Integrated Mosquito Management Program
City of Colleyville, Texas

Integrity -Communication-Excellence-Transparency

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Introduction

Mosquitoes are insects that belong to the order Diptera, or True Flies. Female mosquitoes have modified mouthparts that form a long piercing-sucking proboscis, while male mosquitoes have mouthparts incapable of piercing skin. Over 2,500 different species of mosquitoes have been identified throughout the world, with approximately 150 species occurring in the United States. The Texas Department of Health estimates there are approximately 82-84 mosquito species in the State of Texas, 42 of which have been found in Tarrant County, although only about 12 of these mosquito species have been implicated in the transmission of serious diseases.

Mosquitoes typically need still, stagnant water that is isolated from fish or other small predators to complete their metamorphosis from egg to adult. Larval habitats can range from marshes, freshwater wetlands, and tree holes to human-made structures like catchments, gutters, and discarded tires. Not all species of mosquitoes feed on humans and other mammals, many species feed mostly on birds, amphibians, or reptiles. Only a small percentage of the known mosquito species are considered to carry viruses such as Dengue, Zika, Chikungunya, or West Nile Virus.

Mosquitoes may be controlled through a variety of different physical, chemical, and biological methods. Physical methods usually involve source reduction, which is simply the physical removal of mosquito breeding habitats. Biological measures mainly center on the use of bacteria to kill mosquito larvae or the use of natural mosquito predators such as Gambusia, otherwise known as Mosquito fish. Chemical treatment typically involves the application of pesticides to attempt to control adult mosquito populations.

Today, communities are developing locally tailored mosquito control programs that may be scaled to adapt to changing conditions. For many areas, this means providing the basic level of protection by monitoring mosquito movement, population size, and infection rates. By knowing how many and what kinds of mosquitoes are in the area, we can be proactive and respond more effectively when threatened.

Explanation of Terms

Acronyms

CDC	Centers for Disease Control
IMMP	Integrated Mosquito Management Program
WNV	West Nile Virus
CHIKV	Chikungunya Virus
DENV	Dengue Virus
ZIKV	Zika Virus

Definitions

Adulticide (spraying or fogging) - product used to kill adult mosquitoes. Adulticides can be applied from hand held sprayers, truck-mounted sprayers, or airplanes. Adulticides, when used well, can have an immediate impact by reducing the number of adult mosquitoes in an area.

Aedes – Genus name for the Aedes aegypti (yellow fever) and Aedes albopictus (Asian tiger) mosquitoes. These mosquitoes tend to be day-time biters and are sometimes called ankle biters. Resting areas tend to be in tall grasses and shrubs low to the ground. Both species typically remain within a range of 200 meters or 656 feet (approximately 7 average homes).

These two mosquito species are the common transmitter of Dengue, Zika, and Chikungunya virus.

Aedes aegypti

Aedes albopictus

Arbovirus – Any virus transmitted by arthropods (mosquitoes)

Chikungunya – Chikungunya (pronunciation: \chik-en-goon-ye). The most common symptoms of chikungunya virus infection are fever and joint pain. Other symptoms may include headache, muscle pain, joint swelling, or rash.

Culex – Genus name of a general group of mosquitoes which are nighttime-active, opportunistic blood feeders and a primary vector for the WNV. Temperature-dependence drives prevalence of species. In warmtemperatures Culex quinquefasciatus (southern house) mosquito, becomes prevalent, although Culex restuans is an important vector species in the early spring and late fall. These species tend to rest high in trees during the day and come down at night to feed. The feeding range can be up to 1 mile. Culex quinquefasciatus is a medium-sized brown mosquito that exists throughout the tropics and the lower latitudes of temperate regions.

Culex quinquesfaciatus

Culex restuans

Dengue – Dengue (pronounced den' gee) is a disease caused by any one of four closely related dengue viruses (DENV 1, DENV 2, DENV 3, or DENV 4). The principal symptoms of dengue fever are high fever, severe headache, severe pain behind the eyes, joint pain, muscle and bone pain, rash, and mild bleeding (e.g., nose or gums bleed, easy bruising). Dengue Hemorrhagic Fever (DHF) is a more severe form of dengue infection. With good medical management, mortality due to DHF can be less than 1%.

Integrated Pest Management (IPM) – a science-based, commonsense approach for managing populations of disease vectors and public health pests. IPM uses a variety of pest management techniques that focus on pest prevention, pest reduction, and the elimination of conditions that lead to pest infestations. IPM simply means (1) don't attract pests, (2) keep them out, and (3) get rid of them, if you are sure you have them, with the safest, most effective methods.

Larvicide – products used to kill immature mosquitoes before they become adults. Larvicides can be either biological (such as toxin from specific bacteria that is lethal to mosquito larvae, but not to other organisms) or chemical products, such as insect growth regulators, surface films, or organophosphates. Larvicides are applied directly to water sources that hold mosquito eggs, larvae, or pupae. Larvicides can help to reduce the overall mosquito burden by limiting the number of new mosquitoes produced.

Vector – the primary agent that transmits a disease. For the purpose of this plan, mosquitoes are the common vector.

West Nile Virus (**WNV)** – most people infected with WNV will have no symptoms. About 1 in 5 people who are infected will develop a fever with other symptoms. Less than 1% of infected people develop a serious, sometimes fatal, neurologic illness. There are no medications to treat or vaccines to prevent WNV infection. Risk of being infected is reduced by using insect repellent and wearing protective clothing to prevent mosquito bites.

Zika – a disease caused by the Zika virus. Common symptoms are fever, rash, joint pain, and conjunctivitis (red eyes). The illness is usually mild with symptoms lasting for several days to a week.

Situations and Assumptions

Situations

- West Nile has been present in the DFW region since 2003. The City of Colleyville has experienced both positive mosquito samples and positive human cases of the West Nile Virus in recent years;
- Imported Chikungunya cases have been reported in Texas and the un-exposed American population is at risk if the disease becomes autochthonous;
- The Zika Virus became an emerging concern in 2016;
- These viruses are now part of our environment and should be anticipated as a continuous concern to the City each year;
- Adulticide is our most extreme method for addressing the mosquito population, and is used to help reduce the adult mosquito population;
- There are multiple arboviruses and the different species of mosquitoes (vector) that spread them vary in behavior and ecology;
- The City's response, as a vector control agency, will vary vastly depending on the vector important in the spread of each disease.

Assumptions

- Personal protective measures are an effective method for preventing the spread of arboviruses;
- The City monitors for the presence of WNV in mosquito pools year-round;
- Chikungunya and Zika have yet to show a pattern to establish assumptions, but this plan will be scalable to address any and all arboviral needs.

Objectives

The City of Colleyville's Integrated Mosquito Management Plan was developed to meet several objectives, including but not limited to:

- Provide public education and personal responsibility through the distribution of guidelines and information on mosquito populations, prevalence of diseases, with respect to three distinct arboviruses; West Nile Virus, Chikungunya, and Zika;
- Provide a systematic approach of surveillance and monitoring utilizing mosquito sampling and human disease data to establish risk levels;
- Establish mosquito control methods through consultation with subject matter experts;
- Establish three risk levels and response actions that will be undertaken for each risk level;
- Establish the escalation and de-escalation between risk levels;
- Formalize the public notification procedures.

Public Education

General Information

The prevention of any mosquito-borne disease is most efficiently accomplished by ensuring prompt and accurate information reaches the public in a timely manner, personal protective measures are implemented without panic and confusion. The typical risk begins as mosquitoes emerge in the spring months, therefore, the City will renew a public education campaign, and will provide continuous information on the City's website, social media, publications, and signs concerning arbovirus/disease frequently asked questions (FAQs), disease symptoms, personal preventative measures, and points of contact for additional information.

Personal Protection and Responsibility

Because the CDC and other health-related entities have found the most effective control of arboviral disease is personal protection, all citizens must be active in personal protection and do their part to aid in the abatement process to protect themselves, their family, homes, and community.

Avoiding bites by using personal protection is a very effective way to avoid acquiring disease. In addition, since much of the land within Colleyville is private property, it is imperative residents are aware mosquito breeding sites are developed due to the creation of artificial breeding sites around their homes, thus homeowners must take personal action to prevent breeding mosquitoes.

The key components of personal responsibility include:

- DEET: Use repellants containing DEET as the active ingredient for treating exposed skin areas;
- Dress: Keep skin covered as much as possible by wearing loose, long sleeved shirts and long pants. Light-colored clothing can be more effective as it allows you to see mosquitoes more effectively;
- Drain: Drain any standing water on your property. This includes water from flower pots, bird baths, rain gutters, rain barrels, and pet dishes.

Reduce exposure to adult mosquito populations through the following actions:

- Mow tall grass and reduce the amount of brush and other foliage on the property, both provide a resting site for adult mosquitoes;
- Use screening in homes and pet kennels. Keep door and window screens in good repair, and be sure they are properly sealed around the frames;
- Protect pets with drugs that eliminate heartworm.

Mosquito Surveillance and Monitoring

The City's surveillance and monitoring program is conducted in partnership with Tarrant County Health Department. The timing of the surveillance program is April through November, but may be adjusted as recommended by Tarrant County Health Department. The City can consider Texas Department of State Health Services or utilize private laboratory services, if necessary, for similar services.

Information obtained from these surveillance efforts will be used to map mosquito populations, provide public information, and determine the occurrence of any mosquito-borne disease. All surveillance data is published on Tarrant County's website.

The City will use mosquito surveillance and monitoring to determine what control measures are to be used, and evaluate the potential for any arboviral disease outbreak within the community. The objective of the surveillance and monitoring program is to:

- Identify areas conducive to being at risk for increased adult mosquito populations;
- Identify larval habitats in need of targeted control;
- Monitor the effectiveness of control measures;
- Determine what level of control methods need to be implemented.

Trapping for pools of mosquitoes in a location can provide a scientific basis for taking action and preventing the risk of disease in humans. The purpose of using traps is to determine the relative human health threat by detecting the presence of arboviral agents in female mosquitoes. The City utilizes two distinct traps based upon the species targeted. The information obtained from these surveillance efforts will determine the need for various control measures and their effectiveness and to assess the extent of the problem. Every effort is made to consistently collect a sample of mosquitoes weekly through the trapping season, as defined by Tarrant County (typically, the first week of April through November).

Trapping for Culex Species

The City will utilize six (6) gravid traps to collect for Culex species, an important vector of WNV. Four (4) of these traps will be kept in static locations across the City, and two traps will be moved to different locations in the City, depending on surveillance results or supporting evidence of a localized problem.

Trapping for Aedes Species

Aedes poses a threat to spreading Dengue, CHIKV, and Zika. The City has acquired two (2) BG Sentinel traps, which are the industry standard for collecting Aedes species.

In the event of a regional outbreak of the diseases spread by the Aedes mosquito, the City can implement a trapping scheduled based on the recommendation by Tarrant County.

In the event of a human case of one of the diseases currently monitored; WNV, Dengue, CHIKV, and Zika, Tarrant County will notify the City. This information is considered confidential to the patient and will not be published or shared. For some diseases, monitoring for human

cases is indicative of the risk for local acquisition of disease for the community.

Mosquito Control Methods

Source Reduction

The elimination or modification of mosquito breeding sites is critical, and typically, the most effective and economical solution for long-term mosquito control.

The normal habitat for mosquito larvae is produced by summer rain pools and stagnate water from over watering of landscapes. Small pools of water are created by irrigation or heavy rains during the summer produce most of our nuisance species of mosquitoes. A summer rainfall of less than an inch can produce breeding grounds for mosquitoes. Almost anything, whether natural or artificial, that will hold water for about a week or more, may breed mosquitoes. Mosquitos have adapted to a wide variety of larval habitats, and it is important to check for larvae in any pools of standing water.

However, it may be noted one of the most frequent bodies of water reported to the City are ponds, especially neighborhood ponds. Where mosquito fish and other natural predators (e.g. frogs and benthic insects) exist, these bodies of water rarely support a mosquito population. Introduce or re-introduce populations of predators, especially mosquito fish, where possible.

Source reduction practices are a key component for mosquito control which focuses on eliminating breeding sites for larvae by encouraging the following:

- Inspect property on a regular basis, especially after each rain event, for potential breeding sites;
- Drain and treat areas where shallow stagnant water can accumulate;
- Where appropriate, keep grass cut low to reduce mosquito resting places;
- Reduce all standing water around the property that may provide breeding sites by emptying items such as dog bowls, birdbaths, wading pools, and flower containers;
- Inspect irrigation systems for leaks or breaks and adjust to prevent excessive-watering of lawns and plant beds;
- Clean gutters often to remove debris which traps water;
- Use mosquito fish in decorative ponds and fountains;
- Fill holes or depressions in trees with sand or mortar, or drain them after each rain by drilling holes into the tree;
- Treat culverts, catch basins, fountains, manhole covers, storm water inlets, and other standing water areas with larvicides or other vector control measures
- Utilize larvicidal dunks where water cannot be drained or otherwise treated;
- Provide education outreach to address misinformation about mosquito breeding areas;
- When requested, or if a need exists, perform a field assessment of property, assisting residents in identifying potential breeding areas;
- Provide solutions to property owner(s) when breeding sources are found and treat areas with larvicides as appropriate and with permission and follow-up as needed.

Larval Mosquito Control

Larviciding is utilized when source water cannot be eliminated. There are several larval control methods available and the City will consider effectiveness, ecological impact, and economics when choosing which larval control to apply. These include:

- Industry standard mosquito larvicides with reduced environmental impacts;
- Mosquito fish.

The City will focus on applying larvicide on public property. When inspections determine the source water that cannot be eliminated lies on private property the City encourages the property owner to eliminate the source. In conjunction with section §341.019 of the Health and Safety Code, the City will apply larvicide when either the property owner is not available, non-cooperative, and/or the City believes the source water is creating a health risk.

Adult Mosquito Control

Adulticiding is the application of pesticides to kill adult mosquitoes. It will be an optional procedure utilized at the medium and high risk level. The City will use the following threshold when applying adulticide:

- When a mosquito pool has tested positive for an arbovirus two (2) times during the season;
- When the City has been notified by Tarrant County of a confirmed human case;
- When the City has been notified by Tarrant County of a significant increase in the population of Aedes mosquitoes that warrants further action;
- Upon the recommendation by Tarrant County for any public health reason;
- Or, when the City's leadership believes the threat level has increased to necessitate a response, for example: the presence of an increased population in a location at or before a large public event;

The City will use the following guidelines when applying adulticide:

- Spraying shall be conducted during hours as appropriate for the vector;
- Notification to stakeholders (businesses, residents, regional partners) in the areas being sprayed must occur 24 hours prior to any application;
- The areas where spraying takes places CAN be treated up to 3 times on 3 consecutive days;
- When variables prohibit on a specific day the spray schedule will not be altered;
- The City will seek permission from the property owner prior to applying adulticide on private property;
- Spraying activity will be conducted as recommended by Tarrant County or the CDC.

Risk Levels and Response

The City of Colleyville will operate the Integrated Mosquito Management Program under three different risk levels. The risk levels include low risk, medium risk, and high risk. The risk levels and the actions taken by the City are described below.

Low Risk Level

Probability of human outbreak is low; subnormal to normal mosquito activity is observed; and no evidence of WNV in the immediate area.

Public Education - The City of Colleyville will conduct abatement mosquito operations by providing continuous information on the City's website, social media, publications, and signs concerning arbovirus/disease frequently asked questions (FAQs), disease symptoms, personal preventative measures, and points of contact for additional information.

- provide property assessments by request to help identify mosquito-breeding habitats on individual properties, and publicize information about avoiding mosquito bites and encourage larviciding by residents. (Bacillus Thuringiensis Israelensis (BTI) and other low toxicity products). The Tarrant County Public Health Department (TCPH) website is a good source of the education materials and contains frequently asked questions - http://www.tarrantcounty.com/ehealth/cwp/view;

- Larvicide - The City of Colleyville will larvicide within public rights-of-way areas and City owned properties containing stagnant water with mosquito larvae, using low toxicity materials such as Vectolex FG granules along with BTI, Natular T30 and COCObear oil. These products could change due to availability and product tolerance. This operation will be done year round, more so during the mosquito season (typically April 1 to November 1);

- Surveillance - The City of Colleyville will set out six (6) gravid traps (For WNV Mosquito) each week, alternating between 14 test locations identified within the City, and submit mosquito samples to the Tarrant County Public Health Department for testing (typically April 1 to November 1). The City will also work with the Tarrant County Public Health Department to participate in the winter month sampling program;

- Preparedness - The City of Colleyville will utilize the Tarrant County Interlocal Agreement to provide abatement actions whenever possible. If circumstances are such that the County's contracts do not provide adequate services, the City will contract with a certified entomologist and licensed pesticide contractor for the annual mosquito season. The City will retain their services for consultation and recommendation purposes.

Medium Risk Level

A vIrus has been detected in trapped mosquitoes, probability of human outbreak is increasing, and normal to above normal mosquito activity is observed. All activities at the Low Risk Level will continue and the following additional actions will take place at this level.

- Notification - Citizens and property owners will be immediately notified of the detection of a virus in trapped mosquitoes by Code Red notification within at least a ¼-mile radius of the positive test site and information will be posted on the City's website;

- Site-specific investigation - The City will conduct an area inspection within a ¼-mile radius of the mosquito-sampling site that tested positive in order to identify locations in need of mosquito source or habitat reduction. The survey will include all areas that are visible from public property and will not involve City staff entering private property. If obvious sources of mosquito breeding environments are found, code enforcement officials will notify property owners of the situation and direct that action be taken to eliminate the source(s) within ten (10) days. If, after the ten-day period, the breeding sources have not been remediated, a citation may be issued. Obvious sources of mosquito breeding environments include, but are not limited to tires, open containers, and overhead roof drains plugged with leaves, etc.;

- Test site mitigation – Immediately upon receiving notification of a positive sample, the test site location will be treated using low toxicity materials such as Vectolex FG granule and BTI briquettes, Natular T30, and a Larvicide Oil COCOBEAR Larvicide options may change due to availability or product tolerance;

- Targeted truck and/or UTV mounted fogging application of adulticides – In the situation where a virus has been detected at any test site on two separate occasions, within the same season, a ¼ mile radius of the trap location will receive a targeted application of adulticides and will continue to receive a targeted application of adulticides for the remaining duration of the season in response to any additional positive virus mosquito samples. The first application will occur in response to the second sample that tests positive at any location.

High Risk Level

A confirmed human case has occurred within the jurisdiction, or four (4) mosquito samples at one location have tested positive for a mosquito born virus during the season, and the detection of increased or continued viral mosquito activity is observed. All activities at the Medium Risk Level will continue and the following additional actions may take place at this level.

- Notification - Citizens will be immediately notified of the detection of a positive human case or trap site positive by Code Red notification within a ½-mile radius of the confirmed positive human case and ¼ mile for trap site information of the infected area will be posted on the City's website so that citizens can take extra precautions to avoid being bitten;

- Site-specific investigation - The City will conduct an area inspection within a ½-mile radius of the area of concern that tested positive in order to identify locations in need of mosquito source or habitat reduction. The survey will include all areas that are visible from public property and will not involve City staff entering private property. If obvious sources of mosquito breeding environments are found, code enforcement officials will notify property owners of the situation and direct that action be taken to eliminate the source(s) within ten (10) days. If, after the ten-day period, the breeding sources have not been remediated, a citation will be issued. Obvious sources of mosquito breeding environments include, but are not limited to tires, open containers, and overhead roof drains plugged with leaves, etc.;

Adulticiding – The City may initiate adulticide application based on the following:

- Consistent with the adulticing policy identified at the medium risk level;
- In response to a confirmed human case(s);
- In conjunction with Tarrant County Public Health in response to an identified concern related to public health;
- At this risk level, the City Manager is authorized to initiate a larger application of adulticide utilizing truck mounted fogging equipment to apply within public rights-of-way. In addition, UTV fogging may also be utilized where appropriate.

Adulticiding will be coordinated with larviciding and public information/bite avoidance actions, in order to be effective. Contractors will be certified to apply pesticides and all applications will be in full compliance with all Texas Department of Health requirements.

Elevated Risk Information

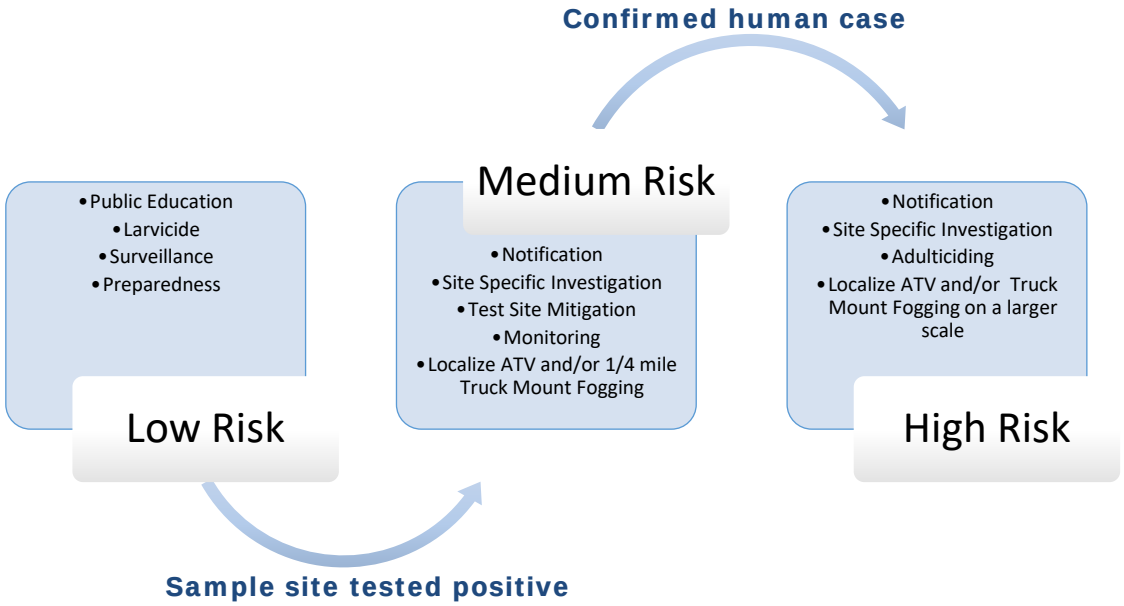
If a sampled mosquito pool tests positive for arbovirus/diseases, information will be posted on the City's website describing the location of the sampling event, the date, and any other pertinent information.

Information dissemination methods may include the following:

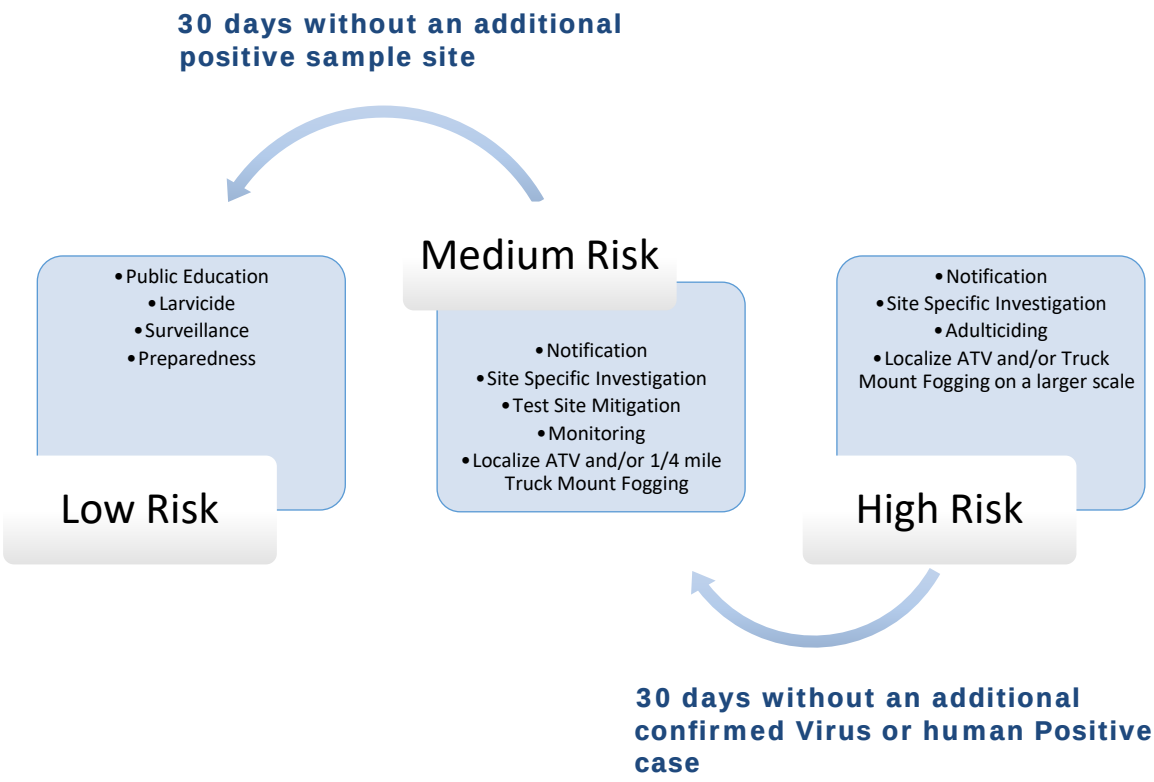
- Utilization of the City's website to post mosquito abatement activities, maps, surveillance reports, mosquito FAQ's, personal protection best practices, and mosquito control website links;
- Utilization of the City's Code Red to alert the community of any potential virus threat and adulticide control applications;
- Letters, pamphlets, brochures, and/or door hangers distributed within the community;
- Presentations to community groups and target populations concerning mosquito breeding reduction and related activities;
- Press releases describing arboviral response activities.

Escalation and De-escalation Charts

Escalation Chart



De-escalation Chart



Contact Information

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Tarrant County Public Health Department 817-884-1111