Sewers, Water and Germs: New York’s Battle Against Pandemics
Plan Exhibiting the System of Sewerage in the City of Brooklyn NY 1875, prepared by J.W. Adams CE to accompany Report to the Brooklyn Board of Health, 1875-76.
Sewers, Water and Germs: New York’s Battle Against Pandemics

By the 2020 Young Scholars of PS/IS 225

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Newly installed sewer pipe.

John Voigt, 72’ sewer/E 40th St north of Flatlands Avenue, 1905, photograph, V1986.247.1.35; Brooklyn Historical Society.
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Dear Reader,

Brooklyn Historical Society’s Young Scholars after school program reinforces three valuable lessons: the importance of research, facts and fact-checking, the relevance of historical information to today’s world, and the unstoppable passion of youth as they discover their voice and power.

In late fall and early winter 2019, the over 80 Young Scholars who entered the sixth year of the Young Scholars program had no idea that their research on sewers and sanitation would become so relevant to their understanding of the spread of the Covid19 Virus. They studied archival documents from the earliest recorded history of Brooklyn in 1624 that revealed the impact of germs and viruses and the spread of cholera, yellow fever, and smallpox, to records of the 1918 Spanish Flu. As they dug deeper into information about local sanitation and environmental issues in the neighborhoods surrounding their schools, and visited the Newtown Creek Wastewater Treatment Plant, they continued to deepen their knowledge about the importance of clean water and different strategies for minimizing the spread of germs.

This book represents the extraordinary work of the Young Scholars of PS/IS 225, and the combined efforts of these seventh- and eighth-grade students, their program educator, Janise Mitchell, and their cooperating teacher Anthony Abbate. This cohort was close to finishing their book when NYC, the schools and BHS closed in response to the Covid19 pandemic. Using their second draft and notes, Janise, the students, their parents, and I completed their book about pandemics caused by water-based diseases and the importance of sewers.

Congratulations to the Young Scholars of PS/IS 225. I enjoyed listening to their conversations as they discovered how wastewater treatment plants help prevent water-based disease pandemics. Through their journals, I saw their critical thinking skills, observations and curiosity grow. They wanted to know “more,” and find the answers to all of their questions. How ironic that these inquisitive students saw a correlation to pandemics and the safety of public health just as the world began to experience a new pandemic. It gave them agency to dive further in the archives with the critical lens of historians and allowed them to give voice to the past and present of pandemics as writers. It allowed them to find their own power as a community to tell the stories necessary for growth.

I thank you, the parents, and guardians, for allowing them to participate in the program this year. To their educator, Janise Mitchell, thank you for all your hard work. I appreciate all of you. Thank you.

Sincerely,

Shirley Brown Alleyne
Manager of Teaching & Learning
Brooklyn Historical Society

A Note from Our Editor
This was my second year of working with the Young Scholars of PS/IS 225. When we began our research in early January, I was elated to see returning students from the previous year, as well as new faces. Our initial focus was on the evolution of the sewage system in New York. The initial reaction was one of puzzlement. More than a few students raised questions as to how this was related to their lives. Then at the next session, we experienced a torrential rainstorm. Though it was January, it was unusually warm for the day. When we cracked open the windows, we were greeted with a most noxious smell. One student yelled out, “close the window, it smells like a wet diaper.” Among the giggles, I posed the question, “where is the smell coming from and why?” Once the students realized the smell came from the overflow of sewage due to the rain, they began to understand how sewers impact our daily lives.

As we delved into more research, our interests shifted to focus more on the importance of public health. We looked at how different pandemics in New York were often accelerated through unsanitary conditions and contaminated drinking water. From there, we investigated how combatting these pandemics must involve the work of city planners, scientists, and doctors. We raised questions about how diseases can impact us not just physically, but also socially. Why are pandemics more deadly for people who lack the means to isolate or obtain adequate health care?

In early March, we toured the Newtown Creek Water Treatment plant. The Young Scholars arrived with their prepared questions and notebooks. As we finished the tour, all were asked to sanitize their helmets and hands. The Coronavirus was on everyone’s mind, but no one seemed overly concerned. As students were preparing to leave for the day, I reminded them to bring their notebooks for the next session later in the week.

Unfortunately, that was our last session. Five days later, all public schools were closed for the year. Little did we know that our book about past pandemics would be written during a current one. For the next few weeks, I managed to conference students through Google Classroom and email. Their classroom teacher, Mr. Abbate, once again proved to be a fearless supporter. We were able to collect their notes, make revisions while practicing social distancing.

For my awesome scholars, you have made me enormously proud. I’ve had the privilege of working with the most amazing 7th and 8th graders in the city. Some of you were taking advanced courses, managing family responsibilities, juggling outside activities, yet we persevered. You are certainly some of Brooklyn’s finest. We do not know the timetable for this virus, when it will dissipate, or if it will return. How will this current pandemic shape future policies regarding public health and safety? These are questions that the Young Scholars of PS/IS 225 will face and hopefully will help to solve in the future.

Finally, a special thank you for Shirley Brown Alleyne for whom the completion of this book would not have been possible.

Janise Mitchell
PS/IS 225 Young Scholars Program Educator
Brooklyn Historical Society
The first remote message I sent to my students as public schools closed was, “You guys are living through an unprecedented event that academia will read, study, write, and debate about for the rest of recorded history...” It is totally ironic, and even poetic, that we began the year studying the causes and effects of infectious diseases created by the lack of infrastructure, technology, medicine, and the social-economic divide of the 19th century, and then as the year progressed, we were plagued with a devastating pandemic taking place in the 21st century. This invisible enemy knows no bounds and does not discriminate based on religion, gender, race, or creed.

That being said, let us take a moment of silent reflection to remember all the people who died in the wake of the Covid-19 virus, especially Dominick Cosmai, father of our honorable Principal Michael. Let us thank the first responders who bravely, selflessly, and tirelessly give their time and lives to ensure public health and safety. Lastly, let us thank the educators and students, for staying engaged in the pursuit of knowledge, rising to the occasion to adapt to the challenges of this new shift in learning, and coming together to make our community stronger through acts of kindness.

Our Young Scholars did not have to continue to engage in this project but were compelled because they understand the importance of academics, commitment, and civic participation. They drive me and make me proud to be an educator. I want to personally thank Janise Mitchell, Shirley Brown-Alleyne, Michael Cosmai, Joann Trani, Shraf Abdelrahim, and my loving family for all their help and support. Grandpa, you are a gentleman and a scholar.

Anthony D. Abbate, M.S.
PS/IS 225 Cooperating Teacher
When New York was still a small colony, most people got their water from community wells and streams. Wells and streams provided fresh drinking water. As the city grew, residents used water from Collect Pond located in lower Manhattan.

By the 1800’s New York changed rapidly. New York was no longer a small town but was emerging into a large metropolis. With this growth, New York faced a couple of problems; how to supply more fresh water for residents and how to deal with water contamination. People were living in crowded conditions. Trash and garbage were regularly thrown into the streets creating unsanitary conditions. Soon, there were outbreaks of diseases (pandemics) such as yellow fever and cholera. Whenever there was a pandemic, wealthy New Yorkers would leave and stay in rural areas until it was safe to return. Poor people, without access to healthcare and medicine, were affected the most. Scientists and doctors, unsure of the origins of these diseases, often relied on ineffective remedies.

**DID YOU KNOW**

Collect Pond was a large, sixty-foot deep pool fed by an underground spring. Throughout the 17th and 18th centuries, Collect Pond was used to provide water for area residents. However, by the 19th century, the pond had become contaminated with sewage.
A view of Brooklyn in the early 1800’s shows the rapid development of the city.

The city of Brooklyn, Currier & Ives, 1879; G3804.N4:3B8A3 1879 .P3; Library of Congress, Geography and Map Division.
Cholera is an infectious bacterial disease that affects the small intestine. The symptoms of cholera are very harsh. The symptoms include an attack of vomiting and diarrhea that is accompanied with cramps. Death occurs because its victims die of severe dehydration. Because dehydration causes the skin to turn blue, it was called the “blue death.” It is usually caught through infected water and food supplies.

What led to the spread of cholera in the 19th century? New York City was vulnerable to cholera because of an increase in population. As many people immigrated to New York, it changed from a small town into a bustling city. Many of these immigrants came to escape poverty from their homeland. Most immigrants lived in poor neighborhoods close together. The horrible, overcrowded unsanitary living conditions, such as the lack of plumbing, also contributed to the spread of disease.

There was no indoor plumbing, so people used outhouses. When people had the urge to relieve themselves, they used a roofed cubicle called an outhouse about 50 to 100 yards away from their houses. For indoor facilities, families placed a chamber pot underneath the bed. Chamber pots were bowls with lids people

DID YOU KNOW

“The Tenement Act of 1901 one of the first such laws to ban the construction of dark, poorly ventilated tenement buildings in the state of New York. Among other sanctions, the law required that new buildings must be built with outward-facing windows in every room, an open courtyard, indoor toilets, and fire safeguards.”

New York (State), and New York (N.Y.). Tenement House Dept. The Tenement House Act: (Chapters 334 And 555, Laws of 1901; Chapter 352, Laws of 1902; Chapter 179, Laws of 1903; Chapter 346 And 739, Laws of 1904.). [New York: M.B. Brown], 1904
used as portable toilets used during the night. The next day the waste was either tossed into the road or street, or into the privy, the vault under the outhouse. This waste was called, “night soil.” Leaks from privies also contaminated wells and drinking water.

Disposing of night soil became a thriving business. Workers shoveled night soil into carts which were later disposed of into the rivers, bays, and ocean fronts of the city. At best, the night soil was placed on steamboats and dumped far out in the harbor. Much of this waste material made its way into Jamaica and Sheepshead Bay, contaminating fish and oyster beds, posing a threat to the livelihood of fishermen. These were ideal conditions to spread diseases.

Fresh drinking water was further contaminated from household trash, waste from factories, and butcher shops in the area. Pandemics were feared by New Yorkers and they often blamed outbreaks of pandemics on immigrants who were often discriminated against.
In the past, doctors, scientists, and city health officials did not understand the causes of diseases like cholera. The standard belief was that cholera was spread by poisonous vapors in the air from decaying matter. It wasn’t until 1854 when a London physician, Dr. John Snow, discovered that germs were the cause of cholera.

Using maps which located outbreaks of cholera, Dr. Snow realized that the outbreaks were clustered around a communal water pump. Snow discovered that cholera was caused by water contaminated with human waste. Politicians began to support new ways to clean up the city. Support for indoor plumbing and access to clean water became more important. In the late-nineteenth century, using scientific responses to curb the spread of diseases was part of a larger trend towards progressive reforms in New York, including creating a sewer system.

**DID YOU KNOW**

Quarantine and improvements in municipal planning including sewage disposal and access to clean water, were effective methods for fighting cholera.
Today, New Yorkers use billions of gallons of fresh clean water and each day billions of gallons of sewage is treated at wastewater treatment centers. Our sewage system and reservoirs are engineering marvels.

OUR SEWAGE SYSTEM

In the mid-1800s, homes were not equipped with running water or indoor toilets. When the causes of how cholera was spread were discovered, the invention of a modern sewage system helped control the spread of this disease. A sewage system meant that contaminated water was treated and would not travel back into homes. The development of the sewage system, along with indoor plumbing, helped slow down outbreaks of cholera, while also keeping the environment clean.

Early indoor plumbing did have some problems. If there was a leak in a pipe there was a possibility that bacteria from human waste could enter homes. With modern advancements in sewer systems, we can avoid outbreaks of diseases caused by water contamination.

In New York City, most sewers use a combined system, a combined sewer system for stormwater and wastewater. That means, one pipe carries both rainwater and sewage waste from buildings, and they are sent to a wastewater treatment plant together.

DID YOU KNOW

The city has a combined sewer system for both storm water and wastewater, meaning that storm water and wastewater are mixed in the sewers and sent on to the same treatment plants.

When it rains, the contents of the storm drains, including wastewater, will spill out on the streets.

Not all areas of New York use combined sewers or CSO’s. Some parts of Brooklyn use separate pipes for rainwater and sewage lines.
Other areas in Brooklyn use a separate storm sewer system. Different pipes are used to carry stormwater and wastewater. Pipes used to carry waste go directly into a wastewater treatment plant, while pipes for stormwater flow directly into local waterways. This creates challenges for neighborhoods such as Bergen Beach and Brighton Beach since pollutants from the water cause further contamination of their ocean fronts.

**DID YOU KNOW**

In 1972, the federal government passed the Clean Water Act. It sets minimum standards for wastewater treatment plants throughout the country. Water treatment plants must be upgraded to remove up to 85% of pollutants.
On March 17, 2020, the Young Scholars of PS/IS 225 visited the Newtown Creek Wastewater Treatment Plant. This treatment plant is the largest sewage plant in New York City. People who work at sites like the Newtown Creek Wastewater Treatment Plant take care of waste and clean the water, so we do not have pandemics caused by dirty/contaminated water. Before touring the facilities, students attended an information session with our tour guide. Students learned about the history of the plant, and the complex nature of treating sewage. The highlight of the tour was taking an elevator to the top of the digester eggs.
1 Deep beneath the city, wastewater, called influent, passes through bars in pipes to separate large pieces of debris.

2 The wastewater enters into settling tanks at the wastewater treatment plant to allow heavier solids to settle and lighter materials to float on top. The lighter materials are skimmed from the surface. The settled product, or sludge, is pumped into a different tank for further processing.

3 The solid sludge goes into a machine to force out sand, dirt and gravel. Once removed, the grit is taken to landfills.

4 The leftover sludge is taken for more processing or secondary treatment. Air is pumped into aeration tanks mixing wastewater and sludge to stimulate the growth of good bacteria. The good bacteria consume the remaining organisms that are harmful to people, creating heavier particles that will settle in the wastewater. This step can take anywhere from three to six hours.

5 The wastewater goes into another tank. More heavy particles settle to the bottom as secondary sludge. Some of this sludge is spun around in an aeration tank to remove excess wastewater. That excess wastewater will sit in another settling tank for anywhere from two to three hours before it goes to get disinfected.

6 Chlorine is used to disinfect and kill harmful bacteria that remains in the wastewater. The treated wastewater is released into our local waterways.

7 The remaining sludge, or “pudding,” is placed in special tanks for a day. When the “pudding” is nice and thick it’s placed in oxygen-free tanks called digester eggs. Bacteria in the digester eggs help decompose the sludge into water, carbon dioxide and methane gas.

8 Finally, the sludge is sent through another spin cycle to remove any remaining water. Additives are used to thicken the substance until it resembles a “cake.”

9 The final product or biosolid can be used as fertilizer.
The placement of sewage lines in those areas have a bigger and brighter circle of whatever color represents them to show those areas are the ones that mostly need the water treatment facilities.

Pennell, Joseph, Artist. StanMap of the Borough of Brooklyn City of New York, showing all sewers completed up to June 1st 1902. Also those completed during the year 1902. Also those not completed, but authorized and in the course of construction during the year 1902, Hyde Map & Atlas, 1902; Flat Maps B A-[1902].Fi; Brooklyn Historical Society.

**DID YOU KNOW**

The 14 wastewater treatment plants in New York City process 1.3 billion gallons of sewage per day.

Workers use special vacuums to clean out grease and other junk that clogs sewer pipes. It takes three hours per day to clean out one pipe.
Chapter 5  Billion Oyster Project

The Billion Oyster Project works to restore oyster reefs to New York harbors. Oyster reefs provide habitat for hundreds of species and can protect our city from storm damage. This helps in reducing flooding and preventing erosion along our shorelines.

At one time, the oysters of Jamaica Bay were considered to be the best to eat in the world. But also, one adult oyster can filter up to 5 liters or 1.3 gallons of water an hour. That is almost equal to 60 two-liter soda bottles a day, just for one small oyster. By filtering out sewage, the oysters help to prevent the spread of disease through contaminated water.

The Billion Oyster Project has a goal of putting a billion oysters in NYC’s waterways to clean the water and further help prevent pandemics.
Chapter 6  2020 Young Scholar Reflections

Through their research, this year’s PS/IS 225 Young Scholars found a connection to sewers and pandemics. They understood the importance of looking at historical documents to understand how pandemics and sewers impacted people then, and the importance of using preventive measures today.

As the Young Scholars of PS/IS 225 worked on this book, the Covid-19 pandemic took hold of the world. We felt it was important for the students, as Young Scholars, to document and record their experiences and reflections for future historical researchers. Through their Google Classroom, we asked these middles school students to write their thoughts about this situation. Some of the Young Scholars chose to remain anonymous, while others gave us their name. Here are their thoughts, reflections and feelings.

Epidemics have been affecting us since the 1800s and all the way up to the present time. Visiting places like New Town Creek and the Billion Oyster Project gave me a great understanding of history and helped me to be part of creating this book. Creating this book was so cool for us, however, we were interrupted with the closure of all schools. This was because of the coronavirus. We stayed home, worked hard and we got the job done.

Maaz
I feel pretty safe but also scared when my parents go outside. The coronavirus was something so unimaginable. It spread across the world in weeks! This disease can easily spread. At home, I usually play video games and exercise. Since I can’t go outside, I need to exercise. Moving forward, I hope schools do not open. You may question it but, if schools open even as the Coronavirus cases have decreased exponentially, there are still going to be some unknown cases. The virus can easily spread again.

Anonymous
I feel depressed about what is currently going on, we the people are suffering drastically. Some are losing their loved ones, others are slowly dying, and the rest are just stuck home, waiting for the economy to get better and bid this virus goodbye. My hope moving forward is that everything gets better in a few months, Covid-19 will also be cured and in quarantine (locked away in case it comes back again), and I also hope that we will rebuild quickly after this virus is gone. The coronavirus affects me because it takes away my freedom to be outside, it takes away my freedom to actually talk to people. Lastly, it takes my freedom to breathe fresh air.

Leyla
It was late-April when I found out I was assigned to create my final reflections for the project, I was put out of my misery trying to figure out how I was going to start it. After hours of brainstorming, I realized life as I know it currently sucks.
We are presently in a Covid-19 pandemic, with thousands suffering as the numbers of infected people rise dramatically each day. Due to the government’s enforcing of social distancing all New York City schools are shut down. As a result, I and all of my classmates have transferred over to remote learning. So, that is basically what occupies most of my time besides from sleeping, eating, and watching Netflix. Personally, this entire situation has affected me terribly. Unfortunately, Covid-19 has already taken two of my family members and a portion of the 7th grade school year. Although I am unable to see most of my friends at school, my goal is to stay safe and use this time as productively as possible.

Irena
I feel pretty scared and worried about what is going on. The virus is new and is not fully known about and spreads easily, therefore, it leaves me in fear of touching surfaces. I am staying at home. I am wiping down many surfaces with Lysol wipes. I am washing my hands a lot and sanitizing them. My hopes moving forward are to get this virus pandemic over with and make sure everyone stays safe. I am really looking forward to a vaccine being created and returning back to a normal lifestyle. Going to school and going outside with my friends.

Anonymous
On the off chance that I consider sitting home beginning from this point until September, I feel exceptionally uncommon. You’re most likely asking why? Since we never felt that we should sit home this way. I was so upbeat and standing by impatiently for Summer so I can go to the beach and hang out with my friends, go to picnics, go camping, go to parks, etc. However, since we are remaining at home, I am appreciative to spend quality time with my family, learn new things, and above all to show restraint. I am happy that I am sitting home so our Mother Nature is getting some rest, simply see how clear the sky is, the means by which our ozone layer is recuperating, and how we can at long last inhale fresh air. On the off chance that we all begin from now, to settle on a choice that we battle with this disease together, we would likely get the chance to head outside, go to the beach and spend time with my friends, go to picnics, camp in my backyard, go to parks, etc.

Zainab
Hello, my name is Zainab Rana and I study in seventh grade and nobody knows it more than me and my fellow students how significant it is for us to finish seventh grade. My response to this emergency was as terrifying as some other individual and I thought of it as a major threat to the US economy. We as a whole are attempting our best to stop the pandemic for spreading. As we are experiencing this emergency, I remain clean, preventing social gatherings. I trust in us all to battle it together and return to our ordinary life. We all recognize what’s happening, yet the significant part is how we respond to it. It’s odd and weird if I am being honest. That we are at home, doing online school, but we are doing this to help. I feel upset about the fact that I can’t
play outside during the summer or actually go to school. To think that we didn’t want to go to school but when we actually can’t, you feel upset and actually miss school. In quarantine, I made a checklist of things I should be able to do when quarantine is over. Such as juggling, whistling, magic with cards, writing my own signature, and calligraphy. I hope that in the future, we will be aware of the consequences of not correctly washing your hands or social distancing and stay home if you are sick.

Anonymous
I feel scared and very upset because so many people are becoming infected. I can’t even go out any longer. People are holding onto supplies, which means that there are shortages. We must come together as a united nation, willing to help each other out.

Hamza
First, I would like to say thank you to all the nurses and doctors who risk their lives every day for the future of everyone. They are on the frontlines of the terrible war. Thank you again for trying your best to save people, not just now in a national crisis, but on a daily basis. In times like these it is crucial for the whole country and the world to unite. You guys (the lovely nurses and doctors) are the bravest soldiers going into this war with a great amount of effort, determination, perseverance, etc. which gives the people the hope that we can survive this almost unwinnable fight. This almost unwinnable fight is really destroying us. This virus (Covid-19) has made people lose all hope. Many don’t believe in the virus and are protesting. I feel embarrassed because some actually are being mean to our nurses. The Nurses/Doctors who risk their lives every day to ensure everybody has a future. I hope this virus is gone in a few months because it really did a good job being a virus. The Covid-19 has made many people be locked in their houses. Me and others really want to get some fresh air. We cannot even go outside because this virus spreads in crowds and the best way to help everyone is to Stay Home!!!
**Glossary**

**Aqueduct**  A bridge-like structure for moving water from a distance, usually by means of gravity.

**chamber pot**  A portable container used for waste.

**cholera**  An infectious disease spread through contaminated water.

**colony**  A settlement that is connected to a parent nation.

**contaminated**  Made unclean or harmful.

**dehydration**  An abnormal loss of water from the body, especially from illness.

**discriminate**  To treat someone unfairly.

**infected**  Made unclean from disease.

**influent**  Flowing in.

**night soil**  Human waste collected from outhouses and chamber pots.

**outhouse**  An outside building or pit that serves as a toilet.

**pandemic**  An outbreak of a disease that infects and spreads throughout an entire area or region or population.

**penicillin**  An antibody used in the treatment of certain diseases.

**poverty**  Having little money or means of support.

**smallpox**  A highly infectious disease that often leaves permanent scars on the body.
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