than 9 million gallons of sewage mixed with stormwater into the waterway.[17] That outfall, like all 58 of the combined outfalls in the city, was built with a dam-like structure that, during dry conditions, is designed to divert the flow of wastewater into a pipe that leads to the Harrisburg's sewage treatment plant. However, because rain frequently overwhelms the system, that device worked to contain only 47 percent of the sewage and stormwater last year. That meant that a majority (53 percent) of the mixed sewage and wastewater from this part of the city poured directly, without any treatment or filtration, into the Susquehanna River, according to a report by the Capital Region Water authority.[18]

Downstream from the outfall pipe near the governor's mansion is Harrisburg's only public swimming area – the City Island Park beach – which is closed because of unhealthy bacteria levels. Neither the city, regional water authority, or the state monitors bacteria levels in the river regularly, despite the frequent sewage overflows, with no government testing the last three years.

To fill this gap in monitoring information, the Environmental Integrity Project worked with the Lower Susquehanna Riverkeeper to conduct sampling for bacteria from June 15, 2019, through July 31, of this year, with testing performed by an independent laboratory.[19] The 60 water samples showed that bacteria concentrations in the river along the city's waterfront were consistently higher than is safe for swimming or water contact recreation. In terms of averages, on City Island Park beach, bacteria levels averaged 801 CFU/100 ml water, more than triple the state's swimming water standard of 235/100 ml.[20] Just downstream from the combined sewage outfalls leading from Governor's Residence beside the Susquehanna River, bacteria concentrations averaged 557 CFU/100 ml of water, more than double the health standard.[21] Downstream from the outfalls leading from the State Office Complex, bacteria levels averaged 621 CFU/100 ml – again, more than double safe levels.[22]

To solve this ongoing sewage problem, at some point in the next few years, EPA and DEP are expected to enter into a final consent decree with the Harrisburg Capital Region Water authority. When this happens, the Environmental Integrity Project urges the federal and

state agencies to significantly strengthen their agreement with the water authority in the following ways:

1) EPA and the DEP should require the Harrisburg Capital Region Water authority to show how its long term plan will demonstrably reduce fecal bacteria levels in the Susquehanna River and allow the public to again use the waterfront for swimming, boating, and fishing.

2) If Harrisburg's plan cannot reduce bacteria levels, EPA and DEP should require Capital Region Water to do more to fix the underlying plumbing problem, such as by building underground storage tunnels to temporarily hold waste during storms before treatment. Such tunnels are already being built by Alexandria, Va., and Washington D.C., and are expected to reduce sewage and stormwater overflows by more than 90 percent in these cities. That's far more than the 60 percent reduction proposed in Harrisburg at a cost of $315 million.

3) Because Harrisburg is the state capital and almost half of the land in the city is owned by state agencies – which pay no taxes – Pennsylvania should commit to paying most of the cost of improving Harrisburg's infrastructure and reducing the flow of sewage into the Susquehanna River.

4) State and federal regulators should mandate regular testing for bacteria along Harrisburg's riverfront and at City Island Park beach to determine whether the investments being initiated by Capital Region Water actually reduce the flow of sewage into the river. Without verification, it will be impossible to know whether additional steps are needed.

5) The state and federal agencies should enforce a consent decree requirement that Capital Region Water notify the media and general public whenever a combined sewage overflow occurs. Such notifications to the news media are not happening today, according to CRW.[23] Public awareness of the problem will help local residents protect their health and understand the need for investments.

6) EPA and the state should encourage stormwater control systems such as rain gardens, tree plantings, and green roofs. But this green infrastructure should be deployed in combination with sewer system upgrades to end the outdated piping of raw human waste directly into the Susquehanna River.

7) DEP and EPA should officially designate the Susquehanna River around Harrisburg as impaired for fecal bacteria under the federal Clean Water Act. This would force Pennsylvania to develop and follow a cleanup plan (a "Total Maximum Daily Load") to solve the sewage overflow problem.

8) Harrisburg and the other cities in Pennsylvania with combined sewage and stormwater systems should factor into their planning the increased amount of rainfall already deluging the region because of climate change. Failing to calibrate planning for the growing intensity of rainfall may mean that any designs will be overwhelmed.

Pennsylvania's state capital boasts a scenic waterfront that is graced by a public riverwalk, stunning bridges, a gardened island park, and a beach and Victorian-era bathhouse. The beach, however, is closed because of high bacteria levels in the water. The value of all these waterfront treasures is diminished by the raw sewage that continues to be piped directly into the river, including from the Governor's Residence and the State Capitol Complex buildings when state officials flush their toilets. For the sake of Pennsylvania's pride and local water quality, state leaders should dedicate enough state funding to modernize Harrisburg's primitive plumbing system and transform the city into a showcase for the Keystone State's commitment to clean water.

The Big Picture: PA Neglecting Water Quality

The fact that Pennsylvania's government has not solved such a serious water pollution problem on its own doorstep is an example of how the Keystone State has fallen short on water quality issues. In EPA's 2018 midpoint assessment of progress in a plan to improve the Chesapeake Bay by 2025 (called the Chesapeake Bay "Total Maximum Daily Load" or TMDL), the federal agency singled out Pennsylvania for being "significantly off track" to meet nutrient reduction goals. Between 2010 and 2018, the Pennsylvania achieved only 18 percent of its nitrogen pollution reduction targets, instead of the 60 percent it was supposed to achieve by that date.[24] This failure on Pennsylvania's part is particularly problematic because the state is responsible for about 44 percent of the nitrogen pollution that is choking the nation's largest estuary -- far more than any other state and almost twice Maryland's 20 percent.[25]

Governors and lawmakers have cut the budget of the state Department of Environmental Protection substantially over the last decade, with funding for key pollution control programs cut by 26 percent from fiscal 2008 to 2016, according to state budget figures.[26] In Pennsylvania's portion of the Chesapeake Bay watershed, only about 4 percent (7 of 189) of the large- to medium-sized municipal sewage treatment plants have been upgraded to the highest level, with enhanced nutrient removal systems, according to EPA data.[27] (This means they discharge less than 3 mg/liter nitrogen and .3 mg/liter dissolved phosphorus.) By contrast, in Maryland, 63 of the 67 largest sewage plants have been upgraded to this level.[28] In Virginia, about 44 percent (40 of 90) of its large municipal sewage plants have been upgraded to similar standards.[29] Washington DC's one sewage plant – Blue Plains, bay's region's largest – has been upgraded to the enhanced level.

In the area of controlling runoff pollution from farms, about a third of Pennsylvania farms still do not have manure management plans that were required by law more than three decades ago.[30] And the Pennsylvania General Assembly in 1980 actually made it illegal for state or local officials to require farmers to fence their cows out of streams, although this is widely recognized as a standard practice to stop a significant source of water pollution.

Clean Water Act Enforcement Efforts in Harrisburg

Because of Harrisburg's chronic sewage discharges into the Susquehanna River, EPA and the state filed a federal Clean Water Act lawsuit[31] in February of 2015 against Capital

Region Water. CRW is an independent municipal water authority that runs the sewer and water systems for Harrisburg itself, which has a population of about 49,000, as well as portions of surrounding municipalities (the Penbrook, Paxtang, and Steelton boroughs, along with Susquehanna, Swatara and Lower Paxton townships.) The authority serves a total of about 120,000 people in all of these communities, about 75 percent of whom have combined sewage and stormwater systems, some of which date back a century or more and have been badly neglected over time. The authority also runs a regional sewage treatment plant south of the city on the Susquehanna River.

The water pollution control permit for Harrisburg's sewage treatment plant expired on December 31, 2014. Capital Region Water, which operates and has upgraded the plant, submitted a renewal application to the state, but the state has yet to renew the permit.

The 2015 consent decree between EPA and CRW failed to require that the authority, Harrisburg, or any of the other local municipalities pay penalties for years of past violations of the federal Clean Water Act by releasing sewage into the Susquehanna River. The decree also fails to require CRW and the communities stop violating the Clean Water Act and the pollution control requirements in their permit. In fact, the opposite is true. The 2015 consent decree, instead, acknowledges that Harrisburg has financial troubles and, as a result, only had to sign a lenient "partial" consent decree. The parties to the agreement admit that the decree "does not resolve any claims the plaintiffs (EPA and DEP) have," and does not even include the defendant's admission of violating the Clean Water Act or the terms of their pollution discharge permit. Furthermore, although the partial consent decree does require defendants to take certain steps aimed at future compliance with the law, it fails to establish concrete deadlines or even timelines for CRW to come into compliance with the law for many items.

In terms of what the 2015 consent decree does require, the agreement mandates that CRW and Harrisburg perform many specified future tasks aimed at resolving legal violations. These include:

- Prohibiting dry weather sewage overflows from combined sewage and stormwater outfalls;
- Prohibiting sewage overflows of all kinds from the roughly 25 percent of the Harrisburg area that has separate sewage and stormwater pipes;

- Requiring the creation of a "long term control plan" with schedules, deadlines, and timetables for remedial measures required to minimize the impacts of combined sewage and stormwater overflows on local waterways and bring all sewage outfall points into compliance with the federal Clean Water Act's technology-based pollution limits and water quality-based limits;
- Requiring public notification of combined sewage and stormwater overflows;
- Mandating an updated Clean Water Act permit for the city's sewage treatment plant, and compliance with those permit limits.

Since the consent decree was signed in 2015, DEP and EPA have imposed $22,500 in fines on Capital Region Water for 29 violations of its consent decree or sewage plant permit.[32] Three of which were for permit violations at the Harrisburg sewage treatment plant for exceeding ammonia limits.

Overall, Capital Region Water was penalized for only about 20 percent of its self- reported violations from 2015 to 2018 and fined only a small fraction of the penalties that could have been imposed.[33] CRW self-reported 131 illegal sewage incidents during this time period, compared to the 29 for which it was penalized. Under the terms of the consent decree, the water and sewer authority could have been fined $500 to $10,000 per incident, depending on the volume. [34]

Specifically, CRW reported 62 dry weather overflow incidents from combined sewage and stormwater lines – under the terms of the consent decree, all illegal – between 2015 and 2018, including 28 in 2018, 7 in 2017, 23 in 2016, and 4 in 2015.[35] On top of this, the agency also reported overflows from the sanitary sewer lines in the part of the city that has separate sewage and stormwater lines. In this category, the agency reported 69 illegal sewage overflow incidents from sewer pipes during this time period, including 18 in 2018, 10 in 2017, 13 in 2016, and 28 in 2015. Of these 131 illegal sewage incidents, only 26 (or about 20 percent) resulted in penalties from the state or federal agencies.

Harrisburg Sewage Discharges	2015	2016	2017	2018
Volume of sewage mixed with stormwater released during wet weather (gallons)	11 mil.	789 mil.	899 mil.	1.4 billion
Number of incidents of sewage and stormwater pipes releasing waste during wet weather	2,813	2,753	2,466	3,188
Inches of rain (annual)	40.6	40.3	43.9	66.8
Number of dry weather overflow incidents from combined sewage and stormwater pipes	4	23	7	28
Dry weather overflow volume (gallons)	69,346	62,980	3,811	77,727
Dry weather overflows caused by blockages	75%	48%	29%	39%
Number of overflows of sewer lines and other unauthorized discharges of raw sewage *	28	13	10	18

*Source: Capital Region Water semi-annual reports. * Volume of sanitary sewer overflows frequently not reported.*

The big picture is that, since the Capitol Region Water signed the partial consent decree in 2015 to improve the sewage overflow problem, neither the volume nor the frequency of sewage overflows in Harrisburg has decreased, according to the agency's semi-annual

reports to the state and federal governments.[36] This suggests that the actions the agency has taken so far are not solving the problem.

While it is true that in 2018 Harrisburg suffered the second highest rainfall on record (nearly 67 inches), which would explain the high volume of sewage combined with stormwater released that year, the total number of *dry weather overflow* incidents, which should not be impacted by rain, also increased last year, from seven in 2017 to 28 in 2018, according to water authority reports.[37] CRW's chief engineer reported that some of the repairs that the agency is making to the sewer and stormwater lines is knocking debris and sediment into the pipes and causing blockages and overflows downstream.[38] From January to July of 2019, Harrisburg has experienced about 30 inches of rainfall.[39] If this trend continues for the remainder of the 2019, the region is on track to match the previous year's near-record rainfall total[40]meaning that, again, far more sewage and stormwater than the historic average may be leased.

Comparison to Other Cities in the Chesapeake Bay Watershed

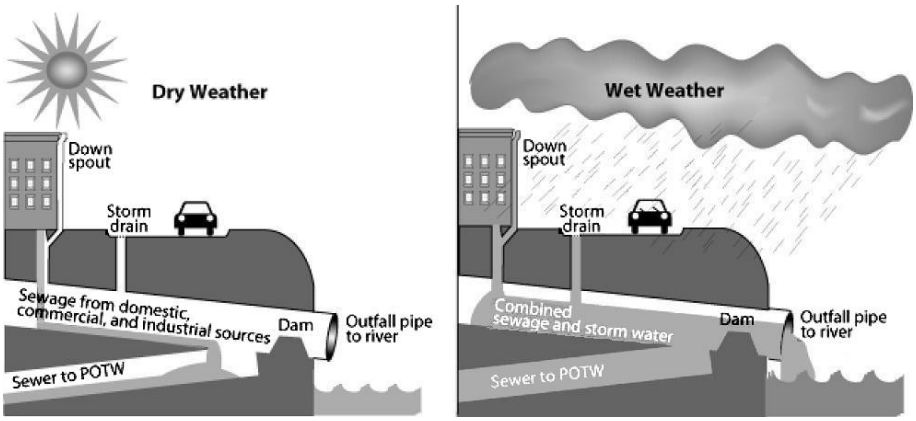
In many ways, EPA and DEP's 2015 consent decree with Harrisburg is weaker and more limited than agreements that the agency has signed with other old cities in the Chesapeake Bay watershed to reduce the sewage discharges from combined sewage and stormwater systems.

For example, Williamsport, Pennsylvania, in 2010, signed a consent decree with EPA that imposed a $320,000 penalty, in contrast to the zero penalty imposed on Harrisburg with its partial consent decree. The Williamsport agreement also gives the city a firm deadline for – among other things – building a new underground containment tank for controlling combined sewage and stormwater overflows during rain events.

In 2012, Scranton signed a consent decree with EPA and DEP that imposed a $340,000 penalty[41] and required Scranton to establish a schedule for building about $140 million of improvements to plumbing and infrastructure, including combined sewage overflow tanks and upgrades to the sewage plant. Scranton's consent decree limits the city to no more than nine overflow events a year into the Lackawanna River (unlike Harrisburg's agreement, which sets no such limits on combined overflows). Scranton had been releasing about 700 million gallons of combined sewage and stormwater per year into the Lackawanna River, only slightly less than Harrisburg.

Outside of Pennsylvania, cities with old combined sewage and stormwater systems, including Alexandria, Virginia, and Washington D.C. – which both release less sewage than Harrisburg – built or are building underground storage tanks to reduce their combined sewage overflows by more than 90 percent. By contrast, Harrisburg's proposed plan would reduce its combined sewage overflows by an annual average of only 60 percent.

In Alexandria, Virginia, the problem of a more than a century-old combined sewage and stormwater system is being solved through a massive construction project that will cost roughly $500 million.[42] The effort will feature a 19-foot-wide, two-mile-long tunnel system that will be 100 feet underground, and is expected to reduce sewage and stormwater overflows by 90 percent.[43] Alexandria has been spilling 140 million gallons of sewage mixed with stormwater a year – less than a fifth as much as Harrisburg, Pa. Virginia lawmakers mandated that Alexandria build the tunnels, giving the city a deadline of 2025 to finish the project. Construction is scheduled to start in 2021.



An EPA illustration of how combined sewage and stormwater systems work. On dry days, sewage is piped to sewage treatment plants (Publicly Owned Treatment Works, or POTW). On rainy days, the sewage mixes with stormwater and is discharged into a nearby waterway.

Washington, D.C., has a combined sewage and stormwater system that covers about a third of the city. Under the terms of a 2005 consent order with EPA, DC Water is building a massive series of underground tunnels – already partially completed – as part of a $2.6 billion project to collect overflows so they can be treated before being released to the Potomac River. Yet Washington's problem is smaller than Harrisburg's, with an average of 654 million gallons of combined sewage overflows from DC annually, according to DC Water.[44] The controls in Washington DC are estimated to reduce combined sewage overflows into the Potomac River by 93 percent by volume and reduce their frequency from approximately 74 events to 4 events in an average year, according to DC water.[45]

In Richmond, back in 1990, the city built a 50 million gallon combined sewage retention facility and later a 6.7 million gallon storage tunnel (investing $463 million) to capture and store sewage and stormwater overflows for later treatment in a sewage plant.[46] An EPA report indicates the storage tunnel and tank have significantly improved water quality of the James River, reducing the city's average annual overflows from 3 billion gallons a year to 1.8 billion.[47]

The Plan in Harrisburg

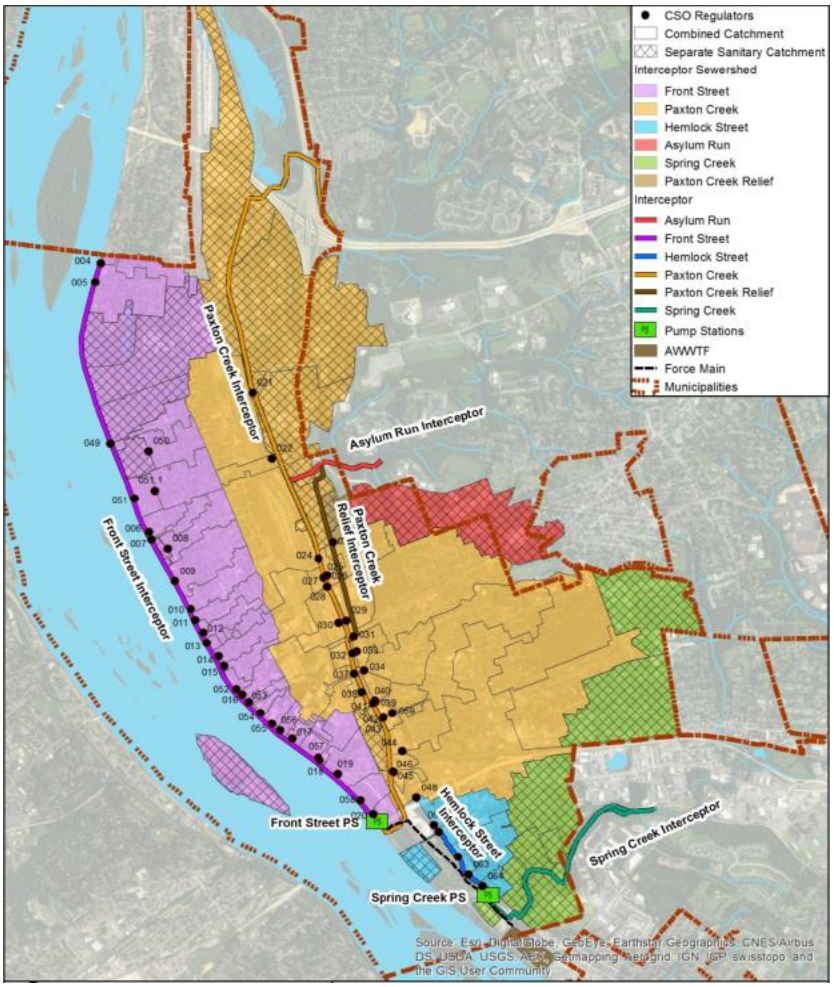
In comparison, Harrisburg is planning a much more limited and low-cost program, and one that emphasizes alternatives to tank construction projects, according to its long term control plan, titled the "City Beautiful H20 Plan."[48]

The city's goal, as expressed in the plan, is not to end sewage overflows into the Susquehanna River, but to "reduce combined and sanitary sewer overflows" through

improved maintenance of the long-neglected combined sewer and stormwater system. Capital Region Water also plans to build a stronger pumping station, install stormwater control systems (called "green infrastructure") on city streets, and make adjustments to the existing sewage outfall devices to reduce discharges. When all of this is complete, the water authority projects that the total amount of sewage and stormwater released into the Susquehanna River would be reduced by about 60 percent.[49]

Capital Region Water estimates that the program cost would be about $315 million over 20 years. The water authority says that ratepayers can't afford a more aggressive project – like those being built by Alexandria, Virginia, and Washington, D.C. – because Harrisburg is too poor. "32 percent of the population is living below the poverty level, which is more than double the national, state and county poverty levels," the City Beautiful H20 plan explains. "The median household income of $33,289 (in Harrisburg in 2015) is more than $20,000 lower than that of the national, state, and county."

David Stewart, Director of Engineering at Capital Region Water, said: "One of the challenges that we face in the city of Harrisburg is that we have an extremely financially challenged rate base. So as we went through the program, we realized that getting to the level of control that would be ideal is going to be financially prohibitive. So we looked at the best we could do."[50]



The locations of combined sewage and stormwater outfalls in Harrisburg are shown on the map above as black circles, and the largest pipes ("interceptors") as colored lines.

However, this calculation of poverty for the Capital Region Water rate base is slightly misleading. The household income figure is only based on the city of Harrisburg – not the surrounding suburbs that the authority also serves, including Paxtang, Penbrook, and Steelton boroughs, as well as Swatara and Lower Paxton townships. Swatara Township, for example, has a median household income of $59,341 per year – almost 80 percent higher than Harrisburg's.[51] The concerns about the funding base also do not take into account the dominating presence of the Pennsylvania state government in Harrisburg, with the state owning 42 percent of the land in Harrisburg and boasting a $34 billion annual state budget.

Officials at Capital Region Water said they had not yet asked the state government for funding for their sewage control proposal, but plan to start moving in that direction. Starting in January 2020, the water authority is planning to start imposing stormwater pollution control fees – also known as "impervious surface" fees – on all rate payers, including state agencies, based on how many square feet they have of parking lots, roofs, or blacktop.[52] For the average home owner in the Harrisburg area, the annual fees would average about $74 per year.[53] For owners of larger homes, as well as commercial properties, the fee would be $6.15 per 1,000 square feet of hard surface per month.[54]On June 26, CRW opened a 90-day public comment period on the proposed stormwater control fees that will run through Sept. 25.[55] The next public hearing on the plan is scheduled for 6 pm on September 12 at Cloverly Heights Park, at 18th and Pemberton Streets in Harrisburg.[56]

David Stewart, Director of Engineering at Capital Region Water, said Harrisburg has limited resources and faces serious financial challenges in trying to reduce combined sewage overflows.

It's not yet clear how much those fees would generate from state agencies, and an inquiry to the state DEP about how much the state would be willing to pay did not produce an answer.[57]

Capital Region Water is proposing several projects to address the sewage issue in Harrisburg, according to David Stewart, the agency's Director of Engineering. CRW plans to spend about $12 million in upgrades to a sewage pumping station, located under I-83 near the river, on the south end of the city. This will provide more pumping force to drive sewage and rainwater during storms into the city's wastewater treatment plant, so the waste does not have to be released straight into the river. The agency also plans to rehabilitate its 120-year -old sewage interceptor system so that the existing pipes can handle a greater volume of sewage and stormwater. Then, the agency is going to raise the level of small dam-like devices called "weirs" located inside the city's 58 combined sewage outfall regulator structures, which lead to the river or a tributary, Paxton Creek. The result will be less wastewater released to the Susquehanna, Stewart said.

"In effect, we'll be holding more water in the system," Stewart said. "And by upgrading our pumping station, the total effect will be that we increase our overall capacity by 50 percent. And then, in conjunction with that, we are doing a citywide program of green infrastructure. That will allow us to intercept more stormwater before it actually gets into the system."

EIP asked Stewart why Harrisburg does not plan on building underground storage tanks or tunnels, as Washington, Arlington, Scranton, Richmond, and other cities have built or are constructing. "The way our city is laid out, we'd have to build those tunnels the full length of the city," Stewart said. "In our analysis, it becomes cost prohibitive rather quickly."

Harrisburg's plan and consent decree do not include any requirements for bacteria monitoring in the Susquehanna River to determine if the planned work will actually reduce sewage pollution and improve water quality. Stewart suggested that such testing would be

too costly. Labs perform *E. coli* and fecal bacteria testing for $40 per sample.[58] "Since we are not obligated to do it, it is going to be an expense and it's a challenge to do," Stewart said.[59] "We are just trying to, day-to-day, manage the operations at the most cost-effective point so we don't have to raise sewer rates any more than is necessary."

Stewart added that he does not believe that sewage releases from the city are harming the beach at Harrisburg's City Island Park, which is closed because of high bacteria levels and is located only a few hundred yards from the city's 58 sewage outfalls. He argued that the Susquehanna's water currents wash the bacteria from the sewage directly along the shoreline, not across to the beach. Regardless of the beach, however, EIP's water sampling also found bacterial contamination along the city's shoreline, directly downstream from where the outfalls are located.

Green Infrastructure as a Technique to Reduce Stormwater

Part of Capital Region Water's plan to reduce the volume of sewage pouring into the Susquehanna River is to employ "green infrastructure" as a sponge to soak up rainwater before it flows down into the combined sewage and stormwater pipes.[60] This would include the planting of trees, the building of stormwater control systems called "rain gardens," the installation of pavement permeable to rainwater in select areas, and the creation of some rooftops planted with vegetation.

Rain gardens and other stormwater pollution control devices, such as this roadside ditch with trees, plants, and underground pipes to collect and filter polluted runoff, are examples of "green infrastructure."

The use of these stormwater control techniques is encouraged by the 2015 consent decree that the water authority signed with EPA and the state. "Capital Region Water will implement selected pilot projects aimed at demonstrating the utility of various green stormwater infrastructure control technologies in highly urbanized areas," the agreement states.[61] This green infrastructure, according to the plan, will include "stormwater tree pits, curb cuts, bump-outs, porous pavement and tree trenches."[62]

One reason the regional water authority is pushing these greening projects as a solution is because they are much cheaper than building large underground containment tanks to hold excess sewage and stormwater during rain storms, as other cities like Washington D.C. and Arlington, Virginia, are building. "A control plan was selected that minimizes combined sewage overflow discharges, improves water receiving quality, addresses stormwater management and local flooding, and meets affordable guideline constraints for rate payers,"

the Harrisburg long-term plan reads.[63] "It must be understood that strongly desired projects and/or control facility elements may need to be ruled out… because their costs are outside the range of affordability."

This more affordable approach would mean, however, that the city's antiquated plumbing system, which pipes human waste directly into the Susquehanna River, would remain indefinitely. Capital Region Water estimates that at least 300 million gallons of sewage combined with stormwater would continue to flow every year into the Susquehanna River.[64] That would be roughly 60 percent less than the current average of about 800 million gallons yearly. Those calculations, however, do not take into account the increasing intensity of rainfall happening because of climate change – or even the unusually high releases of 2017, when 899 million gallons flowed into the river; or 2018, when nearly 1.4 billion gallons were released.[65]

This raises the question of whether a future in which 2018 rainfall levels become the "new normal" would mean little or no reductions in combined sewage overflows into the Susquehanna River, given Capital Region Water's plans to not close the sewage outfalls into the waterway or build a tank or tunnel containment system. "Nobody knows the answer to that," replied Stewart of Capital Region Water.[66] "I hope that the trend does not continue to get worse. If so, we are going to have to adapt."

Capital Region Water estimates that it could cost about $1.2 billion dollars to build an underground tunnel and tank system that would capture 100 percent of the combined sewer/stormwater volume every year and prevent it from flowing into the river.[67] Such a tunnel might have to be 15 feet wide and have the capacity to hold 63 million gallons of sewage and stormwater. A more limited tunnel project that would capture 95 percent of the sewage and stormwater would cost more than $800 million and require the building of a 32 million gallon storage tunnel.[68] Even for a capture rate of 92 percent, the regional water authority estimates it would have to build a 14 million gallon, 10 foot wide tunnel, which would cost more than $700 million. That would be more than twice the $315 million that Capital Region Water believes would be affordable over 20 years – without substantial contributions from the state of Pennsylvania.

Bacteria Monitoring in the Susquehanna River

Neither the City of Harrisburg nor Capital Region Water conducts water quality monitoring in the Susquehanna River along Harrisburg's waterfront, and the state Department of Environmental Protection's most recent tests were three years ago.

To obtain more recent information about bacteria levels along Harrisburg's waterfront, the Environmental Integrity Project worked with the Lower Susquehanna Riverkeeper to gather 60 water samples from June 19, 2019 until July 31, 2019. The groups then hired an independent lab to test the water samples for fecal coliform and *E. coli.* Fecal coliform, while not harmful on its own, is often tested in water monitoring as it can be a good indicator that there are other pathogens from waste present in the water. *E. coli,* or *Escherichia coli,* is a specific strain of bacteria that is found in humans and other warm-blooded animals, and EPA says that *E. coli* is "the best indicator of health risk from water contact in recreational waters."[69]

The first sampling location, "Location 1," was located along the Susquehanna River waterfront just downstream from the Governor's Residence, not far from the intersection of Front Street and Delaware Street, about 50 yards downstream from a combined sewage and stormwater outfall pipe (labelled by the city as "Outfall 007.") The second, "Location 2" was along Front Street waterfront near State Street, just downstream from the Capitol Office Complex, and about 25 yards down river from an outfall pipe ("Outfall 52.") The third location, "Location 3," was on the City Island Park beach, facing the Capitol Office Complex across the river. It should be noted that in our bacteria sampling, we did not conduct fecal source tracking or any monitoring upstream of Harrisburg.

Table B. Dates when *E. coli* Concentrations in Susquehanna River Exceeded Health Standards (235 CFU/100 ml)

Station	Date	Concentration (CFU/100mL)	Weather (wet or dry day)
1	06-19-2019	1,120	Dry
1	06-20-2019	2,420	Wet
1	06-21-2019	1,730	Wet
1	06-22-2019	1,410	Dry
1	07-06-2019	326	Wet
1	07-11-2019	921	Wet
1	07-17-2019	1,730	Wet
2	06-19-2019	727	Dry
2	06-20-2019	2,420	Wet
2	06-21-2019	1,550	Wet
2	06-22-2019	770	Dry
2	06-25-2019	248	Wet
2	06-28-2019	261	Dry
2	07-05-2019	308	Wet
2	07-06-2019	276	Wet
2	07-11-2019	2,420	Wet
2	07-17-2019	2,420	Wet
2	07-18-2019	365	Wet
3	06-19-2019	365	Dry
3	06-20-2019	1,550	Wet
3	06-21-2019	722	Wet
3	06-22-2019	1,300	Dry
3	06-25-2019	2,420	Wet
3	07-05-2019	1,550	Wet
3	07-06-2019	579	Wet
3	07-11-2019	2,420	Wet
3	07-12-2019	365	Wet
3	07-17-2019	2,420	Wet
3	07-24-2019	1,990	Dry

Note: The state's swimming water standard for E coli is 235 CFU/100mL in the Susquehanna River. The results here are expressed as most probable number (MPN) of colony forming units of E. coli, which is a comparable unit of measurement. A wet day is defined as such if there has been rainfall in the past 24 hours of taking the sample. The testing could not register figures higher than 2,420 CFU, so the figures above that list this number are actually 2,420 or greater.

Table C. Dates When Fecal Coliform Concentrations in River Exceeded Health Standards (400 CFU/100mL)

Station	Date	Concentration (CFU/100mL)	Weather (wet or dry day)
1	06-20-2019	3,600	Wet
1	06-21-2019	1,530	Wet
1	06-22-2019	855	Dry
1	06-26-2019	440	Dry
1	07-06-2019	636	Wet
1	07-12-2019	430	Wet
1	07-17-2019	35,400	Wet
1	07-18-2019	873	Wet
2	06-19-2019	690	Dry
2	06-20-2019	8,100	Wet
2	06-21-2019	3,300	Wet
2	06-25-2019	420	Wet
2	07-05-2019	470	Wet
2	07-06-2019	550	Wet
2	07-11-2019	5,100	Wet
2	07-12-2019	712	Wet
2	07-17-2019	28,400	Wet
2	07-18-2019	3,300	Wet
2	07-29-2019	600	Dry
3	06-20-2019	1,050	Wet
3	06-21-2019	1,300	Wet
3	06-22-2019	1,110	Dry
3	06-25-2019	590	Wet
3	07-05-2019	1,900	Wet
3	07-11-2019	17,200	Wet
3	07-12-2019	540	Wet
3	07-17-2019	40,000	Wet
3	07-18-2019	1,740	Wet
3	07-24-2019	3,600	Dry
3	07-26-2019	2,700	Dry

Note: A wet day is defined as such if there has been rainfall in the past 24 hours before sample was taken. Water is considered unhealthy for swimming or water contact recreation by the state if over 10% of samples in a 30-day period are over 400 CFU/100mL.

In general, bacteria levels in the river were several times higher on rainy days than on dry days, suggesting that combined sewage and stormwater overflows are likely driving up *E coli* and fecal coliform concentration levels in the river, combined with other runoff pollution flushed into the waterway from other sources. However, it is worth noting that *E coli* bacteria levels were also frequently high on dry days -- although some of the high readings on dry days were a day or two after rainfall. And in Harrisburg, the bacteria levels averaged significantly higher than healthy levels for swimming at both City Island Park beach and near the Governor's Residence.

E. coli Concentrations in the Susquehanna River on Wet vs. Dry days

Location	Dry Day Average Concentration	Wet Day Average Concentration
Pennsylvania Governor's Residence	308	861
Capitol Office Complex	210	1123
City Island Park Beach	361	1340

Note: A wet day is defined as such if there has been rainfall in the past 24 hours of taking the sample. Water is considered unhealthy for recreational activities if E. coli *levels are over 235 CFU/100mL.*

At the sampling location downstream from the Governor's Residence (see Figure 1), 53 percent of fecal coliform samples taken from June 19, 2019 to July 18, 2019 exceeded 400 CFU per 100mL, far above the state's limit of 10 percent. This location's five-day fecal coliform concentration geometric mean, which should not exceed 200 per 100 mL, averaged more than twice the swimming water standard at 547 CFU per 100 mL. On July 17, 2019, which was a rainy day, a single sample of fecal coliform was up to 35,400 CFU per 100mL (see Table C). About a third of *E. coli* samples taken during this sampling period exceeded the state's recreational standard. Five of the seven samples that exceeded the standard were taken on wet days. One sample taken on June 20, 2019, a day of light rain, had a sample result of over ten times the standard.

The river downstream from the Capitol Office Complex (see Figure 1) exceeded the fecal coliform recreational standard far above the 10 percent limit, with nearly 70 percent of samples exceeding 400 per 100mL from June 19, 2019 to July 18, 2019. Fecal coliform five-day geometric means[70] taken here averaged more than four times the swimming water standard – or 865 CFU per 100mL. Over half of the *E. coli* samples taken during the sampling period exceeded the recreational standard. *E. coli* reached CFU's at least 2,420 on three different days during this time (see Table B). It is important to note that the lab used by EIP and Lower Susquehanna Riverkeeper could not measure E coli levels above 2,420, so these measurements could actually have been significantly higher.

At City Island Park Beach (see Figure 1), 60 percent of fecal coliform samples exceeded 400 CFU per 100mL. The five-day geometric means for these samples averaged 1,245 CFU's above the recreational standard. On July 17, 2019, which was a rainy day, a single sample of fecal coliform was up to 40,000 CFU per 100mL (see Table C).

In terms of *E. coli*, state standards indicate that a waterway is safe for recreational use as long as it does not test higher than 235 per 100mL. Eleven out of twenty sampling dates tested higher than this number at City Island Park beach, with the average number of CFU being 801, which is almost 3.5 times higher than that standard.[71]

In 2016, water sampling by state Department of Environmental Protection along the Harrisburg waterfront also found fecal coliform to exceed the recreational standard, and *E. coli* to be just below the standard.[72] DEP sampled for bacteria in the Susquehanna in August and September of 2016, one year following Harrisburg's Consent Decree. On August 18, 2016, the agency found that *E. coli* concentrations at 220 CFU per 100 mL, only slightly beneath the recreational standard of 235 CFU per 100mL.[73] [74] On that same day, fecal

coliform exceeded the recreational standard at one monitoring point[75] with 700 CFU per 100mL.[76]

In 2014, DEP sampled for fecal coliform in locations upstream, downstream, and in the reach of Harrisburg from July to September of that year and found bacteria levels often too high for safe swimming. Bacteria levels upstream from Harrisburg were generally lower than they were along the city's waterfront or downstream.[77]

These are the most recent state water monitoring results from the Susquehanna River near Harrisburg, as there has been no water monitoring conducted for bacteria in the Susquehanna near Harrisburg in about three years. Capital Region Water's 2015 sewage consent decree[78] does not require it to conduct any bacterial water quality monitoring along the city's waterfront in the Susquehanna River in the future.[79] CRW's long-term control plan, submitted to the EPA on March 29, 2018, says that post-construction water quality monitoring will be implemented by partnering with the state and the Susquehanna River Basin Commission.[80]

Public Notifications of Sewage Overflows

EPA's 2015 partial consent decree with Harrisburg and Capital Region Water requires the local water agency to "provide the public with information concerning CSO discharge occurrences and their impacts on water quality in the Receiving Water(s) (e.g., website notifications within 24 hours of the event, public service announcements on radio and/or television, newspaper public notifications."[81]

Claire Maulhardt, City Beautiful H20 Manager for Capital Region Water, said in an interview on June 6, 2019, that the agency has not been sending out press releases to announce sewage overflows, or doing social media on them (such as on Twitter or Facebook) or posting them on the agency's website. [82]As an alternative, she said CRW has an information line – 888-510-0606 – that people can call if they are curious whether or not there have been any recent overflows, and this line will have tape recorded messages with relevant information. Interested local residents can also sign up for email and text alerts, Maulhardt said.

"It doesn't go out to the newspapers, no," Maulhardt said of notifications of combined sewage and stormwater overflows. "We put it all on the hotline…The CSO notifications are all through the hotline."

However, a phone line is not effective method of notification to the general public or news media. To make use of a phone line, people need to know, in advance, when and how to call the information line. Residents also have to know about the existence of the email messaging system and be motivated enough to sign up for it. The point of public notification is to let all people in a community know when spills have occurred so they can make informed choices to protect themselves. And press releases about sewage releases, when reported in local news outlets, help voters understand why investments in clean water are needed.

The lack of press releases, website postings, or social media notifications about sewage overflow events appears to be a violation of the letter or spirit of the 2015 partial consent decree. The agreement specifies: "website notifications within 24 hours of the (overflow) event, public service announcements on radio and/or television, newspaper public notifications."

Harrisburg Advanced Wastewater Treatment Facility

Harrisburg's sewage treatment plant, the Harrisburg Advanced Wastewater Treatment Facility, is a 45 million gallon per day capacity plant and is the largest publicly owned treatment facility in Pennsylvania within the Chesapeake Bay Watershed.[83] The Harrisburg plant has an expired permit to discharge effluent under the National Pollutant Discharge Elimination System. The permit authorized the Harrisburg Authority, now known as Capital Region Water, to discharge into Harrisburg waterways and expired on December 31, 2014.[84] CRW submitted a renewal application on July 7, 2014, but DEP has yet to renew the permit.[85]

Capital Region Water plans to invest approximately $100 million into their conveyance and treatment system in the next 20-25 years.[86] In order to become compliant with the National CSO (combined sewer overflow) Policy, CRW's long-term control plan details rehabilitation of conveyance and treatment systems in their "Immediate Implementation Phase."[87] CRW has no improvements planned for their secondary treatment system, but will improve and rehabilitate the entire solids processing system, anaerobic digesters, and the methane gas codigestion system.[88] In order to decrease overflow occurrences, CRW plans to improve the hydraulic performance of the sewer system by identifying and correcting defects and hydraulic bottlenecks in the system.[89] CRW also completed cleanouts and replacements in the system.[90]

In April of 2016, the plant completed its upgrade to implement biological nutrient removal to comply with the nutrient removal requirements of the Chesapeake Bay Tributary Strategy and the ammonia reduction requirements of their NPDES permit. [91]

Response from EPA and DEP about Harrisburg's Sewage Plan

Neither the EPA nor DEP has approved Capital Region Water's proposed plan for addressing combined sewage overflows, with EPA asking local water officials for a better capture rate than what Harrisburg is proposing so far. Authorities are also questioning some of the poverty claims of the water authority, by suggesting that the incomes of more suburban residents served by the sewer system should be factored into the ability to pay.

"EPA is currently working with CRW to develop an approvable Long-Term Control Plan that will reduce the volume and frequency of CSO overflows," said EPA spokesperson Terri White in an emailed message to the Environmental Integrity Project on June 14, 2019.[92]

When asked why EPA doesn't require Harrisburg to install underground sewage and stormwater control tanks and other plumbing improvements, like Washington, D.C. and Alexandria, Virginia are installing, White replied: "EPA's CSO Policy considers a number of factors …A system's ability to pay is one of the factors that is taken into account when looking at projects, priorities and implementation schedules."

As part of its research, EIP asked DEP whether the state of Pennsylvania will help pay for Harrisburg's planned sewage system improvements, given the state's ownership of large amounts of land and many buildings in the state capital.

Elizabeth Rementer, Press Secretary for the Department of Environmental Protection, replied in an email on June 14, 2019, that the state agency has not yet approved Capital Region Water's long-term plan. "The commonwealth values its partnership with the city and is currently reviewing the plan," Rementer said.[93] "Issues like these are not unique in Pennsylvania and the Wolf Administration has made it a top priority to address infrastructure needs like this one."

Conclusion and Recommendations

There is no question that overhauling a more than century-old combined sewage and stormwater system like the one in the Harrisburg area is a complex and difficult task. More than 160 miles of pipes, carrying both rain water and human waste, flow beneath the city's streets, guiding waste to the city's wastewater treatment plant on dry days, and – when it rains – to 58 different outfalls into the Susquehanna River or a tributary, Paxton Creek. Much of the system has been badly neglected by the city over several decades, in part because Harrisburg has struggled with poverty, a shrinking population, and an inadequate tax base.

However, the large amount of water pollution flowing out of the city can no longer be ignored, with nearly 1.4 billion gallons of sewage mixed with rainwater pouring from the city's outfall pipes into the Susquehanna River in 2018 alone. And the city's small tax base cannot really be an excuse for inaction when the state of Pennsylvania itself – with its roughly $34 billion annual budget – owns almost half of the land in Harrisburg, including beneath the State Capitol Complex and the Governor's Residence. All of these are state facilities that use Harrisburg's sewer lines – and flush their toilets into the Susquehanna River – without paying local real-estate taxes that could improve local infrastructure.

The Harrisburg region's water and sewer authority, Capital Region Water, is proposing to spend $315 million over 20 years to address the sewage issue – but not in a way that will solve the underlying plumbing problem, close any of the 58 outfalls into the Susquehanna River, or stop the continued dumping of human waste into the river. That's an excessive amount for lower-income ratepayers to shoulder without fixing the problem, or any guarantee that – even decades from now – their children will ever be able to swim or play in the waterway. Capital Region Water is proposing to use some of the money to build "green infrastructure" – stormwater control systems, such as rain gardens and green roofs – to reduce the stormwater flow. But while this is a good first step, it cannot totally replace construction of a more modern sewer system that no longer intentionally pipes human

waste into the river. The city's "partial" consent decree with EPA and the Pennsylvania DEP is inadequate and does not require the city or regional water authority to stop the sewage flow or test for bacteria to ensure that whatever "green infrastructure" is installed actually reduces the amount of pollution in the river.

This report recommends the following steps:

1) EPA and the DEP should require the Harrisburg Capital Region Water authority to show how its long term plan will demonstrably reduce fecal bacteria levels in the Susquehanna River and allow the public to again use the waterfront for swimming, boating, and fishing.

2) If Harrisburg's plan cannot reduce bacteria levels, EPA and DEP should require Capital Region Water to do more to fix the underlying plumbing problem, such as by building underground storage tunnels to temporarily hold waste during storms before treatment. Such tunnels are already being built by Alexandria, Va., and Washington D.C., and are expected to reduce sewage and stormwater overflows by more than 90 percent in these cities. That's far more than the 60 percent reduction proposed in Harrisburg at a cost of $315 million.

3) Because Harrisburg is the state capital and almost half of the land in the city is owned by state agencies – which pay no taxes – Pennsylvania should commit to paying most of the cost of improving Harrisburg's infrastructure and reducing the flow of sewage into the Susquehanna River.

4) State and federal regulators should mandate regular testing for bacteria along Harrisburg's riverfront and at City Island Park beach to determine whether the investments being initiated by Capital Region Water actually reduce the flow of sewage into the river. Without verification, it will be impossible to know whether additional steps are needed.

5) The state and federal agencies should require that Capital Region Water notify the media and general public whenever a combined sewage overflow occurs. Such notifications to the news media are not happening today, according to CRW. This is despite a requirement for public notification in the 2015 partial consent decree. Public awareness of the problem will help local residents protect their health and understand the need for investments.

6) EPA and the state should encourage stormwater control systems such as rain gardens, tree plantings, and green roofs. But this green infrastructure should be deployed in combination with sewage system upgrades to end the outdated piping of human waste into the Susquehanna River.

7) DEP and EPA should officially designate the Susquehanna River around Harrisburg as impaired for fecal bacteria under the federal Clean Water Act, which would force Pennsylvania to develop and follow a cleanup plan (a "Total Maximum Daily Load") to solve the sewage overflow problem.

8) Harrisburg and the other cities in Pennsylvania with combined sewage and stormwater systems should factor into their planning the increased amount of rainfall already deluging the region because of climate change. Failing to calibrate planning for the growing intensity of rainfall may mean that any planned solutions will be overwhelmed.

Pennsylvania has often been criticized by its downstream neighbors – and for good reason – for its lack of commitment to cleaning up the Chesapeake Bay, which starts with the Susquehanna River. But more important to the people of Pennsylvania is local water quality for local residents who want to enjoy waterways like the Susquehanna for fishing, swimming and boating. By investing a substantial amount of money in upgrading Harrisburg's antiquated sewer system, the Pennsylvania state government would greatly enhance the health and beauty of its state capital – which is really the home and responsibility of everyone in the state – and demonstrate that the Commonwealth is committed to clean water.

Methodology

In its testing for bacteria levels in the Susquehanna River to determine if it was safe for swimming, the Environmental Integrity Project used Pennsylvania's recreational use bacteria criteria as noted in DEP's Triennial Review of Water Quality Standards,[94] as well as an informational sheet from the Pennsylvania Department of Health regarding public bathing places.[95] DEP says the following regarding recreational use of waterways: "During the swimming season (May 1 through September 30), the maximum fecal coliform level shall be a geometric mean of 200 per 100 milliliters (ml) based on a minimum of five consecutive samples each sample collected on different days during a 30-day period. No more than 10% of the total samples taken during a 30-day period may exceed 400 per 100 ml." Geometric means are a specific type of average that are determined by multiplying all components together and calculating the square root of the resulting product. The Pennsylvania Health Department identifies two thresholds for *E. coli* to determine recreational use of a waterbody. The first being *E. coli* concentrations over 235 CFU/100mL and the second *E. coli* over 126 CFU/100mL for any thirty day geometric means.

These calculations were followed in order to analyze bacteria sampling conducted by the Environmental Integrity Project (EIP) and the Lower Susquehanna Riverkeeper. The riverkeeper organization collected a total of 60 water samples, 20 each at three locations as indicated on the map earlier this in report. It should be noted that in our bacteria sampling, we did not conduct fecal source tracking or any monitoring upstream of Harrisburg.

A third-party laboratory, ALS Environmental of Middletown, Pa., cultured and analyzed the water samples. The lab's results for *E. coli,* as included in this report, are the most probable number, or MPN, of colony forming units. Our analysis considered whether the sample was taken on a 'wet' day or 'dry' day, where a day is considered wet if there has been rainfall in the past 24 hours. The testing could not register figures higher than 2,420 CFU, so the figures above that list this number are actually 2,420 or greater.

Results from Bacteria monitoring conducted in 2016 was requested by EIP from PADEP. Results for bacteria monitoring conducted in 2014 was available in Capital Region Water's CSS Characterization Report.

Appendix A: Water Sampling by Lower Susquehanna Riverkeeper / EIP

SAMPLING LOCATION 1 (DOWNSTREAM FROM GOVERNOR'S RESIDENCE)

Sampling Date	Precipitation on Sampling Date	Hours Since Last Rain	Fecal Coliform CFU/100mL)	E. coli (CFU/100mL)
6/19/2019	Dry	27.2	90	1,120
6/20/2019	Rain	0.67	3,600	2,420
6/21/2019	Rain	5.48	1,530	1,730
6/22/2019	Dry	24.82	855	1,410
6/25/2019	Rain	6.77	330	163
6/26/2019	Dry	28.92	440	144
6/27/2019	Dry	60.57	167	146
6/28/2019	Dry	80.4	220	201
6/29/2019	Dry	100.9	95	99
7/5/2019	Rain	1.18	310	225
7/6/2019	Rain	11.17	636	326
7/11/2019	Rain	-0.43	200	921
7/12/2019	Rain	16.78	430	93
7/17/2019	Rain	0.4	35,400	1,730
7/18/2019	Rain	11.57	873	138
7/24/2019	Dry	33.98	230	87
7/26/2019	Dry	82.02	260	30
7/27/2019	Dry	100.9	210	24
7/29/2019	Dry	148.95	81	70
7/30/2019	Dry	176.3	144	56

Note: The health-based swimming threshold for E. coli is 235 CFU/100mL. Values highlighted in yellow exceed this threshold. For fecal coliform, the threshold is for no more than 10 percent of sampling dates to exceed 400 CFU/100mL. In our sampling at this location, eight of the 20 samples (or 40 percent) exceeded this limit, meaning that levels of fecal coliform were too high for safe swimming. "Rain" days are defined as those in which precipitation has fallen less than 24 hours before the sampling time. "Dry" means rainfall more than 24 hours before sampling time. E. coli figures on charts expressed as most probable number (MPN) of CFU. The testing could not register figures for E coli *higher than 2,420 CFU, so the figures above that list this number are actually 2,420 or greater.*

SAMPLING LOCATION 2 (DOWNSTREAM FROM STATE OFFICE COMPLEX)

Sampling Date	Precipitation on Sampling Date	Hours Since Last Rain	Fecal Coliform CFU/100mL)	E. coli (CFU/100mL)
06/19/2019	Dry	27.82	690	727
06/20/2019	Rain	0.93	8,100	2,420
06/21/2019	Rain	5.85	3,300	1,550
06/22/2019	Dry	25.07	310	770
06/25/2019	Rain	7.10	420	248
06/26/2019	Dry	29.15	260	104
06/27/2019	Dry	60.73	119	81

06/28/2019	Dry	80.90	240	261
06/29/2019	Dry	101.15	69	57
07/05/2019	Rain	1.65	470	308
07/06/2019	Rain	11.43	550	276
07/11/2019	Rain	-0.18	5,100	2,420
07/12/2019	Rain	16.95	712	99
07/17/2019	Rain	0.87	28,400	2,420
07/18/2019	Rain	11.77	3,300	365
07/24/2019	Dry	34.20	180	56
07/26/2019	Dry	82.30	99	41
07/27/2019	Dry	101.17	126	20
07/29/2019	Dry	149.13	600	147
07/30/2019	Dry	176.45	230	51

Note: The health-based swimming threshold for E. coli is 235 CFU/100mL. Values highlighted in yellow exceed this threshold. For fecal coliform, the threshold is for no more than 10 percent of sampling dates to exceed 400 CFU/100mL. In our sampling at this location, 11 of the 20 samples (or 55 percent) exceeded this limit, meaning that levels of fecal coliform were too high for safe swimming. "Rain" days are defined as those in which precipitation has fallen less than 24 hours before the sampling time. "Dry" means rainfall more than 24 hours before sampling time. E. coli figures on charts expressed as most probable number (MPN) of CFU. The testing could not register figures for E coli *higher than 2,420 CFU, so the figures above that list this number are actually 2,420 or greater.*

SAMPLING LOCATION 3 (ON CITY ISLAND PARK BEACH IN HARRISBURG)

Sampling Date	Precipitation on Sampling Date	Hours Since Last Rain	Fecal Coliform CFU/100mL)	E. coli (CFU/100mL)
06/19/2019	Dry	28.10	340	365
06/20/2019	Rain	1.43	1,050	1,550
06/21/2019	Rain	4.90	1,300	722
06/22/2019	Dry	25.32	1,110	1,300
06/25/2019	Rain	7.37	590	2,420
06/26/2019	Dry	29.28	120	50
06/27/2019	Dry	60.98	24	20
06/28/2019	Dry	81.32	23	23
06/29/2019	Dry	101.32	14	11
07/05/2019	Rain	1.88	1,900	1,550
07/06/2019	Rain	11.75	320	579
07/11/2019	Rain	0.17	17,200	2,420
07/12/2019	Rain	17.13	540	365
07/17/2019	Rain	0.17	40,000	2,420
07/18/2019	Rain	11.95	1,740	35
07/24/2019	Dry	34.57	3,600	1,990
07/26/2019	Dry	82.55	2,700	101
07/27/2019	Dry	101.38	72	31
07/29/2019	Dry	149.45	117	54

07/30/2019	Dry	176.62	9	21

Note: The health-based swimming threshold for E. coli is 235 CFU/100mL. Values highlighted in yellow exceed this threshold. For fecal coliform, the threshold is for no more than 10 percent of sampling dates to exceed 400 CFU/100mL. In our sampling at this location, 11 of the 20 samples (or 55 percent) exceeded this limit, meaning that levels of fecal coliform were too high for safe swimming. "Rain" days are defined as those in which precipitation has fallen less than 24 hours before the sampling time. "Dry" means rainfall more than 24 hours before sampling time. E. coli figures on charts expressed as most probable number (MPN) of CFU. The testing could not register figures for E coli higher than 2,420 CFU, so the figures above that list this number are actually 2,420 or greater.

NOTES

[1] EPA Chesapeake Bay Total Maximum Daily Load for the Chesapeake Bay. https://www.epa.gov/sites/production/files/2014-12/documents/cbay_final_tmdl_exec_sum_section_1_through_3_final_0.pdf
[2] EPA, "Evaluation of Pennsylvania's 2016-2017 and 2018-2019 Milestones," July 27, 2018. Link: https://www.epa.gov/sites/production/files/2018-07/documents/final-evaluation-pa-2016-2017-and-2018-2019-milestones.pdf
[3] Capital Region Water, "Semiannual Report on Consent Decree Implementation, July 1, 2018 to Dec. 31, 2018," released March 2019. Link: https://capitalregionwater.com/wp-content/uploads/2019/04/CRW-Ch94-SemiAnn-Rpt-2018.pdf
[4] Pennsylvania's standard for safe swimming water for E coli is no more than 235 CFU/100 ml water. Sampling performed on 10 dates in June and 10 in July at three different locations along the Harrisburg waterfront, downstream from the Governor's residence, the Pennsylvania State Capitol Complex, and on City Island Park beach. Samples taken by Lower Susquehanna Riverkeeper and analysis by ALS Environmental labs of Middletown, Pa.
[5] Number of combined sewage overflow municipalities from EPA spokesman Terri White on June 14, in response to an EIP information request.
[6] EPA spokesman Terri White on June 14 via email, in response to an EIP information request.
[7] Lower estimate from EPA spokesman Terri White on June 14, in response to an information request. Higher estimate from EIP calculation using EPA Chesapeake Bay Program numbers.
[8] Capital Region Water, "Semiannual Report on Consent Decree Implementation, July 1, 2018 to Dec. 31, 2018," released March 2019. Link: https://capitalregionwater.com/wp-content/uploads/2019/04/CRW-Ch94-SemiAnn-Rpt-2018.pdf
[9] Ibid.
[10] EPA fact sheet, "Why Control Sanitary Sewer Overflows?" accessed August 15, 2019. Link: https://www.epa.gov/sites/production/files/2015-10/documents/sso_casestudy_control.pdf
[11] EPA, "City of Harrisburg Clean Water Act Settlement," February 11, 2015. Visit: https://www.epa.gov/enforcement/city-harrisburg-clean-water-act-settlement
[12] EPA, "City of Harrisburg Clean Water Act Settlement," February 11, 2015. Visit: https://www.epa.gov/enforcement/city-harrisburg-clean-water-act-settlement
[13] Spreadsheet of DEP penalties to Capital Region Water for sewage violations provided on request via email to EIP by Elizabeth Rementer, Press Secretary for the Department of Environmental Protection, on June 14, 2019.
[14] Capital Region Water "City Beautiful H20 Plan," released March 2018. Link: https://capitalregionwater.com/full-plan
[15] Capital Region Water "City Beautiful H20 Plan," released March 2018. Link: https://capitalregionwater.com/full-plan. And interview with David Stewart, Director of Engineering at Capital Region Water, on June 6, 2019.
[16] Ibid.
[17] Ibid.
[18] Ibid.
[19] Testing of water samples performed by ALS Environmental labs of Middletown, Pa.

[20] This is expressed as "most probable number" (MPN) of colony forming units (CFU) of bacteria, a method used by laboratories of estimating the colony forming units per 100 ml of water. Pennsylvania health officials say that MPN can be compared to the state standard of 225 CFU/100 ml of water.
[21] This number is expressed as most probable number (MPN) of colony forming units. See note above.
[22] Ibid.
[23] Interview with Claire Maulhardt, City Beautiful H20 Manager for Capital Region Water, on June 6, 2019, at CRW offices in Harrisburg.
[24] Karl Blankenship, "Midpoint assessment for Bay cleanup: only 40% of nitrogen goal met," Bay Journal, July 09, 2018. Link:
https://www.bayjournal.com/article/midpoint_assessment_for_bay_cleanup_only_40_of_nitrogen_goal_met
[25] EPA Chesapeake Bay Total Maximum Daily Load for the Chesapeake Bay.
https://www.epa.gov/sites/production/files/2014-12/documents/cbay_final_tmdl_exec_sum_section_1_through_3_final_0.pdf
[26] Source: Pennsylvania State Budgets, fiscal 2008 to 2018. Link:
https://www.budget.pa.gov/PublicationsAndReports/CommonwealthBudget/Pages/PastBudgets2015-16To2006-07.aspx. Note: These DEP budget figures include the following pollution control programs: General DEP Government Operations, Environmental Program Management, Environmental Protection Operations, Safe Water, Sewage Facilities Planning Grants, Sewage Facilities Enforcement Grants, Storm Water Management, and Chesapeake Bay Pollution Abatement. The numbers do not include the following programs: Black Fly Control; West Nile Virus Control; Flood Control Projects; Climate Change Initiatives; Consumer Energy Program; Transfer to Home Energy Efficiency Loan Fund; Data Center Energy Conservation Projects; DE River Master; OH River Basin Commission; Susquehanna River Basin Commission; Interstate Commission on the Potomac River; DE River Basin Commission; OH River Valley Water Sanitation Commission; Chesapeake Bay Commission; Transfer to Conservation District Fund; Interstate Mining Commission; and Sea Grant Program.
[27] Pennsylvania sewage plants that are upgraded are generally improved to a lower standard than ENR called Biological Nutrient Removal or BNR, according to the Pennsylvania Department of Environmental Protection, Data on wastewater treatment plant upgrades provided by EPA Chesapeake Bay Program via email.
[28] Maryland Department of the Environment, "Bay Restoration Fund Targeted Wastewater Treatment Plants," July 2018. Link: https://mde.maryland.gov/programs/Water/BayRestorationFund/Documents/7-BRF-WWTP%20Update%20for%20BayStat.pdf
[29] Data sheet on Virginia wastewater treatment plant upgrades provided on October 27, 2017, by Allan Brockenbrough, Manager of the Office of VPDES Permits for the Virginia Department of Environmental Quality. Virginia doesn't use the term "ENR" or Enhanced Nutrient Removal for its sewage plants, but these figures reflect plants designed to discharge 3 or 4 mg/liter nitrogen. MDE update on Bay Restoration Fund sewage treatment plant upgrades, September 2017.
http://mde.maryland.gov/programs/Water/BayRestorationFund/Documents/9-BRF-WWTP%20Update%20for%20BayStat.pdf
[30] Pennsylvania DEP, "Agricultural Inspections: July 1, 2017 through June 30, 2018." Link:
http://files.dep.state.pa.us/Water/BPNPSM/AgriculturalOperations/AgriculturalCompliance/FINAL_CBAIP_Annual%20Summary_2018.pdf
[31] EPA, "City of Harrisburg Clean Water Act Settlement," February 11, 2015. Visit:
https://www.epa.gov/enforcement/city-harrisburg-clean-water-act-settlement
[32] Data from June 14, 2019, emails from EPA and Pennsylvania DEP to EIP in response to requests for information.
[33] Data from June 14, 2019, emails from EPA and Pennsylvania DEP to EIP in response to requests for information. In addition, Capital Region Water sewage consent decree semi-annual reports, posted on its website: https://capitalregionwater.com/full-plan/
[34] Capital Region Water, "Chapter 94 Municipal Wasteload Management Report Calendar Year 2018 and Semi Annual Report on Consent Decree Implementation, July 1, 2018 to December 31, 2018, available at: https://capitalregionwater.com/wp-content/uploads/2019/04/CRW-Ch94-SemiAnn-Rpt-2018.pdf. Data also from previous semi-annual reports posted on CRW website.
[35] Capital Region Water posts its semi-annual reports on sewage discharges, as well as other relevant public records, on its website, here: https://capitalregionwater.com/full-plan/
[36] Ibid.

[37] Ibid.
[38] Interview with David Stewart, chief engineer, at the Capital Region Water Administrative Building on June 6, 2019.
[39] National Weather Service, "Year to Date Observed Precipitation". Link: https://water.weather.gov/precip/#
[40] Ibid.
[41] US Department of Justice press release, "U.S., Pennsylvania and Scranton, Pa., Sewer Authority Settle Violations of Sewage Overflows," Dec. 13, 2012. Link: https://www.justice.gov/opa/pr/us-pennsylvania-and-scranton-pa-sewer-authority-settle-violations-sewage-overflows
[42] City of Alexandria Transportation Commission memo, March 20, 2019. Link: https://www.alexandriava.gov/uploadedFiles/tes/info/Complete%20Docket(10).pdf
[43] Jacob Fenston, "After Decades Of Polluting Potomac, Alexandria Plans New Sewage Tunnel," WAMU, October 3, 2018. Link: https://wamu.org/story/18/10/03/decades-polluting-potomac-alexandria-plans-new-sewage-tunnel/
[44] DC Water, "Potomac River Tunnel Project." Link: https://www.dcwater.com/projects/potomac-river-tunnel-project
[45] Ibid.
[46] City of Richmond website, "Combined Sewer Overflow (CSO) in Richmond," link: http://www.virginiaplaces.org/waste/csorichmond.html
[47] Environmental Protection Agency, "CSO Community Case Studies," 2015. Link: https://www.epa.gov/sites/production/files/2015-10/documents/csortcappc.pdf
[48] Capital Region Water plan, "City Beautiful H20." Link: https://capitalregionwater.com/full-plan/
[49] Ibid.
[50] Interview with David Stewart, Director of Engineering at Capital Region Water, on June 6, 2019.
[51] U.S. Census Bureau fact finer, "Swatara township, Dauphin County, Pennsylvania." Link: https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml?src=bkmk
[52] Capital Region Water press release, "Capital Region Water Opens Public Comment Period for Stormwater Fee Proposal and Implementation Plan," June 27, 2019. Link: https://capitalregionwater.com/news/
[53] Sean Sauro, "A Bad Time for Stormwater Fees? Harrisburg Mayor Says It Is, but Water Board Decides Otherwise," PennLive, June 27, 2019. Link: https://www.pennlive.com/news/2019/06/a-bad-time-for-stormwater-fees-harrisburg-mayor-says-it-is-but-water-board-ignores-him.html
[54] Capital Region Water press release, "Capital Region Water Opens Public Comment Period for Stormwater Fee Proposal and Implementation Plan," June 27, 2019. Link: https://capitalregionwater.com/news/
[55] Ibid.
[56] Capital Region Water July 18 press release, "Capital Region Water Announces Three Community Meetings to Learn More and Provide Feedback on a Stormwater Fee Proposal and Implementation Plan." Link: https://capitalregionwater.com/news/
[57] Email to EIP from Elizabeth Rementer, Press Secretary for the Department of Environmental Protection, on June 14, 2019.
[58] Cost estimate from ALS Laboratories of Middletown, Pa.
[59] Interview with David Stewart, Director of Engineering at Capital Region Water, on June 6, 2019.
[60] Capital Region Water plan, "City Beautiful H20." Link: https://capitalregionwater.com/full-plan/
[61] EPA, "City of Harrisburg Clean Water Act Settlement," February 11, 2015. Visit: https://www.epa.gov/enforcement/city-harrisburg-clean-water-act-settlement
[62] Capital Region Water plan, "City Beautiful H20." Link: https://capitalregionwater.com/full-plan/
[63] Ibid.
[64] Ibid.
[65] Capital Region Water, "Semiannual Report on Consent Decree Implementation, July 1, 2018 to Dec. 31, 2018," released March 2019. Link: https://capitalregionwater.com/wp-content/uploads/2019/04/CRW-Ch94-SemiAnn-Rpt-2018.pdf
[66] Interview with David Stewart, chief engineer, at the Capital Region Water Administrative Building on June 6, 2019.
[67] Capital Region Water plan, "City Beautiful H20." Link: https://capitalregionwater.com/full-plan/
[68] Ibid.
[69] EPA, Water: Monitoring and Assessment, https://archive.epa.gov/water/archive/web/html/vms511.html.

[70] Geometric means are used as a limit as this method normalizes the ranges being averaged, so that no single result overshadows the rest.
[71] The 30-day geometric mean limit for E. coli is 126 colony forming units (CFU) per 100mL. None of the samples taken during this period, at any of the three locations, complied with this limit. On wet days, E. coli had consistently higher colony counts than on dry days, at all three sampling points (see Table B).
[72] DEP's eMapPA application, accessed May 9, 2019, http://www.depgis.state.pa.us/emappa/
[73] DEP's eMapPA application, accessed May 9, 2019, http://www.depgis.state.pa.us/emappa/.
[74]Public Bathing Places Sampling and Laboratory Requirements Q & A, https://www.health.pa.gov/topics/Documents/Programs/Q_A-Sampling_and_Laboratory_Requirements.pdf.
[75] Monitoring point CONO_36.
[76] This represented 17 percent of the total samples, which is above the 10 percent threshold for swimming water. Other samples taken within 30 days at the same sampling point were between 9 and 160 CFU per 100mL, and no other sample results exceeded the recreational standard.
[77] In the 2014 water sampling by DEP, upstream from Harrisburg 17 percent of fecal coliform concentrations exceeded 400 colony forming units (CFU) per 100mL –which is higher than the state recreational use standard of 10 percent of thirty days of sampling. Downstream of Harrisburg, 27 percent of concentrations were above 400 CFU per 100mL. Sampling done in the reach near Harrisburg and on the East Shore adjacent to Harrisburg exceeded 400 CFU per 100mL 30 percent of the time and 40 percent of the time. On the east shore adjacent to Harrisburg, one sample reached 6,000 CFU per 100 mL on August 12, 2014 when there was only light rain. The other method of determining recreational use is a five-day geometric mean of fecal coliform concentrations. The threshold for this method is 200 CFU per 100mL. The upstream site exceeded this threshold four times during the testing period, the downstream site twice, the site in the reach of Harrisburg three times, and the site adjacent to Harrisburg once. Geometric means are used as a limit as this method normalizes the ranges being averaged, so that no single result overshadows the rest.
[78] Harrisburg Partial Consent Decree, https://www.epa.gov/sites/production/files/2015-02/documents/cityofharrisburg-cd.pdf.
[79] Interview with David Stewart, chief engineer, at the Capital Region Water Administrative Building on June 6, 2019.
[80] Capital Region Water Long-Term Control Plan, https://capitalregionwater.com/full-plan/, 10-8 to 10-9.
[81] EPA and DEP partial consent decree with Harrisburg and Capital Region Water, 2015. Link: https://capitalregionwater.com/wp-content/uploads/2014/11/Harrisburg-Partial-CD.pdf
[82] Interview with Claire Maulhardt, City Beautiful H20 Manager for Capital Region Water, on June 6, 2019, at CRW offices in Harrisburg.
[83] Capital Region Water Consulting Engineer's Report for the Wastewater System (September 28, 2018), https://capitalregionwater.com/wp-content/uploads/2018/10/2018-09-28-Wastewater-CEAR-FINAL-2018.pdf, 4.
[84] NPDES Permit No. PA 0027197.
[85] David Stewart.
[86] Ibid.
[87] Long-Term Control Plan, 11-4 to 11-5.
[88] David Stewart.
[89] Long-Term Control Plan, 11-7 to 11-8.
[90] Capital Region Water Consulting Engineer's Report for the Wastewater System (October 3, 2016) https://capitalregionwater.com/wp-content/uploads/2014/06/2016-10-03-Wastewater-CEAR-Final.pdf, 26-28.
[91] Consulting Engineer's Report (September 28, 2018), 30. Note: Prior to this upgrade, CRW was purchasing nitrogen credits for the Harrisburg Advanced WWTP from 2014 to 2016. Another requirement of the 2015 consent decree was for the sewage plant to repair sinkholes caused by sewer infrastructure and investigate combined sewage outfalls that experience river intrusion or wastewater exfiltration.
[92] Email to EIP from EPA spokesperson Terri White on June 14, 2019.
[93] Email to EIP from Elizabeth Rementer, Press Secretary for the Department of Environmental Protection, on June 14, 2019.
[94] Pennsylvania's Department of Environmental Protection's (PADEP) Triennial Review of Water Quality Standards (located from this website, on pages 1 and 2. Link: http://files.dep.state.pa.us/PublicParticipation/Public%20Participation%20Center/PubPartCenterPortalFiles

/Environmental%20Quality%20Board/2016/September%2020/Triennial%20Review/07_7-534_Triennial%202016_Bacteria%20Rationale.pdf)

[95] Informational sheet from the Pennsylvania Department of Health regarding public bathing places. Link: https://www.health.pa.gov/topics/Documents/Programs/Q_A-Sampling_and_Laboratory_Requirements.pdf).

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