**The Leaking Sewers of Rock Creek**

Dangerous bacteria levels are detected in nine selected Rock Creek tributaries

from Fenwick Branch to Melvin Hazen

DC Water works to overcome a century of congressional disinvestment in the sewer system

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**Forward**

This report is not designed to a be scientific study but rather to collect the results of a variety of other water quality sampling networks active on analyzing Rock Creek in pursuit of answering one question: Why are bacteria levels are so high in the upper stem of Rock Creek and what can be done to about it?

To do this, I first gathered the water quality data from the District Department of Energy and Environment that samples dozens of sites around the city. For the Rock Creek sites, their data included E. coli measurements at the mouth of the major tributaries. These data supplied valuable indications as to the extent of pollution in each tributary and the possible extent of contribution it might make to the pollution of the main stem of Rock Creek. I then compared those data to that which was submitted to EPA as part of the periodic Water Quality Assessment. Finally, I compared DOEE’s water quality data to the studies conducted by the Audubon Naturalist Society (ANS) and the Anacostia Riverkeeper.

I reviewed the historical record in the Reports of the District Commissioners and in the news articles of the day. The Reports of the Commissioners, required by Congress, after it abolished home rule in 1874, often contain an exhaustive account of when which sewers were constructed and for how much. The reports also often described the anguish of the Superintendent of Sewers caught in the middle between rapacious real estate speculators who always wanted more pipes and the Congress never able to appropriate the needed funds to maintain the ever-burgeoning sewer system.

The studies all point to the same conclusion: that high E. coli values, indicating sewage pollution, often several times above the standard, persist in both dry and wet weather.

Moreover, these high E. coli levels likely stem from leaking antiquated sewers that have long since passed their useful life.

I am convinced that DC Water is doing the best they can with available resources to correct the inequities visited on the District and its sewer and water system for over a century. But DC Water could do more to raise the priority for several of the sewer rehabilitation projects within the Capital Improvement Program.

I was aware that pressure from the Covid-19 pandemic has created revenue shortfalls and might necessitate some budget cuts in programs. Some federal programs to supply needed funds to sewer and water utilities were put in place in the stimulus package enacted in December. Additional programs to subsidize infrastructure are under discussion in the Congress and it is possible new money might been made available under that legislation. I would request that DC Water carefully track the progress of these federal programs and consider restoring the program cuts where appropriate as federal funding becomes available.

**Race and Sewage in Washington**

No discussion about sewage in the District is complete without at least a mention of race. The effects of racist policies have directly resulted in the vast differences in treatment and outcomes for the Potomac and the Anacostia.[[1]](#footnote-2) The Potomac got a floating barge featuring symphonies and musicals. The Anacostia got the huge outfall from the NE Boundary Sewer that spewed millions of gallons of raw sewage daily into the river. The Potomac got the Kennedy Center for the Arts and Thompson’s Boat Center for rowers. The Anacostia got farms of fuel tanks and sand and gravel operations. The Potomac got flotillas of power boats during the summer docked in Georgetown. The Anacostia got struggling black-owned marinas in perpetual danger of being silted out of existence. The Anacostia did get Langston Golf Course and the Kenilworth Aquatic Gardens. But even these were tarnished by the Kenilworth Dump that was only shut down in the 1950s after a nine year boy, searching for bicycle parts, was burned to death when the ever simmering fires of the dump turned on him.

These racial disparities are just starting to be addressed after a more than a century of enforced White ignorance. Change on multiple levels is coming to the Anacostia that must be benefiting from all the money and attention being heaped on it.

Literally dozens of organizations ranging from the stalwart Anacostia Watershed Society and the Anacostia Riverkeeper to the Anacostia Waterfront Trust, DOEEs Anacostia River Sediment Project, and the Anacostia Watershed Restoration Partnership, groups both within and outside the government are all now actively working to reverse the decline of the Anacostia. It took more than a century to despoil the Anacostia. Restoring it will take time. My deep appreciation goes out to all the staff and volunteers that work on the Anacostia for their dedication and persistence.

On a final note, I am more than aware that this study centers on streams in White Washington. But I take some comfort in the fact that work to rehabilitate streams in the Anacostia watershed in the Black neighborhoods surrounding Pope’s Creek, Watts Branch, Stickfoot, Hickey Run and others are either planned or on-going. Hopefully these projects are the first steps towards equity and environmental justice that are so urgently needed.

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A huge thank you to my family and friends for their tolerance of my endless rattling on about sewers. Marguerite (Mickey) Sayles provided encouragement, support and valuable reminiscences about Pinehurst and my sister Ann Sayles was always ready with an encouraging word.

Finally, it is impossible to express all my love and gratitude to my partner Marion L.R. Granigan for her support over the years. Her patience and advice about how to move the project forward were crucial. Without her, this report simply would not have happened. She deserves a parade.

My deep apologies to anyone I might have missed. My debt to all of you is immeasurable.

Of course, responsibility for mistakes, errors and omissions are mine and mine alone. The persistent hope is simply that we keep moving towards a cleaner Rock Creek.

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Washington, DC

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**Abbreviations**

ANS – Audubon Naturalist Society

BOD – Biological Oxygen Demand

CSO - Combined Sewer Overflow

DO – Dissolved Oxygen

DOEE – Department of Energy and the Environment

EC – enterococci

FB – fecal bacteria

IWLA – Izaak Walton League of America

LTCP – Long Term Control Plan

MPN - Most Probable Number per 100 milliliters

NPS – National Park Service

RCMI – Rock Creek Main Interceptor

USGS – US Geological Survey

VCP – Vitrified Clay Pipe

WMS – Whole Metagenomic Sequencing

**Executive Summary**

Large sections of the District’s antiquated sewer system in Rock Creek Park have long out- lived their useful lives. Four different water quality sampling networks have documented high bacteria levels in Rock Creek. Leaks from this antiquated sewer system are polluting Rock Creek and threaten the public health of all those who come in contact with it.

DC Water has started to identify problems and create projects to begin to address the problem sewers. For example, detailed scoping and planning are proceeding in Pinehurst, Fenwick and Sherrill Drive watersheds. Planning and design may be underway for the heavily polluted Luzon Valley. Construction is slated to begin in Soapstone in the winter of 2021.

Unfortunately, DC Water has proposed cutting funding for its capital improvement program due to shortfalls of revenue due to the Corvid 19 pandemic. These cuts would include funding reductions for the streambed rehabilitation as well as one year delays in the rehabilitation of the Rock Creek Interceptor.

**Recommendations**

* DC Water needs to accelerate its spending in its Capital Improvement Program (CIP) for creek bed sewers and for the rehabilitation of the Rock Creek Main Interceptor Sewer and its associated relief sewers.
* DC Water should carefully reevaluate the need for any proposed cuts as federal funds become available and consider restoring the funds where appropriate.
* Because these projects are on National Park Service (NPS) land, DC Water must work closely with NPS to minimize delay and disruption while fulfilling the requirements of the Environmental Policy Act. For its part, NPS must be clear in what the requirements are to be met at any given project.

**The Leaking Sewers of Rock Creek**

Numerous municipal sewers in Rock Creek Park run under roads and creek channels.[[2]](#footnote-3) Many of these pipes are made of vitrified clay and laid down in the 1910s and have far exceeded their design life of 50 years. Larger sewers, such as the Rock Creek Main Interceptor, were typically made of vitrified brick and concrete. They have a life span of between 50 and 60 years and after a century are beginning to fail.[[3]](#footnote-4)

Erosion, traffic and the passage of time have produced cracks, fissures, deformations and joint separations. The inevitable result is that these old pipes leak sewage into Rock Creek.

Numerous studies have linked high bacteria levels in the Rock Creek to leaking sanitary sewers. For example, both the District’s 1996 and 2002 Water Quality Assessments indicated that leakage from unidentified sewer lines was a problem in achieving water quality standards.[[4]](#footnote-5) The Final General Management Plan and Environmental Impact Statement for Rock Creek and Rock Creek and Potomac Parkway released in 2005 listed leaking sewer lines as a source of contamination.[[5]](#footnote-6) The 2010 Rock Creek Implementation Plan stated that common sources of fecal coliform contamination include illegal connections to sanitary lines and exfiltration (leaks) from sanitary sewers[[6]](#footnote-7). A 2011 paper by US Geological Survey scientists summarized water quality data from three sites including from the center of the Rock Creek channel just downstream from the Joyce Road Bridge on the main stem of Rock Creek. They found that urban sources of chemical contamination include leaking sewer infrastructure.[[7]](#footnote-8)

In March 2016, DC Water, after a preliminary survey of the Pinehurst, Sherrill Drive and Fenwick watersheds, found pipes blocked by gravel and slit, pipes that were cracked and fractured, infiltration from groundwater, and joint separations. And in 2018, the water quality sampling team at the Audubon Naturalist Society (ANS) observed leaking sewers in the Pinehurst Branch which they reported to the National Park Service which then alerted DC Water to take remedial action.

But the largest indictment of leaking sewers comes from the volumes of water quality data accumulated over the years. Four networks are actively supplying water quality data on the creek. The US Geological Survey (USGS) has maintained a continuous real time sampling site on Rock Creek at Joyce Road since 1999. (See Appendix C).[[8]](#footnote-9) On their website, they feature current conditions in real time such as stream flow, turbidity and temperature. Their database features dozens of other parameters including various pesticides and E. coli levels. It is by far the most complete water quality data set for Rock Creek. The District Department of Energy and Environment (DOEE) conducts monthly water quality sampling at dozens of sites around the District. Since the 1990s, volunteers from the Audubon Naturalist Society have been conducting monitoring at three Rock Creek tributaries 3-4 times a year.[[9]](#footnote-10) Most recently, in 2020, the Anacostia Riverkeeper, supported by a grant from the District Department of Energy and Environment (DOEE), released their DC Citizen Science Water Quality Monitoring Report in 2020.[[10]](#footnote-11) Trained volunteers from the Audubon Naturalist Society (ANS), the Potomac Riverkeeper and the Rock Creek Conservancy conducted water quality monitoring at 22 sites from May to September in both 2019 and 2020 and ranked the results in an easy-to-understand swimming guide.

All these studies point to the same conclusion: aged sewer pipes are failing and releasing raw sewage with dangerous bacteria levels that far exceed water quality standards and pose a direct public health risk to those in contact with it.

While these data indicate that the problem is most acute after rains, the data also show high levels even during dry weather. For example, DOEE samples at the mouth of Fenwick Branch on July 14, 2015 were in excess of 2,420 most probable number of colonies per 100 milliliters (MPN/100 ml) -- far in excess of the water quality standard of 410 MPN for a single recreational water sample and a clear indicator of sewage contamination. On the same day, rain gauges throughout the city reported no rain. A year later, on August 27, 2016, the US Geological Survey site at Joyce Road in Rock Creek found that the fecal coliform count was 40,000 MPN.[[11]](#footnote-12) Again, no rain was reported at any of the rain gauges in the area.[[12]](#footnote-13)

In 2019, in each of the samples taken by DOEE at the mouth of the Luzon Branch on February 5, April 2, June 4, and August 6, the E. coli levels were actually beyond the ability of DOEE’s instruments to effectively measure them, over 2,420 MPN. On these same days, the rain gauges at Brentwood Reservoir, Bryant Street Pumping Station, Main Pumping Station, Rock Creek Pumping Station and National Airport all registered zero rain. To consider the possibility of some delay in the sewer system, we also examined rain data for the day before on each of these dates. No rain was recorded on any of those days. [[13]](#footnote-14)

High E. coli levels in times of no rain could likely indicate gross sewage contamination of the stream from a leaking sewer or other source.

High coliform counts during periods of little or no rain poses the key question: where is the contamination coming from? Studies all point to leaking sanitary sewers in the upper segment of Rock Creek upstream of Joyce Road.[[14]](#footnote-15)

Some researchers have suggested that combined sewer overflows (CSOs) are to blame for the high bacteria counts. That is likely true for portions of lower Rock Creek, particularly downstream of the zoo, upstream of P Street Beach and M Street. But for the portions of the creek upstream of Piney Branch all the way upstream to the DC Line, there are no CSOs, the combined sewer servicing the Luzon Valley having been separated in 2002. This was supposed to eliminate the combined sewer discharge to Rock Creek at Joyce Road. The fact that high levels of E. coli persist at the Joyce Road sampling site strongly indicates a source of contamination source upstream.

In the past, some researchers have suggested that high bacteria levels are due to runoff washing animal feces into the creek during rainstorms. But, as previously noted, water samples by US Geological Survey and the District Department of Environment and Energy continue to show that high levels of E. coli levels occur at the Joyce Road -- even during dry weather.

A recent study used molecular methods that could discern between various sources of fecal bacteria. The goal of this small pilot study was to demonstrate the applicability and feasibility of the best available measurement technology to provide a comprehensive analysis of a surface water that went beyond total coliform and enterococci, and could identify the range of microorganisms as well as the effects of rainfall, runoff and increased discharges from CSOs. The study showed that it was possible to identify some of the indigenous non-human contributors to the readings and estimate their magnitude.

Using whole metagenomic sequencing (WMS), bacterial, viral, archaeal, fungal and protozoan communities can be profiled. In this study, avian genetic markers showed no change between pre and post rainfall. Ruminants were detected but at very low concentrations and canine genetic markers were detected only after rainfall. One conclusion from the study was that host-associated genetic markers can reliably track common fecal pollution sources such as human, avian, dog and ruminant.[[15]](#footnote-16) Studies such as these can help to begin to dispel the myth that animals – not humans – may be responsible for high bacterial levels in Rock Creek.

In order to more precisely identify the possible sources, we analyzed water quality data for the tributaries upstream of The National Zoo. In addition, we present the findings of the Audubon Naturalist Society's water quality monitoring project for Pinehurst Branch, Broad Branch and Melvin Hazen. We also present the data on eight Rock Creek sampling sites organized by the Anacostia Riverkeeper collected every Wednesday during the monitoring season from May to September 2019-2020. Lastly, we present two years of E. coli data from the continuous USGS sampling site at Joyce Road in Rock Creek.

**Water Quality Sampling and “critter counts.”**

Scientists and water quality professionals have long relied on numbers to inform them about the health of a stream. Scientists used such parameters as dissolved oxygen (DO), biological oxygen demand (BOD), specific conductance, and bacteria counts to describe the health of a river or stream. But numbers, measuring a single moment in time, can fail to capture the larger picture of the ecological community that supports the biota of the stream over a longer period of time In the 1970s, clean water advocates began to realize that counting the diversity and populations of organisms can measure the ecological health of a stream as surely as bacteria samples or dissolved oxygen readings. In the 1980s, conservation groups like the Izaak Walton League of America (IWLA) trained volunteers in their Save Our Streams program to not only conduct the scientific surveys of populations of key indicator organisms in their local streams, but, even more importantly, they trained these volunteers to present their results to policy makers and to advocate for effective clean water programs. Continuing this tradition, volunteers from the ANS have been conducting monitoring at three Rock Creek tributaries 3-4 times a year since the 1990s in order to supply a more complete picture of the environmental health of Pinehurst Branch, Melvin Hazen, and Broad Branch.[[16]](#footnote-17)

Figure 1 Water qualiy monitor volunteers

We present the results of those studies by watershed in Appendix A, Table B showing 6 years of water quality sampling data. In addition, we offer the results of the “critter counts” studies conducted by the ANS volunteers as well as the results from the 2020 DC Citizen Science Water Quality Monitoring Report conducted by the Anacostia Riverkeeper, working with volunteers from the ANS and the Rock Creek Conservancy.

We examined watersheds of tributaries from the DC Line downstream to Klingle Run near the Porter Street bridge. We selected these watersheds based on available data, the impact on the water quality of the Upper Rock Creek and the potential for human contact. Among the heavily used areas of the Park, we have noted activity in areas around Milkhouse Ford, just upstream from Military Road, the area opposite the Park Police Station, the Rapids Bridge, a scenic spot upstream from the Boulder Bridge, and the area around Peirce Mill.



Figure 2 The Scenic Rapids Bridge

**The Dirty Tributaries of Rock Creek[[17]](#footnote-18)**

**Broad Branch**

The exposed portion of Broad Branch is about two miles long, but the part in storm sewers extends all the way to the District Line. The entire watershed is 1,129 acres but only 15 percent is park land, with the rest commercial and residential. In 1993, the flow was measured at 7.8 cubic feet per second (cfs), by far the swiftest of the tributaries. Although the stream channel is 25 ft. wide, the stream itself averaged only about three inches deep. For most of its exposed length, Broad Branch is bordered by Broad Branch Road on one side and Rock Creek Park on the other. The lower reach of the stream has a 200 ft. buffer of trees and shrub. Floods after rainstorms have eroded the banks and altered the channel in several areas. [[18]](#footnote-19) In 2014, DOEE “daylighted” 1,600 feet of the stream previously encased in storm sewers to restore the stream to its more natural setting.

A summary of water quality values in Rock Creek’s tributaries conducted between 2009 and 2013 found that Broad Branch had a minimum E. coli value of 28 MPN with a maximum of over 10,000 MPN. Over 87 percent of the samples violated water quality standards – making Broad Branch the dirtiest tributary during this survey period.[[19]](#footnote-20) A later more detailed survey conducted by DOEE between 2015 and 2020 indicates four gross exceedances of over 2,420 MPN. Seventeen of the 26 samples or 65 percent of the total samples taken during this period exceeded water quality standards for bacteria. This showed some slight improvement from the earlier numbers in 2009 to 2013. (See Table 1, Appendix A).

Interns from ANS and the Rock Creek Conservancy sampled Broad Branch in both 2017 and 2018. Despite the exceedances, the interns found that during the study period the number of macroinvertebrates at the sample sites on Broad Branch almost doubled. This could indicate that the pollution levels, while high, may be short-lived enough to enable populations of macroinvertebrates to survive.

Citizen volunteers with the Anacostia Riverkeeper sampling Broad Branch in 2019 and 2020 reported the good news that 55 percent of the bacteria samples were below the single sample water quality standard of 410 MPN which marked an improvement. Yet for the longer term geometric mean[[20]](#footnote-21), the news was not so great. In 2020, the geometric mean for bacteria levels in Broad Branch was 540.9 MPN – above the 410 recreational standard. Every sample taken that year exceeded the standard – a significant setback for water quality in Broad Branch that year.[[21]](#footnote-22)

**Fenwick Branch**

The Fenwick system of sewers were probably installed between 1941 and 1966 using vitrified clay pipes (VCP) that now are exceeding their 50 year service life. Fenwick sewer system has two main branches, one adjacent to the Portal Branch stream and the other to the west adjacent to Fenwick Branch. The Fenwick Branch sewer runs underneath the stream bed of Fenwick Branch which drains into a Rock Creek Relief sewer on the east side of the creek just downstream from the Kalmia Road Bridge.

Only 205 acres of Fenwick’s 500 acre watershed is in the District. The Maryland portion of Fenwick Branch has been buried in stormwater drains but emerges at the DC line and flows 0.9 miles to empty into Rock Creek. The District portion of the watershed is primarily single family homes with generous lawns while the buried storm sewers in Maryland serve mainly light commercial development and large apartments. Ninety percent of the stream is residential and commercial with 10 percent parkland. In 1993, researchers found that the stream channel was about 6 feet wide and the stream had an average depth of about 3 inches and a flow of

about 2.0 cfs.[[22]](#footnote-23)

Water quality samples collected by the District Department of Energy and Environment (DOEE) in 2015 found that bacteria levels varied from a low of 45 MPN on April 28 to a high in excess of 2420 MPN on July 14, 2015. (See Table 2). No rain was recorded on any of the gauges around the city for the July 14 date possibly indicating some source of contamination other than storm runoff. Of the 22 samples taken over a 5 year period, 7 were above the water quality standard of 410 MPN. 

Figure 3 A crumbling manhole on Fenwick Branch

Finally, a DOEE survey of the stream for the years 2009 to 2013 found that levels of E. coli varied from a minimum 1 MPN to 3609 MPN, with an average of 598.56 MPN with 25 percent of the samples in violation of water quality standards – ranking Fenwick Branch as the 6th dirtiest among the 9 tributaries studied. (See Table 2, Appendix A).[[23]](#footnote-24)

**Klingle Run**

The surface portion of Klingle Run originates from a 36 inch storm sewer pipe near the intersection of Cortland Place and Klingle Road near the top of the Klingle Valley. Klingle Run’s watershed comprises 320 acres but the surface portion of the stream is only 0.7 miles long from the storm drain to Rock Creek just downstream from the Porter Street bridge. Portions of the stream rush around granite boulders like a mountain stream. In 1993, researchers found Klingle Run to average 6 ft. wide, with a 30 ft. wide channel, and a normal flow of 0.83 cfs. Although the average depth was only 3.5 inches, there were several deep pools, primarily at the end of culverts. The force of high water flows from storms have significantly eroded the banks of the creek, making Klingle Road unusable. After a long campaign by park advocates, the stream was rehabilitated and the road was abandoned as a thoroughfare and turned into parkland. This preserved the few hundred feet of wooded buffer along the creek[[24]](#footnote-25).

Despite the age of the pipes that feed it, Klingle Run is relatively clean compared to the other Rock Creek Tributaries studied. According to the Statistical Summary Report submitted to US EPA, the minimum level of E. coli over the period 2009 to 2013 was only 16 MPN with a maximum of 1985 and an average of 373.9 MPN, a level well below the water quality standard. Unfortunately, only 20 percent of the samples during this period were at or below the water quality standard for E. coli.[[25]](#footnote-26) Of the 26 samples taken in a later survey between 2015 and 2020, nine of the twenty-six or 37 percent violated water quality standards – higher than the earlier survey. However, there were only two gross exceedances over the sample period. (See Table 3 below).

**Luzon Branch**

Luzon's 600 acre watershed extends from Rock Creek at Joyce Road northeast all the way to the Walter Reed site. However, most of the stream is contained in storm drains, with only 0.45 of a mile on the surface before it empties into Rock Creek. In 1993, the Luzon’s channel was 26 ft. wide but the stream itself was only about 8 ft. wide with a depth of seven inches and had a flow rate of only 0.8 cfs -- one of the smaller tributaries in the Rock Creek watershed. The creek had areas of significant erosion from high water and showed high water marks 1.5 meters above the bottom.[[26]](#footnote-27)

The stream has its origins in an outfall structure previously listed as CSO #59, but with subsequent sewer separation in the watershed in 2002 DC Water reports that system is no longer functions as a combined sewer overflow. Theoretically, the stream should now be composed primarily of stormwater and runoff with the separated portion of sanitary sewage being conveyed to the treatment plant.

Yet despite the sewer separation, the overall water quality in Luzon remains quite poor. The DOEE data (see Table 4) demonstrates that of the 27 samples taken between 2015 and 2020, 19 samples -- or a hefty 70 percent, exceeded the water quality standard. Thirteen samples were gross exceedances for bacteria beyond the capacity of DOEE’s instruments to measure. This was the highest number of exceedances of any tributary and might mean either a major pipe break or a cross connection of some kind.

The stream’s poor water quality was confirmed by the Statistical Summary Report for E. coli from 2009-2013 for the 2014 Water Quality Assessment submitted to US EPA by DOEE. It found that Luzon’s average E. coli level during this period was 708.96 MPN with a minimum of 42 value and a maximum value of over 2,420 MPN. Fifty-five percent of the samples were in violation of water quality standards, the highest of any of the tributaries studied.

Luzon’s sewers are old and outdated. Contracts were signed for Luzon Ave Trunk Sewers from Walter Reed to Van Buren and Butternut in 1919 – over a century ago.[[27]](#footnote-28)

**Melvin Hazen[[28]](#footnote-29)**

Melvin Hazen’s watershed is only about 200 acres. It has its origins from a set of springs at the end of aptly named Springland Lane at the base of the ball field of Hearst Playground. The stream is encased in culverts until it reaches Melvin Hazen Park which then buffers the stream for 200 feet on both sides. The stream then enters another culvert. After flowing under Connecticut Avenue the stream tumbles through parkland until it empties into Rock Creek. The stream is only 0.96 mile long. In 1993 researchers found the channel was 11 feet wide, with the actual stream occupying about six feet of the channel bed. The stream was generally only about 6 inches deep, with a normal flow of only 0.9 cfs – the third smallest of the tributaries studied. Despite the low normal flow, there was evidence of erosion in the lower reaches of the stream. However, the Audubon Naturalist Society reported that Melvin Hazen had less erosion than Pinehurst or Broad Branch. In the winter of 2010, researchers found copious strands of filamentous green algae in the stream indicating excessive nutrients and pollution.[[29]](#footnote-30) They also found that since 2015 the diversity of the biota in the stream was decreasing. Several intolerant families of biota had simply vanished meaning that the stream is under stress. This lack of diversity coincides with the high E. coli levels reported by DOEE (see Table 5). Despite the reduction is diversity and the bacteria reading, the ANS team reported finding schools of small fish and fish eggs in Melvin Hazen and in the fall of 2010, three eels were netted and two kinds of salamanders were found – all biota being sign of good – or at least recovering -- water quality.[[30]](#footnote-31)

Unfortunately, many of the indicator biota reported present earlier – spiny crawler mayflies, flatheaded mayflies, spring stone flies and common stone flies -- have not been observed in the stream since 2009. These biological families are generally intolerant of pollution. Despite these losses, researchers found that the aquatic community of Melvin Hazen had the highest diversity of the three streams ANS studied – remarkable for such an urban stream.

Despite its relatively small size, Melvin Hazen has surprisingly high bacteria levels. According to the Statistical Summary Report for E. coli for Rock Creek tributaries between 2009 and 2013, the minimum level for E. coli was 8 MPN with a maximum of greater than 2420 MPN and an average value of 331.5 MPN which is beneath the water quality standard. However, twenty-one of the samples taken or over 77 percent were in violation of the water quality standard for E. coli.[[31]](#footnote-32) For a later five year sampling period 2015 to 2020 DOEE reported the stream was so polluted that six out of the 27 samples over the five year period 2015-2020 or 23 percent exceeded the upper limit of measuring instruments. This level of what we call gross exceedances was only two percentage points higher than the 2009-2013 survey – suggesting a chronic pollution problem in the stream.

In 2019, Anacostia Riverkeeper researchers, echoed DOEEs data. Forty-five percent of the samples exceeded the water quality standard for bacteria. Turning to the longer term measurement using the geometric mean, the Riverkeepers found a bacteria level of 554.8 MPN, with only 25 percent of the geometric mean passing the standard. This was about the same as the DOEE findings.

**Pinehurst Branch**

Pinehurst’s 619 acre watershed is the third largest of the Rock Creek tributaries studied. Seventy percent of its 1.3 mile length is in the District as an open waterway but the Maryland portion has long been buried in storm sewers to accommodate residential development. Its flow in 1993 was 1.2 cfs -- the third most vigorous of the 12 Rock Creek major tributaries. Seventy percent of the watershed is buffered by exclusive single-family homes with sizable yards. In 1993, the stream had an average depth of only 5 inches with some pools 2 feet deep. The stream had an average flow of only 1 to 2 cfs but nearby residents report that during heavy rains the stream “roars.” [[32]](#footnote-33) The Pinehurst sewer has two branches. One branch collects sewage from homes on the west side of the stream along Alberfoyle Street NW and the other branch collects sewage from houses from the other side of the stream along Beech St NW. This pipe then continues downstream to ultimately empty into the Rock Creek Main Interceptor sewer that runs alongside of Rock Creek. These two pipes are linked by 3 cross connections that were originally buried under the creek. But over time the flash floods have eroded the underpinnings and exposed these pipes that are now likely leaking sewage into the creek, particularly during heavy rains. The Pinehurst sewers were built and installed in 1918 using vitrified clay pipe that has outlived its lifespan of fifty years.

Figure 4 Exposed sewer lines in Pinehurst Branch

Of the 26 samples taken between 2015 and 2020 thirteen, or 50 percent, exceeded the standard, and two samples exceeded the capability of DOEE’s instruments (i.e. > 2,420 MPN). (See Table 6). The Statistical Report submitted to the US EPA looking at samples from 2009-2013 found that the minimum bacteria count was 14 MPN, the maximum was 4,611 MPN[[33]](#footnote-34), with an average of 605.82 MPN. Overall, only 23.53 percent of samples were in violation of water quality standards.

Overall, the Audubon Naturalist Society volunteers looking at Pinehurst found that the stream health was poor but stable over the study period.[[34]](#footnote-35) After a thunderstorm on July 3, 2018, they reported soap suds in the water downstream from the Oregon Ave bridge suggesting an improper sanitary sewer connection.[[35]](#footnote-36)

Despite the pollution levels, between the winter of 2012 and the summer of 2017, the ANS monitoring team reported finding Eastern blacknose dace (Rhinichthys atratulus) and other small fish. In addition, the team also found Northern two-lined salamanders – all signs of generally good water quality. They reported that benthic (creek bottom dweller) communities, including those tolerant of pollution, showed some slight improvement. In September 2018, the ANS volunteers, working with a volunteer monitoring team led by Anacostia Riverkeeper, found bacteria levels of 547.5 MPN, slightly above the recreational water quality standard of 410 MPN.[[36]](#footnote-37)

Confirming these measurements, in 2020, volunteers with the Anacostia Riverkeeper found that 75 percent of the samples taken on Pinehurst failed to meet water quality standards for bacteria, the highest failure rate of any of the five Rock Creek tributaries we looked at in this analysis. Similarly, the geometric mean bacteria level for the stream was 980 MPN, the highest of the five examined. In that year, every sample failed to meet the water quality standard for bacteria.

**Piney Branch**

The 2,500 acre Piney Branch watershed is the largest of Rock Creek’s tributaries. The sewershed extends in a massive trunk sewer system that funnels sewage and stormwater in combined sewers from Takoma Park to Rock Creek Park. The exposed stream is only three-quarters of a mile long stretching from 16th Street and Arkansas Ave to Rock Creek. The remaining vestige of this once formidable creek is now but a small stream with a channel approximately 12 feet wide with a depth of 4 inches and normal flow rate of 1.8 cfs – the fourth largest of the tributaries. Piney Branch is composed completely of discharges from the combined sewer overflow #49 outfall. Three massive wooden flood gates swing open under the force of water to discharge into the creek. According to the Quarterly Report for combined sewer overflows, in the third quarter of 2020, this CSO released an estimated 12.5 million gallons of combined sewer overflow, the third greatest in the CSO system. 

Figure 5 CSO#49 and headwaters of Piney Branch

Construction of the massive Piney Branch outfall, one of the handful of sewer-related New Deal funded projects, was started in 1939 and completed until 1941.[[37]](#footnote-38) (The other notable New Deal sewage related project was the construction of the first sewage treatment plant completed in 1936.) The Piney Branch sewershed serves the close-in neighborhoods of Petworth and Crestwood as well the more far afield neighborhoods in Takoma Park.[[38]](#footnote-39)

The Summary Data for the 2009-2013 period submitted to EPA as part of the 2014 Assessment revealed that the minimum value was 24 MPN, the maximum was 5,938 MPN, and the average was 766.53 MPN. More than 41 percent of the samples violated the standard. Two years later, the DOEE data for 2015-2020 revealed that 35 percent of the samples taken violated the standard – a slight improvement from the earlier survey. However, there were three gross exceedances of water quality standards (greater than 2420 MPN) though only nine samples exceeded the standard. For a big improvement, 17 of the samples were actually cleaner than the standard – surprising for a CSO this large. Experts have surmised that one reason for this relatively low level of pollution at this overflow is the massive volume of stormwater that dilutes the sanitary sewage contained in the overflow. (See Appendix A, Table 8.)

In 2020, the citizen scientists of the Anacostia Riverkeeper found that the geometric mean for bacteria levels for Piney Branch was among the lowest of the five streams studied (620.8 MPN). But sadly, for this picturesque little stream, 94 percent of the samples violated the water quality standard.[[39]](#footnote-40)

**Portal Branch**

Portal Branch is a tributary of Fenwick Branch. The surface portion of the stream is roughly 2,200 feet (0.42 miles) long, and its watershed measures roughly 200 acres, of which about one-third is within the District. The District portion of the stream is buffered on either side by low density residential development featuring upscale homes with large lawns and 100 ft. of parkland. In Maryland, the stream is encased in storm sewers serving high density residential and light commercial development. In 1993 the channel bed averaged 10 feet wide, with the stream occupying approximately six feet of the channel. The stream averaged three inches deep with several two-foot pools observed. Flow volume was 1.1 cfs. The stream shows signs of severe erosion from storm surges.[[40]](#footnote-41)

The 2009-2013 Summary Report for E. coli reported that the minimum E. coli value for Portal Branch was 22 MPN, the maximum value 2420 MPN – the limit of detection – with an average value of 565.41 MPN. Of the samples taken, over 35 percent were in violation of water quality standards. This ranked Portal as the 4th dirtiest among Rock Creek tributaries – surprising for such a small stream.[[41]](#footnote-42) Two years later, DOEE found two gross exceedances in water quality in the stream that exceeded 2420 MPN. Of the 23 samples taken between 2015 and 2020 fifteen, or over 65 percent, were above the 410 MPN standard. (See Appendix A, Table 8)

**Soapstone Branch**

Soapstone's 550 acres makes it the fifth largest of the creek’s tributaries. The Soapstone’s storm sewers gather stormwater from a neighborhood stretching from the shops and apartments along Connecticut Ave to the single family homes near Woodrow Wilson High School at Nebraska and Chesapeake St NW. The surface portion of Soapstone flows through a narrow strip of parkland for not quite a mile. Its flow in 1993 was 3.0 cfs -- the second most vigorous stream of the 12 Rock Creek tributaries.

DOEE’s summary E. coli data from 2009-13 revealed a low reading of 102 MPN, a high reading in excess of 2420 MPN and an average of 766.53 MPN. This generally agrees with the five years of single samples collected between 2015 and 2020. (Appendix B Table 9). During those years, fifteen of the 26 samples – over 58 percent – exceeded the 410 MPN standard. However only two of the samples were gross violations above 2410 MPN.[[42]](#footnote-43)

In their examination of Soapstone, the Anacostia Riverkeeper report found that 45 percent of the single samples for the stream exceeded the water quality standard. However, the geometric mean was 551.2 MPN – slightly above the standard. This may indicate that despite an occasional low bacteria reading, overall, Soapstone bacteria levels remain consistently above the standard.

**E. coli Samples From the Main stem of Rock Creek at the USGS site at Joyce Road**

The previous data sets describing the bacteria levels taken from the mouths of each of nine tributaries supplied one indication of the relative contribution they might make to the overall pollution of Rock Creek. Now we examine samples taken from the center channel of the main stem of Rock Creek at the Joyce Road USGS site on Rock Creek.



We looked at two years of samples collected by the US Geological Survey between 2019 and 2020, at the Joyce Road sampling site in the center channel of the creek, just downstream from the Joyce Road Bridge. (Appendix C. Table 1) Of the 109 samples over this period, 83 of the samples – 79 percent -- exceeded the standard of 410 MPN. The values ranged from a low of 41 MPN on February 6, 2019 MPN to an astounding 98,000 MPN[[43]](#footnote-44) on July 22, 2020. Forty-seven of the samples – over 43 percent -- were at least 10 times the single sample recreational standard.

Figure 6. USGS Sampling Site, Joyce Road, Rock Creek Park

By any definition, these data indicate that this section of Rock Creek is grossly polluted with fecal bacteria.

**The Rock Creek Main Interceptor**

In the previous section, we looked at sewers and their sewersheds and their bacteria levels for nine separate Rock Creek tributaries. But one sewer system that encompasses the entire Rock Creek Valley is the Rock Creek Main Interceptor. As its name implies, the purpose of the Rock Creek Main Inceptor (RCMI) is to intercept sewage that otherwise would have gone into the creek and direct it to the treatment plant. The idea of the Rock Creek Main Interceptor was first envisioned in a detailed engineering report sent to Congress by President Harrison in 1890.[[44]](#footnote-45) The Hering report, named after one of the prominent sanitary engineers that authored the report, established the blueprint for the District’s modern sewer system.

The Rock Creek Main Interceptor extends from the DC Line through the Rock Creek Valley to the Rock Creek Pumping Station near 27th and K Streets NW. The Interceptor is approximately 42,120 feet long and varies in diameter from 51 inches to 78 inches in diameter and is mainly built of vitrified brick and concrete.

Construction on the outlet section started in 1908. However, the Rock Creek Pumping Station was not built until 1921.[[45]](#footnote-46) This means that the majority of sewer flows in the Interceptor probably were dumped into the Potomac via the massive B Street Trunk Sewer that now runs underneath Constitution Avenue.[[46]](#footnote-47) The RCMI Interceptor was built in sections but it took a decade to complete construction as far as Military Road. It took four years to build the first and second section as far as the vicinity of Connecticut Ave.[[47]](#footnote-48) The third section extended the sewer to Adams Mill Road was finished that same year. One year later in March 1913, a fourth section, requiring a 4,000 ft. tunnel, was excavated from Adams Mill Road to Klingle Road. But it took two more years to extend the sewer past Peirce Mill to Broad Branch. [[48]](#footnote-49) The seventh section, from Broad Branch to just north of the Boulder Bridge was put under contract in 1915. The eighth section, finally completed in 1918, was a 3,507 ft. sewer of vitrified brick and concrete extending from the Boulder Bridge to Military Road.[[49]](#footnote-50)

Despite the fact that a receiving pipe was not yet built, Congress authorized Maryland to tap into the non-existent section of the Interceptor in 1916. But 1919 and 1920 passed with no additional work to extend the Interceptor. Even after seven years and a plea from the Commissioners that extending the Interceptor to the DC Line to connect with Maryland would cost $1 million, no money was appropriated, no contracts were signed and no work was done.[[50]](#footnote-51) This meant that sewage from development in Montgomery County continued to be dumped into Rock Creek.

**The Problem of Financing Sewer Projects in the District**

Historically, before the creation of DC Water, one reason for the lengthy construction times was that the District had few funds of its own and was largely dependent on appropriations from Congress for most of the larger sewer projects. Miserly appropriations from Congress habitually treated the District as the last colony. This continued to hamper the District’s operations for decades.

In 1903, Congress rejected a plea from the District for a $10,000,000 loan to be repaid in $500,000 increments. That same year, the Superintendent of Sewers submitted a request to Congress for $2.09 million for capital improvement projects for sewers but it was never acted upon. In 1909, Congress actually enacted a law prohibiting the District from even requesting any money from Congress for sewers in any amount greater than twice the revenues collected in the previous fiscal year. Because revenues were paltry compared to the need, this severely limited the size of the District’s request and subsequent appropriations.[[51]](#footnote-52) In another example, constructing the Interceptor took more than ten years. One reason for the long construction time was that the Congress rarely appropriated adequate funds to do the job.

Making matters worse, Congress prohibited the District from carrying over funds from one year to the next. For example, in 1914, the District was able to spend only $28,878 building the Interceptor. In 1915, the Commissioners requested $258,000 to extend the Interceptor from Klingle to Broad Branch. But Congress appropriated only $40,000.[[52]](#footnote-53)

Adding to the problem, even after partial home rule was granted to the District in 1973, some Mayors felt they could siphon off money from Water and Sewer Fund to pay for their favorite projects. This situation continued to shortchange the DC Department of Sanitary Engineering and it persisted until the creation of the independent authority – DC Water and Sewer Authority now known as DC Water – in 1996. This independent agency was empowered to issue bonds, relieving of the agency of the stricture of congressional and mayoral meddling and inadequate federal appropriations.

Before the creation of DC Water, revenue from the sewer and water rates was the main source of money, but it was a mere fraction of the capital outlays needed to improve the District’s sewer system. Aside from sewer revenues, historically the District had a complicated system of funding construction of sewers by allocating costs to adjacent landowners. But the rampant land speculation that has always characterized the District’s real estate market often meant that the cost of sewer construction for new development fell on existing ratepayers. In a meeting with irate citizens in 1903, Commissioner Biddle explained that appropriations for “suburban sewers” (sewers north of the then District boundary at Florida Ave.) fell into two categories: one for suburban sewers and one for permit and assessment work paid for by the affected landowners. Normal practice was to charge the full cost to abutting landowners for sewers larger than 15 inches in diameter. For sewers smaller than 15 inches abutting landowners would be charged one-half the cost.[[53]](#footnote-54) But one Commissioner at the time, Commissioner Biddle, rightly recognized that this system was unfair and supported an appropriation from Congress to relieve the burden to the landowner. This appropriation rarely materialized. But Congress had less trouble making special appropriations for large trunk sewers that tended to benefit large landowners who needed the sewer capacity to subdivide and develop their land. For example, in 1903, congressional appropriators approved a request for a trunk sewer from Tunlaw Road to Tenley Circle despite the fact there were few houses there.[[54]](#footnote-55) However, there were substantial lands owned by the Glover family at the end of that pipe. Charles Carroll Glover was the President of Riggs Bank, a prominent philanthropist and credited with creating Rock Creek Park. The Glover Park neighbor is named after him.[[55]](#footnote-56)

In 1905, in another plea for fairness, the Business Men’s Association urged the construction of service sewers serving houses instead of trunk sewers that typically would be used to accommodate flows from future development while taxing already burdened local landowners.[[56]](#footnote-57) And ten years later, in 1915, A.S. Trumbell, representing the Tax Association, in a hearing before a joint committee of Congress, questioned under what law District residents were being taxed for streets and sewers in unimproved portions of the city built under pressure from real estate speculators.[[57]](#footnote-58) No explanation was provided by the Joint Committee.

Although the Blue Plains Sewage Treatment Plant finished in 1938, it was overloaded as soon as it was put into operation. Despite the fact that the treatment plant continued to dump raw sewage into the Potomac, additional sewer lines continued to be built to accommodate rampant real estate speculation and the exponential population growth that occurred both in the District, particularly during the two World Wars, and in the suburbs, that had won the right to connect into the overloaded system. The problem of gross overloading of the plant persisted well beyond the 1970s when federal money under the 1972 Clean Water Act, after being impounded by President Nixon, was finally made available to the District to begin the long overdue expansion of the treatment plant.[[58]](#footnote-59) This resulted in a dramatic improvement in the water quality of the Potomac River which had been plagued by stinking algal mats as far upstream as Georgetown.[[59]](#footnote-60)

The creation of the DC Water and Sewer Authority, now known as DC Water in 1996 dramatically improved the District’s ability to manage its sewer system.[[60]](#footnote-61) For the first time, an independent agency had the power to issue bonds to finance the work that needed to be done to improve the system. This freed the District from the stricture of having to depend of inadequate appropriations from Congress and allowed DC Water to begin to attack the problems that had been mounting in the century-old sewer and water system.

**What is DC Water doing about these leaking sewers**?

DC Water is well aware of the problem of leaking sewers. At a public meeting on November 17, 2005 on the reconstruction of Beach Drive, a Park Service presentation indicated that as part of Phase 3 of the project, DC Water proposed to install a new liner throughout the entire length of the Rock Creek Main Interceptor. This would have involved repairing defects and lining the Interceptor for approximately 13,800 feet from Joyce Road to near the intersection of Oregon Ave and Western Ave NW. [[61]](#footnote-62) For FY2019, preliminary design and planning was budgeted at $48,000 and $22,000 for FY2021. However, for a variety reasons, by March 2021, over fifteen years after the initial announcement, that relining work had yet to be undertaken by DC Water.[[62]](#footnote-63)

In March 2016 DC Water, working with the National Park Service (NPS), conducted a scoping session to identify issues surrounding the remedial work on the sewer systems in the Fenwick, Pinehurst and Sherrill Drive watersheds. In the handout for that meeting, DC Water explained that the work was needed because these three areas have required emergency repairs that were expensive and that long term solutions would be needed to prevent sanitary sewer overflows and protect the sewer system.

Soapstone is an example of a typical partnership between the NPS and DC Water. This is a closely watched project by the neighborhood that has enjoyed hiking along the Valley for decades. Alerted to problems in the Soapstone Creek Valley, in 2010 and 2011 DC Water conducted extensive surveys and used closed circuit TV to peer into the inside of the pipes in Soapstone Valley. DC Water’s examination revealed that the sewer infrastructure in the Valley had multiple defects including pipe and manhole cracks, fractures, root intrusions and stream and groundwater infiltration. An Environmental Assessment (EA) was conducted and on May 8, 2019 DC Water announced that the National Park Service had approved the DC Water plan that would involve relining 6,200 ft. of sewer pipe. Construction is now scheduled to begin during the winter of 2021-2022.[[63]](#footnote-64)

Most of DC Water’s effort on sewer rehabilitation is contained in the Capital Improvement Program (CIP) that is reviewed and adopted by DC Water’s Board of Directors usually around April of each year. In the 2020 budget adopted by the Board on April 4, 2019, the lifetime budget for the Capital Improvement Program was set at $29.56 million. For the overall Capital Improvement Program (CIP), the pre-Covid plan was to double the CIP budget by 2022 and triple that investment by 2027.[[64]](#footnote-65)

Unfortunately, because of the downturn in revenues due to the Covid pandemic, DC Water has been forced to undergo cutbacks. According to a presentation to the Environmental Quality and Operations Committee on February 18, 2021, the capital improvement budget could be cut by $36.3 million in FY2021 and a proposed $134.4 million cut in FY2022. One result is that work on the rehabilitation of the Rock Creek Main Interceptor was deferred for two years although some recent information indicates that delay could be cut in half to a single year delay.[[65]](#footnote-66) Other pipe rehabilitation programs were similarly deferred for an undetermined amount of time. This only added to the more than 150 miles of needed sewer rehabilitation in the current backlogged schedule.[[66]](#footnote-67)

In addition to the Rock Creek Main Interceptor work, DC Water has at least four creek bed rehabilitation projects around the city, ranging from work rehabilitating approximately 20,400 feet of pipe in Glover Archbold Park, 22,000 feet of pipe in the Pinehurst, Sherrill Drive and Fenwick project area, and 6,200 ft. in Soapstone Valley (see below for a more detailed description of that project.) among others. Because all of these projects involve land controlled by the National Park Service (NPS), Environmental Impact Statements (EIS) are typically required. Some critics have charged that the NPS has a cumbersome and bureaucratic process that tends to slow action on these projects, but others maintain that the NPS is merely following the requirements of the law and once the requirements are met, work tends to flow smoothly.

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**Appendix A.**

**Table 1. E. coli levels in Broad Branch 2015-2020[[67]](#footnote-68)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020[[68]](#footnote-69)** | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
| 1/6 | 326 | 1/5 | 545 | 1/17 | 1986 | 1/16 | 727 |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  | 2/4 | 517 |
| 4/28 | 77 | 4/5 | 260 | 4/4 | 548 | 4/3 | 921 | 4/2 | 93 | 3/3 | >2420 |
|  |  |  |  |  |  |  |  | 5/14 | 980 |  |  |
| 7/14 | 687 | 7/19 | ----- | 7/18 | 299 | 7/16 | 326 | 6/4 | 1553 |  |  |
|  |  |  |  |  |  |  |  | 7/9 | >2420 |  |  |
|  |  | 10/18 | 178 | 10/3 | 727 | 10/2 | >2420 | 8/6 | 248 |  |  |
|  |  |  |  |  |  |  |  | 9/17 | 101 |  |  |
|  |  |  |  |  |  |  |  | 10/21 | 980 |  |  |
|  |  |  |  |  |  |  |  | 11/5 | 488 |  |  |
|  |  |  |  |  |  |  |  | 12/3 | >2420 |  |  |

**Table 2: E. coli levels in Fenwick Branch 2015-2020[[69]](#footnote-70)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020[[70]](#footnote-71)** | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
| 1/16 | 53 | 1/5 | 75 | 1/17 | 276 | 1/16 | 30 | ---- |  | 2/4 | 37 |
|  |  |  |  |  |  |  |  |  |  | 3/3 | 921 |
| 4/28 | 45 | 4/5 | 379 | 4/4 | 148 | 4/3 | 37 | 4/2 | 326 |  |  |
|  |  |  |  |  |  |  |  | 6/4 | 167 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 7/14 | >2420 | -- |  | 7/18 | 579 | 7/20 | 228 | 7/9 | 730 |  |  |
|  |  |  |  |  |  |  |  | 8/6 | 228 |  |  |
| 10/6 | 45 | 10/18 | 1786 | 10/3 | 435 | 10/2 | 345 | 9/17 | 68 |  |  |
|  |  |  |  |  |  |  |  | 10/21 | 461 |  |  |
|  |  |  |  |  |  |  |  | 11/3 | 91 |  |  |
|  |  |  |  |  |  |  |  | 12/03 | 60 |  |  |

**Table 3: E. coli levels in Klingle Branch 2015-2020[[71]](#footnote-72)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020**[[72]](#footnote-73) | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
| 2/3 | 29 | 2/2 | 34 | 2/14 | 8 | 2/6 | 26 | 2/5 | 24 | 2/4 | 55 |
| 5/12 | 79 |  |  |  |  | 5/15 | 1733 | 4/2 | 35 | 3/3 | 33 |
| 8/11 | 816 | 8/6 | 2192 | 8/15 | >2420 | 8/14 | 866 | 5/14 | 192 |  |  |
|  |  |  |  |  |  |  |  | 6/4 | 308 |  |  |
|  |  |  |  |  |  |  |  | 7/9 | 387 |  |  |
| 11/3 |  | 11/8 | 8 | 11/14 | 61 | 11/6 | >2420 | 8/6 | 26 |  |  |
|  |  |  |  |  |  |  |  | 9/7 | 291 |  |  |
|  |  |  |  |  |  |  |  | 10/21 | 921 |  |  |
|  |  |  |  |  |  |  |  | 11/5 | 66 |  |  |
|  |  |  |  |  |  |  |  | 12/3 | 17 |  |  |

**Table 4. E. coli levels in Luzon Branch 2015-2020[[73]](#footnote-74)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020**[[74]](#footnote-75) | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
| 2/3 | 415 | 2/2 | >2420 | 2/17 | 190 | 2/6 | 150 | 2/5 | >2420 | 2/4 | >2420 |
|  |  |  |  |  |  |  |  | 4/2 | >2420 | 3/3 | >2420 |
| 5/12 | 54 |  |  | 5/16 | >2420 | 5/15 | >2420 | 5/14 | 1733 |  |  |
|  |  |  |  |  |  |  |  | 6/14 | >2420 |  |  |
| 8/11 | >2420 | 8/16 | >2420 | 8/15 | >2420 | 8/14 | 1733 | 7/9 | 770 |  |  |
|  |  |  |  |  |  |  |  | 8/6 | >2420 |  |  |
| 11/3 | 60 | 11/8 | 126 | 11/14 | 225 | 11/6 | >2420 | 9/17 | 866 |  |  |
|  |  |  |  |  |  |  |  | 10/21 | 1733 |  |  |
|  |  |  |  |  |  |  |  | 11/5 | 156 |  |  |
|  |  |  |  |  |  |  |  | 12/3 | 261 |  |  |

**Table 5. E. coli levels in Melvin Hazen Branch 2015-2020[[75]](#footnote-76)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020[[76]](#footnote-77)** | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
| 2/3 | 16 | 2/2 | 40 | 2/14 | 40 | 2/6 | 105 | 2/5 | 35 | 2/4 | 18 |
| 5/12 | 54 |  |  | 5/16 | 39 | 5/15 | >2420 | 4/2 | 517 | 3/3 | 62 |
| 8/11 | 816 | 8/16 | >2420 | 8/15 | >2420 | 8/14 | 365 | 5/14 | 326 |  |  |
|  |  |  |  |  |  |  |  | 6/4 | >2420 |  |  |
| 11/13 | 39 | 11/8 | 13 | 11/14 | 111 | 11/6 | >2420 | 7/9 | >2420 |  |  |
|  |  |  |  |  |  |  |  | 8/6 | 488 |  |  |
|  |  |  |  |  |  |  |  | 9/7 | 727 |  |  |
|  |  |  |  |  |  |  |  | 10/21 | >2420 |  |  |
|  |  |  |  |  |  |  |  | 11/5 | 220 |  |  |
|  |  |  |  |  |  |  |  | 12/3 | 96 |  |  |

**Table 6. E. coli levels in Pinehurst 2015-2020[[77]](#footnote-78)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020[[78]](#footnote-79)** | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
| 3/3 | 18 | 3/15 | 687 | 1/17 | 1203 |  |  |  |  | 2/4 | 42 |
|  |  |  |  |  |  | 3/6 | 50 | 3/5 | 34 | 3/3 | 6130 |
| 6/2 | 1986 | 6/14 | 122 | 4/4 | 579 |  |  | 4/2 | 60 |  |  |
| 9/33 | 727 | 9/20 | 387 | 7/18 | 194 | 6/5 | 1300 | 5/04 | 365 |  |  |
|  |  |  |  | 10/3 | 86 |  |  | 6/14 | 531 |  |  |
|  |  |  |  |  |  |  |  | 7/0 | 599 |  |  |
|  |  |  |  |  |  |  |  | 8/6 | 328 |  |  |
|  |  |  |  |  |  | 9/18 | >2420 | 9/17 | >2420 |  |  |
|  |  |  |  |  |  |  |  | 10/21 | 517 |  |  |
|  |  |  |  |  |  |  |  | 11/5 | 502 |  |  |
|  |  | 12/6 | 365 |  |  |  |  | 12/3 | 119 |  |  |

**Table 7. E. coli levels in Piney Branch 2015-2020[[79]](#footnote-80)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020**[[80]](#footnote-81) | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
|  |  |  |  |  |  |  |  |  |  | 2/4 | 111 |
| 3/3 | 185 | 3/15 | 249 | 3/14 | >2420 | 3/6 | 34 | 3/5 | 173 | 3/3 | 120 |
|  |  |  |  |  |  |  |  | 4/2 | 50 |  |  |
| 6/2 | >2420 | 6/17 | 210 | 6/6 | 92 |  |  | 5/14 | 518 |  |  |
|  |  |  |  |  |  |  |  | 6/4 | 921 |  |  |
| 9/21 | 147 | 9/20 | 687 | 9/19 | 249 | 9/18 | >2420 | 7/9 | 866 |  |  |
|  |  |  |  |  |  |  |  | 8/6 | 37 |  |  |
| 12/15 | 510 | 12/6 | 365 | 12/5 | 167 |  |  | 9/17 | 387 |  |  |
|  |  |  |  |  |  |  |  | 10/21 | 1300 |  |  |
|  |  |  |  |  |  |  |  | 11/5 | 153 |  |  |
|  |  |  |  |  |  |  |  | 12/3 | 214 |  |  |

**Table 8. E. coli levels in Portal Branch 2015-2020[[81]](#footnote-82)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020[[82]](#footnote-83)** | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
| 3/3 | 18 | 3/15 | 687 | 1/17 | 1203 |  |  |  |  | 2/4 | 42 |
|  |  |  |  |  |  | 3/6 | 50 | 3/5 | 34 | 3/3 | 613 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 6/2 | 1986 | 6/14 | 447 | 4/4 | 579 |  |  | 4/2 | 60 |  |  |
| 9/33 | 727 | 9/20 | 816 | 7/18 | 194 | 6/5 | 1300 | 5/04 | 365 |  |  |
|  |  |  |  | 10/3 | 86 |  |  | 6/14 | 531 |  |  |
|  |  |  |  |  |  |  |  | 7/9 | 579 |  |  |
|  |  |  |  |  |  |  |  | 8/6 | 328 |  |  |
|  |  |  |  |  |  | 9/18 | >2420 | 9/17 | >2420 |  |  |
|  |  |  |  |  |  |  |  | 10/21 | 517 |  |  |
|  |  |  |  |  |  |  |  | 11/5 | 502 |  |  |
|  |  | 12/6 | 366 |  |  |  |  | 12/3 | 119 |  |  |

**Table 9. E. coli levels in Soapstone Branch 2015-2020[[83]](#footnote-84)**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **2015** | | **2016** | | **2017** | | **2018** | | **2019** | | **2020[[84]](#footnote-85)** | |
| **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** | **Date** | **MPN** |
| 3/3 | 340 | 3/15 | 164 | 3/14 | >2420 | 3/6 | 13 | 3//5 | 78 | 2/4 | 80 |
|  |  |  |  |  |  |  |  | 4/2 | 416 | 3/3 | 613 |
| 6/2 | >2420 | 6/14 | 285 | 6/6 | 291 | 6/5 | >2420 | 5/14 | 345 |  |  |
|  |  |  |  |  |  |  |  | 6/4 | 387 |  |  |
| 9/21 | 84 | 9/20 | 276 | 9/19 | 138 | 9/18 | >2420 | 7/9 | 649 |  |  |
|  |  |  |  |  |  |  |  | 8/6 | 865 |  |  |
|  |  |  |  |  |  |  |  | 9/17 | 1046 |  |  |
| 12/15 | 326 | 12/6 | 59 | 12/5 | 10 |  |  | 10/21 | 488 |  |  |
|  |  |  |  |  |  |  |  | 11/5 | 613 |  |  |
|  |  |  |  |  |  |  |  | 12/3 | 291 |  |  |

**Appendix B.**

**Statistical Summary Report for E coli for Selected Rock Creek Tributaries 2009-2013 (MPN/100 ml) (Listed in order of % violation.)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tributary** | **Min Value** | **Max Value** | **Avg Value** | **% violation WQ std** |
| **Broad Branch** | **28.00** | **10,112** | **2,245.81** | **87.5** |
| **Luzon** | **42.00** | **2,420.00** | **708.6** | **55.00** |
| **Soapstone** | **102.00** | **2,420.00** | **795.93** | **46.67** |
| **Piney Branch** | **24.00** | **5,938.00** | **766.58** | **41.18** |
| **Portal** | **22.00** | **2,420.00** | **565.41** | **35.29** |
| **Fenwick** | **1.00** | **3,609.00** | **598.56** | **25.00** |
| **Pinehurst** | **14.00** | **4,611.00** | **605.32** | **23.52** |
| **Melvin Hazen** | **8.00** | **2,420.00** | **331.95** | **21.05** |
| **Klingle** | **16.00** | **1,986.00** | **373.90** | **20.00** |

Derived From: Water Quality Assessment, 2014 as submitted to US EPA by the District Department of Energy and the Environment

Note: Rankings and values may not represent current conditions.

**Appendix C.**

**E. coli, Center Channel Rock Creek USGS (Joyce Road site no. 01648010) 2019-2020 MPN/100mL)**

| DATE | AGENCY | MPN |
| --- | --- | --- |
| 2019-02-06 10:45 | USGS-WRD | 41 |
| 2019-02-20 20:15 | USGS-WRD | 120 |
| 2019-02-24 11:45 | USGS-WRD | 2600 |
| 2019-03-04 11:30 | USGS-WRD | 990 |
| 2019-03-06 11:45 | USGS-WRD | 120 |
| 2019-03-21 11:00 | USGS-WRD | 860 |
| 2019-03-21 13:00 | USGS-WRD | 1300 |
| 2019-03-21 14:00 | USGS-WRD | 1700 |
| 2019-04-04 10:45 | USGS-WRD | 50 |
| 2019-03-21 13:00 | USGS-WRD | 1300 |
| 2019-03-21 14:00 | USGS-WRD | 1700 |
| 2019-04-04 10:45 | USGS-WRD | 50 |
| 2019-04-12 19:30 | USGS-WRD | 910 |
| 2019-04-13 01:45 | USGS-WRD | 1300 |
| 2019-04-13 07:45 | USGS-WRD | 6000 |
| 2019-04-19 16:45 | USGS-WRD | 740 |
| 2019-05-05 02:45 | USGS-WRD | 1500 |
| 2019-05-05 04:45 | USGS-WRD | 3700 |
| 2019-05-05 08:45 | USGS-WRD | 6100 |
| 2019-05-05 10:40 | USGS-WRD | 5200 |
| 2019-05-09 11:00 | USGS-WRD | 160 |
| 2019-05-12 13:00 | USGS-WRD | 4700 |
| 2019-05-12 17:00 | USGS-WRD | 13000 |
| 2019-05-12 23:00 | USGS-WRD | 6800 |
| 2019-05-28 08:00 | USGS-WRD | 4500 |
| 2019-05-28 10:00 | USGS-WRD | 33000 |
| 2019-05-28 12:15 | USGS-WRD | 15000 |
| 2019-06-02 23:00 | USGS-WRD | 41000 |
| 2019-06-03 01:00 | USGS-WRD | 15000 |
| 2019-06-03 10:45 | USGS-WRD | 19000 |
| 2019-06-06 10:30 | USGS-WRD | 270 |
| 2019-06-13 07:15 | USGS-WRD | 4000 |
| 2019-06-13 09:15 | USGS-WRD | 3800 |
| 2019-06-13 13:15 | USGS-WRD | 5200 |
| 2019-07-08 09:15 | USGS-WRD | 22000 |
| 2019-07-08 11:30 | USGS-WRD | 29000 |
| 2019-07-08 14:00 | USGS-WRD | 41000 |
| 2019-07-08 15:30 | USGS-WRD | 34000 |
| 2019-07-08 21:30 | USGS-WRD | 19000 |
| 2019-07-11 10:00 | USGS-WRD | 400 |
| 2019-08-05 11:00 | USGS-WRD | 710 |
| 2019-08-07 17:30 | USGS-WRD | 9600 |
| 2019-08-07 19:30 | USGS-WRD | 16000 |
| 2019-08-07 23:30 | USGS-WRD | 24000 |
| 2019-08-08 05:30 | USGS-WRD | 12000 |
| 2019-08-21 19:30 | USGS-WRD | 750 |
| 2019-08-21 21:30 | USGS-WRD | 6100 |
| 2019-08-22 01:30 | USGS-WRD | 22000 |
| 2019-08-22 07:30 | USGS-WRD | 13000 |
| 2019-08-22 10:00 | USGS-WRD | 10000 |
| 2019-08-23 09:45 | USGS-WRD | 2800 |
| 2019-09-05 11:00 | USGS-WRD | 8700 |
| 2019-10-04 10:30 | USGS-WRD | 140 |
| 2019-10-16 13:45 | USGS-WRD | 1400 |
| 2019-10-16 16:00 | USGS-WRD | 11000 |
| 2019-10-16 16:15 | USGS-WRD | 11000 |
| 2019-10-16 19:45 | USGS-WRD | 22000 |
| 2019-10-16 23:45 | USGS-WRD | 14000 |
| 2019-11-06 11:45 | USGS-WRD | 83 |
| 2019-12-04 10:45 | USGS-WRD | 280 |
| 2019-12-10 10:15 | USGS-WRD | 3300 |
| 2019-12-14 04:30 | USGS-WRD | 1900 |
| 2019-12-14 06:30 | USGS-WRD | 1200 |
| 2019-12-14 09:15 | USGS-WRD | 1900 |
| 2019-12-29 21:30 | USGS-WRD | 1400 |
| 2019-12-29 23:30 | USGS-WRD | 4500 |
| 2019-12-30 03:30 | USGS-WRD | 5200 |
| 2020-01-08 12:15 | USGS-WRD | 1200 |
| 2020-02-04 12:30 | USGS-WRD | 180 |
| 2020-02-06 15:15 | USGS-WRD | 880 |
| 2020-02-06 17:15 | USGS-WRD | 1200 |
| 2020-02-06 21:15 | USGS-WRD | 2800 |
| 2020-02-07 12:15 | USGS-WRD | 3600 |
| 2020-03-04 11:30 | USGS-WRD | 93 |
| 2020-03-19 11:00 | USGS-WRD | 2400 |
| 2020-03-28 12:05 | USGS-WRD | 1900 |
| 2020-04-01 11:35 | USGS-WRD | 570 |
| 2020-04-13 04:40 | USGS-WRD | 840 |
| 2020-04-13 06:45 | USGS-WRD | 3900 |
| 2020-04-13 10:30 | USGS-WRD | 7500 |
| 2020-04-23 23:15 | USGS-WRD | 2900 |
| 2020-04-24 01:20 | USGS-WRD | 1700 |
| 2020-04-24 05:25 | USGS-WRD | 1900 |
| 2020-05-05 10:20 | USGS-WRD | 210 |
| 2020-06-02 12:20 | USGS-WRD | 340 |
| 2020-06-04 23:55 | USGS-WRD | 82000 |
| 2020-06-05 02:00 | USGS-WRD | 34000 |
| 2020-06-05 06:05 | USGS-WRD | 37000 |
| 2020-07-07 11:10 | USGS-WRD | 22000 |
| 2020-07-21 20:15 | USGS-WRD | 3000 |
| 2020-07-21 22:20 | USGS-WRD | 69000 |
| 2020-07-22 02:20 | USGS-WRD | 98000 |
| 2020-07-22 08:20 | USGS-WRD | 14000 |
| 2020-07-22 11:10 | USGS-WRD | 3700 |
| 2020-08-04 13:05 | USGS-WRD | 15000 |
| 2020-08-04 15:10 | USGS-WRD | 19000 |
| 2020-08-04 19:15 | USGS-WRD | 19000 |
| 2020-08-10 09:50 | USGS-WRD | 390 |
| 2020-08-29 09:30 | USGS-WRD | 9100 |
| 2020-09-04 12:10 | USGS-WRD | 11000 |
| 2020-09-08 11:50 | USGS-WRD | 1200 |
| 2020-09-11 08:45 | USGS-WRD | 10000 |
| 2020-10-06 11:30 | USGS-WRD | 130 |
| 2020-10-12 10:30 | USGS-WRD | 20000 |
| 2020-11-03 10:40 | USGS-WRD | 3500 |
| 2020-11-12 10:45 | USGS-WRD | 13000 |
| 2020-12-10 09:35 | USGS-WRD | 200 |

1. The most complete historical treatment of the Anacostia is chronicled in Anacostia: The Death and Life of an American River, John R. Wennersten, The Chesapeake Book Company, 2008. Distributed by Alan C. Hood & Co. Inc. PO Box 775 Chambersburg, PA 17201 (Phone: 717-267-0867, toll-free, www.hoodbooks.com.) [↑](#footnote-ref-2)
2. Final General Management Plan, Environmental Impact Statement, Rock Creek Park and Rick Creek and Potomac Parkway. (http//www.npc.gov/rocr/pphtml/documents.html, January 1, 2005) [↑](#footnote-ref-3)
3. This estimate from the web page of city manager, Leavenworth Kansas accessed January 26, 2021 www.leavenworthks.org [↑](#footnote-ref-4)
4. Water Quality Assessment, 2009 and 2014 as submitted to US Environmental Protection Agency by the District of Columbia Department of Energy and the Environment. [↑](#footnote-ref-5)
5. Final General Management Plan, Environmental Impact Statement, 2005 [↑](#footnote-ref-6)
6. Rock Creek Watershed Management Plan, District of Columbia Department of Energy and the Environment, Watershed Protection Division, August 2010. [↑](#footnote-ref-7)
7. Water Quality in the Anacostia River, Maryland and Rock Creek, Washington, DC Continuous and Discrete Monitoring with Simulations to Estimate Concentrations and Yields of Nutrients, Suspended Sediment and Bacteria by Cherie V. Miller, Jeffrey G. Charat, and Joseph Bell, MD-DE-DC Water Science Center US Geological Survey, 5522 Research Park Drive, Baltimore, MD 21228 (<http://md.water.usgs.gov>), 2011. [↑](#footnote-ref-8)
8. waterdata.usgs.gov/dc/nwis/inventory/?site\_no=016480108agencycd=usgs&amp. [↑](#footnote-ref-9)
9. “Report on Stream Health at Select Tributaries of Rock Creek in Washington, DC 2010-2018.” Audubon Naturalist Society, Water Quality Monitoring Program Cathy Wiss, Program Coordinator, December, 2018 [↑](#footnote-ref-10)
10. DC Citizen Science Water Quality Monitoring Report, Department of Energy and Environment (DOEE), 2020. (https://www.anacostiariverkeeper.org/wp-content/uploads/2020/11/RK-VWQM-2020-Report\_Final-with-Appendix-A.pdf) [↑](#footnote-ref-11)
11. The USGS data are derived from their continuous monitoring site at Joyce Road and available on their website: waterdata.usgs.gov/dc/nwis/inventory/?site\_no=016480108agencycd=usgs&amp. [↑](#footnote-ref-12)
12. Rain data comes from Monthly Operations Report for the Combined Sewer System. The Reports are grouped quarterly and generally available by the 15th of the month following the end of the quarter. The reports are available on DC Water's web site: [↑](#footnote-ref-13)
13. Monthly Operations Report for the Combined Sewer System, DC Water August 2016 accessed from DC Water website February 14, 2020. [↑](#footnote-ref-14)
14. Final General Management Plan, Environmental Impact Statement, Rock Creek Park and Rock Creek and Potomac Parkway. (http//www.nps.gov/rocr/pphtml/documents.html (January 1, 2005) p. 135 [↑](#footnote-ref-15)
15. “Metagenomic Sequencing and Quantitative Real Time PCR for Fecal Pollution Assessment in an Urban Watershed.” Kyle D. Brumfield, Joseph A. Cotruvo, Orin C. Shanks, Mano Sivaganesan, Jessica Hey, Nur A. Hasan, Anwar Huq, Rita R. Colwell, and Menu B. Liddy. Waterdoi: https://doi.org/10.3389/frw2021,626849. Published February 15, 2021 [↑](#footnote-ref-16)
16. “Report on Stream Health at Select Tributaries of Rock Creek in Washington, DC 2010-2018.” Audubon Naturalist Society, Water Quality Monitoring Program, Cathy Wiss, Program Coordinator, December 2018 [↑](#footnote-ref-17)
17. For the purposes of this study of the Upper Rock Creek, we examined only selected sites. Eleven sites in the Upper Rock Creek including Fenwick are sampled for a variety of water quality parameters by the DOEE about once a month. Other sites sampled in the Rock Creek watershed include the Main stem Rock Creek at the DC Line, the Main Stem of Rock Creek at Connecticut Ave, and at the mouth of each of eight tributaries: Klingle Run, Luzon Branch, Melvin Hazen, Pinehurst, Portal Branch, Piney Branch, Soapstone and Normanstone among others. [↑](#footnote-ref-18)
18. Rock Creek Watershed Implementation Plan, District Department of Energy and the Environment, Watershed Protection Division, August 2010. [↑](#footnote-ref-19)
19. Water Quality Assessment 2014 as submitted to US Environmental Protection Agency by the District Department of Energy and Environment. [↑](#footnote-ref-20)
20. A geometric mean is the product of all the values of a given dataset and nth root of that product where n equals the number of values in the data set. Some water quality analysts believe that taking the geometric mean has the effect of minimizing the high and low readings and better representing trends in values than a simple average. Critics maintain that in the case of bacteria levels, high levels are the most dangerous and using geometric means could distort and minimize the true health threat posed by a given stream at a given moment. [↑](#footnote-ref-21)
21. DC Citizen Science Water Quality Monitoring Report Anacostia Riverkeeper 2020. [↑](#footnote-ref-22)
22. Rock Creek Watershed Implementation Plan, District Department of Energy and the Environment, Watershed Protection Division, August 2010. [↑](#footnote-ref-23)
23. Water Quality Assessment 2014 as submitted to US Environmental Protection Agency by the District Department of Energy and Environment. [↑](#footnote-ref-24)
24. Rock Creek Watershed Implementation Plan, District Department of Energy and the Environment, Watershed Protection Division, August 2010. [↑](#footnote-ref-25)
25. Water Quality Assessment 2014 as submitted to US Environmental Protection Agency by the District Department of Energy and Environment. [↑](#footnote-ref-26)
26. Rock Creek Watershed Implementation Plan. [↑](#footnote-ref-27)
27. Report of the Operations of the Engineers, Department of Sanitary Engineering, District of Columbia Board of Commissioners Annual Report. 1919 [↑](#footnote-ref-28)
28. Melvin Hazen is one of the two Rock Creek tributaries named for a person. Melvin C. Hazen was appointed to the DC Commission, the longtime governing body of the District, by President Franklin Roosevelt in 1933. Hazen served eight years as chair of the Commission and played a key role in overseeing the development of the highway plan and was instrumental in displacing the black community around Fort Reno to site a reservoir, Alice Deal Middle School and Woodrow Wilson High School. The Rock Creek Conservancy, Delegate Eleanor Holmes Norton and others have called for renaming the park and creek that holds his name. See also: “A ‘city father’ tried to erase a Black Neighborhood. Now the neighborhood wants to erase him.” Justin Wm. Moyer, Washington Post, March 16, 2021. [↑](#footnote-ref-29)
29. Report on Stream Health at Select Tributaries of Rock Creek, Audubon Naturalist Society (ANS), December 2018 [↑](#footnote-ref-30)
30. Report on Stream Health, ANS. [↑](#footnote-ref-31)
31. Water Quality Assessment 2014 as submitted to US Environmental Protection Agency by the District Department of Energy and Environment. [↑](#footnote-ref-32)
32. Reports from neighbors Marguerite (Mickey) Sayles and Mary Whelan. Also see Report on Stream Health at Select Tributaries of Rock Creek in Washington, DC 2010-2018, Audubon Naturalist Society, Water Quality Monitoring Program, Cathy Wiss, Program Coordinator, December 2018. [↑](#footnote-ref-33)
33. These readings were taken using a different protocol than DOEE whose instruments could not measure levels greater than 2420 MPN. [↑](#footnote-ref-34)
34. “Report on Stream Health, 2018 Audubon Naturalist Society, p. 14. [↑](#footnote-ref-35)
35. ”Report on Stream Health at Select Tributaries of Rock Creek in Washington, DC 2010-2018.” Audubon Naturalist Society, Water Quality Monitoring Program, Cathy Wiss, Program Coordinator, December 2018. P. 5 [↑](#footnote-ref-36)
36. ANS, p. 23 [↑](#footnote-ref-37)
37. Rock Creek Stem Sewers – Condition Assessment [↑](#footnote-ref-38)
38. Rock Creek and Piney Branch Trunk Sewers, Washington. DC (<https://livingnewdeal.org/new-deal-categories/infrastructure>/sanitation-water-disposal/) [↑](#footnote-ref-39)
39. DC Citizens Science Water Quality Monitoring Report, 2020` [↑](#footnote-ref-40)
40. Watershed Management Plan p. 13 [↑](#footnote-ref-41)
41. Water Quality Assessment, 2014. [↑](#footnote-ref-42)
42. Water Quality Assessment, 2014

    [↑](#footnote-ref-43)
43. As discussed in an earlier footnote, different sampling protocols have different limits and sensitivities. The USGS system is capable of detecting E. coli levels many times that of DOEE instruments. [↑](#footnote-ref-44)
44. Rock Creek Watershed Plan [↑](#footnote-ref-45)
45. “Rehabilitation of Three Sanitary Pumping Stations.” CCJM consulting firm. As assessed on their website: ccjm.com/2011/04/27/rehabilitation-of-three-sanitary-pumping stations/ [↑](#footnote-ref-46)
46. Report of the Operations of the Engineers, Department of Sanitary Engineering, District of Columbia Board of Commissioners Annual Report 1908. [↑](#footnote-ref-47)
47. Report of the Operations of the Engineers, Department of Sanitary Engineering, District of Columbia Board of Commissioners Annual Report 1912. [↑](#footnote-ref-48)
48. Report of the Operations of the Engineers, Department of Sanitary Engineering, District of Columbia Board of Commissioners Annual Report for 1914. [↑](#footnote-ref-49)
49. Report of the Commissioners, 1918 [↑](#footnote-ref-50)
50. Report of the Commissioners, 1923 [↑](#footnote-ref-51)
51. Commissioners complained about the law enacted March 3, 1909 in the 1909 Report of the Commissioners. [↑](#footnote-ref-52)
52. Report of the Commissioners, 1915 [↑](#footnote-ref-53)
53. “Trunk Sewer Project, Taxpayers Petition for Its Consideration, Commissioner Biddle Approves,” Evening Star, November 9, 1903 [↑](#footnote-ref-54)
54. “The District Budget on Course of Preparation.” Evening Star, October 12, 1903 [↑](#footnote-ref-55)
55. Wikipedia, accessed March 3, 2021. "Charles Carroll Glover.” [↑](#footnote-ref-56)
56. “For Cheaper Sewers, Business Men Oppose Costly Trunk Sewer Method, Benefits All in Future.” Washington Post, October 24, 1905 [↑](#footnote-ref-57)
57. Report of Commissioners, 1915 [↑](#footnote-ref-58)
58. A US District Court ruled on May 8, 1973 that the Administration must release $5 billion – about half – of the appropriated funds. [↑](#footnote-ref-59)
59. Personal observation by the author. Also, “A River Revived” by Noman M. Cole, Jr., Washington Post, May 18, 1980. [↑](#footnote-ref-60)
60. The DC Water and Sewer Authority (DCWASA), now known as DC Water, was created by legislation championed by Rep. Tom Davis (R-VA) after successive DC mayors raided the DC Sewer and Water Fund for their other priorities. [↑](#footnote-ref-61)
61. DC Water 2020 Budget Adopted by the BOD April 4, 2019. [↑](#footnote-ref-62)
62. According to the Capital Improvement Plan adopted by the DC Water Board March 5, 2020, $4K was budgeted in FY2019, $78K in FY2020, and a final amount FY$7K in FY2021. (P iv-48, FY2011-2020 Capital Improvement Program. [↑](#footnote-ref-63)
63. Forest Hills Connection, May 26, 2019 (foresthillsconnection.com/news/soapstone.fonsi) [↑](#footnote-ref-64)
64. CIP Quarterly update by Paul Gittridge before the Environmental Quality and Operations Committee, February 18, 2021. [↑](#footnote-ref-65)
65. Email communication from Emanuel Briggs, February 25, 2021. [↑](#footnote-ref-66)
66. Presentation to the Environmental Quality and Operations Committee, February 18, 2021, Kisha Powell, Chief Operating Officer and Lenard Benson, Executive Vice President and Chief Engineer, CIP project Delivery. [↑](#footnote-ref-67)
67. These data generously provided by Roque Hernandez of DOEE. Levels are Most Probable Number (MPN) of colonies. The Water Quality Standard is 200 MPN. [↑](#footnote-ref-68)
68. 2020 readings were curtailed due to the Covid-19 pandemic. [↑](#footnote-ref-69)
69. These data are provided by the District Department of Energy and Environment (DOEE). Rock Creek tributaries are typically sampled at the mouth of the tributaries about once every three months but some locations are sampled after severe rainstorms. [↑](#footnote-ref-70)
70. Data for 2020 was curtailed due to Covid 19 pandemic. [↑](#footnote-ref-71)
71. These data generously provided by DOEE. Levels are Most Probable Number (MPN) of colonies. Water Quality Standard is 200 MPN. [↑](#footnote-ref-72)
72. 2020 readings were curtailed due to the Covid-19 pandemic. [↑](#footnote-ref-73)
73. These data generously provided by Roque Hernandez of DOEE. Levels are Most Probable Number (MPN) of colonies. The Water Quality Standard is 200 MPN. [↑](#footnote-ref-74)
74. 2020 readings were curtailed due to the Covid-19 pandemic. [↑](#footnote-ref-75)
75. These data generously provided by Roque Hernandez of DOEE. Levels are Most Probable Number (MPN) of colonies. The Water Quality Standard is 200 MPN. [↑](#footnote-ref-76)
76. 2020 readings were curtailed due to the Covid-19 pandemic. [↑](#footnote-ref-77)
77. These data generously provided by DOEE. Levels are Most Probable Number (MPN) of colonies. Water Quality Standard is 200 MPN. [↑](#footnote-ref-78)
78. 2020 readings were curtailed due to the Covid-19 pandemic. [↑](#footnote-ref-79)
79. These data generously provided by DOEE. Levels are Most Probable Number (MPN) of colonies. Water Quality Standard is 200 MPN. [↑](#footnote-ref-80)
80. 2020 readings were curtailed due to the Covid-19 pandemic. [↑](#footnote-ref-81)
81. These data generously provided by DOEE. Levels are Most Probable Number (MPN) of colonies. Water Quality Standard is 200 MPN. [↑](#footnote-ref-82)
82. 2020 readings were curtailed due to the Covid-19 pandemic. [↑](#footnote-ref-83)
83. These data generously provided by DOEE. Levels are Most Probable Number (MPN) of colonies. Water Quality Standard is 200 MPN. [↑](#footnote-ref-84)
84. 2020 readings were curtailed due to the Covid-19 pandemic. [↑](#footnote-ref-85)