IPM Mission Statement:
To insure public health and safety while continuing compliance with federal and state environmental agency mandates acting as entrusted stewards for the City of Hampton's environmental and ecological resources.

Integrated pest management (IPM) programs are essential and effective ways to manage any pest. The City of Hampton Public Works Department utilizes a successful integrated mosquito control strategy that includes several tactics to eliminate mosquitoes and their habitats. Four basic disciplines of a successful integrated mosquito management program (IMM) are:

1. **Cultural Control Practices** -
2. **Mechanical Control Practices -**
3. **Biological Control Practices -**
4. **Chemical Control Practices -**

1. Cultural Control Practices-

An important part of mosquito control around residential areas is making sure that mosquitoes do not have a place to lay their eggs. Mosquitoes need water for two stages of their life cycle, and it is important to monitor standing water sources. Source reduction practices like dumping containers that hold water, or reducing standing water are common cultural controls.

Community involvement is essential for source reduction in urban areas. Public outreach and education are also important tools. Residents, neighbors, and landlords can all be proactive in eliminating even the smallest sources of standing water. The Asian Tiger mosquito, Aedes *albopictus,* has evolved so that they can reproduce in the most minimal aquatic environment. Residents that engage in source reduction provide one of the most effective and cost saving means of controlling The Asian Tiger mosquito.

Larva and egg controls can be effective, inexpensive, methods to control mosquitoes, but these interventions are not likely to be 100% effective, especially for mosquitoes like the *Aedes albopictus* that breed in varied and scattered locations. Eliminating or treating all or even most standing water sources can be nearly impossible. Successful control efforts will need to supplement habitat removal with other means of source reduction.

Some examples of cultural mosquito control practices are as follows:

- **Remove of standing water in rain gutters, old tires, buckets, plastic covers, toys or any other container where mosquitoes can breed (Source Reduction).**
- **Empty and change the water in bird baths, fountains, wading pools, rain barrels and potted plant trays at least once a week to eliminate potential mosquito habitats.**
- **Drain temporary pools of water or fill with dirt.**
- **Keep swimming pool water treated and circulating.**
- **Public outreach and education at community events to inform and educate citizens and businesses about mosquito protection and prevention.**
- **Door to door with informative literature on how homeowners can reduce mosquito populations around the home.**
- **Notifying local media when arboviral disease has been detected in a region or section of a city.**
- **Three L's of clothing when going outside – loose, long and light. Educate on the benefits of DEET and other naturally occurring insect repellents.**
- **Encouraging property owners to utilize aerated ponds for predacious insects and to mount bat boxes and Purple Martin houses to help bolster bio rational mosquito control.**

2. Mechanical Control Practices -

Because *Aedes* and *Culex* mosquitoes frequently bite indoors, using structural barriers is an important way to reduce a nuisance presence. Using both automated and hand held equipment to help the flow of stormwater runoff is another means of diminishing mosquito populations without using chemicals or other treatment options. If the standing water is reduced or eliminated the pressure from temporary floodwater mosquitoes is greatly affected. This is a general list of mechanical techniques to fight mosquito pressure:

- **Install window and door screens if they are not already in place.**
- **Cover all gaps in walls, doors and windows to prevent mosquitoes from entering.**
- **Make sure window and door screens are "bug tight."**
- **Screen in porches or utilize screened tents outside.**
- **Keep doors and windows shut when mosquitoes are at their height of activity.**
- **Utilize tools and equipment to keep stormwater conveyances clear from standing water.**
- **Install drainage in areas holding water longer than a week after rain events.**

3. Biological Control Practices –

Field surveillance for both juvenile and adult mosquitoes is the most important aspect of an effective IMM program. A biologist predicting mosquito populations is not playing a guessing game, they employ solid science founded on precise and consistent surveillance practices designed for a specific region or area. The data collected helps predict not just quantities and species of mosquitoes, but also the potential for disease issues and severe nuisance mosquito outbreaks. Biologists routinely test specific adult mosquitoes in house for potential arboviral diseases.

In Hampton, pest surveillance is done by trapping and counting adult mosquitoes. Devices such as a CDC Light trap, a Gravid trap, or a BG Sentinel trap are the three devices most commonly utilized. All three trap styles are used to catch different mosquito types and sexes, and all trap types can be deployed as needed to trap adult mosquitoes.

Typical juvenile mosquito surveillance is conducted using aquatic dippers. This is basically a cup on the end of a telescoping rod that is extended out over a body of water to dip capture elusive larval and pupal samples quickly and easily. Both adult and juvenile mosquito surveillance techniques are key in deciding what type of cultural, mechanical or chemical control means will be used to help control each specific mosquito issue.

3. Continued**:**

Trapping and larval sampling provides population information that is used to establish threshold's for arboviral disease threat or nuisance presence that would determine the need to engage in a spray event. Thresholds are derived and adjusted from accumulating adult mosquito trapping data. These thresholds per species per trap are as follows:

***Gravid trap**
****CDC Light trap**
*****BG trap**

Aedes albopictus	**30 **40 *** 150*
Aedes atlanticus	**5 **50 ***25*
Aedes aegypti	**1 **1 ***1*
Aedes canadensis	**5 **300 ***300*
Aedes fulvus pallens	**5 **25 ***25*
Aedes grossbecki	**5 **25 ***25*
Aedes infirmatus	**5 **25 ***25*
Aedes japonicas	**5 **25 ***25*
Aedes sollicitans	**50 **1000***1000*
Aedes sticticus	**5 **25 ***25*
Aedes tormentor	**5 **25 ***25*
Aedes taeniorhynchus	**50 **1000***1000*
Aedes triseriatus	**5 **10 ***10*
Aedes vexans	**5 **75 ***75*
Psorophora ciliate	**10 **200 ***200*
Psorophora columbiae	**10 **200 ***200*
Psorophora ferox	**10 **200 ***200*
Psorophora horrida	**10 **200 ***200*
Psorophora howardii	**10 **200 ***200*
Psorophora cyanescens	**10 **200 ***200*
Psorophora mathesoni	**10 **200 ***200*

Anopheles atropos	**5 **50***5*
Anopheles bradleyi	**5 **500***5*
Anopheles crucians	**5 **500***5*
Anopheles punctipennis	**5 **250***5*
Anopheles quadrimaculatus	**5 **20 ***5*
Anopheles walkeri	**5 **50 ***5*
Culex erraticus	**5 **20 ***5*
Culex pipiens	**10 **50 ***5*
Culex restuans	**10 **50 ***5*
Culex salinarius	**10 **500***25*
Culex territans	**10 **50 ***25*
Culiseta inornata	**10 **50 ***5*
Culiseta melanura	**10 **50 ***5*
Orthapodamia signifera	**10 **50 ***5*

4. Chemical Control Practices-

Using an EPA-registered pesticide is one of the fastest and best options to combat an outbreak of mosquito-borne disease being transmitted by adult mosquitoes. The pesticides registered for this use are known as adulticides. Adulticides are applied by truck-mounted ultra-low volume (ULV) sprayers or by an airplane using an aerial spray in emergency situations.

Aerial spraying techniques can treat large areas with only small amounts of pesticide and are effective when utilized correctly. Aerial sprays are fully evaluated by EPA and do not pose unusual risks to people or the environment when applied according to the labeling and when sufficient public notification has occurred.

More commonly, mosquito adulticides are applied as ultra-low volume (ULV) sprays from a truck unit. ULV sprayers dispense extremely small droplets. When released, these tiny droplets are intended to stay airborne as long as possible and drift through an area above the ground killing the mosquitoes in the air on contact. The small droplet size of 30-50 microns makes the pesticide more effective, which means less pesticide is used.

There are a number of registered adulticides on the market. Choosing which adulticide to use in a given area depends on a variety of factors. The type of mosquito, whether the mosquitoes are resistant to particular types of pesticides, weather, etc., are all factors that affect control choices.

Before considering ULV application, conditions in an area must meet certain criteria. Mosquito population threshold's, species presence, nuisance presence and arboviral disease detection are all criteria considered by the Environmental Services manager and the lead biologist. These primary criteria, along with other detail information, such as pesticide application records, field surveillance, juvenile mosquito assessments, 311 Citizen Requesting, weather patterns, pest technician observations and shared data from regional mosquito abatement groups, will determine the need to make a ULV application.

4. Continued**:**

To date, there is no evidence of a significant pesticide resistance issue in the City of Hampton pertaining to mosquito management. Lack of insecticidal resistance can be attributed to limited and well-planned adulticide use and to regular chemical rotations. Management will switch active ingredients every 3-5 years insuring this trend continues.

Since 2010, organophosphates have not been used. Applications have rotated between 4 different pyrethroid- based products:

Anvil 2+2 – (adulticide) – A.I. Sumethrin and Piperonyl Butoxide
1.08 fl. oz. /acre
Aqua Anvil – (adulticide) – A.I. Sumethrin and Piperonyl Butoxide
Dilution ratio of 1:2 = 1.09 fl. oz. /acre
Duet – (adulticide) – A.I. Prallethrin, Sumethrin, and Piperonyl Butoxide
.79 fl. oz. /acre
Aqua Duet– (adulticide) – A.I. Prallethrin, Sumethrin, and Piperonyl Butoxide
Dilution ratio of 1:1 = 1.09 fl. oz. /acre

- **A.I. = active ingredient**

Future adulticides under consideration for use are bacterial based and have low toxicity to birds and bees.

4. Continued:

The greatest impact of any control measure on mosquito populations will occur when the mosquitoes are *concentrated, immobile* and *accessible*. This emphasis focuses on habitat management and controlling the immature stages (egg, larva, and pupa) before the mosquitoes emerge as adults. This approach maximizes the effectiveness of pesticide application and minimizes the use from widespread pesticide application. Larvicides target larvae in the breeding habitat before they can mature into adult mosquitoes and disperse, which also helps reduce the adult mosquito population in nearby areas.

One example of a mosquito that has a high competency for arbovirus transmission is the Northern House mosquito, *ssp*. *Culex pipiens.* These mosquitoes are found in the subterranean stormwater system which the City of Hampton treats aggressively with slow release larvicides during the summer months.

The City of Hampton typically utilizes naturally occurring bacteria to combat most mosquito larvae, but in certain scenarios will use growth regulators and mineral oil films to address tenacious mosquito species and mosquito pupae. Typical larvicides used in Hampton are:

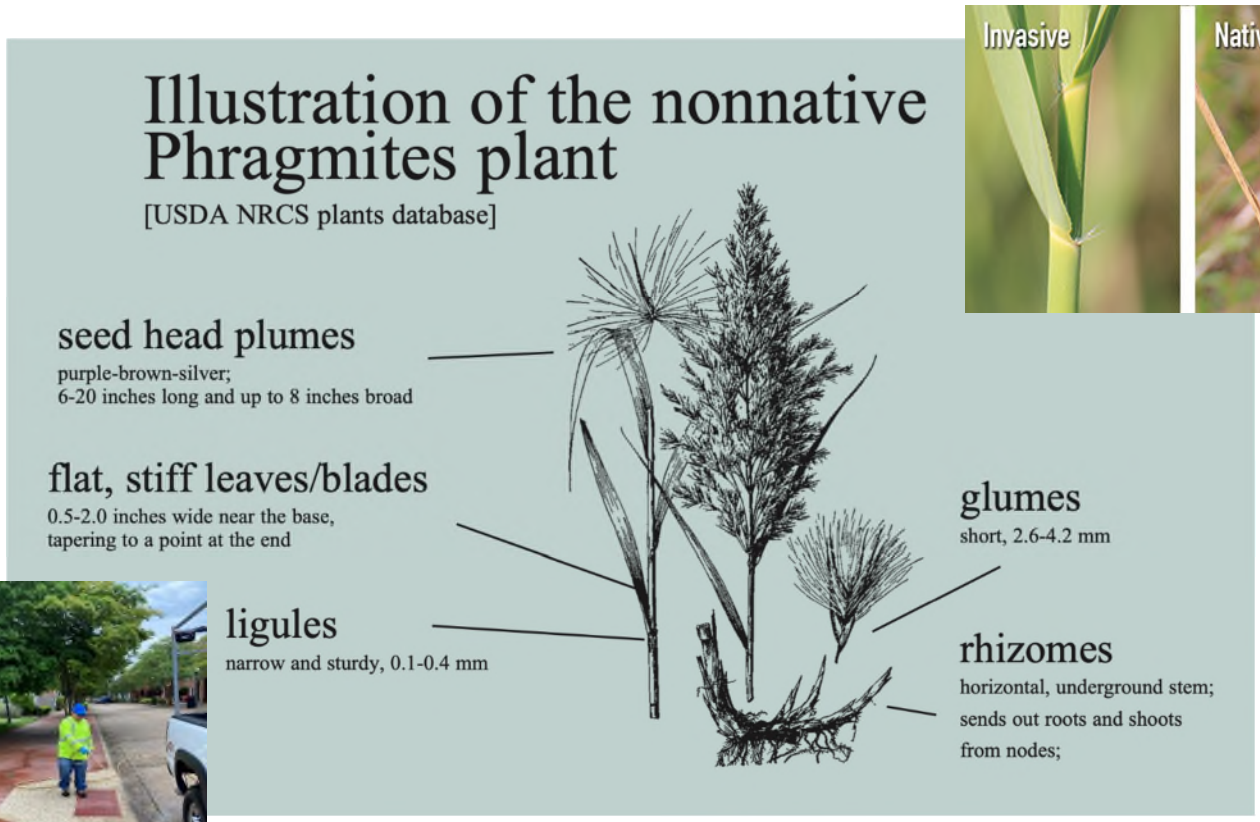
Vectomax WSP's – (bacteria) mix of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*
***50* sq. ft. /bag**
Altosid Pellets- *(*growth regulator) A.I. Methoprene
1 oz. /135 sq. ft.
Cocoa Bear- (film) natural environmentally safe mineral oil
1 oz. /100 sq. ft.

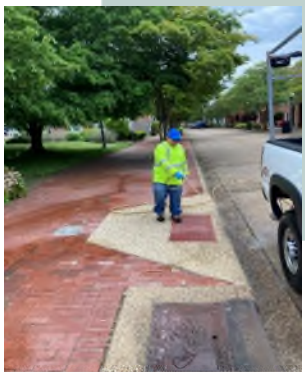
4. Continued:

The Entomology/Environmental Services team is responsible for terrestrial and aquatic herbicide applications. This practice is predominately used to help bolster the Stormwater Operations Division. Typical areas herbicided are concrete headwalls, rip rap bulkheads invasive weeds and stormwater management facilities (SWMF's). Herbicide applications are limited due to erosion and phytotoxicity issues that can arise from overuse and improper applications in stormwater conveyance areas. Vegetation propagation is a main tool in eliminating erosion from wind and rain and is encouraged where possible.

When herbicide applications occur the IPM coordinator chooses and approves the appropriate herbicide for the specific site and issue. Herbicides used in Hampton are as follows:

Diquat- (Contact) Aquatic and terrestrial
.5 gallons / acre
A.I. Glyphosate – (Systemic) Aquatic and Terrestrial
2 fl .oz. / 1000 sq. ft.
A.I. Prodiamine – (Premergent) terrestrial *** crack weeds on concrete only!
.5 fl. oz. / 1000 sq. ft.
A.I. Poly Glycol-(nonionic surfactant) terrestrial and aquatic
.1 fl. oz. / 1000 sq. ft.





5. Training –

Pest Technician's conducting mosquito abatement for the City of Hampton's (COH) Entomology/Environmental Services Division must possess a state license to apply pesticides in Virginia. These licenses must be valid and kept up to date through the Virginia Department of Agriculture and Consumer Services (VDACS).

COH Pest Control Technicians must possess a public health license. Other licenses they may possess are as follows:

Category #60 (Registered Technician) License allows for non- certified personnel to spray directly under the supervision of a Virginia State Certified Pesticide Applicator. *Minimum required.

Category #5A (Aquatic) license allows for pesticide applications in aquatic environments. All pesticides used must be EPA approved to safely use in and around aquatic environments.

Category # 6 (Right of Way) license allows for pesticide applications along roadside and utility easements, typically with soil sterilants and various herbicides.

Category #8 (Public Health) license allows for pesticide applications in public to eliminate disease and nuisance pests. *mandatory for City of Hampton Pest Control Technicians.

All Virginia Certified Pesticide Applicators must attend 8 hours of state approved training bi-annually to keep license up to date. If the 8 hours have not been met in the timeframe, the applicator must retest for that specific category with VDACS.

Other training opportunities are provided through the Entomology/Environmental Services Division for all pest control technicians. Monthly mosquito control training is mandatory through the City for all technicians. Monthly and annual mosquito control associations provide training events specific to public health. Many of these training events focus upon recent and important issues facing the environment and ecology at that time, especially in the Tidewater area. Besides mosquitoes, bed bugs, ticks and pollinator protection are some of the key topics addressed.

6. Recordkeeping –

All certified applicators are mandated through VDACS to keep pesticide application records for 7 years. The City of Hampton keeps all workflow data using the Lucity software program. This program collects and stores all application records for future reference.

Global Harmonized System chemical program mandates all safety data sheets (SDS) are kept for 30 years.

7. IPM Coordinator-

The Entomology /Environmental Services Division manager is the IPM coordinator. This position is responsible for insuring all IPM protocols are followed. Any changes to this program are to be approved by the IPM coordinator.

All final decisions to conduct ULV truck applications are determined by the IPM coordinator. Aerial spray applications are recommended by the IPM coordinator and the final approval is determined by the City Manager and Public Works Director.

All public notifications for aerial or truck mounted spray will be the IPM coordinators responsibility. The City's Marketing Department, City's website, 311 Citizen Call Center, local news channels, newspapers, Channel 47 and the City's Facebook account are all notification tools available for public notification. IPM coordinator insures notification occurs for local butterfly enthusiasts, residents with allergies, and beekeepers that volunteer their contact information before each mosquito spray. Notification occurs by noon of the designated spray night for ULV truck sprays. Notification for aerial spray occurs up to a week in advance but will be no less than 72 hours as a minimum.

IPM coordinator insures proper Personal Protective Equipment (PPE) is provided for pest control technicians. The manager insures all pesticides are purchased and stored correctly. The IPM Coordinator main focus is to insure all IPM practices are conducted in a fashion that places the health and safety of the City's ecological and environmental resources first.

The IPM coordinator secures a bi-annual state Collections permit for juvenile insects, fish and amphibians through the Virginia Department of Game and Inland Fisheries (VDGIF). Collections permit with the state allows for City biologists to routinely check on juvenile terrestrial and aquatic fauna insuring susceptible species are not negatively affected by any IPM program practice. This permit also allows for Eastern Mosquito Fish, *ssp*. *Gambusia hollbrooki* be relocated from natural occurring water bodies to poorly drained areas, helping combat juvenile mosquitoes as a bio rational means of control.

Biologist routinely check known locations that possess indigenous pollinator species insuring the City's pest control operations do not negatively affect any local populations. Biologists routinely meet with local beekeepers insuring a positive relationship and an open line of communication. The City of Hampton operates a pollinator friendly program and recognizes and strives to adhere to the pollinator protection protocols recommended by the Environmental Protection Agency (EPA).