

## **OVERVIEW OF THE PLAN**

### *Introduction*

Mosquitoes impact human health and public welfare in Suffolk County. To alleviate these impacts, the Suffolk County Charter established a vector control agency, and charged it (in concert with the Department of Health Services) to protect the citizens of the County from disease and other deleterious effects of mosquito infestations.

This Long-Term Plan uses the Integrated Pest Management (IPM) approach to mosquito management to decrease risks to human health and impacts to public welfare from mosquitoes and mosquito management. Simultaneously, implementation of the Long-Term Plan will reduce impacts to the environment and provide potential ecological benefits. The Long-Term Plan stresses public education and associated source reduction as key elements to achieve these goals, with progressive marsh management implementation being necessary to achieve significant reductions in overall pesticide use. The Long-Term Plan also relies on scientific surveillance of mosquito conditions to target mosquito problems that may remain through use of biorational larvicides. If adult mosquito populations of concern still exist, and rigorous decision criteria are met, adult mosquito control with pesticides may be employed.

### *Progressive Water Management*

As part of the Long-Term Plan development process, the County was able to implement a progressive water management demonstration project at Wertheim National Wildlife Refuge, the first of its kind on Long Island. This wetlands restoration project appears to have created a more diverse salt marsh that enhances wildlife and finfish habitat values, using Open Marsh Water Management (OMWM) techniques (which achieve mosquito management by improving habitat for fish to consume mosquito larvae). This is an alternative to maintenance of the legacy grid ditch system for mosquito control, and, as implemented elsewhere in the northeast US, has led to significant reductions in the acreage and instances of pesticide usage. Similar kinds of water management projects in other jurisdictions have also been found to provide significant improvements to the ecological functions of treated marshes, especially improving habitat for marsh birds and nekton.

Salt marshes are not the sole source of mosquitoes in Suffolk County, but the species that do develop there cause public health and welfare impacts. The Long-Term Plan proposes serious consideration of the implementation of a selection from 15 progressive water management Best Management Practices across 4,000 acres of salt marsh, areas the County identified as probably needing restoration because they are currently larvicided regularly to control mosquito populations. Implementation of progressive water management at all of these sites might be expected to result in the elimination of up to 75 percent of current larvicide use (as measured by acres of marsh treated in a year, in comparison to a baseline of 30,000 acres).

These assumptions are supported by decades of experience at other northeast US salt marshes. So far they have been validated by monitoring at the Wertheim site. Progressive water management is expected to serve as the basis for a vector control program that relies on natural processes where control is necessary to address mosquito problems, and therefore one that will be able to substantially reduce pesticide applications.

However, concerns raised by a broad spectrum of involved parties have persuaded the County to slow implementation of its Wetlands Management Plan. The County will create a Wetlands Stewardship Committee to create a broad definition of salt marsh health. The Committee will have a membership drawn from governmental agencies at all levels, but will also include local representatives and non-governmental, environmental advocacy organizations. This definition of marsh health will be used to develop a comprehensive marsh management plan that includes factors other than mosquito management. The Integrated Marsh Management program that will be developed from the plan will include mosquito control projects, but in the overall context of comprehensive coastal marsh planning and marsh health.

The Wetlands Stewardship Committee will have broad review responsibility for proposals using those water management projects with activities that may cause the greatest alterations to existing marsh conditions, and for other projects of interest or concern to the Committee membership. In addition, for all but the most basic projects, the County will require that water management projects undergo additional State Environmental Quality Review Act (SEQRA) review, as recommended by the Wetlands Stewardship Committee, and as developed by the Council on Environmental Quality.

Nonetheless, this tidal wetlands management approach represents a dramatic change in County direction, from a decades-long commitment to ditch maintenance to a general presumption in favor of marsh reversion as an interim policy. Some 4,000 acres of County salt marsh are slated for non-intervention for vector control purposes, although it is possible that wetlands in this category may require active management to restore necessary ecological functions, as developed by the Integrated Marsh management program. An additional 4,000 acres have been identified as high priority sites for progressive water management to address mosquito control needs. The remaining 9,000 acres of County salt marsh will be assessed over the next 10 years, with appropriate management actions developed cooperatively by all interested parties in light of the assessments, and in the service of the broad County Integrated marsh management program for its salt marsh resource. While this program is developed, it is expected that ditch maintenance (when essential for public health or ecological reasons) will affect less than 50 acres of tidal wetlands per year. The pre-existing policy of "no new ditching" (except when necessary for restoration) will, of course, continue to be in effect, and any essential ditch maintenance will be conducted in accordance with criteria described in the Long-Term Plan.

Implementation of the Wetlands Management Plan, as modified by the development of the Integrated Marsh management program, not only can reduce pesticide usage and provide a sound basis for salt marsh mosquito management, but will serve as a basis for managing the marshes themselves in a healthier, more sustainable manner. Salt marshes have been identified as key features in the County's shoreline ecosystems, and clearly play a role in regulating water quality and sustaining estuarine food chains. Improving their overall health is a clear necessity for any overall restoration plan for the County's coastal environment.

#### *Scientifically-based Decision Making*

All marsh and mosquito management decisions will be based on scientifically-grounded data generation. The County currently has one of the most comprehensive surveillance programs for mosquito monitoring. This network this will be expanded, which will allow the County:

- to determine exactly where and how to reduce larval populations of mosquitoes to prevent mosquito problems from occurring;
- to look for the presence of and then further track the progress of mosquito-borne pathogens that can threaten human health;

- to prevent untoward impacts to public welfare from aggressive human-biting mosquito populations that also threaten to transmit disease; and,
- to carefully and specifically target those mosquitoes that require treatment as adults to prevent impacts to human health, in accord with State and federal guidelines.

Surveillance activities have been the basis for mosquito management decision-making. The Long-Term Plan, by augmenting existing networks, and establishing new means of testing mosquito populations and the effectiveness of its operations, will improve the County's ability to make crucial decisions based on best available information.

In addition, in a new approach to public outreach, the County will use these data to clearly and concisely explain to the public why it made particular treatments (*i.e.*, to document pre – treatment mosquito levels in relation to criteria which trigger treatment) and to demonstrate the efficacy of the control efforts. This will help the general public understand why particular actions were taken when they were, how effective they were, and to potentially appreciate the benefits received from progressive vector control.

#### *Plan Approach*

The Long-Term Plan follows the tenets of IPM. It is composed of 11 parts.

The first sets out the goals and objectives of the Long-Term Plan, identifies the mosquitoes found in the County, which ones represent potential problems for people, and gives the basis for actions by Suffolk County Vector Control to address any mosquito problems that may arise. It demonstrates the County's commitment through its vector control activities to decrease impacts to human health and public welfare, and to decrease environmental impacts while also restoring significant portions of the County's environment.

The second part of the Long-Term Plan focuses on public education and outreach, which, when successful, can eliminate the need for organized control activities. Public education focuses on two main objectives:

- ensure that residents take personal responsibility, as much as is possible, for deterring mosquito bites by avoiding mosquitoes, and using effective repellents as directed by the label when encountering mosquitoes;

- promote proper housekeeping, especially regarding standing water in the vicinity of homes and businesses, to deny pestilential mosquitoes the breeding habitats they need.

The third part of the Long-Term Plan addresses surveillance activities, which generate the data that allow for scientifically-grounded treatment actions. Surveillance defines where the mosquitoes are, and what diseases they may be infected with. The risk that they will impact the health and welfare of the citizens of the County can then be determined. The County is expanding its surveillance activities, and adapting them to face new issues, such as other emerging diseases and changes in the ways existing disease can be tracked.

The fourth part of the Long-Term Plan is source reduction, which is the most efficient means of addressing mosquito problems. Important programmatic elements include site inspections by Vector Control personnel, discarded tire management, and maintenance and upkeep of storm water systems. For example, proper efforts in these aspects of source reduction lead to decreased breeding opportunities for some species that are essential for West Nile virus propagation.

Source reduction also includes water management, and the stand-alone Wetlands Management Plan has been appended to and made part of the Long-Term Plan. Water management is meant to be the centerpiece of the County's mosquito management efforts. Through water management, areas that are the source of the most aggressive, and, by some accounts, most dangerous mosquitoes in the County, can be largely reduced. Progressive water management holds the promise of not only effectively controlling mosquitoes, but serving as a means of enhancing natural marsh health. Implementation of the Wetlands Management Plan, in accord with an overarching Integrated Marsh Management program developed through the Wetlands Stewardship Committee, should improve biodiversity and concomitant marsh values, while also achieving vector control aims, with little need for ongoing maintenance.

Biocontrols are also discussed in the Long-Term Plan. Inherent in progressive marsh management is the use of fish to control larval populations (thus reducing adult populations). The undeniable success of this biological control has raised many hopes that other, natural elements of the local ecosystem can be augmented or supported to provide consistent control of mosquitoes, as well. The evaluation of other mosquito predators showed that it was extremely unlikely that any can be implemented to achieve the degree of control necessary to reduce impacts from mosquitoes to human health and public welfare. Some fish and aquatic

invertebrate species may be effective at larval control if released to carefully selected environments. The County will continue to educate itself regarding potential benefits from organisms that will prey on mosquitoes, and determine under what conditions they can be released to achieve acceptable control. Although some organisms clearly prey on adult mosquitoes under some conditions, it is difficult to increase naturally occurring populations so as to achieve good levels of control.

Pesticides are the most visible component of nearly all mosquito control programs, although mosquito control experts have long advocated an integrated approach to control. Pesticides have an important role in controlling populations of mosquitoes and the disease threat they represent, especially in a jurisdiction such as Suffolk County. Suffolk County has so many larval habitats that eliminating them all is a practical impossibility. Because many larval habitats are found in protected wetlands with important environmental values, eliminating many of these habitats is generally not desirable. Therefore, pesticides will be needed to provide acceptable levels of control. Part 6 of the Long-Term Plan addresses larval control, which, because the organisms are concentrated in aquatic environments, is more efficient than control of adult mosquitoes. Part 7 of the Long-Term Plan discusses the procedures for identifying when adult mosquito control might be considered, and, if extensive criteria for applying pesticides are met, exactly how those applications might be made (see Overview Table 1, below). The decision making process described here is consistent with and is based on guidelines published by State and Federal health agencies.

Overview Table 1. Adulticide Decision Parameters

Type of Parameter		Factor for Vector Control Applications?	Factor for Applications under Health Emergency?	Criteria	Comment
Basic Surveillance Parameters	Number of mosquitoes	Yes	No	Counts in light traps significantly above criteria; landing rates; complaints	Based on female, human-biting species; 25+ per NJ trap, 100+ per CDC trap; landing rate 1+/min.; complaints invaluable where traps are not set; intend to set CDC traps before all non-Fire Island applications
	Species present	Yes	Yes	Light trap content analysis	Information on basic mosquito biology essential: Vector Control targets aggressive biters; Health Emergency targets specific (bridge) vectors; ; intend to set CDC traps before all non-Fire Island applications
	Complaints	Yes	Yes	Number/location of calls	Evaluate in historic context; complaints must be supported with appropriate surveillance data; complaints document extent of problem better than traps can
	Historical population trends	Yes	No	Surveillance data records	Data patterns often signal that problem is about to abate, or is likely to worsen
Species Specific Parameters	Aggressiveness of target species	Yes	Yes	Documented biting patterns of trapped mosquitoes	Aggressive biters indicate greater problem, increased likelihood for bridge vector participation
	Activity patterns of target species	Yes	Yes	Documented host seeking patterns, flight ranges of trapped mosquitoes	Guides actual control decision; e.g., evening vs. later at night; day-time flying may inhibit control; spot treatments only effective for short flight range species; large flight ranges require applications to cover larger, continuous areas to be effective
	Vector Potential	No	Yes	Infection rate, vector competence, % mammalian meals of trapped species	Establishes relative risk for species present
	CDC Vector Index	No	Maybe	MIR, trap counts for all potential vectors	CDC light trap counts * MIR, summed over all vector species; higher index correlates to more human infections following week; requires high mosquito/human infection rates for use; can use only with multiple trap data sets

Type of Parameter		Factor for Vector Control Applications?	Factor for Applications under Health Emergency?	Criteria	Comment
Species specific parameters, continued	Parity rates	Sometimes	Yes	Age (blood meal history) of biting population	For Health Emergency, high parity rates indicate majority of biters had prior blood meal – direct indication of increased Vector Potential; for Vector Control, an aging population, even if smaller, will be treated since it represents increasing vector potential
	Life Cycle Type	Yes	Yes	Trap analysis	Brooded mosquitoes eventually die off on own, continuous breeders build populations over season
Public Health Parameters	Bird testing	No	Yes	Presence/absence of virus	Provides early warning in terms of bird to bird transmission; documents active disease foci in County
	CDC mosquito pool testing	No	Yes	Presence/absence of virus	Amplification vectors provide early warning, document active disease foci in County; bridge vectors indicate virus present in human-biting species, is signal that human health risk is imminent
	Veterinarian reports	No	Yes	Ill/dead target animals	Non-mammals provide early warning, document active disease foci in County; mammalian cases indicate virus present in bridge vectors, signal that human health risk is imminent
	Physician reports	No	Yes	Human cases	Realized human health threat
	Disease history	No	Yes	Number of human/important animal cases in prior years	Indicates that local conditions are favorable for pathogen amplification and transmission
	Avian dispersal/migration patterns	No	Yes	Time of year regarding dispersal of hatch year birds and known migration periods	Identifies new areas for concern, signals need to control known bridge vectors
Climatic Parameters	Current weather	Yes	Yes	Temp = 65+ Wind < 10 mph No rain	Application time decision
	Short-term weather forecast	Yes	Yes	Presence of fronts & storms; barometric patterns	Application planning
	Time of year	Yes	Yes	Spring, Summer, & Fall activity patterns for trapped mosquitoes	Species-specific behavior; generally, cooler weather retards activity, warmer weather increases activity; virus presence not as significant when activity decreases



Type of Parameter		Factor for Vector Control Applications?	Factor for Applications under Health Emergency?	Criteria	Comment
Ecological Parameters	Environmental factors in target area	Yes	No	Environmentally sensitive settings (R-T-E species)	Prior mapping is essential to clearly identify all environmentally sensitive areas; usually addressed through NYSDEC; Town and other expert cooperation is sought
	Population	Yes	Maybe	Number of impacted people/population density	For Vector Control: no people means no problem; for Health Emergency, threat may be sufficient
	Application restrictions	Yes	In some settings	Farms; no-spray list; NYSDEC wetlands, wetlands buffers; open water buffers	Vector Control no-spray areas include crop areas, no-spray list, buffers – discontinuities may make application ineffective

Adulticide applications that are made to reduce vector populations and relieve quality of life impacts will be required to conform to the following four criteria:

1. Evidence of mosquitoes biting residents (there is no problem unless people are affected):
  - Service requests from public - mapped to determine extent of problem
  - Requests from community leaders, elected officials
2. Verification of problem by SCVC (service requests must be confirmed by objective evidence):
  - New Jersey trap counts higher than generally found for area in question (at least 25 females of human-biting species per night).
  - CDC portable light trap counts of 100 or more females of human-biting species.
  - Landing rates of one per minute (measured over a five minute period).
  - Confirmatory crew reports from problem area or adjacent breeding areas.
3. Control is technically and environmentally feasible (pesticides should only be used if there will be a benefit):
  - Weather conditions predicted to be suitable (no rain, winds to be less than 10 mph, temperature to be 65°F or above).
  - Road network adequate and appropriate for truck applications.
  - "No- treatment" wetlands, wetlands and open water buffers, and no-spray list members will not prevent adequate coverage to ensure treatment efficacy.
  - There are no issues regarding listed or special concern species in the treatment area.
  - Meeting label restrictions for selected compounds (such as avoiding farmland) will not compromise expected treatment efficacy.

4. Likely persistence or worsening of problem without intervention (pesticides should not be used if the problem will resolve itself):
- Considerations regarding the history of the area, such as the identification of a chronic problem area.
  - Determination if the problem will spread beyond the currently affected area absent intervention, based on the life history and habits of the species involved.
  - Crew reports from adjacent breeding areas suggest adults will soon move into populated areas.
  - Life history factors of mosquitoes present – i.e., if a brooded species is involved, determining if the brood is young or is naturally declining.
  - Seasonal and weather factors, in that cool weather generally alleviates immediate problems, but warm weather and/or the onset of peak viral seasons exacerbate concerns.
  - Determining, if the decision is delayed, if later conditions will prevent treatment at that time or not. Conversely, adverse weather conditions might remove most people from harm's way.

In essence, criteria 1 and 2 are necessary thresholds which must be met, prior to a treatment being considered. This means that floor values of 25 mosquitoes per night (New Jersey light traps) or 100 mosquitoes in a CDC light trap **must** be exceeded for vector control to be considered. With enhanced surveillance, there will be rigorous, numeric validation of mosquito control infestation near a potentially affected population in all cases. Treatment will not occur unless criteria 1 and 2 are satisfied through a combination of surveillance indicators, although not all surveillance techniques may be feasible in every setting and situation.

Criteria 3 and 4 are “treatment negation” criteria. If certain conditions are met, treatment will not occur, even if treatment is otherwise be indicated by criteria 1 and 2. Careful

records on criteria and thresholds (and related conditions) which trigger each treatment will be kept, for every adulticiding event.

The remaining four parts of the Long-Term Plan discuss how it will be implemented, including:

- establishing an administrative structure for vector control activities in both the Department of Public Works and in the Department of Health Services,
- describing how the technology necessary for implementation should be evaluated,
- developing a framework by which the Long-Term Plan can be adaptively managed (including continuation of the Steering Committee, Technical Advisory Committee, and the Citizens Advisory Committee), and
- estimating the costs to the County of adopting the Long-Term Plan.

One last section specifically describes actions that should be taken to enable implementation of the Long-Term Plan.

#### *Improved Vector Control*

An evaluation report on surrounding vector control agencies and Suffolk County's current program described the current program as one of the finest in the Northeast. Nonetheless, there was room for improvement, and the Long-Term Plan proposes to improve essentially all aspects of the current program, from public outreach, to data management, to pesticide applications. As has been mentioned, the adoption of more progressive water management techniques, which the County was by-and-large unable to implement earlier due to resource and regulatory issues, may reap the greatest benefits. However, all aspects of the Long-Term Plan will combine to reduce the risks to County residents from disease and mosquito control activities, and also lead to environmental improvements that may be an invaluable legacy to future generations of County residents.

#### *Interagency Cooperation and Public Input*

This Long-Term Plan was the product of an open and extraordinary process that sought, and received, input from local, State, and Federal government agencies and officials, from non-governmental organizations concerned about mosquitoes, pesticides, and

wetlands, and from concerned individual citizens and citizen groups. Suffolk County has invested a great deal of money and time into the Long-Term Plan, but could not have reached these goals without the input, suggestions, and hard work from many others, which it gratefully acknowledges. Overview Table 2 lists major accomplishments of the Long-Term Plan to date, and outlines how some of the technical elements led to components of the plan.

Overview Table 2. Long-Term Plan Accomplishments to date (October 2006)

Plan Element	Accomplishment	Discussion
Public Education & Outreach	Project website Literature Search National conferences Associated committees	All project output: <a href="http://www.suffolkmosquitocontrolplan.org">www.suffolkmosquitocontrolplan.org</a> 1300 pages, with extensive expert review SETAC, AMCA, LI Geologists TAC, CAC, Wetlands Subcommittee
Surveillance	Trap network improvements Enhance larvicide & adulticide efficacy monitoring WNV monitoring re-evaluation EEE conceptual reevaluation	Refinement of a program widely acknowledged to be excellent. The result of literature search and input from national experts.
Source Reduction	Stormwater management expansion from 15,000 to ~50,000 sites	Result of Early Action project
Water Management	Wertheim OMWM  Seatuck and Wertheim retrospective studies Salt marsh mapping Identification of unditched marshes Salt marsh extent Wetlands Subcommittee BMP manual  Wetlands Management Plan Conceptual re-evaluation of marsh systems	Designed, permitted, began construction on 80 acre salt marsh restoration Early Action project: long-term influences on salt marsh health  First GIS map of Suffolk marshes to name them all  Recalculated County salt marshes (17,000 acres) Collaboration between Towns, County, NGOs on wetlands Design manual for Suffolk County OMWMs, including tie-ins between mosquito control, wetlands restoration, and Phragmites control Plan to achieve salt marsh management Recognition of uniqueness of each marsh system
Biocontrols & Other Alternatives	Field tests (garlic & rosemary oils, Mosquito Magnet)	Barrier systems & mosquito trap evaluations
Larvicides	Caged Fish experiment Benthic survey  Paired marsh invertebrate experiment Risk assessment of 3 current products	Field test of larvicide impacts; included fate & transport Statistical comparison of treated and untreated invertebrate populations 5 pairs of marshes compared for invertebrate impacts  Calculation of human health and ecological impacts
Adulticides	Minimize usage, optimize control: Application methodology re-evaluation Caged Fish experiment Adapco Wingman system Risk assessment on current and potential products	Modeling revealed means to reduce off-target drift  Field test of adulticide impacts; included fate & transport Purchased computer model to optimize pesticide applications Calculation of human health and ecological impacts
Project Management	GIS construction  Data management re-evaluation Public outreach emphasis Personnel and capital needs evaluation Remote sensing evaluation	Digitized and mapped SCVC records in relational databases First digitized tidal wetland map Digitized 21 PSAs characteristics Need to communicate program effectiveness better  ABDL BSL-3 recommendation, staff augmentation, marsh restoration equipment identification Can provide cost-effective coastal marsh monitoring

Three major elements of the project have been three major field programs (the Wertheim OMWM, the Caged Fish experiment, and the characterization of 21 Primary Study Areas in fresh and salt wetlands), the literature search, and the quantitative risk assessment. The literature search resulted in the completion of 26 separate reports, concentrating on the topics of Suffolk County mosquitoes, mosquito-borne disease, vector control, pesticides, and salt marshes. The literature search directly led to major operational improvements such as purchase of the Adapco real-time modeling and weather monitoring system for adulticide application guidance. This state-of-the-art system optimizes mosquito control while minimizing pesticide usage. The literature review also demonstrated that progressive water management, as practiced throughout much of the northeast US, can be successful as a mosquito control technique, and also used as a restoration means for salt marshes. The Literature Search proved to be the technical heart of the project.

In addition to the Literature Search, other written reports were produced as products of other specific project tasks. By far the most important of these was the quantitative risk assessment. This document related the quantifiable risks of impacts to human health and the environment from three currently used larvicides and four adulticide products, based on extensive modeling of pesticide applications, the subsequent fate of those products, and the receptors (human and ecological) that could be affected by their use. Associated with this quantitative assessment were evaluations of impacts from mosquito-borne disease, proposed water management actions, and impacts to human health and the environment from other pesticides use.

Ultimately, the risk assessment demonstrated that each year, in the absence of vector control, it is possible that 16 people might die in Suffolk County from WNV, and another 150 or so might become seriously ill. Risks from EEE, while not quantified, included opportunity for the most efficient mosquito vector of this disease to become infected, and so potentially result in human illness where one-third to three-quarters of those people who become infected might die. Conversely, the risk assessment of pesticides found little to no risk for adverse human health impacts because of the relatively low exposure experienced by people to these control agents. Of the control agents evaluated, only the

adulticides posed potential ecological risks. One possible impact is to flying non-target insects, using extremely conservative worst-case assumptions. No actual impacts have been documented in literature, and a California study showed no impacts and suggests that mitigation is feasible. None of the agents evaluated showed any aquatic ecosystem impacts, with the possible exceptions of permethrin and malathion (which are not expected to be front-line agents, as the County anticipates implementing the Long-Term Plan).

The Wertheim OMWM project was addressed as a collaborative effort among USFWS, Ducks Unlimited, and the County and its consultants. Two years of negotiation and discussion with NYSDEC resulted in a permit application that the State, the County, and USFWS were all satisfied with. Approximately half of the reconstruction was accomplished in March 2005; the remainder has been accomplished in the first few months of 2006. Extensive, comprehensive, and long-term monitoring efforts, begun two years before construction and to be continued in accordance with the permit issued by New York State Department of Environmental Conservation, carefully document this project. The County is hopeful that this project's initial success and the results of the ongoing comprehensive monitoring effort will be persuasive, in light of the documented achievements of similar projects elsewhere in the northeast US, to allow implementation of the aggressive water management program outlined in the Wetlands Management Plan and Section 4.3 of the Long-Term Plan.

The Caged Fish experiment was intended to be a field exercise to document effects of pesticides on representative fish and invertebrates. It evolved into a major effort to document the fate of applied pesticides from release to degradation, and to understand impacts to sentinel organisms in the water column. The effort required modeling, air sampling, efficacy tests, fish and shrimp survival and non-lethal impact studies in the field and laboratory, testing of approximately 100 samples of pesticides in water, sediments, and biota, to the parts per quadrillion level in some cases, using highly specialized equipment and research-level techniques, and multivariate statistical tests to determine the import of all the data. The effort was led by researchers from Stony Brook University, Southampton College, USGS, and the County Public and Environmental



Health Laboratory, together with other County employees and the Long-Term Plan consultant team.

In addition, the collaborative nature of the management plan process, with participation by interested parties in local, state, and federal government, and non-governmental organizations with both local and national ties, created a dynamic planning process that allowed for concerns to be raised, suggestions to be made, and expertise to be interjected. The Long-Term Plan is thus more than a critical examination of past County practices. It is the fruit of a complete reconsideration of vector control intentions and capabilities, in light of practical constraints based on available technology and existing infrastructures. The Long-Term Plan offered here is intended to implement a state-of-the-art example of Integrated Pest Management, where the twin goals of reductions in risk to human health and increases in environmental quality can both be achieved.

**Note:**

This Revised Long-Term Plan is an update of the Long-Term Plan dated May 3, 2006. Revisions were made to the Long-Term Plan in light of the many and well-considered comments offered to the County through the SEQRA process, primarily as comments on the Draft Generic Environmental Impact Statement (May 3, 2006) for the Long-Term Plan. In this revision, numerous changes were made to the text of the Long-Term Plan, including correcting misspellings or statements of fact. The more substantial changes of substance and tone included the following:

- Section 1:**     p. 36: identification of changes made in the water management approach
- p. 38: Goal 2, Objective 1 was modified to reflect the need for an Integrated marsh management program
- p. 39: Goal 2, Objective 3 was modified to reflect changes made in the primary wetlands management project review organizations
- Section 2:**     pp. 60, 62: educational program changes
- Section 3:**     pp. 78-79: refinement of landing rate procedures

- Section 4:** pp. 104-118: substantial changes made regarding wetlands management project identification, review, implementation, and evaluation
- Section 7:** Table 18, pp. 190-192: consistency in mosquito counts as triggers for action  
  
Inclusion of Figure 7 (mistakenly not included in the original text)
- Section 10:** pp. 250-255: proposed content of the Triennial Report  
  
p. 256: identification of additional SCVC-ABDL reporting requirements  
  
pp. 257-258: discussion of how the Integrated Marsh Management program may change the Wetlands Management Plan
- Section 11:** p. 259: identification of the need to provide staff support to the Wetlands Stewardship Committee
- Section 12:** the above changes are reflected in this section