SPECIAL MEETING
ENVIRONMENT, LAND ACQUISITION & PLANNING COMMITTEE
of the
Suffolk County Legislature

Minutes of Hearing on Groundwater Quality

A special meeting of the Environment, Land Acquisition & Planning Committee of the Suffolk County Legislature was held in the Rose Y. Caracappa Legislative Auditorium of the William H. Rogers Legislature Building, Veterans Memorial Highway, Smithtown, New York, on August 13, 2002.

MEMBERS PRESENT:
Legislator David Bishop - Chairman

MEMBERS NOT PRESENT:
Legislator Michael Caracciolo - Vice-Chair
Legislator Andrew Crecca
Legislator Ginny Fields
Legislator Jonathan Cooper

ALSO IN ATTENDANCE:
Paul Sabatino - Counsel to the Legislature
Maeghan O'Keefe - Aide to Legislator Bishop
Allyson Feld - Intern/Legislator Bishop's Office
Barbara LoMoriello - Aide to Legislator Cooper
Lisa Keys - Aide to Legislator Caracciolo
Jim Dobkowski - Aide to Presiding Officer Tonna
Nicole DeAngelo - County Executive's Office/Intergvrnmental Relations
Vito Minei - Suffolk County Department of Health Services
Martin Trent - Chief/Bureau of Groundwater Resources/DHS
Jeff Dawson - Department of Public Works/Highway
Herman Miller - Suffolk County Water Authority/Dep CEO of Operations
Karen Randazzo - Suffolk County Water Authority/Director of Laboratory
Tim Hopkins - Suffolk County Water Authority
Lee Koppelman - Long Island Resource Planning Board
Sarah Meyland - Exec.Dir/Citizens Campaign for the Environment
Adrienne Esposito - Assoc Ex.Dir/Citizens Campaign for the Environment
Jessica Ottney - Program Coord./Citizens Campaign for the Environment
Laurie Farber - Chairperson/Long Island Sierra Club
Julie Penny - South Fork Goundwater Task Force
Stephen Terracciano - Hydrologist/U.S. Geological Survey
Mark Serotoff - Townline Association
Valerie Burgher - Newsday
J. Jioni Palmer - Newsday
Leonard Grecco - Suffolk Life
All Other Interested Parties

MINUTES TAKEN BY:
Alison Mahoney - Court Stenographer
Donna Barrett - Court Stenographer

(*THE MEETING WAS CALLED TO ORDER AT 10:10 A.M.*)

CHAIRMAN BISHOP:
Welcome to the special meeting of the Suffolk County Legislature's Committee on Environment, Land Conservation & Planning. Please rise for the Pledge of Allegiance to be led by Alison Mahoney.

Salutation

I am informed that Legislator Crecca is on his way. Legislator Caracciolo, who is the Vice-Chairman of the committee, is represented by his staff this morning, Lisa Keys who is to my left, he will be here this afternoon. Legislator Fields will be joining us later this morning as well.

One of the most critical issues facing Long Island's future is the quantity and quality of our ground water. We have all been witnesses to the recent and seemingly unending heat wave, which we have today as well. Over the past few weeks comes a drought alert for New York City. Long Island residents assume that because we draw our water from beneath the ground that it exists in a never-ending supply, but we are on the same land mass as Brooklyn and Queens and Nassau and if we look at the history of those jurisdictions, at one time they drew their water from beneath the ground and through overdevelopment they have been forced to bring in their water from Upstate.

So as Chairman of this committee, I have asked a prestigious panel of experts from around Long Island who have a passion and knowledge for the issue of our ground water to discuss whether the ground water supply in Suffolk County is, in fact, inexhaustible; and if it is not, what policies should government be undertaking to preserve our ground water so that it exists a hundred years from now and 200 years from now as well. It is my hope that these hearings will provide that information for the long-term viability of our water supply, especially questioning whether the water supply can sustain the current rate of development.

So I have invited and pleased to have received acceptances from representatives from the Citizens Campaign for the Environment, the Sierra Club, the South Fork Ground Water Task Force, the U.S. Geological Survey, the Suffolk County Water Authority, the Suffolk County Department of Health, the Long Island Regional Planning Board

and Stony Brook University. Obviously it's a complex issue and one that requires a great deal of time. This committee will be meeting for the next two days to consider these issues.

So with that, I would ask that our first witness, presentation by Sarah Meyland. She's the Executive Director and General Counsel for Citizens Campaign for the Environment, she's also professor at New York Institute of Technology. Sarah? She is joined by Laurie Farber from th Sierra Club.

MS. MEYLAND:
Thank you. It's a pleasure to join you today and I want to thank you for convening these two days of hearings to discuss a very, very

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important issue for all the residents of Suffolk County and really the residents of Long Island as a whole.

My name is Sarah Meyland, I'm the Executive Director of Citizens Campaign for the Environment, as you just indicated. I would like to share with you my curriculum vitae to demonstrate my professional credentials. I have been doing water resources for Long Island for the last --

CHAIRMAN BISHOP:
Pull the microphone closer.

MS. MEYLAND:
Is that better?

CHAIRMAN BISHOP:
That's better.

MS. MEYLAND:
Very good. I have been doing ground water and water resources work on Long Island for over 20 years and I have professional degrees in Environmental Law, Water Resources Management, Oceanography and Marine Zoology. And I'm joined by Laurie Farber

MS. FARBER:
I am Chair of the Long Island Sierra Club. I actually have a degree in Environmental Science and I have taught Environmental Science at the college level.

MS. MEYLAND:
Water has obviously been in the news quite a lot lately and I believe that in the these two days of hearings you are going to hear a lot of information, some of it may not agree with what other people are

saying so you may see some divergence of opinion. I think that my role and Laurie's role here as the first people to speak is to basically offer the big picture to start with and try to put this issue into perspective and then give you some of the details that we think are very important to your consideration on this issue.

And I hope that you will understand that the people who have, for the last 20 plus years, recommended to the public and to everyone that the water supply on Long Island is finite, is vulnerable, is fragile, it can be lost, have been the ones who have unfortunately been proven to be the ones correctly portraying how the ground water system works. And so what we will be doing today is to talk about the lessons of the past and how they inform us on what is likely to happen to Suffolk County today and in the future. And I hope you will take some of this to heart as we go through the information.

I have some slides that I'd like to show you and this is one of those situations where a picture is worth a thousand words. And we also have some press packets to share with you.

CHAIRMAN BISHOP:
You are going to use the projector. Just grab a microphone over there.

MS. MEYLAND:
So I think that this is actually the question that most people are concerned about and interested in which is really how long is our water supply going to last on Long Island and in Suffolk County. I don't think anyone has an absolute answer to that question, but I think that from what you're going to hear today and tomorrow you will actually start to get a very informed sense of how long we have and what the steps are needed to be taken to protect our supply.

This isn't just an issue that is being considered in Suffolk County and New York State, this is an issue that is actually being considered all across the world. And the answer is that worldwide, water is becoming a very important commodity, is becoming more and more scarce. And as you can see on this U.S. News and World Report cover which is just from last week, or actually this week, Monday, August the 12th, the future is costly, dirty and scarce, and hopefully we can avoid some of that here in Suffolk County.

I'd like to start by looking at the big picture because actually the big picture is going to have some ramifications for us here on Long Island regardless of what we choose to do in the future. As you've probably seen in the press and extensively in a lot of different media coverage, the Earth is changing and one of the things that is happening is that a lot of the fresh water that is stored in ice deposits is melting and becoming water again, liquid water, and that

has important ramifications for us here on Long Island.

If we look at what had happened in the 20th Century, we know that global temperature has been rising. We know that both the polar ice deposits and glacial deposits are melting, and you've certainly heard reports about the ice shelf and the Antarctic falling into the ocean and now in the summer in the Arctic, the Arctic Ocean is ice-free and you can sail around up there. As a consequence, sea level is rising and in the 20th Century sea level rose on average about six inches, half a foot; that is much more than it had risen in the last several thousand years prior. And additionally, there are many more severe storms that are affecting not only the United States but countries all over the world and this trend is expected to continue.

So what is the coming century going to look like? Well, the most conservative estimates are that sea level is likely to rise several more feet, probably as much as three feet. And if this three foot rise actually occurs, the projections are that along the coast line of the east coast United States and the gulf of Mexico, the coast line itself will probably receive something on the order of one mile. So here we are an island, if we saw a one mile decrease inland of our coastal areas, that would have a significant impact not just on the water supply itself but on our quality of life as well. Ninety percent of the ice is in the polar regions and 10% of the ice is in areas like Greenland. Now, Greenland ice is also starting to melt and the ice deposit in Greenland is over a mile thick. And the projection is that if all of the ice in Greenland, which is much more vulnerable to melting than say the Antarctic, if all of that ice were to melt in this century, sea level rise would be 23 feet. And if that should actually come to pass, then what we're talking about here today is really moot because it would be a catastrophic impact on Long Island.

What's going on with aquifers around the world? Well, world-wide, not just here on Long Island, water tables and aquifer systems everywhere on every continent are starting to be -- are falling because our water use is outrunning the sustainable yield of the aquifers. This phenomenon is especially prominent in the last half of the last century and that is primarily because of our ability to get so much water out now with the pumps that have been developed in the last 50 years or so. We can actually pull much much more water out of the aquifers than precipitation can replace, and so that's why we're seeing this depletion problem all over all parts of the globe.

Now unfortunately, even though we are in a drought situation here on Long Island and we have a long history of water quantity issues, the media usually has been portraying our water system here on Long Island as flush, lots of water, no problem. Even as the rest of the world or the rest of the east coast is suffering a drought, we on Long Island

are somehow invulnerable to such impacts, even though here the Hempstead Lake is actually nothing more than a mud puddle, and this is a photograph from several months ago, now it doesn't even have the puddle there. However, at the same time we see headlines like this where certain wells in Suffolk County are, in fact, being impacted by the low rain fail, meaning that the water table has declined below the screen of the well and the well has run dry. And so obviously both stories can't be correct and both stories aren't correct.

Basically, just to backup and explain how the ground water system works. All of the water that's in the aquifer system that is fresh water has gotten there through precipitation. And you may recall that the glaciers were Long Island and stopped on Long Island about 10,000 years ago and since then the aquifers have been filling up and much of the water in the deep parts of the aquifer is actually thousands of years old. And so all of the fresh water that's in the ground is there because of precipitation slowly filtering down to the sandy soils and collecting and being stored in the ground water system.

Because we're dealing with a resource that is hidden from view, we tend to have to rely on snapshots of how the ground water system works and what the aquifer looks like. And the acquifer is really a formation of three large layers and a number of smaller subsets of the overall system. And these are layers like a layered cake except that they're tipped so that up here along Long Island Sound, the formations that hold the water are thinner and they sit over a bedrock formation that does not store water. And as you get -- move towards the south side of the Island, the formations become larger and larger and therefore are available to store more and more water.

There's a long line of hills, it runs down the center of Long Island, that are remnant of glacial activity and these hills are very important because they create high elevation in the acquifer system because the water level mounds up beneath them. And so where we all understand the process of water running down hill and so basically the high elevation here in the center of the Island creates the force necessary to move the water through the acquifer system and out toward the shoreline. And then when you get toward the shoreline, the fresh water and the salt water meet and that's called the salt water interface. And one of the critical issues is to try to keep that salt

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water boundary as far off shore as possible, because as it moves on shore it replaces fresh water in the system and obviously then we have lost that area as an area for usable fresh water needs. And you can see that this is a circulating process so that as water is coming into the system water is also going out of the system, and we call that basically the hydrologic cycle.

And I think all of you are probably familiar but I'll just mention it again. The three main formations, the top most formation is the upper glacial, that's where the water first enters the system; below that is the primary formation which is called the Magothy and it's the largest and holds the largest quantity of water. So the Magothy in the center of the Island is roughly about 800 to a thousand feet deep, below that is a thin layer of clay that's a couple of hundred feet thick and then below that is a thin formation called the Loid which has the oldest water in it and is the deepest formation. And along the south shore the Loid can go down to depths of 1,500 to 2,000 feet.

So in the natural system waters coming in through precipitation, waters going out through off shore flow and streams and so forth and a certain amount of -- a significant amount of water is in storage. And of course we humans, now that we've come here to live on the Island, are participating in that recycling process as well and so we discharge waste water to the ground and that becomes part of the water system itself, although the quality is degraded. We are extracting water out through water supply and other needs and we discharge some of the water off shore through our sewer systems. We've also got streams that are discharging water off shore and so we are participating in this cycling process except that our impact is having and undue and very negative consequence in many parts of the Island.

From the 208 study which concluded in 1978, it became very clear that there was a division in how the ground water system moved water through it and that there were some areas that had a very significant role to play in both protecting the quality and the quantify and that area was identified as the central area of the Island, the central corridor of the Island and it was given the name deep flow recharge. And the concept was that as water entered this high area, this spine across the length of Long Island and got into the system, water that came into this deep recharge area actually fed all of the ground water layers. Whereas water that actually fell as rainfall around the parameter of the Island did not feed all three formations, and so it's called the shallow recharge area. And so the challenge has always been to try to do everything possible to keep as much water going through the deep recharge portion of the Island and to keep that recharge as clean as we possibly could. And historically now, we know that although the same land mass is still functioning in largely the same way, it has changed over time as a response to drought and over use and things like that, and you will be seeing some more slides about that in a moment.

So basically, if you -- if we could slice the acquifer in half and look at flow patterns of water through the system, we would see that water that falls right in the very center of the deep recharge area would flow most deeply and flow through the entire acquifer area and this would take a considerable amount of time, meaning that it would

take thousands of years under natural conditions. And as you get into recharge closer to the shoreline, you can see that the pattern is much shorter, the time that it takes water to move through the system is much quicker and it discharges out through the coastal area. And so here's the deep recharge area and these are the discharge areas along the shoreline.

And so just like in most of nature, how the ground water system responds to change is that ideally it doesn't like change, it likes things to stay in equilibrium. And when one incidence or another occurs, that upsets the equilibrium, the ground water system is always going to try to reestablish a new equilibrium and that's really what we're dealing with. If we upset the equilibrium, what are those changes that are going to occur in the ground water system that may be detrimental as far as we're concerned but are natural in terms of how nature likes to operate.

One way of thinking of the acquifer is like a bath tub, and we know that the bath tub can hold a finite amount of water and that if we put too much water in it simply over flows. If you fill the bath tub nearly full and you let some water always be draining in as you're always allowing some water to leak out of the bottom of the bath tub, you can maintain an amount of water in the bath tub that is relatively constant. And so the idea is that if you have an equal amount coming in as going out, the amount that the bath tub is holding in the interim basically stays the same. The challenge, however, is can we keep what comes in and what goes out roughly equivalent?

So the other analogy that I would like to suggest is that an acquifer is like a bank. And if you could think of the acquifer system as like a banking network and think of all of the banks on Long Island as being owned by one entity and we have banks in every single community on Long Island, and every community has to use the available resources of their local bank. Now, the fact that if we added up all the money in all the banks on Long Island, there would be, you know, a huge amount of money in the bank, it's irrelevant for every community that is limited to the amount of money in their local banks. And so in a bank we've got money coming in, we've got money in storage and we've got money going out, and ideally we would like a system where there's more money coming into the bank than there is money going out. Because if you've got more money going out, what happens? The money in storage in the bank slowly depletes until ultimately the bank goes bust.

Well, the acquifer system is very similar to that. We've got water coming in, we've got water held in storage, just like the money in the bank, and then we've got water going out. And we've got water going out through sewer discharges, drinking water demands, coastal

discharge to keep the estuaries in proper saline balance, streams discharging to the estuaries, a technical process called evapotranspiration. So just like in a bank, you've got inflow equals outflow, plus or minus which is what is in storage. And just like in a bank, if people lose confidence in their bank and they have a run on the bank and they start taking all their money out, that bank is not going to be in existence any longer. Where similarly, if we start increasing all the draw-outs of the acquifer system, what is it going

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to do; it's going to take water out of storage. The system is going to change and it is no longer going to be a healthy, viable and usable resource for us.

So just from a technical standpoint, this is the essential equation; inflow equals outflow plus or minus what you've got in the bank.

And so when we've got drought, when we've got excessive pumping -- and remember, it's all local. Just like there's an untold amount of water in the acquifer system, the demands are local and so the system responds locally. And so you can have one scenario in Port Jefferson with its set of conditions and you can have a similar demand on the resource or a different set of conditions in Babylon and the acquifer in Babylon, the portion of the acquifer in Babylon can respond radically differently. So it's, you know, think globally but act locally, this is an example of that.

So we know that the water that comes in, the fresh water comes in as precipitation, we know that we get about 44 inches of rain on average a year, half of that 44 inches goes into the ground. And in general, we assume that on average we're getting about one million gallons per day of recharge per square mile of Long Island; if we get that, we can more or less keep the system in balance.

Now, the balance issue can be very complicated. This is a very complicated diagram of a water balance, but let's just look at basics. What happens if two little water is entering the ground water system? Well, the system is going to want a new balance. And so what is it going to do? Well, one thing that will happen is that the water table will start to fall. Just like when we drain too much water out of the bath tub or if we take too much water -- too much money out of the bank. We're depleting that water that's in storage and as a consequence the amount of water expressed and the elevation of the water table above sea level starts to fall. Secondly, because we're surrounded by salt water, salt water will start to move in and take the place of fresh water in the ground water system. Secondly, the flow coming through the steams out into the coastal areas will start to decline, less water is moving out through the streams and the streams can dry up. And usually what happens is a combination of

these things, depending on how radically we have changed the amount of water coming into the system compared with the water going out.

Now, a water balance is a very valuable concept. And while it isn't something that is talked about very much in Suffolk County, it is a concept that has been considered in great detail in Nassau County because Nassau County has a history that Suffolk County ideally would like to avoid. And every ten years or so Nassau County relooks at this idea of the water budget and every ten years or so they have tinkered with it and every ten years or so it is changed to give the image that things are still okay when, in fact, every ten years we've seen that the system has been further depleted, it has further shrunk, the streams have dried up, salt water intrusion has increased. And so they have this goal of how much can they use consumptively, how much water is going out through the streams, how much water is being lost through underflow. And again, they're always trying to get a balance

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so that what's coming in equals what's going out, and basically they are losing the battle.

And so the response to this, the State response, since the State basically is the ultimate steward of the waters of the State of New York, the waters of the State of New York are owned by the State for the people of the State. So we all have a vested interest in keeping the water supply as clean and abundant as possible.

So at the end of the 80's, seeing the trends that were occurring in Nassau County and knowing what had happened in other parts of western Long Island, the State imposed water caps and Nassau County is the only County in New York State with permanent water use restrictions. And so every year all the pumpage from the different 52 water suppliers is reviewed and analyzed and tabulated to see if they have stayed within their individual limits. And why is this? Well, because historically we know that as the different counties on Long Island, the two boroughs in New York City, Queens -- Brooklyn and Queens and now Nassau County -- have historically damaged their ground water system to such a degree that it has become almost useless as a water source. This started first in Brooklyn and this is the line between Brooklyn and Queens, here's Queens, here's Brooklyn. And our first recorded information on water table elevations is from 1903 and this was basically the start of major development in Brooklyn and you can see that these lines on here are water table elevation lines and this one closest to the shore line is five feet above sea level, then 15 feet above sea level and there's a little mound up here of high ground water. And you can see that the elevation goes up to about 45 feet above sea level over here and continues over into Nassau County.

Well, by 1936 you can see that in Brooklyn, all of these water table

elevations are not above sea level, they're below sea level. And so instead of being five feet above sea level, this is zero and then this was 15 feet below, 25 feet below, 35 feet below sea level. So what we now have is a hole in the acquifer, and as a consequence salt water invaded the acquifer, it turned salty, it was no longer usable and they had to find another source. Development proceeded into Queens and a similar scenario occurred; the water table elevation fell and high pumpage areas, the water table elevation actually was below sea level, and here we again have a hole in the acquifer that's about 20 feet below sea level. Well, Queens then this hole needed to be filled and so the ocean was more than happy to try to do that and so you had salt water intrusion coming in from Nassau and also a considerable amount of water loss from Nassau into Queens to try to fill the hole.

This is the picture today; here's Brooklyn, here's Queens and here's Nassau. Once they abandoned the ground water system in Brooklyn and it wasn't being used as a water source, look what happened. Here's a five foot water table elevation above sea level, just like it was in 1903, and all of the water table elevations are now above sea level. And these black dots that you see everywhere, this is dewatering activities because they built the subways when the water table was low, they abandoned the acquifer, the water table rebounded and now the subways are in the water table and so they're constantly pumping water out to keep them dry. And the water table has rebounded some in Queens because they have started to cut way back on water pumpage

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there, but you'll see that there is still a hole in the acquifer in Queens, and water from Nassau is continuing to drain into Queens to fill that hole up. And now that New York City has had the experience with the drought this year, New York City had proposed to add an additional 40 million gallons a day of pumping back out of the wells that had been closed in Queens and what they will do is to deepen and widen this hole that still is there.

So when you over pump the acquifer, one of the things that happens is that salt water is no longer being held out because the less water in the acquifer the less pressure available to hold the ocean out. And so it overcomes the pressure from the fresh water and comes into the acquifer formation. And it comes into what -- in a form called salt water wedge. And because the salt water is more dense than the fresh water, instead of invading it as a solid front, it comes in more like a tongue or a wedge and it comes at the bottom of a formation because it's heavier and the fresh water rides up above it. So -- and the Magothy, we see it coming in at the base of the Magothy, up here in the glacial we see it coming in at the base of the glacial. And this is the salt water wedge that cuts across the southwest corner of Nassau County trying to fill up that salt water -- that hole in the acquifer in Brooklyn -- in Queens I mean.

And the front has come through, all three of the formations; here it is out in the Loid. This second middle line is the salt water front as it's come into the Magothy and the top line is -- excuse me, and this top line is the shallow Magothy and this is the deep Magothy. And of course it isn't just the south shore of Nassau County that is at risk, you've got peninsulas on the north shore of Nassau County as well, the Great Neck peninsula, the Port Washington peninsula, they have a history of salt water intrusion problems. And a recent report by the USGS further documented that there are serious areas around the peninsulas, this is Great Neck and this is Port Washington, where salt water is continuing to invade the ground water system because they're surrounded by salt water on three sides. And it has raised very serious problems for the ability of the water utilities there to provide adequate service to their customers by taking the water out of the peninsula.

This is a computer projection of the scenario for Great Neck. This is kind of the salt water front that was projected based on pumpage from 1900, this was the prediction of the salt water front in 1990 and this is a prediction of where the salt water front would be, if they continued current pumping practices, about a hundred years from now. So you can see that the whole peninsula would basically be lost as a productive source of water. We know that the acquifer will change also because the streams start to dry up. So this is a graph of the streams in Western Nassau County.

Back in 1903 when our data first began, we can see that most of the streams are fed entirely by ground water, so the pink is ground water contribution of the stream and the blue is storm water run-off. So Valley Stream back in 1903 was virtually all flow from ground water discharge into the stream. By the 1960's we can start to see that the amount of ground water feeding the stream has dropped, storm water run-off is a larger contribution and the overall amount of water

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flowing through the stream has greatly reduced. By the 80's we can see and into the year 2000 the stream has virtually dried up. And the only water that is in the stream is intermittent flow that represents storm water run-off. So the stream is a stream in name only.

So that's western Nassau County, let's look at a stream closer to Suffolk County and we see a very similar scenario. This is Massapequa Creek, again, 1903 looks almost identical to Valley Stream. In 1945 the same scenario, drop in overall flow, drop in base flow, larger contribution of storm water run-off. And here they are down here in the year 2000 and there is a small amount of base flow left but again the predominant flow now is intermittent storm water discharge. And why is it that way? Well, because this is the way the ground water

system works. In these areas, traditionally the bottom of the stream was in the acquifer below the water table. So as long as the water table is high, the water from the acquifer simply discharged into the stream and flowed out of the stream. But now that the water system has -- is reestablishing a new balance because inflow is not equaling -- is not as high as it was originally, the water table has now dropped below the base of the stream, the water can't leap up against the force of gravity and therefore it can't continue to feed the stream.

And if we look at what this has meant to streams all across the southern half of Nassau County, these are the streams that cut through the southern half of the County. This is where the stream originally began and these are all marked at the -- as the brown reaches of the stream, and they're not flowing that length any more, and the blue is basically the length of the stream that has flowing water in it at the moment. So we're losing not only the flow in the stream but also we're losing the fresh water discharge that they contributed to the estuaries, it allowed the estuaries to be healthy and maintain the proper salinity and so forth.

At this point I want to turn it over to Laurie who has some further slides that make this point.

MS. FARBER:
One of the things I wanted to show is what's happened as we've been pulling the water out, and I have these as a series of overlays. Here's -- as Sarah showed you, the depth of the -- I'm sorry, the ages of the water predevelopment. As you can see, down the Lloyd acquifer we had 2,000, 3,000 year old rain water and most of us were drinking water from the deeper parts of the Magothy, two to 300 years old was not uncommon at all. What's happened over the years is -- let me match this up properly -- is -- it's hard to do upside down, that's the problem. If you can see where the red lines are, which is sort of hard to see on here, but what's happened in the Magothy is now we've got 20 year old water, 100 year old water and that's about it going down into the Magothy, it's not a whole lot more than that. Whereas the water in the Lloyd is still fairly old, it's clearly not quite the same as well. As we're pulling this out, we're pulling the water through faster so we're drinking water that's not anywhere near as old as it used to be; and I think you'll here tomorrow why that's such a severe problem. Because it means that whatever we're pulling down we're pulling down considerably faster.

Bear with me as I line these up because it's sometimes hard to do. Again, here's development, predevelopment water tables. Okay. The reason the south -- the east -- the forks are not there is just the data wasn't collected, not because the water didn't exist. But as

this -- this is predevelopment estimation. What happened to the elevations, this is for 1965 which was after a big part of our development but obviously it's still going on. You can see that the areas of high water table are a depth of 80, it shrunk, the 60 has shrunk. Again, we've dropped the water tables drastically, we're changing the contours of where our water table is. And by looking at these comparisons, and you can see later on obviously we got some data on the forks, but we have changed this considerably.

The other piece of this that I wanted to share is what's happened in terms of the deep flow recharge area in Nassau County; and I apologize, that blue marker didn't work too well. This is, the top one here, was predevelopment estimation of the deep flow recharge. The block areas are the ones that went all the way down to the Lloyd, the red into the deep Magothy. And this would match up fairly well with the 208 study maps of the deep flow recharge ara. What happened now, present day, is you'll notice that the Magothy, the area going down to the Magothy has increased while the areas that now still feed into the Lloyd have decreased considerably. So what's happening in the Lloyd is less water is going in, more water may be going into the Magothy but it's only going into the shallow areas because we're just pulling this through so quickly that a lot more of the water is just going down to where we're filling the vacancies basically from our wells.

Interestingly enough, because -- Nassau is mostly sewer, and interestingly enough, before the sewers were built they were doing some projections and they were projecting that the drawdown of the water table in central Nassau would be 16 feet and about two feet around the coast; and that has indeed happened, if not more so. They're sewering because we're pulling this water out, we're putting it back into the ocean, not in the ground, we are having this dramatic difference in our water tables in our water supply. Southwest Sewer District is not immune from this and I know there are plans to expand that and I think we're going to see a lot of the same pattern in western Suffolk because again, the water is not going back in, we're pulling it through faster, we're not allowing as much recharge. It's also fairly clear to me that what's left of these little black areas are the ones we ought to be focusing a lot of attention on in terms of making sure that they're still there, because they certainly are considerably in danger.

Sarah talked a lot about the water budget and the salt water intrusion. Here's a comparison for Nassau County of what would happen, possibly, with pumping as it continues now or with increased pumping, even though they're not supposed to do it. They say that the blue line down here is the present interface between fresh water and the salt water and the deep Magothy. Without pumping, it's still likely to move inward; with pumping, in other words, if we continue to take out the water, it's going to move inward faster. Nassau County's 1998 Ground Water Study suggests that in 50 years 13 wells in the

southwest of Nassau will be salt water, so that's this whole area here. And you can see the red is for the interface for the Lloyd,

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that's also going to be moving in. Long Beach is pumping out of the Lloyd acquifer, so not much is coming back.

Here's a quick look. This is the water budget and if you look carefully at it, it does balance but there are some basic assumptions here and one of those is that Nassau County will actually adhere to the 180 million gallons a day water cap. Is that happening all the time? Obviously not, but that is an assumption. Looking carefully at some of the numbers too, you can see that there's less water going deep into the ground. Although there's more going into the Magothy, there's also more taken out, we're pulling this water down through faster. But the fact is we've changed this whole water budget considerably and so that's why we've impacted on our streams, we're impacted on the salinity of the bays where we have the -- and the Long Island Sound where the water does leak out underneath, we're impacting on our streams. And as well as moving this water through the whole system much more quickly will not only have an impact on our quantity but will have an impact on what has been put into our water because we're pulling it through this whole system that much faster.

It's kind of -- what I find very interesting, looking at some of the information from Nassau County, is that if you start to look at some of the historic projections of what they were saying, when would we actually meet the balance point and what are our estimated deficits? In looking back in the 1970's, they estimated that by 1990 we would have a 32 million gallon a day deficit and by the year 2020, 177 million gallons a day. But if you look at the projections now, no, no, everything is fine, but you have to look at what are the impacts. And it's to -- so there's two pieces of this; one is is there really enough water and how does our use of this water impact the whole system. So I think there's a lot to say there. And we will go back to Sarah now.

MS. MEYLAND:
So we've been talking a lot about Nassau and see how some of that information translates to Suffolk. We understand that the original source of the water has to come through precipitation, the fresh water. And so we know that the average amount of rainfall that we get over an extended period of time historically has been around 44 inches a year, and so this line represents the 50 year average of about 44, 45 inches of water a year. And then these lines up and down are the actual precipitation from year to year, and so obviously we have wet years, we have normal years, we have dry years, and so you can see the wet years versus the dry years. And then most notable is this area right here which was the 100 year drought from the last century and

that was in the mid 60's. We had a multi-year drought where the precipitation declined and declined and in one of the years it only rained about 21 inches in that year. And so obviously this is the inflow, part of water budget, so if inflow is down then the whole system is going to respond.

The agency that has been in charge of historically collecting this very important information on just basic what's in the acquifer, how much is there, how is it responding from year-to-year has been the U.S. Geological Survey. And so this is just a snapshot of some of their data to illustrate the point that I want to make. This is a map

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of where their monitoring wells are, historically where they have the longest record of water table elevation data. And so we're going to compare two wells, one well right here in Nassau which is right in the center of Nassau is in the Old Westbury area, and this well right cross the boarder into Suffolk County in the Pinelawn area. And let's look at how these two wells have responded to basically the same circumstances over time.

This is a ten year snapshot of how the water table elevation and these two wells has changed over ten years. This is the Nassau well, this is the Suffolk well; we're starting to look at in February of '92 compared to February of 2002. And the solid black line is the water table elevation, again, in response to precipitation in part and to pumping as well. And so we can see that the water table elevation has risen and fallen over the course of a ten year period, but most notably you can see that ten years ago the water table elevation in the Nassau well was 74 feet above sea level and ten years later, and we didn't have any particularly notable drought over that ten year period, it was down to 66 feet. Similarly in Suffolk County, which does not have water caps, does not have water conservation programs, you see a sharper cycle from year-to-year, it's more muted here in Nassau County but the trend is the same. So in 2000 -- so in 1992 the water table elevation in this well was 55 feet above sea level and ten years later it's down to something under 50 feet, something around 49 feet. So again, over that ten year period, the well in Suffolk responded similarly to the well in Nassau.

Now, let's look at the 50 year summary. Same two wells, the well in Nassau, the well in Suffolk, and now we're looking at trends where we did have histories of heavy precipitation and cycles of low precipitation. And again, here is that drought from the 60's, the hundred year drought. And in 1952 the water table elevation at the well in Nassau was 86 feet above sea level, it dropped down to 69 feet above sea level during the 60's drought, came back up again, and then in the 90's it started to fall once again. And here we are, 2002, the water table elevation in the Nassau well is lower than the hundred

year drought. The Pinelawn well -- and again, remember this is local location-specific, so I could go to other wells in Nassau and in Suffolk where we wouldn't see the same pattern. That isn't the point, the point is if we have similar conditions you get similar results. So heavy development, heavy water use, sewering, all these things where they're similar, the aquifer is going to respond similarly.

So in Suffolk you had 50 years ago the water table elevation was 59 feet above sea level, it dropped to 47 feet above sea level and the drought of the 60's picked back up, again now it's down to 49 feet. So it's very close to being just where it was in the 60's drought. So I guess the lesson is that when the conditions are the same, you're going to get the same response in Suffolk that you have gotten in other parts of the Island, and that's really the whole story we're telling you here at the moment.

Let's look very quickly at this question of salt water intrusion. Along the shoreline you've got water filling the formations that are salty as you go off shore, and at some point either near the shore line, off shore or where salt water intrusion is very serious, you

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know, inland of the shore line, there's a boundary where the salt water and the fresh water meet. And that boundary line is not a zone where there's a very gradual change in salinity. It's a fairly sharp zone, a fairly narrow zone and the salinity changes pretty rapidly from fresh water to salt water. And where we've got the forks, which are probably the most vulnerable part of Suffolk County in terms of salt water intrusion, you've got the added problem that not just along the shore line but actually in the deeper parts of the acquifer itself, salt water has invaded the system and so you've got salt water in the main formation of the acquifer in the deep portions. And so here you've got a salt water/fresh water interface completely encircling basically a bubble of fresh water contained in the center of the forks. And so this pocket of fresh water is very vulnerable to over pumping, to drought, to all the conditions that cause the ground water system to change.

And here's exactly what can happen in the forks. Here's the interface between the fresh water and the salt water, and you can see that it wants to move inland and move under the main formation. And where you've got salt at depth and you put a water supply well in this land of fresh water to draw it out and to use it. If you over pump this well, if you have a combination of water table falling, drought, over pumping, you reduce the pressure locally right at this point and you induce salt water from depth, actually spike in to the fresh water land. And once it has displaced this fresh water, it doesn't like to easily give it up again. And so this is why it's very important that you limit the number of wells on the forks, that you monitor the water

table elevation. And I think even this year there have been wells out on the south fork where according to the permit, when the water table level drops to a certain point the well can't be used any longer and I think that has actually occurred this year on the forks. So the forks are very, very vulnerable to over use, but they're not the only ones.

So what are the conditions again that did he stabilize the acquifer? Low precipitation, high temperatures which increase evaporation, they also increase water use. When we pave over the land surface and make it impermeable, it decreases the area that recharge can occur in. When we increase pumping, obviously we're starting to take more water out and then we can't forget sea level rise because it's there and it's going to have a significant impact. And how does the ground water system respond to these stresses? Well, first of all we're going to be recharging less water so there's less water coming in. The water table elevation will drop meaning that there's less pressure to hold sea water out and wells, shallow wells can dry up as we've already seen happening this year. Stream flow drops so there's less water coming out of the streams, less fresh water being contributed to the estuaries, the estuary salinity changes, that effects the entire ecosystem on the coast line. Similarly, ponds dry up so any fresh water pond habitats are impaired. And the total amount of fresh water in storage now changes and this affects quality as well which you'll probably be talking about in detail tomorrow, and then add to that the whole sea level rise and you're further going to destabilize the system.

So the bottom line really of the story is that there is a concept called safe yield and what that is about is that you can take a certain amount of water out of the system and the system can cope with that. But when you add all the stresses together, you exceed the safe yield of the acquifer and then you start to get all the negative consequences that we have just been describing to you. And remember, this is not water that is only being used by we humans, the entire natural system of Long Island is dependent on a plentiful water supply as well. And so when we impair the salinity of the bays, when we impair the flow of the streams and we dry up our ponds, when we change the amount of water that's in the soil and change the ability of plants to survive drought periods, we're really talking about a change of the whole ecosystem and natural water system of the Island, both fresh water and salt water.

So I think that's everything I wanted to try and cover this morning. I hope it wasn't too detailed. Thank you.

CHAIRMAN BISHOP:
I have a few questions. The salt water boundary line in Suffolk County, have you seen movement in that line?

MS. MEYLAND:
I personally don't have data on that. I know that the Suffolk Health Department has been monitoring that and I would suggest to you that they might be a better source of that information. I would say that one of the things that I would recommend to you in terms of just understanding what is happening in Suffolk County is that in Nassau County every year the County Health Department prepares two documents, but one in particular is a summary document of everything that the county knows about the ground water system. So it talks -- it gives you detailed information on the pumpage of every water utility, it gives you detailed information on the water table elevation, on stream flow, precipitation, and it is an invaluable way for anybody who has a question to get their questions answered very expeditiously and properly. And something like that would be very helpful in Suffolk County as well.

MS. FARBER:
The Department of Public Works in Nassau did another ground water study and, again, they do this about every ten years and this is actually where Sara and I did get some of our data and some of our graphics from.

CHAIRMAN BISHOP:
Does Nassau County limit the pumpage and how do they control that?

MS. MEYLAND:
The State gave every water utility a maximum amount of water that could be withdrawn within a given year and they have to report them --

CHAIRMAN BISHOP:
And in Suffolk as well?

MS. MEYLAND:
No, only in Nassau.

CHAIRMAN BISHOP:
Okay.

MS. MEYLAND:
And so they have to report their water use annually to the State, actually they send that information more quickly than that, but on an annual basis they have to document. And every well has essentially a counter on it and so they can record how much water each well pumps; it's simply a matter of adding up the totals on each well and providing that documentation.

CHAIRMAN BISHOP:

Is it your opinion that Suffolk County has crossed the safe yield?

MS. MEYLAND:
I think Suffolk County is on the edge of crossing the safe yield, it absolutely is. When you take all the factors together, the likelihood of more severe droughts in the coming years increase and the water table, sea level, the high temperatures that we've noted in the last decade encourage people and people end up using more water just as a matter of high temperatures and drought and there is no curb on that. And the same forces that have affected the other parts of Long Island clearly will affect Suffolk and it won't be universal, it will be parts of the County where there's a low population, a low water demand and the acquifer can sustain a safe yield in those parts of the County. Where you've got the reverse, high population density, high water use, hot summers and all the other things combined, you're going to exceed safe yield in parts of the County. And given the sensitivity of the forks as well, they are particularly vulnerable because you've got the high summer use, you've got the irrigation for agricultural activities out there and it's the prescription for very serious problems on the forks in the coming years.

MS. FARBER:
What Nassau County did do some years back, actually prior to their having a Legislature, was enact a law about limiting lawn water sprinkling and I believe it also includes that car washes must recycle some of their water. So that was I think the only action that the County actually did because they have 52 water suppliers so it's pretty hard to do something besides that I guess.

CHAIRMAN BISHOP:
In western Suffolk it's clear that the water table has dropped. In my district I have two streams that are no longer streams, we also have Deer Lake on the border of Islip and Babylon that's no longer a lake. Could you just tell me how significant an indicator is that of having crossed the safe yield point.

MS. MEYLAND:
Absolutely. Because the whole idea of safe yield is that you don't put the system in a detrimental condition, and the fact that your streams are drying is a detrimental condition. I mean, what the goal is is to allow the natural system to continue to operate and still be able to serve the needs of the public. And once you've crossed the boundaries so that the system is having to readjust because we, humans are taking more out than the system can afford to yield, means that

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you've crossed the boundary. And as you go farther and farther over the boundary line, then the system continues to respond with a continued drop in water table elevation, salt water intrusion and the

whole picture. So yes, you have crossed the line there.

MS. FARBER:
Keep in mind, Dave, that your district is part of the sewered area. So you have that having a major impact on that as well.

CHAIRMAN BISHOP:
Are you opponents of sewering?

MS. MEYLAND:
No, we're not opponents of sewering because sewering is clearly a trade off. But you have to expect that Suffolk County is going to have to address the sewering issue head on in the very near future because you have a complex sewer system here with over a hundred sewage plants discharging back into the ground water system. So on the one hand you're helping to sustain the quantity by putting the water back into the system, unfortunately the quality that is being discharged is detrimental to the system and so, again, it's this balancing act.

MS. FARBER:
Nassau County hooked up most everyone to the sewers as an attempt to get the nitrates out of the groundwater. And yeah, it had -- it definitely had an impact on that but now it's having an impact on the quantity. One of the things that was tried some years ago when they got some Federal funds was to do a test at the Cedar Creek Sewage Plant where they did some tertiary treatment of the water, pumped it back up to East Meadow behind the jail and injected it back into the ground. From all accounts, from anyone who worked on that they will tell you it was very much a success, the problem was it was costly and when they ran out of the grant money and they needed to expand the sewage treatment plant the whole project disappeared. But that's -- it's a costly option but it's something that we may need to be looking at in the future.

MS. MEYLAND:
And, you know, the other piece about Nassau County is that the 90% of the County that is sewered, all of that sewered water is discharged off-shore. So it's a one time use through the system and, you know, lost forever.

MS. FARBER:
As is the Southwest Sewer District, I know where the outflow pipe is, I worked in the Turn Colony the year they put it through.

CHAIRMAN BISHOP:
Mr. Amper from the Pine Barrens Society is in the audience and when he sits in that chair he lectures us about how Suffolk County will be completely built out in approximately a decade. Assuming that occurs, what is your estimate as to the length of time that the water supply

as it currently exists will last in Suffolk County?

MS. MEYLAND:
I don't have a crystal ball so I can't give you an answer. We can look at some of this question of safe yield and I can talk about that if you want. And again, it's going to be a local response and so where you have the longest history of high water use, high demand, high pumpage --

CHAIRMAN BISHOP:
How important is that? So if the well in Babylon suffers salt water intrusion, can't we just get our water from Centereach?

MS. MEYLAND:
Yeah, but go back to the bank scenario. There's only so much in storage so if your bank goes bust, you're going to have to borrow it from somebody else which means you're trucking it in, you're bringing pipe lines from other parts of the County into local areas. I mean, in theory you can move the water anywhere you want to if you simply have enough money and the will to build a pipe big enough but, you know, it is not unlimited. And with all the stresses, when you add up all the stresses, higher population, more demand, all of the things put together, it isn't a scenario where it's rosey; it's bleak.

CHAIRMAN BISHOP:
Well, you're familiar with the Suffolk County Water Authority's positions as articulated in public documents.

MS. MEYLAND:
Right.

CHAIRMAN BISHOP:
Do you disagree with their assessments?

MS. MEYLAND:
Well, actually, you know, that has been a bone of contention for some time now and I know that the Water Authority has on numerous occasions made the claim that if it never rained another drop and the number changes from 250 years to 300 years to 400 years, so I think that part is a moving target. And apparently the basis for that claim is that there are USGS documents that try to tabulate on a quantitated basis how much water there is actually in the acquifer. So I think that it's a very dangerous thing to get into the numbers game because I don't think that the numbers that get thrown around are helpful, they don't really describe the situation and the fragileness of the acquifer. But nevertheless, I did look at that to try to see if that is a reasonable statement and so I have some slides here I would like to show you, how my analysis worked out anyway.

If the USGS has often tried to make a reasoned guess at how much water is actually in storage in the ground water system, and the number has changed over the years. Some years back they looked at the acquifer and said, "Okay, if this is the budget area that we're evaluating, how much water is actually in the system"; and this is all of Nassau County and a good portion of Suffolk County with the two forks not included. And in this analysis they predicted that they thought there was about 60 trillion gallons of water in the ground water system which is quite a lot of water. So recently, or not so recently, we've

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been seeing things that the Water Authority has put out and this is actually a quote from their website that says verbatim, "Hydrogeologists estimate that the aquifers in our area contain 70 to 90 trillion gallons of drinking water, enough to supply the current population for hundreds of years even if it never rained or snowed again." So let's look at this claim and see what actually a more realistic scenario might be.

We know that Suffolk Water Authority in their latest report pumped over 69 billion gallons of water in their annual report, so in one year. Similarly in Nassau County it was 52 suppliers and this is -- I'm just representing the pumpage from Suffolk Water Authority, obviously you've got a number of other water utilities in Suffolk County that add to the total amount of pumpage that's going on in the aquifer, but we'll just take the Water Authority's pumpage. Let's look at the pumpage in Nassau for public water supply, again, 69 billion gallons. And then look at some other reports from the USGS, they talk about this idea of how much water can you actually get out. Now, remember, where is all of this water? This water is in formations that are primarily sand and gravel and all the water is held in the minute spaces between the grains of sand that are holding this water. And so when you put the well in the ground and pull the water out, you're not pumping every bit of water out, you're pumping a part of the water that's held in storage. And the reasoned estimate is that for an acquifer like we have, you can actually only pump out about 10%, the rest is held on the -- as surface tension on the surface of the sand grains through molecular attraction.

So, okay, fine, you've got we'll say 80 trillion gallons, split the difference, 80 trillion gallons in the acquifer, 10% of that which is what we can actually get out reduces the available water to eight trillion gallons. And if we have a 139 billion gallons being pumped say on an annual basis, well, what's the math on that. So if we pumped 139 billion gallons a year to try to get the eight trillion gallons out, how many years -- if you pumped it dry, if you pumped it all out, it never rained or snowed again, what does the math tell you? The math tells you you've 57 years of water left.

Now, I think that this is a completely fruitless process because it doesn't serve anyone's interest to go through an analysis like this, but this is what the numbers tell you. So we clearly don't have an infinite supply. If you just take the Water Authority's claim on face value, they're wrong, okay.

CHAIRMAN BISHOP:
Let me ask you a question that you will probably demure from. Why would they be so wrong, how could they be so wrong in your opinion?

MS. MEYLAND:
Because they're looking at the 90 trillion gallons and thinking that you can pump every drop out, and they aren't even reading the literature correctly.

CHAIRMAN BISHOP:
Don't they have PhD's and experts who understand --

MS. MEYLAND:
Well, like I said, I think it's a fruitless claim because it doesn't serve anyone's interest to present an image that there is an unlimited supply of water, whether it's 57 years or a hundred years or whatever it is. You certainly don't want your children living on an island or in a County where the water supply is depleted and it was on our watch that we allowed that to happen.

CHAIRMAN BISHOP:
So let me conclude with one last question. What policies would you recommend that government undertake in Suffolk County?

MS. MEYLAND:
Well, I think that providing the data like they do in Nassau County allows an incredibly informed evaluation process; so better data collection, better data dissemination is vital. Changing the public's view and changing the way the press reports on water issues would be very helpful, and we would get away from this idea that the laws of nature don't apply in Suffolk County and that, you know, we've got a free ride with the water supply. Taking conservation seriously is very important, because when you start talking tomorrow about quality you'll start to see that what we're really talking about is not just pumping the acquifer dry but wasting the pristine water that we still have. Because there will be water in the acquifer hundreds of years from now but it may not be potable, it may not -- it certainly won't be pristine in the way we've enjoyed it in the past. And so the challenge isn't to get every drop out, the challenge is to sustain the high quality water in the system as long as possible, and so conservation serves that goal in both ways

MS. FARBER:
I think we need to -- two things. One is I think the County can certainly be looking at how County facilities can set example, and the other is I think we need to look at what our use of this other means not just for how much is left but what are the other impacts, what are the ecological impacts that we're having on streams and wetlands and our surrounding waters as well as our forests. What are the impacts we're having bu pulling these pollutants through the systems faster, how many more wells were going to be contaminated because just hold it right there, hold it closer. So I think we need to look at the impacts of what we're doing as well as just the numbers.

MS. MEYLAND:
And, you know, the whole debate about land use comes right to the fore again. What is the density that we should allow in communities because the greater the density the greater the demand, and then you get all the other ramifications of decreased recharge, contaminated recharge. And so we go back to, again, protecting areas that have the greatest benefit of getting clean abundant recharge back into the system so that everybody can benefit from that and so you go right back into all the questions about the special ground water protection areas, about protecting the Pine Barrens and other similar areas in the County. And it all really is relevant to this consideration of sustaining the acquifer, you know, as long into the future as we possibly can.

CHAIRMAN BISHOP:
Thank you very much. I appreciate it. We'll take a five minute break and then we'll hear from Julie Penny from the South Fork Ground Water Task Force.

(*BRIEF RECESS TAKEN: 11:31 A.M. - 11:44 A.M.*)

CHAIRMAN BISHOP:
Ready? Alison's ready, the most important thing in this operation. Alison Mahoney is ready. Good morning. We're reconvening. Julie Penny from the South Fork Ground Water Task Force has joined us, and I appreciate your presence here.

MS. PENNY:
Thank you very much for convening these hearings on the quantity and the quality of our ground water, it's very important. And I thought Sarah Meyland's presentation was very important, very enlightening, gives it another point of view than what's generally out there.

I am July Penny, the Co-Chair of the South Fork Ground Water Task Force and I'd like to read my statement into the record. The South Fork Ground Water Task Force is a not-for-profit organization made up

of concerned citizens from the Towns of Southampton and East Hampton. Its goal is to protect the south fork's ground water from contamination, depletion and misuse. Our aim is to implement protection of our special ground water protection areas and promote wise stewardship of this finite resource. For years we have been pressing Southampton and East Hampton to create a watershed protection management plan for the south fork region as a unit; it's been slow in coming yet we have raised awareness of this issue to a remarkable degree through public education and working with government bodies.

The question posed to us this day is can Suffolk County's water supply sustain unlimited development? The answer is a resounding no. First of all, with more development there is less quality recharge and less recharge period. Second of all, our fresh water lens has been punctured from over pumpage in many areas of the island and we're suffering incursions of salt water. Also, ponds and streams have lowered. We, along with the rest of the world, do have a water problem and have to make some hard choices; we can't think short-term, we must think long-term.

Let me say a word here about the process of recharge. Recharge is the process by which ground water is replenished. A recharge area is where waterfront precipitation is transmitted down to the acquifer. Most areas, unless composed of solid rock or covered by development, allow a certain percentage of total precipitation to reach the water table. However, in some areas more precipitation will infiltrate than in others. Areas which translate the most -- transmit the most precipitation are often referred to as high or critical recharge areas. How much water infiltrates depends on vegetation cover, slope, soil composition, depth to water table and other factors. Recharge is promoted by natural vegetation cover, flat topography, permeable soils and a deep water table. On the south fork, our critical deep water recharge areas are situated in the wooded and hilly regions of the terminal moraine.

A look at the Southampton Town Code, for instance, goes to show how importantly these recharge regions are regarded. The code says, "The Town Master Plan and subsequent studies and updates have located geographic areas in the town where water recharge into the aquifers is the deepest and therefore the greatest recharge occurs. These water catchment regions affect the water quality of the entire town. The types of land use which occur above the water catchment region directly impact upon the acquifer and its quality. Thus, the type of land use in the water catchment regions must be compatible with the function of water recharge to ensure the goal of protecting and drinking the drinking supply of the town"; and so ends the quote.

Unfortunately while the code exists, it seems when making decisions

the town board members never seem to consult with it. Southampton is not unique in this respect. All across Long Island bad decisions are made that affect these precious resource areas.

It has been the goal of the South Fork Ground Water Task Force and its predecessor organization, the South Fork Coalition for Fresh Water, to create and implement a water shed protection management plan for the Towns of East Hampton and Southampton as a single region. Moving water across the Shinnecock Canal to the south fork would be cost prohibitive and from Southampton on out to Montauk we must husband wisely what water resources we have in place. After much pushing, the Town of Southampton is working on a plan called The Critical Wildlands and Ground Water Protectin Plan. East Hampton has included ground water protection in its mat master plan update. It remains uncertain if they will make the hard choices that must be made to protect this finite resource and if they will act as a unit in its protection in management. For all of Long Island, the time for action is now. In many years -- in many areas it's already too late.

I am a member of the Southampton Town's Citizens Advisory Committee for this above mentioned plan, and Chris Schubert of the united States Geological Survey is one of the members of the Technical Advisory Committee. In a presentation made to the joint committees, his data showed that when making allowances for perturbations in drought years, the USGS measurements indicate a dropping in the water table. As the south fork has been in the throws of increasing development with its concomitant demand for water use, quantity does become an issue. Figures show that every year the Suffolk County Water Authority's pumpage of water increases, this trend is not about to reverse itself, demand will become even greater.

The south fork depends mostly on its upper glacial acquifer because our older acquifer, the Magothy, to a great extent has salt water intrusion and we have no ancient Lloyd acquifer to speak of as they do west of the Shinnecock Canal. The north and south forks are mere tines of a fork with the emmens pressure of the Atlantic Ocean, Sound and Bays pushing in on us at all times making us pray to punctures in our delicate fresh water lens. Development with its increased consumption and concurrent diminishment of recharge, exacerbates the problem.

Around 1997-98, I read the Suffolk County Water Authority's Draft Environmental Impact Statement for a proposed well field in Hither Hills. They were surprised when their test well hit salt water as soon as it did. In Montauk they have to cycle the public wells every few weeks to keep salt water intrusion at bay. Salt water intrusion is already a big problem in many of our coastal regions. Over pumpage from continuing development, over development, golf courses,

agricultural irrigation, lawn sprinkling, etcetera, coupled with removal of vegetation and paving surfaces over diminish the land's ability to recharge and the precipitation then ends up as runoff.

As I said, on Long Island the south fork and the USGS records indicate that there has been a discernible drop in the water table. We are not unique. If you look at it globally, the world is running out of fresh water. Let me quote from an article in a recent New Yorker article about how corporations like Enron and BechTel have been rating third world communities with good water, bottling it for export thereby jacking up the prices for poor communities from whence this water comes. It says, "There's water everywhere, of course, but less than 3% of it is fresh and most of that is looked up in polar ice caps and glaciers, unrecoverable for practical purposes. Lakes, rivers, marshes, aquifers and atmospheric vapor make up less than 1% of the earth's total water and people are using more than half of the accessible runoff."

"Water demand, on the other hand, has been growing rapidly. It tripled world-wide between 1950 and 1990 and water use in many areas already exceeds nature's ability to recharge supplies. By the year 2025 the demand for water around the world is expected to exceed supply by 56%."

"Acquifer depletion, the less visible, is an even more serious problem. There are 60 times as much fresh water stored under ground as in lakes and rivers above ground. And yet, parts of Northern China, to take one example, are approaching ground water bankruptcy. Beijing's water table has dropped more than a hundred feet in the past 40 years. In the United States the Ogallala Aquifer which reaches from Texas to South Dakota and is indispensable to forming on the Great Plains is being drained eight times faster than it can naturally recharge. In vast areas of India, Mexico, the Middle East, California's Central Valley, the story is the same."

Yet, in the light of the above, we constantly hear the Suffolk County Water Authority saying that if it were to stop raining today we would have enough water for the next 300 years; factually true, but what about the quality? What about the ramifications to the whole ecosystem? To make such statements to the public is irresponsible and wrong-headed. By and large, the public has no notion of how our aquifers work and such statements lulls people into complacency and a false sense of security. The Suffolk County Water Authority should be behaving like responsible stewards of our ground water resources rather than indulging in such misleading statements. Such glib sound bites are ultimately harmful. The public should be given incentives to conserve water, not to squander it.

Such a statement is wrong-headed for other reasons, too. The more we use the less volume there is to dilute the contaminants that are constantly coming in to insult the system. Think of a tea bag in a tea cup, it will turn your water brown in a few minutes. Now think of that same tea bag in a swimming pool, with all that pool water you would hardly notice those tea molecules after -- at all, it would be so dilute.

No, the Suffolk County Water Authority should be actively preaching conservation along with the Town, County and State. Educating the public in schools and in the community in a big, big, big way is the only way we'll ever make headway in curbing the wholesale contamination and depletion that goes on daily.

Here are other errors to that way of thinking. Consumption affects the underflow into the sound, the bays, affecting the salinity. Changes in salinity affects our estuaries which are the nurseries of our fishing industry. Consumption, coupled with drought, lowers our ponds and streams and negatively affects wetlands.

What studies have been done on changing the salinity on coastal waters; are they being done? If so, the Suffolk County Water Authority, as well as our government bodies, needs to take these into account; if not, they should be promoting such studies.

If it were to stop raining and we kept on pumping, we'd get salt water intrusion so much the quicker without recharge to the system. Yes, if it stopped raining we'd have 300 years of unpotable water, destroyed fisheries, dried up ponds and streams, thank you very much. What's the point.

Certainly on the south fork, the Suffolk County Water Authority is operating without a master plan to protect, conserve and manage the south fork's fragile drinking water resources. It should have been leading the way at least and be in the vanguard now to impress upon Southampton and East Hampton the necessity of creating a watershed protection, watershed management plan that will protect this resource for hundreds of years to come and beyond, as we have to protect high quality special ground water protection areas for future public use. The Suffolk County Water Authority needs a master plan, one in conjunction with the south fork as a unit.

I also --

CHAIRMAN BISHOP:
That's wonderfully clear, your perspective.

MS. PENNY:
And pointed. I also brought along a chart that I made indicating --

CHAIRMAN BISHOP:
Yes.

MS. PENNY:
-- the comparative thicknesses of the special ground water protection areas compared to other areas outside of those districts. And if you

look at it, you can see that the special ground water protection areas, especially in the Noack Hills, the fresh water lens can be as thick as 780 and 800 feet thick. But if you go out to the coast you see how that really thins out where in an area like Napeague it thins down to about 50 feet. And the closer you get to the cost, you know, the quicker the lens gets punctured by pumpage. So this is just like a graphic representation.

CHAIRMAN BISHOP:
I will certainly include that in the record. Your remarks are -- I didn't call the hearing to focus on the Water Authority per se, but since your remarks have led me there. Obviously I'm sure you've had dialogue with them about the need for a master plan and so on; what has been the response?

MS. PENNY:
No, actually I haven't had a dialogue with them.

CHAIRMAN BISHOP:
Okay. Why is that?

MS. PENNY:
To date I haven't.

CHAIRMAN BISHOP:
Okay.

MS. PENNY:
But I will.

CHAIRMAN BISHOP:
Okay, good. Because I don't know if they would be adverse to that. And I assume you're critical of the town governments of East Hampton and Southampton for not --

MS. PENNY:
In fact, to get back to the question, that was one of the things that I was going to bring up at this critical wildlands and ground water protection plan in East Hampton. The Suffolk County Water is on its technical committee, but they weren't at the meetings so I never had a chance to ask them why.

CHAIRMAN BISHOP:
The ground water task force is in general critical of the townships for not following the --

MS. PENNY:
Yes. Well, actually a lot of the town code that's in place is good. If they would only follow the town code we would be far ahead of the game, but the fact is they actually violate its own town code in many respects and that's a problem.

CHAIRMAN BISHOP:
What about our Health Department and its codes; you don't have a similar criticism?

MS. PENNY:
No. No, no, I don't.

CHAIRMAN BISHOP:
All right. Well, thank you very much. I appreciate the statement.

MS. PENNY:
And I'll be here tomorrow about the contaminants.

CHAIRMAN BISHOP:
All right. It's high noon now, we're running ahead of schedule which is fantastic. Mr. Minei and Mr. Trent, can you be back here at one rather than 1:30, would that be better?

MR. MINEI:
Sure.

CHAIRMAN BISHOP:
Okay. Then we'll reconvene at one o'clock, we'll take a lunch break for this time. I would go right into it but I -- Mr. Bokuniewicz is not here, right?

MR. MINEI:
We're without technology right now.

CHAIRMAN BISHOP:
Okay, good. So one o'clock will do. Thank you.

(*THE MEETING WAS RECESSED AT 12 P M*)

(*THE MEETING RESUMED AT 1:05 P.M.*)

(SUBSTITUTION OF STENOGRAPHER - DONNA BARRETT)

CHAIRMAN BISHOP:
Good afternoon. Legislator Fields and Crecca both indicated earlier that they wish to attend the afternoon session; I assume they're in transit, but we may as well begin. We can get them caught up when they arrive. Or -- yes, let's begin. Good afternoon.

MR. MINEI:
Good afternoon.

CHAIRMAN BISHOP:
Vito Minei.

MR. MINEI:
I'm Vito Minei. I'm Director of Environmental Quality for the Suffolk County Department of Health Services. I'm joined today by Martin Trent, who supervises our Groundwater Resources Bureau. We're pleased to be here this afternoon. We put together sort of an overview of groundwater quantity issues. We kind of got late notice of this hearing, but I think we can touch on some issues here. And we'll lead really into tomorrow the quality issues. I want to thank your staff for accommodating my schedule. I had a few conflicts today and tomorrow, so I appreciate that. Let's -- let's get into this.

Essentially I think, although I missed some of the speakers, I did see some of their notes. I suppose our position is rather consistent with that. And it's -- it's been pretty much the story of Suffolk County's groundwater conditions since it's been studied from the early 1900s that if you want to only focus on quantity for today, that's what we'll do, that there seems to be ample quantity to supply the population in Suffolk County into the foreseeable future. The issues have always been some of the natural resource concerns when you couple pumpage of water supply with sewer -- regional sewering and dry weather conditions as we have today. So I thought I'd quickly go through some of the issues, touch on some of the historic reports and then ask Martin to go into some of the details about our surveillance activities, some of the planning that we hope to go into the future. And one of the -- one of the recurring themes will be a major project that we're just undertaking both in Nassau and Suffolk County, some of the partners include the Planning Departments of both counties, the Water Authority in Suffolk. It's called the Source Water Assessment Program. It has the unfortunate acronym SWAP, but it is a very important program. And we're proud to say we probably have the premiere investigation ongoing. We'll talk about the quality issues more tomorrow with SWAP.

Essentially, let me go through some of the these slides. When you're talking about groundwater quantity there are obviously water supply

issues as well as natural resources. We can talk a little bit today about the public and private well monitoring programs and some of the commercial institution uses and agricultural irrigation that's always been an issue here in Suffolk County. And we'll talk a little bit later on about the natural resource impacts, what dry weather coupled with sewering and water supply pumpage can to do to lake levels, stream flow, and groundwater discharge to the estuaries. That is a very major issue. We spent considerable time in the Peconic Estuary Program evaluating the amount of groundwater underflow to the Peconic system as well as the water quality implications. This is again a short list of some of the monitoring studies and some the responsible entities that have carried out water quantity and quality studies. We in the Department have been doing this for well over 30 years, the Water Authority carries on their own investigation, the Long Island Regional Planning Board has overseen major regional water quantity and quality investigations as has the New York State DEC. One of your partners in groundwater investigations for at least the last 35 years that I'm aware of is the United States Geological Survey. I'm pleased to see they are on your agenda for tomorrow afternoon. They are a required speaker at these kinds of meetings.

This is really a short list of required reading. My staff treats me like the office boy, and I was involved in many of these, but some do predate my work with the County. We'll talk a little bit about the Comprehensive Water Supply Study from 1970. The 208 Plan is discussed even today as sort of a reference with regard to planning, zoning, water quality and quantity issues. We oversaw the North Fork Water Supply Plan in the early '80s. The Long Island Groundwater Management Program was a success with the 208 and was actually the administrative mechanism for implementing a lot of the recommendations in the 208 Study. And then we in the Health Department were responsible for the Suffolk County Comprehensive Water Resource Management Plan of the

late '80s. I think that would be an issue for discussion as well.

Starting with th CPWS 24 there was a couple of interesting findings. You have to think back, the time period of the study was I think '68 to '70. It was in -- we were in the throws of at least the tail end of the drought of the '60s. And there was a lot of investigations going on. One the first models that I'm aware was ever utilized for groundwater conditions was something called the (Healy Shaw) Model. It was actually sort of a little flume, a mechanism that replicated the transect from Huntington Harbor down to Robert Moses Causeway. And the concern back in the late '60s was saltwater intrusion. And they tried to investigate whether or not that would be a concern for Suffolk County in that era. The finding from that was, no, they didn't believe that saltwater intrusion would become a significant problem again into the foreseeable future. The planning horizon for

CPWS 24 was 1970 to 2020. So they didn't see saltwater intrusion as a major problem. I later got the opportunity to go up to MIT in the late '70s and the (Healy Shaw) Model was unceremoniously thrown underneath one of their other hydrodynamic studies. But modeling has been a major component of a lot of the investigative work here. This kind of physical modeling in the mid '60s was followed by the GS, they had what was referred to as an analog model. It was just a whole series of electrical components; capacitors and resisters that tried to simulate groundwater conditions in Suffolk County. That was followed in the early '80s by the USGS with what is referred to as computer digitized models, that is using mathematical equations to try to simulate a natural system. A lot of the -- the primary investigator for the GS back then was a student at Princeton, and George {Pindor} was the major East Coast groundwater modeler in the earlier '80s. So that has moved ahead, and we'll talk about the state of the art of groundwater modeling in a second.

Basically what CPWS 24 talked about was there were concerns about nitrate, nitrogen with groundwater quality. And they really made the firm recommendation that we had to establish a groundwater monitoring network to talk about the utilization of trying to smooth out pumping regimes around the County and consolidate water suppliers under a single agency, that's been a recurring theme over the last several decades, and to create water districts to serve outlying areas. And we'll talk about the specific problems to the North and South Forks.

This is the afore mentioned {Healy Shaw} Model that probably is a hydrodynamics laboratory at MIT. It looks impressive, it isn't treated the same anymore. The 208 Study was a project that I worked on, Lee Koppelman oversaw that. Again we start now, that study is mid '70s, late '70s was when it was completed. A lot of the discussion was, yes, we know we have enough quantity, what are some of the water issues in Nassau and Suffolk County? And we picked out some of the quick recommendations out of the 208 Study. There was concern about declining water levels from sewering. Again, we had the USGS, we used that analog model I talked about, tried to simulate the impact of both the regional Nassau County sewering with the new sewering that was going on in Southwest Suffolk County. And it replicated some of the declines in groundwater levels and indicated a concern for stream levels. And we'll talk a little bit more about in a moment. They talked a little bit about regional impacts of saltwater intrusion and

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pretty much isolated to areas of Nassau County. I think you spoke about that this morning, up in the Great Neck Peninsula in Northwest Nassau. There's also concern down in Long Beach as well. And the concern was that the -- and the conclusion was that the loss of usable groundwater because of saltwater intrusion would be -- would me minor.

Some of the important things that came out was the groundwater quality environmental effects on stream flow. We developed a whole concept of groundwater management zones as part of the 208 Study. It's what we use today with regard to Article 6, that's the segment of the Sanitary Code that deals with housing densities and sanitary sewage laws as well as where to store toxic and hazardous chemicals. All of those concepts about groundwater management zones came out of the Long Island 208 Study and the success of the groundwater management plan. It talked about implementing land use controls to minimize development in critical recharge areas, again, the Pine Barrens concept grew out of this in protecting large swaths, contiguous areas to protect groundwater quantity . And the idea was to expand waste water collection systems, but in a -- in a less ambitious way that Nassau County did. As you know, Nassau County is pretty much entirely sewered. There was a concern in the late '70s about the Southwest Sewer District and the plans essentially to sewer every square inch out to the Montauk Lighthouse. So the idea was be very conscientious about were you extend sewering to serve the more populated areas. We followed in the early '80s after the Comp Study for the North Fork Water Supply Plans. The concerns about this isolated reservoir of drinking water on the Forks has been well known for decades. The concern there too is that the population should be restricted. And I believe that the Town of Southhold and Riverhead has really moved until the last two decades to really get more aggressive with restrictive zoning out there. We've been dealing with the Water Authority and the planning entities out on the North Fork to talk about supplying water to the -- to the real priority areas contaminated with agricultural pesticides. And Martin's made a presentation to this committee about our pesticides investigation.

The Long Island Groundwater Management Program I talked about was the successor to the 208 Study, and there was concerns about again, this whole idea of water quality. And in the mid '80s was really the advent of major comprehensive investigation of toxic substances, industrial solvents, household use of solvents, those kinds of concerns. Nitrogen was still a water quality concern and remains one as well. So we've got about 30 years of concern with that water quality issue. There was quite a bit about protecting deep recharge. Again, that Zone III, the deep recharge area of the Pine Barrens and the use of zoning to really protect the water resources really came out of that. I think I'm going to turn this over now to Martin. He'll start talking about the volumes of groundwater and talk about our surveillance programs, and I'll wrap up quickly with some of our conclusions.

MR. TRENT:
The Suffolk County Water Resources Management Plan was completed in 1987, and the estimate in that plan was similar to the numbers you heard this morning, 70 trillion gallons of water. It's important to note that this amount is 200 times the amount of annual recharge. The report also

showed that there are areas of limited water quality, and they are east of Mattituck Inlet on the North Fork and east of the Shinnecock Canal on the South Fork. These are the areas of Long Island where quantity is an issue. It also showed that 65% of the pumpage is from residential use, which is two thirds of the entire pumpage as possessed to the commercial, industrial, agricultural end of it and golf courses and other uses were relatively minor in comparison. One of the findings again, of the comprehensive plan, the top graph shows the increase of population as the second line and the increase of water pumpage as the first line. You also see that the population is beginning to level off at around 1.5 million here, and that's largely due to the land use controls that were implemented. A lot of the earlier studies predicted we're Suffolk County would have a population of over 3 million people. We're not going to approach that with the controls that are in now. It did address the quantity issues, again, emphasizing the marine discharge of waste water, especially in the Southwest Sewer District. The need to control excessive pumping to avoid saltwater in localized areas, to improve drainage and stormwater runoff to increase recharge and where necessary, to reallocate water from areas of surplus to areas of deficit. And again, those areas in Suffolk County are largely going to end up on being on the forks. The only place where it's really necessary now is in very very insolated peninsulas; Great Hog Neck in Southold and along the Napeague Strip in East Hampton where you see a large amount of development now and insufficient local freshwater reserves.

And the -- among the recommendations of that plan was as mentioned this morning, public education. It's a big issue to keep these items in the forefront of the public so they think about these so that the Health Department, DEC and others can enforce the proper regulations of the Planning Commission, Suffolk County Planning Commission and the Town to look at water supply issues and zoning groundwater investigations as far as quality goes and conservation for the first time became a major recommendation of that report. To get into our current programs now this is the Suffolk County monitoring well network. We have 470 monitoring wells located throughout the County. There are quarterly water table evaluation taken from each of the those. There's an annual water table contour map produced that shows those water table elevations. That map is made available to the Planning Department, to builders, to developers so that they can see what impacts the aquifer may have on any proposed projects there.

At each of these wells you could produce a similar hydrograph that shows a long term monitoring record, and it shows the wet periods where precipitation recharge is exceeding the long term average and those sometimes in periods of drought where we're in right now where water the table is several feet below normal. You can also use the data to show where water, supply fresh water supply, is accurate -- adequate. This

representation of Shelter Island shows areas of water supply that have at least a three foot contour. And the areas that could be developed with private wells and public water supplies on Shelter Island. The same data can also show the problems -- the problems that -- the areas that may have problems, specifically here on Shelter Island. Again, you can see Ram Island Peninsula, the West Neck Peninsula at the northeast and southwest corners of the Island where saltwater intrusion can be a problem if there's overdevelopment.

Some of our programs include this water table elevation monitoring. We also do water quality monitoring at those 470 wells as well as other specific investigations. We have the capacity to drill and install our own monitoring wells wherever we think they're necessary in response to problems or concerns, anything from doing {shallow geoprobe} work along the South Shore. With this particular rig we can drill wells into depths of 300 feet. This is an example of a recent investigation. It was of a plume of tetrachloroethylene} in Yaphank that we got involved in because the original suspicion was that it was coming from the County facilities near the County Infirmary or the Police Department. We ended up installing 26 wells and tracing it back to a property unrelated to the County. From that we're able to produce is cross section of what that contaminant plume looks like in the aquifer, the depth of it and where it's located and where it's traveled. The slide is a little light, but this is a more recent investigation. This is of Speonk, the two major roads there that are marked are Old County Road and Montauk Highway. And we have a very large plume of volatile organic compounds where a very specific thing contains four compounds including trichloroethene} tetrachloroethylene} for chloroform and {carbon tetrachloride}, which is a pretty unusual contaminant outside an industrial area. So we're in the process of delineating this plume and trying to investigate what sources may lie upbreeded. One of the other programs we're involved with is to investigate groundwater discharge to surface water bays and estuaries. The Department along with Cornell Cooperative Extension has developed an ultrasonic seepage meter where we can actually measure the quantity of freshwater that's being discharged from the aquifers into these bays, and we're getting pretty near being able to look at the quality of that water as well. This particular slide shows a small drilling instrument, the geoprobe, that's mounted on an old barge we borrowed from the Department of Public Works. We can actually install small diameter monitoring wells right through the bay bottom. To measure those discharges we can gamalog them and look at the actual pathology and also located the saltwater interface offshore.

This is one of the most powerful tools that we have right now is the groundwater model that was developing in conjunction with {Camp Dresser McKean} in the Water Authority. This is a 3-D finite model -- finite element model, it covers over 1500 square miles from the Nassau County border out east to Mattituck inlet, and it's in the Shinnecock Canal.

We've developed separate models since this to look at both the North and South Forks and Shelter Island individually. This model has 2400 individual loads, 4700 elements and eight layers from bedrock to the water table. So we can simulate the aquifer pretty well with this. One of the things we can use this for is to look at the stream flow, to look at the groundwater contributing areas to all the streams in Suffolk County. We can look at -- I don't like to measure the areas impacting the streams, but it can tell us where to sample and where we might have problems quality wise along those streams.

Vito mentioned SWAP, and this will be one the major uses of this model. It can be used to show the areas that contribute to the pumping wells, the public waters supplies throughout the County. And contrary to the last slide, this slide shows areas that are in use for public water supply located mostly down the spine of the Island. The previous slide showed those areas where shallow groundwater was discharged into the streams and bays.

MR. MINEI:
I just want to wrap this up for you, Dave. Basically, what we're trying to do is bring you forward in time just to give you an overview of some of the planning that's taking place and to show you that the surveillance continues. Martin is the head of Groundwater Resources, so our monitoring continues for the streams as well as groundwater elevations, and we have marine monitoring as well. One of the projects I wanted to touch base on, and I think this probably should be a subject of a separate presentation from DPW we've been assisting in, towards the tail end of the construction of the sewers in the Southwest Sewer District in the late '70s and '80s there was concern about the environmental impacts that might occur by exporting all this freshwater that used to be recharged through on-lot septic systems out through the outfall of the Bergen Point Sewage Treatment Plant out to the ocean. So there's been an investigation going on for nearly 20 years as to the possible impacts of the sewering on the stream flow and salinity. There was also investigations of salinity in comparison to the Fire Island Inlet. And these -- these investigations continue. There are indeed over that 20 year period fluctuations in the stream flow in the Southwest Sewer District. But the most -- these bullets are taken from the most recent letter from DPW to the relevant agencies and talks about the small declines in these rivers. We were particularly concerned from the stream corridors from Amityville Creek on the west to Carlls River, the largest stream in the Southwest Sewer District. And this mentions as the letter does recently that the headwaters locations are pretty close to pressuring levels, and that -- one of the other concerns, there's been a lot of thorough investigations of the vegetation, there's cross sections across several of the streams to look at the wetland and the impacts. And according to the last report that there really hasn't been a change in the vegetative communities along some of the these streams.

I would like to just summarize, if we can just move along, to what our findings and our position pretty much. And I think this is similar to what we're been hearing for over a century actually, in fact, some of the earlier studies that were done in the 1900s were investigating the groundwater resources in Suffolk as a possible source to -- to Nassau County. A study in the late '50s indicated that the permissive sustained yield could supply water to nearly 3.3 minimum people in Suffolk County. Those were some of the early estimates of what build out would really represent in terms the population. That population estimate obviously was backed off considerably in the 208 Study. And currently I think we have about 1.3 million plus that the LIPA estimates are. We are indeed slightly larger than Nassau, that's been the case for about five years. And we've kind of used Nassau as our living infield experiment, that they have considerable public water to almost all reaches of Nassau County, they have sewering in that area, and we've been following their situation for the last 30 years with regard to water supply.

So basically, if you just want to focus on just keep the blinders on for this afternoon, there is indeed sufficient groundwater quantity to meet the water supply needs. We'll talk about quality more tomorrow and what the SWAP program will dictate in terms of qualifying some of these conclusions. And there has been discussion over the last few decades about the need at times that reallocate from surplus areas to some of the deficit areas. And the concerning about avoiding excessive concentrated areas of withdrawal. Sometimes when we're talking about concentrated

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withdrawals, it might be small in relative size on the North Fork and Shelter Island. And then to monitor and mitigate environmental effects of sewering. This -- this remains the paramount concern. What is the affect on stream flow, lake levels and the bays? You saw the fan study, we probably should talk about that some more at another meeting, but the whole idea is that the we're not complacent, surveillance continues, planning continues, we'll talk more about that tomorrow, and the ideas that water conservation is just a good rule for everyone to utilize. But the concern for lake and stream levels continues, monitoring is ongoing.

And the possible salinity changes, I just quickly got some from my Marine Resources Bureau out in Riverhead, and they gave me some stations in Great South Bay. Starting from the east, 2001, which is a relatively wet year compared to this year, the salinity in the eastern Great South Bay was about 25 parts per thousand. It's typically what it is in eastern Great South Bay. There's a lot of residence time out there east of the Fire Island Inlet, typically freshwater builds up. This year instead of 25, it's about 27 and a half parts per thousand. It sounds like a subtle difference, but those two parts per thousand sometimes can encourage some of the predators, like star fish, into the bay system. Even on the western end out near Amityville Creek, there's a change of about one part

per thousand from 29 to almost a seawater quality of about 30 plus parts per thousand. So we monitor very closely the salinity changes. And as subtle as they sound, and they can be very important to the system. So that continues to be some of our water quality issues. I think that pretty much wraps up our presentation.

CHAIRMAN BISHOP:
I have a question. The last significant planning document with regard to water quantity was created in 1987; is that correct? That's --

MR. MINEI:
The last time we were involved in compiling that kind of information, that's true. The SWAP program picks up from that, from the late '90s and moves us forward into this millennium. So we're currently involved in a comprehensive investigation of both quantity and quality issues. That slides Martin showed of the stream flows represents some of the modeling, the powers of the molding, with regard to quantity issues.

CHAIRMAN BISHOP:
The 1987 report --

MR. MINEI:
The Comprehensive Resources Management Plan.

CHAIRMAN BISHOP:
Now, that was a planning document which I guess Long Island Governments were supposed to absorb and use to guide them, correct?

MR. MINEI:
Right.

CHAIRMAN BISHOP:
The SWAPS will do the same thing?

MR. MINEI:
SWAP will do exactly -- what the SWAP does by definition is it provides an assessment. That's been a concern to us all along. We want to move into the management implications of what all these assessments will do. Tomorrow I'm going to show you some more, I think, pertinent slides about what the SWAP modeling will do with regard to water supply. I think the question --

CHAIRMAN BISHOP:
I thought SWAP allowed you to identify were pollutants came from. I thought that was the most significant --

MR. MINEI:
Well, that's the most significant, but it's not the only utility of the

model. I mean, the model helps us delineate stream subwater sheds, it helps us calculate the amount of groundwater underflow into the bays. The molding capability goes above and beyond just a drinking water supply investigations, and SWAP is part of that. SWAP is an assessment, we're talking about the management implications that jump out of assessment that comprehensive.

CHAIRMAN BISHOP:
And in the 1987 -- what do you call it?

MR. MINEI:
Comprehensive water Resources Management Plan.

CHAIRMAN BISHOP:
You don't -- you don't have something for that.

MR. MINEI:
There is a slide that summarizes the --

CHAIRMAN BISHOP:
I'm see, I'm on that.

MR. MINEI:
Yes, it's a big thick two volume set.

CHAIRMAN BISHOP:
I'm going to call it the 1987 report.

MR. MINEI:
That's fine.

CHAIRMAN BISHOP:
The 1987 report, has Suffolk developed in accordance with its projections, and has the governments in and around Suffolk; town, county, followed through on its recommendations? And if not, where -- I mean, if there has been some strain, where has that occurred?

MR. MINEI:
Since that mid '80s time period, Brookhaven moved dramatically towards the end of the '80s and upzoned considerable property in the Town of Brookhaven. Both the North and South Fork, Southampton, East Hampton as well Southold have moved to upzone considerable properties. The

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power -- the power of the '87 report really, I think, gave us a picture and was one of the things I think that really leads us to get away from complacency. I think if you hear every week the water quality is okay, the drinking water is okay, you can almost be lulled into a sense of, gee, everything's fine. What SWAP does in move us

forward in time to be able to forecast any problems on their way. That's really the power of these modeling capabilities. What the '87 report did was really shake us once again. I sort of was a little bemused at looking at 1970 report and the perimeters of concern back in the late '60s. And when you look at 08 it was really the advent of all these investigations and viruses and solvents and things like that. There's a number of emerging concerns out there that we really have to be vigilant about and really be very, I would say conservative, in what we estimate will be our ability to provide wholesome water supply into the next 50 years or so. The '87 report gave us nice pictures of the quality of the aquifer at different levels, it highlighted the concern about those insulated areas, those peninsulas, on the North Fork, it really told us that we had to have more powerful tools to forecast groundwater quality, and not just keep tabs on it, which is what surveillance does. A lot of the times it gives you forecasting ability, but really it's a snapshot in time. Today your water quality's okay, tomorrow it might not be that great. So that's what the modeling is for.

CHAIRMAN BISHOP:
SWAP is more dynamic than that. SWAP not only gives you the snapshot, but it -- it leads you to the -- to the projections and --

MR. MINEI:
I think I've captured that whole concept tomorrow in one slide. I hope -- I hope that bring that all home to you tomorrow.

CHAIRMAN BISHOP:
All right. But that's on -- that's on quality. Has SWAP revealed anything to date regarding quantity issues?

MR. MINEI:
I think the quantity discussion remains what it's been for probably close to 50 years, that in periods of dry weather combined with sewering withdrawals and overpumpage that people have to be concerned about the surface streams, lake level and salinity levels in some of the bays, that there seems to be adequate water supply, in terms of sheer volume, to supply the residents of Suffolk County into a population now that's far reduced in expectations than what it was 40 years ago. They literally in the late '60s and '70s were talking about three and a half million people in the Suffolk County by the Year 2020. That's not the case. They were also talking about dramatic changes, there was something on the order of 120,000 acres of farmland in 1950, by 1964 there was 74,000 acres of farmland. They forecast that by 2020, back in the '70s, that there would be 11,000 acres of farmland by the early 2002s. We have 36,000 acres. So the idea is that the picture of land use has changed dramatically from what was though 30 years ago. The picture of our ability to supply water on a quantity basis still remains the same. Quality remains the concern with regard to water supply, quantity will remain an issue

with regard to our natural resources.

CHAIRMAN BISHOP:
You may not have been here, I think Mr. Trent was here earlier for Ms. Meyland's presentation, which said among other things that the -- if you synthesized it, that we were withdrawing faster than nature's depositing, and this is creating a stress on the overall hydrogeological system.

MR. TRENT:
She discussed the concept of permissive sustained yield in the County, and she --

CHAIRMAN BISHOP:
I'd like to get your perspective on her --

MR. TRENT:
She maintained that -- that we were nearing or at that point, and, in fact, in the issue of quantity, overall quantity, we're no where near that point in Suffolk County, that there is more than adequate freshwater reserves to serve the population now and the projected population.

MR. MINEI:
That will be one of the outcomes of the model to SWAP, the whole concept of permissive sustained yield.

CHAIRMAN BISHOP:
Mr, Trent, if you could expound on that.

MR. TRENT:
That addresses the issue of water supply for drinking water, that doesn't address the issue of natural resources.

CHAIRMAN BISHOP:
Right, I understand that.

MR. TRENT:
There are -- because of all the studies that were in the past, in '87, and going back to '78 the 208 Study was a biggest implement -- impedence for many of the land use controls that are in place today. But because of the land use controls that are in place today, while the earlier studies had shown that the build-out population for Suffolk County was going to be over 3 million people, in fact, we're never going to get there. And build out is going to be much much less in concept, and that population unless they do something severely wrong will not exceed the sustained -- permissive sustained yield of the water supply.

CHAIRMAN BISHOP:

What's the difference just in -- I have to bring her -- her presentation down to the level where I could -- what's the difference between Babylon and Valley Stream? I think she indicated that Valley Stream now -- that those wells are not usable any longer, there's no stream in Valley Stream.

MR. TRENT:
The stream has dropped up -- has dried up because of the reduction in water levels for those two reasons, because 90% of Nassau County is sewered.

CHAIRMAN BISHOP:
Now, I have streams in Lindenhurst that are in the same situation; Strongs Creek, which is now only a drainage stream, it's no longer a stream, will my wells be in the same situations as southwest Nassau?

MR. TRENT:
The streams intercept shallow groundwater, the top few feet of the water table, okay. They're wells, public and private wells, are screened much much deeper into the aquifer. It's a misnomer to say that the wells will dry up.

CHAIRMAN BISHOP:
I understood that. I mean, they're not usable. There's, I think, in the situation in Nassau there was saltwater intrusion.

MR. TRENT:
In some areas in Nassau it's foreseen as a management problem, where --

CHAIRMAN BISHOP:
And the essence of her presentation was, look, here was Brooklyn, here was Queens, then Nassau, are you next? And then one the pieces of evidence was stream -- stream levels. And I can see streams levels in my area are down.

MR. TRENT:
Part of the --

CHAIRMAN BISHOP:
And not just from the drought, I mean, they've been down five or six years.

MR. MINEI:
We do check -- part of the investigations is to check the Carmans River out in Brookhaven and Yaphank with Carlls and all the other streams; Amityville Creek, Strongs, etcetera with that, and it fluctuates dramatically with water conditions as well. The idea too is the water

supply is extracted so deep in the system that we will not exceed the permissive sustained yield. The amount of volume you have in the reservoir plus all the recharges taking place will not exceed the ability to provide water. That's been really the findings since the '50s with regard to water supply. The concern still remains the creeks.

CHAIRMAN BISHOP:
How is it that if you go down lower that it's immune to any consideration of withdrawing more than is being deposited? You're pointing to depth. Maybe it's --

MR. MINEI:
The value of the depth is really two fold; one, you are drawing from the deeper part of the resolver in terms of sheer volume. Also, the quality is better much -- much lower in the system, especially in areas like Babylon that for decades had significant development without sewer, things like that. I was curious also, the 1970 report they talked about the magothy. That's our -- that's our most plentiful water supply portion of the aquifer system that we serve most of Suffolk County did

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not show any signs of industrial or domestic impacts back in 1970. So that story has changed. Again, tomorrow should be a much more interesting discussion with you. And I think we can clarify even that point about pumping in the Babylon area with regard to the sheer ability to provide wholesome water long into the future. It's really more of a quality issue. Quantity, we will not exceed the ability to provide the volume of drinking water necessary in the Babylon area without the well itself being impacted.

CHAIRMAN BISHOP:
So the quality issue, as long as the population stays in this one point -- 1 1/5 million range, in your opinion, there is no -- the system is self sustaining. That's the bottom line from the Health Department.

MR. MINEI:
Yes.

CHAIRMAN BISHOP:
Okay. I'm fascinated when learned experts disagree.

MR. MINEI:
Again, the discussions tomorrow should be --

CHAIRMAN BISHOP:
No. I know you're -- we did earlier hearings on --

MR. MINEI:
We're focusing on --

CHAIRMAN BISHOP:
-- that report, and it was fascinating, I'm sure tomorrow will be evenly so. On the issue that -- on the streams and on the quality of surface water and the impacts of sewering, what can be done for Deer Lake, Strongs Creek, any of these areas? Can we ever get those streams back to where they were?

MR. MINEI:
There was discussion, and if you ever travel around Belmont Lake, you'll see wells that replenish Belmont Lake. There are discussions about extracting water from different levels, diverting more stormwater to surface streams. Some of those carry a whole another sweep of environmental concerns with them. The idea of reclaiming them to the same level, from an engineering standpoint you could. The cost of pumping and maintaining them during dry weather patterns would certainly be a huge economic issue to address. Also, this idea that again, if you look back -- I'm sure the GS rep -- the United States Geological Survey rep will tomorrow -- will show you that in the drought of the '60s, Sampawams Creek dried up well past Guggenheim Lake. So anyone who's traveled along -- Deer Lake is on Sampawams. It's a small water body, but when you talk about Guggenheim Lake drying up and things like that, and water bodies that sizeable. So these -- these impacts predated sewering. And we haven't discussed the water quality benefits provided by that sewering. We can discuss those more tomorrow. But, yes, physically and from an engineering standpoint you could replenish the streams year round during any condition you wanted. If you wanted to take extreme measures of pumping groundwater into them at different

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areas. Do you want to maintain the headwaters od the stream? Do you want to maintain the lakes? Do you want to maintain salinity in the western part of the Great South Bay at all times during the summer? Those are huge issues with equally large financial implications.

CHAIRMAN BISHOP:
I know we're diverging from the topic of hearing, but I obviously have a parochial interest in this. Recently, at the headwaters of Carlls River was approved a very large development, senior complex. Did the Health Department comment on that or was comment sought from you?

MR. MINEA:
I'm sure. Any development hooked into the Southwest Sewer District by right they're allowed to connect to the Southwest Sewer District. So there would be no regulatory --

CHAIRMAN BISHOP:
Why do they a right? They're outside the --

MR. MINEI:
They're within the boundaries of the --

CHAIRMAN BISHOP:
It's outside. The headwaters are in -- above Southern State.

MR. MINEI:
I'm sorry. I know it well, I've sampled it oftentimes. I don't recall the actual project. I'm sure if it was outside we would have been asked. Connecting to the Southwest Sewer District is really our preferred option. In fact, we have another major concern with an apartment complex up in North Bay Shore we would really like to see connected to the Southwest Sewer District. Having said that, we're also pleased about the Legislative resolution talking about comprehensive planning for extending the Southwest Sewer District. We think that's truly imperative, and we'll bring the natural resources impacts question I think a little bit clearer and better understood in the planning process. So we are very pleased with that resolution moving forward and the response from DPW. And I think it even mentioned the need to be very cognizant of the surface stream implications of extending sewers further north.

CHAIRMAN BISHOP:
I suppose my question --

MR. MINEI:
All the projects --

CHAIRMAN BISHOP:
The question is do you have the power in the Health Department if you think that a project is going to diminish the stream quantity or quality to stop it?

MR. MINEI:
Not really. We have only one issues -- two issues; proper water supply provided and proper sanitary sewage disposal, and typically, we're the major proponent of hooking to the Southwest Sewer District. We've been told many times by the County Attorney in a SEQRA, in an environmental

review context, we can comment on the implications of the project, but we cannot deny a permit outside of our regulatory authority of public water supply and sewage disposal.

CHAIRMAN BISHOP:
And that's by virtue of County law?

MR. MINEA:
Sanitary Code as delegated by the State Health Department. So I'm talking in particular about Article 6 of the Sanitary Code, which talks

about the need for getting your approval out of our waste water management section. We raised the issue --

CHAIRMAN BISHOP:
It sounds like you're the guardians of the streams, you know, you monitor them, you're concerned about them, but you ultimately don't have the power to protect them.

MR. MINEI:
I think the towns would say rightfully so. To answer your question a little bit more, in the environmental review, we oftentimes bring up those issues. At the final end with the application, if it meets our Sanitary Code requirements for water supply and sewage disposal, it will be approved by the Health Department. But we bring up these issues all the time to the towns.

CHAIRMAN BISHOP:
Has the saltwater -- back to our original problem. Has the saltwater interface moved at all anywhere in the County since we've been --

MR. MINEI:
Not along the South Shore that we're aware of. Shelter Island continues to be an area of investigation and concern, but actual movement has not been significant, and that's pretty much been the position of independent scientists for the last 40-50 years. United State Geological Survey and others have pretty much indicated that at least in Suffolk County.

CHAIRMAN BISHOP:
And then just the Swaps has not yet shown any area where there's a quantity issue other than Shelter Island.

MR. MINEI:
Not in Suffolk County, no. It's a Nassau and Suffolk County Swap Program, its a regional program, but not in Suffolk County.

CHAIRMAN BISHOP:
Okay. Thank you very much. You'll stick around for a while, please.

CHAIRMAN BISHOP:
After Mr. Bokuniewicz's presentation, if any members of the public want to comment on anything that they've heard or the Water Authority wishes to comment, we'll do so at that time.

CHAIRMAN BISHOP:
Henry Bokuniewicz is a professor and he is the Director of the Long Island Groundwater Research Institute of Stony Brook University.

I appreciate you taking the time to be here this afternoon.

MR. BOKUNIEWICZ:
Well, what can I say. One of the advantages of speaking last is that all the important issues have been put on the table. So I don't have any slides, I don't have any overheads. This is not Hydrology 101. I do want to say a few words about the Groundwater Institute at the University, which is the easy part. And then while I don't any answers for you, I think I do have a massage on some of the testimony that we've heard today and perhaps a suggestion.

First, about the University and the Groundwater Institute. It was established in 1994 in an effort to marshal the resources of the University towards studies of groundwater resources on Long Island in particular. And I wasn't paying attention one day so I was made Director and have -- still have that job. Now, the University has two great missions; research is one and education is the other. The faculty at Stony Brook University have engaged in research in groundwater for over 30 years, almost the entire history of the University. Some of the pioneering work on fingerprinting pollutants was done in the Chemistry Department there. And today even so work is being done to use naturally occurring isotopes to pinpoint pollution sources. We have some of the most sensitive laboratories in the world for detecting metals in groundwater. There's pioneering work being done now in the region of pharmaceuticals and personal care products, we're in the forefront of some of that research. And we're involved with many of the ecological concerns in terms of the interactions of groundwater and surface water, bringing the international community into Long Island and its environments.

Now, all of that would be done even without the Groundwater Institute, but the institute is meant to have a special role. The problem with research is that very often by its very nature, it's uncertain, it goes by trial and error, it goes down a lot of blind alleys and dead ends, and many people see it as fairly esoteric. Some of it is fairly esoteric. But some of it is not, and some of it's really vital to our understanding and practical applications. Unfortunately, it often takes years or decades for research results to filter down into practical applications. And one of the missions given to the Groundwater Institute was to try to short circuit that process a little bit, open up a dialog between the regulators, managers, water suppliers and concerned citizen of the general public, open up a dialog so the that scientists understood what those problems they were facing were, and that they had some outlet to present research results to this group. So that's one the jobs that we try to do.

The second mission of the University is that of education. Everyone associated with the institute within the University has a full-time teaching load and teaches graduate students. The special mission of the Institute, however, is to try to ensure that the next generation of educators and technical specialists and professionals will have a

commitment to Long Island and to its special problems. And if you can get that interest, lay that ground work early on, I think you can ensure high quality, high level of professionalism for dealing with Long Island's problems in the future. So that's what the Institute is meant to do.

Now, let me go on to talk a little bit about some of the testimony I've heard today and make some comments in general gain about it. I don't have to tell you this is a new world. This is not Brooklyn at the turn of the century, this is not pre -- post-war Nassau County. We have new contaminants we're going to deal with, and that you'll hear about tomorrow, things like MTBE, a decade ago no one was concerned about it, few people even heard about it. But here we are with a monstrous MTBE problem. We have a new -- we have a legacy of old contamination that's is that taking new forms, looking at pesticides that have long been banned, but things that appear as degradation products of these in surface waters. And on the horizon, we have really a changing viewpoint of contamination in general, no longer -- perhaps not no longer, but in addition to worrying about industrial contamination, agricultural contamination, contamination by individuals, just the sure crush of the population is becoming something that needs some attention. It's not necessarily a problem, but in a growing way, things like pharmaceuticals, uses of antibacterial soaps, the discharge of waste drugs, even something as simple as asprin is kind of changing the roles in which we're viewing contamination in the environment, with much more emphasis on individuals and individual stewardship. So it's a different sort of world that we're dealing with. The -- one of the most widely detected contaminations in surface waters today is caffeine. Now is this a problem? Well, a lot of us consume a lot of caffeine every morning. We don't really know, but these thing are appearing. And individual action is certainly going to be changing the quality of our environment.

We have learned a lot from the research. We have learned from the experiences in Brooklyn, experiences in Nassau, experiences in Georgia and New Jersey and experiences in Europe. I think the problems that we discussed today in terms of quantity and overpumping in the water budget are really not surprises. They are things that have been known for a long time, basic facts that have been known for a long time. And people are well aware of these dangers. Development and any use of water resources doesn't come without a price. And the trick is to realize what the price is and decide whether or not you're going to be able to pay it. Some one pointed out these are difficult choices. They're difficult because it's a very complicated system. And I think that's part of my message as I go a little further on here. We're not going to escape with some platitudes and vague generalizations of how the water supply system, the water resource system works. It really demands some hard study and very detailed information. They're difficult choices, but they are choices. There are many choices that yet can be made, and we're not up

against the wall here. And it becomes a matter of not so much choosing the technology, which is often much more up to the challenge of providing choices then you would like to think sometimes, not just technological limitations, but social and economic limitations as we are all aware.

What do we need? What do we need to worry about? Someone mentioned that it was dangerous to play the numbers game. But I think we better damn well play the numbers game; trying to make decisions without quantitative information, not whether the change is good or bad, but how big it is, how many people are effected, how many acres are going to be changed. Anything we do is going to make changes, and we have to be built into our choices the magnitudes of those changes, not just the direction in which they are going. It would be nice to solve all the environmental problems by shipping everone to Utah, but that's not going to be an option. So we

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don't want just qualitative indications, but quantitative indications. There's really a danger to be avoided in oversimplification. I think it's nice when you're dealing with these complicated things to get a general picture, kind of a cocktail talk, a view of how the world works, but when it gets down to really planning in long term, you need the sort of attention that the people in this room have given these problems and you need the sort of full-time attention to the complications that arise in this -- in this sort of environmental system, especially in groundwater.

And some of -- it was mentioned this morning also that you need to worry about the -- the specificity of sites. Most of the water that we use -- all of the water that we use really does come from pretty much under our feet. I think we don't transport water more than maybe a dozen miles, so that happens at particular sites is controlled by the conditions at that site, even though all these systems are linked. And we talk about the intergraded sole source aquifer, the sight specificity cannot be ignored in dealing with these problems. We have to treat different places differently probably in order to come to some resolution of development.

Now, we've talked about this morning safe yield and the water budget and caps. I think at a different level there's a little bit of a danger with those terms, and I have a little bit of a problem with them even, in that they give the impression that there's a fixed solutions, that there's a number that you nail to the wall, a cap that you put on, and once you do that, you can go on and worry about other problems. That's not really true, and I believe everyone realizes that. In fact, you kind of hit on the point just with the previous speaker when you asked whether the recommendations of the 1987 study were put into effect, were they effective. Those are the kinds of questions that need to be asked and probably were a little bit delinquent in asking them. The modern world management theory is tending towards what's called adaptive management. I'm sure many of you are familiar with that. These -- in adaptive

management you treat these environmental problems not so much as problems to solve, but problems to be negotiated, problems to be wrestled with, constantly to be reevaluated and constantly to be accessed. Once you decide on a course of action, revisit it, take stock of whether that was a good recommendation or not, and you try to make the adjustments, you try to adapt not only to the what might be fallacies in the original assumptions but also change in conditions under which the original choices were made.

Unfortunately, some of the choices are not going to be retractable, so you have to proceed carefully, but that's not telling you anything. It's good to have a plan, but you better have plan B and plan C and have a plan for when you're going to switch plans. Not very reassuring, but it's going to have to be the way that water resource management is working. And it does in large part do that, we revisit objectives all the time. But we have to be careful that we keep the door open for this adaptive management. There are three essential elements to it, and there's a danger in every one of them of dropping the ball as we move forward. One of these elements is data assessment. Information is a two edge sword. In one sense we have too much information, there's certainly an explosion of numbers, many of the those were presented today. In the standard reference text there are something like 10,000 compounds we could worry about in terms of pollutants. They are hundreds of thousands

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of test results on Long Island alone, and there's probably millions of calculations around those results. It's very difficult even to look at this sort of information, let alone to make sense out of it and use it as it should be used as planning for the future. There's also -- on the other edge of the sword there's always not enough information. And I need to make a pitch for monitoring at this point, even though we're overwhelmed by numbers sometimes. As I mentioned before, these are very complicated systems, and we're not going to get away with the back of the envelopes sorts of calculations. The only way we're really going to understand how they're behaving and how they're behaving at different sites is to watch them. Suffolk County and the -- Suffolk County Health -- Department of Health Services and the US Geological Service on -- in Suffolk County had been tremendous resources in keeping up this monitoring level, this vigilance that's absolutely indispensable. Unfortunately, it's expensive, it's often very boring, but you can't loss that focus that the monitoring data gives us. I think you may hear later that in Nassau County much of the USGS monitoring has just disappeared and probably that's a serious mistake for our future planning.

CHAIRMAN BISHOP:
Don't we have an extensive monitoring system?

MR. BOKUNIEWICZ:
We do have one. I thing -- the point is it has to be kept going. The

third element, data assessment monitoring, brings me to modeling efforts. Both Nassau and Suffolk County have invested, well, probably over a million dollars in what is probable the most sophisticated mathematical modeling of an aquifer system in the country. It is very powerful, it is used for making some of the decisions as it should be used. Part of the problem with it though is again it continually has to be maintained. You can't -- you can't develop it and then leave it sit on a shelf, it has to be used, it has to be accessible. And I believe that there should be provisions made for keeping that model current, up do date and available when it has to be used in making these decisions. It's not a trivial exercise. It requires technical expertise and a dedication, a commitment, to keeping that sort of capability current and functional. We can't ignore these things if we want to go forward.

So what's the suggestion? Well, we have to be careful that the County continues to keep its house in order. This wealth of data that's there even though it can be crushingly overwhelming really should be developed into a functional data base that can be used whether it's at the Health Department, whether it's at the USGS, whether it's at the University. Wherever it is, it needs -- it cannot be ignored, it needs to be used. We need to keep up this modeling effort. That's the way that we're going to quantify these choices that are going to have to be faced. It's the only way to make predictions, and it's really a very good tool, even though it can be cumbersome to use. And as was mentioned by Vito Minea, the SWAP Program is in place, but the SWAP Program is just an assessment program. You touched on it too Mr. Bishop, at the same -- almost the same breath that the SWAP Program has to be carried to the next step and turn it into a management plan. We cannot operate in today's world with a 1987 management plan. It just -- it's not going to get us into the future. These problems are difficult ones because they need to be considered in the comprehensive manner. To the extent we can do this which are primary all technical aspects of the groundwater problem, I

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believe that we can go a along way toward solving some of the problems, but it won't take away all the difficulty choices. We deal at the University in the technical issues, dealing in numbers, but as everyone realizes, they are social issues and economic issues that have to somehow be factored into that. The best we can hope from the technical advice is to put aside some of the emotional arguments and put aside some of the arm waiving and to really focus on where the important differences are. Thank you.

CHAIRMAN BISHOP:
Thank you. All right. So we've invested this million dollars and we've been monitoring, what do you see? When you look at the data that's coming, what do you see in terms of -- we don't have you tomorrow, right? So I've got to get quantity and quality.

MR. BOKUNIEWICZ:
Well, quantity, as was pointed out, there is an immense reservoir of water. And in terms of the recharge, we're not using probably 10% of the recharge, so we're not mining our groundwater. And everyone is carefully watching that. In -- individually though, every man, woman, and child demands about 150 gallons of water everyday. You know, three of those big 55 gallon drums. Now, you and I don't drink that much water, but most of it is -- part of it is our share of agricultural industry, part of it is flushing the toilet, watering the lawn, and things of that. We're taking this very quality water and putting it to these other uses. So there's a lot of water there, we're using a lot of water, conservation is only a reasonable and appropriate step to take. I think the difficult issues and what's pointed out in the modeling results very succinctly is that pollutions problem, contamination problems are often very localized, and you can have effects at one well that will cause you to have to do treatment or close down a well that don't appear in another. And that's part of this problem of this very specific, sight-specific nature of this system. In some ways that's a blessing, because if you can identify these areas, these plumes, you have a chance of cleaning them up. In some ways it's a disadvantage because it means that you have to go in in great detail in order to properly assess the quality of the water.

CHAIRMAN BISHOP:
Let me just break it up into quantity and quality, and I'll just ask my quantity question. If we're not mining water, why do we need to conserve water?

MR. BOKUNIEWICZ:
Well, the water that we supply is very strictly regulated and very well tested. It's a high quality product. In some cases -- in almost all cases, it's better than the quality of bottled water. But it's expensive to do. And if most of our use of that high quality water is spraying it on the lawn or flushing it down the toilet, I think reasonable people would say perhaps those are uses that we should moderate a little bit rather than to treat it as a completely expendable resource.

CHAIRMAN BISHOP:
But we generate more than we're using, am I understanding?

MR. BOKUNIEWICZ:
In terms of quantity.

CHAIRMAN BISHOP:
Why can't I water my lawn without guilt. I mean, if it's going to --

MR. BOKUNIEWICZ:
Well, many people do.

CHAIRMAN BISHOP:
I feel the guilt.

MR. BOKUNIEWICZ:
Because you can't really separate the issue of quality from quantity. There is an immense reservoir down there, rainfall is supplying it at a rate faster than we are using it, but we are using it in a way that adds contamination to the the surface waters. One arena in which this is going to be critical in my opinion is the consideration of private wells. Private wells are not tested usually. They are usually shallow, they're usually drawing water that's fairly young. And the recycling of water in through a contaminated surface and back down into the groundwater may balance the budget in terms of quantity, but not quality. The sewering in Nassau County was done to preserve water quality not necessarily quantity.

CHAIRMAN BISHOP:
It's correct to say that you agree with the Health Department assessment.

MR. BOKUNIEWICZ:
That's correct.

CHAIRMAN BISHOP:
Now on quality. Gasoline spills, we have thousands on Long Island. Are we seeing evidence of that in our water supply?

MR. BOKUNIEWICZ:
I don't believe that that's a threat to public water supplies. There are some wells that have to be treated. They're fairly few, and I can't give you numbers, but the Suffolk County Water Authority can. But most of the water supply that is test is not seeing the effects of surface contaminations.

CHAIRMAN BISHOP:
So why should we expend money to clean up surface contaminations?

MR. BOKUNIEWICZ:
Well, just because you're not seeing it in the public water supply doesn't mean that that gives us the right to insult the environment by adding these pollutants. And in the long term, there has to be problems arising from these sorts of issues, even if it is only the leakage of those contaminants into the surface waters and not into the potable water supply.

CHAIRMAN BISHOP:
Derivative of products from chemicals that we do test for, and I learned at the prior hearing that chemicals break down, they meet other chemicals that are breaking down and form new chemicals that we don't test for, how concerned should policy makers be about that?

MR. BOKUNIEWICZ:
Well, I guess the real question is how concerned can you be about that?

CHAIRMAN BISHOP:
Isn't Europe more concerned than we are about the standards for a lot of these things that we don't have here?

MR. BOKUNIEWICZ:
European standards are different then we have here. European conditions though are also different. Often there's a great deal of recharge sewage -- sewered water, there are higher density of populations that have been in place for longer periods of time. Now, that doesn't mean that we shouldn't be concerned. But the -- the setting of standards itself is a conundrum because many of these derivative products have not been investigated, and there have not specific standards for what levels might become dangerous in terms of human health. And as a result, we view them with an generic standard merely because the information that is usually generated by the EPA is not available. It may be that we have something to learn from the European community in terms of their assessment of these chemicals. There first has to be a careful examination of our vulnerability; which ones do we have reasonable -- reason to believe are of concern on Long Island and what information do we know about them. And we would hope that someone somewhere has studied those derivatives, because if it has to go through a standard setting process, it could be a very long time before we have those answers.

CHAIRMAN BISHOP:
What -- what concerns you most about the quality of our groundwater supply? Where do you see the danger? You don't see a problem with quantity, so do we have a problem with quality on the horizon or?

MR. BOKUNIEWICZ:
We have a problem -- I think there is a problem with quality --

CHAIRMAN BISHOP:
In your preamble you spoke about choices. So obviously there must be an issue out there that causes us to have to make choices.

MR. BOKUNIEWICZ:
Well, I think one of the issues that I've been thinking about lately is whether we have the need or can afford the luxury of having private wells. And I know that that's not merely a technical issue, but that's one in which water quality may force us to make some of these choices early on. Many of the contaminant levels that are in the surface waters make the private wells more susceptible to contamination than public wells which are usually deeper monitored, treated if necessary. I know that bring up issues of development and how do you bring in water from other areas and what's the proper justice in transporting water, but I

suspect that the water quality issues are first an foremost going to be -- drive us into making those kinds of choices.

The other important choice that's going to have to be made is one of sewering and establishing sewer districts. Much of the use of water in Suffolk County now preserves as best as we can the water budget keeping -- recycling water, not using consumptive uses. And the problems in decline of the water table in Nassau have been because the waste water

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has been expelled from the system into the ocean. So their water tables have dropped, preserving water quality at an expense of surface waters.

CHAIRMAN BISHOP:
Right. So overall, would you grade the sewering of Suffolk County to date as successful or simply a trade off and a choice, or unsuccessful?

MR. BOKUNIEWICZ:
Well, I think the sewering has been successful in the sense that it has -- it has helped to maintain the quality of the water. You have seen the effects though, I think; stream levels have declined, some lakes have disappeared. The decision had to be made at some point whether the installation of sewers was worth those effects. And the best way to make that choice is to have the best information you can going into it as to what those effects would be.

CHAIRMAN BISHOP:
MTBE, how serious a problem is that in the near term, next ten years?

MR. BOKUNIEWICZ:
I think it is not a serious problem in terms of the public water supply. It is a serious problem in terms of how ubiquitous their contamination by MTBE is and how really little we have -- we know about the ecological effects of that contamination. So it's a prudent course of action to try to clean up plumes of MTBE as we can and as we can find high concentrations and to be vigilant as to where this contamination is ending up in our surface waters and what effects it might be having.

CHAIRMAN BISHOP:
The final question is can Long Island sustain the level of growth that it currently enjoys in items of its water supply. I think the answer is yes, but.

MR. BOKUNIEWICZ:
That's a real tough one. We can't sustain a level of growth for a long period of time based on quantity issues. We can sustain a level of growth
if we start to consider methods of distributing water that really we haven't used ver much in the past; pumping water from one area to

another. But it probably is going to require much more careful intergration of aquifer systems on a whole across the Island.

CHAIRMAN BISHOP:
Thank you very much. Now, I have one card. If anybody else -- we really don't have to do cards. We can -- we're an intimate enough crowd that we don't need the cards. Mark Serotoff, and if anybody else would like to follow him, just indicate.

MR. SEROTOFF:
Good afternoon. My name is Mark Serotoff, I'm the Chairman of Health and Environment of the Sustainable Energy Alliance of Long Island. There is a very recent issue and cause of concern of the numerous power plants being proposed for Long Island, and their prodigious water consumption. For example, Brookhaven Energy has just been approved by the State Siting Board to be permitted, and its consumption of potable water is about two and a half million gallons a day. Kings Park Energy has roughly a

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million gallons a day potable water consumption, and Spagnoli Road is about is million and a half gallons of water a day. One question is were these power plants and their consumptions of potable water supply being taken into account by the modeling that the various agencies used to determine that they feel there is enough water now and in the future for future growth?

And the other problem is with the consumption, with the high water consumption of these power plants, what effects will that have on saltwater intrusion in various areas, on displacement of pollution plumes? For example, King Park Energy is adjacent to the Northport landfill, the Huntington landfill. And one the largest subterranean pollutions plumes if not on the Island in the region extends from the Northport landfill northeast to Sunken Meadow Creek. Will pumping of Suffolk County water supply wells in that area of a million gallons a day displace this plume? Will it cause the plume to move to wells that are not contaminated? Will this pollution, as I said, spread to other areas? So the --

CHAIRMAN BISHOP:
You raised those questions I can tell in sort of a rhetorical way. Do we have answers? Have you received answers to those?

MR. SEROTOFF:
No, I'm not rhetorical. I'm -- I don't

CHAIRMAN BISHOP:
I know you're opposed to the plant.

MR. SEROTOFF:

I don't know. It's cause of concern. It's possible.

CHAIRMAN BISHOP:
There hasn't been official answers to those questions.

MR. SEROTOFF:
No. I don't know, and I think studies have to be made. But these are issues of concern. And another thing would be what would be the speed if there were displacement of pollution plumes or saltwater intrusion? Would -- what would be the speed of these displacement or intrusion. The Sustainable Energy Alliance has several recommendations regarding these power plants and how they would effect -- in this case, how they would effect the water supply. Number one, monitor the water consumption of these proposals, and if there were an issue, participate in the siting process so Suffolk -- local government will have input on issues of concern. If the existing power plants, existing KeySpan plants such as Northport, Glenwood etcetera, were repowered with state of the art equipment, it would be much less pollutions, much less water consumption, much greater electricity generated and much less fuel costs. So repowering is one of the primary recommendations before building new power plants. Another, of course, another recommendation is to cut demand with great efficiencies and conserve. And finally, alternative energy sources such as wind, solar, tidal, geothermal power, should be at utilized at the maximum extent again before building new power plants. Thank you

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CHAIRMAN BISHOP:
Thank you, Mr. Serotoff. Is there anybody who would like to comment on anything they heard earlier? Anybody want a second bite of the apple? If not, then I'll just -- tomorrow in the morning at 10:15 Martin Trent and Vito Minea, also followed by the State DEC. They'll be here in the morning. Julie Penny, then we'll break for lunch, Sarah Meyland and Laurie Farber back again. And then the -- Steve Terracciano from the US Geological Survey will be our final presenter at two o'clock tomorrow. Our Legislators who apparently are still in transit. They must be coming by Rick {Shalvoy's} row boat. Are -- I know Jon Cooper said he'll be here tomorrow, I assume Ginny Fields will be here. So we should have a greater compliment of them. Thank you very much for coming to today's hearing. We are adjourned.

(*THE MEETING WAS ADJOURNED AT 2:30 P.M.*)

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