LICAP

Long Island Commission for Aquifer Protection

STATE OF THE AQUIFER

2020 UPDATE



Providing Safe Drinking Water In The Year Of COVID-19

LICAP

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Cover Photo (taken at Hicksville Water District): In the year of COVID-19, Long Island water suppliers and the agencies that oversee our sole source aquifer that together comprise the Long Island Commission for Aquifer Protection (LICAP) worked fearlessly to make sure the drinking water supply continued to be supplied to Long Island residents uninterrupted. From left are: Stan Carey, Superintendent, Massapequa Water District; Jennifer Pilewski, Professional Geologist, New York State Department of Environmental Conservation; David Ganim, District Manager, Nassau County Soil & Water Conservation District; Richard Passariello, Superintendent, Roslyn Water District; Jason Hime, Principal Public Health Engineer/Chief, Office of Water Resources, Suffolk County Department of Health Services; and Brian Schneider, Deputy Nassau County Executive.

MESSAGE FROM THE CHAIRMAN

AT THE BEGINNING OF 2020, WATER SUPPLIERS ON LONG ISLAND WERE BUSY ADDRESSING THE THREAT TO OUR SOLE SOURCE AQUIFER CAUSED BY THE EMERGING CONTAMINANTS 1,4-DIOXANE, PFOS AND PFOA, ALL OF WHICH WERE ON THE CUSP OF BEING REGULATED BY NEW YORK STATE, AND ALL OF WHICH WOULD REQUIRE SUBSTANTIAL INVESTMENTS IN NEW TREATMENT INFRASTRUCTURE.



Jeffrey W. Szabo
2020 LICAP Chairman

But in the blink of an eye, the immense challenge of taking the necessary steps to provide for the long-term safety of the drinking water supply was eclipsed by a much more sudden imperative—ensuring the safety of the essential workers who provide drinking water to nearly three million Long Islanders in the middle of the greatest health threat to strike the country in 100 years: the COVID-19 pandemic.

Though the pandemic has had no direct impact on the quality of the drinking water provided to Long Islanders, which continues to meet and surpass all state and federal regulations, it has had a profound impact on the working conditions of the dedicated employees who retrieve, test and supply the water. All over Long Island, water suppliers and the associated agencies that oversee our groundwater supply developed innovative strategies to keep their workers on the job—and the vital supply of water flowing.

This report, an update to the Long Island Commission for Aquifer Protection's original 2016 State of the Aquifer report, tells their story. The report also features a story on the groundbreaking groundwater modeling and mapping project being undertaken by the United States Geological Survey that could transform the ability of agencies to protect and preserve our aquifer system from contamination threats and overuse. Key updates to vital topics such as water pumpage, groundwater monitoring, water quality, hydrologic conditions and water conservation are also included in this report.

Collectively, all of this work aims to create a greater focus on our most precious natural resource and all that needs to be done to ensure its continued sustainability. All of us at LICAP encourage you to join us in that effort.

Jeffrey W. Szabo
2020 Chairman,
Long Island Commission for Aquifer Protection

LICAP MEMBERS

VOTING MEMBERS AND THE ORGANIZATIONS OR OFFICES THEY REPRESENT

Jeffrey Szabo
Chairman
Suffolk County Water Authority

Paul Granger
Vice-Chairman
Long Island Water Conference

Stan Carey
Nassau-Suffolk Water Commissioners Association

Walter Dawydiak
Suffolk County Commissioner of Health

Don Irwin
Nassau County Commissioner of Health

Dorian Dale
Suffolk County Executive

Brian Schneider
Nassau County Executive

Chris Ostuni
Nassau County Legislature Presiding Officer

Michael White
Suffolk County Legislature Presiding Officer

Brian Culhane
Suffolk County Soil and Water Conservation District

David Ganim
Nassau County Soil and Water Conservation District

EX OFFICIO MEMBERS AND THE OFFICES THEY REPRESENT

Honorable Tom Cilmi
Suffolk County Legislature Minority Leader

Sarah Meyland
Nassau County Legislature Minority Leader

Christina DeLisi
Suffolk County Legislature Presiding Officer

Chris Schubert
U.S. Geological Survey
Long Island Program Office

Carrie Meek Gallagher
New York State Department of
Environmental Conservation

Suffolk County Commissioner of Public Works

Suffolk County Commissioner of Parks,
Recreation and Conservation

Nassau County Commissioner of Parks

Nassau County Planning Commission

Long Island Groundwater Research Institute

SUNY Stony Brook: School of Marine
and Atmospheric Sciences

STATE OF THE AQUIFER

Perhaps the most significant news about the state of Long Island's sole source aquifer in 2020 is what is not impacting the groundwater stored there: COVID-19.

One challenge for LICAP members this year was assuring Long Island residents that their drinking water would remain safe throughout the pandemic. The federal Centers for Disease Control and Prevention and the World Health Organization made clear early on that COVID-19 is transmitted through person-to-person contact, not through water, and that airborne viruses are not a threat to groundwater. Even if COVID-19 were a waterborne virus, water suppliers add a trace amount of chlorine to the water supply to prevent the growth of pathogens.

What is impacting groundwater quality, however, are the contaminants 1,4-dioxane, PFOS and PFOA, all of which have been regulated by New York State this year, creating some of the strictest water quality standards for these chemicals in the country. Water suppliers on Long Island are now developing treatment systems to remove these contaminants from the drinking water supply, but all Long Islanders must do their part to prevent these and other dangerous contaminants from reaching groundwater in the first place.

LICAP FACTS

FOUNDED: By unanimous votes of the Suffolk County and Nassau County Legislatures in 2013. Reauthorized in 2018 and extended through 2023.

MISSION: To advance a coordinated, regional approach to the protection of Long Island's sole source aquifer through the preparation of a State of the Aquifer report, updated annually, and a Groundwater Resources Management Plan.

MEMBERS: LICAP has 11 voting members. The Suffolk County Water Authority, the Long Island Water Conference, the Nassau-Suffolk Water Commissioners Association and the Nassau and Suffolk Departments of Health are permanent members. Additionally, the Nassau County and Suffolk County Executives each appoint one member, as do the Presiding Officers of the Nassau and Suffolk Legislatures and the Nassau and Suffolk Soil and Water Conservation Districts. There are also ex officio members with no voting power.

COMMITTEE STRUCTURE: LICAP maintains four standing subcommittees: The 2040 Water Resources and Infrastructure Committee identifies long-term risks to the water supply industry created by global climate change. The Water Resource Opportunities Subcommittee identifies and quantifies short-term risks to groundwater resources. The Conservation Subcommittee develops strategies to educate Long Islanders about the importance of conserving our groundwater. The fourth subcommittee works in conjunction with the Long Island Nitrogen Action Plan (LINAP) working group.

MEETINGS: LICAP is required to meet at least quarterly and hold one public hearing in each county annually.

WORKING THROUGH THE PANDEMIC

SUPPLYING DRINKING WATER IN THE YEAR OF COVID-19

It was February of 2020, and the virus coming to be known as COVID-19 was a mere curiosity; something to be tracked, no doubt, but a distant, not immediate threat. The leaders of the Suffolk County Water Authority gathered for their monthly department head meeting to discuss notable projects underway.

"I brought up COVID-19 and we were tracking its spread across the globe and I remember saying something like 'Some of you may think this is not a serious threat to the United States and our operations at SCWA, but there is real potential for COVID to disrupt our lives and how we operate'," said SCWA Chief Executive Officer Jeffrey W. Szabo. "[Chief Engineer] Tim Kilcommons turned to me and said 'No, it's real, and it's smart to discuss even at this early stage.' Having senior leaders at SCWA believe that it was important for us to share information about COVID in February really hit home as to the overall serious nature of the spread."

What came next still boggles the mind, and, as of this writing in mid-December, it's nowhere near over yet, and the worst, the experts say, has yet to come. Hundreds of thousands of deaths in the United States alone, and a daily new case count regularly topping 200,000. Locally, the second wave experts said would come is in full bloom and bringing new case numbers akin to numbers in mid-March, when the pandemic hit with full force.

There is, of course, a monumental difference between the first and second waves—we are now all walking, talking health and safety protocol models. It has become second nature to stay six feet away from others, to wear a mask whenever near anyone. To wash our hands all the time, and disinfect surfaces. To socialize and meet via computer.

But in March, with the threat just as high as it is in December, it was nothing like this. No one had ever been through anything comparable. Everyone had to learn quickly to adapt and, quite literally, survive.

And all the while, the water had to keep flowing. While others were directed to lockdown in their homes, the essential workers of drinking water suppliers and the associated agencies that oversee the sole source aquifer that provides all drinking water for Long Islanders had to make sure this vital service remained intact.



From left, Nassau County Executive Laura Curran and Plainview Water District Commissioners Andy Bader and Amanda Field at a ceremony honoring first responders and emergency workers.



SCWA Construction/Maintenance crews, masked and socially distanced, worked all throughout the pandemic to keep water flowing to 1.2 million Suffolk residents.



Plainview Water District Water Servicers John Curro (Left) and Frank Caraturo (right) preparing a tapping machine as part of a new water service installation.

Doing so meant that superintendents and CEOs needed to develop creative protocols to keep workers safe, and they did. The Oyster Bay Water District, for instance, on March 17 assigned all employees take-home vehicles, curtailed in-person gatherings and had employees sign in remotely to ensure proper social distancing. Office space was cleaned and disinfected regularly and offices were closed to in-person customer visits. All employees were supplied with face masks and supplies of hand sanitizer, board meetings were held remotely and protocols were developed for entry into customer homes.

Water suppliers emphasized that the COVID-19 virus—which is an airborne, not waterborne, virus—did not impact water quality on Long Island...

That aspect—entry into customer homes—was one of the trickiest challenges to navigate, according to Massapequa Water District Superintendent Stan Carey, who noted that the vital work of conducting cross connection control inspections to prevent the backflow of any contaminants into a customer's drinking water supply was made very difficult by the pandemic, with customers reticent to allow entry into their homes and the New York State Department of Health nonetheless offering little flexibility on annual testing requirements.

Water suppliers emphasized, though, that the COVID-19 virus—which is an airborne, not waterborne, virus—did not impact water quality on Long Island, a point that was made emphatically by Plainview Water District Commissioner Amanda Field.

"First and foremost, it bears repeating: As we stated at the start of the pandemic and which holds true now, the public water source is and will continue to be unaffected by the COVID-19 pandemic," Field said. "The impacts of this virus are far-reaching and scary, but residents can take some comfort in the reliability of their drinking water."

Plainview temporarily halted non-emergency non-emergency residential services early on in the pandemic to help curtail the spread of the virus. Automated bill payments become the norm, and the district operated fully in accordance with protocol recommendations from the Centers for Disease Control and Prevention.

Plainview Water District, though, also participated in a special (socially distanced) ceremony to create a lasting tribute to the community's first responders, hospital staff and frontline healthcare workers by renaming a stretch of Old Country Road "Heroes Way." Essential workers taking place in a tribute to other essential workers.

And it wasn't just water suppliers making on-the-fly adjustments. Suffolk County Department of Health Services (SCDHS) drinking water staff were deemed to be essential employees, working throughout the pandemic to help keep our water safe. SCDHS very quickly facilitated staff to work from home on an A/B schedule (50% office density) and provided remote access to computers and files through virtual private network (VPN) capability. Essential staff overseeing the drinking water supply in Suffolk County had previously been provided with county cell phones and communication with public water suppliers was maintained throughout the pandemic.

Staff helped provide guidance regarding regulatory compliance, helped get answers to COVID-19-related questions, and coordinated with the county's Office of Emergency Management to ensure public water suppliers received hard-to-get personal protection supplies (e.g. hand sanitizer, gloves, masks). Many SCDHS staff volunteered to assist with supplemental contact tracing, interviewing COVID-positive patients and delivering supplies. Staff responded to complaints and problem issues (e.g., emergency private well concerns), and quickly resumed full sampling of source water and distribution systems.

At SCWA, meanwhile, office space that had been unused for years was renovated and repurposed for employees in an effort to spread out staff as much as possible, and shifts were staggered and many employees worked from home for the same purpose. Hand sanitizer dispensers and new plexiglass partitions popped up everywhere. SCWA employees even created their own disinfectant product out of on-hand chlorine supplies—Bompson's Superclean, combining the last names of the product's creators, Emergency Managers Rich Bova and Phil Thompson—when disinfectant couldn't be found.

Employees were also constantly distributed information about new protocols, as well as information about employees impacted by the virus. At the time of this writing, a peak of 12 SCWA employees were out due to either a positive test result or were presumed positive, and another 33 were out in precautionary quarantine.

And yet, never once, did a lack of staff prevent water suppliers from fulfilling their vital mission—providing drinking water that meets or surpasses all drinking water regulations to approximately three million Long Island residents.

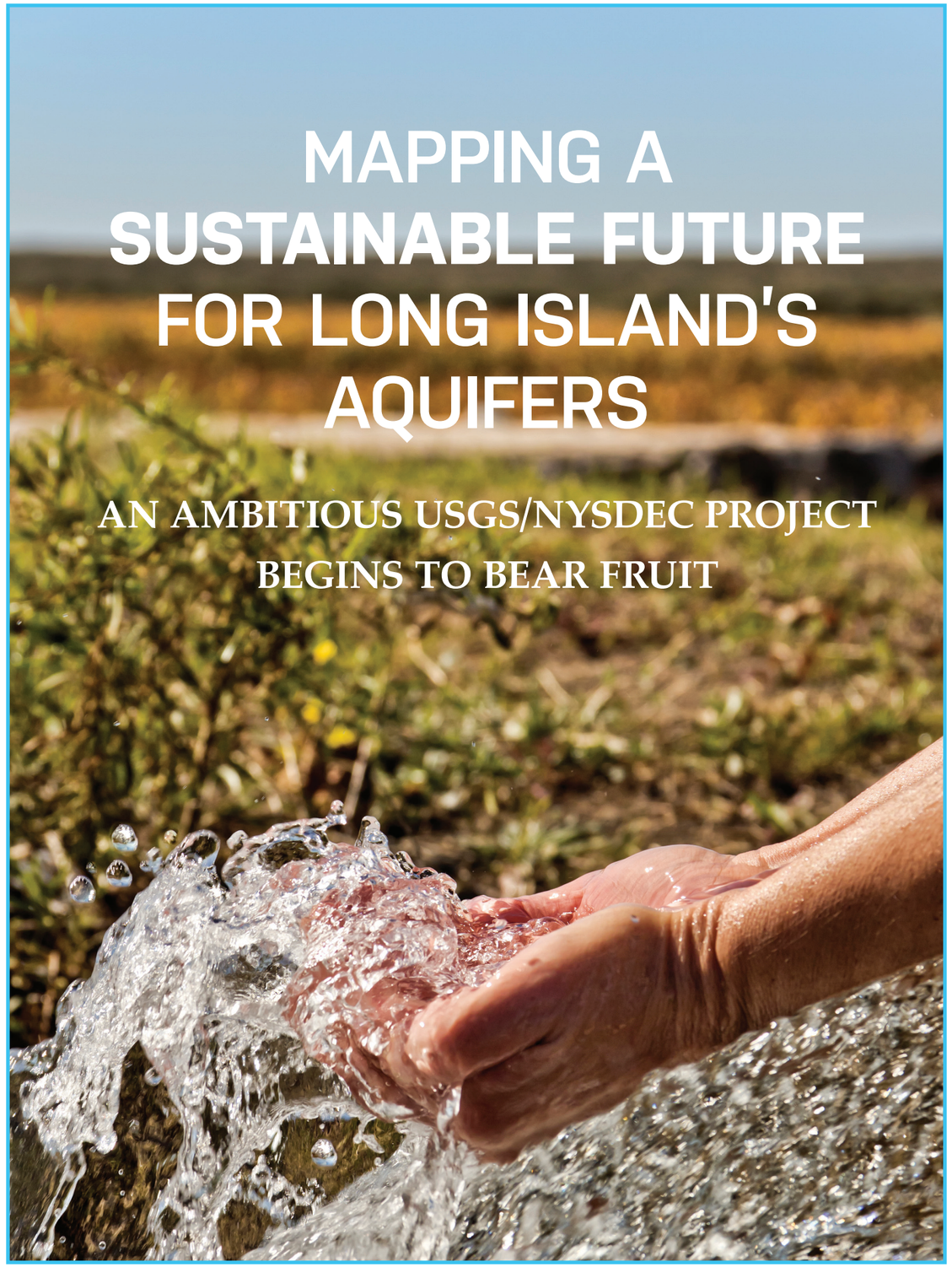
"I'm very proud of our team at Hicksville Water and all water suppliers across our great nation during this pandemic," said Hicksville Water District Superintendent Paul Granger. "Always know that our essential workers have the backs of our first responders and frontline workers by keeping safe drinking water flowing 24/7. Teamwork will get us through the COVID-19 pandemic."



Hicksville Water District employees on the job, masked and socially distanced.

MAPPING A SUSTAINABLE FUTURE FOR LONG ISLAND'S AQUIFERS

AN AMBITIOUS USGS/NYSDEC PROJECT BEGINS TO BEAR FRUIT



A comprehensive, multi-pronged study led by the United States Geological Study (USGS) and New York State Department of Environmental Conservation (NYSDEC) that will provide a blueprint for many aspects of the future management of Long Island's groundwater resources is beginning to bear fruit, with reports on the first aspects of the study recently published.

The effort, known collectively as the Long Island Groundwater Sustainability Study, aims to evaluate the sustainability of Long Island's groundwater resources, first by conducting a multi-million dollar drilling program to improve the understanding of the hydrogeology and mapping the current location of inland saltwater intrusion in the aquifers. Next, the USGS is using this improved understanding of the hydrogeologic conditions to develop a state-of-the-art groundwater-flow model for Long Island's sole source aquifer system.

The study, according to the project coordinator, USGS hydrologist John Masterson, emerged initially from concerns of some Nassau County residents about reports that the New York City Department of Environmental Protection, as part of their "In-City Water Supply Resiliency Plan," was looking at the potential reactivation of long dormant supply wells formerly operated by the Jamaica Water Supply Company in southeastern Queens, a proposed plan that would have allowed for the pumping of approximately 62 million gallons of water per day on a short-term, emergency basis. Prompting from nearby Nassau County residents led the NYSDEC to conduct a study on the potential impact of this level of pumping prior to permitting this emergency use plan, and that analysis led Governor Cuomo to the concept of conducting a groundwater sustainability study for all of Long Island.

"It could've just been a study for western Long Island, but it was expanded out to include the entire island," Masterson said. "Now, we're looking at potential impacts of climate change, such as sea-level rise and extreme drought conditions and the potential effects of future buildout plans on



water resources, thus providing a comprehensive groundwater assessment for all of Long Island."

The role of USGS and NYSDEC, according to Masterson, is to provide whatever analysis a steering committee assembled to guide the study would like to see conducted to game plan a wide variety of potential future water usage scenarios.

"We're providing the science, but the steering committee, in partnership with the NYSDEC, is coming up with scenarios they'd like us to run,"

Masterson said. "So, they may say 'we'd like to see what the effects of sewering all of Suffolk County would be.' We'd then use our flow model to look to see how such a scenario could impact streamflows—for instance, if you do this then flow in the Connetquot River could be reduced by X." These 'what if' scenarios are critical for making informed decisions for long-term water resources planning.

Don Walter, another USGS hydrologist and lead groundwater modeler in the study, said Long Island is ideal for studying the impacts on groundwater resources because it is a place where a wide variety of factors—such as its designation as a sole source aquifer system for about three million people, threats of saltwater intrusion, sea level rise, the enormous volume of water pumped out of the aquifer system every day and the contamination threats from various land uses—make it a fertile ground for a hydrologic study.

Though he called the Long Island aquifer system one of the most studied hydrologic systems anywhere, the place where the development of modern day groundwater-flow modeling essentially started, Masterson said that the USGS hadn't developed a full model for Long Island since the 1980s, making the current endeavor that much more significant. And since the time in which the last study was conducted, many new scientific advances and computer resources have become available to hydrologists, allowing USGS and the NYSDEC to take the current study to the next level.

The first reports to emerge from the study were being prepared for release just as this story was going to print. They include:



A USGS employee works in the field.

MAPPING A SUSTAINABLE FUTURE FOR LONG ISLAND'S AQUIFERS

1. **Mapping of the current extent of onshore saltwater intrusion in western Long Island:** https://pubs.usgs.gov/of/2020/1093/ofr20201093.pdf
2. **Characterization of the hydrogeologic characteristics of the Upper Glacial and Magothy aquifers:** https://pubs.er.usgs.gov/publication/sir20205023
3. **Analyses of aquifer properties of western Long Island:** https://pubs.er.usgs.gov/publication/ofr20201108
4. **Development of groundwater-flow model:** https://pubs.er.usgs.gov/publication/sir20205091

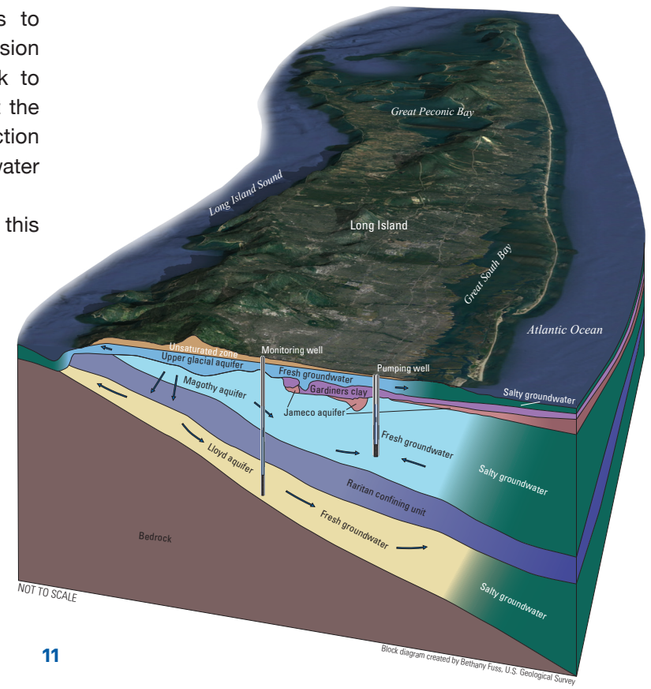
These interim reports synthesize the hydrogeologic data and information available since the last comprehensive USGS study was conducted in the 1980s. These building blocks will be used for the development of the final groundwater-flow model needed to complete this groundwater-sustainability study.

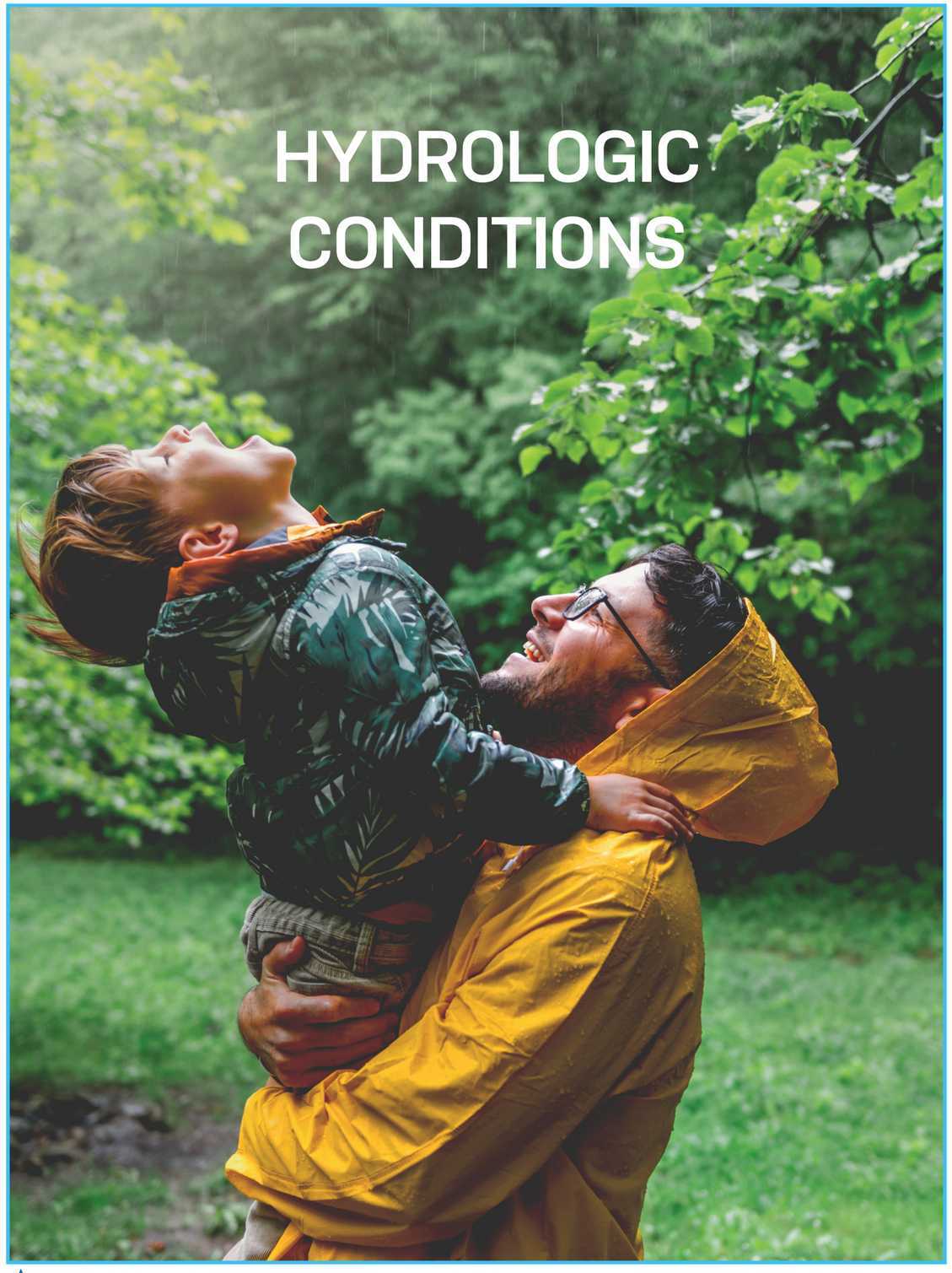
Over the next one to two years, the USGS will continue to drill deep monitoring wells to map the location of inland saltwater intrusion and to update the hydrogeologic framework to improve the groundwater model and conduct the analyses needed for the ultimate goal of protection and preservation of Long Island's groundwater resources.

All the data and findings associated with this study will be available to the public.

"The goal ultimately is to provide information that anyone can access from the project website," Walter said. "That is in keeping with the mission of the USGS."

The Long Island aquifer system is one of the most studied hydrologic systems anywhere, the place where the development of modern day groundwater-flow modeling essentially started.





HYDROLOGIC CONDITIONS

This year's hydrologic update focuses on the past three years. Precipitation is the only means by which water enters Long Island's aquifers. Approximately half of all precipitation recharges the aquifers, roughly one million gallons of water per day for each square mile of land. Recharge occurs during the non-growing season (October to May). From June through September, aquifer recharge is minimal. As has been noted in recent editions of this report, precipitation had been below normal for much of the previous 10 years, leading to a significant cumulative deficit, but this changed beginning in late 2017. For the next two years, precipitation was significantly above normal, bringing both groundwater levels and streamflows back to normal or above normal, before dipping back below normal this past year.

PRECIPITATION IN RECENT YEARS

Normal, or long-term average precipitation for a given site, is calculated based on weather statistics from the previous three decades. This data is then updated at the beginning of each new decade. For example, normal precipitation levels for the current decade (2011 to 2020) are the average values from 1981 to 2010. In 2021, these normal levels will be updated using averages from the period 1991 to 2020. In this manner, changing climatic patterns are accounted for, but do not skew the data excessively for any given decadal period.

The current value for normal annual precipitation for Long Island MacArthur Airport is approximately 46 inches. For this SOTA update, rather than utilizing calendar years as was done previously, precipitation records from MacArthur Airport were examined in one-year increments for the period of September 1, 2017 to August 31, 2020. Data for the MacArthur Airport precipitation gauge was downloaded from the National Oceanographic and Atmospheric Association (NOAA) website: www.ncdc.noaa.gov.

As expected, precipitation was above normal between September 1, 2017 and August 31, 2018, when MacArthur's precipitation totaled 53.5 inches, and between September 1, 2018 and August 31, 2019, when MacArthur's precipitation totaled 58.14 inches. For the period of September 1, 2019 to August 31, 2020, MacArthur's precipitation totaled 41.87 inches. Groundwater levels and streamflows reflect the recent higher-than-normal precipitation trends in the first two years, and the below normal trend this past year, as shown in the diagrams in the ensuing pages.

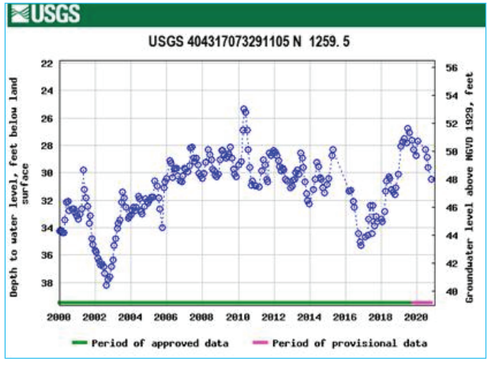
Background information pertaining to specific wells and streamflow gauges represented in this section can be obtained from the USGS report entitled "Statistical Analysis of Long-Term Hydrologic Records for Selection of Drought-Monitoring Sites on Long Island, New York," accessible at the following web address: https://pubs.usgs.gov/sir/2004/5152/sir20045152.

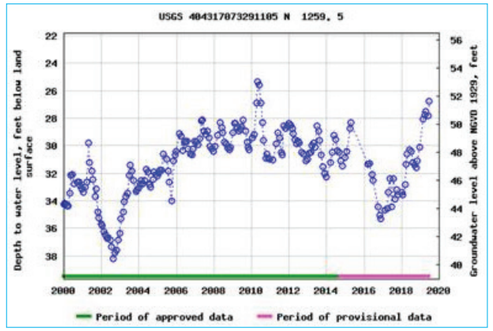
GROUNDWATER LEVELS

It was noted in the 2018 update that aquifer levels on Long Island have fluctuated historically due to human influences such as pumping and sewering and fluctuate seasonally due to precipitation, recharge and evapotranspiration. Regardless of these stresses, groundwater levels beneath most of Long Island are usually highest in March, April and May and lowest in September, October and November. The following is an update of some of the well data originally presented in the 2018 update, with the focus being on the period from 2000 to the present.

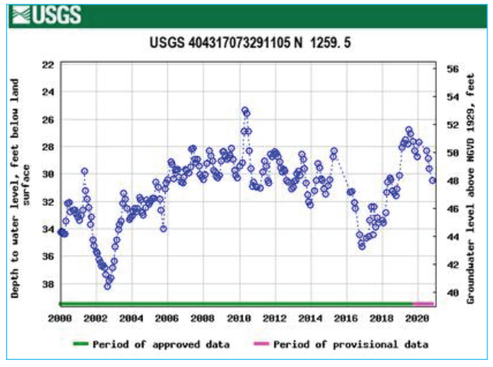
The hydrograph below shows that water levels in the upper glacial aquifer in this portion of Nassau County recovered from their recent lows in mid-2017, and have begun a slight decline from their recent highs.

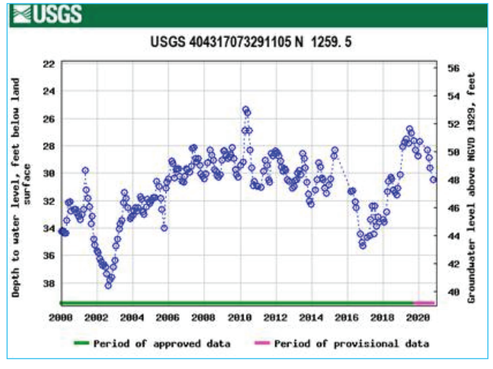
N 1259.5. This well is located in eastern Nassau and is 41 feet deep.





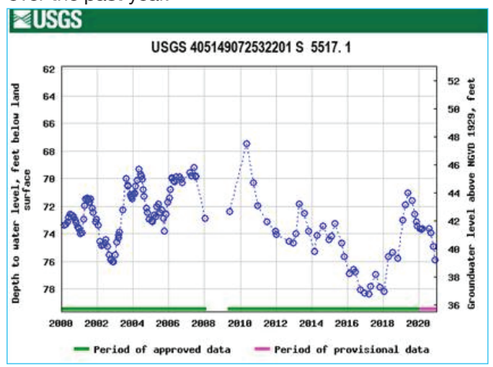
The lowest water level ever recorded in the below well was +59.12 feet mean sea level (MSL) in early 1967, just after Long island's historic drought period of the mid 1960s. The most recent low was approximately +63 feet MSL in early 2018. While recovery has been significant from that 2018 low, its water level is still below historic average.

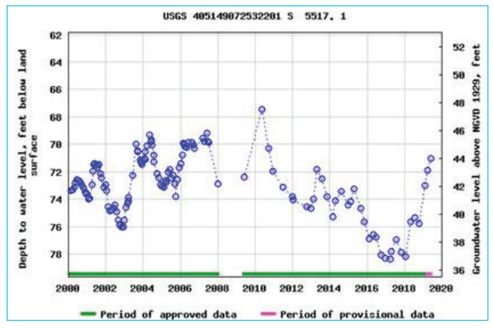




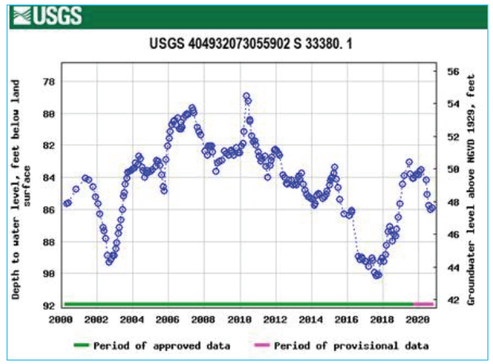
N 2528.2. This Magothy aquifer monitor well is 328 feet deep.
S 5517.1. This 91-foot deep upper glacial aquifer monitor well is located near Brookhaven National Laboratory.

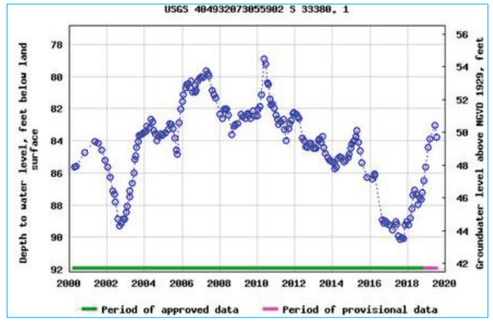
As the hydrograph shows, the 2017 to early 2018 period saw extremely low water levels in the upper glacial aquifer in this portion of east-central Suffolk County. The hydrograph also shows that water levels recovered approximately seven feet from those lows by late 2019, but have since begun another sharp decline over the past year.





S 33380.1. This well is located in Ronkonkoma in central Suffolk County. It is 855 feet deep and monitors water levels in the deepest portions of the Magothy aquifer.





Water levels in this well recovered by more than six feet from their most recent low in late 2017 to near long-term average conditions by the end of 2019. Since then water-levels have begun another sharp decline.

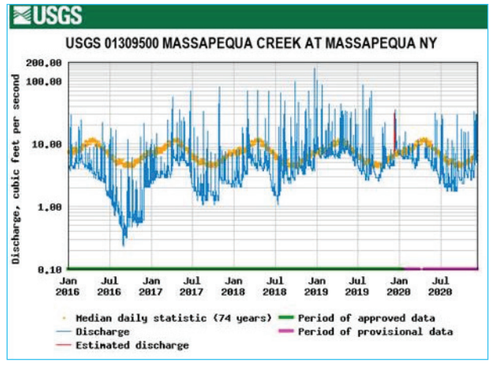
STREAMFLOWS

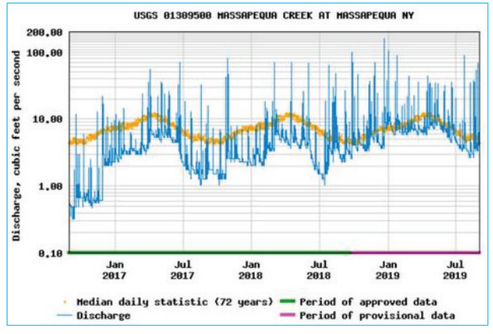
Since all of Long Island's streams are in direct hydraulic contact with the upper glacial aquifer, their flows closely reflect changes in the water table altitude. The 2018 SOTA update showed hydrographs from six Long Island streams, reflective of different conditions of development or urbanization within their watersheds, which impact both water levels and streamflows. This update focuses on three of these waterways: Massapequa Creek (highly developed), Peconic River (minimally developed), and Connetquot River (an intermediate level of watershed development).

As with groundwater levels, streamflows fluctuate throughout the year, from their highs in the spring to their lows in late summer. For each of the hydrographs below, the orange line represents the historical average flow and the blue line represents the actual measured discharge. For this year's update, the focus is on more recent (2016 to 2020) data, to better represent recent precipitation trends.

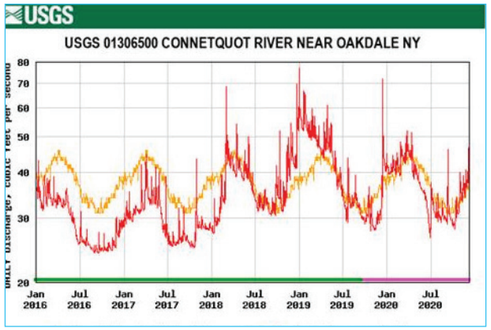
Massapequa Creek. The flow of all Nassau County streams reflects the significant human impacts of sewering and pumping on water levels within the upper glacial aquifer. Discharges have decreased markedly since the 1960s and have not recovered due to these impacts.

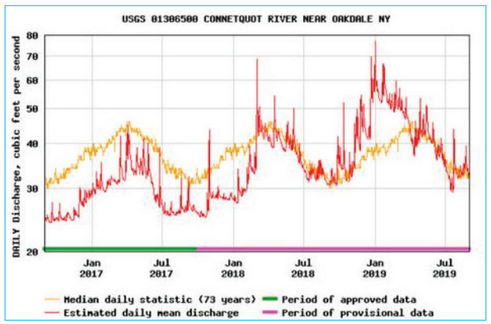
The discharge of Massapequa Creek since 2016 reflects the larger precipitation trends. Discharges were largely below historical averages until late 2018. Since that time, streamflows recovered to near long-term average, but have declined to below average again over the past year.



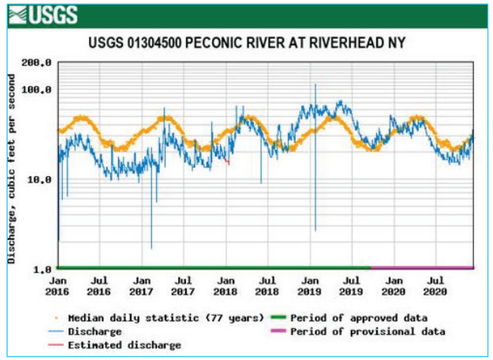


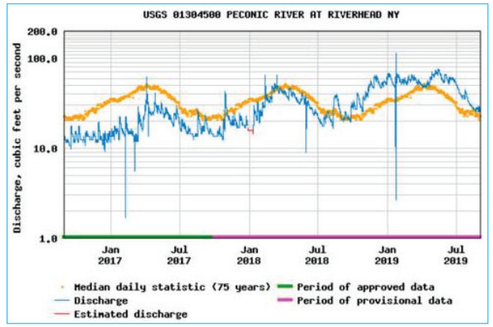
Connetquot River. This stream borders areas showing significant human impacts (to its west) and minimal human impacts (to its east). Streamflow had been below normal for more than two years from 2015 to early 2018. Since 2018, discharge has been largely near or above long-term average values. In early 2019, discharge was significantly above average, but has subsided since then to approximately average values.





Peconic River. Flow for this stream in eastern Suffolk reflects a largely undeveloped watershed. Flows were well below normal for more than two years, finally recovering to near normal by early 2018. Flows were significantly above normal from late 2018 to mid-2019, but have since returned to below normal levels.

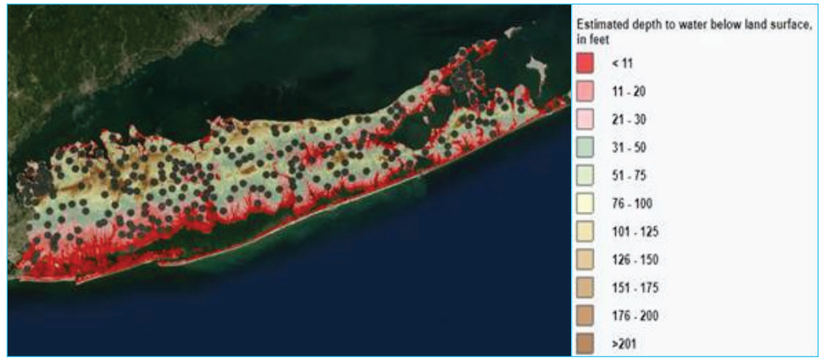




The data displayed in the graphs in this section show that Long island has experienced the full spectrum of hydrologic conditions in a very short time frame, from record or near-record lows as recently as 2017 to generally-above to well-above normal conditions in 2019. The abundance of groundwater and surface water data collected by the United States Geological Survey and other agencies over a long period of time ensures that water suppliers, regulatory agencies and the public are well informed about groundwater and surface water conditions at any given time. This data is an invaluable aid in making decisions to protect both public health and the health of the environment.

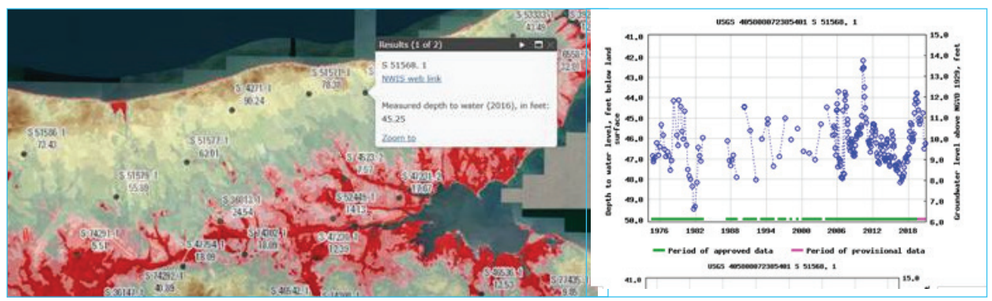
HOW CAN I FIND OUT MORE INFORMATION ON LONG ISLAND'S HYDROLOGIC CONDITIONS?

The USGS maintains a depth-to-water map for Nassau and Suffolk Counties. The map is shown below, with the color coded intervals to its right. Each color represents a depth below land surface interval, below which groundwater will be encountered. Also shown below (as black dots) are the locations of USGS monitoring wells that were utilized in creating the map.



The map is fully interactive and available at the following web address: https://ny.water.usgs.gov/maps/li-dtw/. To use it, click on a monitoring well to get a measured depth to water, or click elsewhere on the map to get an estimated depth to water. The map allows the user to zoom in to a particular area for greater detail.

Below is an example of a close up of the depth to water in eastern Suffolk County. When the user clicks on a particular monitoring well (in this case well number S-15568.1), its information is displayed, including a link to its historical water level record. Clicking on the "NWIS web link" will display the hydrograph shown to the right of the figure. The user can then specify a particular time period for which data is desired and see a graph of water levels within that time period.



By utilizing this and other publicly-available websites and web tools, anyone can obtain instant information on hydrologic conditions anywhere in Nassau and Suffolk Counties and compare current data with past trends.

GROUNDWATER PUMPAGE

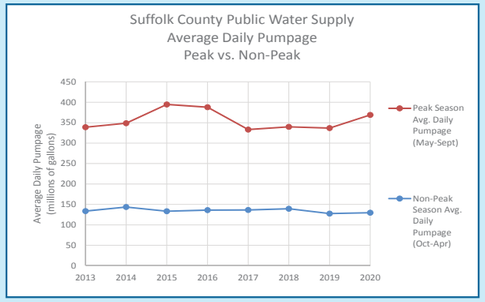
Groundwater pumpage statistics, which are vital in providing a window into the demands put on our sole source aquifer, are maintained by the New York State Department of Environmental Conservation (NYSDEC). All public water suppliers and other large users of groundwater—such as golf courses, commercial establishments and most farms—are required to submit pumpage records to the NYSDEC on a monthly or annual basis.

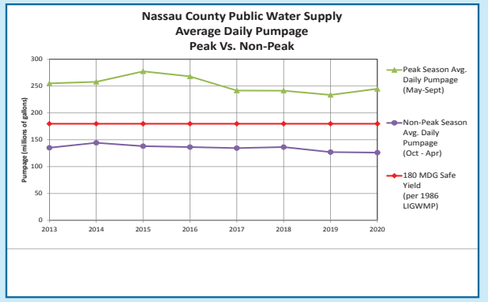
PUBLIC SUPPLY PUMPAGE

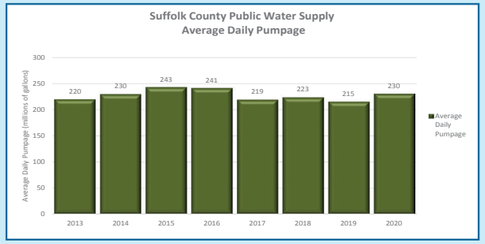
Groundwater used for public supply purposes is the largest use on Long Island. The below chart and graphs track public supply pumping records in Nassau and Suffolk Counties for the past eight years in various ways, including average daily usage; peak vs. non-peak usage; average daily pumpage vs. precipitation levels; and peak usage vs. precipitation levels. For each calendar year referenced, the period captured begins on October 1 of the prior year and continues through September 30.

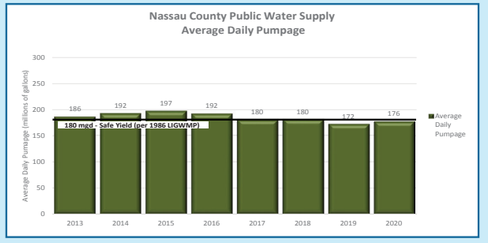
Year	Suffolk Non-Peak Avg. Daily Pumpage Oct.-April	Suffolk Peak Avg. Daily Pumpage (mgd) May-Sept.	Suffolk Avg. Daily Pumpage (mgd) All Months
2013	133.62	339.03	219.72
2014	143.56	348.74	229.57
2015	133.52	348.74	243.00
2016	135.97	394.70	241.33
2017	136.30	388.01	218.88
2018	139.46	333.29	223.45
2019	127.67	336.73	215.31
2020	129.83	368.96	230.42

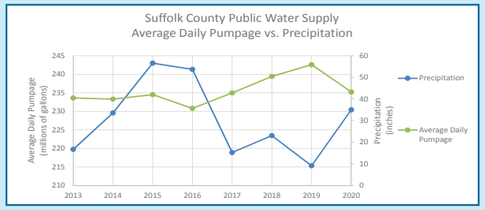
Year	Nassau Non-Peak Avg. Daily Pumpage Oct.-April	Nassau Peak Avg. Daily Pumpage (mgd) May-Sept.	Nassau Avg. Daily Pumpage (mgd) All Months
2013	135.22	255.18	185.50
2014	144.49	258.10	192.12
2015	138.26	277.61	196.67
2016	136.46	268.21	191.54
2017	134.69	241.21	179.63
2018	136.46	241.89	180.48
2019	127.09	233.66	171.77
2020	126.26	245.11	176.43
Avg.	134.87	252.65	184.27

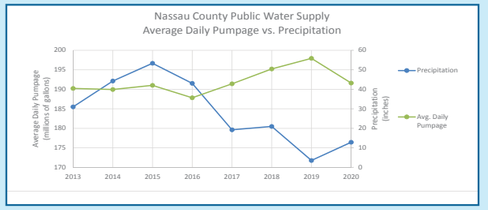


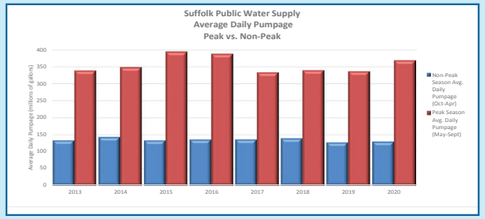


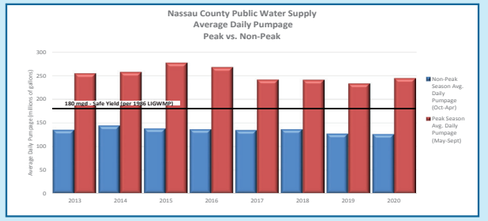














Below are updates to important groundwater quality initiatives tracked by LICAP.

PFAS 1,4-DIOXANE THREATS IN PUBLIC AND PRIVATE WATER SUPPLY IN SUFFOLK COUNTY

Per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane continue to threaten public and private water supply wells in Suffolk County. The Suffolk County Department of Health Services (SCDHS) developed the in-house analytical capability to analyze drinking water and groundwater samples for 1,4-dioxane in 2015. Further, SCDHS has worked collaboratively with the NYSDOH, NYSDEC and others to conduct sampling of public and private water supply wells in Suffolk County for PFAS. Since 2016, the SCDHS has conducted 32 private well surveys and collected more than 1,000 private well samples for these chemicals, and about 180 private wells exceeded current New York State drinking water standards for PFOA and or PFOS and about 7 private wells exceeded for 1,4-dioxane. As a result, public water has been extended to hundreds of homes in the areas of Yaphank, Westhampton, and East Hampton, with additional connections in Suffolk County likely. Analytical results generated from this sampling by the county have further benefitted the public water supply by helping identify impacted wells and prioritizing mitigating measures such as removing wells from service, treatment and blending.

The task reports completed as part of LICAP's Groundwater Resources Management Plan projected the costs to connect 24,677 Suffolk County private residential wells to public water at ~$773.5 million including new water main, service connections, wells and storage. SCDHS estimates a slightly higher total of approximately 30,000 to 35,000 facilities utilizing on-site domestic well systems if commercial and industrial potable use wells are included with the residential private well estimate above. With the continual threat of groundwater contamination, it remains a priority to identify funding sources to help extend and connect vulnerable private wells to the regulated public water supply in Suffolk County.

NEW YORK STATE DRINKING WATER QUALITY COUNCIL OVERVIEW

The New York State Drinking Water Quality Council (DWQC) was established in 2017 under New York State Public Health Law §1113 to identify strategies to address emerging threats to water quality. This action was undertaken in response to the emerging compounds detected as part of the 2013 U.S. Environmental Protection Agency's Unregulated Contaminant Monitoring Rule 3 (UCMR3) program. Sampling was conducted by large water supply systems from 2013 through 2016. Perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS) and 1,4-dioxane were the primary compounds detected throughout New York State during the UCMR 3 sampling program. 1,4-dioxane was the predominate compound detected on Long Island. Under the law the DWQC was charged with reviewing the science concerning PFOA, PFOS, and 1,4-dioxane and providing guidance to the NYSDOH on setting maximum contaminant levels (MCLs) for these contaminants. The DWQC is also required to make recommendations to the NYSDOH on the following actions:

- Appropriate timeframes and frequencies for testing emerging contaminants;
- Best practices for public notifications in the event an emerging contaminant is found above a notification level in drinking water;
- Whether and when to remove contaminants from an emerging contaminants list.

The DWQC consists of 12 members and is chaired by the New York State health commissioner and state environmental conservation commissioner. Six other individuals were appointed by the governor for their expertise in water operations, risk assessment, microbiology and environmental engineering. The DWQC's final four members were appointed by the governor at the recommendation of the temporary president of the Senate and the speaker of the Assembly. These members include water operations representatives and representatives of the public who have a background or expertise in toxicology or health risk assessment.

The first meeting of the DWQC was held on October 10, 2017 at Stony Brook University. In December 2018, the DWQC submitted its formal MCL recommendations to the NYSDOH to regulate 1,4-dioxane at 1 part per billion (ppb) and PFOS and PFOA at 10 parts per trillion (ppt). The DWQC met at total of six times through February 2020. Action to promulgate the new MCLs were delayed due to the COVID pandemic. The following provides a timeline of the promulgation of the new MCLs since the December 18, 2018 recommendations:

- July 24, 2019 - NYSDOH publishes draft regulations in the state register for public comments;
- July 30, 2020—New York State Public Health and Health Planning Council approves new regulations for 1,4-dioxane, PFOS and PFOA;
- August 26, 2020—Publication of the regulation in the state register;



Northrop Grumman has installed more than 4,000 linear feet of underground piping that will convey contaminated water removed from the aquifer by three existing pumping wells to a nearby treatment plant.

- Perform initial sampling within 60 days of publication in the state register (by October 25, 2020);
- Submit deferment application (issued system-wide) within 90 Days of publication in the state register (by November 25, 2020);
- MCLs go into effect November 25, 2020.

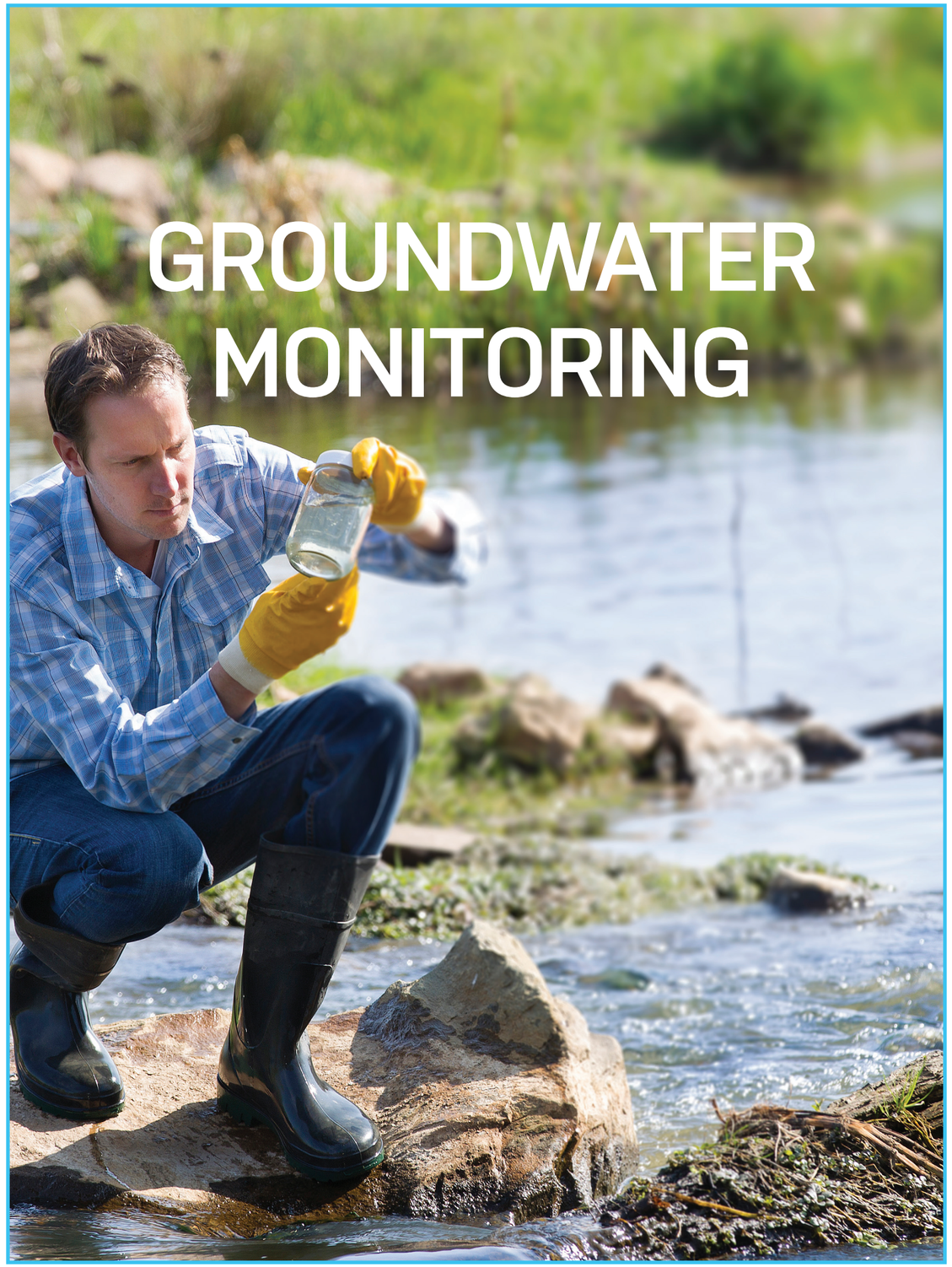
The DWQC continues to meet to assess other potential actions. Compounds under the DWQC's review include 1,2–trichlorpropane, other preflourinated compounds and perchlorate.

NAVY/GRUMMAN GROUNDWATER PLUME REMEDIATION PLAN FINALIZED

In December 2019, the NYSDEC selected the final plan to not only hydraulically contain but to expedite cleanup of the Navy/Grumman groundwater plume. This plan is outlined in an Amended Record of Decision (AROD) that can be found on the NYSDEC project-specific website (https://www.dec.ny.gov/chemical/35727.html). The selected remedy includes the extraction of contaminated groundwater at a rate of approximately 17 million gallons per day from 24 pumping wells. Following removal, the contaminated groundwater will be treated at one of five possible treatment plants before being beneficially re-used as aquifer recharge or streamflow augmentation.

In response to a letter issued by the NYSDEC to both the U.S. Navy and Northrop Grumman for implementation of the selected remedy, the NYSDEC has continued to engage the U.S. Navy and Northrop Grumman to advance the necessary work to hydraulically contain and expedite cleanup of the plume. The parties are currently negotiating the technical designs and required legal agreements that will guide the construction of the needed extraction wells and associated infrastructure.

While these negotiations have been underway, both the Navy and Northrop Grumman have made significant progress on existing commitments to address the Navy/Grumman groundwater plume. Specifically, Northrop Grumman has installed more than 4,000 linear feet of underground piping that will convey contaminated water removed from the aquifer by three existing pumping wells to a nearby treatment plant. Additionally, the Navy recently secured access to properties in three key areas to support the installation and operation of two separate groundwater extraction and treatment systems. The NYSDEC also continues to partner with the United States Geological Survey on a groundwater flow modeling program to optimize the remedial design for hydraulically containing the Navy/Grumman groundwater plume.



GROUNDWATER MONITORING

Long Island's governmental agencies have monitored the quality and quantity of Long Island's groundwater for almost a century by utilizing networks of shallow and deep monitoring wells to periodically assess water levels and water quality parameters.

This year's State of the Aquifer update features a prominent look at the joint sustainability study currently being undertaken by the USGS and the NYSDEC elsewhere in the report, but below are updates on other groundwater monitoring projects on Long Island.

PFAS Groundwater Monitoring Investigations in Suffolk County

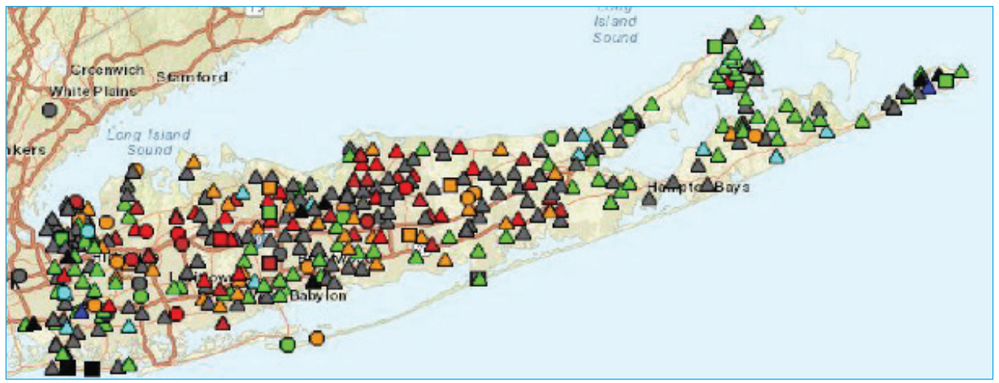
As part of SCDHS's strategy to monitor and help manage emerging contaminants, Suffolk County initiated 12 groundwater investigations. As part of this work, more than 175 monitoring and profile wells were installed and more than 850 PFAS samples have been collected. From the analytical data received thus far, more than 40 wells had detections above the USEPA health advisory level of 70 parts per trillion (ppt) for PFOS and PFOA and a total of more than 85 wells exceeded the recent New York State drinking water standards for PFOS or PFOA of 10 ppt, respectively. The county's well drilling and sampling efforts have resulted in a number of sites being included or evaluated under New York State's Superfund cleanup program.

Groundwater Monitoring in Nassau County

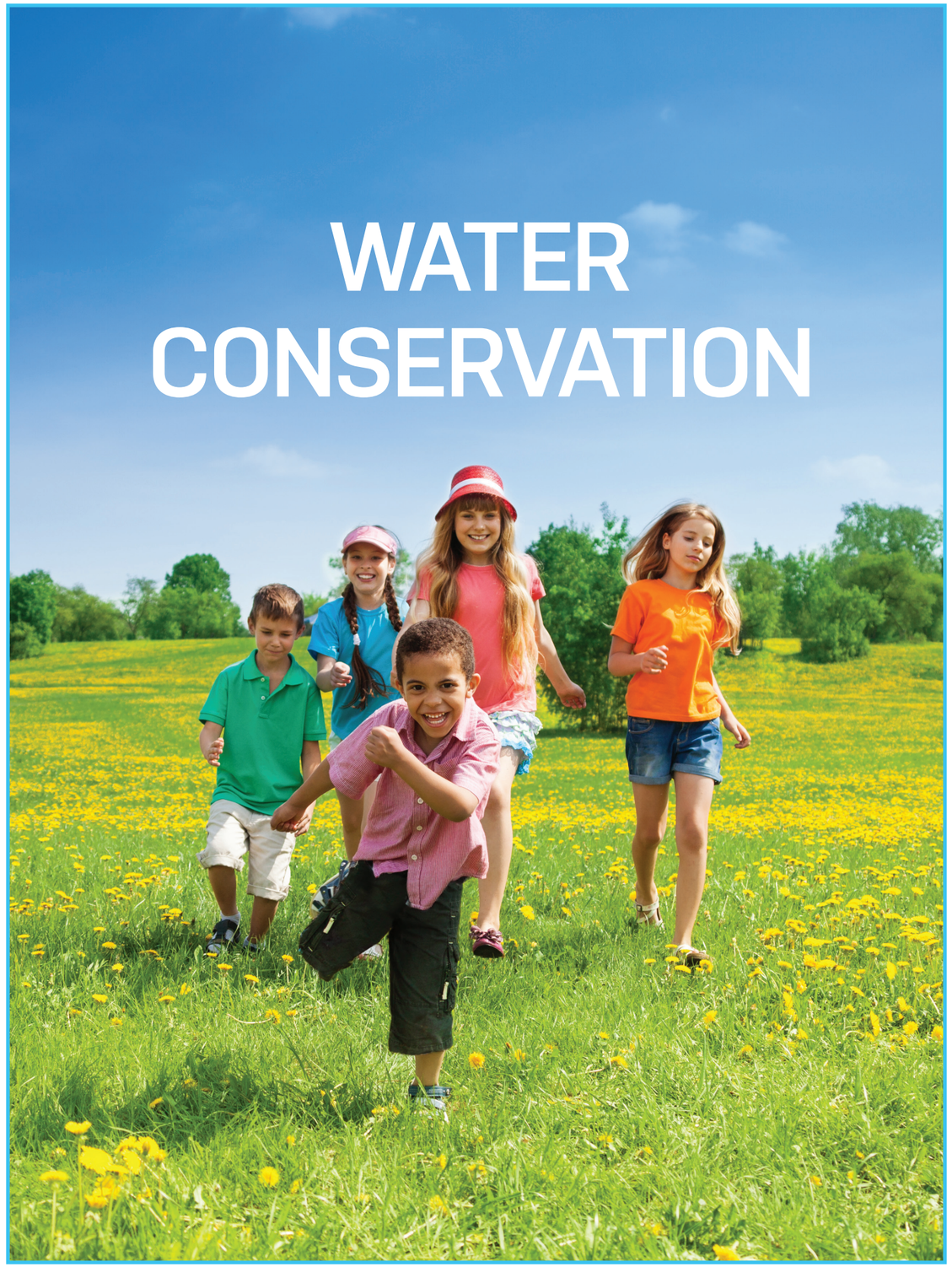
Nassau County's monitoring well network of more than 600 wells was created in the 1940s and has helped the county build an extensive water quality database. The Nassau County Department of Public Works, which maintains the network, in 2019 entered into a cooperative agreement with USGS to measure 15 continuous-recording observation wells, 50 monthly observation wells, 68 annual-synoptic observation wells and 15 water supply wells. There will also be six real-time continuous-recording streamflow stations at five streams, 12 bi-annual streamflow stations, annual determination of start-of-flow positions at six streams and saltwater intrusion monitoring at up to five saltwater outpost wells. Hydrologic data collected by this network is used to monitor the long-term conditions of the aquifer system.

Groundwater Monitoring by the USGS

In addition to the sustainability study featured previously in this report, the USGS has operated a groundwater monitoring network on Long Island since the early 20th century. This network provides water level information that aids in the production of groundwater elevation maps for Long Island's aquifers and also valuable water quality information, such as monitoring for both current and legacy pesticides, pesticide degradates and nitrogen and phosphorus compounds.



Wells within the Long Island Active Groundwater Level Network



Urging Long Islanders to conserve and protect Long Island's precious groundwater supply is one of the primary functions of LICAP. Though LICAP's efforts are primarily geared toward the Our Water Our Lives public education and water conservation campaign, we like to also note each year the efforts being made to further conservation goals by individual water suppliers from both counties. Below are of the steps water suppliers are taking to educate their customers about the importance of conservation.

Dix Hills Water District

The Dix Hills Water District recently updated its Water Conservation Plan to reduce the overall pumpage of water from the Long Island aquifer system. Starting in early spring, the water use patterns for the Dix Hills community changes significantly. And once we reach the hot and dry days of the summer, we hit record water use. On a typical winter day, the Dix Hills Water District pumps an average of two million gallons per day. That is about 50 gallons per day per person, typical for most communities across the United States.

However, on a hot summer day, the district sees a 900% increase in water use compared to the typical winter day. All this extra water use can be directly attributed to lawn irrigation systems. On a hot summer day the total water demand can go as high as 18 million gallons per day! That calculates to more than 440 gallons per day per person and 1,440 gallons per day per home.

So why are we concerned about this peak water use? One reason is to make sure the district has enough water pumping capacity to meet the water use demands and have sufficient water remaining for fire protection. In addition, we don't have a totally unlimited supply of water in our underground aquifer system. While we do not think the Dix Hills Water District wells would be adversely impacted by over pumping of the aquifer, North Shore and South Shore water suppliers may have to be concerned with saltwater intrusion. The New York State Department of Environmental Conservation (NYSDEC) in Stony Brook has requested all public water suppliers in Nassau and Suffolk Counties to continue implementing a water conservation program with the goal of reducing the peak water use in May through September by 15%.

The Dix Hills Water district conservation efforts will include increased public education and awareness programs, enforcement of the district's ODD/EVEN irrigation restrictions, auditing of major water users and conducting a leak detection program. One simple way you can assist the district in conserving water is to reduce the run times on your sprinkler controller. Try reducing each zone by two minutes. This will have little or no effect on your lawn but reduces your water use by 10% to 15%.

Freeport Village

Freeport applies conservation measures to ensure that future generations will enjoy the same water quality we do today. These measures include the review of new service applications and screening of water-intensive users before issuance of water availability letters; leak detection programs; and the expedient repairs of water main and service leaks.

Hampton Bays Water District

Residents are urged to implement their own water conservation measures such as retrofitting plumbing fixtures with flow restrictors, modifying automatic lawn sprinklers to include rain sensors, repairing leaks in the home, installing water conservation fixtures/appliances and maintaining a daily awareness of water conservation in their personal habits. Besides protecting our precious underground water supply, water conservation will produce a cost savings to the consumer in terms of both water and energy bills (hot water). Water conservation is critical in protecting Long Island's groundwater system as it is the sole source of drinking water for all of Long Island, including Hampton Bays. Conservation allows us to preserve our water supply, increase water availability for emergency situations, and reduce stress on our drinking water wells and water distribution piping.

This year, the Hampton Bays Water District is promoting a voluntary ODD/EVEN lawn water program. We ask odd numbered addresses to irrigate on odd-numbered days, and even numbered addresses to irrigate on even-numbered days. We also ask that residents run irrigation systems from 9 p.m. to 11 p.m. and refrain from using the system in the middle of the night. This will allow the water to be available for household use for the early morning.



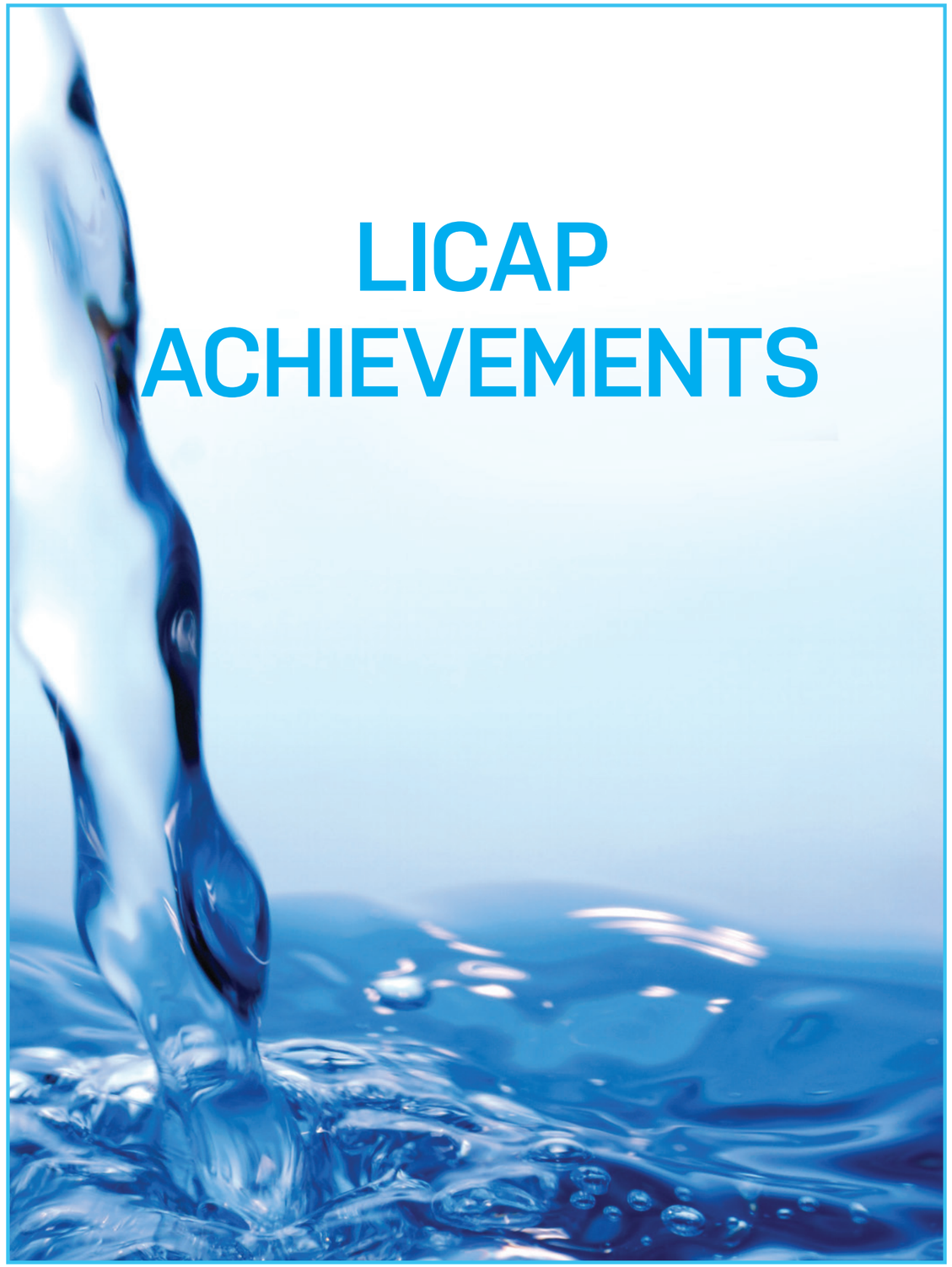
Plainview Water District

Plainview Water District launched the Preserve Plainview water conservation campaign to ensure our area's water source is healthy and sustainable. The program includes a comprehensive list of water saving tips and incentives, including urging customers to use smart irrigation controllers to save water (and money); limiting lawn watering; mulch around plants to retain moisture; cover pools to reduce evaporation during winter; replace standard showerheads with low-volume heads; and check toilets regularly for leaks, among many other helpful tips. The district also offers rebates up to $75 for the purchase of smart irrigation devices for the first 50 customers who meet the program's eligibility requirements.

Riverhead Water District

The Riverhead Water District encourages all residents to incorporate water conservation in their everyday lives. The district urges residents to reduce watering times in each lawn zone by 10%; adopt ODD/EVEN watering; use smart irrigation controllers; and check for leaks frequently.





LICAP ACHIEVEMENTS

Despite the challenges presented by the onset of the COVID-19 pandemic, LICAP had several notable achievements in 2020, including the publication of the organization's landmark Groundwater Resources Management Plan, the start of the realization of the plan's most urgent priorities, advancing the goals of LICAP's Our Water Our Lives water conservation campaign and the creation of a dynamic new website.

Groundwater Resources Management Plan

The publication of the Groundwater Resources Management Plan is the culmination of much of LICAP's most important work since its inception seven years ago. The plan provides recommendations for actions to be taken on numerous initiatives to safeguard the sole source aquifer that provides 100% of Long Island's drinking water.

The plan can be viewed or downloaded in its entirety on LICAP's website, licaponline.com. More than 140 specific recommendations are provided in the plan, including 20 that are considered to be top priorities. Those priorities are:

- Investigating ways to optimize pumping for coastal wells;
- Funding the development of a regional groundwater model for planning purposes;
- Implementing conservation pricing for public water suppliers, and including a full description of water conservation pricing in annual water quality reports;
- Establishing guidelines for best management practices to reduce peak pumpage for landscape irrigation;
- Establishing guidelines for the use of water by geothermal systems;
- Making the case against reactivation of public supply wells in Queens;
- Identifying federal, state and local funding sources to conduct groundwater monitoring, plume identification and modeling;
- Actively remediating or strategically containing groundwater contamination plumes, such as the Grumman/Navy plume, to minimize and prevent potential impacts to public drinking water;
- Maintaining, updating and utilizing the existing Nassau County Department of Public Works monitoring well network;
- Expanding the development and use of the WaterTraq GIS-based contaminant mapping system;
- Requiring that water suppliers are notified when a geothermal system has been permitted in their service area;
- Requiring that the New York State Department of Environmental Conservation and the Nassau and Suffolk County Health Departments review and provide comments to municipal planning boards on projects that may impact water resources through the state SEQRA process;
- Reauthorizing LICAP for a second-five year term;
- Ensuring that any water pumpage caps implemented in the future are based on scientific data;
- Preventing the creation of any new state or regional entity to provide oversight of drinking water resources, as those powers are already vested in the New York State Department of Environmental Conservation and the New York State Department of Health;
- Expanding programs in both counties to upgrade wastewater treatment in currently unsewered areas;
- Identifying and promulgating funding sources to enable impacted or threatened private wells in both counties to connect to public water;
- Identifying opportunities to enhance monitoring and regulatory enforcement efforts to prevent volatile organic compound release and mitigate contamination;
- Expanding monitoring capabilities under the New York State Department of Environmental Conservation Pesticide Monitoring Program and support the Long Island Pesticide Management Strategy to minimize or eliminate excess pesticides via best management practices;
- Expanding assessment management programs for pharmaceuticals and personal care products (PPCPs) and enhancing monitoring for PPCPs, including

1,4-dioxane near wastewater discharges from sub-regional plants and individual on-site wastewater treatment systems; identifying wastewater treatment technologies that demonstrate PPCP reduction or removal; expanding support to local Stop Throwing Out Pollutants (STOP) programs; funding local laboratory capacity to analyze potential threats to public and private water supplies from emerging contaminants such as PFOS/PFOA.

Though the COVID-19 pandemic inhibited the ability to move forward on some of these initiatives, significant progress was made on advancing quite a few.

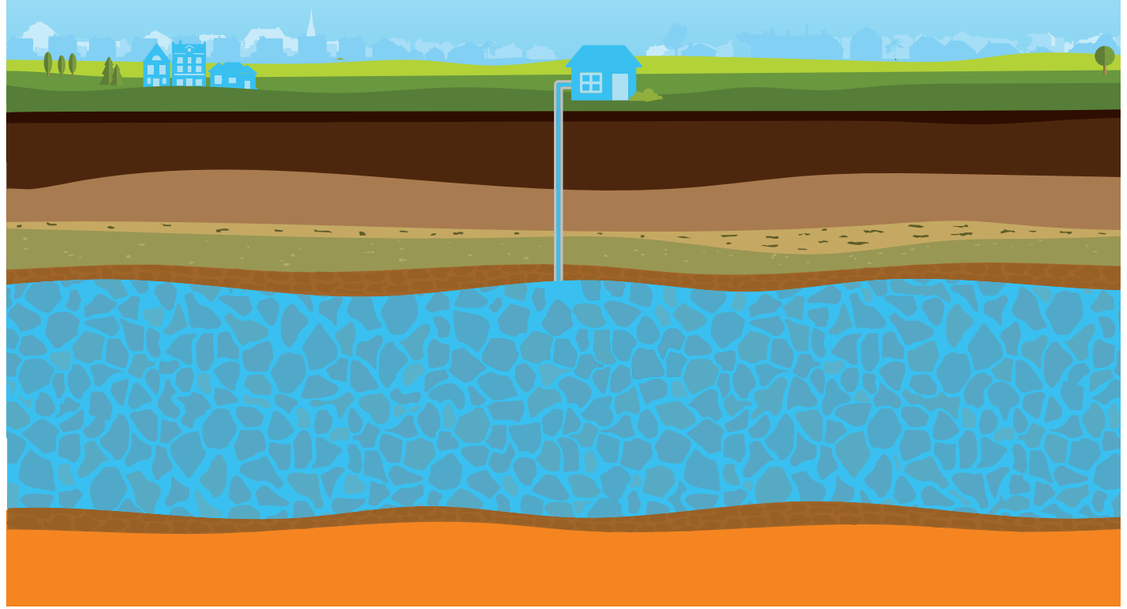
LICAP's commitment to ensuring that geothermal heating and cooling systems do not negatively impact Long Island's sole source aquifer, for instance, was taken up by the Suffolk County Water Authority, which in June prohibited anyone seeking new water service from utilizing an open loop geothermal system. Other municipalities have since looked to SCWA's model ordinance and are considering similar bans of their own.

LICAP has also conducted a survey of Long Island water suppliers to assess water conservation strategies utilized to help preserve Long Island's sole source aquifer. Some of those strategies are covered in the Water Conservation section of this report, but LICAP will be using the information gathered to further the goal noted above regarding conservation pricing.

Great progress has also been made on various other priorities. Suffolk County has made tremendous strides in upgrading wastewater disposal systems to innovative nitrogen treatment systems in unsewered areas of the county. The county in 2020 published the first study in the county's history to delineate and establish load reduction goals for 190 individual watershed areas in Suffolk.

The Suffolk County Department of Health Services five years ago developed its Volatile Organic Compound Action Plan to protect Suffolk County groundwater by preventing unpermitted discharges of volatile organic compounds in the environment. The plan calls for close monitoring of high risk facilities, including dry cleaners, through annual site inspections. To date, more than 1,300 inspections of 260 dry cleaners have taken place, and remediations have occurred at impacted locations.

The county has also made progress in addressing pesticide pollution of groundwater and is working towards the expansion of management programs for pharmaceuticals and personal care products.



Our Water Our Lives

LICAP in 2019 introduced its Our Water Our Lives water conservation campaign, designed to educate Long Islanders about the sole source aquifer that provides all of our drinking water and to promote water conservation to help protect the aquifer. The campaign launch was a huge success, including a multi-platform ad campaign, new social media accounts and a new website, all touting the conservation measures advocated by LICAP's Conservation Subcommittee, which created the Our Water Our Lives campaign.

In 2020, LICAP continued to build on its Our Water Our Lives internship program, which features top students from environmental programs at Long Island colleges and universities. This year, the two-person intern team developed exceptional social media content for Our Water Our Lives, created new social media accounts for LICAP's new website and prepared and presented innovative program touting Our Water Our Lives goals for groups such as the Girl Scouts.

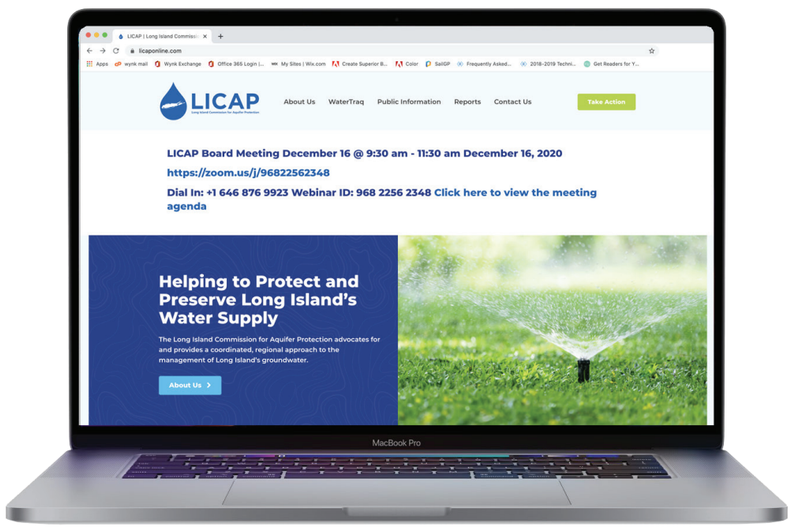
OUR WATER
OUR LIVES
SAVE LONG ISLAND'S ONLY
DRINKING WATER SOURCE

New LICAP Website

LICAP in 2020 introduced a dynamic new website that provides easy access for the general public to the pillars of LICAP's work, such as the GIS-based contaminant tracking database WaterTraq, all annual updates to the State of the Aquifer report and the Groundwater Resources Management Plan. The website also contains minutes of LICAP meetings and brand new social media accounts.

LICAP's new website address is licaponline.com. Stop by and check out all the great work being undertaken by LICAP!

VISIT US AT
LICAPONLINE.COM



LOOKING FORWARD

Without question, the most significant challenge facing Long Island water suppliers for the foreseeable future will be taking the immense steps needed to adhere to New York State's tough new regulations on 1,4-dioxane, PFOS and PFOA. The state in the summer of 2020 enacted water quality standards of 1 part per billion for 1,4-dioxane and 10 parts per trillion for PFOS and PFOA.

While these actions by the state, undertaken at the recommendation of the state's Drinking Water Quality Council, will ensure Long Islanders will have among the toughest water quality standards in the country for these contaminants, the cost to ratepayers for the construction of treatment systems to remove the contaminants from groundwater will be immense. Some water suppliers have proactively addressed these costs—estimated to be in the hundreds of millions of dollars for all Long Island—by levying charges on bills, while others will need to so in the near future. State grants have helped to cover a portion of the costs, and many Long Island water suppliers have sued the companies responsible for polluting the groundwater, but it may be years before litigation is settled.

In the meantime, water suppliers must meet the new standards in the present, and that means navigating an extraordinarily comprehensive process for seeking approval for, building and testing treatment systems. PFOS and PFOA are removed via granular activated carbon treatment systems, which, fortunately, are already in place at many well fields to remove other contaminants. But treatment for 1,4-dioxane is a whole different story—the contaminant requires specialized advanced oxidation process treatment systems, and each system requires approval from the state Department of Health. The entire process—from filing an application to putting the system into service—can take years.

Long Island water suppliers are thus thoroughly dependent on the state—the very entity that established the new regulations—to efficiently facilitate the approval process to ensure water suppliers can comply with the regulations.

Fortunately, the early returns are good; the state has moved more quickly on approvals than in the past. But even so, without question, designing, construction—and funding—these systems will be the primary focus of water suppliers in 2021—and beyond.

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