



Suffolk County Legislature

General Meeting/Committee Information

Abbreviation Key for Marked Agenda

- A: Approved
- T: Tabled
- F: Failed
- W: Withdrawn
- O: Overridden
- SU: Sustained
- R: Recessed
- C: Closed
- CC: Sent to Consent Calendar
- SC: Sent to Committee
- TSC: Tabled Subject to Call
- X: No Action Taken
- S: Status of Resolution

SUFFOLK COUNTY LEGISLATURE

HEALTH COMMITTEE

WILLIAM R. SPENCER, M.D., CHAIR
LEGISLATOR 18TH DISTRICT



15 PARK CIRCLE, SUITE 209
CENTERPORT, N.Y. 11721
PHONE: (631)-854-4500
EMAIL: william.spencer@suffolkcountyny.gov

COMMITTEES:

Chair, Health Committee
Vice-Chair, Ways & Means Committee
Member, Public Safety Committee

TO: Members of the Health Committee
Legislator Fleming, Vice-Chair
Legislator Calarco
Legislator Cilmi
Legislator Martinez
Legislator Trotta
Legislator Kennedy

FROM: Legislator William R. Spencer, Chairman

DATE: August 24, 2016

RE: Health Committee Agenda

Please be advised that the next meeting of the Health Committee will be held on Thursday, September 1, 2016 at 2:00 p.m. in the Maxine Postal Legislative Auditorium in the Evans K. Griffing Building, Riverhead County Center located at 300 Center Drive in Riverhead.

I. PLEDGE OF ALLEGIANCE

II. CORRESPONDENCE

III. PUBLIC COMMENTS

IV. PRESENTATIONS

- Long Island Commission for Aquifer Protection (LICAP) Presentation

V. TABLED RESOLUTIONS

1207. Adopting Local Law No. -2016, A Local Law prohibiting the distribution of plastic carryout bags used in retail sales. (Spencer)

1598. Adopting Local Law No. -2016, A Local Law to register retailers of liquid nicotine in Suffolk County. (Cilmi)

1649. Adopting Local Law No. -2016, A Local Law to reduce the use of carryout bags in retail sales. (Spencer)

VI. INTRODUCTORY RESOLUTIONS

A
CC
7-0-0-0
1674. Amending the 2016 Adopted Operating Budget to accept and appropriate 100 % additional State Aid from the New York State Office of Mental Health (NYS OMH) to Concern for Independent Living and Options for Community Living for mobile residential support services. (Co. Exec.)

Acc
7-0-0-0
1675. Amending the 2016 Adopted Operating Budget to accept and appropriate 100 % additional State Aid from the New York State Office for People with Developmental Disabilities (NYS OPWDD) to Skills Unlimited and United Cerebral Palsy (UCP) for a Cost-of-Living Adjustment (COLA). (Co. Exec.)

A
CC
7-0-0-0
1676. Amending the 2016 Adopted Operating Budget to accept and appropriate 100 % additional State Aid from the New York State Office of Mental Health (NYS OMH) to Hands Across Long Island, Federation of Organizations, Pederson Krag Center and PSCH, Inc. for mobile crisis services. (Co. Exec.)

Acc
7-0-0-0
1677. Amending the 2016 Adopted Operating Budget to accept and appropriate 100% additional State Aid from the New York State Office of Mental Health (NYS OMH) to Family Service League for Assertive Community Treatment (ACT) team expansion. (Co. Exec.)

Acc
7-0-0-0
1713. Accepting and appropriating 100% federal pass-through grant funds from New York State Department of Health in the amount of \$435,937 for the Maternal and Infant Community Health Collaborative ("MICHC") administered by the Suffolk County Department of Health Services, Division of Patient Care and to execute grant related agreements. (Co. Exec.)

Acc
7-0-0-0
1714. Accepting and appropriating 23% New York State and 77% federal pass-through grant funds from the New York State Department of Health in the amount of \$3,638,909 for the Special Supplemental Nutrition Program for Women, Infants and Children ("WIC") administered by the Suffolk County Department of Health Services, Division of Patient Care and to execute grant related agreements. (Co. Exec.)

Acc
7-0-0-0
1715. Accepting and appropriating 100% grant funds from the New York State Department of Health in the amount of \$284,836 for the HIV Partner Notification Program administered by the Suffolk County Department of Health Services, Division of Public Health and to execute grant related agreements. (Co. Exec.)

A
CC
7-0-0-0
1716. Accepting and appropriating 100% grant funds from New York State Department of Health in the amount of \$227,042 for the Emergency Medical Services Program Agency ("EMSPA") administered by the Suffolk County Department of Health Services, Division of Emergency Medical Services and to execute grant related agreements. (Co. Exec.)

Acc
7-0-0-0
1717. Amending the 2016 Adopted Operating Budget to re-allocate 100% State Aid from Pederson Krag Center to PSCH, Inc. for the purpose of operating Mental Health Programs. (Co. Exec.)

Acc
7-0-0-0
1718. Amending the 2016 Adopted Operating Budget to re-allocate funds from Pederson Krag Center to PSCH, Inc. for the purpose of operating Chemical Dependency Programs. (Co. Exec.)

Acc
7-0-0-0
1719. Accepting and appropriating 100% grant funds from New York State Department of Health in the amount of \$566,745 for the Public Health Tuberculosis Prevention and Control Program ("TBPC") administered by the Suffolk County Department of Health Services, Division of Patient Care and to execute grant related agreements. (Co. Exec.) HEALTH

Acc
7-0-0-0
1720. Accepting and appropriating 100% federal grant funds from the Department of Health and

Human Services Food and Drug Administration in the amount of \$70,000 for the continuing to advance Suffolk County's Conformance with the Voluntary National Retail Food Regulatory Program Standards (VNRFRPS) administered by the Suffolk County Department of Health Services, Division of Public Health and to execute grant related agreements. (Co. Exec.)

1721. Accepting and appropriating 100% federal grant funds from the Department of Health and Human Services Food and Drug Administration in the amount of \$70,000 for the continuing to advance Suffolk County's Conformance with the Voluntary National Retail Food Regulatory Program Standards (VNRFRPS) administered by the Suffolk County Department of Health Services, Division of Public Health and to execute grant related agreements. (Co. Exec.)

A
CC
7-0-00

1723. Accepting and appropriating 100% federal pass-through grant funds from the New York State Department of Environmental Conservation in the amount of \$149,225 for the State Pollutant Discharge Elimination System (SPDES) Water Quality Management Planning Program administered by the Suffolk County Department of Health, Division of Environmental Quality and to execute grant related agreements. (Co. Exec.)

A
CC
7-0-00

1736. Accepting and appropriating 100% grant funds from New York State Department of Health in the amount of \$24,720 for the Immunization Action Plan ("IAP") administered by the Suffolk County Department of Health Services, Division of Patient Care Services for a Cost-of-Living Adjustment (COLA). (Co. Exec.)

ACC
7-0-00

1737. Accepting and appropriating 100% grant funds from New York State Department of Health in the amount of \$26,690 for the Tobacco Enforcement Program-ATUPA administered by the Suffolk County Department of Health Services, Division of Preventive Medicine for a Cost-of-Living Adjustment (COLA). (Co. Exec.)

ACC
7-0-00

1760. Adopting Local Law No. -2016, A Local Law to regulate animal rescue organizations operating in Suffolk County. (Martinez)

1 PH
7-0-00

1767. Establishing a carryout bag reduction Public Education Working Group. (Spencer)

A 7-0-00

VII. HOME RULE MESSAGES

VIII. TABLED SUBJECT TO CALL RESOLUTIONS

IX. ADJOURNMENT

cc: Honorable DuWayne Gregory, Presiding Officer
Honorable Steve Bellone, County Executive
Honorable Jason A. Richberg, Clerk of the Legislature
George M. Nolan, Counsel to the Legislature
Robert Lipp, Director, Office of Budget Review

Intro. Res.

1948

Res. No.

997

November 19, 2013

Motion:

Krupski, Schneiderman, Browning, Muratore, Anker
Calarco, Montano, Cilmi, Hahn, Barraga,
Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, Spencer

Co-Sponsors:

Krupski, Schneiderman, Browning, Muratore, Anker
Calarco, Montano, Cilmi, Hahn, Barraga,
Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, Spencer

Second:

Krupski, Schneiderman, Browning, Muratore, Anker
Calarco, Montano, Cilmi, Hahn, Barraga,
Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, Spencer

LD	Legislator	Yes	No	Abs	NP	R
1	Albert J. KRUPSKI					
2	Jay H. SCHNEIDERMAN					
3	Kate M. BROWNING					
4	Thomas MURATORE					
5	Kara HAHN					
6	Sarah S. ANKER					
7	Rob CALARCO					
8						
9	Ricardo MONTANO					
10	Thomas CILMI					
11	Thomas F. BARRAGA					
12	John M. KENNEDY, JR.					
13	Lynne C. NOWICK					
15	DuWayne GREGORY					
16	Steven H. STERN					
17	Lou D'AMARO					
18	William SPENCER					
14	Wayne R. HORSLEY, P.O.					
Totals		17				

MOTION
<input checked="" type="checkbox"/> Approve
Table: _____
<input type="checkbox"/> Send To Committee
<input type="checkbox"/> Table Subject To Call
<input type="checkbox"/> Lay On The Table
<input type="checkbox"/> Discharge
<input type="checkbox"/> Take Out of Order
<input type="checkbox"/> Reconsider
<input type="checkbox"/> Waive Rule _____
<input type="checkbox"/> Override Veto
<input type="checkbox"/> Close
<input type="checkbox"/> Recess
APPROVED <input checked="" type="checkbox"/> FAILED _____
No Motion _____ No Second _____

RESOLUTION DECLARED
<input checked="" type="checkbox"/> ADOPTED
<input type="checkbox"/> NOT ADOPTED

Roll Call _____ Voice Vote

Tim Laube

Tim Laube, Clerk of the Legislature

Testimony of Stan Carey

Vice-Chairman – Long Island Commission for Aquifer Protection

Suffolk County Legislature Health Committee

September 1, 2016

Good afternoon, my name is Stan Carey and in addition to serving as superintendent of the Massapequa Water District I am currently the vice-chairman of the Long Island Commission for Aquifer Protection, or LICAP. I'm joined today by the Suffolk County Water Authority's Chief Executive Officer, Jeff Szabo, who also served as LICAP's first chairman.

I appreciate having the opportunity to update you on the vital work being conducted by LICAP, formed through legislation unanimously supported by both the Suffolk and Nassau County Legislatures in 2013.

Before I discuss a few of LICAP's achievements to date, I want to frame the discussion by taking you back to 2013, prior to LICAP's formation. You'll undoubtedly recall that a proliferation of reports and studies called for the need to take proactive measures to safeguard the sole source aquifer that provides all of our drinking water. But the ability to protect our greatest natural resource was a tremendous challenge due to the many governmental entities and decentralized land use controls that define life on Long Island. This is because the aquifer system is not subject to local rule; it crosses all

local geopolitical boundaries, and thus protecting it required a regional solution.

But no action was being taken. And so the Suffolk County Water Authority, in conjunction with the more than 100 utility and non-utility members of the Long Island Water Conference, proposed what was to become LICAP, a commission consisting of private and public experts on groundwater issues that would gather relevant data and lead the way in protecting our groundwater supply.

And the two legislatures, in their wisdom, strongly supported the initiative and approved legislation to create LICAP. In addition to the Suffolk County Water Authority and Long Island Water Conference, among the nine voting and 13 ex-officio LICAP members are representatives of the executive and legislative branches of both county governments, as well as representatives of each county's health department, the United States Geological Survey and the New York State Department of Environmental Conservation. It is a group with a tremendous breadth of knowledge about all issues pertaining to groundwater.

I'm pleased to report that LICAP has, by any objective reckoning, more than fulfilled its charge. As required by the legislation which created it, the commission has drafted the region's first State of the Aquifer report, an assessment of the structure of the sole source aquifer and the contaminant threats that could potentially challenge its long-term health if not addressed soon. Since decisions made by Nassau and Suffolk's nearly three million residents—how they dispose of their unused prescription drugs, what they put

on their lawns--have an enormous impact on the health of the aquifer system as a whole, the LICAP members who participated in developing and writing the report have consciously made it as accessible to the general public as possible. A huge aspect of what LICAP seeks to accomplish is making sure Long Island residents are knowledgeable about the source of their drinking water and what they can do to protect it, which is why we've already held public hearings in both counties, and have three additional hearings scheduled: October 13 at 6 p.m. in Hauppauge, October 17 at 6 p.m. at the Nassau County Legislature Chambers in Garden City and October 20 at 6 p.m. at the Evans K. Griffing Building in Riverhead.

LICAP's State of the Aquifer report is currently being finalized and will be published this fall. It will be updated annually.

The commission's other statutory focus is the creation of a Groundwater Resources Management Plan, which is scheduled to be released next year. The plan will identify threats to groundwater quality and quantity, assess the adequacy of existing groundwater management regulations and recommend amendments to regulations where needed, as well as recommend an implementation plan for all stakeholders.

Perhaps our greatest accomplishment to date, simply because it is an achievement that I believe is a result of getting groundwater experts from both counties together, is WaterTraq. WaterTraq is a GIS-based contaminant mapping system that is allowing us to chart out contaminant threats throughout the region and share the information with the public. It is the first program of its kind in New York State.

The program, through the use of interactive maps, allows users to search for levels of contaminants at set limits to pinpoint whether the contaminant poses a threat at any given location. The program is a direct result of water suppliers for the first time sharing accumulated data on contaminant levels and should prove to be invaluable in helping us to protect our sole source aquifer.

The program is a direct result of the creation of LICAP.

LICAP has also placed a great emphasis on water conservation. A major conservation effort launched this summer by the Suffolk County Water Authority focused primarily on the East End and a smart irrigation system controller pilot program initiative also announced this summer by the Port Washington Water District can be attributed to discussions among LICAP members who understand the need to preserve our sole source aquifer. These efforts will only be expanded upon in the coming years.

And so though I realize there are those who would like to see a single, state-operated management entity running all of Long Island's water resources, I'm asking that you keep WaterTraq and LICAP's other early accomplishments in mind when such proposals are made. It's also worth keeping in mind that the DEC has just added two new staff members in its Region One Water Supply Section, is in the process of developing a separate web page on its website just to note water withdrawals on Long Island, and is implementing electronic reporting of monthly and annual pumpage totals via Excel spreadsheets for 2016. And, of course, it's important to remember that no one has a greater stake in preventing the pollution of our aquifer system

than Long Island's water suppliers, as we're required by law to remediate any groundwater contamination before distributing drinking water to our customers. It goes without saying that pollution prevention is much less expensive than remediation.

So we're all essentially on the same side. But it's important to keep in mind that while there are always ambitious proposals, the Long Island public water suppliers who launched LICAP with your support have been hard at work on developing actual solutions. We don't need, at this point in time, an additional layer of government determining how to best protect our precious groundwater supply, because, frankly, we're already doing it. And we'd like to continue our work until we're assured of a future that includes a sole source aquifer that is plentiful and, to whatever degree possible, free of pollutants.

Thank you, and Jeff and I would now be happy to take any of your questions.

YOU'RE INVITED

Officials from Suffolk County invite you to attend a free, 30-minute online presentation about tip411's anonymous tip and branded agency smartphone app offerings.

Learn How:

- tip411 encourages the public to engage with your department
- tip411 can help fight crime & solve more cases
- tip411 encourages the public to submit anonymous tips
- tip411 integrates with Facebook
- tip411 enables real-time community notifications

DATE: Thursday, September 15, 2016

TIME: 10:00 am-10:30 am

To register, click [here](#).



Used in over 1,500 communities across the U.S. and by many agencies in N.Y., tip411 is a digital toolset that features innovative smartphone apps, anonymous text tips, group alerting, and secure social media publishing tools. tip411 helps agencies engage community members of all ages by enabling anyone with a cell phone to submit tips via a smartphone app or text anonymous tips that can be responded to in real time by authorized personnel in the agency or organization.

Learn more at www.tip411.com or by following [@tip411CO](https://twitter.com/tip411CO) on Twitter.



YOU'VE BEEN INVITED BY:

Leg. Kate Browning
Chair
Public Safety Committee
Suffolk County, NY

Leg. Robert Calarco
Vice-Chair
Public Safety Committee
Suffolk County, NY

Leg. Tom Cilli
Member
Public Safety Committee
Suffolk County, NY

Leg. Bridget Fleming
Member
Public Safety Committee
Suffolk County, NY

Leg. Kara Hahn
Member
Public Safety Committee
Suffolk County, NY

Leg. Leslie Kennedy
Member
Public Safety Committee
Suffolk County, NY

Leg. Monica R. Martinez
Member
Public Safety Committee
Suffolk County, NY

Leg. William Spencer
Member
Public Safety Committee
Suffolk County, NY

Mr. Terry Halsch
President
Citizen Observer
tip411

Thomas McAbee
Operation Big Red
Med. Disposal Box

THE PLASTIC PROBLEM

Plastic was once touted as "the material of the future." That claim is proving to be alarmingly accurate - we now know that plastic debris persists in the environment indefinitely.

Due to its durability, buoyancy, and ability to accumulate and concentrate toxins present in the ocean, plastic could be harmful to marine life and to us.

What are the major issues we're facing with plastics in the marine environment?

WHERE DOES PLASTIC DEBRIS COME FROM?

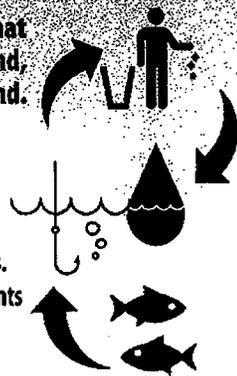
The majority of all marine debris is generated from human activities. About 40% of marine debris comes from land-based sources and commonly consists of the items listed on this page. Plastics can enter the marine environment a number of ways: through ineffective or improper waste management, intentional or accidental dumping and littering on shorelines or at sea, or through storm water runoff.

THE PLASTIC PATHWAY: WHERE DOES IT GO?

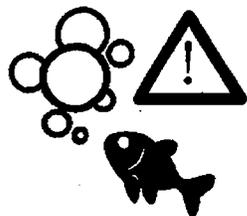
Ocean currents and wind carry plastic debris to shorelines all over the world. Some areas where currents converge, called gyres, have large concentrations of plastic debris.

Plastic photodegrades (by sunlight)—breaking down into smaller pieces. Plastics can absorb toxic chemicals which eventually contaminate sediments and waterways. The negative effects of these toxins on marine life and our food web are currently being investigated.

What goes around, comes around.



HOW DOES IT HARM OUR WORLD?



Plastic debris is more than just an eyesore - it can do serious harm to the environment and wildlife in the ocean and on shore.

Some species of marine birds mistake colorful floating plastic bits for food and carry it back to their chicks, causing them to starve due to a stomach "full" of plastic. Entanglement remains a serious problem for marine species including sea turtles and whales.

Current studies are evaluating how toxins leached from plastics may enter the food web and might make it back to our dinner plates!

TOP 10 DEBRIS ITEMS

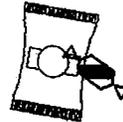
Found on beaches worldwide (Ocean Conservancy 2014)

1 CIGARETTE BUTTS



Many cigarette filters are made of plastic. Don't litter! Dispose of cigarette butts properly in an ashtray.

2 FOOD WRAPPERS



Use reusable containers to pack your on-the-go snacks and skip the wrapping/wrapper.

3 PLASTIC BEVERAGE BOTTLES



Make sure single-use disposable bottles end up in a recycling container. Better yet, get your own reusable bottle!

4 PLASTIC BOTTLE CAPS



Bottle caps are made of a type of plastic that many cities are unable to recycle, so they end up in landfills or the ocean.

5 STRAWS AND STIRRERS



"Please, no straw! Thank you!" Repeat as necessary.

6 PLASTIC BAGS (OTHER)



Plastic bags of all types easily become marine debris due to their durability and light weight.

7 PLASTIC GROCERY BAGS



Don't forget your reusable bags when you go grocery shopping! Plastic bags are wasteful and harmful to wildlife.

8 GLASS BEVERAGE BOTTLES



If you purchase an individual drink in a glass bottle, always pack it out!

9 BEVERAGE CANS



Aluminum cans are recyclable, but often become litter. Make sure you dispose of cans properly in the bin!

10 PLASTIC CUPS AND PLATES



Plastic cups and plates are found littered on nearly every beach. Bring your own reusable dishware to use instead.

ACTION STEPS FOR A PLASTIC-FREE OCEAN

Small steps you can take TODAY to make a BIG DIFFERENCE!

BE A SMART SHOPPER

Only buy what you really need, and shop secondhand whenever possible.

Buy reusable products and products made from recycled materials with little or no packaging. Shop in bulk and bring a bag!

REFUSE DISPOSABLES

Reduce, reuse and recycle at home, work and school.

Use reusable. If you must drink from single-use disposable bottles and cans, make sure they end up in a recycling container.

FIND GOOD ALTERNATIVES

Wrap lunches in a reusable cloth and trade your plastic container for metal or glass!

Some face washes, scrubs, toothpastes and handsoaps are made with plastic "microbeads" that make their way into the marine environment. Look for the words **polypropylene** and **polyethylene** on labels and avoid these products. Choose natural exfoliants like apricot peel instead!

JOIN THE MOVEMENT: TAKE THE PLASTICS PLEDGE

Visit www.NAMEPA.net for more information and to take the Pledge!

LEARN MORE

Programs coordinated by NAMEPA include marine environmental education, debris reduction, beach cleanup and conservation jobs, and outreach from marine habitats.

FINDING SOLUTIONS

Marine debris and plastic pollution are problems we as humans created - and ones we as a global community can solve.

Our trash moves from the streets, into storm drains, to the ocean where it becomes a hazard to wildlife and poses a threat to our health and safety as a global community.

How can we work together to solve the Plastic Problem?

Most plastic recycling systems and materials will break down and are not destroyed but displaced.

Persistent materials in our environment can impact marine habitat and wildlife.



THE SOLUTION: Try to buy only sustainable products - and the next time you go to throw something "away," think about whether you can reuse or recycle it!

America alone throws away over 100 billion plastic bags a year (the average bag) used for only about 20 minutes.

It takes 12 million barrels of oil to make those bags, and only about 3% are recycled.

THE SOLUTION: Bring a bag with you when you go to the store instead of accepting a plastic bag. If don't have a bag with you, ask yourself if you really need one!

CLEAN UP YOUR COAST!

8 out of the top 10 items commonly found during International Coastal Cleanup Day every year are plastic! This annual cleanup event is hosted by The Ocean Conservancy across the globe on the third Saturday in September. Visit www.oceanconservancy.org to learn more.



North American Marine Environment Protection Association



2014 Lloyd's List Awards ENVIRONMENT AWARD WINNER



CALIFORNIA
COASTAL
COMMISSION



MYSTIC
AQUARIUM

SC Legislature's Health Committee • 9-1-16 • LICAP and its Mandate • Karen Blumer, Open Space Council

Resolution 805 - 2013 created LICAP - the LI Commission on Aquifer Protection. Dr. Spencer sponsored it; passed unanimously by both NC & SC Legislatures. YOUR MANDATE IS CLEAR:

WE'RE IN WATER CRISIS. FIND US A SOLUTION. — SCDHS Comprehensive Management Plan, 2015 plus HALF A CENTURY of similar reports. Water trajectory is not improving but DECLINING precipitously Hence: in the Resolutions's last "Whereas," LICAP is clearly directed to produce a Plan to form the "scientific underpinning for a **yet to be established entity**"

The Resolution 17th Resolved enumerates what that Plan must contain, to include "Management opportunities, Recommendations, Methods for implementing" In other words **action, a solution**, What should this "yet to be established entity" look like? Be? What are the options? Possibilities to recommend? We want you, LICAP, give us your best **recommendations for a SOLUTION**.

THERE HAVE BEEN REPEATED REQUESTS FROM OFFICIAL MEMBERS OF THE COMMISSION as well as the Public and Various Water Experts around the table to discuss an "entity". **LICAP LEADERSHIP's RESPONSE has been:**

1. An adamant refusal to discuss an "Entity," claiming it is "premature" to do so.

Premature? After half a century of water decline? After being told by the Legislature's — your — mandate to "find us a solution"? We suggest it is 40 to 50 years late. We are urging you to discuss with Steve Colabufo today or other representative of LICAP's leadership how such a consideration of options for an "Entity" could possibly be "premature." This is going to be the most important Nassau-Suffolk regional discussion in a century for our waters. Do not suppress.

LICAP has been meeting now since March 2014, two and a half years already. This discussion, working toward a solution, should have begun on Day One and not be receiving continued pushback and refusal to ignore the requests from Commission members and expert/Public participants to explore options for an "Entity."

2. Worse than the refusal to immediately create a working group or subcommittee whose focus in on the possibilities for Solution and Entity, is the **attempt by LICAP Leadership to remove any mention of Entity** options from the rightful reports being generated in the Subcommittees. We are a member of at least one of those: The PPP — Public-Private Partnership Subcommittee. Again, we urge this Committee most pointedly to discuss this today with the LICAP leadership representative.

++KUDOS to LICAP leadership, on one positive hand, on **PROCESS**. Inclusive, public, open, sharing, grounds for a Brain Trust. However we have grave concerns about the leadership lack of focus on its Mandate.

The current Leadership, Frank Koch of the Long Island Water Conference, **has** stated that he will "entertain" a discussion on "Entity" at the upcoming LICAP general meeting on September 14. A similar promise was made previously. Entertaining a discussion may be far from creating an active forum or subcommittee focussed on working toward a solution. Please, we urge this Committee to ensure that your legislative mandate is carried out.

Submitted by: Karen Blumer, Vice President, Open Space Council • Administrator, Carmans River Watershed Trust Fund
Member, Water for Long Island and the LI Clean Water Partnership • Coordinating Committee, Long

WATER FOR LONG ISLAND

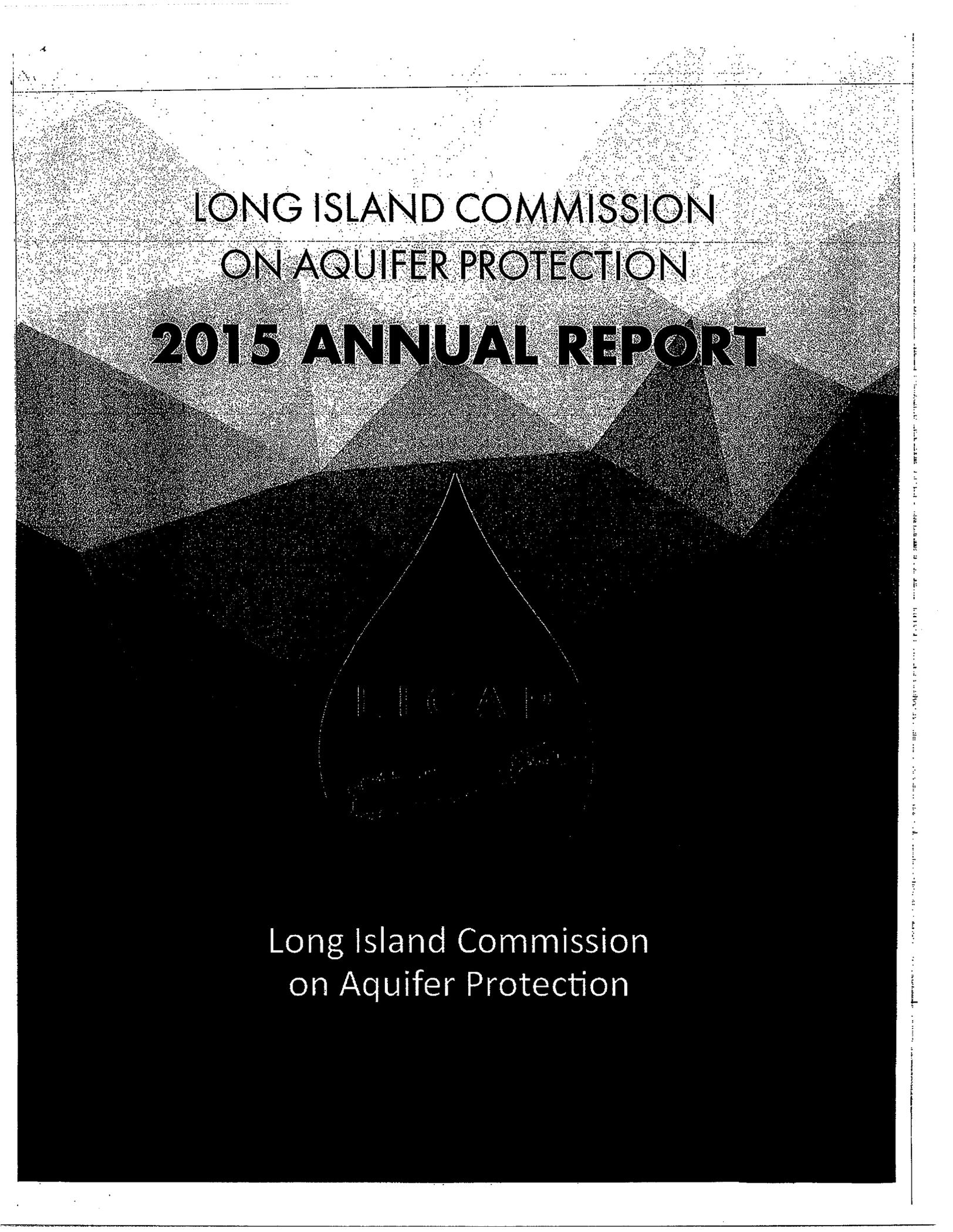


Our Mission: to work with Long Island water suppliers, governmental entities and officials, community and environmental groups, academic institutions, conservationists, individuals and others who are concerned about the water and drinking water conditions of Long Island and to advance actions for effective groundwater and water supply management.

The Unmet Groundwater Management Needs for Long Island's Sole Source Aquifers

There are a number of unmet needs that must be fulfilled if Long Island is to stand a chance of maintaining a sustainable source of high quality drinking water, now and in the future. The unmet groundwater management needs include:

- **Groundwater monitoring** (quality and quantity)
- **Groundwater research**
- **Determine Water Budget and Carrying Capacity**
- **Annual reporting on conditions and problems**
 - 2011 Water Withdrawals & Reporting Law (§15-1501)
- **Evaluation and use of data** annually reported
- **Analysis** of stressed areas: quality and quantity
- **Computer-aided Tools:**
 - GIS and Mapping
 - Modeling
 - Data Management
 - Well Permit Program Tracking
- **Public Education**
- **Groundwater Protection and Remediation of Contaminated Sites** (Superfund and others)
- **Inspections of Regulated Activities**
 - NPDES Discharges
 - Sand Mining and Composting Facilities
 - Solid Waste Disposal/Dumping – C&D and other
 - Bulk Storage and Gasoline Spills
- **Enforcement** of Regulatory Programs
- **Water Conservation** Mandates & Water Demand Management
- **Regulation** of Geothermal Wells
- **Commitment to Lloyd Aquifer Protection**
- **Saltwater Intrusion Mitigation and tracking**
- **Tracking unregulated drinking water pollutants**
- **Long-range Planning and Oversight**
- **Equitable Groundwater Allocation using Managed Yield & Carrying Capacity**
- **Protection from Outside Interests**

The background of the cover features a stylized, grayscale illustration of a mountain range. The mountains are composed of various shades of gray, creating a sense of depth and texture. In the foreground, a large, dark water drop is centered, with a white outline. Inside the water drop, the words "LONG ISLAND COMMISSION ON AQUIFER PROTECTION" are faintly visible, mirroring the text on the cover. The overall aesthetic is clean and professional, emphasizing the theme of water and environmental protection.

LONG ISLAND COMMISSION
ON AQUIFER PROTECTION
2015 ANNUAL REPORT

Long Island Commission
on Aquifer Protection

MISSION STATEMENT

The Long Island Commission on Aquifer Protection (LICAP) is a bi-county entity formed to address both quality and quantity issues facing Long Island's aquifer system, and to advocate for a coordinated regional approach to groundwater resources management.

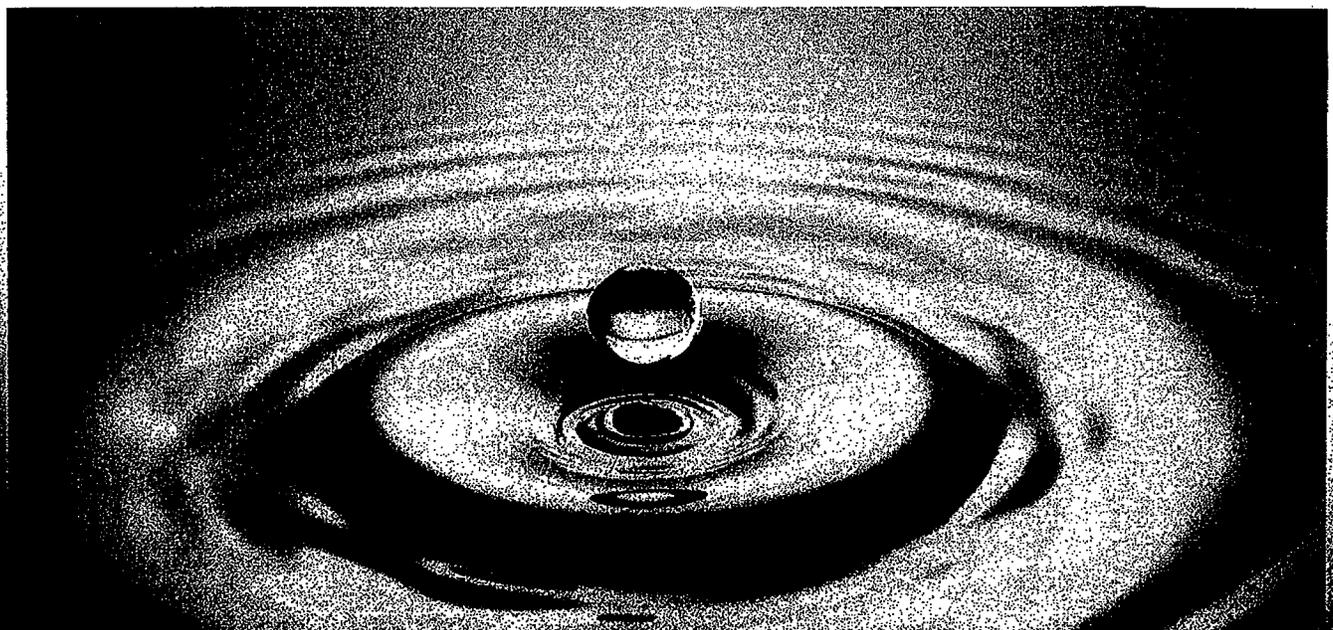
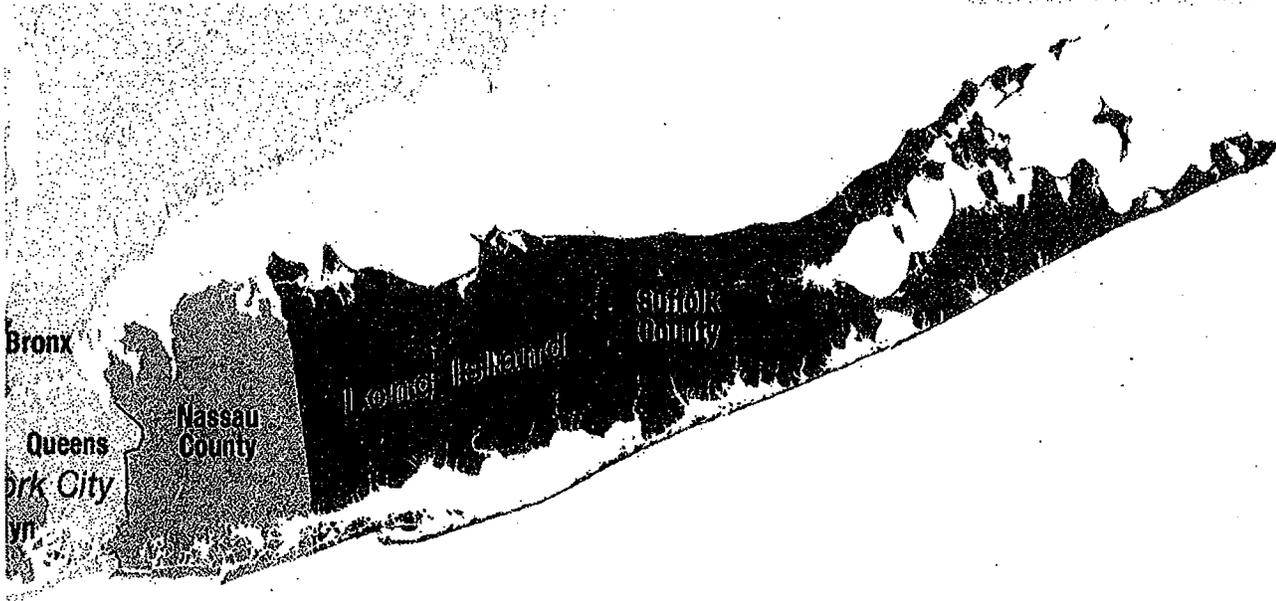
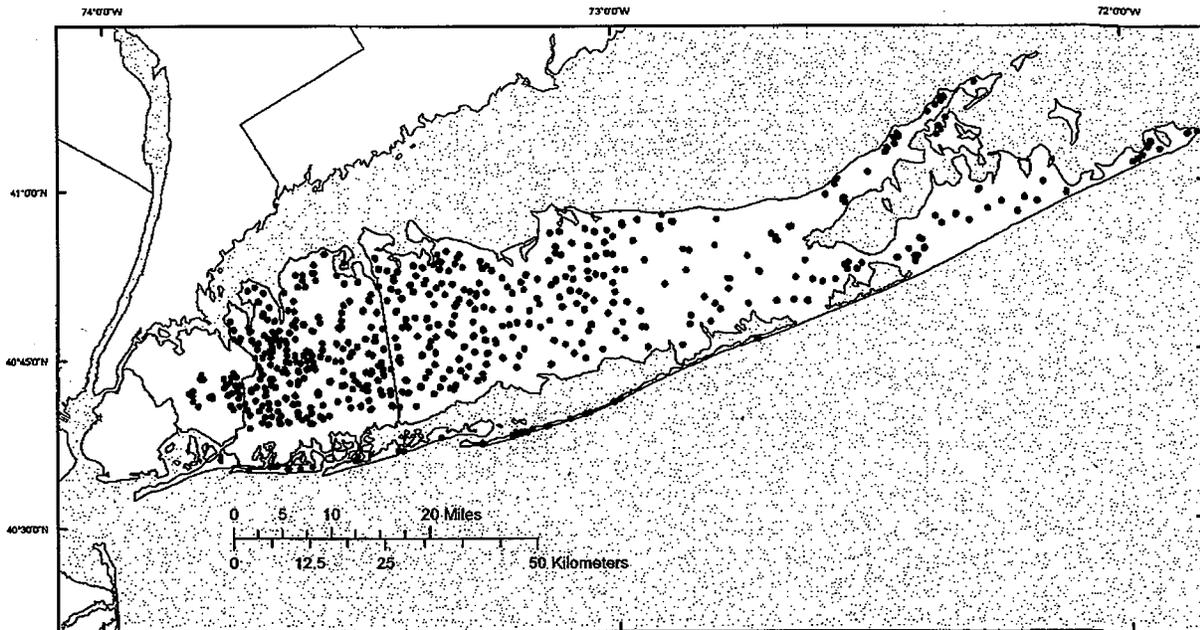


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LONG ISLAND WELL LOCATIONS



Generalized location of over 1,100 large capacity drinking water supply wells used since 2007



A MESSAGE FROM LICAP'S CHAIRMAN AND VICE CHAIRMAN

Since its creation by both the Nassau and Suffolk County Legislatures at the very end of 2013, the Long Island Commission on Aquifer Protection (LICAP) has been hard at work addressing the issues facing the quality and quantity of Long Island's drinking water.

The primary task of this landmark bi-county Commission is to report on the state of our aquifer and recommend additional proactive measures that should be taken to safeguard our aquifer system for future generations. In recognition of the enormity of this challenge, LICAP advocates for a coordinated regional approach to groundwater resource management.

LICAP is comprised of both voting and non-voting members of public water suppliers, health officials, elected officials, environmental officials, academia and the general public. Collectively, these individuals represent 3 million people who reside in Nassau and Suffolk counties and rely on the groundwater beneath each county as their sole source of drinking water.

The unwavering desire of these LICAP members to work in a nonpartisan regional fashion has resulted in a very productive year. The Commission has held five full Commission meetings, eight subcommittee meetings and two public hearings, one in Nassau and one in Suffolk.

The Commission's enabling resolution also called for the empanelling of two subcommittees, the 2040 Water Resource and Infrastructure Subcommittee and Water Resource Opportunities Subcommittee. Much of the work of these two important subcommittees will help develop the Commission's Groundwater Resources Management Plan.

A significant milestone will be reached in the very near future with the anticipated release of the Commission's inaugural State of the Aquifer Report. The Report is currently undergoing final editorial review and will be made public and available on this website within the next few months.

Sincerely,

A handwritten signature in black ink, appearing to read "Jeffrey Szabo".

Jeffrey Szabo
Chairman, LICAP

A handwritten signature in black ink, appearing to read "Michael Levy".

Michael Levy
Vice Chairman, LICAP

LICAP LEGISLATIVE SPONSORS

Hon. William Spencer
Suffolk County Legislator, 18th District

Nassau County Legislature

VOTING MEMBERS OF LICAP

Jeffrey Szabo, Chairman
Suffolk County Water Authority

Mike Levy, Vice Chairman
Long Island Water Conference

Stan Carey
Nassau-Suffolk Water Commissioners Association

Dorian Dale
Suffolk County Executive

Walter Dawydiak
Suffolk County Commissioner of Health

Brian Schneider
Nassau County Executive

Don Irwin
Nassau County Commissioner of Health

Chris Ostuni
Nassau County Legislature Presiding Officer

Michael White
Suffolk County Legislature Presiding Officer



EX-OFFICIO MEMBERS OF LICAP

Honorable Kevin J. McGaffrey
Suffolk County Legislature, Minority Leader

Sarah Meyland
Nassau County Legislature, Minority Leader

Jared Hershkowitz
Suffolk County Legislature, Presiding Officer

Gilbert Anderson, P.E.
Suffolk County Commissioner of Public Works

Brian Schneider
Nassau County Commissioner of Public Works

Nick Gibbons
Suffolk County Commissioner of Parks,
Recreation and Conservation

Michael Comerford
Nassau County Commissioner of Parks

Donita Dele
Suffolk County Department of
Economic Development and Planning

Sally Seod
Nassau County Planning Commission

Paul Tenyenhuis
Suffolk County Soil and
Water Conservation District

Ajay Shah
New York State Department of
Environmental Conservation

Stephen Terracciano
U.S. Geological Survey
Long Island Program Office

Henry Bokuniewicz
Long Island Groundwater Research Institute

LICAP LEGISLATION AND BY-LAWS

LEGISLATION

In 2013, the Nassau County Legislature and the Suffolk County Legislature passed legislation creating the Long Island Commission for Aquifer Protection.

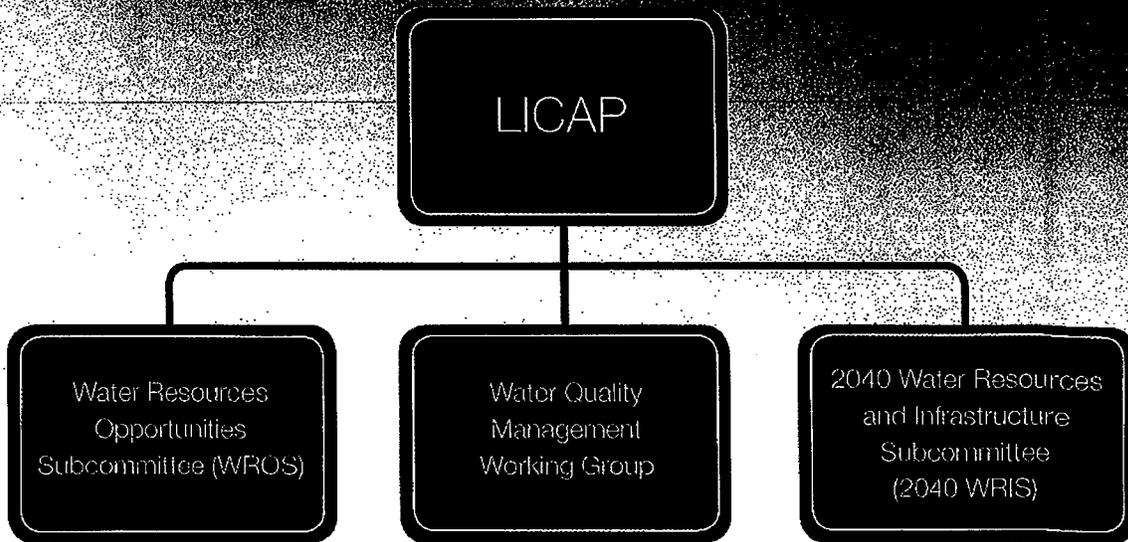
Legislation Establishing LICAP Nassau County

Legislation Establishing LICAP Suffolk County

BY-LAWS

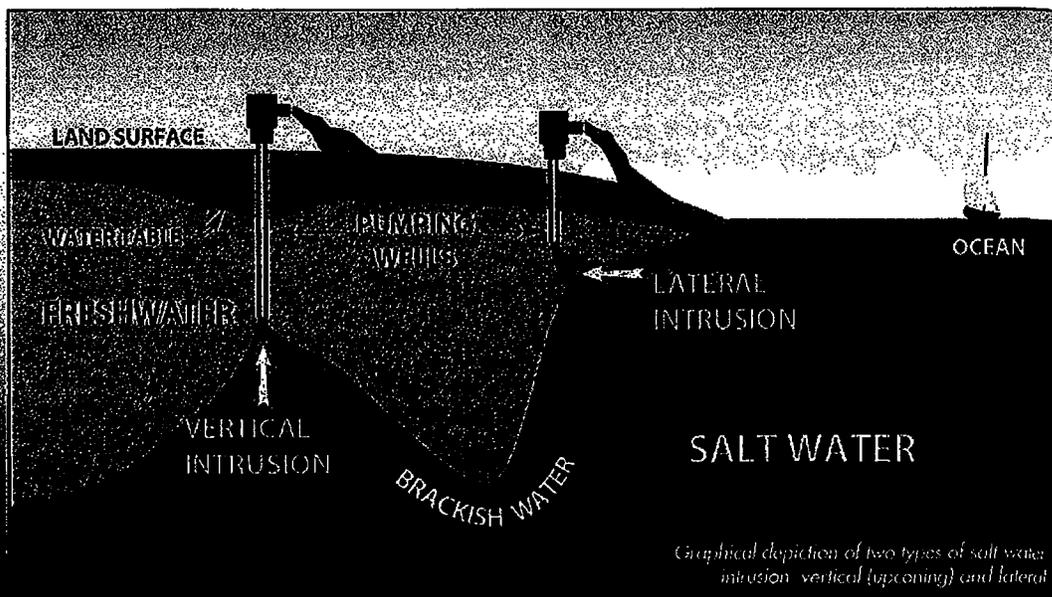
LICAP adopted its by-laws in 2014 for the internal governance and regulation of its affairs.

LICAP STRUCTURE



WROS – The Water Resources Opportunities Subcommittee was established as part of the original LICAP enabling legislation to identify and quantify short-term risks to groundwater. The WROS will look at potential short-term risks facing water suppliers, treatment and distribution of potable water from our sole source aquifer. Some short-term risks include pending water quality regulations, increasing demand for water during the peak season, plans for additional sewerage throughout Suffolk County, and groundwater contamination specific to volatile organic compounds, nitrates, perchlorate, carcinogenic volatile organic compounds, pharmaceuticals and personal care products, and salt water intrusion.

The issues, risks, and recommended actions identified by the WROS will be incorporated into the Groundwater Resources Management Plan to be released in 2017.



LICAP STRUCTURE

Water Quality Management Working Group

A common theme throughout the first year of LICAP meetings was the lack of a coordinated, regional water quality monitoring and reporting program. This ad hoc working group was created to address this concern. The primary objectives of this working group are (1) to determine which water quality parameters are most critical to monitor and report on annually through LICAP; (2) to develop a common/universal data reporting format; and (3) to identify the most appropriate platform for storing, analyzing and sharing the data.

2040 WRIS – The 2040 Water Resources and Infrastructure Subcommittee was established in the original LICAP enabling legislation to develop a 2040 WRIS Plan identifying long term risks to the water supply industry created by global climate change. The 2040 WRIS will also investigate ways that public water suppliers and other agencies involved in water supply in Nassau and Suffolk Counties can address these risks, by a combination of infrastructure and facilities management, regulatory changes, and alterations in consumer water usage.

The 2040 WRIS will identify three major criteria in its investigations. First, it will identify the specific environmental changes that are likely to occur, including sea level rise and the resulting changes to the aquifer system (i.e., salt water/freshwater interface and overall water availability), and projected alterations in weather patterns and resulting effects on both aquifer recharge and consumer demand. Second, the 2040 WRIS will determine what facility management responses will be needed to address environmental changes, such as long distance transmission of water, changes in well locations, and monitoring data requirements. The third investigative criteria will be to determine what consumer behavioral changes and regulatory requirements are necessary to achieve the responses mentioned above. The findings of the 2040 WRIS will be incorporated into the County Water Resources Management Plan for the LICAP will be due in 2012.



LICAP MEETINGS

LICAP has held five full commission meetings, eight subcommittee meetings, and two public hearings, one each in Nassau and Suffolk County. The full commission meets quarterly, the subcommittee meets bi-monthly, and at least one public hearing is held annually in each county.

All meetings of LICAP are open to the public.

GENERAL MEETINGS

March 27, 2014

June 25, 2014

August 13, 2014

November 18, 2014

February 11, 2015

SUBCOMMITTEE MEETINGS

2040 Water Resources and Infrastructure Subcommittee (2040 WRIS)

September 11, 2014

October 23, 2014

December 2, 2014

Water Resources Opportunities Subcommittee (WROS)

September 30, 2014

December 16, 2014

JOINT SUBCOMMITTEE MEETINGS

February 25, 2015

April 22, 2015

WATER QUALITY MANAGEMENT WORKING GROUP

March 31, 2015

PUBLIC HEARINGS

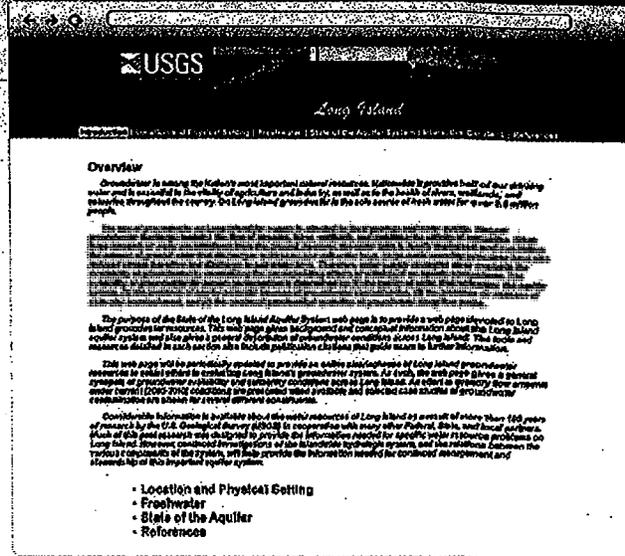
LICAP held public hearings in both counties and encouraged members of the public to attend, ask questions and offer suggestions about self-cleaning our aquifer system.

Nassau County September 11, 2014

Suffolk County October 23, 2014

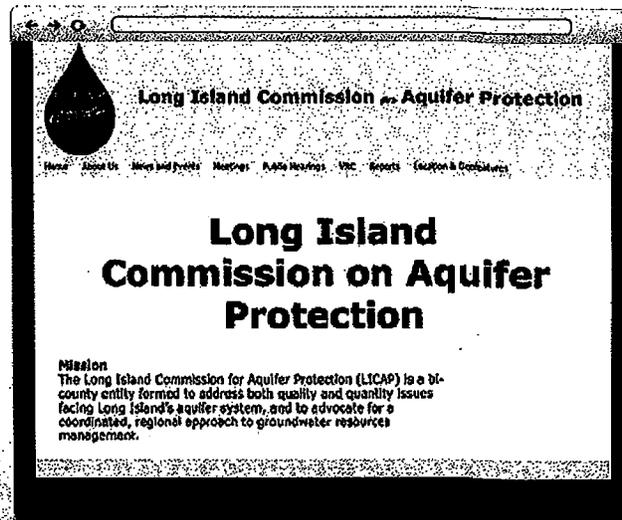
DELIVERABLES

- **State of the Aquifer Website**
State of the Aquifer website created:
<http://ny.water.usgs.gov/projects/SOTA/>
- **LICAP Website**
LICAP website developed:
www.liaquifercommission.com/home.html
- **Virtual Reference Collection**
A Virtual Reference Collection (VRC) of published research and studies about the Long Island aquifer system compiled and available through the LICAP website:
www.liaquifercommission.com/vrc.html



State of the Aquifer Website

- **State of the Aquifer Report**
Draft State of the Aquifer Report shared with the Commission. Revisions underway to incorporate the many helpful comments received.
- **Groundwater Resources Management Plan**
Groundwater Resources Management Plan preparation has begun through the efforts of both subcommittees.



LICAP Website

STATE OF THE AQUIFER

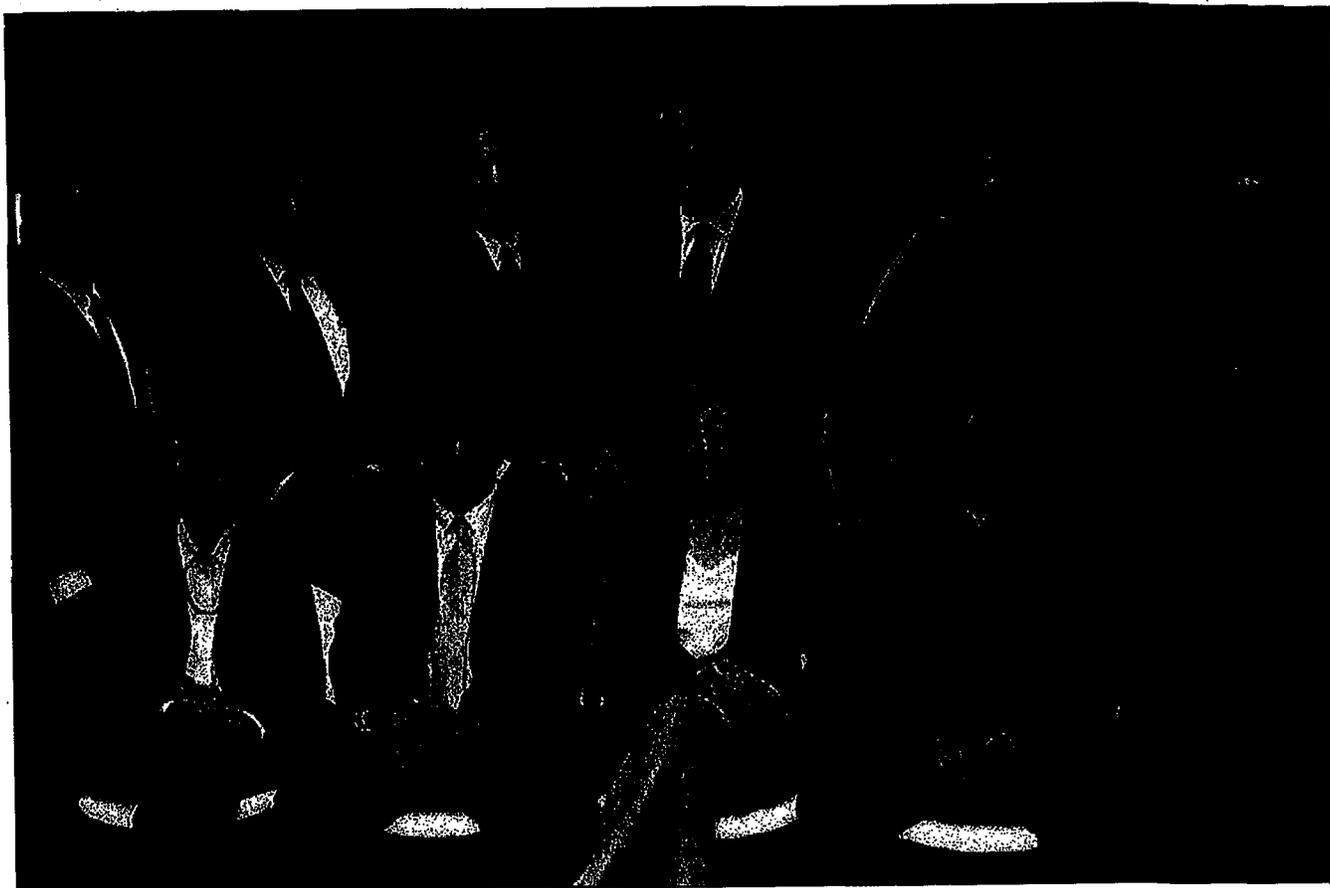


Long Island Commission for Aquifer Protection



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***Members of the Long Island Commission for Aquifer Protection and
the organizations, government entities or agencies they represent.***

Seated from left:

Sarah Meyland, Nassau County Legislature Minority Leader

Stan Carey, Nassau-Suffolk Water Commissioners

Carrie Meek Gallagher, New York State Department of Environmental Conservation

Stephen Terracciano, United States Geological Survey

Standing, from left:

Frank Koch, Long Island Water Conference

Don Irwin, Nassau County Department of Health

Brian Schneider, Nassau County Executive's Office

Michael White, Suffolk County Legislature's Presiding Officer

Walter Dawydiak, Suffolk County Department of Health

Chris Ostuni, Nassau County Legislature

Jared Hershkowitz, Suffolk County Legislature's Presiding Officer.



LICAP Facts

FOUNDED: By unanimous votes of the Suffolk County and Nassau Legislatures in 2013.

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, to be updated annually, and a Groundwater Resources Management Plan.

MEMBERS: LICAP has nine 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 and Suffolk County Executive each appoint one member as do the presiding officers of each county's Legislature. There are also 13 ex-officio members with no voting power.

COMMITTEE STRUCTURE: LICAP maintains two standing subcommittees: the 2040 Water Resources and Infrastructure Subcommittee will identify long-term risks to the water supply industry created by global climate change. The Water Resource Opportunities Subcommittee will identify and quantify short-term risks, if any, to groundwater resources.

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

The State of the Aquifer: Our Most Valuable Natural Resource Faces Challenges

The quality of water supplied to Long Island's residents by their community public water suppliers continues to be excellent, meeting or surpassing all federal and state standards. Local contamination issues are present in various locations in both Nassau County and Suffolk County, and some areas of Long Island face water quantity issues as well. Finding solutions to these issues is an ongoing task for Long Island's water professionals.

This report, and the formation of the Long Island Commission for Aquifer Protection itself, are part of the effort to address these challenges in a coordinated, regional manner. LICAP's goal is to play a vital role in making sure Long Island residents will always continue to enjoy the high quality of life that results from healthy groundwater resources.



Where does our water come from?

All water used by Long Islanders for drinking and all other purposes comes from groundwater situated below the land surface. Groundwater is found virtually everywhere beneath Long Island, contained within naturally occurring geologic formations known as aquifers. Long Island's aquifers are underground sand or gravel formations that store and yield significant quantities of water. The water itself is found in the empty spaces, or voids, between the sand and gravel grains. Water within the aquifers behaves in a manner similar to an underground sponge filled with water.

On Long Island, water initially enters these aquifers solely from precipitation (rain, snowmelt, sleet and hail) that falls to the ground and percolates vertically through Long Island's permeable soils until it reaches the aquifers. The "water table" represents the upper most part of groundwater stored in the aquifer system. Below the water table, the voids between the grains of sediment are completely saturated with groundwater. The water table lies just beneath the land surface at coastal locations. Beneath some hilly locations on central Long Island, the water table may be several hundred feet below the land surface.

Most parts of Long Island receive from 42 to 50 inches of precipitation per year (<http://ny.water.usgs.gov/pubs/wri014165/wrir01-4165.pdf> - page 8) Approximately half of this precipitation is lost to evaporation, the biological processes of plants (known as "transpiration"), or to surface waters ("runoff"). Approximately half of all precipitation enters the aquifer system ("recharge"). Recharge is far greater during the non-growing season (mid-September to mid-May) since evaporation and plant activity (together known as "evapotranspiration") are much less than during the warm months. Conversely, during the summer, very little recharge to the groundwater system occurs. The overall volume of precipitation that is recharged to the aquifer system, averaged all across Long Island and averaged throughout the year, amounts to approximately one million gallons per day of recharge for every square mile of land on Long Island.

The three principal Long Island aquifers are the upper glacial aquifer, the Magothy aquifer, and the Lloyd aquifer. The upper glacial aquifer directly underlies the ground surface. It was formed during the last ice age (approximately 10,000 years ago), as large masses of ice, known as glaciers, covered a large portion of North America, including parts of Long Island. The ice, and the meltwater streams emanating from the ice, deposited the boulders found on the

North Shore, and the sandy plains of the south shore. The water bearing sediments of the upper glacial aquifer typically consist of coarse sand and gravel, with some larger pebbles and boulders as well. Wells that tap this aquifer are capable of producing very large quantities of water. However, because it is the shallowest and most permeable of Long Island's aquifers, it is also most prone to contamination from land-derived sources. The vast majority of wells that provide water to farms, golf courses, and industry take water from the upper glacial aquifer. Additionally, most private wells that serve individual homes tap the upper glacial aquifer. The upper glacial aquifer is used for public supply purposes primarily on eastern Long Island, where the population is less dense, and the threat of contamination is also reduced. Many of these public supply wells require some type of treatment for land-derived contaminants. These contaminants and the treatment facilities will be described in greater detail in later sections of this report.

The Magothy aquifer is the largest and most extensive of Long Island's aquifers, and was formed approximately 65 million years ago. It contains sediments derived from erosion of the mountains to the west of Long Island. Consisting of fine sand and silt deposits alternating with clay, it attains a maximum thickness of approximately 1,100 feet in southeastern Suffolk County. The Magothy aquifer on Long Island is similar to coastal plain aquifers found up and down the east coast, as far south as the Carolinas. Water in the deepest portions of the Magothy aquifer on Long Island can be as much as 800 hundred years old. Though not as permeable as the upper glacial aquifer, wells that tap the Magothy aquifer are still usually capable of pumping large quantities of water. The vast majority of Long Island's public supply wells take water from the Magothy aquifer. A notable exception is on the North and South Forks of eastern Suffolk. In those areas, most of the Magothy aquifer contains naturally salty groundwater, and so public suppliers must utilize the upper glacial aquifer. There are also areas on Long Island where the Magothy aquifer is not present. Most of these areas are on the North Shore, where the actions of the glaciers gouged out large sections of the Magothy aquifer long after it was initially deposited. In western Nassau County high levels of groundwater pumpage in the Magothy aquifer have caused some degree of saltwater intrusion in portions of the barrier island communities on the South Shore of the County (Atlantic Beach, Lido Beach and Long Beach), and on

LONG ISLAND'S AQUIFER SYSTEM



the peninsulas on the North Shore (Great Neck, Manhasset Neck). This salt water intrusion in the Magothy on the south shore has also reached far enough inland to affect more "mainland" areas as well. Later sections of this report discuss this issue in greater detail.

The Raritan Formation underlies the Magothy, and was formed in a similar manner to the Magothy. Its two primary units are an upper clay member (the "Raritan clay") and a lower sand member named the Lloyd sand. The clay member is very impermeable in most areas, and so helps to minimize the movement of contaminants between the Magothy and Lloyd aquifers. Geologists call formations such as the Raritan clay a "confining" unit. The lower sand unit of the Raritan Formation comprises the Lloyd aquifer.

The Lloyd aquifer is the deepest and oldest of Long Island's aquifers. It consists mostly of fine sand and silt, and ranges from zero to 500 feet thick. At its deepest, it is ap-

proximately 1,800 feet below the surface. The water contained in the Lloyd aquifer can be as old as several thousand years. The Lloyd aquifer is not used as extensively as the Magothy, since the Magothy is a highly productive aquifer, and because a moratorium on construction of new Lloyd wells was enacted in 1986 by the New York State Legislature. Due to its depth and degree of "confinement" by the overlying Raritan clay, the Lloyd is generally much less prone to contamination than either the upper glacial or the Magothy aquifers. However, due to its lower permeability and its confined nature, it is not as productive as the other two aquifers. Nevertheless, approximately 40 public supply wells in Nassau County and five public supply wells in Suffolk County draw water from the Lloyd aquifer. Most of these wells were permitted prior to the 1986 moratorium. Some western Nassau water suppliers have seen saltwater intrusion in parts of the Lloyd aquifer as a result of the extensive pumping. The Lloyd is underlain by bedrock, which is not a source of water on Long Island. Several exploratory borings have been drilled through the full extent of the aquifer system and into the bedrock. However, these have been largely for "academic" studies, rather than for the purpose of pumping water from them. There are also several other geologic layers found beneath Long Island that are not water bearing. They include the Gardiners clay and the Monmouth Greensand. They are situated beneath the upper glacial aquifer and above the Magothy, and are considered "confining units" (<https://pubs.er.usgs.gov/publication/ofr95401> - page 6). These formations are typically found throughout the south shore of Long Island, and are important on a local scale.

These three major aquifers, together with several minor aquifers that occur in portions of Nassau County, comprise what is known as the Long Island aquifer system. Since this aquifer system is the only source of drinking water for Nassau and Suffolk Counties, in 1978, the United States Envi-

How did the Long Island aquifer system form?

The sediments that comprise Long Island's aquifers were deposited during two distinct time periods in geologic history. The Lloyd and Magothy aquifers were formed approximately 60 to 140 million years ago by the deposition of sediments originating from the erosion of the Appalachian Mountains located to the west of Long Island. The Long Island area at that time resembled the Mississippi River Delta in terms of climate and surface characteristics. The upper glacial aquifer was formed approximately 10,000 years ago when the large continental glaciers that covered large portions of North America (including present-day Long Island) melted. The ice itself, as well as the streams emanating from the ice sheets as they melted, carried sand and gravel southward from them. They also left behind the large boulders observable today on the North Shore of Long Island and the sandy hills of central Long Island. These latter two features, known as "terminal moraines", indicate the actual southernmost advancement of the ice sheets themselves.

proximately 1,800 feet below the surface. The water contained in the Lloyd aquifer can be as old as several thousand years. The Lloyd aquifer is not used as extensively as the Magothy, since the Magothy is a highly productive aquifer, and because a moratorium on construction of new Lloyd wells was enacted in 1986 by the New York State Legislature. Due to its depth and degree of "confinement"

Are there any supplies on Long Island that don't use groundwater?

The small island of Fisher's Island has a surface water treatment system to augment its main public water supply, which is from two very low capacity wells located on the Island. Even though Fisher's Island is physically separated from the main body of Long Island (and actually has a New England zip code), it is part of the Town of Southold and therefore of Suffolk County. The primary source of water for residents on and vacationers to Fisher's Island is groundwater supplied by small capacity shallow wells tapping the upper glacial aquifer. Fisher's Island does however, have an auxiliary supply of public water from a surface water source - a small pond located on the Island. Therefore this facility represents the only non-groundwater public supply water source anywhere within Nassau or Suffolk Counties.



Welcome

In late 2013, a group consisting of water utility representatives, elected officials and scientists joined to form the Long Island Commission for Aquifer Protection (LICAP) to assess the long-term health of Long Island's aquifer system and to develop a blueprint for its protection. This inaugural State of the Aquifer report is the first step in realizing these goals. We hope that this report, which will be updated every year, will serve as a vital tool in keeping Long Island residents informed about the aquifers that provide all of our drinking water and helping them to make better decisions about how to keep our drinking water safe.

A noteworthy finding during LICAP's first two years is that there are significant data gaps in island-wide water quality information that make it very difficult to draw any definitive conclusions about patterns of contamination. One primary objective of LICAP is to create a water quality database connecting all of Long Island, as well as an island-wide monitoring program. We expect that these steps will help us to better draw conclusions about specific threats to the aquifer system and the potential damage of each threat.

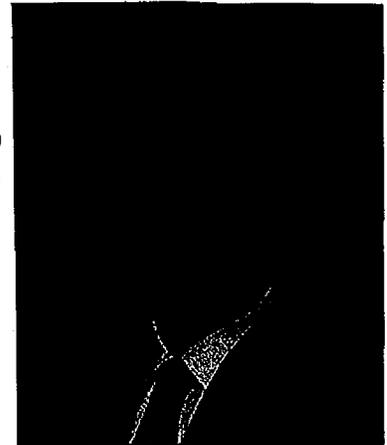
While there can be no doubt that Long island's groundwater faces threats every day, island residents can be assured that the quality of the drinking water provided by Nassau and Suffolk's public water suppliers is excellent and will continue to be so in the future. Given the extensive water quality testing required of these providers by state and federal law, the millions of dollars spent on treatment systems to remediate contaminants, state-of-the-art technologies including computerized groundwater and distribution system models and the technical expertise of those overseeing Long Island's aquifers, groundwater-related threats can be prevented from becoming drinking water problems impacting Long Island residents. As a result, Long Island's public drinking water supply remains safe.

The purpose and primary focus of this first State of the Aquifer report is to ensure that as many Long

Islanders as possible understand that all the water they drink comes from the ground directly beneath us, and thus the actions we take directly above it, impact the quality of the water we depend on for daily use. With this in mind, we've included in this report information about the water cycle, how the aquifer system beneath Long Island was formed geologically, the various systems used to collect and treat wastewater, how land use and population growth have influenced water quality and quantity, the threat from saltwater contamination and other contaminants and the overall quantity of water in our aquifer system in relation to the amount we use. Since we are all living and working directly on top of our water supply, issues concerning the quality and quantity of water in Long Island's aquifers directly impact the quality of all of our lives.

Sincerely,

Jeffrey W. Szabo
Past Chairman, LICAP



Frank Koch
Current Chairman, LICAP

LONG ISLAND'S AQUIFER SYSTEM



Environmental Protection Agency (USEPA) designated the Long Island Aquifer System a "sole source aquifer," thereby affording it a high degree of legal protection.

In addition to groundwater's importance as a critical resource for drinking and other purposes, virtually all surface water bodies on Long Island exist because of groundwater that naturally discharges into them. There are over 100 stream channels on Long Island, typically less than five miles long, that flow to the tidewater that surrounds Long Island. The channels were formed by glacial melt water and therefore are more abundant along the southern shore than along the northern shore. Groundwater discharge to streams has a major effect on flow patterns within the groundwater system. Under pre-development conditions, about 21 percent of precipitation was discharged to streams (<http://ny.water.usgs.gov/projects/SOTA/aquifer.html>).

Under natural conditions, approximately 90% of the flow of rivers and creeks is due to the contribution by groundwater discharging into them, while only about 10% of their flow is attributable to surface runoff. Therefore, all of Long Island's surface waters (rivers, lakes, and estuaries such as the Great South Bay) depend on groundwater in order to maintain their viability and health.

In developed portions of western Long Island, the combination of both intense groundwater pumpage and regional sewerage has reduced the volume of groundwater to the point where it has seriously affected surface water bodies

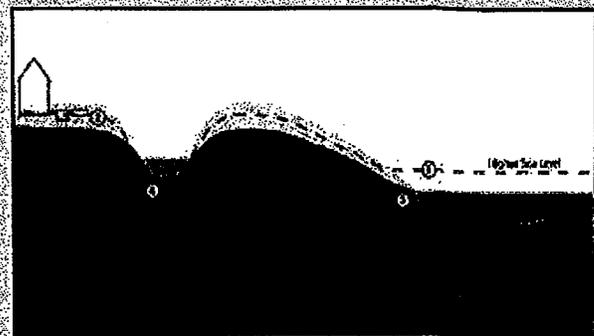
All of Long Island's surface waters (rivers, lakes, and estuaries such as the Great South Bay) depend on groundwater in order to maintain their viability and health.

In contrast, in unsewered areas of central and eastern Long Island, the use of cesspools and septic systems has not affected the overall quantity of groundwater. However, the quality of shallow groundwater has become impaired to some degree, and this has negatively affected water quality in rivers, creeks and bays. As the quality and quantity of Long Island's groundwater changes over time, so too will the health of these critical surface water ecosystems.

Sea Level Rise Impact on Coastal Water Resource

Should even the most moderate predictions of sea level rise be accurate, levels will rise 2 feet between now and 2100, more than tripling the frequency of dangerous coastal flooding throughout most of the Northeast. Subsidence will compound, with the coastal land mass of New York slowly sinking at 1.35 mm/yr (<http://www.ngs.noaa.gov/CORS/Map/>). In addition there has been a 70% rise in extreme precipitation in the Northeast, from 1958 to 2010.

Sea level will impact coastal groundwater systems, raising the fresh water table, thus increasing basement flooding and septic system failure. Groundwater supplies can be contaminated due to landward and upward movement of sea-water in coastal aquifers, impacting the freshwater-saltwater interface near public groundwater supply wells. Pumping from public supply wells in coastal aquifers underlain by saltwater can lower the water table with respect to sea level, decreasing the depth to the freshwater-saltwater interface beneath the pumping well. This increases the potential for saltwater intrusion, and potentially limits the amount of potable water available from the well. (<http://wh.er.usgs.gov/slr/coastalgroundwater.html>)



A rise in sea level will affect ground-water flow in coastal aquifers (1). An increase in the elevation of the water table (dashed-blue line) may result in basement flooding and compromise septic systems (2). A rise in sea level may also result in an upward and landward shift in the position of the freshwater-saltwater interface (3). Where streams are present, an increase in the water-table elevation also may increase ground-water discharge to streams and result in local changes in the underlying freshwater-saltwater interface (4).



The Water Cycle

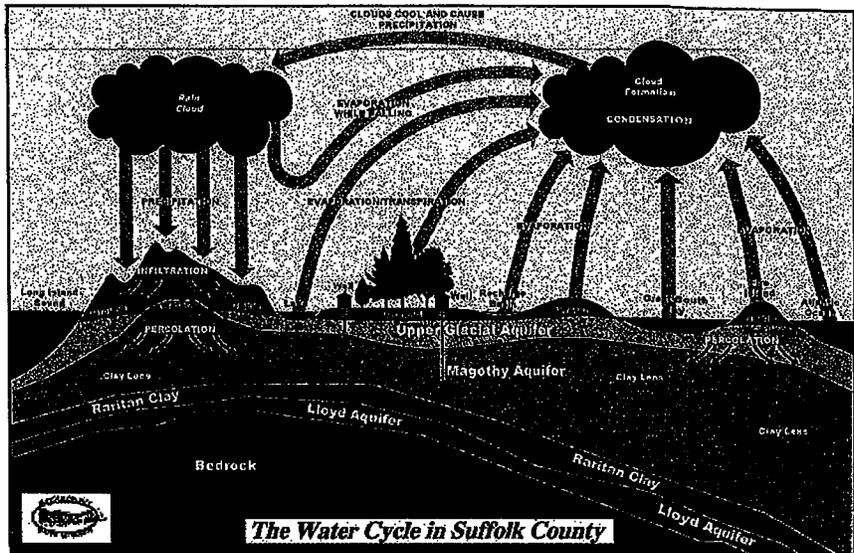
The overall quantity of water within the Earth and its atmosphere has remained the same throughout the Earth's history. The Earth's water may change its phase—solid, liquid, vapor, or gas—or its location—the ocean, a glacier, river, or below ground,—but the overall quantity of the Earth's water is a constant. On Long Island, we are fortunate to be located in an area of relatively abundant fresh water. Many places on the Earth, such as deserts or small, isolated islands - have much less available fresh water. The water cycle—also known as the “hydrologic cycle”—is the term used to describe everything that happens to water as it moves, or cycles, through the earth and the atmosphere. Since water is in constant motion throughout the earth and its atmosphere, the water cycle has no beginning and no end. In this example, we will begin our entrance into the water cycle in the Earth's oceans.

As heat from the sun warms the water in the oceans, some of that water evaporates and rises into the air. Additional water enters the atmosphere as plants give off water through their biological activity, which is known as transpiration. The combination of these two processes is known as evapotranspiration. Water given off by evapotranspiration rises into the atmosphere to a certain point, at which the atmosphere becomes saturated with water vapor. This water then condenses to create clouds. As clouds continue to accumulate more water vapor, this vapor falls from them as precipitation. Once precipitation reaches the land surface, it can take several different paths.

Some precipitation falls on impervious surfaces such as pavement, and flows over land into surface water bodies (*lakes or streams*). This process is known as runoff. Some precipitation may be immediately utilized by plants, and some may also evaporate quickly after reaching the surface (“evapotranspiration” as described above). Approximately 50% of precipitation enters the underground aquifers as recharge. On a yearly basis, the recharge to the aquifer system from precipitation amounts to approximately one million gallons per day per square mile of land on Long Island.

Once water enters the aquifer system, it moves from areas of higher elevation to areas of lower elevation. The average speed of groundwater flow is approximately one foot per day in the horizontal direction, and approximately 1/10 of a foot per day vertically. The speed at which groundwater moves through the aquifers depends upon a number of factors. Some groundwater will flow naturally out of the aquifers (or “discharge”) into surface waters, such as rivers, lakes, tidal waters (such as the Great South Bay), or far offshore beneath the Atlantic Ocean or the Long Island Sound. This journey, from where water enters the aquifer as precipitation, to where it discharges from the aquifer, may take up to several thousand years under natural conditions. Some groundwater discharges by being pumped from a well. The pumping of wells can greatly accelerate this horizontal and vertical movement. For this reason, contaminants introduced at the surface can be drawn into the deeper aquifers much faster than if there were no pumping.

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Water Cycle Definitions:

Condensation – the change in state from a gas or vapor to a liquid.

Evaporation – the conversion of a liquid to the vapor state.

Evapotranspiration – the overall process whereby water is released to the atmosphere from plants and animals (transpiration), as well as evaporated from soils and surface water bodies.

Infiltration – the process by which water enters the subsurface.

Precipitation – the falling of water in liquid or solid form that occurs when the atmosphere becomes saturated with water vapor.

Recharge – the addition of water into the aquifer system.



Will Long Island run out of water?

Nassau and Suffolk counties together comprise approximately 1,200 square miles of land mass. The aquifer system extends beneath virtually all of this land mass (and beneath many of the bays and inlets, and into Queens and Brooklyn as well), and varies in thickness from a few hundred feet beneath the north shore of Nassau, to well over 2,000 feet beneath southeastern Suffolk County. Using only the two-county land surface area, and using a conservative estimate of 1000 feet (roughly 2/10 of a mile) for its average thickness, this amounts to a volume of 240 cubic miles of saturated aquifer material beneath the two counties. Given the typical porosity of 25 percent for sand and gravel aquifers, one can calculate that Nassau and Suffolk counties together have over 65 trillion gallons of groundwater stored within its aquifer system. Precipitation adds approximately 300 billion gallons of recharge to the aquifers annually. Some groundwater naturally discharges from the aquifers via subsurface flow into rivers, lakes, and estuaries. Total annual pumpage from the aquifer system beneath Nassau and Suffolk Counties is approximately 150 to 200 billion gallons. Therefore, total pumping throughout Long Island is less than recharge by precipitation, and only a fraction of the overall volume of water already stored in the aquifer system.

However, this does not mean that water can be pumped freely out of the aquifers without any impacts. Any use of groundwater and any change in surface activities will have some effect on either the quality or the quantity of groundwater (or both). For example, increased pumping will reduce the volume of groundwater that ultimately flows to streams, possibly changing the character of that stream or of the body of water into which that stream discharges. Pumping from deeper aquifers may move shallow contaminants deeper into the aquifer system. Excessive pumping will cause salt water to migrate into freshwater aquifers, thus impairing water quality. And, as more pollutants enter the aquifer system there will also be less uncontaminated water available for drinking without the use of costly treatment facilities. Finally, the long term effects of climate change may alter precipitation patterns and affect water usage by consumers, groundwater recharge, and natural groundwater discharge to surface water

bodies. Long Island is not expected to run out of water at current and future levels of pumpage and recharge. But improper management of water resources could significantly alter both the quality and quantity of Long Island's groundwater, and as a result alter our quality of life.

Water Efficiency and Conservation

In many parts of the United States, the main purpose for water conservation is to reduce consumption as much as possible in order to maximize the life of a very limited resource.

Extreme Conservation - Southern Nevada

In other parts of the country, extreme conservation measures have been implemented in the face of severe water shortages. An interesting example is the Southern Nevada Water Authority in the Las Vegas area. Since 1991, the Southern Nevada Water Authority (SNWA) has developed and implemented one of the most progressive and comprehensive water conservation programs in the nation. Conservation efforts in the Las Vegas Valley have helped the community reduce its per capita water use by more than 40 percent between 2002 and 2014. (<http://www.snwa.com/consrv/goals.html>)

One interesting program that SNWA has instituted a "turf buyback" program, in which it reimburses business owners \$2 for every square foot of irrigated turf that the business replaces with desert landscaping for the first 5,000 square feet, and \$1 per square foot thereafter (for a maximum of \$300,000). SNWA projects a savings of 825,000 gallons of water per year for the average 15,000 square-foot conversion to "water-smart" landscaping. (http://www.snwa.com/biz/rebates_wsl.html) The SNWA estimates that the turf buy back program has eliminated over 174 million square feet of grass and has saved over 88 billion gallons of water since the program began in 1999 (<http://www.snwa.com/consrv/goals.html>). While these types of measures are not necessary, and this volume of water savings would probably not be realized on Long Island, it is quite revealing to see what conservation measures are a reality in truly water-stressed areas of the United States.

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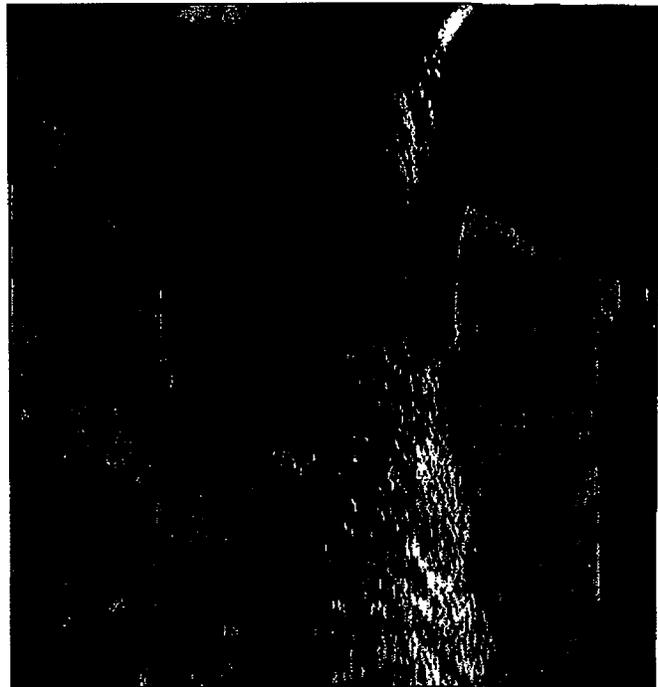
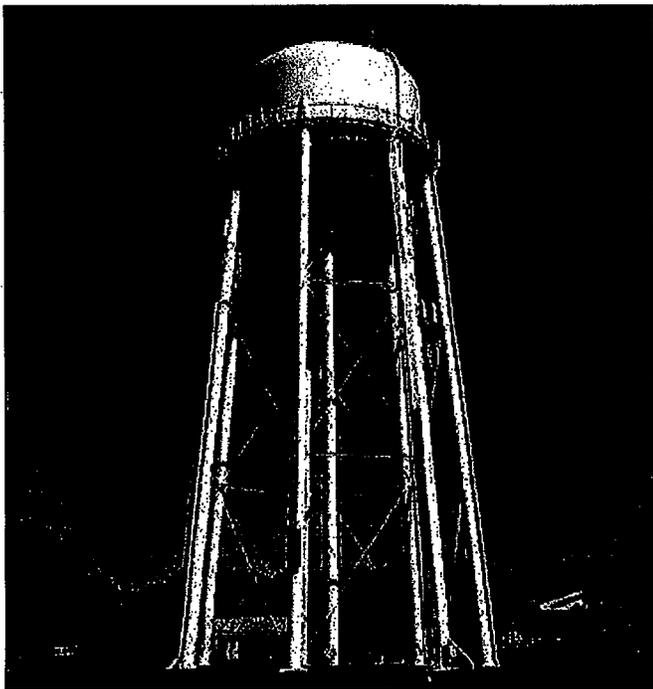


Strict water use limitations and water conservation measures are a normal part of everyday life in many parts of the United States. Conservation on Long Island is not a matter of preserving a limited quantity of water, but rather one of using our groundwater more efficiently and managing peak usage of water, especially for non-potable purposes such as lawn irrigation.

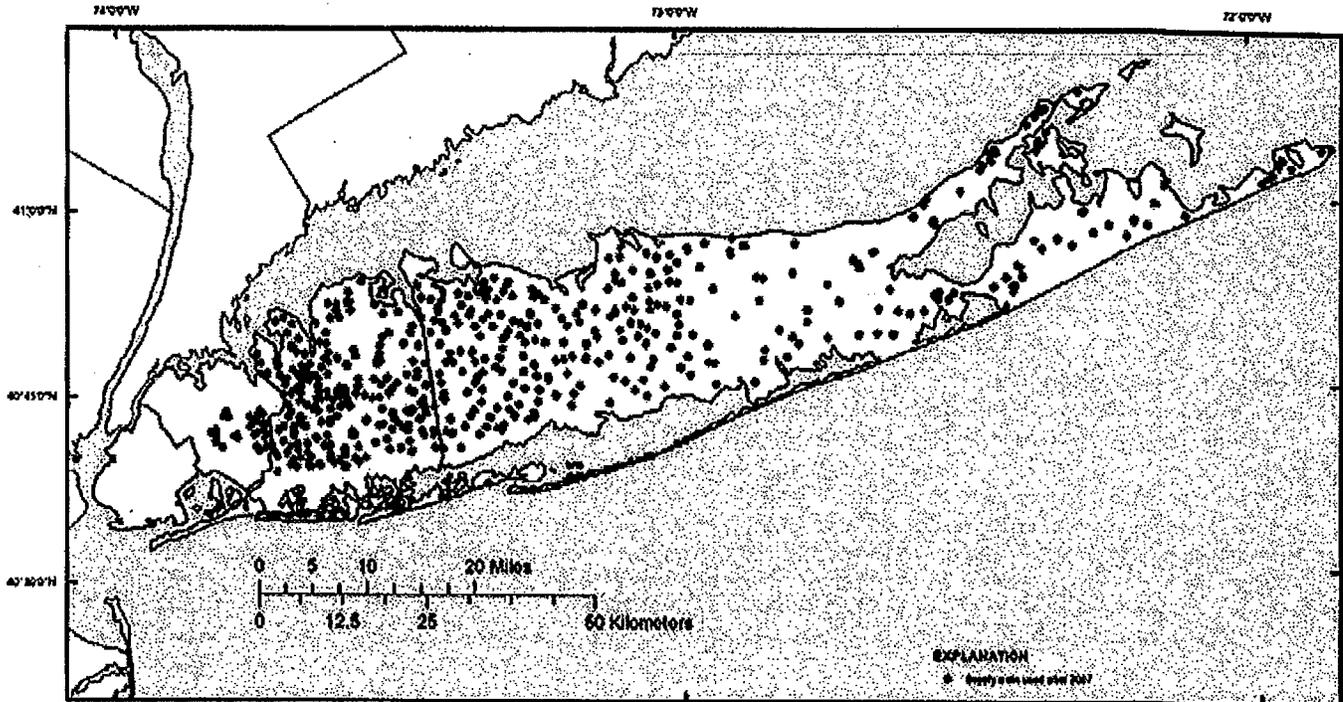
Some savings in indoor water uses have been realized on Long Island through the use of low flow plumbing fixtures (toilets, shower heads), but the most significant potential for conservation and demand management lies in addressing outdoor water use, particularly lawn watering. According to the Suffolk County Comprehensive Water Resources Management Plan ("Comp Plan"), approximately 30 to 60 percent of total pumpage from two of Suffolk's largest water suppliers can be attributed to outdoor use (p. 4-36). The Riverhead Water District (RWD) experienced severe increases in demand during the hot, dry summer of 2010, when pumping of all of the District's 13 wells was not sufficient to keep up with demand on several peak days. The Riverhead area experiences a seasonal population increase during the summertime, so some of this water use can be attributed to tourism. However, a large portion of this increase in water demand is attributable to lawn watering. The RWD has since installed several additional wells to meet this summertime demand, but a conservation program to reduce peak pumpage would be beneficial.

One Town in Suffolk County that has imposed strict conservation measures is the town of Shelter Island. Given the limited fresh water resources on the Island, new sprinkler systems have been outlawed for several years, and existing systems were required to be abandoned by late 2013 (Comp Plan, p. 4-37). Other, less drastic conservation measures that have been implemented or recommended elsewhere on Long Island have included: mandatory & voluntary "odd-even" lawn watering, altering water rate structures to make high rates of water use more expensive and requiring rain sensors for all lawn irrigation systems. Nassau County enacted a conservation ordinance in 1987 addressing many of these issues.

Although we have enough water to meet present and future demands if managed properly, there are many reasons why conservation is important. Since water from Long Island's wells must be pumped out of the ground using high capacity electrically driven well pumps, conserving water also conserves energy by reducing the amount of electricity needed to meet water demand. Conservation also reduces the need to construct new wells, treatment facilities, and tanks to meet demand, thus saving rate payers money. Conserving water insures that there will be sufficient water pressure – even during peak demand periods – to fight fires. In summary, conserving water not only saves money, it ensures that there will be an adequate supply for future generations.



Water Use on Long Island



Locations of public supply well fields on Long Island

The most significant use of groundwater on Long Island is for public drinking water supply. Between 1985 and 2005, it is estimated that approximately seventy to eighty percent of groundwater withdrawn from Long Island's aquifer system was used for this purpose. In 2014, Long Island's public water suppliers pumped an average of 413 million gallons per day (mgd). There are also an estimated 200,000 people not connected to public water that utilize their own private well for their water supply. The number of private wells is estimated at 47,000 (Comp Plan, p. 4-6), and they pump an estimated 15mgd. Total water use for all purposes (potable, irrigation, and commercial/industrial) on Long Island is estimated at 450 to 500 mgd. Over seventy five percent of all groundwater withdrawals are from the Magothy aquifer.

It is important to recognize that not all water pumped is necessarily consumed. For example in unsewered areas, much of the water pumped for public supply returns to the groundwater system as infiltration through onsite-septic systems (recharge from wastewater return). Some other uses of groundwater are similar in that some portion of the water pumped is returned to the aquifers. (<http://ny.water.usgs.gov/projects/SOTA/aquifer.html>). However, any water used for landscape or agricultural irrigation is not considered to be returned to the aquifer system.

Residents of Nassau and Suffolk Counties obtain their public drinking water from a decentralized network of water supply wells located throughout both counties. These wells are located within the areas where the water that they pump is consumed. The figure above shows that the development of public water infrastructure on Long Island tends to follow a pattern very similar to population trends. Where population density is greatest, such as in Nassau County, there tend to be more well fields per square mile and therefore more intensive water supply pumping. In total, there are approximately 1,200 community public supply wells throughout Nassau and Suffolk counties.

The aquifer system underlying some portions of Nassau County has experienced some degree of water quality degradation (particularly salt water intrusion) due to this intensive use in localized areas. While western Suffolk exhibits water supply infrastructure trends similar to Nassau, there have been no such water quality issues relating to overuse in that part of Suffolk County. In stark contrast to Nassau, there are large portions of eastern Suffolk County that have not been developed extensively (or at all) with public water supply infrastructure. As a result, numerous homes in eastern Suffolk are not served by public water, and continue to utilize individual private wells for their water supply. There are an estimated 47,000 private wells supplying drinking water to

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homes in Suffolk County.

Seasonal use is a major factor in how much water is pumped and used on Long Island. During the past 30 years, there has been a marked increase in summertime water usage across Long Island. In Nassau County during the period from 1988 to 2009, summer pumping averaged 220-340 mgd while the winter averaged 130-150 mgd. For Suffolk County, the summer average was 160-360 mgd and for winter the average was 80-100 mgd. This is largely attributed to the increased use of underground sprinkler systems for lawn irrigation. Outdoor recreational activities and increased summertime population in some areas, also contribute to increased water use. However, even in Nassau and western Suffolk County with minimal population increase in the past decades, per capita water usage has increased significantly, due almost entirely to lawn watering with automatic sprinkler systems.

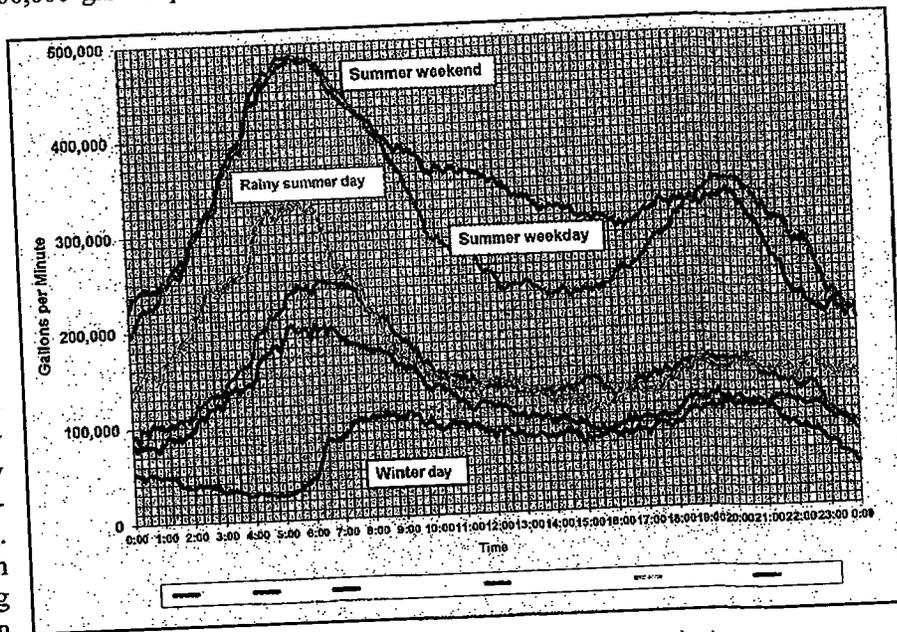
The graph on this page shows overall system wide pumpage at SCWA on several specific days in 2007. The dark blue line shows demand during a typical winter day ranging from a low of approximately 20,000 gallons per minute (gpm) to a high of approximately 100,000 gpm. This level of usage can be considered the baseline, or "essential" volume of water necessary for typical residential indoor purposes. In stark contrast to this, the red line on the graph shows water usage during a summer weekend day. Usage ranged from a low of approximately 200,000 gallons per minute to a high of almost 500,000 gallons per minute—almost 10 times the water use at the same time of day in the winter. This means that public water suppliers must provide sufficient well capacity and infrastructure to handle this additional water demand on peak summer days above and beyond what is necessary for "normal" usage, largely for the purpose of accommodating lawn watering, although seasonal population increase is also a factor in some places. Also shown on this graph is water usage during a rainy summer day (light blue line). Even during this rainy day, water use peaked at approximately 350,000 gpm in the early morning. The remaining lines on the graph (green and magenta) show water use on spring and fall days, respectively. Demand on those days lies somewhere between winter and summer usage, as expected.

These seasonal water use patterns point to the necessity for water suppliers throughout Nassau and Suffolk

to manage peak water demand, in order to maximize water supply efficiency. Reducing summertime peak pumpage "spikes" is an essential ingredient in such a strategy. If the summertime peaks could be reduced by as little as five percent, instantaneous demand for the SCWA system would be reduced by approximately 25,000 gallons per minute. This represents approximately 20 wells that would not have to be pumping at that time. The energy savings of this reduced pumping are significant. Additionally, both fire protection and operational redundancy would be enhanced by having this extra well capacity in reserve. Should similar conservation-based demand reductions be realized throughout Nassau and Suffolk, overall stresses on the aquifer system could also be reduced, with obvious benefits to the aquifer system.

Non-potable water uses are also significant in different portions of the Long Island area. The vast majority of wells used for these purposes take water from the upper glacial aquifer. Farms and golf courses pump large volumes of water from the aquifer system. There are over 200 wells supplying irrigation water to golf courses on Long Island. Additionally, agricultural water use is quite extensive in eastern Suffolk County.

Suffolk County has for many years been among the top three agricultural counties in New York State, based on the dollar value of crops produced. These agricultural products all depend on the availability of groundwater for irrigation. The number of active agricultural wells is difficult to de-



This graph illustrates the demand, in gallons per minute, on the entire SCWA supply system, throughout the day on several specific days during one calendar year. Note the difference in demand in the early morning in winter (blue line) vs. summer (red line) due mostly to lawn watering.

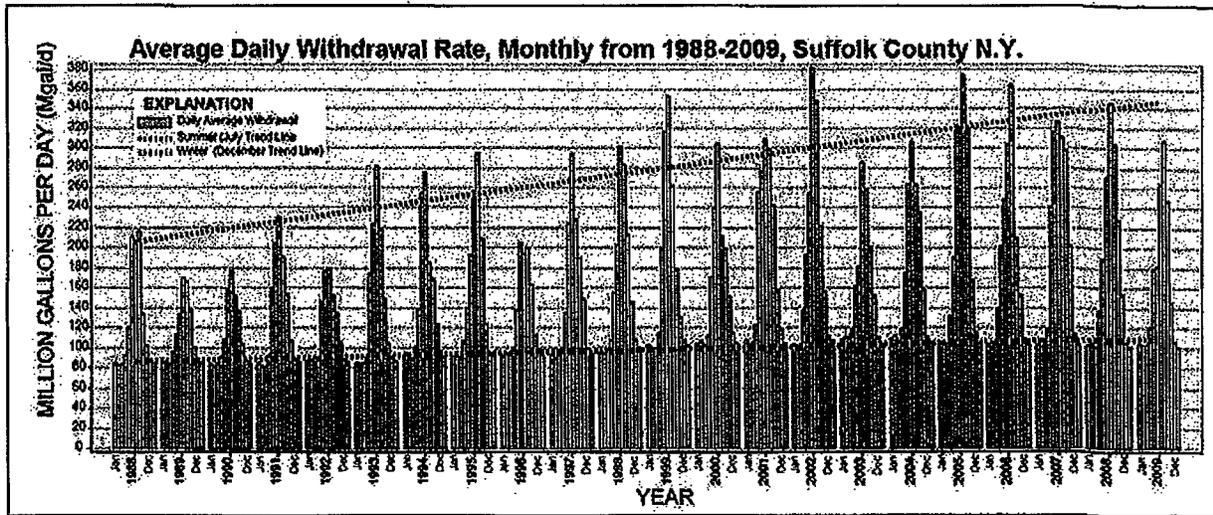
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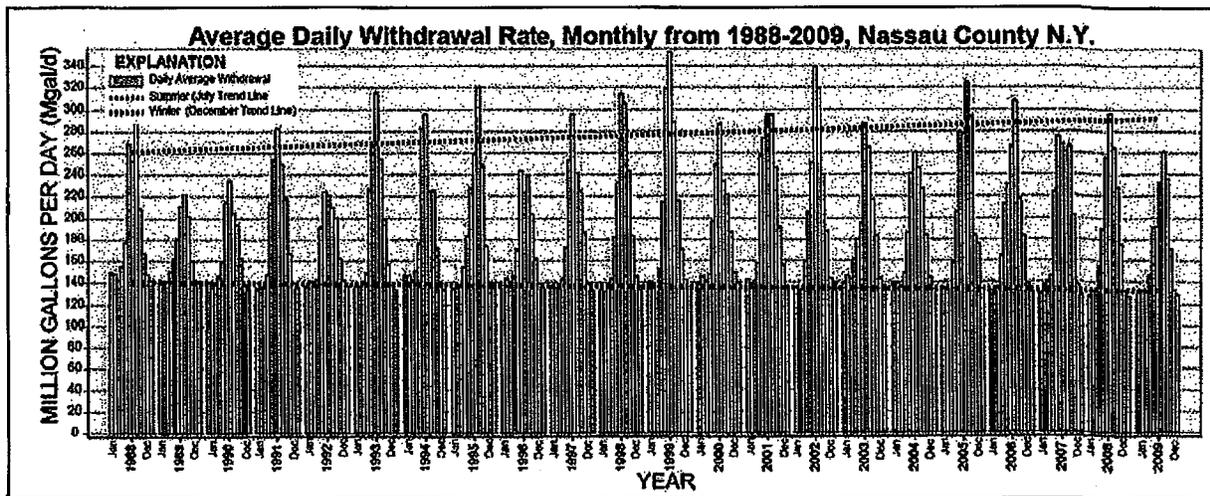
termine. Many of these wells are not documented, because they may have been in service for decades, and pre-date any permitting programs.

Farms and golf courses use all of their water between mid-April and mid-October, adding to the increased seasonal stress on the aquifer system during that time. If these seasonal stresses are significant enough, long-term impacts to both the quality and quantity of Long Island's groundwater can result. The United States Geological Survey estimates that the total groundwater pumpage for agricultural and golf course irrigation is approximately 10 mgd when averaged throughout the year.

There are also hundreds of wells throughout Nassau and Suffolk that supply water for laundry facilities, lake and pond augmentation, cooling and heating operations, and other industrial processes. Numerous wells also pump water for construction dewatering operations, and as part of groundwater contamination clean-ups. All of these wells use water from the Long Island aquifer system, and contribute to the overall water use throughout Long Island. In 2005, an estimated 67 mgd was used for industrial purposes across Long Island (<http://ny.water.usgs.gov/projects/SOTA/aquifer.html>)



The graph above shows the overall trend in public supply water use in Suffolk County. While winter pumpage has increased slightly over time, summer pumpage has increased much more dramatically.



The graph above shows data from the same time period for Nassau County. Winter pumpage has actually decreased in Nassau over time. Summer pumpage has shown a slight increase, but nothing of the magnitude seen in Suffolk.



Land Use and Water Quality

Land use and land management practices can have a significant impact on the quality and quantity of water within the aquifer system. With approximately three million residents living and conducting business and industrial activities above the water supply, contaminants released at the land surface can seep through the ground and reach the aquifers. Despite these population and land use pressures, the quality of drinking water provided by Long Island's community water supply systems continues to meet all state and federal drinking water standards. However, there are areas throughout Long Island where groundwater quality has degraded over time due to land use activities. This fact highlights the lifestyle choices desired by Long Islanders and the potential groundwater impacts resulting from them.

Whether or not any degraded groundwater quality impacts drinking water depends on a number of factors, including the depth, locations, and pumping rates of any nearby drinking water wells, the natural direction of groundwater flow in the area and the subsurface geology. Groundwater quality is affected by both human activities and natural processes that occur as groundwater flows through the aquifer system. The arrangement of the geologic layers beneath the subsurface also plays an important role in the susceptibility of the aquifer to changes in water quality.

An unconfined aquifer is one that has no impermeable layers (usually consisting of clay) above it. The upper glacial aquifer is an example of an unconfined aquifer. Because groundwater can flow easily into an unconfined aquifer from the land surface above it, unconfined aquifers like the upper glacial are more vulnerable to contamination from land surface based sources. A confined aquifer has a low permeability layer lying above it, between the aquifer and the land surface. These types of aquifers are less vulnerable to land based contamination, due to the low permeability effects of the overlying confining units. The Magothy aquifer is unconfined in some areas, particularly on the north shore, and confined in other locations on Long Island (<https://pubs.er.usgs.gov/publication/ofr95401> - page 6). The Lloyd aquifer is confined over virtually its entire extent, which is one reason why it is much less prone to surface-derived contamination than the other two aquifers. As a general guideline, the deeper beneath the ground that an aquifer is situated, and the greater its degree of confinement by overlying clay layers, the less prone it is to contamination. However, there are numerous localized exceptions to this.

It is a well known fact that human activity can have a major impact on groundwater quality. Urban and suburban development above the aquifers can reduce aquifer recharge by increasing the area of impervious surface. Additionally, the

manner in which domestic wastewater is managed – whether by regional sewerage or via individual septic systems – has important implications for shallow water quality (and water quantity), especially when the density of suburban development is considered. High density residential development in unsewered areas has a high potential to introduce contamination (especially nitrate) to underlying groundwater. Larger residential lot sizes, and reduced population density usually result in a lower nitrogen impact to the aquifers in unsewered areas. This may be somewhat offset by nitrogen impacts from residential lawn fertilization, which may be greater in areas with larger lot sizes. Human activity can pollute the water that recharges the aquifer, as well as runoff that flows into surface waters. Regional sewerage with ocean discharge of the effluent, as is practiced in almost all of Nassau and parts of Suffolk Counties, has helped reduce the pollutant load to the upper glacial aquifer from domestic and industrial wastewater. However, this type of sewerage has also reduced the overall volume of water in the upper glacial aquifer by conveying domestic wastewater out to tidal waters, thereby removing it completely from the aquifer system. While there have been some negative consequences to this (such as declining water levels), the overall contamination loading to shallow groundwater has been reduced in such sewerage areas.

Although residential development can have an adverse impact on groundwater quality, particularly with regard to nitrate, land use impacts to groundwater are certainly not limited to residential development. Agricultural practices may also adversely impact groundwater by introducing nitrate, pesticides, and other chemicals associated with farming. In addition, commercial and industrial land uses may be a source of volatile organic compounds (*Camp, Dresser, and Mckee, 2009*). There have been numerous large VOC plumes that have affected communities across Nassau and Suffolk, and have necessitated extensive and costly clean-ups. Industrial sites such as Grumman in Bethpage, Northville Industries in both Setauket and Holtsville, Lawrence Aviation in Port Jefferson, Lockheed Martin in Lake Success, and Brookhaven National Laboratory in Upton (to name only a few) have had a long history of extensive VOC contamination and resulting remediation efforts. Once pollutants are discharged at the surface or into the shallow portions of the aquifer system, pumpage of wells screened in the deeper aquifers can accelerate the vertical movement of contaminants from shallow depths into these deeper aquifers.

Excessive pumpage can also induce the flow of salty groundwater from offshore toward a well, resulting in lateral salt water intrusion. This was first observed locally in the early 1900s in Brooklyn, as wells were over pumped and the



water table dropped to elevations below sea level. When pumping was stopped from these wells in the 1940s, the water table slowly recovered to close to its original elevation in the ensuing decades.

Groundwater quality can also be altered by natural processes that affect groundwater as it flows through the aquifer system. For example, iron and manganese levels are usually higher in Magothy and Lloyd wells that pump deeper, older water. The drinking water standards for these compounds are known as “secondary” standards. This means that they do not represent health concerns at levels typically found in Long Island’s public supply wells, but are aesthetically undesirable (largely due to taste and odor issues associated with them). Many water suppliers utilize filter systems to remove iron and/or manganese from the water before it reaches the distribution system.

Source Water Protection

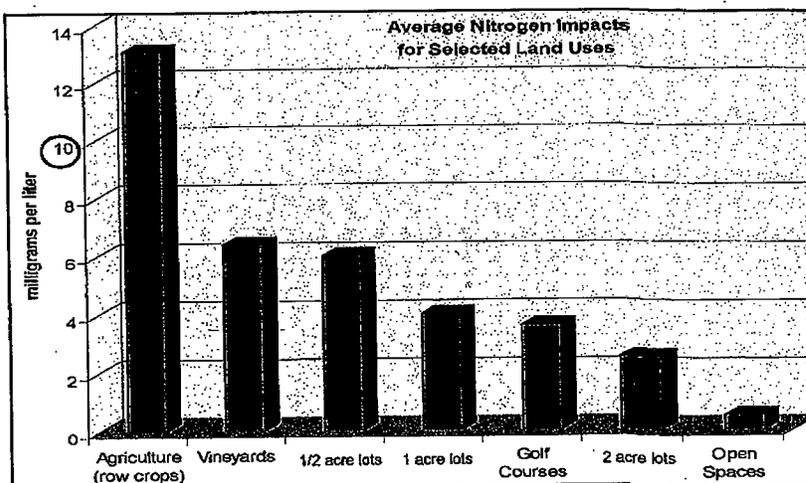
There are over 1,200 community public supply wells located throughout Nassau and Suffolk Counties. Most of these wells are located within the neighborhoods that they serve. Water used by Long Islanders most likely was pumped out of the ground from a well located no more than a few miles from where it was consumed. Since public supply wells are located throughout Long Island, any activity on the land’s surface has the potential to affect the quality and/or quantity of the water we drink. While the quality of water that is consumed by the public is generally excellent, threats to the overall quality of the groundwater resources exist throughout Nassau and Suffolk Counties. For this reason, water suppliers and public health officials have become more interested in better determining the specific locations (“capture zones”) from where a well ultimately draws its water.

As defined by the USEPA, source water is the “raw”, untreated water from our underground aquifers that is utilized as the source for drinking water. For all public water supplies regardless of their initial water quality, some degree of basic water treatment is usually necessary, prior to delivery to the customer. Municipal public water suppliers on Long Island are required to chlorinate the water for disinfection, and to adjust the pH of the water (in order to minimize corrosion of distribution pipes and household plumbing fixtures) before it is consumed by the public. It is important to note that unlike New York City, no public water suppliers on Long Island add fluoride to their water.

As previously mentioned, human activities within the source area for a well (its “capture zone”) can impact

quality of the source water, possibly necessitating more enhanced treatment on the part of the utility in order to meet drinking water standards.

The costs of constructing, installing, and operating any enhanced treatment facilities, such as those needed to remove nitrate or organic contamination, can be reduced or even avoided altogether by protecting source water from contamination. Protecting groundwater quality also has benefits to the surface waters to which it discharges. Pollution prevention is always preferable to remediation. The USEPA and other federal agencies, as well as New York State, Nassau and Suffolk Counties, local communities, businesses and citizens all play a role in ensuring that drinking water is protected.



The figure above shows the overall nitrogen impacts to groundwater from different land uses. The drinking water standard of 10 ppm is indicated by the red circle

SWAP – Source Water Assessment Program on Long Island

Even routine land uses impart some type of “contaminant signature” to the underlying groundwater. The bar graph illustrates the nitrogen impacts of several different land uses found throughout various portions of Long Island. It is important to note that the mere presence of some type of contamination of the groundwater in an area does not automatically mean that the quality of your drinking water is impacted. The federal Safe Drinking Water Act (SDWA) Amendments of 1996 created a Source Water Assessment Program (SWAP) to evaluate existing and potential threats to the quality of the public drinking water supplies throughout the U.S. The figure below shows the overall nitrogen impacts to groundwater from different land uses.

The foundation of SWAP is to ensure safe drinking water by being able to track the fate of groundwater as it flows through the subsurface. By knowing the general

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area from which a well draws its water, the potential for contamination from both routine land uses as well as specific point sources of contamination of a given public supply well can be accurately assessed.

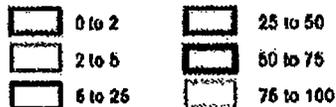
New York State Department of Health (NYSDOH) developed Source Water Assessment Program (SWAP) in the early 2000's to better determine the vulnerability of public supply wells to contamination from both general land uses and specific contamination events occurring within a well's source area. A computerized groundwater model was developed in order to simulate the pumping of all public supply wells throughout Nassau and Suffolk at their average annual pumping rates. Using this model, the source areas were determined for each well. Existing data bases were then utilized to determine land uses and contamination sites within

those source areas, and ultimately the overall susceptibility to different types of contamination for all public supply wells in Nassau and Suffolk Counties was evaluated.

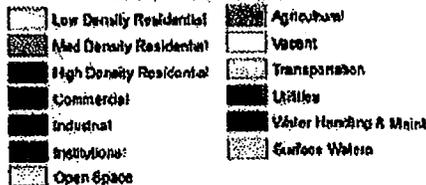
A major finding that came from the SWAP was the realization that, while many land uses and specific instances of groundwater contamination do have a negative impact on drinking water, there are also a great many such instances that are not a threat. If a point source of contamination lies outside of any public supply well capture zone, it may still pose an environmental threat, but is not a threat public drinking water. The SWAP analyses allowed water suppliers and public health officials to determine which groundwater contamination problems in a specific area were a threat to the drinking water supply to a community and which were not.



Travel Time (Years)



Land Use Classifications



Above is an example of the source area to one particular public supply well in Suffolk County. (Land uses within the capture zone are shaded).

The figure to the right shows the capture zones of all wells within the vicinity of a given area. Note that in densely populated areas, the capture zones abut each other. (The well field shown in the previous figure is indicated with a red star).



Testing and Regulation

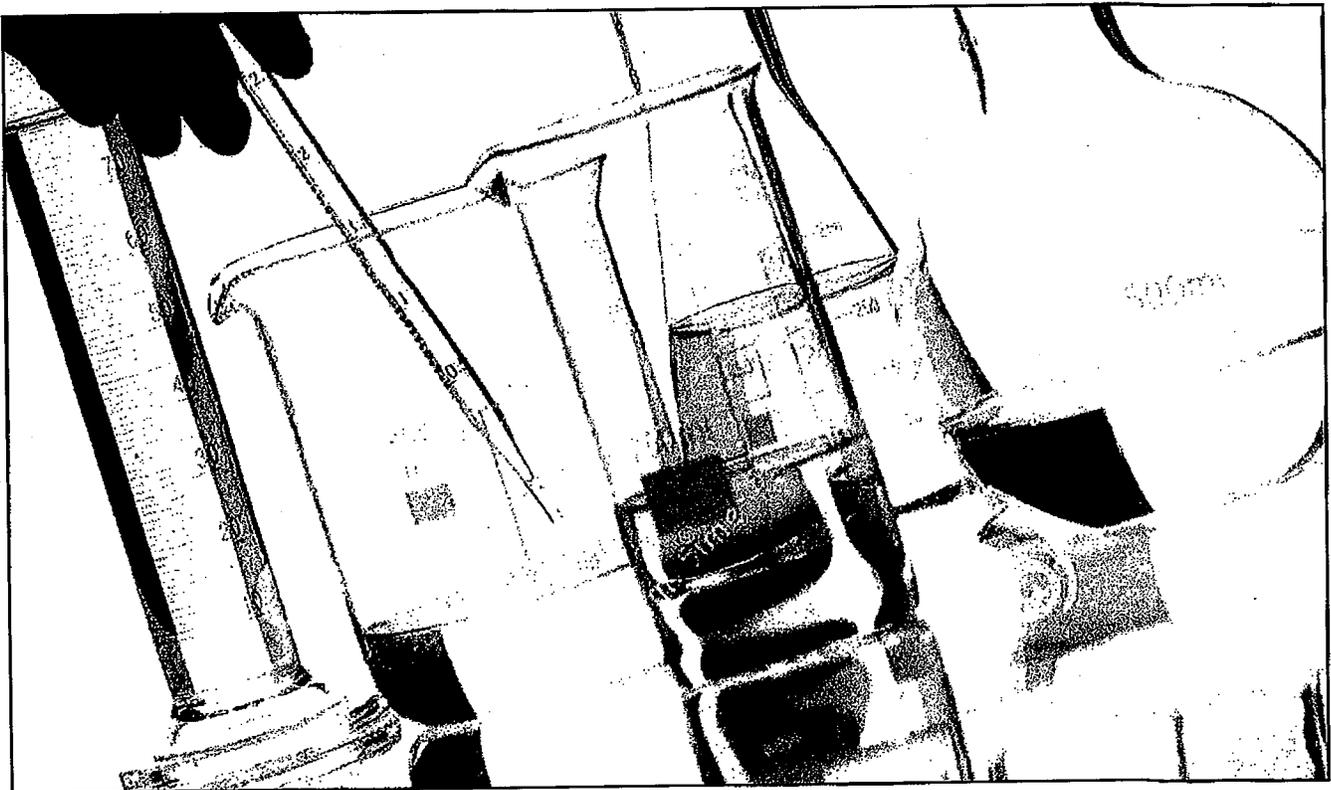
Historically, drinking water regulations were enacted to prevent waterborne diseases such as typhoid and cholera that had plagued mankind for centuries. Over the past century, as these regulations have been adhered to, and as drinking water infrastructure has been upgraded, waterborne diseases in the United States have become uncommon. In more recent decades, as new contaminants are discovered and analyzed, and laboratory equipment becomes capable of detecting smaller and smaller concentrations of these compounds, the primary public health concern with drinking water is the prevention of non-pathogenic diseases.

In addition to drinking water regulations to protect public health, federal, New York State, and local governments have enacted strict groundwater regulations to protect the environment from pollution. Such groundwater regulations include chemical and hazardous materials storage requirements, zoning laws that prohibit a variety of industries from locating within the “deep recharge” areas that contribute re-

charge to the Magothy and Lloyd aquifers, and strengthened sewage treatment requirements. Additionally, Long Island’s public water suppliers have had a long-standing commitment to working alongside the state and county health departments in the best interests of public health and safety, and take many steps (such as redundant, or “back-up” sampling of public water supplies by both the county laboratory and the water suppliers laboratory) to protect against the possibility of contamination of drinking water.

As required by law, public water suppliers conduct hundreds of thousands of water quality tests each year, testing for more than 140 different substances including volatile organic chemicals, inorganics (such as iron, manganese, and chlorides), pesticides and herbicides at a cost of over \$3 million per year to insure that the water is safe to drink. Some suppliers actually test for more substances and at higher frequencies than the law requires.

Results of these tests are published each year in an an-



Community public Water suppliers are required by law to test for more than 140 different substances annually.

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nual drinking water quality report, many of which are now available online. The test results are reported to the respective Health Departments, which conduct their own duplicate samples to verify the results. Any supply well with any sample exceeding drinking water quality standards is required by law to be shut down until corrective measures are implemented.

The standard unit of measurement for many compounds is parts per million (ppm). This means that the concentration of a particular substance is extremely low, even though the regulatory agency may consider it to be significant. To illustrate how minute this concentration is, the following comparisons are the equivalent of **one part per million** (*source: sgufurms.com*):

1 inch to 16 miles

1 minute to 2 years

There will always be traces, no matter how minute, of inorganic and organic constituents in water. The world in general, and the aquifer system specifically, are not “sterile” environments. Within the last thirty years, allowable levels of certain contaminants in drinking water have been reduced to the part per billion or even part per trillion level. The following comparisons further illustrate how miniscule **one part per billion** is:

1 inch to 16,000 miles

1 second to 32 years

Drinking water standards are set based on two primary factors: the maximum level of any constituent determined to be safe for humans and the lower limit that can be detected reliably by current laboratory technology. As both laboratory technology and treatment technology evolve over the years, drinking water standards for some contaminants often become stricter. An example of this pertains to many volatile organic chemicals (VOCs). From the time they were first regulated in drinking water in the mid 1970s until 1988, the allowable concentration was 50 parts per billion (ppb). This allowable level was reduced to 5 ppb in 1988. Safe levels are established by the EPA based on a rigorous protocol of tests. The levels established, called MCL’s (maximum contaminant levels), are enforceable standards based on current testing and treatment technology. The exhaustive testing protocols used by the United States EPA result in standards that represent those levels at which a contaminant presents a very minimal risk to humans.

Every five years, the EPA requires major public drinking water providers to test additional unregulated contaminants. This is known as the Unregulated Contaminant Monitoring Rule (UCMR). The UCMR lists 20 to 30 unregulated contaminants that must be monitored for by large public water systems. Used as a tool to find unregulated contaminants

of concern in drinking water, the EPA can then determine whether to set drinking water standards or to require providers to use certain treatment systems to reduce or eliminate these contaminants. Consumers should rest assured that the public water they drink is one of the most extensively tested product that they consume.

There are still approximately 47,000 households on Long Island (located mostly in eastern Suffolk) that rely on individual private wells for their water supply. Most private wells are very shallow (typically 40 feet below the top of the water table), and are therefore susceptible to contamination from virtually any household chemicals used on the property or within the neighborhood. According to the Comp Plan, nitrate exceeded the drinking water standard in 7% and VOCs exceeded the drinking water standard in 19% of private wells sampled by the SCDHS between 1997 and 2013. Homeowner wells are not constructed to public supply standards, and are not tested with any degree of frequency, if at all. The SCDHS provides water quality testing services for private well owners for a nominal fee. However, very few homeowners with private wells (approximately 1%) have utilized this program (Comp Plan, p. 4-6). Additionally, in Nassau County, the Department of Health will provide an initial test for drinking water quality of a private well at no cost to the homeowner. The New York State Dept. of Health recommends that homeowners with a private well should test the well at least annually at a qualified laboratory to make sure their water is safe to drink.





Water Quality Issues on Long Island

Saltwater Contamination

Since Long Island is surrounded on all sides by salt water, contamination of the aquifers by salt water is always a concern. In the central portion of Nassau and Suffolk, fresh water exists throughout the entire aquifer system, all the way down into the bedrock (over 2,000 feet below ground in many places), and no real threat of saltwater contamination exists in those central areas. However, for more coastal locations, particularly the peninsulas on the North Shore and the barrier islands on the South Shore of Nassau County, and portions of the North and South Forks of eastern Suffolk County, salt water contamination of the aquifers has been, and continues to be, an ongoing issue.

The principal indicator of salt water contamination for most water suppliers is the level of dissolved chlorides in the water being pumped by a well. Chlorides at very low concentrations are naturally occurring in Long Island's aquifers, principally because precipitation (and therefore recharge) is largely derived from evaporation of seawater (see the Water Cycle section of this report). Natural (or "background") chloride levels are approximately 20 to 40 mg/L in the upper glacial aquifer and approximately 5 to 10 mg/L in the Magothy and Lloyd aquifers (<https://pubs.er.usgs.gov/publication/ofr95401> - page 7). The drinking water standard for chlorides is 250 mg/L, and is a secondary standard based on the levels at which consumers will begin to notice a salty taste in their water. However, many Long Island water suppliers will take action at far below this level. This is because elevated chloride levels in wells are an indicator of an environmental problem—salt water contamination—that may result in the degradation of water quality in an aquifer, even at levels below the drinking water standard.

There are three principal ways that Long Island's groundwater can become contaminated by salt water: (1) lateral salt water intrusion, (2) upconing, and (3) road salting.

Lateral Salt Water Intrusion

The most familiar way that groundwater can become contaminated with salt water is what is known as "lateral salt water intrusion." This has occurred recently in western Nassau County, and in the past in parts of Brooklyn and Queens. It has also been an ongoing problem throughout the United States, affecting portions of Texas, Florida, and California, among other places. Lateral salt water intrusion occurs due to continued overpumping of the aquifers in an area in close proximity to the coast. Excessive withdrawal of fresh water from the aquifers over a long period of time results in lowering of the water table, often times below sea level. This low-

ering of the water table allows salty groundwater beneath tidal water bodies to advance landward.

When this happens, the levels of dissolved chlorides in water pumped by wells in these coastal locations will begin to increase. This initial increase in chlorides is an early warning to the water suppliers that a problem may be starting. Reducing or eliminating pumpage from affected wells usually eases the problem temporarily. However, if the over pumping continues, this salty groundwater may migrate all the way into a well's production zone, rendering the well and the surrounding aquifer segment unusable for potable water supply. Once native fresh groundwater becomes "replaced" by salty groundwater, the entire water resource is compromised, and the results are very difficult to reverse.

The Great Neck and Manhasset Neck peninsulas in northwestern Nassau County, as well as the Long Beach-Lido Beach areas on the barrier islands of southern Nassau, are currently experiencing this type of saltwater contamination in both the Magothy and Lloyd aquifers. Due to the very dense population in those areas, and the highly localized nature of public water supply to those communities, there has been over pumping of the public supply wells located within those communities. Remedial measures have been enacted, resulting in some short term resolution to the problem. Such remedial measures have included limiting or eliminating water supply well construction on the peninsulas and the construction of wells outside of areas prone to salt water intrusion. A long-term solution must be enacted however, in order to completely solve the saltwater contamination problems in these areas.

Suffolk County is fortunate in that development on its barrier islands is minimal, and so pumpage from wells situated on them is negligible. Additionally, because of the way that water distribution infrastructure has been built, water can be more easily transmitted in Suffolk County from inland areas to coastal areas, which minimizes pumping stresses near the coast. As a result, there have been no large scale regional problems with lateral salt water intrusion in Suffolk County, although isolated areas on the north fork and Shelter Island have seen problems.

Salt Water Upconing

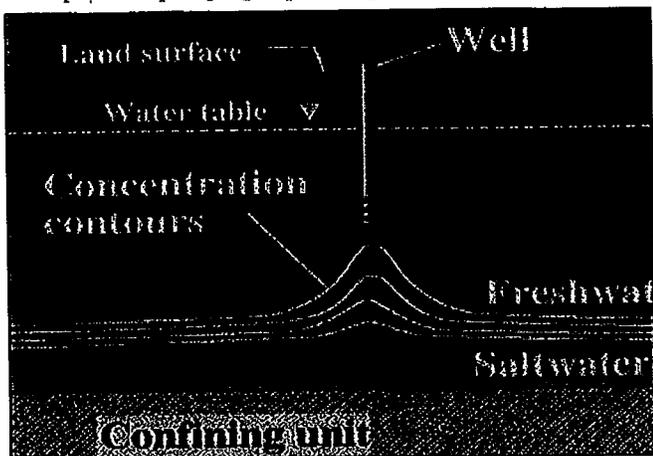
A second, highly localized and less severe way that groundwater can become contaminated with salt water is known as "upconing". Upconing typically occurs beneath individual pumping wells that are located in areas where fresh groundwater exists as an isolated "bubble". Such areas include the north and south forks of eastern Suffolk County. Since fresh water is less dense than salt water, fresh groundwater in those areas occurs as a lens or "bubble" floating on the salty ground



water beneath it. The depth at which the salty ground water is encountered is known as the “salt water interface.”

The density of salt water is 1.025 vs. 1.000 for fresh water. Therefore, since salt water is 1/40th more dense than fresh water, for every foot above sea level that the water table occurs, the salt water interface will be located 40 feet below that. The relationship is known as the “Ghyben-Herzberg relationship,” named after the Dutch hydrogeologists who first defined it in the early 1900s. Since the elevation of the water table over most of the north and south fork is approximately 5 feet above sea level, the depth to the interface is generally no greater than 200 feet below sea level (although there are numerous local exceptions where the interface is deeper). The maximum thickness of the fresh groundwater lense is therefore generally no greater than 205 feet. It is important to note that this “40 to 1 relationship” is strictly based on the density differences between fresh and salt water. Since Long Island’s aquifers are less permeable in the vertical direction than in the horizontal direction, these differences in subsurface geology usually increase the depth of the interface below what would be expected simply from this density relationship. However, for purposes of being as conservative as possible, the Ghyben-Herzberg relationship is usually used.

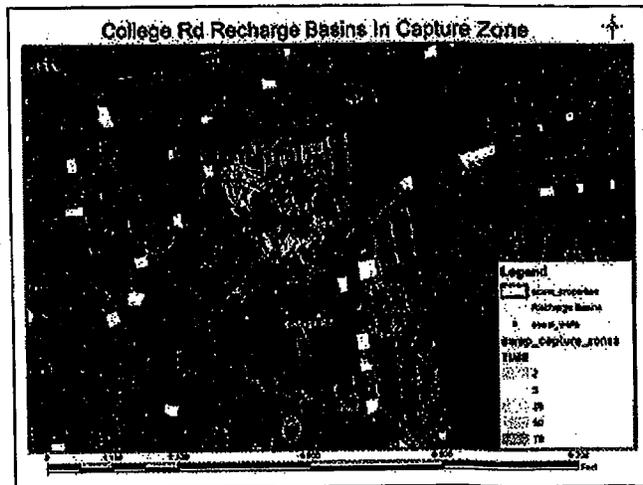
The potential for upconing beneath a pumping well situated in this “floating lense” setting can be calculated utilizing mathematical equations first proposed by hydrogeologists over forty years ago (*Schmorak and Mercado, 1969*). These equations have been utilized by hydrogeologists at the SCWA to minimize the impacts of pumping of shallow wells located on the North and South Forks of eastern Long Island. When shallow East End wells are pumped, the salt-water interface will rise to some extent in response to this pumping stress. The degree to which the interface will rise in response to pumping depends upon the following factors:



An illustration of salt water upconing beneath a pumping well. As the pumping rate increases, the interface is drawn upward, closer to the well screen. This results in increasing chlorides in the pumped water.

the permeability of the aquifer, the pumping rate of the well, and the original distance from the bottom of the well screen to the top of the saltwater interface.

Once these three factors are known, a “critical rise” can be calculated. SCWA scientists have calculated a “critical rise” of the salt water interface, which is the amount of rise in the interface beneath a pumping well that will potentially result in long term water quality degradation. Even though experience has shown that maintaining a rise in the interface of 50% of the original distance is acceptable, SCWA scientists use a figure of 30% for an extra factor of safety. As long as pumpage remains relatively low, this rise will should result in any long term water quality degradation, although the levels of dissolved chlorides will usually increase



The location of an SCWA well field affected by road salting. Capture zone is shaded according to time of travel to the well. (Yellow squares indicate roadside recharge basins).

somewhat during the summer. However, if a well’s pumping rate is too high, the interface will rise to a point very close to the bottom of the well. When this happens, chloride levels increase more drastically, and the pumping rate must be cut back immediately and properly managed throughout the summer peak pumping season.

Road Salting

Contamination of shallow groundwater due to road salting is a recently discovered issue. Given the frequent and heavy snowstorms that have occurred in recent winters, and the public safety related issues of maintaining safe, passable roads at all times, the increased use of road salts for de-icing and snow removal has caused some unexpected groundwater quality problems. Some shallow wells on the North and South forks, and some deeper wells in central portions of Long Island, have seen marked increases in chloride levels during winter and early spring that do not subside when pumpage is reduced.



This stands in contrast to the previously mentioned scenarios, when the increases in chlorides occurred in response to summer peak pumpage.

Despite the fact that there are strict guidelines pertaining to proper storage and usage of road salt at municipal maintenance yards, road salt contamination remains a problem due to its routine and widespread use throughout the area. As the snow covering a road begins to melt, any salt applied will dissolve along with it, and the water/salt solution will flow into the nearest drain or recharge basin. The salt residue builds up in the recharge basin, so that any succeeding precipitation will dissolve it as it recharges the aquifer, and carry it downward into the aquifer system. It was discovered

that the water in some recharge basins located along major highways had a salt content greater than that of the Atlantic Ocean for brief periods immediately after a snowmelt. Any well that captures some of this water as it recharges the aquifer will reflect this water quality trend. SCWA scientists discovered that by analyzing the water chemistry from specific wells, they could determine whether a chloride increase was due to road salting or saltwater intrusion/upconing. By determining the specific source of the chloride increases, a management strategy was devised by SCWA to minimize chloride impacts from road salting, and increase the useful life of supply wells.

Specific Case Studies in Saltwater Contamination:

Great Neck and Manhasset Neck Peninsulas Saltwater Intrusion

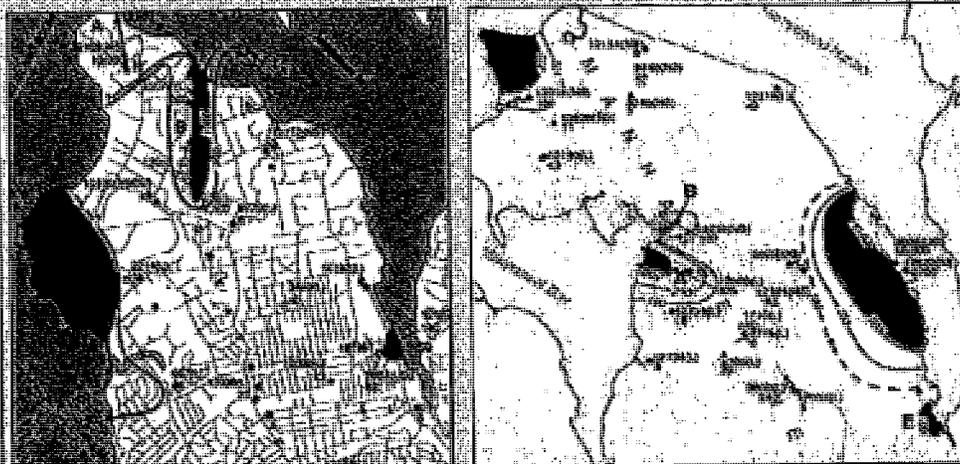
Since the 1980s, public supply wells on both the Great Neck and Manhasset Neck peninsulas of northwestern Nassau County have been impacted by lateral salt water intrusion. In response to this threat, an extensive research project was undertaken to define the extent of the intrusion beneath each peninsula, and to minimize or reverse its advance. Over 40 boreholes were drilled between 1991 and 1996 to collect geologic and water quality data, and to monitor changes in the magnitude of the intrusion. Additionally, offshore geophysical surveys were done to better define the subsurface geology beneath the surrounding bays.

Four distinct areas of salt water intrusion were discovered and delineated beneath the Great Neck Peninsula, and five such areas were discovered on Manhasset Neck. All aquifers were affected to differing extents, and chloride levels within them ranged from just over 100 mg/l (below drinking water

standards but far above normal "background" levels) to over 13,000 mg/l (a little less than half as salty as ocean water). Two of the areas on Manhasset Neck showed active saltwater intrusion, and numerous public supply wells on both necks have been either shut down or significantly affected by elevated chlorides in the areas. (USGS WRI 00-4193 and WRI 99-4280)

Southwest Nassau Saltwater Intrusion

The United States Geological Survey (USGS) and Nassau County Department of Public Works (NCDPW) have been studying saltwater intrusion in southwestern Nassau since the early 1950s. As Nassau County developed, and pumpage from all aquifers was increasing dramatically at that time, the need arose for an enhanced delineation of the extent of the aquifers, and the extent of any salt water intrusion that may have been occurring in response to the increased pumpage. Numerous monitoring wells were constructed during several investigations, and geologic and water quality information was obtained from them. The



The figures to the left illustrate the extent of saltwater intrusion on Great Neck (left) and Manhasset Neck (right). Individual salty water "wedges" are labeled A through E, and chloride concentration contours are illustrated by the black contour lines. (USGS WRI 00-4193 and WRI 99-4280)



monitoring wells were also utilized to track the movement of groundwater in response to stresses such as well pumping and tidal influences.

In a 1966 USGS report (*Luszczynski and Swanzenki, 1966*), several distinct wedges of salty water were discovered within the upper glacial and Magothy aquifers, and in some of the clay confining units from these early investigations. Groundwater in some of these wedges had chloride concentrations as high as 16,500 mg/L. Some of these deeper wedges extended up to seven miles inland at that time and were advancing landward at measureable rates. The report also mentioned that salty water was also beginning to migrate vertically from the base of the Raritan clay downward into the Lloyd aquifer. Elevated chloride levels in Lloyd aquifer public supply wells in Atlantic Beach, Lido Beach and Rockaway Park were noted at that time.

For several decades, the NCDPW maintained an extensive network of monitoring wells throughout the county and was actively monitoring water quality data, part of which included chlorides within the deeper aquifers. In recent years, much of the groundwater monitoring program has become inactive. In order to effectively monitor and trend elevated levels of chlorides on Nassau County's south shore, upgraded groundwater monitoring program should be enacted, and a long term funding source needs to be secured.

Saltwater intrusion along the south shore will become more pronounced and may affect public supply wells in the coming decades, based on current pumping patterns and the anticipated rise in sea level. For this reason, efforts to restart the monitoring program are underway.

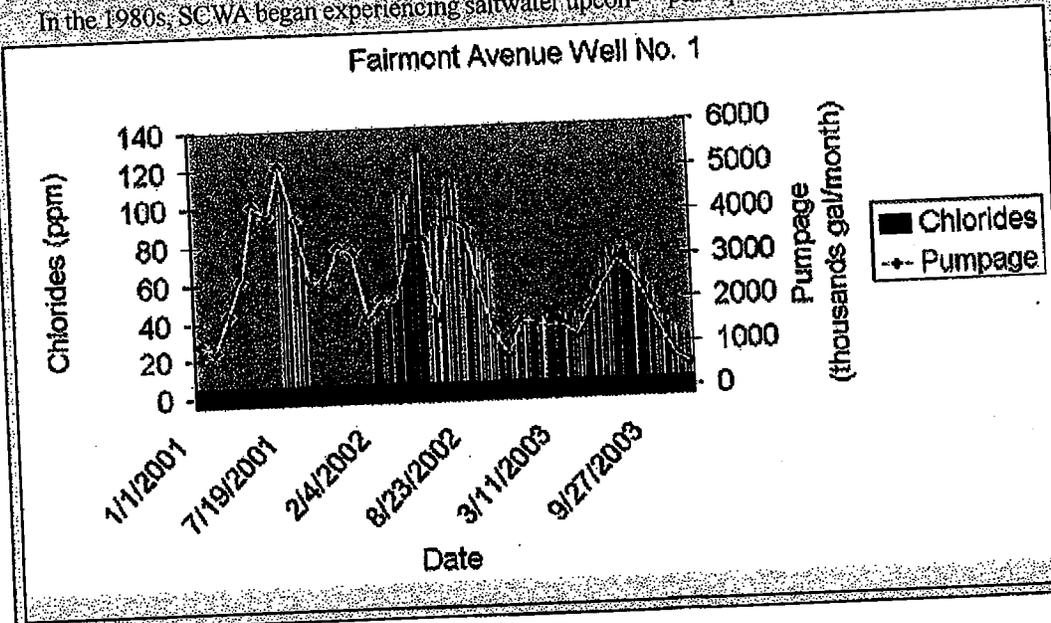
Montauk Upconing

In the 1980s, SCWA began experiencing saltwater upcon-

ing in its Montauk wells. SCWA had taken over the Montauk Water Company in the 1970s and added numerous wells to increase overall system capacity. By the mid 1980s, many of the wells serving the village began showing increased chlorides during the summer peak pumping season. SCWA embarked on a 10-year study to determine the exact cause of the problem and to find and enact a solution.

Many of the Montauk area supply wells produce water with elevated concentrations of chloride when pumped at their permitted capacities (for the purposes of this report, elevated chloride concentrations are considered to be those in excess of 60 mg/l (milligrams per liter), which is the concentration at which experience has shown may cause permanent degradation of water quality in a particular Montauk well. Chlorides occur in production wells because the wells tap a thin freshwater zone within the principal aquifer which is underlain by a salt water zone (*Prince, 1986*). As stated in the above sections, when the pumpage from the wells exceeds a certain critical threshold, the interface between the freshwater and saltwater zones is drawn upward until it is intercepted by the well. This process, known as "upconing," typically occurs within a limited radius around the well.

Previous analyses of the Montauk area, as well as the experience of the SCWA, have indicated that chloride concentrations are typically correlated to the pumpage of individual wells. However, the magnitude and timing of the response of the chloride concentrations to increases and decreases in the pumpage varies among the individual wells in the system. This is typically explained by differences in the thickness of the freshwater zone at various well locations, as well as the presence of a semi-confining silt and clay stratum (the "marine clay unit") within the principal aquifer. In some locations in Montauk, the freshwater/



Graph of pumpage (white line) vs chlorides (black bars) at a well in Montauk affected by salt water upconing. Note the close relationship between pumpage and chloride levels. Chloride levels remain far below the 250 mg/L drinking water standard.



salt-water interface occurs within the marine clay. At other locations, the interface occurs within the transmissive zone above the marine clay unit. The graph on the previous page illustrates the close correlation between pumpage and chlorides for one particular well in Montauk. It is important to note that even though the drinking water standard for chlorides is 250 mg/L, chloride levels from this well were kept at approximately half this level in order to avoid further water quality degradation.

It was discovered that some of the wells were screened very close to the salt-water interface, and/or were being pumped at too high a rate to maintain chlorides at proper concentrations.

Previous analyses indicated that chloride concentrations in the Montauk area wells can be controlled by ensuring that the pumpage of each well does not exceed corresponding critical threshold values. The pumping protocols that were developed for each Montauk area well included limits on the amount of water pumped in a single day, the amount of water pumped in a single month, and on the total amount pumped during the high demand season and the recovery season. Where it was possible to implement these recommendations, the SCWA was generally successful in controlling chloride concentrations. However, on many occasions during the summer season, the demand on the Montauk area system resulted in pumping of the wells in excess of their respective assigned limits. In some cases, this over pumping led to long-term degradation in local groundwater quality.

Chloride levels remained manageable through the 1990s. Eventually, however, demand in Montauk continued to grow, and a transmission main was installed to supplement the water supply to Montauk. The transmission main allowed the SCWA to pump water from the main body of East Hampton and transmit it to Montauk, thus reducing the demand on the individual Montauk wells, pumping them at lower rates. Since the transmission main was installed and put into service in 2000, no chloride problems have occurred in any of the Montauk wells. The lessons learned from Montauk have been applied to the SCWA territory on the north fork. Upcoming behavior of wells situated there has been both studied and managed to a great extent, with minimal problems.

North Fork Road Salting

Concerns as to both the quality and quantity of drinking water are particularly acute on the North Fork, where fresh water is only available at shallow depths, and there are many large volume groundwater users (farms, golf courses) within a fairly small geographic area. Contamination by agricultural chemicals (fertilizers and pesticides) has always been a concern to water suppliers. A contaminant of particular in-

terest more recently is road-deicing salt (sodium chloride, or NaCl), and the role it plays in elevating chloride levels within the upper glacial aquifer. This process is of concern at present because high concentrations of chloride have been detected in storm water and in shallow groundwater. In the recent past, several SCWA public supply wells on the North Fork became impacted by elevated chloride concentrations, potentially due to road salt contamination, or saltwater intrusion. In 2000, the Suffolk County Water Authority studied the effects of storm water runoff on the water quality at the Mill Lane and Ackerly Pond Road well fields in Peconic. Because these well fields consist of shallow wells that are in close proximity to water bodies and a major road (County Route 48), SCWA was concerned with the vulnerability of these wells to chloride contamination. The locations of these sites are approximately midway between Peconic Bay and the Long Island Sound. SCWA scientists developed an interesting method for determining the source of the elevated chlorides by looking at the Bromide-Chloride Ratio (Br/Cl) ratio in the water pumped by affected wells.

The majority of precipitation on Long Island originates from evaporation of seawater and so has an average molar Br/Cl ratio of 1.54 nM/ μ M (nanomole/micromole). Therefore, the Br/Cl ratio in groundwater will be similar to that of both precipitation and ocean water (Schoonen, 1995). As a result, analyzing the deviations in the Br/Cl ratio can be used to determine source of chloride contamination, because certain contaminants will result in a Br/Cl ratio above or below that of normal precipitation and normal groundwater. Road salt, which in Suffolk County consists of NaCl (halite), is an ever-increasing problem affecting shallow aquifers and the elevated chloride levels that result its presence in shallow groundwater are often mistaken for saltwater upconing. Analyzing molar Br/Cl ratios allow for differentiation between the two chloride sources. Since seawater, precipitation, and groundwater have an average molar Br/Cl ratio that is relatively constant, a well field impacted by saltwater encroachment or upconing will still show the Br/Cl ratio similar to that for seawater (Schoonen, 1995). A well field impacted by road salt would display a much lower Br/Cl ratio.

Vertical profiles were collected at the Mill Lane well field in Peconic during January and July of 2000, allowing for both spatial and temporal analysis of Na⁺, Br, and Br/Cl ratios. The temporary boreholes were drilled using hollow stem augers. The cutter head of the lead auger was sealed with a plastic plug to prevent leakage into the augers. Subsequent auger sections were sealed at the joints by O-rings to prevent groundwater infiltration. The same methodology was used to collect samples at Ackerly Pond well field in March of 2002. The molar Br/Cl data analyzed from Mill Lane is summarized in Tables 1 and 2, on the next page.

STATE OF THE AQUIFER—QUALITY

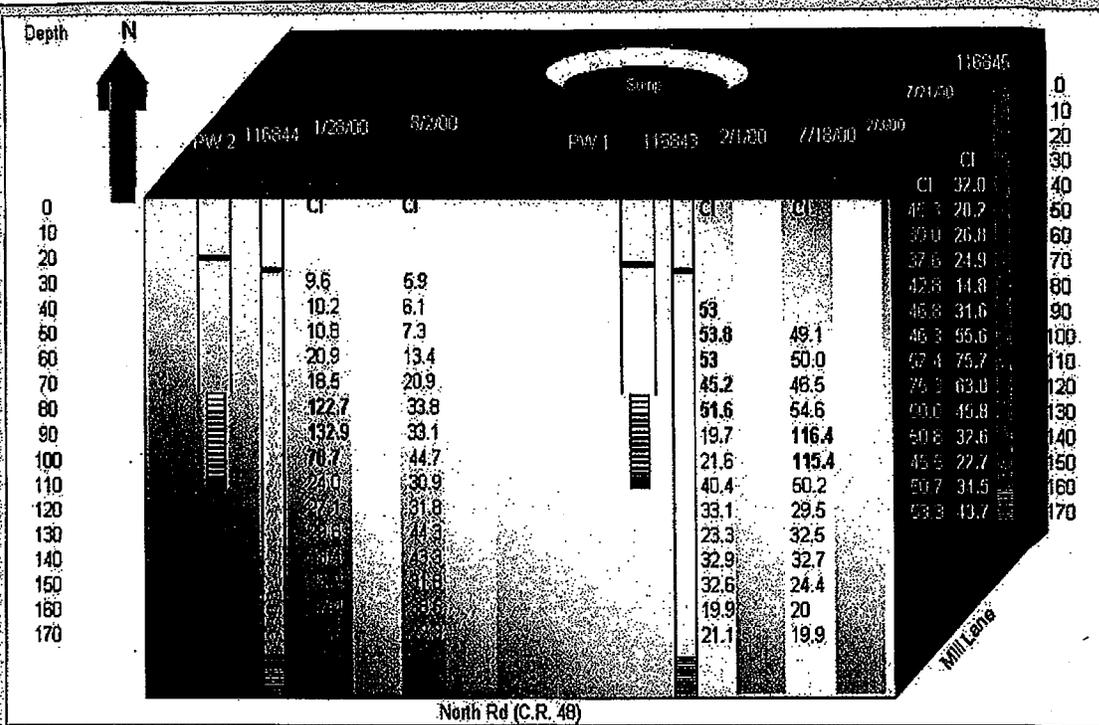


Table 1 Mill Lane Vertical Profile Results (chlorides in mg/l)

The vertical profiles above indicate that, at depths ranging from 80 to 120 feet, the chloride levels are elevated (exceeding 100 mg/L), while Table 1 indicates that, at those same depths, the Br/Cl ratio is consistent with road salt. This depth corresponds to the screen setting of the production well. Pumping of the production well would be expected to draw in contaminants (such as road salt) from the surrounding area and the data collected supports the idea of surface contaminants affecting the well field. The results

of this study show that Br/Cl ratios are an effective means of identifying road salt contamination within well fields and differentiating between road salt and naturally salty groundwater or seawater. A side benefit of this study was that, since chloride levels never exceeded approximately 150 mg/L (and therefore never came close to the drinking water standard despite increased pumping rates during the summer), the SCWA was able to pump the Mill Lane wells at their full capacity.

Table 2 Br/Cl Molar Ratio of Vertical Profiles at Mill Lane

The vertical profiles show a distinct difference in Br/Cl ratios at depths where the unusually high chloride concentrations were detected (yellow shading). The sample results from profile S-116843 indicated at a depth of 90 feet, the Br/Cl ratio is .3 nM/uM (table 1). This unusually low ratio was also present at a depth of 100 feet (.35 nM/uM), but improved at a depth of 120 feet (1.8 nM/uM). Comparison of these results with the chloride concentrations shown in Table 1 show that at depths where the chloride concentrations are higher, the Br/Cl molar ratio is much lower than that found in either precipitation, groundwater, or seawater. Additionally, unlike in the upcoming examples mentioned previously, chloride levels returned to their low background levels below the screen area. These data therefore indicate an alternative "external" source for the high chlorides, namely road salt.

Depth	S-116843 July 2000	
	Cl Mg/l	Br/Cl (nM/uM)
30		
40		
50	49.10	0.54
60	50.00	0.62
70	46.50	0.57
80	54.60	0.47
90	116.40	0.30
100	115.40	0.35
110	50.20	0.80
120	29.50	1.80
130	32.50	1.77
140	32.70	1.90
150	24.40	1.82
160	20.00	1.55
170	19.90	1.56
180		



Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are carbon-containing compounds that evaporate easily from water into air at normal air temperatures (this is why the distinctive odor of gasoline and many solvents can easily be detected). The most common VOCs include (1) chlorinated solvents and (2) fuel components.

Chlorinated solvents are widely used in industry and in common household products. These are chemicals used as degreasing fluids for many different purposes such as dry cleaning clothes, removing the caffeine from coffee, cleaning metal machinery, and dissolving grease build up in septic tanks. Some chlorinated solvents are found in such household products as spot removers, typing correction fluids, adhesives, automotive cleaners, inks, and wood furniture cleaners. One VOC, vinyl chloride, is used to make plastic materials, such as vinyl and plastic wrap and pipe. People are most commonly exposed to VOCs through the air, in food, or through skin contact. When VOCs are found in groundwater, the potential exists for the drinking water supply to become an exposure pathway for VOCs.

The use of VOCs on Long Island started to become widespread in the mid 1940s. The aircraft industry, as well as other manufacturing and heavy industries, many of which are gone from Long Island, were the biggest users of these chemicals. VOCs began being detected in groundwater in 1976 (Ponturo, 2015, personal communication) and regulations on allowable VOC concentrations were enacted beginning in the late 1970s. By 1979, a total of 13 public supply wells in Suffolk County and 23 public supply wells in Nassau County (out of a total of 872 wells tested) were closed due to VOC contamination.

VOCs have become a very common class of contaminants affecting groundwater and surface water supplies nationwide. Most VOCs found in the environment result from human activity. Exposure to VOCs poses a threat to human health because many of them may be carcinogenic. Since they are so commonly used, they are commonly detected in Long Island's groundwater. When VOCs are spilled or improperly disposed of, a portion will evaporate, but some of it will percolate vertically into the ground. Once they are in or below the soil, VOCs may eventually reach the groundwater table. VOCs travel through the subsurface at the same speed and in the same manner as groundwater, and so can show up in drinking water wells. Water suppliers are required to test for organic compounds on at least a quar-

terly basis, and the finished water that they supply must meet very stringent standards, as defined by the USEPA. Initially, most VOCs in drinking water were regulated at a level of 50 parts per billion (ppb). As detection and treatment technology improved, and the carcinogenic effects of VOCs were better understood, the drinking water standard for most VOCs was lowered to five ppb in 1989.

In order to prevent or reduce the chances of health effects from occurring due to drinking water contamination, MCLs have been established by the United States Environmental Protection Agency (USEPA) for many VOCs. MCLs are limits that public water systems are required to meet by law, and are set at levels well below those known to cause health effects in lab animals and humans. In Nassau and Suffolk counties, MCLs for many VOCs are more strict than the USEPA levels. Additionally, some drinking water providers in Nassau and Suffolk Counties have voluntarily set MCLs for many VOCs at far more stringent levels than required by the EPA while other providers take facilities out of service when trace levels of VOCs (well below the MCL) are detected.

Several factors increase the likelihood that a water supply will be contaminated. One factor is the distance between the well and a source of contamination. Many wells contaminated with VOCs are located near industrial or commercial areas, gas stations, landfills or railroad tracks. A second factor is the amount of VOCs dumped or spilled. Some spills are small and localized. Others occur over a long period of time, or involve large quantities of contaminants. When a large quantity of chemicals has leaked or spilled, as may occur with leaking underground tanks or industrial spills, a large geographical area may be affected. Third, the depth of a well can be a factor. Shallow wells are often affected sooner and more severely than deep wells when contaminants have been spilled on the land surface.

A fourth factor is local geology. Unconfined aquifers, especially those where the depth to groundwater is shallow, are most vulnerable to contamination from surface activities. Low permeability confining units (clay and silt layers) may slow down the movement of contaminants and may help to absorb them somewhat. The fifth factor affecting contamination of water is time. Groundwater typically moves very slowly. A spill may take years to reach nearby wells. So wells may not be contaminated until years after the spill is discovered. Additionally, some contaminants naturally degrade over time.



Close up of actual granular activated carbon media used in VOC removal



The highest levels of VOC contamination are found in industrial, commercial, transportation and institutional areas. However, low levels of VOC contamination are detected in shallow groundwater throughout both Nassau and Suffolk Counties. This suggests that VOC use is very widespread, albeit mostly at very low levels, (*Comp Plan*, p. 3-65, 3-67). In the unsewered areas of Suffolk County, cesspools and septic systems can serve as point sources for low levels of VOCs to shallow groundwater. As a result, homeowners in

Suffolk utilizing private wells may be especially vulnerable to VOC contamination. In Nassau County, most of which is served by municipal sewers with discharges to tidal waters, and with almost no areas using private wells, the problem is less widespread. However, with more industry than Suffolk, where VOC contamination problems exist in Nassau, they tend to be quite severe. Numerous widespread VOC plumes are documented throughout Nassau. Remediation of them is ongoing.

Treatment for Volatile Organic Compounds (VOCs)

When public supply wells become contaminated by VOCs at levels close to or above the drinking water standard, Long Island water suppliers choose one of two treatment options in order to supply their customers with water that meets the standard. The two technologies used most often on Long Island are: (1) Granular Activated Carbon (GAC) adsorption, and (2) Packed tower aeration (PTA), also known as air stripping. A brief description of each follows. It is important to note that there are numerous other technologies for remediating VOC contamination which are constantly being tested by public water suppliers. In the future, these other technologies may also be used in place of, or in addition to GAC and air stripping.

Granular Activated Carbon (GAC)

GAC is basically carbon in a granular form, which is made from raw carbon materials such as coconut shells or coal. This material is "activated" using heat to burn off some of the raw materials and produce microscopic pores within the carbon grains which are capable of trapping the molecules of contaminants in water in a process known as "adsorption." The activated carbon is then pulverized and sieved into appropriate and uniform particle sizes before it is used for water treatment. The carbon material is placed in large vessels (often as large as twelve feet in diameter). These vessels are installed at the well field, and piped in such a way that contaminated water from the well enters the vessels from the top of the carbon bed and is allowed to move through the porous carbon medium before exiting out the bottom of the vessel and into the distribution system. As the water moves through the carbon bed, the contaminants are removed by adsorption. Eventually, the carbon bed is no longer capable of adsorbing any more of the contaminant and becomes "spent." At this point, the carbon material will be replaced so that the well can be put on line once again. Most organic contaminants found in public water supplies

on Long Island can be treated by GAC; however, there are some organic compounds that cannot be effectively treated by this method. GAC vessels are quite large, and require a large piece of land for the vessels, a building to contain them, and all of the piping required. For this reason, they are more common in Suffolk County, where space limitations are fewer.

Packed Tower Aeration

Packed Tower Aeration, or "air stripping," is the process of moving air through contaminated water in an above-ground treatment system. An air stripper provides contact between air and water that encourages VOCs to be released from the water. Air stripping removes VOCs since these are chemicals that easily evaporate. This means that they can change from a liquid to a vapor (gas). The air passing through contaminated water helps evaporate VOCs faster. After treating the water, the air and chemical vapors are collected, and the vapors are either removed or vented outside if VOC levels are low enough.



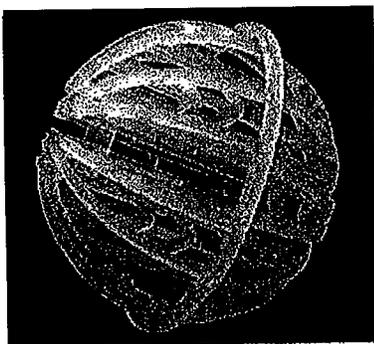
A typical Granular Activated Carbon (GAC) adsorption vessel in use at a public supply well field in Suffolk County. Each vessel is 12 ft. in diameter and 15 ft. high and contains 20,000 lbs. of carbon media.



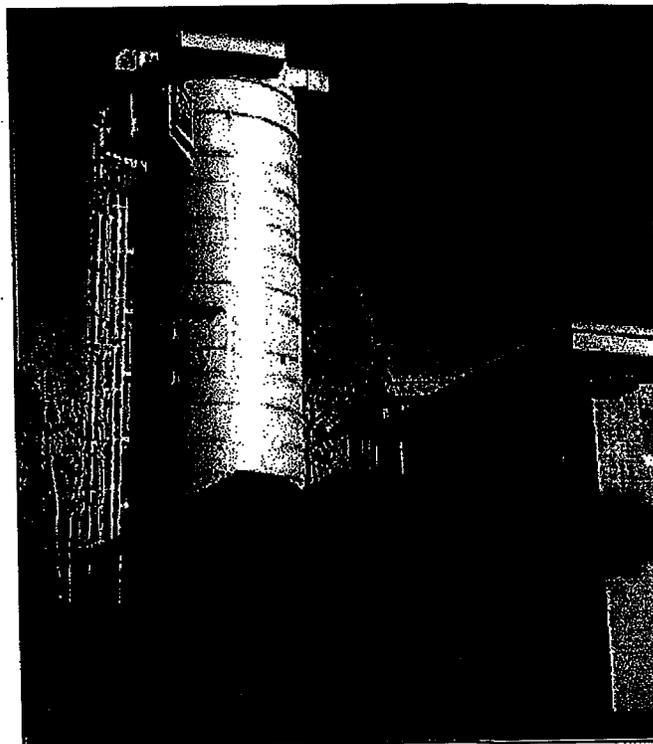
The most common type of air stripper is a packed-column air stripper, which is a tall tank filled with pieces of plastic, steel, or ceramic packing material. Contaminated water is pumped above ground and into the top of the tank and sprayed over the top of the packing material. The water trickles downward through the spaces between the packing material, forming a thin film of water that increases its exposure to air blown in at the bottom of the tank. Rising air and vapors accumulate at the top of the air stripper where they are either released to the atmosphere, or collected for treatment. Treated water flows to the bottom, where it is collected in an underground tank known as a "clear well". Uncontaminated water is then pumped from the clear well into the distribution system.

VOC Treatment of Drinking Water on Long Island

According to the Health Departments of both Nassau and Suffolk Counties there are approximately 89 air strippers in use by Long Island's public water suppliers, treating 120 wells. They are more common in Nassau County than in Suffolk (83 units vs. six), principally because space limitations at many Nassau well fields may preclude the use of large GAC systems. A total of 146 GAC vessels are in use by Long Island's public water suppliers, treating 161 wells. The Suffolk County Water Authority, Suffolk's largest public supplier, uses 132 GAC vessels to treat 143 of its wells for VOC contamination. In Nassau County, a total of 140 public supply wells are treated for VOC contamination, including eight wells that have both an air stripper and a GAC adsorption unit, (Alarcon, 2015).



Close up of typical packing material used in an air stripper



An air stripper in use at a well field in East Farmingdale.

Pharmaceuticals and Personal Care Products (PPCPs)

Pharmaceuticals and personal care products include virtually anything that people apply to their skin and hair, or inject into their bodies. This diverse array of thousands of chemical substances, includes:

- prescription and over the counter therapeutic drugs
- fragrances and cosmetics
- lotions such as sunscreen and insect repellants
- food and drink additives, including: caffeine and nicotine
- vitamins

PPCPs are continually released into the environment from bodily excretion, bathing, and disposal of unwanted medications to septic systems, sewers or trash. They have the poten-

tial to enter our groundwater system via septic discharge or sewage treatment plants that discharge their effluent inland. In 2002, the U.S. Geological Survey (USGS), in cooperation with the Suffolk County Water Authority (SCWA), began a four-year study to document the occurrence of pharmaceutically active compounds in groundwater monitoring wells throughout Suffolk County. Seventy (70) water samples were collected from 61 monitor wells in the upper glacial and Magothy aquifers (nine wells were sampled twice) during 2002–2005 and analyzed for 24 pharmaceuticals. Wells were selected for their proximity to known wastewater-treatment facilities that discharge to the shallow upper glacial aquifer. Of the 70 samples taken, over half of them had no pharmaceutical compounds detected. Pharmaceuticals were detected in 28 of the samples taken, of which 19 contained one compound, and nine contained two or more



compounds (<http://ny.water.usgs.gov/projects/SOTA/aquifer.html>). There are thousands of PPCPs, their metabolites, and their breakdown products that can potentially be released into the environment. For example, in shallow monitoring wells located near laundromats in unsewered areas, the insect repellent compound DEET has been routinely detected. DEET has also been detected in monitoring wells near golf courses, reflecting use by golfers and course staff (*Comp Plan, 2015, p. 3-93*).

The two studies cited underscore the point that in most cases, detections of PPCPs in groundwater occur in shallow monitoring wells constructed for the purpose of targeting these compounds.

The mere presence of these compounds in groundwater (or even in a public water supply well) is not necessarily cause for alarm, since these compounds are routinely used and encountered in our daily lives through medicines, food, beverages and other sources. However, since they usually enter groundwater from the waste stream, they are an indication that some element of wastewater discharge is present in groundwaters where they are detected. Fortunately, while detections of these compounds in groundwater (especially shallow groundwater in unsewered areas) has become fairly commonplace, detection of them in public drinking water is less common.

There are no compound-specific drinking water standards for individual PPCPs. Instead, they are regulated in New York State as part of the “unspecified organic contaminant” standard of 50 parts per billion. Where PPCPs have been detected in public supply wells, levels have been far less than 50 ppb. In many cases in Suffolk County, granular activated carbon (GAC) treatment is already present at well fields where PPCPs have been detected. GAC is usually, but not always, effective in remediating PPCP contamination.

The detection and quantification of these chemicals has only recently been possible due to advances in laboratory testing technology. We have the technology today to detect more substances and at lower levels (i.e. parts per trillion) than ever before. As described in previous sections of this report, the following analogies can be used to illustrate how small **one part per trillion** is:

- 1 inch to 16 million miles**
- 1 second in 320 centuries**

Concentration of PCPPs at these minute levels have no documented effect on human health, since they are thousands of times below the levels necessary to cause a “therapeutic effect.” As an example of this, studies have shown that a person would need to consume almost 1,300 eight-ounce glasses of water per day in order to achieve the lowest therapeutic dose of a cholesterol lowering drug known as gemfibrozil (brand name “Loprid”), if the water had the highest known concentration

of this drug ever detected to date in groundwater in Suffolk County (*Comp Plan, 2015, p. 3-89*).

The SCDHS has begun monitoring PPCPs in groundwater. Since 1997, the SCDHS has analyzed over 21,000 samples from both public supply and private wells for the presence of 30 PPCPs. Each year, an average of 2.5% of community supply wells, and 5.5 to 10% of private wells, have had detections of PPCPs, mostly in the part per trillion to low part per billion range (*Comp Plan, 2015, p. 3-92*).

PPCPs are also being found at these low levels in many of our nation’s lakes, rivers and streams. Even at these low concentrations, these compounds may have significant effects on aquatic wildlife. Some of the known potential impacts on organisms include delayed development in fish, delayed metamorphosis in frogs, and a variety of reactions including altered behavior and reproduction. Researchers at several universities have recently discovered that a group of antidepressants, including drugs like Prozac, Zoloft, Paxil, and Celexa may be found in frogs and fish and significantly slow their development. Synthetic estrogen hormones are taken by many women for birth control and hormonal replacement therapies and are sometimes taken by men for treatment of prostate cancer. Increased feminization of fish populations (e.g., inter-sex, hermaphroditic fish—males with eggs, high proportion of females to males) has been observed in several fish populations exposed to waste water containing estrogens (www.campus ecology.wsu.edu/page_055.htm). Therefore, the environmental and ecological effects of PPCPs are being increasingly investigated by scientists.

PPCPs are not removed from the waste stream at sewage treatment plants, so they can enter the groundwater system in their discharge stream even if all “conventional” water quality criteria are being met.

There are currently no EPA health standards for pharmaceuticals in drinking water and public water providers are not required to test for them. However, in order to be proactive with regard to public health, many suppliers test for PPCPs, as does the SCDHS. When PPCPs are found in public supply wells, water suppliers have utilized existing GAC systems in an effort to minimize their presence in finished drinking water.

As new drugs are developed, the number of PCPPs detected in Long Island’s groundwater is likely to increase. By properly disposing of unwanted or expired medications at approved drop-off locations, citizens can help to help prevent release of these compounds into ground and surface waters. In Suffolk County, Operation Medicine Cabinet allows residents to drop off unwanted medications at drop boxes in any Suffolk County Police Precinct, 24 hours a day, seven days a week. East End residents can drop off unwanted medications at participating local police departments. In Nassau County, all police precincts are now accepting unwanted

medications. New Federal rules allow pharmacies to collect unwanted and unused medications. Ask your local pharmacy if they plan to implement a drug take back program.

Nitrogen in the Aquifer: Nitrate

Nitrate is a common contaminant found in groundwater. Nitrate is a naturally occurring chemical made of nitrogen and oxygen. Nitrate is found in air, soil, water, and plants. Much of the Nitrate in our environment comes from decomposition of plants and animal wastes. Some additional Nitrate is derived from precipitation containing airborne nitrous oxides. The impacts from man-made sources of Nitrate are far greater than those of these naturally derived sources. The primary sources of Nitrate contamination to Long Island's groundwater are on-site cesspools and septic systems, sewage treatment plants that discharge their effluent on the land surface, and fertilizers used in agriculture and on suburban lawns. Fortunately, Nitrate concentrations at the levels that are harmful to human health are rare in our environment on Long Island. Nitrate delivered to coastal waterbodies via groundwater, however, is having detrimental effects.

Historically, as Long Island developed into a suburban area, nitrate levels in the upper glacial aquifer increased. The construction and use of municipal sanitary sewers has greatly reduced the levels of Nitrate (as well as other contaminants such as detergents) in the upper glacial aquifer in sewered areas. Unsewered areas that continue to rely on cesspools and septic tanks to handle household sewage have not seen such a reduction in nitrate. In fact, in many unsewered areas, nitrate levels in the upper glacial aquifer have continued to increase. This phenomenon is more pronounced in Suffolk County, where approximately 70% of the population utilizes cesspools and septic tanks rather than regional municipal sewers. In some of the more densely populated unsewered areas, nitrate levels within the upper glacial aquifer exceed the drinking water standard of 10 mg/L. (*Comp Plan*, p. 3-4). This water quality trend has also been observed in surface waters, such as lakes, rivers, and bays. Elevated nitrate in surface waters can cause harmful algal blooms and reduced oxygen levels, resulting in fish kills and other negative effects.

Nitrate in drinking water starts affecting the health of the general populace at levels in the range of 100 to 200 mg/l but the effect on any given person depends on many factors, including other sources of Nitrate and nitrite in their diet. Infants and nursing mothers may experience Nitrate related health problems at concentrations as low as 40 mg/L. Excessive concentrations of Nitrate in drinking water can cause serious health problems for young infants, such as methemoglobinemia, or "blue baby syndrome". Fortunately, cases of methemoglobinemia, are exceptionally rare. According to local public health officials, there has never been a docu-

mented case of it due to tainted drinking water anywhere on Long Island. The drinking water standard of 10 mg/L, many times lower than the level at which health is impacted, greatly minimizes the likelihood that public drinking water supplies will cause Nitrate-related adverse health effects to humans.

Wells that are most vulnerable to Nitrate contamination are typically shallow and screened in the upper glacial aquifer, and are most often situated in agricultural areas (such as Eastern Long Island), or in fairly high density residential areas where homes are served by individual on-site septic systems for waste disposal. Wells that provide irrigation water to golf courses and farms often have elevated Nitrate levels. Private homeowner wells in areas not served by public water (typically eastern Suffolk County), especially in agricultural areas, often show elevated Nitrate levels. Efforts have been made by public water suppliers to extend public water to these residents. Some public supply wells in more densely populated, unsewered portions of western Suffolk County have seen marked increases in Nitrate levels over the past 20 to 30 years. These wells are typically screened in shallow sections of the Magothy aquifer, in areas where no overlying confining units are present. In many instances, these are areas that were agricultural prior to post World War II suburbanization, and the legacy Nitrate contamination has been exacerbated by more recent residential Nitrate contamination.





Water Quality Mapping:

The Next Step in Coordinated Water Resources Management

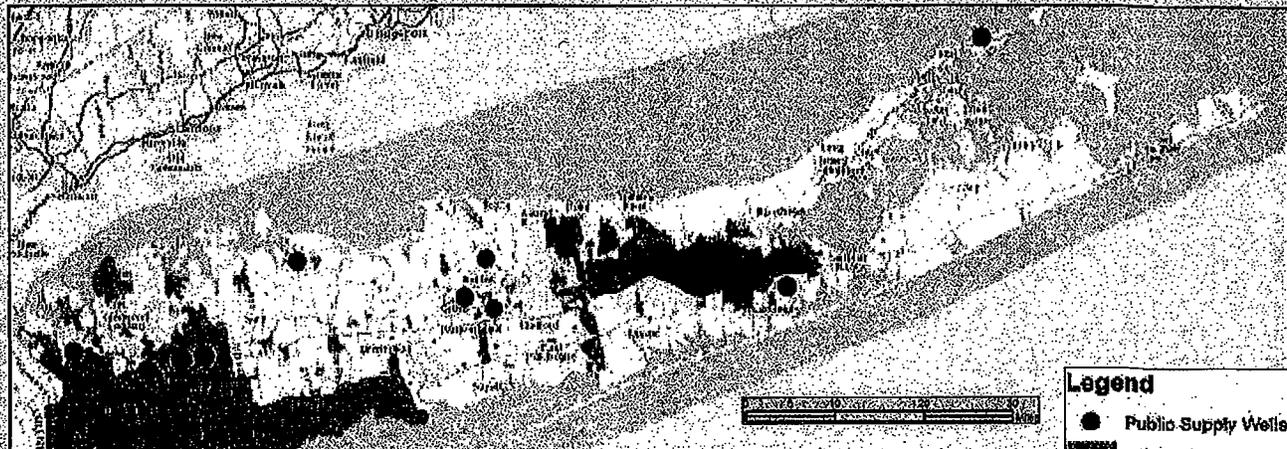
For decades, researchers, scientists and officials from public agencies and water utilities have collected and analyzed water quality data from wells located all across Long Island. This data has been used to produce reports vital to the understanding of Long Island's aquifers. Water quality data from thousands of wells—as well as information about well location, the aquifer from which water was drawn, water table elevation and pumping history—is managed in dozens of independent databases by various entities. But until now, no one has attempted to unify all available information into a single database available to everyone, including the general public.

As stated in the mission at the beginning of this report, Suffolk and Nassau county officials created LICAP to ad-

vance a coordinated regional approach to groundwater resources management. To that end, water suppliers from across Long Island shared water quality data from calendar year 2015 to develop a single, unified database called WaterTraQ. The creation of this database allows water utilities and public agencies to search for any chemical constituent and have results visually displayed by concentration, location, depth and sample date, among other criteria.

This tool offers an unprecedented view into the Long Island aquifer system. The next step will be to add all monitoring wells within Nassau and Suffolk and create a web-based version of the system. The program may also be expanded to include geologic and source water data.

Nitrates in Long Island wells greater than 10 mg/l



Well #	Supplier	Aquifer	Depth	Remedy
N-5007	Plainview	Magdaly	465	Blending
N-10577	Manhasset-Lakeville	Magdaly	405	Blending
N-7357	Westbury	Magdaly	435	Blending
N-7562	Hicksville	Magdaly	558	Blending
S-6880	SCWA	Magdaly	597	Blending
S-203015	SCWA	Glacial	58	In home filtration units
S-23373	SCWA	Glacial	475	Blending
S-46400	SCWA	Glacial	265	Blending
S-28347	SCWA	Glacial	176	Abandoned - no longer in service
S-23184	SCWA	Glacial	138	Abandoned - no longer in service
S-35393	SCWA	Glacial	162	Blending

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GEBCO, IGN, Keeler, N.L., Orange Sky, Esri Japan, MI, Esri China (Hong Kong), Swisstopo, Mapbox, © OpenStreetMap contributors, and the GIS User Community

The above map shows the approximate locations of public supply wells on Long Island that had nitrate levels above the NYS drinking water standard of 10 mg/L in 2015. These wells cannot be pumped directly into their distribution system, but must be either (1) outfilled with a nitrate removal system, similar to that shown at the top of

page 30, or (2) pumped simultaneously ("blended") with a lower nitrate well. The data table in this section also shows how each water supplier mitigated their nitrate problem. Water delivered to customers is required by state and federal law to have a nitrate level below 10 mg/L.

Nitrate and Human Health

Nitrate can interfere with the ability of the blood to carry oxygen to vital tissues of the body in infants of six months old or younger. The resulting illness is called methemoglobinemia, or "blue baby syndrome". In the presence of nitrate, hemoglobin in the blood can be converted to methemoglobinemia, which cannot carry oxygen. Consuming drinking water with nitrate levels near the drinking water standard does not normally increase the methemoglobinemia level of humans beyond infancy. Some individuals, however, may have increased susceptibility to methemoglobinemia due to a number of different factors (such as pregnancy or certain rare diseases). Once diagnosed, methemoglobinemia can be



readily reversed, although permanent damage may have occurred. Eighty to 90 percent of the nitrate most people consume comes from vegetables, but this is unlikely to cause health problems because very little of the nitrate in vegetables is converted to nitrite. Meat products account for less than 10 percent of nitrate in the diet, but 60 to 90 percent of the nitrite consumed. This is primarily because of sodium nitrite added to foods such as hot dogs, bacon, or ham. Fruits, grains, and dairy products contribute almost no nitrate or nitrite to people's diets.

A picture of a nitrate removal plant in use at a public supply well in E. Northport. Photo shows one component of the system known as the "ion exchange media carousel"

This phenomenon was investigated extensively as part of the Comp Plan. A set of 390 public supply wells in all three major aquifers were sampled in 1987 and again in 2013. Data showed that nitrate levels in public supply wells increased in all three aquifers between 1987 and 2013. Nitrate levels increased by an average of 1 mg/L in the upper glacial aquifer (from an average of 2.63 mg/L to an average of 3.69 mg/L) and by 0.76 mg/L in the Magothy aquifer (0.95 mg/L to 1.71 mg/L). Only one Lloyd aquifer well was sampled in both years, and nitrate levels in that Lloyd public supply well increased by 0.5 mg/L.

Some of the above-mentioned increase in nitrate levels as described above may be attributable to increased public supply pumpage over the past four decades. While the population of Suffolk County has increased by 14 percent between 1980 and 2013, public supply pumpage has increased by 56 percent during that same time period (146 mgd in 1980 vs. 228 mgd in 2013). Much of this increase can be attributable to increases in lawn watering. Winter pumpage during this time period is up by approximately 15 mgd, while summer pumpage is up by over 100 mgd (*Comp Plan*, p. 4-34). As mentioned in a previous section of this report, increased pumping can have the effect of accelerating the movement of water (and any contaminants dissolved in it) through the aquifer system. The good news from all of this is that, despite these nitrate increases, the average nitrate concentration in the sampled public supply wells remained at less than half the 10 mg/L drinking water standard.

Surface Water Impacts

In recent years, Long Islanders have come to recognize that the potential for groundwater pollution to impact surface waters is just as important as drinking water impacts. Groundwater is a primary conduit for contaminants entering coastal water bodies. Pesticides, organic contaminants and metals can all impact coastal ecosystems, but nitrogen loading via groundwater is the primary threat to water quality in all of Long Island's estuaries. More than forty years of research has revealed areas where nitrate concentrations in shallow groundwater are elevated to at or near drinking water standards – typically in agricultural areas in eastern Suffolk County, and in high density residential areas without sanitary sewerage, most of which are in western Suffolk County (with some notable exceptions).

Since all surface water bodies on Long Island are groundwater dependant, contamination of the groundwater resources, particularly by elevated nitrate levels, impacts the water quality of a receiving surface water body. Negative ecological effects in coastal systems can result from groundwater nitrate concentrations far below the drinking water standard. Surface water bodies can begin showing negative ecological effects at nitrate concentrations much lower than 2 mg/L.

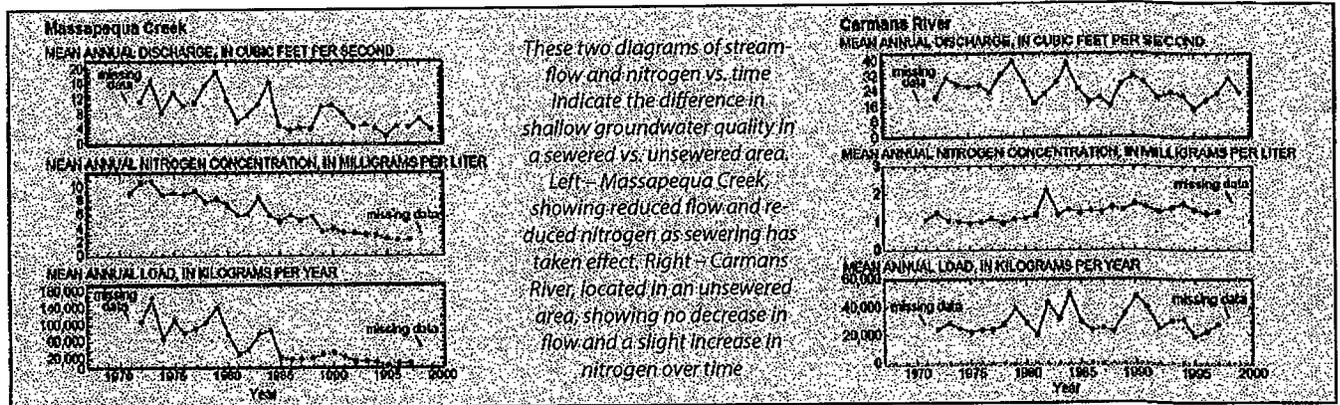
Excess nitrogen loading contributes to many impacts to Long Island's bays, including harmful algal blooms, fish kills, loss of aquatic plants such as eelgrass, and wetland degradation. This leaves parts of Long Island more vulnerable to flooding and storm and hurricane damage.

STATE OF THE AQUIFER—QUALITY



These species are important for erosion control and serve as habitat for fish and shell fish in the bays. For improved estuary health, nitrogen delivered to estuaries via groundwater must be reduced. Possible solutions to reducing nitrogen levels in shallow groundwater include reduction of fertilizer use, expansion of regional sanitary sewers and the use of “high performance” septic systems for individual homes in place of conventional septic systems. These high performance systems can reduce the nitrogen content of domestic sewage by over half, resulting in lower nitrate levels in shallow groundwater.

Regional sanitary sewerage has the dual effect of reducing nitrogen loading in streams and ultimately the receiving tidal water body, while also reducing the baseflow of the stream itself. The overall nitrogen load to both the upper glacial aquifer and to receiving surface water body is reduced by regional sewerage, but the reduction in streamflow may have negative effects on the health of the receiving water. The two graphs below represent historic nitrogen loading and stream flows in creeks flowing through sewerage (Massapequa Creek) and unsewered (Carman's River) areas (<http://ny.water.usgs.gov/pubs/wri/wri024255/>).



Pesticides

Pesticides include any substances (or mixture of substances) intended to destroy, repel, or otherwise mitigate problems associated with organisms determined by the NYSDEC to be pests, including insects, rodents, fungi, weeds, viruses (or other forms of plant or animal life) present in the environment or living on humans or animals. The term also applies to the degradation products of these substances. Pesticide monitoring and management is a complex issue, because many of these compounds and their breakdown products easily dissolve in and move through groundwater. They can exist within the aquifer system for decades. This is a concern not only for drinking water, but also for Long Island surface water features, such as lakes, streams and estuaries.

In accordance with the federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), New York State has developed a pesticide product registration program and reporting law that includes requirements for the registration and use of pesticides. This law mandates that a water quality monitoring program be conducted in order to provide an adequate understanding of the health and environmental impacts of pesticide use within New York State. The SCDHS first began a pesticide monitoring program in 1997.

Since then, this program has expanded to include numerous monitoring wells installed at nearly 70 different locations to help assess any impacts to water resources from pesticide use. As part of this effort, the SCDHS works with a variety of stakeholders, including the NYSDEC, the New York State Department of Health (NYSDOH), USEPA, Cornell Cooperative Extension (CCE), the Nassau County Department of Public Works, public water suppliers and the USGS.

The program has been tailored to testing groundwater quality associated with specific land uses, including golf courses, vineyards, greenhouses, nurseries, farms, residential areas and public utility right of ways. The information obtained from this program is also to be used to support the NYSDEC's Long Island Pesticide Pollution Prevention Strategy and the long-term monitoring of pesticides as recommended in Suffolk County's Comprehensive Water Resources Management Plan.

Pursuant to the NYS Sanitary Code, all organic compounds without a specific drinking water standard are classified as either unspecified organic contaminants (UOCs) with an assigned drinking water standard of 50 parts per billion (ppb) or principal organic contaminants



(POC) with an assigned value of 5 ppb. Most pesticides and their degradation products do not have specific drinking water standards and, as such, have an assigned value of 50 ppb. The SCDHS Public and Environmental Health Laboratory (PEHL) tests for approximately 150 different pesticides including degradation products. However, this may only represent about 15% of the active pesticide ingredients registered in the state for use on Long Island.

Pesticide Monitoring Results / Detections

According to the SCDHS, more than 100 pesticide-related compounds have been detected in Long Island groundwater since the pesticide monitoring program began in 1997. Public water suppliers operating in Nassau and Suffolk Counties also routinely test for a variety of pesticides as part of their self-monitoring requirements conducted under the NYS Sanitary Code. For example, SCWA tests for approximately 70 different pesticide compounds as part of their public water supply monitoring efforts. Through Suffolk County's ongoing monitoring programs, the SCDHS has observed the following:

- Pesticide breakdown products have been detected more frequently and in higher concentrations than parent compounds. However, the majority of pesticide detections have been low.
 - Sampling efforts performed by the SCDHS in cooperation with other agencies and stakeholders have helped to facilitate the voluntary withdrawal of several pesticides registered for use on Long Island. Notable examples include aldicarb, carbofuran, oxamyl, dacthal, and dichloropropane in the 1980s and metolachlor and alachlor in the 2000s.
 - SCDHS records indicate that there have been fewer detections of the oldest pesticides, most of which are no longer used. Also, the maximum concentrations detected by the SCDHS of several of these compounds have decreased. However, these compounds are persistent and in some cases still exceed the drinking water standards.
 - According to SCDHS records, between 1997 and 2012, the most prevalent compounds detected in drinking water wells have all been withdrawn for use on Long Island, except for one (atrazine), which has been restricted for use by the NYSDEC.
- There has been an increase in the frequency of detections of other pesticides, although the measured concentrations remain lower than their respective drinking water standards.
 - Samples collected by the SCDHS between 1997 and 2012 show that treated samples collected from public drinking water wells meet NYS drinking water standards.
 - Sampling data compiled by the SCDHS between 1997 and 2012 from drinking water sources revealed that pesticide compounds were detected with the following results:
 - At least one pesticide compound was detected in about 22% of Public Community Supply Wells tested during this period (196 of 865 wells sampled);
 - At least one compound was detected in about 25% of the Public Non-Community Supply Wells sampled during this period (150 of 589 wells sampled);
 - At least one compound was detected in about 23% of the private wells sampled during this period (2300 of 9900 wells sampled).

Recommendations / Actions Moving Forward

In order to address the ongoing potential impacts of pesticides to groundwater and surface waters, the SCDHS and involved stakeholders will continue its robust monitoring and sampling programs and continue to identify compounds that are frequently used on Long Island and can potentially impact our water resources.

Recently, staff at Cornell Cooperative Extension have identified at least twelve pesticides that could potentially impact our water resources. Involved agencies and stakeholders are in the process of exploring the ability to test for these compounds. Finally, as part of the NYSDEC's Pesticide Pollution Prevention Strategy, stakeholders, regulatory agencies and agricultural communities will continue to work together to implement Best Management Practices (BMP) at various agricultural settings to help mitigate the impact of pesticide use on Long Island.



Grumman - Navy Groundwater Plume

Background

The Northrop Grumman Corporation was established in 1929 in Bethpage on a 635-acre parcel, 105 acres of which were occupied by the Naval Weapons Industrial Reserve Plant (NWIRP), a Government Owned Contractor Operated (GOCO) facility. Activities conducted at the facility included engineering, administrative, research and development, and testing operations, as well as manufacturing operations for the Navy and NASA. The facility also had an active airfield. Both Northrop Grumman and the NWIRP sites had maintained numerous industrial groundwater supply wells, drinking water supply wells, and recharge basins. Former manufacturing and other operations have been phased out, and Northrop Grumman has sold significant portions of the property. Northrop Grumman does, however, maintain a permanent presence with minimal staff at the site.

Groundwater beneath the site has been contaminated by both volatile organic compounds (VOCs) (primarily trichloroethylene, tetrachloroethylene, dichloroethylene and vinyl chloride) and chromium which entered the groundwater through various source areas. These include recharge basins, sumps, dry wells, spill areas and former hazardous waste storage areas at both the Grumman facility and the adjacent Hooker/RUCO EPA Superfund site. In 1976, water pumped from some of the on-site Grumman public supply on wells was found to contain VOCs. Subsequently, Grumman discontinued use of its wells for drinking water purposes and connected to the Bethpage Water District (BWD) public water system.

In 1986, the Nassau County Health Department, in conjunction with the United States Geological Survey (USGS), began an investigation of the groundwater resources in the vicinity of the Grumman plant. During this study, a groundwater plume estimated to be more than 2,000 acres in area and more than 700 feet deep in places has been identified beneath, and south of, these facilities. This plume is emanating from this facility, and is commingled with a plume from the upgradient and adjacent Hooker/RUCO site.

Northrop Grumman has implemented an on-site groundwater remediation and monitoring system which is known as OU-1. OU-1 includes three extraction wells which remove contaminated groundwater from the site and pump it through an air stripping treatment system for VOC removal. Following treatment, the groundwater is discharged into recharge basins located along the southern boundary of the site. This process has not only treated on-site contaminated groundwater but has also created a partial hydraulic barrier which has supposedly minimized off-site migration of the contamination. However, recent vertical profile boring data upgra-

dient from Bethpage Water District Plant 6 indicates that the on-site system may not be capturing deep contamination.

A second operable unit, OU-2, includes a network of wells which are used to monitor the off-site contamination plume. Data from these monitoring wells indicate there is a significant contaminant plume flowing in a southeasterly direction that is not being treated by the OU-1 Groundwater Remediation System. Therefore, the groundwater plume is poorly delineated, and part of the plume has "broken away" from the Grumman-Navy site and impacted public supply wells to the south. In 2014 the Navy commenced with additional delineation work.

Since 1986 off-site groundwater contamination has adversely impacted or threatened several public drinking water supply wells including facilities operated by the Bethpage Water District (BWD), Levittown Water District (LWD) and New York American Water (NYAW). Public supply wells operated by South Farmingdale Water District (SFWD) and Massapequa Water District (MWD) are threatened by the contamination. To address this threat, the NYSDEC implemented a sentinel well installation program siting early warning monitoring wells upgradient of public supply wells operated by SFWD, MWD and NYAW. Based on contaminants detected in some sentinel wells, wellhead treatment systems were constructed at SFWD Plants nos. 1 and 3 and NYAW Seamans Neck Road Plant in 2014.

Operable Unit 3 (OU-3), an area immediately off-site which was used for sludge drying and fire control training, is an 18-acre area that now is the Bethpage Community Park. Prior to being developed as a park, this property was reportedly used by Grumman as a wastewater discharge recharge area, sludge drying bed area, and fire training facility, where waste oil and jet fuel were ignited and extinguished. Preliminary data indicates that the OU-3 area could have been a historic source of six chlorinated volatile organic compounds. As part of the off-site investigation into the contamination plume emanating from the park, vertical profile borings (VPBs) were installed and extensive off site contamination of the deep magothy aquifer was documented. The NYSDEC issued a Record of Decision in April of 2013.

Plume Location

The dissolved VOC plume is currently approximately 15,000 feet long (north to south), 9,000 feet wide (east to west) and approximately 700 feet deep. The aerial photograph on page 34 depicts the extent of the commingled OU-2 and OU-3 plumes which encroach into the NYAW, SFWD, and LWD service areas. The plume of contamination, the largest impact-



ing a federally-designated sole source aquifer in the country, travels both horizontally and vertically in the Magothy aquifer and moves in a range of 0.3 to two feet per day, based on information from reports prepared by Grumman or the Navy. An average estimated rate of one foot per day has been typically used to define groundwater movement in the area.

Drinking Water Wells Impacted and Threatened

In addition to the wells referenced above, this extensive plume is expected to impact additional public supply wells operated by the SFWD and NYAW. The Massapequa Water District (MWD) is further south and will likely be impacted by the plume in the future if proper action is not taken to perform full delineation and remediation of the plume.

A total of 34 public drinking water supply wells operated by five regional purveyors with an aggregate capacity of over 70 mgd are threatened or already impacted by the plume. These five regional suppliers provide potable water to a population of over 250,000. A total of nine wells are already equipped with wellhead treatment in response to the plume, with two more planned to be constructed in the near future. 23 remaining public drinking water supply wells are in the path of the commingled OU-2 and OU-3 plume.

Contaminants of Concern

TCE is the primary contaminant that has impacted or is threatening public drinking water supply wells in the path of the plume. TCE is heavier than water and therefore sinks in the aquifer as it migrates down-gradient. TCE has been classified as carcinogenic to humans. Concentrations of TCE in deep aquifer sections far exceed applicable drinking water standard of 5 parts per billion (ppb). For example, TCE was detected in a vertical profile boring upgradient from BWD Plant 6 during 2014 at a concentration of 4,600 ppb. Additionally, a Total Volatile Organic Compound (TVOC) concentration of 14,700 ppb was most recently discovered upgradient of BWD wells as part of an OU-3 pre-design investigation by Grumman. This represents the highest TVOC concentration found off site to date and is almost 3,000 times greater than the MCL.

Future Drinking Water Regulatory Action

The EPA is considering lowering the MCL for tetrachloroethylene (PCE) and trichloroethylene (TCE), to a level that is closer to the detection limit of 0.5 ppb, based on the context of the Safe Drinking Water Act (SDWA) requirement that the MCL must be as close to the MCLG "as feasible." The lowering of the MCLs will result in far higher wellhead treatment costs. 1,4-dioxane is another contaminant of con-

cern. EPA risk assessments indicate that the drinking water concentration representing a one in a million cancer risk level for 1,4-dioxane is 0.35 ppb (EPA IRIS 2013). For purposes of comparison, the State of Massachusetts has established a drinking water guideline level of 0.3 ppb (Mass DEP 2012).

During Grumman's December 2015 sampling program for the OU-3 pre-design, 1,4-dioxane was detected in an upgradient monitoring well at a peak level of 114 ppb. According to the EPA, 1,4-dioxane is a compound likely to be present at sites contaminated with certain chlorinated solvents because of its widespread use as a stabilizer for those solvents. Since the Navy and Grumman started to incorporate testing for 1,4-dioxane, it has been consistently detected in the plume. Air stripping and GAC Adsorption do not remove this contaminant. A more costly advanced oxidation process (AOP) using hydrogen peroxide with ultraviolet light or ozone has been shown to be potentially successful to remove 1,4-dioxane. The probably MCL for 1,4-dioxane is 50 ppb. Therefore this contaminant must be considered as plume delineation and remediation moves forward.

Perchlorate has been detected in BWD supply wells. To date no sampling has been conducted by Grumman and Navy to determine the source of the contamination. Such testing needs to be performed immediately, especially since fire training operations were a part of Grumman past practices on the property and perchlorate is a component of jet fuel and munitions.

The New York State Department of Health (NYSDOH) provisional standard for perchlorate requires public notification when perchlorate is found at 18 ppb, and requires large water suppliers to report findings in their Annual Water Quality Reports. Several states have initiated regulatory reviews to prepare a drinking water standard for perchlorate. California and Massachusetts have set "public health goals" for the contaminant levels of 6ppb and 1ppb respectively. Accordingly this contaminant must be considered as plume delineation and remediation efforts at this time.

Remediation Efforts

Until very recently, the NYSDEC has not required off-site cleanup of the groundwater contamination, but decided to allow the funding of treatment systems at impacted public supply wells. In reaching this determination, the NYSDEC has decided that the groundwater contamination can remain and will not be subject to cleanup. NYSDEC regulations list four remediation measures: (1) removal and/or treatment; (2) containment; (3) elimination of exposure; and (4) treatment of source at the point of exposure. The plume containment and remediation approach was reviewed by the NYSDEC during 2001.

Another option for remediation, would be the construction of extraction wells north and south of Hempstead Turnpike in order to contain and remediate the plume. Such an



Aerial photograph showing the location of the Grumman-Navy plume relative to nearby public supply wells

approach could prevent additional public drinking water supply wells from being adversely impacted or threatened and protect public health. Potential areas for installation of recovery wells and treatment facilities have been tentatively identified, and impacted and threatened water suppliers continue to meet with regulatory agencies and the responsible parties to encourage the installation of recovery facilities to intercept the plume to prevent further impacts. Since locating a plume containment/remediation extraction treatment system in residential areas can be potentially difficult, conveying the extraction water back to the Grumman property for treatment may be necessary if this approach is adopted. Treated water effluent will be re-injected into the aquifer and also should be considered for stream flow augmenta-

tion and golf course irrigation. The Bethpage State Park Golf Course is located in very close proximity to the Grumman-Navy site. This would be most beneficial to the water balance as the treated plume water would re-enter the aquifer system.

Benefits of proactive plume containment and remediation may include a potentially significant cost savings given the cost for wellhead treatment, as compared to cleanup of the groundwater; fewer upgrades to existing wellhead treatment systems to treat for 1,4 dioxane; optimum public health protection via the prevention of contamination from impacting supply well source water and maintaining a multi-barrier approach for drinking water quality protection; cleanup of the environment; and elimination of any negative impact to Great South Bay.



Sewering vs. Septic Systems

The method by which domestic wastewater is treated in an area is an important influence on both the water quality and the water quantity in that area. Municipal sanitary sewers, especially those with effluent discharge to tidal waters, completely remove wastewater from the groundwater system. This has a positive effect on shallow groundwater quality by eliminating pollutants such as nitrate and industrial waste. However, since this water is not recirculated back into the groundwater system, sewerage also has the effect of reducing the overall volume of water within the aquifer system, which has a negative effect on water quantity.

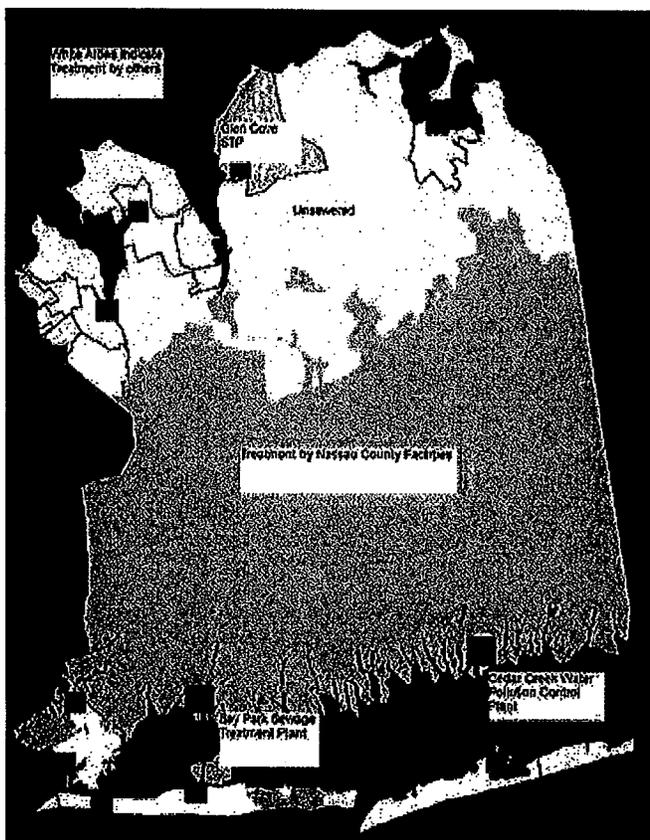
Approximately 90% of the population in Nassau County is served by municipal sanitary sewers. Construction of these large public works began in the 1950s, and was essentially finished by the early 1980s, except for a few small areas within the county. The Nassau County Sewer and Stormwater Author-

ity (NCSAA) operates two large wastewater collection and treatment systems which primarily serve the south shore of the County. These two plants are the Bay Park and the Cedar Creek sewage treatment plants, which together treat an average of 58 million gallons per day (mgd) of wastewater. After treatment, the effluent from these plants is discharged to the south shore estuaries or to the Atlantic Ocean. The NCSAA also operates the City of Glen Cove sewage treatment facility, and receives effluent from an additional six municipal sewer districts in Nassau. Nine additional independent municipal sewage treatment systems serve Nassau County. Collectively, these nine systems process approximately 15% of Nassau's wastewater.

Construction and use of regional sewers in Nassau has resulted in significant changes to the groundwater system in the county. Since these sewer systems remove wastewater from the groundwater system along with all contaminants associated with it, shallow groundwater and surface water quality in Nassau have improved dramatically, especially with regard to nitrate levels. However, since regional sewerage reduces the overall volume of water within the upper glacial aquifer, water levels in portions of central Nassau have declined as much as 10 to 15 feet since the onset of sewerage. Some of this water table decline has even been observed in portions of western Suffolk County (as much as 5 to 8 feet). This decline has negatively affected water levels in surface water bodies (lakes and streams) located within the sewerage areas. Some creeks have shortened in length or completely dried up, and the water level of many lakes have declined significantly since the onset of sewerage.

In contrast to Nassau County, approximately 70% of Suffolk County's residents utilize individual cesspools and septic tanks for domestic waste disposal. Rather than having wastewater conveyed to a distant treatment facility, the septic/cesspool system is located on the homeowners property. However, since untreated domestic waste typically has a nitrate concentration of over 40 mg/L, the quality of water within the upper glacial aquifer in areas served by on-site cesspools and septic systems is usually somewhat degraded.

Suffolk also has numerous larger municipal, and smaller privately owned wastewater treatment plants that discharge treated effluent to a large basin located near the plant. While these two above-mentioned practices tend to maintain groundwater levels in the upper glacial aquifer by keeping water within the groundwater system, they often result in water quality degradation within the upper glacial aquifer (especially in the case of individual homeowner septic systems).



Map showing sewerage areas in Nassau County and locations of municipal wastewater treatment facilities. County facilities are shown in red. Unsewered areas utilize on site disposal systems for domestic sewage.

WASTEWATER: SEWERING VS. SEPTIC

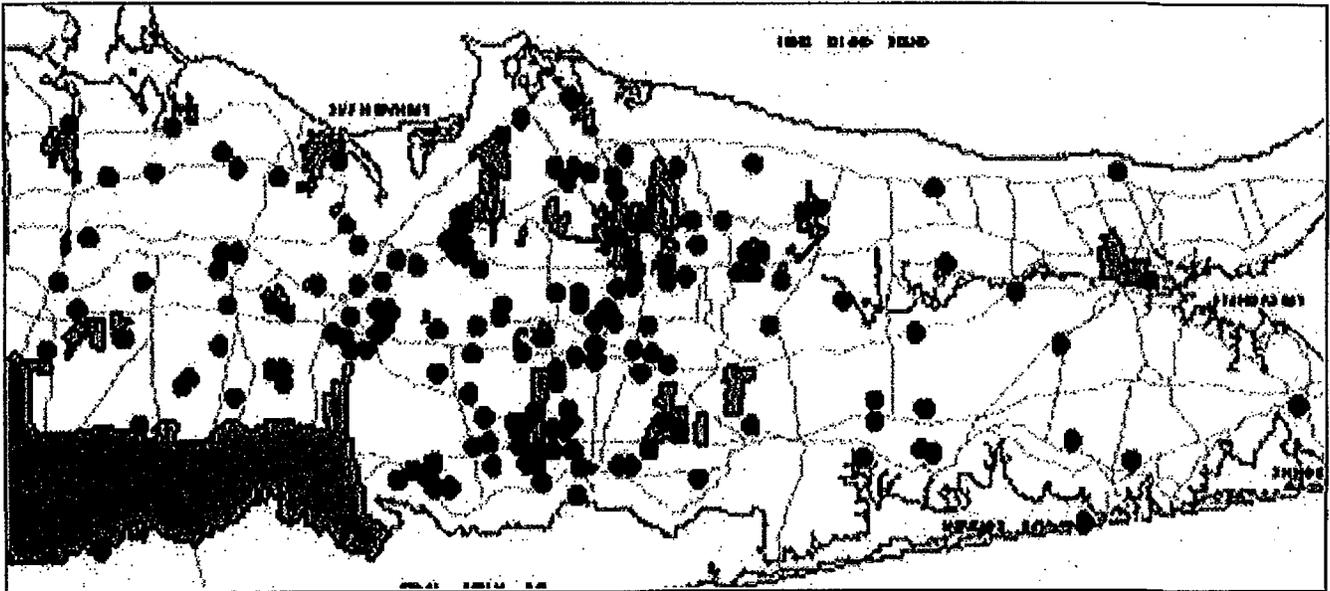


Suffolk County does have several large municipal wastewater treatment facilities that discharge to tidal waters (similar to those in Nassau County), the largest of which is the Bergen Point treatment plant in West Babylon. Some water level declines within the upper glacial aquifer have been observed since the construction of the Bergen Point plant. However, the vast majority of Suffolk's residents rely on individual cesspools and septic tanks.

Utilizing cesspools for individual homes also affects the quality and quantity of groundwater, in the opposite manner of regional sewers. Since water is re-circulated back into the ground via the cesspool, minimal impact to overall volume of water within the upper glacial aquifer results. However, since untreated domestic waste is quite high in nitrate concentration, the quality of water within the upper glacial aquifer in areas served by cesspools is usually degraded. The degree to which nitrate levels are elevated depends upon the density of the housing units.

Previous studies conducted on Long Island by scientists and planners have shown that in unsewered areas with lot

sizes of ¼ acre or smaller, groundwater in the upper glacial aquifer typically has nitrate levels above the drinking water standard of 10 parts per million (ppm). In unsewered areas with lot sizes averaging ½ acre, nitrate levels are typically 5 to 6 ppm, lot sizes averaging 1 acre in unsewered areas typically result in nitrate levels of 3 to 4 ppm and lot sizes of 2 acres or larger have minimal nitrate impact on groundwater quality. Many residential neighborhoods on Long Island are situated on lands that were farmland at one time. On such lands, there is often "legacy" groundwater contamination from past agricultural activity even before residential development began. Succeeding residential development using septic systems often exacerbates such contamination. In conclusion, larger lot sizes in unsewered residential areas results in lower nitrate concentrations in the local shallow groundwater. However, utilization of regional sewerage, with offshore wastewater disposal virtually removes sewage-related contaminants from the groundwater system altogether.



Map showing sewerage areas in Suffolk County. Regional sewer districts are shown in green, and sewage treatment plants are shown by the red circles.

Note that most of Suffolk County is not sewerage, and therefore utilizes on-site cesspool/septic systems for wastewater disposal.



Concluding Thoughts...

In just a short period of time, the Long Island Commission for Aquifer Protection has taken great strides toward creating a blueprint for a coordinated approach to groundwater resources management on Long Island, such as through the creation of this State of the Aquifer Report. But these are just initial steps. The protection of our water supply depends on the continued active involvement of researchers, scientists, officials from public agencies and water utilities, elected officials and the general public.

To that end, LICAP will continue work on its Groundwater Resource Management Plan, which will include detailed information about groundwater data management, threats to water quality and quantity and recommendations for potential regulatory changes, among other related topics.

The State of the Aquifer Report and the Groundwater Resources Management Plan will provide the impetus for a new era of groundwater management on Long Island. It is our sincere hope and expectation that others will build on the work we've started to protect forever this incredible natural resource.

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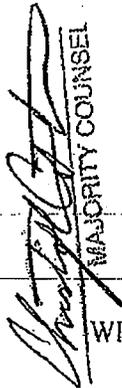
Res 107
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RESOLUTION NO. 107 - 2013

A RESOLUTION ESTABLISHING THE LONG ISLAND COMMISSION ON AQUIFER

PROTECTION

Passed by Nassau County Legislature on
12/19/13 A voice vote was taken with 15
Legislators present.
Voting: aye 15, nay 0, abstained 0, recused 0
Became a resolution on 12/27/13
With the approval of the County Executive

FORM APPROVED

MAJORITY COUNSEL

WHEREAS, an aquifer system underlies both Nassau and Suffolk Counties; and

WHEREAS, the critical importance of the aquifer system was recognized by the United States Environmental Protection Agency when the system was designated a sole source aquifer (the "SSA"); and

WHEREAS, numerous studies and reports have recognized the critical importance of protecting the quantity and quality of water in the SSA; and

WHEREAS, groundwater and surface water are inextricably linked in the Long Island water cycle and protecting the quality of groundwater will protect the quality of the surface water into which groundwater flows; and

WHEREAS, the proliferation of local governmental entities and decentralized land use controls on Long Island limits the ability of the two Counties to adequately address water quality issues due to the very nature of the SSA, which crosses all geopolitical boundaries; and

established; and be it further

RESOLVED, that the Nassau County Executive is hereby empowered and authorized to enter into an inter-municipal agreement with Suffolk County, which agreement will set forth the terms and conditions under which the LICAP will operate, such agreement to be consistent with the terms of this resolution; and be it further

RESOLVED, that the LICAP shall consist of nine members. Five entities shall have a permanent membership position, the Suffolk County Water Authority, the Long Island Water Conference, the Nassau-Suffolk Water Commissioner's Association and the Nassau and Suffolk Departments of Health. Each entity or member may designate a representative to attend meetings and such representative shall serve at the pleasure of his or her designating entity. There shall be four appointed members, two members to be appointed from Nassau County and two members to be appointed from Suffolk County, as set forth below. A quorum of the LICAP shall consist of no fewer than five voting members, which, at a minimum, must include three of the permanent members and at least one member from Nassau County and at least one member from Suffolk County. Any subcommittee of the Council shall contain equal representation from each County and at least one permanent member; and be it further

RESOLVED, that the Nassau County Executive and the Presiding Officer of the Nassau County Legislature shall each, subject to the approval of the Nassau County Legislature, appoint one member to the LICAP, each of whom shall reside in Nassau County. Each appointment shall be for a four year term except the initial non-permanent members of the LICAP shall have staggered terms, with the two Suffolk members having initial terms of one and four years and the two Nassau

meetings during the calendar year; and be it further

RESOLVED, the Chair and Vice-Chair of the LICAP shall rotate between the Suffolk County Water Authority, the Long Island Water Conference and the Nassau-Suffolk Water Commissioner's Association on a two year basis. The first Chair shall be the Suffolk County Water Authority's representative. The Chair shall keep a record of its resolutions, transactions, findings and determinations, which shall be public record, and shall adopt and file with the Clerks of the Nassau County and Suffolk County Legislatures by-laws governing its operations, including by-laws governing procurement that comply with all state requirements and, to the extent possible and reasonable, provide for competitive solicitation of goods and services; and be it further

RESOLVED, that the LICAP shall meet quarterly, or more often as agreed to by the LICAP. Notice of such meetings shall be provided, and such meetings shall be open to the public in compliance with the provisions of the Public Officers Law. Minutes of the meetings shall be kept and meeting agendas and minutes shall be provided to all LICAP members and ex-officio members; and be it further

RESOLVED, that the LICAP is hereby authorized and empowered to receive and expend public and private funds, including grants from non-profit foundations, agencies, corporations, including public benefit corporations, and private entities, contract with public corporations for in-kind services, and may apply for and accept grants, donations, subsidies, or other funding from the federal, state and local governments, and enter into contracts for and agree to accept such grants, donations or subsidies in accordance with its approved purposes and make grants to public education and/or research institutions, such funds to be used for research purposes, provided that no more than 15% of the LICAP funds are used to pay for overhead or associated costs; and be it further

2/25

RESOLVED, LICAP shall establish two standing committees, the 2040 Water Resources and Infrastructure Subcommittee (2040 WRIS) and the Water Resource Opportunities Subcommittee (WROS). The 2040 WRIS shall develop a 2040 WRIS Plan to identify long-term risks to the water supply industry created by global climate change. The 2040 WRIS Plan shall recommend short term measures to strengthen public water distribution systems against these long term risks, including, but not limited to, the development of well placement criteria, mechanism for hardening water distribution system infrastructure in coastal areas and loss mitigation strategies, including methods for isolating vulnerable portions of distribution system during an event. The WROS will identify and quantify short term risks, if any, to groundwater resources; and be it further

RESOLVED, within three years of the Report, LICAP shall issue a Groundwater Resources Management Plan (the "Plan") that includes, but is not limited to, the following:

- a. Qualitative and quantitative groundwater data,
- b. Anthropogenic threats to groundwater quality and quantity,
- c. Existing regulatory groundwater management regimes,
- d. Assessment of adequacy of existing groundwater management regulations,
- e. Management opportunities,
- f. Development of recommendations,
- g. Methods for implementing the recommendations and proposed regulatory amendments, and
- h. Implementation program, including stakeholders, roles and responsibilities, prioritization of actions, schedule and costs; and be it further

RESOLVED, in preparing the Plan, the LICAP may:

b. the LICAP shall be subject to audit by the Nassau and Suffolk County Comptrollers. LICAP need not prepare such reports, if either County, on LICAP's behalf, engages a third party to perform work at the direction of LICAP or if either County hires employees to work on LICAP projects; and be it further

RESOLVED, the LICAP shall focus its efforts solely on quality and quantity of groundwater in the SSA and methods for preventing further degradation of such waters, improving these waters and ensuring their quality and quantity for future generations and those issues as requested by either County Executive and/or either County Legislature; and be it further

RESOLVED, that this resolution shall become effective upon the approval and adoption of a substantially similar resolution or ordinance by Suffolk County; provided, however, that such a resolution or ordinance shall not be construed as "substantially similar" if it affects the powers of Nassau County or its members on the LICAP, including, but not limited to, representation, voting powers or Nassau County's financial contribution to the LICAP; and be it further

RESOLVED, that the LICAP will expire and the terms of its members will terminate five years after the effective date of this resolution or the effective date of the ordinance adopted by Suffolk County, whichever is later, unless both counties enact a new resolution/ordinance reauthorizing LICAP and its mission; and be it further

RESOLVED, it is hereby determined by the Nassau County Legislature, the lead agency, and pursuant to the provisions of the State Environmental Quality Review Act ("SEQRA"), 8 NYECL section 0101 et seq. and its implementing regulations, Part 617 of 6 NYCRR, and section 1611 of the County Government Law of Nassau County, that this Local Law will not have a significant impact

Intro. Res. No. 1565-2013
Introduced by Legislators Spencer, Horsley, Hahn, Anker and Stern

Laid on Table 6/18/2013

**RESOLUTION NO. 805 -2013, ESTABLISHING THE LONG
ISLAND COMMISSION ON AQUIFER PROTECTION**

WHEREAS, an aquifer system underlies both Nassau and Suffolk County; and

WHEREAS, the critical importance of the aquifer system was recognized by the United States Environmental Protection Agency when the system was designated a sole source aquifer (the "SSA"); and

WHEREAS, numerous studies and reports have recognized the critical importance of protecting the quantity and quality of water in the SSA; and

WHEREAS, groundwater and surface water are inextricably linked in the Long Island water cycle and protecting the quality of groundwater will protect the quality of the surface water into which groundwater flows; and

WHEREAS, notwithstanding the numerous reports and studies prepared to date, the preliminary results of Suffolk County's Comprehensive Water Resources Management Plan highlight the need to undertake additional proactive measures to safeguard Long Island's SSA; and

WHEREAS, the proliferation of local governmental entities and decentralized land use controls on Long Island limits the ability of the two Counties to adequately address water quality issues due to the very nature of the SSA, which crosses all geopolitical boundaries; and

WHEREAS, Nassau and Suffolk recognize the need for comprehensive planning and special studies to focus on opportunities and issues, such as groundwater protection strategies, that are best handled on a broad geographic scale; and

WHEREAS, Nassau and Suffolk Counties need a strong bi-County commission specifically devoted to addressing the host of groundwater issues facing Suffolk and Nassau and to advocate a coordinated approach to the groundwater issues facing our region; and

WHEREAS, the commission membership should include a consortium of private and public experts on groundwater issues; and

WHEREAS, the Suffolk County Executive and this County Legislature have determined that it is in the best interest of the County to establish, in conjunction with the County of Nassau, the Long Island Commission for Aquifer Protection (the "LICAP") to build upon the previous studies and reports, identify areas for further research and suggest programmatic opportunities for preventing the further degradation of Long Island's SSA and identify mechanisms, including land use controls, for improving the quality of water within the SSA and for implementing safeguards to maintain the quantity of water within the SSA; and

WHEREAS, LICAP is intended to be a temporary commission charged with gathering relevant data on groundwater issues and preparing a State of the Aquifer Report and

6th **RESOLVED**, that the members of the LICAP shall receive no salary or compensation for their services; and be it further

7th **RESOLVED**, that any LICAP member may be removed by their appointing or designating authority for cause, including a member's failure to attend at least half of all regularly scheduled meetings during the calendar year; and be it further

8th **RESOLVED**, the Chair and Vice-Chair of the LICAP shall rotate between the Suffolk County Water Authority, the Long Island Water Conference and the Nassau-Suffolk Water Commissioner's Association on a two-year basis. The first Chair shall be the Suffolk County Water Authority's representative. The Chair shall keep a record of its resolutions, transactions, findings and determinations, which shall be public record, and shall adopt and file with the Clerks of the Nassau County and Suffolk County Legislatures by-laws governing its operations, including by-laws governing procurement that comply with all state requirements and, to the extent possible and reasonable, provide for competitive solicitation of goods and services; and be it further

9th **RESOLVED**, that the LICAP shall meet quarterly, or more often as agreed to by the LICAP. Notice of such meetings shall be provided, and such meetings shall be open to the public in compliance with the provisions of the Public Officers Law. Minutes of the meetings shall be kept and meeting agendas and minutes shall be provided to all LICAP members and ex-officio members; and be it further

10th **RESOLVED**, that the LICAP is hereby authorized and empowered to receive and expend public and private funds, including grants from non-profit foundations, agencies, corporations, including, public benefit corporations, and private entities, contract with public corporations for in-kind services and may apply for and accept grants, donations, subsidies, or other funding from the federal, state and local governments, and enter into contracts for and agree to accept such grants, donations or subsidies in accordance with its approved purposes and make grants to public education and/or research institutions, such funds to be used for research purposes, provided that no more than 15% of the LICAP funds are used to pay for overhead or associated costs; and be it further

11th **RESOLVED**, the LICAP shall have the power and authority to enter into agreements with consultants and experts and to pay for their services; and to provide for such other expenses as may be necessary and proper within the appropriations therefor; and be it further

12th **RESOLVED**, that the members of the LICAP shall be subject to the Codes of Ethics contained in Chapter 77 of the Suffolk County Code or Section 2218 of the Nassau County Charter and Sections 22-4.2 and 22-4.3 of the Nassau County Administrative Code depending on their place of residence; notwithstanding the foregoing, LICAP staff members employed by a public corporation with its own Code of Ethics shall be subject only to the employing entity's Code of Ethics; and be it further

13th **RESOLVED**, LICAP members and the firms that they work for, or are associated with, shall be precluded from providing any paid services to LICAP; and be it further

14th **RESOLVED**, that the LICAP shall prepare and release a State of the Aquifer Report (the "Report") within one year of its first meeting and thereafter provide annual updates of the Report. The Report and its updates shall be issued to the Nassau and Suffolk County

and public and private entities in matters related to regional groundwater protection issues; and

- c. establish relationships with local universities and colleges on groundwater protection issues;

and be it further

19th **RESOLVED**, the LICAP shall provide public notice upon completion of a draft Groundwater Resources Management Plan and shall conduct at least one public hearing in each County on such draft prior to the issuance of the Plan; and be it further

20th **RESOLVED**, notice of all hearings conducted pursuant to this resolution shall comply with the requirements of the Public Officers Law and shall, in addition, be provided to appropriate organizations identified by the LICAP; and be it further

21st **RESOLVED**, if the LICAP maintains funds in its exclusive custody and control or enters into any agreement providing for the payment of LICAP funds, it shall, consistent with the requirements of General Municipal Law Section 239-h, engage a Certified Public Accountant to complete an annual financial audit and audit of the internal control structure of the LICAP, a copy of which shall be included in the annual report:

- a. the LICAP shall file with the Nassau and Suffolk County Executives and the Nassau and Suffolk County Legislatures the terms and conditions of its employment/consultant agreements within 30 days of entering into such agreements; and
- b. the LICAP shall be subject to audit by the Nassau and Suffolk County Comptrollers. LICAP need not prepare such reports, if either County, on LICAP's behalf, engages a third party to perform work at the direction of LICAP or if either County hires employees to work on LICAP projects;

and be it further

22nd **RESOLVED**, the LICAP shall focus its efforts solely on quality and quantity of groundwater in the SSA and methods for preventing further degradation of such waters, improving these waters and ensuring their quality and quantity for future generations and those issues as requested by either County Executive and/or either County Legislature; and be it further

23rd **RESOLVED**, that this resolution shall become effective upon the approval and adoption of a substantially similar resolution or ordinance by Nassau County; provided, however, that such a resolution or ordinance shall not be construed as "substantially similar" if it affects the powers of Suffolk County or its members on the LICAP, including, but not limited to, representation, voting powers or Suffolk County's financial contribution to the LICAP; and be it further

24th **RESOLVED**, that the LICAP will expire and the terms of its members will terminate five years after the effective date of this resolution or the effective date of the ordinance adopted by Nassau County, whichever is later, unless both counties enact a new resolution/ordinance reauthorizing LICAP and its mission; and be it further

Intro. Res.

1565

Res. No.

805

October 8, 2013

Motion:
 Krupski, Schneiderman, Browning, Muratore, Anker
 Calarco, Montano, Cilmi, Hahn, Barraga,
 Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, Spencer

Co-Sponsors:
 Krupski, Schneiderman, Browning, Muratore, Anker
 Calarco, Montano, Cilmi, Hahn, Barraga,
 Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, Spencer

Second:
 Krupski, Schneiderman, Browning, Muratore, Anker
 Calarco, Montano, Cilmi, Hahn, Barraga,
 Kennedy, Nowick, Horsley, Gregory, Stern, D'Amaro, Spencer

LD	Legislator	Yes	No	Abs	NP	R
1	Albert J. KRUPSKI					
2	Jay H. SCHNEIDERMAN					
3	Kate M. BROWNING					
4	Thomas MURATORE					
5	Kara HAHN					
6	Sarah S. ANKER					
7	Rob CALARCO					
8						
9	Ricardo MONTANO					
10	Thomas CILMI					
11	Thomas F. BARRAGA					
12	John M. KENNEDY, JR.					
13	Lynne C. NOWICK					
15	DuWayne GREGORY					
16	Steven H. STERN					
17	Lou D'AMARO					
18	William SPENCER					
14	Wayne R. HORSLEY, P.O.					
	Totals	17				

MOTION

Approve

Table: _____

Send To Committee

Table Subject To Call

Lay On The Table

Discharge

Take Out of Order

Reconsider

Waive Rule _____

Override Veto

Close

Recess

APPROVED FAILED _____

No Motion _____ No Second _____

RESOLUTION DECLARED

ADOPTED

NOT ADOPTED

Roll Call _____ Voice Vote

Tim Laube

Tim Laube, Clerk of the Legislature

Intro. Res. No. 1948-2013
Introduced by Legislator Spencer

Laid on Table 11/6/2013

**RESOLUTION NO. 997 -2013, ADDING A REPRESENTATIVE
OF SOIL AND WATER CONSERVATION DISTRICT TO THE
LONG ISLAND COMMISSION ON AQUIFER PROTECTION**

WHEREAS, Resolution No. 805-2013 created the Long Island Commission on Aquifer Protection ("LICAP"); and

WHEREAS, various organizations dedicated to the protection of the environment and groundwater will serve as members of LICAP; and

WHEREAS, the Suffolk County Soil and Water Conservation District should be represented on LICAP; now, therefore be it

1st RESOLVED, that the 5th RESOLVED clause of Resolution No. 805-2013 is hereby amended to read as follows:

5th RESOLVED, that the Suffolk County Executive, the Presiding Officer of the Suffolk County Legislature, the Minority Leader of the Suffolk County Legislature, the Commissioner of the Department of Public Works, the Commissioner of Parks, Recreation and Conservation, and the Commissioner of the Department of Economic Development and Planning, or their representatives, and the Suffolk County Soil and Water Conservation District, shall serve as ex-officio members of the LICAP, but shall not be entitled to vote, and a representatives from the New York State Department of Environmental Conservation, the United States Geologic Survey and the Long Island Groundwater Research Institute shall be invited to serve as ex-officio members; and be it further

and be it further

2nd RESOLVED, that all other terms and conditions of Resolution No. 805-2013 shall remain in full force and effect; and be it further

3rd RESOLVED, that this Legislature, being the State Environmental Quality Review Act (SEQRA) lead agency, hereby finds and determines that this resolution constitutes a Type II action pursuant to Section 617.5(c)(20), (21) and (27) of Title 6 of the NEW YORK CODE OF RULES AND REGULATIONS (6 NYCRR) and within the meaning of Section 8-0109(2) of the NEW YORK ENVIRONMENTAL CONSERVATION LAW as a promulgation of regulations, rules, policies, procedures, and legislative decisions in connection with continuing agency administration, management and information collection, and the Suffolk County Council on Environmental Quality (CEQ) is hereby directed to circulate any appropriate SEQRA notices of determination of non-applicability or non-significance in accordance with this resolution.

___ Underlining denotes addition of new language

SUFFOLK COUNTY
County Legislature
RIVERHEAD, NY



This is to Certify That I, TIM LAUBE, Clerk of the County Legislature of the County of Suffolk, have compared the foregoing copy of resolution with the original resolution now on file in this office, and which was duly adopted by the County Legislature of said County on November 19, 2013 and that the same is a true and correct transcript of said resolution and of the whole thereof.

In Witness Whereof, I have hereunto set my hand and the official seal of the County Legislature of the County of Suffolk.

Tim Laube

Clerk of the Legislature