The Combined Sewer Overflows of Rock Creek

Where They Are; When They Flow

and

What We Should Do About Them

A Single CSO at Piney Branch is responsible for 80 percent of the CSO discharges to the Rock Creek

Discharges from two CSOs underneath Q St Bridge are a threat to downstream waders at P St Beach following wet weather

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Foreword

This report is the second of a series of papers that strive to explain why Rock Creek is polluted and what we can do about it. A previous paper, released in March, 2021, described the leaking sewers of Rock Creek and their contribution to the pollution in the creek.[1] This report, like the previous effort, is not designed to be a scientific study but merely to gather information from existing data sets and present it in a way easily understood by the layperson. In this paper, we look at the combined sewer overflows (CSOs) in Rock Creek, the volume and the frequency of their overflows, and what might be some of the solutions to begin to stem the pollution.

To characterize the CSOs in Rock Creek, I made extensive use of the *Quarterly Operations Report for the District of Columbia*, prepared by the DC Water and Sewer Authority (DC Water), Department of Sewer Services. This report, available on the DC Water website by 23rd of the month following the end of the quarter, not only contains details on such things as the volumes of wastewater pumped, trash removal, and daily rain data, but, for the purposes of this paper, it also contains the results of a computer model of the discharges of each of combined sewer outfalls run for each calendar quarter from the District's CSO system. It was these data that I relied on for this paper. Therefore, discharge data and the accompanying graphs may or may not resemble actual conditions. But the model has been verified with real time measurements and, viewed over the five-year study period, I am confident they supply a reasonably accurate picture of the functioning of the CSO system.

As outlined in my previous study, Congress was always reluctant to appropriate the needed funds and DC mayors habitually tried to siphon off cash from the revenue based sewer and water fund. Although the New Deal generously supplied resources in the 1930s for the construction of various trunk sewers as well as the treatment plant, what was desperately needed was a reliable funding source. That came in 1996 with the creation of the independent DC Water and Sewer Authority, now known as DC Water. For the first time, this gave the agency the ability to issue bonds that could furnish the funding to modernize the system. It also gave the agency protection from periodic raids on the Sewer and Water Fund by politicians. Its consistent triple a bond rating has placed it on a firm financial footing.

But it took a citizen suit from the Anacostia Watershed Society, the DC Chapter of the Sierra Club, The Canoe Cruisers Association, and a band of other clean water advocates, all ably guided by the legal wizards at Earthjustice to force action to clean up the combined sewer overflows that have plagued our waterways for over a century. Later joined by EPA and the Justice Department, the consent decree signed in March of 2005 to settle the lawsuit mandated, among other things, the creation of the Long Term Control Plan (LTCP) to curtail the worse of the combined sewer overflows through the use of massive 23 foot concrete tunnels that store the combined stormwater and sewage until after the rains and pump it to the treatment plant. As of

[1]That report, "Leaking Sewers of Rock Creek" was released in March, 2021 and is available upon request from the author via email: marchant_wentworth@msn.com

late summer of 2021, much of the Anacostia Tunnel was in place, already removing over 96 percent of the overflows and, as a side benefit, tons and tons of trash. Plans for a similar tunnel for the Potomac are finalized and construction set to commence soon. For the Piney Branch overflows, the green infrastructure (GI) has already created 0.90 million gallons (MG) of storage for stormwater. Additional work will add 2.1 MG of stormwater storage. Finally, an additional 4.2 MG of storage would be provided by a storage facility sited in the Piney Branch. Together, these measures further reduce overflows to no more than 1 per year as mandated by the Long Term Control Plan. Other CSOs on Rock Creek would be limited to 4 overflows per year.

But until that work is completed in 2030, overflows will continue to pollute Piney Branch Creek and Rock Creek. These overflows, and the others along Rock Creek are the subject of this report.

Figure 1. Under the terms of the Consent Decree, each CSO outfall is required to have a small brown and white sign identifying the outfall by number and explaining what it is and warning of polluted water. As the vast majority of the CSO structures are on land controlled by the National Park Service, any identifying sign, even one required by the Long Term Control Plan, must conform to the Park Service signage protocols.

Acknowledgements

This paper is largely the result of extensive use I made of the *Quarterly Operations Report for the District of Columbia,* prepared by the DC Water and Sewer Authority, Department of Sewer Services. This report, available on the DC Water website by 23rd of the month following the end of the quarter, not only contains details on such things as the volume of wastewater pumped, trash removal, and daily rain data, but, for the purposes of this paper, it also contains the results of a computer model run of the discharges for from the District's CSO system for each quarter of the year. Deep thanks for the staff of DC Water for their diligence in furnishing the report. As with the previous report, I am indebted to Carlton Ray, Director, Clean Rivers Project and his staff including Mr. John Cassidy for their generosity in supplying needed background on some of the Rock Creek CSOs. My appreciation continues to flow to Mr. Emanuel Briggs, Manager, Community Outreach, Office of Marketing and Communication, DC Water who is unfailingly responsive to my queries. My colleagues in the environmental community, particularly Mr. Chris Wiess, Executive Director, DC Environmental Network, who continues to furnish needed support and sage advice. Jeanne Braha, Executive Director and John Boland, Watershed Programs Manager, Rock Creek Conservancy, offered a valuable broader perspective on the eco-system of Rock Creek.

Family and friends continue to offer encouragement to this somewhat odd quest to grapple with pollution in Rock Creek. My sister, Ann Sayles, has always offered a note of encouragement as has Marguerite (Mickey) Sayles and the late Mary Whelan whose wise counsel was always helpful. But, as always, it continues to be the support from my partner Marion L.R. Granigan, whose eagle-eye for detail and on-going faith in me has proven to be amazing, baffling and humbling. She continues to deserve a parade.

My apologies to any folk I may have missed. My debt to all of you is as large as the sky.

Of course, responsibility for mistakes, errors, and omissions remains mine alone.

Abbreviations

BPWWTP – Blue Plains Wastewater Treatment Plant

CD – Consent Decree

CSO – combined sewer overflow

DOEE – District Department of Energy and the Environment

EPA – US Environmental Protection Agency

GI – Green Infrastructure

LID – Low Impact Development

LTCP – Long Term Control Plan

MG – million gallons

MGD – million gallons a day

NPS – National Park Service

RCMI – Rock Creek Main Interceptor

Executive Summary

- Of the 29 Rock Creek CSOs, one single CSO, the Piney Branch CSO 49, contributed over 80 percent of the CSO volume discharged to the creek over the five year study period 2015-2020. It released over 27 times the volume of overflow compared to the next dirtiest CSO.
- Ranked by discharge volume over the five-year period, of all the Rock Creek CSOs, with the exception of CSO 49, (see Appendix, Table C), the second and third dirtiest CSOs are CSO 35 underneath the P Street Bridge (20.63 MG) and CSO 43 just upstream of the Harvard St./Zoo Bridge (18.1 MG)
- The fourth dirtiest of the Rock Creek CSOs is CSO 36 beneath the Que Street Bridge (12.52 MG).
- Of the remaining CSOs on Rock Creek, none discharged more than 5 MG over the five year study period, a volume so minimal that no control strategies were considered in this study.
- Ranked by neighborhood (see Table A), the Mt. Pleasant/Piney Branch sewershed, excepting flows from the giant Piney Branch CSO, is by far the dirtiest, releasing over 75 MG of combined sewer overflow. The next dirtiest, the Dupont Circle West overflows, discharged over 42 MG. According to the model, the Georgetown group discharged a mere 4.89 MG while the Kalorama sewershed overflowed only about 2 MG. But the Normanstone CSOs had no combined sewer overflows during the five year study period.

Recommendations

- Continue efforts to reduce overflow volumes at CSO 49 Piney Branch through a combination of green infrastructure (GI) and storage as required by the Long Term Control Plan. Consider additional measures such as green roofs, more extensive use of permeable pavement for alleys and roads, and continued work on drainpipe disconnects.
- Work to reduce overflows at CSO 35 and 36 that endanger waders at P St Beach. through regulator improvements, water saving devices, expanded drainpipe disconnects, and raingardens where appropriate
- Evaluate innovative stormwater controls in Mt Pleasant to reduce overflows at CSO 43 just upstream of Harvard St Bridge. Consider distributing free water saving devices to the neighborhood to reduce flows as well as stormwater reduction measures such as rain barrels, rain gardens along Irving St. and drainpipe disconnects.
- Consider distributing free water saving devices in the hotels and condos in the West End that are tributary to CSO 33. Consider installing raingardens in the sewershed to reduce stormwater flows.
- Anticipate the effects of climate change on the CSO system that, according to climate scientists, will increase the severity and frequency of rainstorms with concomitant increases in CSO overflows.

When It Rains – It Pours – A Preview of the Rains to Come?

It was an otherwise unremarkable day on July 8, 2019, when the US Women's Soccer Team won its 4th World Cup, Iran raised uranium enrichment levels…and it rained.

At one point, meteorologists estimated it was raining 5 inches an hour. Three billion gallons of water fell from the sky; the equivalent of 27 million hot tubs or 48,000 Metro rail cars. Avenues became creeks, Metro entrances became cascading waterfalls. When it hit our sewer system, the effect was dramatic. Fountains of sewage shot from manhole covers at 17th St, D St, F St and Virginia Ave in Northwest Washington. CSO 12 near the baseball stadium gushed for almost three hours. CSO 21 by the Kennedy Center overflowed for about an hour and a half. And CSO 34 near P Street Beach, conveying the remnants of the old Slash Run Creek that used to flow through downtown, discharged its load into Rock Creek for almost half an hour. Clearly, this was no time to be in the water.

This extreme example shows us the worst that could happen. But climate scientists tell us this event is a preview of the future effects of climate change. Even now, a gentle summer rain produces a torrent of billions of gallons of storm water and combined sewer overflows in our often out of sight, out of mind sewer system.

The Combined Sewer – An Artifact of Sanitary Engineering

The combined sewer is an antiquated sanitary engineering artifact that attempted to solve the perpetual problem in sanitary engineering: how to accommodate the huge volumes of stormwater and wastewater as quickly and cheaply as possible and with minimal disruption to the neighborhood. This system combined wastewater from toilets and baths in the same pipe with stormwater from roofs and streets by confining the wastewater to a central sunken channel in a middle of the larger pipe (see Figure 1). During dry weather, as long as the sewage is contained in the channel, the wastewater flows, usually by gravity, to the treatment plant. But during rainstorms, the pipes fill rapidly and the sewage laden wastewater overtops its channel and flows into the nearest water course.

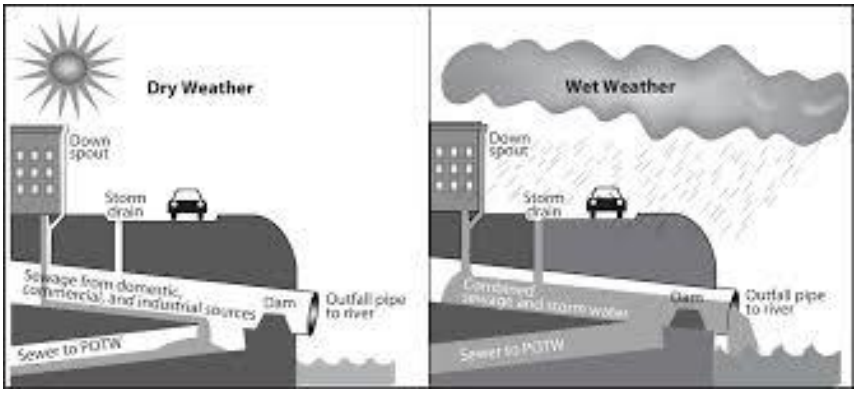

Figure 1. This schematic illustrates generally how CSOs work to pollute nearby waterways

When this system was first employed in DC in the heyday of sewer construction during "Boss" Shepard's tenure as Mayor in the 1870s, sensibilities around pollution were quite a bit different than today.[2] Then the adage "the solution to pollution is dilution" was in full sway.

Engineers computed that the offensive overflows would only occur when there was as much as three times the amount of stormwater as wastewater, theoretically making pollution impact on the stream, in their eyes, relatively minor.

However, as it developed, there were a number of problems with this approach. For one thing, under pressure from real estate speculators, rapid development occurred in the District, particularly after the First and Second World Wars, which brought armies of office workers to town. This flood of folks overwhelmed the sewer system, both overloading the pipes that were built to accommodate a much smaller population and overwhelming the treatment plant that was habitually forced to discharge its load with minimal treatment back to the Potomac River. This

[2] Most historians agree that Mayor Shepard's sewer system was a disaster. Pipes often lacked even a nod to the basic principles of hydraulics. Designed mainly to satisfy his friends in the real estate business. Most of them had to be rebuilt by the Army Corps of Engineers after Shepard's tenure. Shephard's sewers typically just drained into the Washington Canal, already a dangerous fetid ditch that periodically only flowed with the tides to form the malaria laden swamp flats adjacent to the present site of the Lincoln Memorial. Small wonder that many presidents decamped to higher and less dangerous suburbs especially during the dank humid days of Washington summers.

Why Can't We Just Separate Our Sewers?

To separate combined sewers, crews dig trenches seven to ten feet deep, usually in the middle of the street, locate the offending pipes, and reconnect them to pipes leading to the treatment plant. This is a messy, expensive, and cumbersome process that is, understandably, not popular with the adjoining neighbors. It is best accomplished when the number of sewers that need reconnecting is relatively small or when utility work is already scheduled for the location and the neighborhood disruption is already happening anyway. But even then it is hardly a happy time for the locals. On Georgetown's M Street in 2001, for example, during work to realign and improve the 100 year old gas, electric and sewer lines, deadline after deadline slipped as crews ran into surprises digging into the century old infrastructure. Trendy shop owners howled about losing customers and irate and influential Georgetown residents hammered on politicians to force the utilities to hurry up and get the job done. DC Water is understandably reluctant to undertake a similar sewer separation project. Small wonder that they were eager to embrace a deep tunnel system 100 ft. beneath the surface that would store the polluted rainwater but be much less disruptive.

had devastating results. Fish died. Contact with the Potomac was banned. The river stank and huge floating stinking algal mats formed as far upstream as Georgetown. Instead of opening at intervals, some of the overflows, connected to pipes far beyond their capacity, flowed constantly. Adding to the problem, the District's Department of Sanitary Engineering was perpetually behind in badly needed maintenance of the system. And the Potomac, Anacostia and Rock Creek paid a heavy pollution price. In 1972, the DC Council banned contact with all of them.

But even much earlier in the late 1800's, it did not take an expert to know that District's sewage was flowing into the Washington Canal and festering there subject only to the tides. In response to the ongoing pollution, and the stench, malaria, and cholera that accompanied it, President Harrison convened a special panel to review the situation and recommend improvements. The "Hering Report" released in 1907 contained the all the key elements for creating the present day sewer system. For example, the city started building separate systems of wastewater and stormwater. Generally speaking, this meant that newer portions of the District, particularly the White middle class parts, received separate sewers, while the older (and Blacker) portions of the city, generally the city south of Florida Ave and stretching east past Capitol Hill to the Anacostia River, remained on the combined system. Some exceptions include most of Southwest, which got its sewers separated as a consolation prize for the devastation caused by the "urban renewal" that wiped out complete neighborhoods. For some reason, large portions of

Anacostia east of the river were also built with separate sewers. With the exception of Georgetown, almost all the land west of Rock Creek Park is served by separate sewers. Other ideas contained in the Hering Report included the construction of large interceptors to block sewerage from flowing into Rock Creek, Potomac and the Anacostia and the recommendation of siting of a treatment plant downstream from the city. All that remained was to gain the funding to implement the recommendations. That effort would take over a century.

FIGURE 2. INSIDE THE TIBER CREEK COMBINED SEWER, JANUARY 2017. THIS TYPE OF SEWER FEATURES A CENTER CHANNEL OR CUNETTE THAT IS OVERARCHED BY MULTIPLE COURSES OF BRICK DURING HEAVY RAINS, THIS ENTIRE TUNNEL WILL FILL WITH COMBINED SEWAGE.

CSO Regulator Structures

To relieve the volumes of wastewater and protect the sewer system from being overloaded, CSOs have special valves that open during heavy rains (and sometimes not so heavy rains) to disgorge the contents of the pipe, now mixed sewage and rainwater, into the nearest waterway. This protects the sewer system but grossly pollutes the nearest creek or stream. The flows out of these pipes are controlled by CSO regulator structures.

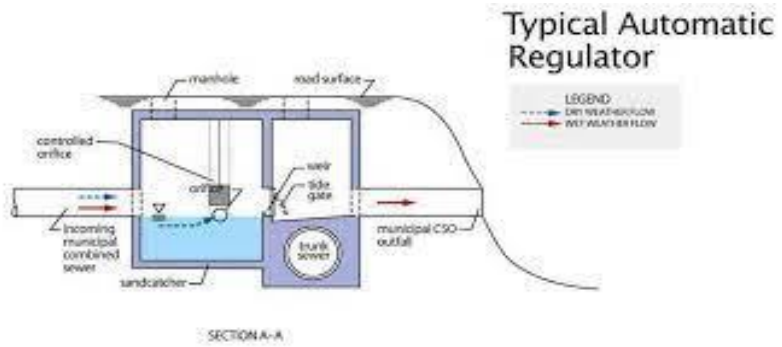

Figure 3. This regulator has a float that opens a valve when the flow of combined sewers reaches a certain level.

The Monthly Operations Report records 131 CSO regulator structures in DC's system. Forty-two are associated with Rock Creek outfalls but five of these outfalls have either been separated or otherwise do not function as CSOs (see the list in Appendix. Table B.) These structures vary widely as to design, operation, and location. For example, some structures are merely simple weirs or dams across the pipes directing water behind the weir to the treatment plant. In the event of heavy rains, the combined wastewater overtops the weir and flows into a pipe leading to the CSO outfall. Some structures, like the one pictured above, feature automatic gates to control the overflows. Some of the structures are near their associated outfalls but others are blocks away and may control multiple outfalls. Each CSO sewershed has its unique typography and hydraulics and each overflow itself is governed by a CSO regulator that determines when and how often combined wastewater is released to the creek. [3]

[3] In the early days of combined sewer construction, long before the passage of the Clean Water Act in 1972, knowledge and awareness of the problems of water pollution were considerably less than they are now. Sanitary engineers typically set CSO regulators to open when sewer flows were over one third of the flows of the receiving stream which in their mind provided adequate dilution to the pollution.

The case of CSO 34 is an interesting example. According to the listing in Table B, CSO 34 has three structures devoted solely to control its outflow. But in addition, there are seven other regulator structures that control both CSO 34 and CSO 22. In this case, these multiple regulators for CSO 34, often called "Slash Run" after the creek it replaced, may work to conveniently shift the wastewater away from CSO 34, an outfall on the south end of "P Street Beach," and towards CSO 22, a large outfall on the Potomac just downstream from the Thompson's Boat Center across from the Watergate complex.

For a sense of how regulators might work to reduce discharges, we compared the discharges of two different outfalls controlled by the same set of regulators. The monthly operating report for the combined sewer system for the second quarter of 2021 reported that discharges to the Potomac from CSO 22 amounted to over 25 million gallons. In stark contrast, the discharge to Rock Creek from the associated CSO 34 was zero. This could indicate that the pollution load of the small Rock Creek with limited assimilative capacity was lessened by 25 MG and the load to the Potomac with a massive assimilative capacity was slightly increased by 25 MG.

The Consent Decree (CD) recognized the role that regulator structures might play in reducing overflows and improving water quality. The Decree required DC Water to undertake monitoring at Rock Creek outfalls 33, 36, 47 and 57. In addition the CD mandated the sewer separation of CSOs 31, 53 and 58. According to the quarterly reports submitted by DC Water to EPA, DC Water met those deadlines in the CD. The relevant CSO sewersheds were separated in 2011 and the regulators for CSOs 33, 36, 47 and 57 were adjusted to reduce overflows by 2013. CSO 57 was also to be completely separated, eliminating the CSO discharge from that outfall. But, as we can see from the quarterly reports, there continued to be discharges recorded by the model from some of these CSOs during the 2015-2020 study period.

We recognize that understanding how the DC Sewer System works is a complex task and that water diverted from one outfall usually has to go somewhere to prevent the flooding in basements and streets that makes people unhappy. Still, there may be opportunities to shift the load away from vulnerable resources. In this case, if the regulators have indeed played a small

role, shifting 25 million gallons of overflow from Rock Creek to the Potomac, would be good news for the water quality of Rock Creek.

How much did this additional discharge affect the water quality of the Potomac? The answer is that it was hardly noticeable. While the extra 25 million gallons of wastewater from CSO 22 during the second quarter of 2

021sounds like a lot, it is important to put this in context. For example, during the same time period, CSO 21, immediately downstream of CSO 22, next to the Theodore Roosevelt Bridge, disgorged 105 million gallons of wastewater in the Potomac, over five times the discharge from CSO 22 and the largest single CSO discharger on the Potomac River.

There are other CSOs that appear to have multiple regulator structures. For example, CSO 35 has two regulatory structures controlling the flows from the NW Boundary Sewer. CSO 44 has two regulators that control flows from part of the Mt Pleasant neighborhood. It might be possible to reduce overflows to Rock Creek though judicious manipulation of the regulators to these CSO outfalls.

In the long term, all of these CSOs along the Potomac, including CSO 22, will be connected to the Potomac tunnel and their overflows to the Potomac will be eliminated. However, this construction is not slated to be completed until 2030. In the meantime, DC Water should investigate all other available methods for reducing overflows, particularly to vulnerable creeks such Piney Branch and Rock Creek.

The Rock Creek Combined Sewer Overflows: Where They Are; When They Flow

The Long Term Control Plan (LTCP) lists 29 combined sewer overflow outfalls on Rock Creek, three of which have been separated.[4] This compares rather unfavorably to the number of CSOs on the much larger streams of the Anacostia and the Potomac, which have 17 and 14 CSOs respectively.[5]

Rock Creek's CSOs are a varied lot and fail to yield to the solutions posed for the CSOs on the Anacostia and the Potomac. For example, the tunnel underneath the Anacostia that stores the overflows before sending them to the treatment plant, even though not completely finished as of this writing, still functions to keep millions of gallons of combined sewer overflow out of the river each month.[6] As a side benefit, tons of trash has been captured too. The planned tunnel under the Potomac riverfront extending from the Theodore Roosevelt Bridge to Key Bridge holds similar promise, particularly is capturing the largest flows into the Potomac from CSO 21, slightly upstream from the Theodore Roosevelt Bridge near the Kennedy Center as well as overflows surrounding the aquatic recreational areas of Thompson's Boat Center, the Potomac Canoe Club and the pleasure boat mecca that materializes along the Georgetown waterfront in the summer.

But for the Rock Creek CSOs, several commenters to the LTCP felt that a similar tunnel for the Piney Branch was inappropriate and would cause wide-spread environmental damage to the frail Piney Branch Valey. They urged various GI solutions to attach the problem of overflows at Piney Branch.

But with the exception of much studied CSO 49 at Piney Branch and the separation of one of the CSO in Kalorama and one in Georgetown, the rest of the Rock Creek overflows have been largely ignored and left out of the mix of solutions. However, there are reasonable explanations for this. There are no quick fixes for the Rock Creek CSOs. Their overflows, with

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[4] CSO 31, CSO 37 and CSO 53 have been separated. CSO 54 and 56 have no tributary area and served formerly as relief outfalls for the West Rock Creek Diversionary Sewer. CSO 55 is abandoned.

[5] Three Anacostia CSOs have been consolidated in the tunnel system and no longer discharge to the river.

[6] According to the DC Water website, the Anacostia tunnel is removing 98 percent of the CSO volume that otherwise would have been disgorged into the Anacostia. (dcwater.com/cleanrivers.)

some exceptions, are relatively minor even though they discharge to a relatively small stream that may lack the

assimilative capacity of the Potomac or Anacostia. Solutions may likely be case by case, more complex and more expensive. Other than CSO 49, the Piney Branch overflow, the majority of the Rock Creek problem overflows that are active appear to be in the Mt. Pleasant neighborhood. In the Dupont Circle area, two overflows, CSO 31 and CSO 33, drain only 1.ll acres and 13 acres respectively in the Kalorama neighborhood and West End neighborhoods. CSO 31 has been separated.[7] These two overflows were originally reported in the Long Term Control Plan to act as relief valves for the often overloaded Rock Creek Main Interceptor but subsequent work by DC Water has rectified the problem by resetting the regulators.[8] But the paradox remains as to why such relatively small sewersheds should yield such dramatic overflows. This could mean that reducing that discharge might involve a different strategy of reducing flows elsewhere in the system rather than applying other remedial measures such Green Infrastructure

In keeping with its name, the Mt. Pleasant neighborhood is largely built on a hill. Developed as a streetcar suburb of downtown, the rows of closely built row houses have little public space, which could make installing green infrastructure (GI) a challenge. Nonetheless, DC Water might investigate a instituting a robust water saving campaign in these neighborhoods to reduce flows by providing free water saving devices to each house, office building and apartment dweller. The Rock Creek Conservancy might, with additional funding, expand their down spout disconnect program to this neighborhood to disconnect as many downspouts as possible from the sewer system. DC Water could institute a robust, heavily subsidized, program of green roofs in the West End neighborhood. In addition, working with the National Park Service, DC Water might investigate the possibilities of installing GI along the fairly level portion of the western side of Adams Mill Road from Kenyon Street to Porter Street and installing green roofs in the catchment area north of Dupont Circle to protect “P St Beach” from overflows.

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[7] Long Term Control Plan, page 3-3. The Kalorama sewershed is composed of high end single family homes. The West End neighborhood, originally a blend of light industrial and car dealerships, now is mix of high rent condos and hotels.
[8] Email communication with John Cassidy, Program Manager, Clean Rivers, DC Water, June 11, 2021.

There is one overflow at 22nd St NW south of Q St NW but again these flows appear to be relatively minimal – and usually occur only after heavy rains. But in very wet conditions things change. In the third quarter of 2020 for example, all of the CSOs in Rock Creek opened up. Not counting the gargantuan CSO 49, the rest of the CSOs disgorged over 32 million gallons of combined sewage and stormwater into Rock Creek in that one quarter.

As the Table C in the Appendix indicates, aside from the behemoth Piney Branch CSO 49 which we will discuss separately, the next largest CSO discharger is CSO 35 (20.62 MG), which gathers household sewage and stormwater from an area roughly from 12th and Florida Ave NW, west to 23rd St. and south to R Street. Also known as the NW Boundary Sewer, this CSO has the largest drainage area (546.69 acres) of any of the ranked Rock Creek CSOs except for Piney Branch. This CSO, because of its location just upstream from the recreational area of P St Beach, could threaten the public health of waders who come in contact with the creek in this area, especially after rain events.

The third largest CSO discharger would be CSO 43 (18.1 MG), just upstream of the Zoo Bridge at Harvard St. and Beach Drive. This area of Rock Creek has also been known to entice waders during the summer months.

CSO 36, the fourth largest of the ranked Rock Creek CSOs (12.52 MG), is, like CSO 35, just upstream from P St. Beach, making the pair of them a hazard to waders after rainstorms. The CSO 35 catchment area is generally from the embassy row area along Massachusetts Ave. and north to the fashionable area of Kalorama. Surprisingly, although this CSO has a substantial catchment area (more than 69 acres) it released a relatively small amount of overflow. The outfall is controlled by two regulators. Whether the relatively small amount of flow is the result of both regulators or the character of the catchment area or other hydraulic factors is unclear.

The Special Case of the Piney Branch CSO 49

More than eighty percent of the CSO volume discharged to Rock Creek between 2015 and 2020 comes come from a single CSO — CSO 49 at Piney Branch. It is by far the dominant polluter on Rock Creek. No other CSO comes remotely close in both frequency and volume. (See Appendix Table D[9]). CSO 49 is the largest combined sewer overflow in the entire city (513.95 MG) – conveying all the stormwater and wastewater from more than 2,000 acres of mostly residential land extending from 16th St and Arkansas Ave in Rock Creek almost to Takoma Park. This massive sewershed explains the volumes of overflow. Figure 3 showing the three gigantic gates of the outfall gives the reader some indication of the immense amounts of water that can be released from this outfall. During one torrential downpour, the author observed this outfall completely filling up the spillway and inundating the adjacent road up to the hubcaps of his car.

Before it was entombed in storm and sanitary sewers, the Piney Branch Creek originally stretched from Rock Creek almost to Eastern Ave, rivaling only the Tiber Creek in size and drainage area. Much of the creek, under pressure from real estate interests, was encased in storm sewers to free land for development. But the final blow came in the 1930's, when under the New Deal, Piney Branch was forced into massive tunnels over 12 ft. high at a cost of $3.5 million.[10] This served the developers of Crestwood, Sixteenth St. Heights and Takoma Park well, but condemned the once mighty Piney Branch Creek to a flow largely composed combined stormwater and sewage.

[9] Table D shows that the largest discharges in CSO 49 are typically in the 3rd quarter of 2018, 2019 and 2020.

[10] The Works Progress Administration (WPA) of the New Deal financed a number of sewer improvements including the construction of the treatment plant at Blue Plains. More information from: thelivingnewdeal.org/projects/rock-creek-and piney-branch-sewer-system-washington-dc/.

Figure 4. This combined sewer overflow outfall, CSO 49, is the largest in the system. During heavy rainstorms, this spillway can fill up completely due to its massive catchment area of over 2,500 acres. Photo by author, 2014.

DC Water has been grappling with what to do about CSO 49 for decades and has made some progress. Now, during dry weather a weir directs much of the flow of CSO 49 to the West Rock Creek Diversionary Sewer which connects to CSO 21 that discharges to the Potomac. Originally, the LTCP contemplated a giant 23 foot storage tunnel on the north side of Piney Branch, similar to that planned for the Anacostia and the Potomac to retain the overflows and send them to the treatment plant after the storms. But in January, 2016, DC Water proposed a hybrid Green Infrastructure (GI) approach that would employ the extensive use of GI such as green roofs, rain gardens and permeable pavement to reduce or retain stormwater. But after evaluating the results of two projects in the sewershed, in June, 2020, DC Water concluded that the cost of applying GI to the entire treatment area of 365 acres was more than the cost of a tunnel and that there was not enough public land available to install enough GI to meet the water quality goals of the program. In April, 2021, DC Water received approval from EPA for its "Practicality Assessment" that concluded that attaining the necessary acreage of GI was not possible. This new agreement requires an additional 2.1 MG of stormwater retention to be built, gives a credit of 2.3 MG of stormwater credits from public and private landowners, and requires

an additional 4.2 MG storage facility to be built. These actions were predicted to limit the overflows at Piney Branch to one per year and the rest of the outfalls on Rock Creek to no more than 4 overflows annually – all by 2030. As of September, 2021, the project is awaiting an Environmental Impact Statement as the project would likely be sited on National Park Service land.

Where the Combined Sewers Are

This study divides the 29 Rock Creek CSOs into five neighborhoods based on the sewershed served by that particular outfall. (See Appendix, Table E) The Mt. Pleasant/Piney Branch/Zoo area has the most active outfalls (nine), followed by Georgetown/Foggy Bottom with six, and the Dupont Circle west area and the Kalorama neighborhood tied with five outfalls each. However, as we shall see as we examine the flows from outfalls over the five year study period, some outfalls discharge all the time, some only during periods of heavy rains, and some not at all.

The following Figure 5 shows the relationship between rainfall and Rock Creek CSO volume. While CSO volumes generally trend with rainfall, the relationship is far from linear.

During the five year study period, five distinct peaks of rainfall appear, with the second and third quarters of 2018, 2019, and 2020 being the wettest of the quarters and producing the largest volume of overflows.

FIGURE 3. ROCK CREEK CSO VS RAINFALL

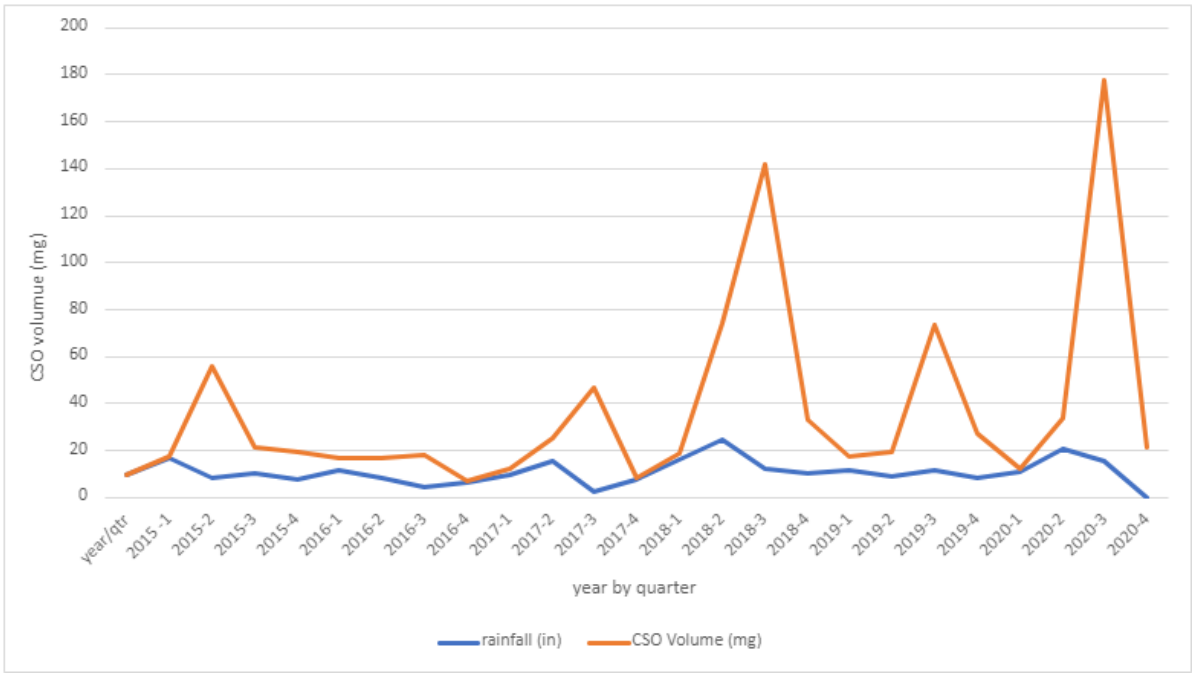


Figure 2. Relatively small changes in rainfall can result in large increases in CSOs. Typically, the 2nd and 3rd quarters are the wettest and create

the most CSOs.

Overflows by Neighborhood

We discuss each of the neighborhoods with a graph showing the discharges of their associated CSOs over the 2015-2020 study period. Each line graph is derived from data in Appendix Tables E. F, G, H, I and J that list the overflows by outfall for the period of 2015-2020. In general, the overflows are most active during the wettest quarters – the 2nd and 3rd quarters of 2018, 2019 and 2020. The neighborhoods are grouped starting from the most downstream overflows in Georgetown/Foggy Bottom/West End and proceeding upstream to Mt. Pleasant/Piney Branch.[11]

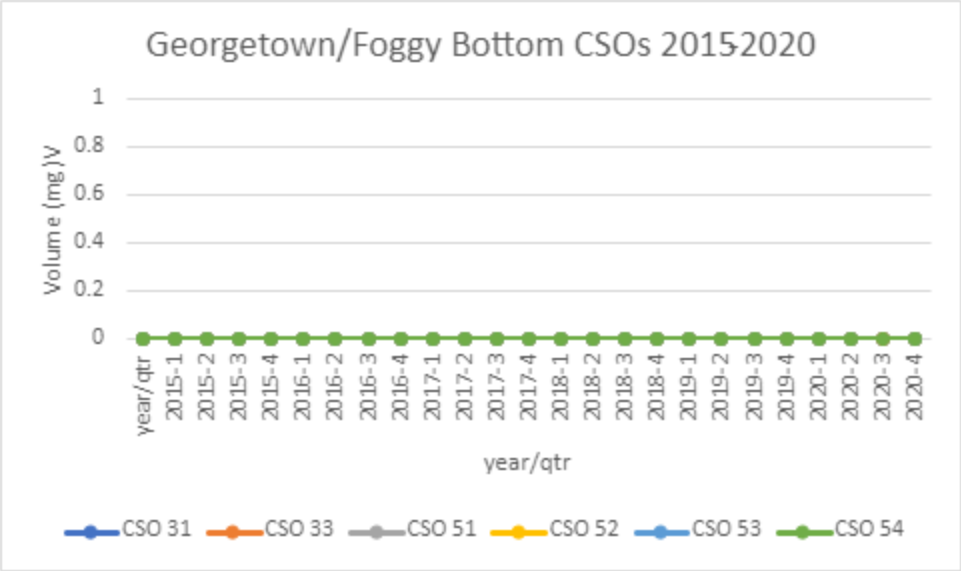
[11] With the separation of CSO 59 at Luzon Branch in 2002, there are no CSOs on Rock Creek upstream of Piney Branch. This could indicate that that high E. coli levels detected upstream of Piney Branch may stem from other sources such as illegal cross-connections or leaking sewer lines (see the author's previous study "Leaking Sewers of Rock Creek available at marchant_wentworth@msn.com.

Georgetown/Foggy Bottom/West End CSOs 2015-2020

The first two CSOs (31 and 32) on the east bank of Rock Creek have no discharge to the creek. CSO 31, underneath the Pennsylvania Ave Bridge, has been separated, and CSO 32 has no discharge over the study period. CSO 33 on the east bank of Rock Creek in the West End neighborhood near 25th and N Streets was only slightly active, releasing 4.89 million gallons (MG) of combined storm and wastewater over the five year period and releasing 2.45 MG in the wet 2nd quarter of 2020 alone. (See Appendix Table E). This CSO was only active in the second quarters of 2018, 2019 and 2020, relatively wet quarters. The sewershed area of CSO 33 is composed of only 11 blocks in the West End neighborhood (3.08 acres) and extends from N St NW on the north, M St. on the south, 24th St on the East and 25th St on the West. In the nineteen fifties, this area was mostly light industrial, with car repair and car dealerships. It is now replete with condominiums, offices and hotels. This relatively large discharge of this CSO is surprising for a comparatively small sewershed. Earlier reports indicated that this CSO acted primarily as a relief overflow for the Rock Creek Main Interceptor but DC Water staff now reports that the regulator structures have been adjusted to reduce the overflow.[12] However it is clear from the quarterly reports that overflows, however slight, continue.

The remaining CSOs in this neighborhood include one on the west bank at Olive Street in Georgetown, two on the west bank at O St and one further upstream on the west bank 300 ft. south of the Massachusetts Ave Bridge. As the graph below indicates, none of these appear active. The discharges to this area of Rock Creek from West End downstream to the mouth of Rock Creek are relatively slight. This means that this portion of the creek is relatively clean.

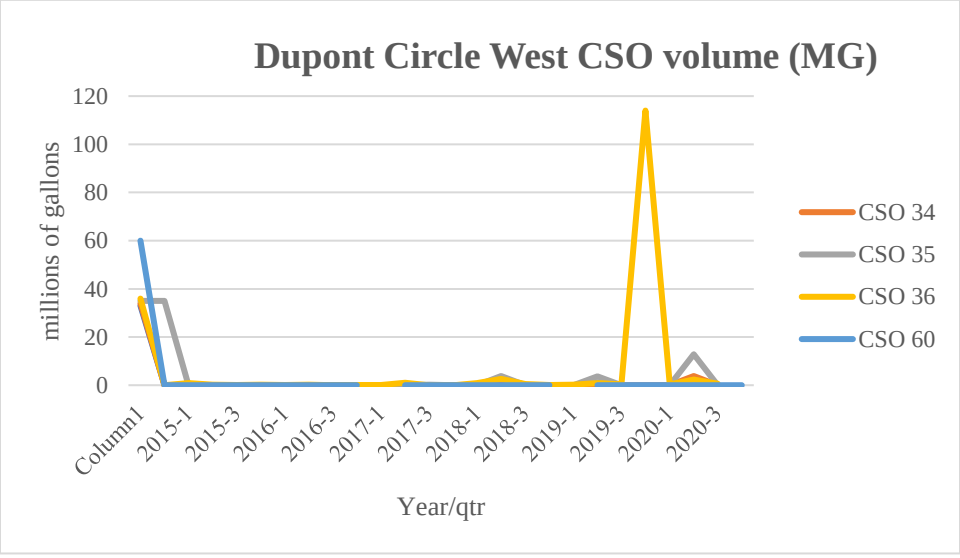
[12] Email communication from John Cassidy, Program Manager, Clean Rivers Program, DC Water, June 11, 2021


Georgetown/Foggy Bottom CSOs 2015-2020
Volume (mg)V
1
0.8
0.6
0.4
0.2
0
year/qtr
2015-1
2015-2
2015-3
2015-4
2016-1
2016-2
2016-3
2016-4
2017-1
2017-2
2017-3
2017-4
2018-1
2018-2
2018-3
2018-4
2019-1
2019-2
2019-3
2019-4
2020-1
2020-2
2020-3
2020-4
year/qtr
CSO 31
CSO 33
CSO 51
CSO 52
CSO 53
CSO 54

The CSOs of Dupont Circle West

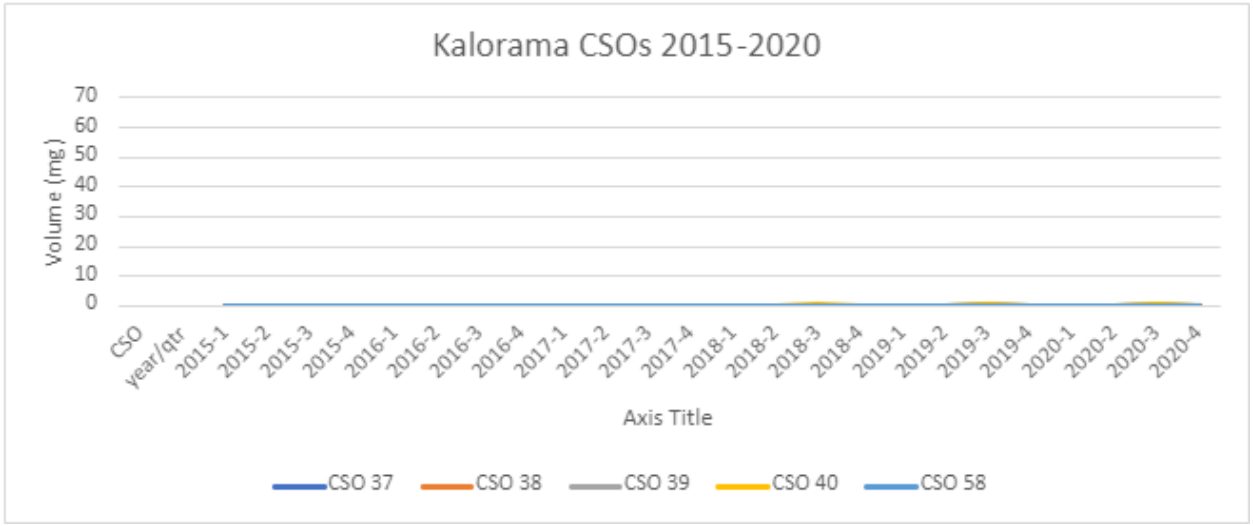
Of the four CSOs in this area, by far the heaviest discharger is CSO 35 located under the P Street Bridge, discharging over 20.6 MG during the study period — the majority of it in the wet 2nd and 3rd quarters of 2017, 2018, 2019 and 2020 (See Appendix Table G for details). Aside from the massive overflow volume of CSO 49 on Piney Branch, CSO 35 is the second largest discharger on the creek. Just upstream from CSO 35, also underneath the Q St Bridge is CSO 36, the fourth largest discharger on Rock Creek, which was active during the wettest 3rd quarters of 2018 and 2020 but releasing only about 12.5 MG. Because these two outfalls are immediately upstream of "P Street Beach," a popular gathering place in the summer, they pose a particular threat to water contact in that area – particularly after rain storms.

The sewersheds of these two CSOs are some of the largest on the creek—and therefore difficult to control. In the case of CSO 35, also known as NW Boundary Sewer, to picture the extent of the sewershed of 546.69 acres, think of a giant funnel extending northeast from Dupont Circle to Adams Morgan, north up 16th St to Columbia Rd, east to 14th St. and south to R St. Only CSO 34, also known as Slash Run, rivals it in the size of its drainage area of 473.34 acres.. In the case of CSO 36, that sewershed drains 69.76 acres and extends along Embassy Row along Massachusetts Ave. and northeast to the Kalorama neighborhood.



The Kalorama CSOs 2015-2020

The five CSOs in the Kalorama neighborhood of Rock Creek are quiet compared to others in the system. Two of them, CSO 37 and 53 have been separated. Of the three remaining, CSO 38 discharged only a negligible 0.0001 MG during the five year study period – hardly noticeable compared to some of the others in the system. CSO 39, underneath the Connecticut Ave Bridge, discharged slightly less than 1 MG while CSO 40 at Biltmore St extended, was the most active, releasing 1.5 MG during the same period. All of these overflows generally only occurred during the wettest quarters of 2018, 2019 and 2020.

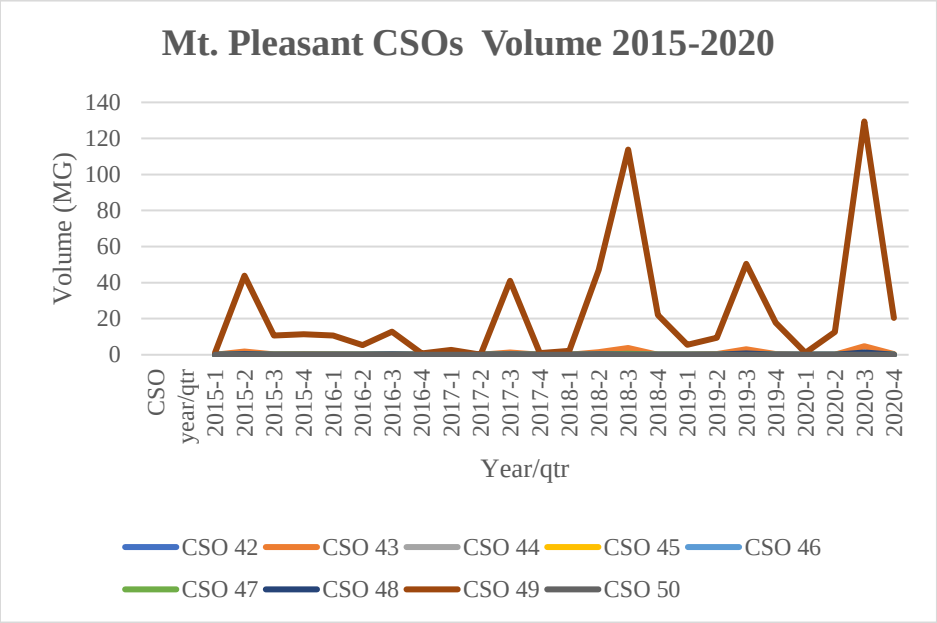


Mt. Pleasant/Piney Branch/Zoo/Crestwood CSOs

The CSOs in this neighborhood discharge more overflows than any other on Rock Creek. They serve the distinct neighborhoods of Mt Pleasant, Columbia Heights and Crestwood. Four of these CSOs drain to Rock Creek in the area bordered by Mt. Pleasant on the east side of the creek and the National Zoo on the west side. The rest of the five discharge to the tiny and picturesque Piney Branch Creek, whose flows, since being entombed in trunk sewers, are almost entirely composed of combined sewer overflows laced with small seepages of spring water. At the outfall of CSO 49 they now form the headwaters of what remains of Piney Branch Creek, once a mighty stream that extended almost to Maryland, but now confined in storm sewers to accommodate land development.

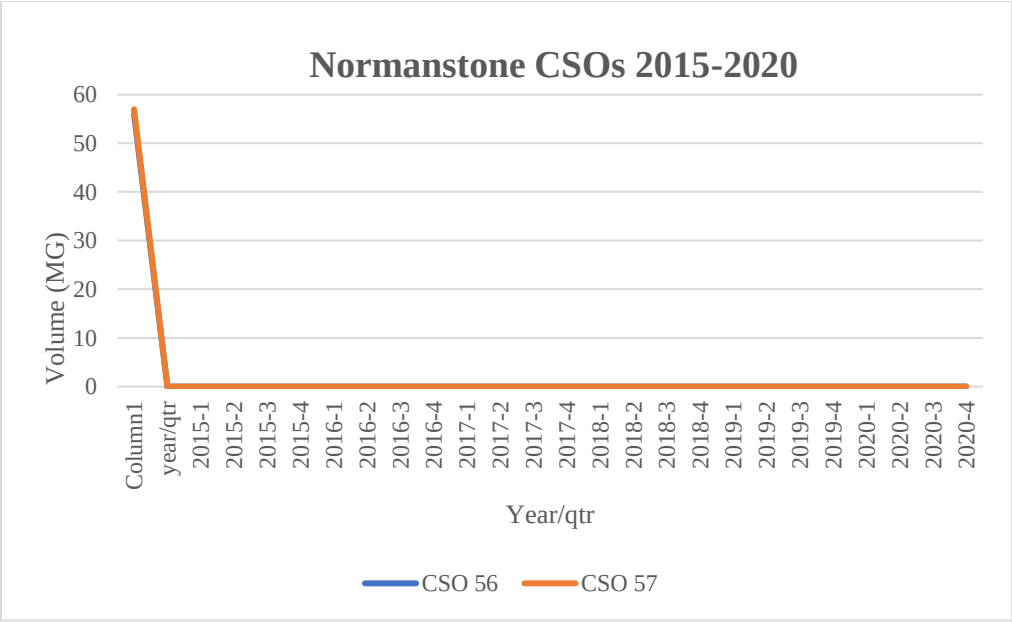
As discussed previously, one single CSO in the neighborhood dwarfs all the rest (See the Special Case of the Piney Branch CSO 49 Figure 3).

Of the remaining CSOs in the Mt. Pleasant neighborhood, CSO 43 is the main offender, releasing 18.14 MG of overflow making it the third largest in the system and second only to Piney Branch in the Mt. Pleasant neighborhood. Located just upstream of the Harvard St Bridge, it serves 20.31 acres of portions of the row house neighborhood of Mt. Pleasant. The next largest discharger, CSO 48, drains the small catchment area of Oak St. and Mt Pleasant St. (2.5 acres) and released only 3.62 MG over the five-year period.


Mt. Pleasant CSOs Volume 2015-2020
Volume (MG)
140
120
100
80
60
40
20
0
CSO year/qtr
2015-1
2015-2
2015-3
2015-4
2016-1
2016-2
2016-3
2016-4
2017-1
2017-2
2017-3
2017-4
2018-1
2018-2
2018-3
2018-4
2019-1
2019-2
2019-3
2019-4
2020-1
2020-2
2020-3
2020-4
Year/qtr
CSO 42
CSO 43
CSO 44
CSO 45
CSO 46
CSO 47
CSO 48
CSO 49
CSO 50

Normanstone CSOs

Although this valley of stately single family homes suffers from leaking sewers, the two CSOs contributed no overflows during the five year study period. This not to say the neighborhood is spared from the onslaughts of pollution: surveys by the Anacostia Riverkeeper Network reveal consistently high bacteria counts in the Normanstone tributary there. This is consistent with the problem of leaking sewers in the area that have plagued the neighborhood for years.



References

District of Columbia Water and Sewer Authority (WASA), 2002. Combined Sewer System Long Term Control Plan (LTCP). https://www.dcwater.com/sites/default/files/Complete%20Long-term%20Control%20Plan.pdf

Hering Report. Report upon the Sewerage of the District of Columbia. Rudolph Hering, Samuel M. Gray, Frederic F. Stearns Board of Sanitary Engineers. House of Representatives, 51st Congress, 1st session, Ex.Doc No. 445. Washington. Government Printing Office, 1890.

Monthly Operations Report for the Combined Sewer System. The Reports are grouped quarterly and generally available by the 23rd of the month following the end of the quarter. The reports are available on DC Water's web site: DC Water.com under publications.

Rock Creek and Piney Branch Trunk Sewers, Washington. DC (https://livingnewdeal.org/new-deal-categories/infrastructure/sanitation-water-disposal/)

Appendix

Table A. Neighborhood CSOs Ranked by Discharge Volume 2015-2020 (MG)

Mt. Pleasant/Piney Branch[13]	75.21
Dupont Circle West	42.11
Georgetown/West End	4.89
Kalorama	2.43
Normanstone	0

[13] The Mt. Pleasant discharge volumes excludes CSO 49 for the purposes of this study to afford a better comparison between CSO discharges and because control strategies are in progress.

Table B: Rock Creek CSOs, Regulator Structures, Location, and Discharge (MG) 2015-2020

CSO #	Reg Structure	Location	discharge (MG)
31	49	beneath PA Bridge	0
32	50	26th and M Sts	0
33	51	25th and N extended	4.89
34	52	22nd between M & N Sts	4.86
34	52a	N St between 22nd and 23rd	ditto
34	54	23rd and O Sts	ditto
34, 22	36b	19th and L Sts	ditto
34, 22	36d	17th and L Sts	ditto
34, 22	36g	18th and M Sts	ditto
34, 22	36h	18th and M Sts	ditto
34, 22	53	22nd and M Sts	ditto
34, 22	53a	22nd and M Sts	ditto
34, 22	53b	L St between 21st St and NH Ave	ditto
35	55	22nd St south of Q St.	20.62
35	55a	22nd St south of Q St.	ditto
36	56	23rd and Mass Ave	12.52
36	57	23rd south of Q St	ditto
37	58i	NW of Belmont Rd	0
38	59	North of Belmond Rd	0
39	60	Beneath Conn Ave Bridge east bank	0.93
40	61	Biltmore St extended east bank	1.5
41	62	Ontario Rd extended	0.09
42	63	Harvard St and RC Pkwy extended	2.46
43	64	Adams Mill Rd and Irving St extended	18.1
44	65	Adams Mill Rd and Kenyon St extended	0.914
44	65a	Adams Mill Rd and Kenyon St extended	ditto
45	66	Adams Mill Rd and Lamont extended	2.10
46	67	Beneath Park Rd Bridge	0.37
47	68	Ingleside Terrace and Piney Branch Pkwy extended	1.54
48	69	Mt Pleasant and Piney Branch Pkwy extended	3.62
49	70	Piney Branch Pkwy west of 16th St.	513.95
49	70i	5th and Quackenbos Sts	ditto
50	71	28th St extended	0
51	72	Olive St extended	0
52	73	Olive St extended	0
53	74	Que St extended	0
54	75	West bank, 300 ft. south of Massachusetts Ave Bridge	0
56	77	Normanstone Dr extended	0
56	77a	Normanstone Dr and Normanstone Lane	0
57	78	28th St extended	0
58	79	Beneath Conn Ave Bridge east bank	0
totals 42 structures 5 separated or abandoned			

Table C. Rock Creek CSOs Ranked by Discharge (MG) 2015-2020

Outfall #	Location	Drainage (acres)	Catchment area (acres)	Discharge (MG) 2015-2020
49	Piney Branch Pkwy and 17th St	2,433.20	16th St to Eastern Ave	513.95
35	Beneath P St Bridge	546.69	NW Boundary Sewer	20.62
43	Upstream of Harvard St and Beach Dr	20.31	Irving St Mt. Pleasant	18.1
36	22nd and Q St NW	69.76	Mass Ave and 24th	12.52
33	West of 25th and M Sts NW	13.08	25th and N	4.89
34	South End P St Beach	473.34	Slash Run*	4.86
48	Aligned with 17th St and Piney Branch	26.06	Oak St Mt. Pleasant	3.62
42	Aligned with Harvard St and Beach Drive	36.22	Quarry Rd	2.46
45	Aligned with Walridge Pl and Beach Dr	70.31	Lamont Mt. Pleasant	2.15
47	Aligned with Piney Branch and Ingleside	18.16	Ingleside Mt. Pleasant	1.54
40	Between Conn Ave and Ellington Bridges	24.52	Biltmore St	1.5
44	Aligned with Kenyon St and Beach Dr	17.17	Kenyon St, Mt. Pleasant	1.5
39	Underneath Conn Ave Bridge	54.25	Belmont St	0.93
46	Underneath Park Rd Bridge	17.38	Park Rd, Mt. Pleasant	0.37
41	Aligned with Beach Dr and Ontario Rd	27.17	Ontario Rd	0.09
38	North of footbridge, south of Conn Ave	9.54	Kalorama Circle East	0
31	Beneath PA Ave Bridge	1.11	West End	0
32	26th and M St NW	10.38	26th and M St NW	0
37	Waterside Dr and Rock Creek	16.83	Kalorama Circle	0
50	Aligned with L St and Rock Creek Pkwy	36.41	27th and M Sts NW	0
51	Aligned with Olive St and Rock Creek Pkwy	11.87	29th and Olive Georgetown	0
52	Aligned with O St between P St and PA Bridges	108.5	31st and O Sts Georgetown	0
53	Underneath Q St Bridge	5.05	Que St Georgetown	0
54	Mass Ave and Beach Drive and Rock Creek Pkwy	none	Relief	0
55	Mass Ave and Rock Creek Pkwy	none	abandoned	0
56	Aligned with Normanstone and Rock Creek Pkwy	none	Relief	0
57	Aligned with 28th St and Rock Creek Pkwy	84.5	28th St and Cleveland Ave	0
58	Underneath Conn Ave Bridge West Bank	5.24	Conn Ave Cathedral Ave	0
59	Aligned 16th St and Rittenhouse	477.12	separated	0
Notes: CSO 34 shares catchment with CSO 21, just north of TR Bridge on the Potomac				

Table D: Volumes of CSO 49 and the rest of Rock Creek CSOs (MG) 2015-2020

Year/qtr	CSO 49	Rest of CSOs
2015-1	1.02	0.01
2015-2	43.88	3.37
2015-3	10.7	0.62
2015-4	11.4	0.57
2016-1	5.43	0.2
2016-2	8.06	0.33
2016-3	12.8	1.24
2016-4	0.72	0
2017-4	0.98	0.009
2018-1	2.19	0.023
2018-2	46.99	2.88
2018-3	113.79	15.38
2018-4	22.1	0.474
2019-1	5.31	0.14
2019-2	9.51	0.84
2019-3	50.4	11.87
2019-4	17.82	1.18
2020-1	1.03	0.114
2020-2	0	0
2020-3	129.42	32.35
2020-4	20.4	1.25
Total	**513.95**	**72.85**

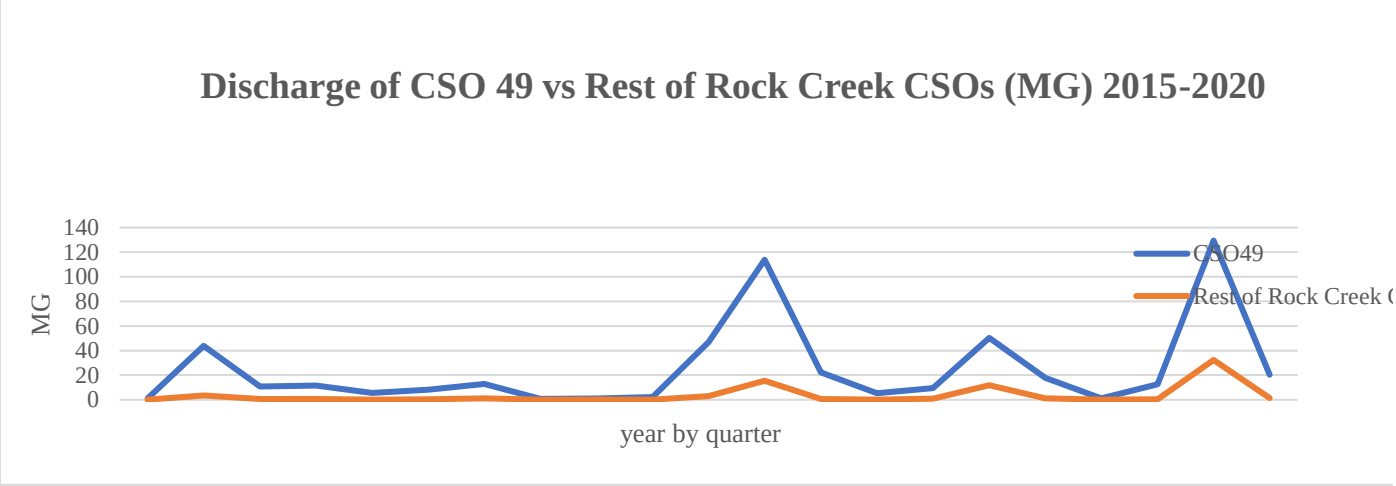


Table E: Rock Creek CSOs By Neighborhood/Sewershed

	CSO #	Location
Georgetown/West End	31	Pennsylvania Ave east back Rock Creek
	32	26th St and M Sts. NW
	33	N St extended west of 25th St NW
	51	Olive St extended to west bank Rock Creek
	52	O St extended to west bank Rock Creek
	53	O St extended to west bank Rock Creek (separated)
	54	500 ft. south of Massachusetts Ave west bank Rock Creek
Dupont Circle West	34	23rd St and O Sts. NW
	35	23rd St south of Q St NW
	36	22nd St. south of Q St NW
	53	O St, West Bank, Rock Creek Pkwy (separated)
	60	P St. and 26th Sts NW
Kalorama	37	NW of Belmont Rd east bank of Rock Creek (separated)
	38	North of Belmont Rd, east of Kalorama Circle
	39	Connecticut Ave east bank of Rock Creek
	40	Biltmore St extended east bank pf Rock Creek
	58	Connecticut Ave and Rock Creek Parkway (separated)
Mt Pleasant/Piney Branch/Zoo/Columbia Heights/Crestwood	41	Ontario Rd and Rock Creek Parkway
	42	Harvard St and Rock Creek Parkway
	43	Adams Mill Rd south of Irving St.
	45	Adams Mill Rd and Lamont
	46	Park Rd, south of Piney Branch Parkway
	47	Ingleside Terrace extended to Piney Branch Parkway
	48	Mt. Pleasant St extended to Piney Branch Parkway
	49	Piney Branch Parkway and Lamont St extended
	50	28th St west of 16th St NW
Normanstone	56	Normanstone Dr extended west to Rock Creek.
	57	28th St extended west to Rock Creek

Notes and Observations:

Historical notes: CSO 34 is the outfall for Slash Run, one of the original major creeks in pre-Civil War District. It originated in the highlands area of 18th and Champlain Sts NW, proceeded south and then curved around 20th St and L Sts NW before running west and emptying into Rock Creek just below "P St Beach" – a popular gathering place during the summer near 23rd and P Sts NW. The stream probably got its name from the slaughterhouses then along its banks.

CSO 49 is a massive outfall fed by trunk sewers constructed by the Works Progress Administration (WPA) during the New Deal. It discharges the largest volume of combined sewer overflows of any Rock Creek CSO and with the incorporation of CSO 19 in the Anacostia Tunnel System, it is now the largest CSO by volume in DC's combined sewer system.

CSOs designated as separated have had their stormwater flows directed toward Rock Creek and the wastewater directed towards the Blue Plains Wastewater Treatment Plant in SE DC so they no longer function as a combined sewer overflow.

DC Water's web site has an interactive map using a google maps background where you can see the outfalls and drainage area, zoom in and out, etc. https://www.arcgis.com/apps/webappviewer/index.html?id=7796821c5b6a4166b4eae7f17d915a78&extent=-8601958.9805,4694391.6523,-8546924.3202,4724737.1525,102100. In addition, DC Water's Long Term Control Plan has drainage area maps on pages 72 to 74 of the PDF, see https://www.dcwater.com/sites/default/files/documents/Long%20Term%20Control%20Plan.pdf. Links and details courtesy of John Cassidy, Clean Rivers, DC Water.

https://na01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.arcgis.com%2Fapps%2Fwebappviewer%2Findex.html%3Fid%3D7796821c5b6a4166b4eae7f17d915a78%26extent%3D-8601958.9805%2C4694391.6523%2C-8546924.3202%2C4724737.1525%2C102100&data=04%7C01%7C%7C4933845a45494803f54508d92ab19412%7C84df9e7fe9f640afb435aaaaaaaaaaaa%7C1%7C0%7C637587764440941103%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=o6GJfYEVa9pdXTfhtFqJ9FKkrq%2FngVGLH%2BeDqGekig0%3D&reserved=0

Overflows by CSO Sewershed, Year and Quarter

Table F: Georgetown/West End CSOs by Volume (MG) 2015-2020

Year/ Quarter	31	33	32	51	52	53	54
2015-1	0	0.03	0	0	0	0	0
2015-2	0	0	0	0	0	0	0
2015-3	0	0	0	0	0	0	0
2015-4	0	0	0	0	0	0	0
2016-1	0	0	0	0	0	0	0
2016-2	0	0	0	0	0	0	0
2016-3	0	0	0	0	0	0	0
2016-4	0	0	0	0	0	0	0
2017-1	0	0	0	0	0	0	0
2017-2	0	0	0	0	0	0	0
2017-3	0	0	0	0	0	0	0
2017-4	0	0	0	0	0	0	0
2018-1	0	0	0	0	0	0	0
2018-2	0	1.56	0	0	0	0	0
2018-3	0	0	0	0	0	0	0
2018-4	0	0	0	0	0	0	0
2019-1	0	0	0	0	0	0	0
2019-2	0	0.85	0	0	0	0	0
2019-3	0	0	0	0	0	0	0
2019-4	0	0	0	0	0	0	0
2020-1	0	2.45	0	0	0	0	0
2020-2	0	0	0	0	0	0	0
2020-3	0	0	0	0	0	0	0
2020-4	0	0	0	0	0	0	0
totals		**4.89**					

Overflows by CSO Sewershed, Year and Quarter

Table G: Dupont Circle West CSOs by Volume (MG) 2015-2020

Year/ Quarter	34	35	36	60	
2015-1	0	0	0	0	
2015-2	0	0	0.895	0	
2015-3	0	0	0.245	0	
2015-4	0	0	0.128	0	
2016-1	0	0	0.245	0	
2016-2	0	0	0.07	0	
2016-3	0	0	0.273	0	
2016-4	0	0	0	0	
2017-1	0	0	0.031	0	
2017-2	0	0	0.135	0	
2017-3	0	0	0.989	0	
2017-4	0	0.23	0.009	0	
2018-1	0	0	0.023	0	
2018-2	0	0	0.872	0	
2018-3	0.06	3.76	2.645	0	
2018-4	0	0	0.474	0	
2019-1	0	0	0.139	0	
2019-2	0	0	0.252	0	
2019-3	0.24	3.72	0.933	0	
2019-4	0	0	0.379	0	
2020-1	0	0	0.37	0	
2020-2	0	0	0.393	0	
2020-3	3.8	12.91	2.406	0	
2020-4	0	0	0.621	0	
totals	**4.1**	**20.62**	**12.527**	**0**	**42.107**

Overflows by CSO Sewershed Year and Quarter

Table H: Kalorama CSOs By Volume (MG) 2015-2020

Year/ Quarter	37	38	39	40
2015-1	0	0	0	0
2015-2	0	0	0	0.01
2015-3	0	0	0	0
2015-4	0	0	0	0
2016-1	0	0	0	0
2016-2	0	0	0	0
2016-3	0	0	0	0
2016-4	0	0	0	0
2017-1	0	0	0	0
2017-2	0	0	0	0
2017-3	0	0	0	0
2017-4	0	0	0	0
2018-1	0	0	0	0
2018-2	0	0	0	0
2018-3	0	0	0.11	0.38
2018-4	0	0	0	0
2019-1	0	0	0	0
2019-2	0	0	0	0
2019-3	0	0	0.23	0.32
2019-4	0	0	0	0.03
2020-1	0	0	0	0
2020-2	0	0	0	0
2020-3	0	0.0001	0.59	0.76
2020-4	0	0	0	0
Totals	**0**	**0.0001**	**0.93**	**1.5**

Overflows by CSO Sewershed, Year and Quarter

Table I: Mt. Pleasant/Zoo/Colombia Heights/Crestwood CSOs by Volume (MG) 2015-2020

Year/ Quarter	42	43	44	45	46	47	48	49	50
2015-1	0	0	0	0	0	0	0	1.02	0
2015-2	0.25	1.73	0	0.22	0.05	0.01	0.42	43.883	0
2015-3	0	0.24	0	0.04	0.01	0.002	0.07	10.699	0
2015-4	0	0.31	0	0.04	0.004	0.005	0.07	11.325	0
2016-1	0	0.24	0	0.04	0.01	0.002	0.07	10.69	0
2016-2	0	0.09	0	0.01	0.0005	0	0.02	5.425	0
2016-3	0.06	0.09	0.004	0.07	0.01	0.001	0.12	12.8	0
2016-4	0	0	0	0	0	0	0	0.72	0
2017-1	0	0	0	0	0	0	0	2.65	0
2017-2	0	0	0.0001	0.03	0.01	0.00005	0.01	0.06	0
2017-3	0	1.31	0.03	0.16	0.03	0.004	0.28	40.97	0
2017-4	0	0	0	0	0	0	0	0.97	0
2018-1	0	0	0	0	0	0	0	2.19	0
2018-2	0	1.42	0.066	0.14	0.06	0.031	0.26	46.99	0
2018-3	0.56	3.75	0.407	0.44	0.26	0.477	0	113.79	0
2018-4	0	0	0	0	0	0	0	22.1	0
2019-1	0	0	0	0	0	0	0	5.51	0
2019-2	0.01	0.34	0.0001	0.05	0.02	0	0.08	9.51	0
2019-3	0.54	2.96	0.344	0.32	0.14	0.34	0.72	50.4	0
2019-4	0	0.46	0.033	0.06	0.03	0	0.11	17.82	0
2020-1	0	0	0		0	0	0	1.15	0
2020-2	0	0.05	0	0	0	0	0	12.59	0
2020-3	1.05	4.73	0.61	0.48	0.2	0.58	1.27	129.42	0
2020-4	0	0.37	0.02	0.05	0.02	0.07	0.1	20.4	0
Totals	**2.47**	**18.09**	**1.5142**	**0.53**	**0.8545**	**1.52205**	**3.6**	**513.95**	**0**

Overflows by CSO Sewershed, Year and Quarter

Table J: Normanstone CSOs by Volume (mg) 2015-2020

Year/ Quarter	56	57
2015-1	0	0
2015-2	0	0
2015-3	0	0
2015-4	0	0
2016-1	0	0
2016-2	0	0
2016-3	0	0
2016-4	0	0
2017-1	0	0
2017-2	0	0
2017-3	0	0
2017-4	0	0
2018-1	0	0
2018-2	0	0
2018-3	0	0
2018-4	0	0
2019-1	0	0
2019-2	0	0
2019-3	0	0
2019-4	0	0
2020-1	0	0
2020-2	0	0
2020-3	0	0
2020-4	0	0
Totals	**0**	**0**