AGENDA
CITY OF DENTON CITY COUNCIL
June 25, 2012

After determining that a quorum is present, the City Council of the City of Denton, Texas will convene in a Special Called Meeting on Monday, June 25, 2012 at **3:30 p.m.** in the Council Work Session Room at City Hall, 215 E. McKinney Street, Denton, Texas at which the following items will be considered:

1. Receive a report from staff and hold a discussion concerning Risk Level 5 of the Mosquito Surveillance and Response Plan of the City of Denton.

2. Consider approval of a resolution authorizing control measures to be taken by the City of Denton concerning Risk Level 5 of the Mosquito Surveillance and Response Plan of the City of Denton; and declaring an effective date.

NOTE: The City Council reserves the right to adjourn into a Closed Meeting on any item on its Open Meeting agenda consistent with Chapter 551 of the Texas Government Code, as amended, including without limitation, Sections 551.071-551.086 of the Texas Open Meetings Act.

C E R T I F I C A T E

I certify that the above notice of meeting was posted on the bulletin board at the City Hall of the City of Denton, Texas, on the _____day of _____, 2012 at _____o'clock (a.m.) (p.m.)

_____
CITY SECRETARY

NOTE: THE CITY OF DENTON COUNCIL WORK SESSION ROOM IS ACCESSIBLE IN ACCORDANCE WITH THE AMERICANS WITH DISABILITIES ACT. THE CITY WILL PROVIDE SIGN LANGUAGE INTERPRETERS FOR THE HEARING IMPAIRED IF REQUESTED AT LEAST 48 HOURS IN ADVANCE OF THE SCHEDULED MEETING. PLEASE CALL THE CITY SECRETARY'S OFFICE AT 349-8309 OR USE TELECOMMUNICATIONS DEVICES FOR THE DEAF (TDD) BY CALLING 1-800-RELAY-TX SO THAT A SIGN LANGUAGE INTERPRETER CAN BE SCHEDULED THROUGH THE CITY SECRETARY'S OFFICE.

AGENDA INFORMATION SHEET

AGENDA DATE: June 25, 2012

DEPARTMENT: Utility Administration

ACM: Howard Martin, 349-8232

SUBJECT

Receive a report from staff and hold a discussion concerning Risk Level 5 of the Mosquito Surveillance and Response Plan of the City of Denton.

BACKGROUND

The prevalence of West Nile Virus (WNV) has been unusually high during this mosquito season. A total of 16 mosquito monitoring traps have been deployed at approximately weekly intervals since May 15. Mosquitoes captured in these traps are sent to the Texas Department of State Health Services (TDSHS) for identification and viral screening. The City of Denton has received notification of results for all traps collected through the week of June 6, for a total of 64 "trap-nights"(16 traps per week for 4 weeks). Through June 6th, mosquitoes in 12 of these traps have tested positive for WNV. These results have prompted changes to the Mosquito Surveillance and Response Plan (MSRP) Risk Levels from Level 2 "Enhanced Response" at the start of the mosquito season, to Level 3 "Public Health Concern" on June 5, 2012, to Level 4 "Public Health Warning" on June 12, 2012. This year, West Nile Virus appeared in Denton mosquito populations approximately 6 weeks earlier than in previous years, and is particularly widespread.

On June 21, 2012 the City of Denton received notification from the Denton County Health Department of two human cases of West Nile virus in Denton. The locations of these two cases are in close proximity to each other (approximately 0.3 miles). This result places Denton at Risk Level 5, based on the following trigger condition:

5.3.5 Risk Level 5 - Public Health Alert

Condition: Human outbreak is confirmed
Trigger: Multiple human cases within a short (1-2 week) timeframe, or clustered human cases.

The Mosquito Surveillance and Response Plan outlines the following control measures for Risk Level 5.

"Use public information to promote source reduction and personal protection. Intensify larviciding efforts. If the threat to human health is considered imminent and larvicides appear to be ineffective in reducing the threat, consider highly targeted adulticides using ground-based Ultra-Low Volume (ULV) applications of pyrethroids. The decision to spray should be made by

the City Council of Denton and efforts should be implemented only in the vicinity (approximately 1 mile) of areas where positive human cases were detected. Control measures will be implemented based on the following IPM (Integrated Pest Management) criteria: time of year, the extent of previous mosquito control activities, the current level of mosquito activity, weather conditions, the species of mosquitoes that test positive for disease, the number of local mosquito pools which test positively for disease, the likely time until a killing frost, the density of roads or other access to mosquito breeding grounds, and the density of human populations. If public health emergencies are declared at the county or state level, the recommended responses associated with the declaration will take precedence over the control plan of the City of Denton".

Staff is providing this information to discuss the topic of ground-based applications of mosquito adulticides with the City Council. If the Council decides to progress with ground based adulticide applications, staff will take the necessary measures to ensure applications are completed in accordance with the MSRP.

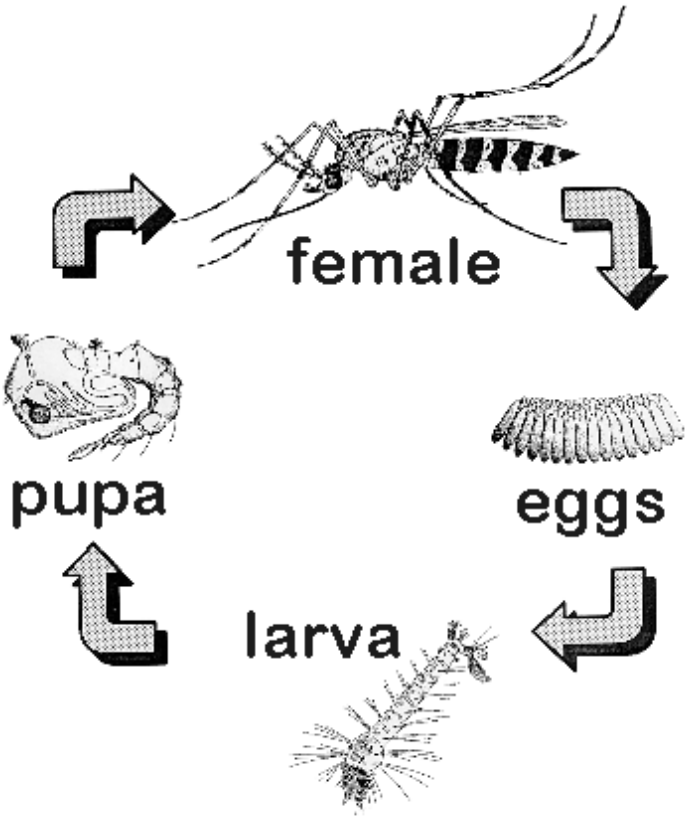
EXHIBITS

1. Mosquito Response Plan 2009
2. Resolution

Respectfully prepared and submitted by,

Kenneth Banks.
Director, Environmental Services and Sustainability

Mosquito Surveillance and Response Plan
City of Denton, Texas



2009 season

prepared by Kenneth E. Banks, Ph.D.
Division of Environmental Quality, City of Denton
phone: (940) 349-7165

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1.0 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 that are incapable of piercing skin. There are over 2500 different species of mosquitoes that have been identified throughout the world, with approximately 150 species occurring in the United States. The Texas Department of Health estimates that there are approximately 82-84 mosquito species in the State of Texas, 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 feed on humans and other mammals, and many species feed mostly on birds, amphibians, or reptiles. Only a small percentage of the known mosquito species are considered to be diseases vectors.

Although only a small percentage of mosquito species are capable of transmitting diseases, mosquitoes are still considered to be a very important vector for disease transmission. Within the United States, the occurrences of mosquito-borne illnesses have been relatively rare in recent years. However, epidemics of mosquito-borne diseases were once common in the United States. Outbreaks of Yellow Fever have been recorded as far north as Philadelphia during the Colonial Period, and Dengue fever was prevalent along the Gulf Coast until the mid-1940s. At one time, malaria was well established in the continental United States, especially in the south. Other mosquito-borne illnesses like LaCrosse, St. Louis, and Eastern Equine Encephalitis are still threats in certain areas of the country. Although many of these historical mosquito-borne diseases have been eliminated or at least controlled, the introduction and subsequent rapid spread of West Nile Virus within the United States is a topic of current concern.

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 that kill mosquito larvae or the use of natural mosquito predators. Chemical treatment typically involves the application of pesticides to attempt to control adult mosquito populations.

Mosquito control pesticides are applied by various means, depending on the type and size of the area being treated. No matter how pesticides are applied, however, pesticides have the potential to impact non-target species, including humans. Potential impacts may be in the form of acute or chronic toxicity, reproductive and / or developmental effects, and indirect effects through the food chain and pollination. The tests required for the registration of pesticides also do not address many forms of non-target impacts that may be of concern. Information is particularly weak with regard to the effects of inert ingredients in pesticide formulations, food chain effects, multi-generational effects,

and the interaction of specific pesticides with other chemicals in the environment. It is therefore important to realize that there are risks associated with the use of pesticides just as there are risks associated with the potential for human or animal infection by a mosquito-borne illness. The purpose of this response plan is to provide a systematic way to consider and balance the risks associated with mosquito control measures.

2.0 West Nile Virus (WNV) Concerns

West Nile Virus was first recorded in North American during August 1999 shortly following the Center for Disease Control and Prevention (CDC) and the New York City Department of Health responses to an unusual outbreak of encephalitis in northern Queens, New York. The cause of the observed illnesses was determined to be West Nile virus. During 1999, approximately sixty people were diagnosed with West Nile virus and seven elderly residents died from the infection. During the summer of 2000, WNV activity was detected again in New York City and appeared to be spreading. Fourteen people in the City of New York were diagnosed with acute WNV infection, six were identified in New Jersey, and 1 was reported from Connecticut. Outside of New York, WNV was detected in 12 states and in the District of Columbia. During 2001, the virus appeared again in New York City, causing seven cases that required hospitalization. In 2001, a total of 66 human cases with nine fatalities were reported throughout the nation, mostly spread throughout the eastern United States. During 2002, there were 4156 laboratory-positive human cases and 284 deaths. The number of cases increased dramatically in 2003 as the disease spread westward, with 9862 cases and 264 deaths. During 2004 there were 2539 cases with 100 deaths, and in 2005 there were 3000 cases with 119 deaths. The 2006 season had 4269 human cases of the disease and 177 deaths.

The relatively rapid spread of West Nile virus and the increase in disease incidence indicates that WNV is permanently established in the United States. It is likely that the virus survives the winter either within birds that remain in the area or possibly within mosquitoes that survive the winter in the adult stage. When spring returns, the virus recrudesces within the birds and is readily passed to early season mosquitoes. As mosquito populations increase, mosquitoes begin to feed more frequently on birds, causing an increasing number of birds and mosquitoes to become infected. If environmental conditions are favorable for transmission, the virus will amplify to a theoretical point of spillover. At spillover, the virus can bridge out of the enzootic, bird-mosquito cycle through mosquitoes that feed on birds, humans, and other animals. At the point of spillover, transmission to humans becomes more likely unless a mosquito control program is implemented.

The past experience of numerous mosquito control districts suggests that a mosquito control program should be based on the principals of Integrated Pest Management (IPM). The principals of IPM are:

- knowledge of mosquito biology and the epidemiology of the mosquito-borne diseases;

- surveillance and monitoring efforts for the detection and status assessment of mosquito populations and / or mosquito-borne diseases;
- a multifaceted prevention and control program comprised of a system of control tactics which are compatible with each other and which are proven effective;
- continued program evaluations and updates to ensure that the best methods are being used to meet the prevention and control objectives of the program; and
- continued education of the public to create awareness, understanding, and support.

These general guidelines have been used to develop the threshold-level responses of this surveillance and response plan.

3.0 Denton's Plan for Mosquito Surveillance:

The risk of mosquito-borne diseases depends on the size of mosquito populations and the incidence rate of disease. Collecting information on adult mosquito populations is thus important for both targeting control measures and gauging the potential for disease outbreak. An adult mosquito surveillance program for Denton has been developed by forming a partnership between the City of Denton and the University of North Texas. This surveillance program will collect adult mosquitoes through the use of either light traps or gravid traps. Captured mosquitoes will be sent to the Texas Department of State Health Services for testing. Each sample or pool will consist of female mosquitoes that are collected at a single collection site using a single type of trap. The information obtained from these surveillance efforts will be used to map mosquito populations, provide public information, and to determine the incidence of WNV or other arbovirus.

The mosquito surveillance efforts that have been designed for the City of Denton will allow analysts to map potential mosquito breeding grounds. Using this information, more targeted efforts towards habitat disruption, source reduction, larviciding operations, and other control mechanisms are possible. An effective surveillance and control program should therefore allow analysts to detect the presence of WNV of other mosquito-borne viruses during the amplification phase. If targeted mosquito controls are implemented at the amplification stage, the likelihood of bridging can be minimized, thus reducing the risk of human transmission. Depending on results, trapping may be expanded or contracted and the trapping season may be lengthened or shortened. If control measures are applied, trapping may be used more frequently to evaluate the effectiveness of the control measures.

The overall goal of the mosquito surveillance program is the use data on mosquito populations and mosquito virus infections rates to:

- assess the threat of human disease;
- determine the geographical areas of highest risk;
- assess the need for and timing of intervention events;
- identify larval habitats that are in need of targeted control;

- monitor the effectiveness of control measures; and
- develop a better understanding of transmission cycles and potential vector species.

Adult surveillance methods should:

- Use both fixed and flexible trap positions if possible
    - Fixed positions allow for the development of a database so year to year comparisons are possible
    - Flexible sites allow for responses to epidemiological and natural events.
- Use a variety of trapping methods (CDC light traps, gravid traps, etc...)
- Account for different influencing factors, including:
    - Habitat size and diversity
    - Resource availability
    - Proximity to human population centers and / or recreational areas
    - Flight ranges of vector specie

Advantages of using adult mosquito surveys:

- May provide the earliest evidence of viral activity in an area
- Helpful for determining if viral activity is local and / or restricted to a few areas
- provides information on potential mosquito vector species
- provides an estimate of vector species abundance
- provides information on virus infection rates for different mosquito species;
- provides information on the potential risks to humans and animals;
- provides baseline data that can be used to guide emergency controls.

Disadvantages of using adult mosquito surveys:

- Labor intensive and can be expensive
- Substantial expertise is required for collecting and handling mosquitoes
- Collectors may be at risk from mosquito bites, although using personal protection methods can minimize risks.

3.1 Adult mosquito collections

The adult mosquito surveys implemented by the City of Denton in conjunction with the University of North Texas are designed to determine the relative abundance of various

species present during the sampling period as well as the incidence of arthropod-borne virus/diseases within the captured specimens. Using this information, City of Denton personnel can determine the need for various control measures, conduct more effective searches for larval breeding places, assess the extent of the problem, and potentially gauge the effectiveness of control measures. Reports concerning the incidence rates of arthropod-borne virus/diseases and the relative risks to citizens may also be produced. Currently, the majority of collections are likely going to be made using light traps, resting traps, and gravid traps.

4.0 Mosquito Control Strategies

Human activities can greatly affect the ecology of mosquito populations. Large concentrations of people or animals, for example, can increase exposure rates and the probability of disease outbreak. The use of irrigation, development of drainage networks, elimination of mosquito predators, prevalence of improperly maintained birdbaths and other water holding containers can increase the numbers of certain types of mosquitoes. Expanding international trade and travel has increased the chance of introducing new mosquito species into our areas, as has recently happened with the Asian tiger mosquito (*Aedes albopictus*).

Mosquito control strategies have changed dramatically over the last few decades. Diesel oil, inorganic poisons, and source reduction using ditching operations were the basic tools of early mosquito control programs. Chlorinated hydrocarbons, organophosphates, pyrethrins, monomolecular oils, bacteria, and natural predators are more recent additions to mosquito control efforts. With the growth of ecological consciousness and environmental science, people began to realize the environmental damage that accompanied the use of broad-spectrum chemical control agents, particularly those that did not readily break down in nature. Concerns were also raised because many mosquito populations also appeared to develop resistance to the more commonly utilized chemical control agents.

Over the past few years, major advances have been made in the areas of biological mosquito control. Biological control strategies may include using natural predators like *Gambusia affinis* (Mosquito fish), fungi, protozoans, round worms, flat worms, and bacterial agents such as *Bacillus thuringiensis israelensis* (Bti). Each biological control agent has certain benefits and restrictions. In order to use a biological control agent successfully, the applicator must have a basic knowledge of biology associated with the control agent. Some biological control mechanisms, for example, are limited by salinity, temperature, or organic pollution and some mosquito species are much more susceptible to specific types of biological control agents. All of these factors must be considered when choosing and applying biological control agents.

The perfect pesticide is one that is easily applied, reasonably inexpensive, non-toxic to non-target organisms, and eliminates the pest quickly before it becomes a threat.

Although no single pesticide can combine all of these factors, certain types of *Bacillus* bacteria have been developed into pesticides that are very close to the perfect pesticide model. *Bacillus thuringiensis israelensis* (Bti), for example, is a naturally occurring soil bacteria that produces a poison capable of killing mosquito larvae. Bti is considered ideal for mosquito management because of its specificity for mosquito larvae and because of the lack of toxicity to non-target organisms. These bacteria form asexual reproductive cells, called spores, which enable them to survive in adverse conditions. The endospores of *Bacillus thuringiensis israelensis* also contain crystals of an insecticidal protein toxin called delta endotoxin. Once ingested by a mosquito, the alkaline conditions of the stomach dissolve the crystal and release the delta-endotoxin. The toxin has an affinity for the stomach wall lining causing the cells to first swell then rupture. When enough stomach cells burst, the alkaline fluid of the midgut can enter the blood. This movement of stomach fluid increases the alkalinity of the blood and results in a general paralysis. Death typically occurs a few hours after digestion. Currently, Bti is commercially available in powder, liquid, granular, capsule, and briquette formulations.

4.1 Larviciding vs. Adulticiding:

In the past, many mosquito control programs have relied heavily upon adult mosquito controls using chemical agents. In certain areas, routine mosquito spraying has been an integral component of mosquito control strategies. However, even near-continuous exposures to pesticides may not kill all mosquitoes. Those mosquitoes that are genetically able to resist higher pesticide concentrations may survive and pass on this resistance to future generations. Eventually, the pesticide becomes less effective as resistance increases in the mosquito populations.

The onset of resistance, however, can be minimized through the "Management by Moderation" approach. Management by moderation is an attempt to prevent the onset of resistance by:

- using doses that are no lower than the lowest level rate to avoid genetic selection.
- using less frequent applications
- using chemicals of short environmental persistence
- avoiding the use of slow release formulations
- avoiding using the same class of pesticides to control both adults and immature stages
- applying pesticides to only hot spots. Area-wide treatments should only be considered during imminent public health threats.
- Leaving certain generations, populations, or population segments untreated
- Establishing action thresholds that accentuate control mechanisms other than chemical control of adult mosquitoes.

Although management by moderation is a viable means of minimizing resistance, there are other environmental and human health concerns associated with the application of

pesticides for adult mosquito control. Routine mosquito spraying, for example, has the potential to continuously expose the public to pesticides. In some cases, effects on humans are possible, particularly for people who already suffer from asthma or other respiratory problems. If proper safety precautions are not followed, applicator personnel may also be in danger of overexposure. Managers must therefore decide whether mosquitoes or the chemicals used to control mosquitoes represent the biggest threat to humans.

All mosquitoes begin their lives in water. Prime breeding sites include discarded tires left outdoors, poorly maintained bird baths, clogged rain gutters, unused swimming pools and plastic wading pools, pet dishes, or any other container capable of holding water for more than 1 week. Mosquito breeding can therefore be prevented by either eliminating the source of water (source reduction) or by killing larvae (larviciding). Larviciding programs use a combination of source reduction, biological, and possibly chemical measures to control mosquito larvae before they develop into biting adults. If properly implemented, this strategy can be the most effective, economical and safest method for mosquito control because mosquito larvae are minimized, thus reducing the need for adult mosquito control and subsequently reducing the impacts of control measures on non-target organisms. Larviciding programs also offer the opportunity to use biological controls, which minimizes the impacts of the control program on non-target organisms and lessens the risk of chemical exposures to the public. Using biological controls also minimizes the chance of pesticide resistance in the mosquito populations. Experience suggests that the most effective and economical way to reduce mosquito populations is by larval source reduction through a locally funded abatement program. The goal of this program should be to monitor mosquito populations and initiate controls before diseases are transmitted to humans or domestic animals (CDC, 2001).

4.2 Rationale for different treatment methods

Chemical usage should not be viewed as a long-term control strategy, and should be only implemented when there are occasional episodes of heavy uncontrolled breeding concurrent with a high degree of public health risk. This strategy is most appropriate because prolonged use will lead to the development of resistance in mosquito populations, thereby limiting overall management options (Tabashnik, 1990). However, some chemical treatment methods do have lower risks for human health or the environment than others. The insect growth regulator methoprene, for example, is a juvenile hormone mimic that is environmentally benign because of its relative specificity for mosquitoes (Main and Mulla, 1982). The organophosphate, temephos, is a pesticide that is relatively target specific for mosquitoes and is generally suitable for use in environmentally sensitive freshwater wetlands (Moreau, 1988). However, because of effectiveness issues, weekly use may be required during summer months (Tennessen, 1993), and persistence can be reduced to just a few days in polluted or colloidal waters.

The most efficient and effective program is one in which mosquito larvae are prevented from becoming biting adults through the use of biological control agents. The bacterium

Bacillus thuringiensis israelensis (B.t.i) or the bacterium *Bacillus sphaericus* (B.s.) are considered to be the among the most environmentally acceptable commercially available biological control agents because of their relative specificity for mosquitoes and negligible toxicity for vertebrates (Rishikesh et al., 1983). Larvivorous fish can also be a valuable component of an integrated control program, either alone or together with chemical control agents (Walton et al., 1990; Walton and Mulla, 1991; Reed et al., 1995)

4.3 Integrated Pest Management (IPM)

Integrated pest management dictates that control efforts should be dependent on threshold levels. This means simply that a certain defined risk needs to exist before particular control measures are recommended. Levels of risk are based on knowledge of mosquito biology, the epidemiology of the mosquito-borne diseases, and monitoring efforts for the status assessment of mosquitoes and / or mosquito-borne diseases. Risks levels are then used to design multi-tactic prevention and control program that are comprised of a system of control tactics which are compatible with each other and which are proven for their effectiveness. Continual program evaluations and updates are used to ensure that the best methods are being used to meet the prevention and control objectives of the program and continued public education is used to create awareness, understanding, and support. Frequent sampling will allow analysts to map potential mosquito breeding grounds. Using this information, more targeted efforts towards habitat disruption, source reduction, larviciding operations, and other control mechanisms are possible.

5.0 Denton's Plan for Mosquito Control:

The primary objective of mosquito control is to decrease the risk of mosquito-borne human diseases. This objective should be accomplished by:

- Continuing to stress source reduction as a viable means of control
- Larviciding where such activities are feasible, practical, and likely to be effective.
- Using personal mosquito protection measures, especially for the elderly and those individuals with compromised immune systems.

5.1 Adulticiding

Adulticiding should and will be considered a supplemental control measure. The decision to spray should be based on the considerations listed (in no particular order) below.

5.1.1 Triggers for adulticides: Adulticiding should be considered only when there is evidence of WNV activity at a level suggesting a high rate of human infection (high dead bird densities, high mosquito infection rates, multiple positive mosquito species, horse or mammal cases indicating escalating transmission, or human cases with evidence

of epizootic activity. In general, finding a WNV-positive bird or mosquito pool does not by itself constitute evidence of an imminent threat to human health and does not warrant adulticiding.

5.1.2 When to use adulticides: The goal of spraying is to reduce the risk of human diseases by decreasing the number of vector adult mosquitoes as much as possible. However, the pesticide is only effective if it physically contacts the mosquito, which is most likely to happen when mosquitoes are actively flying. This typically will mean that spraying should be conducted between dusk and dawn. It is also important to realize that weather conditions, including air temperature, have a large influence on the effectiveness of adulticides.

5.1.3 Where to use adulticides: The terrain of the proposed spraying area has a major impact on the pesticide effectiveness. If there is substantial vegetation, dense shrubbery, trees, or hedges, pesticide applications can be rendered ineffective. The density of houses and other physical obstructions can also influence the effectiveness of pesticides.

5.1.4 Human population density considerations: The human population density in an area where there is evidence of intense epizootic activity should also be considered. If the area in question is rural and does not contain many people, the cost and potential risk associated with spraying may not justify its use. If the area in question is more densely populated, adult mosquito control is more justified as long as adequate protection measures are taken.

5.1.5 Mosquito population considerations: Information from mosquito surveillance can be helpful in determining when to conduct mosquito control and in determining the effectiveness of control measures. It is also important to know the numbers and species of the vector populations in specific localities. The best way to obtain this information is through mosquito trapping efforts. The City of Denton formed a partnership with the University of North Texas to provide the specially trained staff needed for systematic mosquito trapping.

5.1.5.1 Lag Time: It is important to realize that determining the presence of diseases within surveillance specimens requires some processing time after collection. In the time between collection and the date of test results, circumstances may have occurred which would alter a decision to spray. For example, weather conditions may have adversely affected mosquito populations, local mosquito habitats may have been altered, or larviciding efforts may have reduced the number of newly emerged adults. All of these occurrences may result in a reduced need to spray.

5.1.5.2 Surveillance results over time: Surveillance information can be considered through time to determine the progress of diseases. Information collected using a routine surveillance program can also be used to determine the relative risk of disease and to gauge the effectiveness of control measures. The available survey information should therefore always be considered before enacting adulticidal activities.

5.1.6 Local perspectives on spraying: Different communities have different perspectives on the benefits and risks associated with adulticiding activities. While these perspectives are valid and should be considered, individuals are likely to have strong opinions on either side of the issue. The City of Denton has tried to incorporate a rationale framework within the mosquito control program that is designed to be protective of both human health and the environment. The decision to spray, however, is a complex issue that will likely be faced without complete information. Thus, there will be citizens that do not believe that the City of Denton has done a good job with regards to reducing public health and environmental risks. The mosquito control program should therefore remain flexible and should attempt to address citizen complaints through public education and dialogue.

5.1.7 Denton's plan for mosquito adulticiding operations

Once arbovirus activity is detected and the decision is made to implement mosquito control using adulticides, the size of the area to treat must be determined. Unfortunately, there is no simple formula for determining how large of an area to treat around a positive surveillance indicator, nor is there adequate information to guide decisions about the degree of vector population suppression that must be attained, or for how long this suppression must be maintained to reduce the risk of disease. The CDC (2001) suggests considering the following factors where deciding the scope of the adulticiding effort:

- the general ecology of the area
- the flight range of vectors that are known or are believed to be of importance in the area
- the population density of the vectors
- the length of time since virus-positive mosquito pools were collected
- the potential risk to the human population (including the age demographics of the area) as well as the community perception of the relative risk of pesticides versus the risk of arbovirus infection.
- the season of the year - how much time the transmission risk can be expected to persist until the vector(s) enter diapause.

It is very likely that some of these factors will be unknown or only poorly known, and practical experience in conducting a mosquito control program is needed to refine control recommendations. If adulticiding operations are conducted, the following parameters should be monitored (CDC, 2001):

- Pre and post spray mosquito densities inside and outside the control area using light traps and gravid traps
- Mosquito infection rates pre and post spray, both inside and outside the control area.
- Weather conditions during the application (temperature, wind speed, wind direction, etc...).
- Droplet size and flow rate of Ultra-Low Volume applications
- Population age structure of key mosquito species (if practical).

If the application of adulticides is deemed necessary, the public must be informed. The following actions / activities will take place if before adulticides are applied:

- Information will be released 48 hours in advance through the media and through the city of Denton web site. Under certain conditions in park areas, applications may take place in less than 48 hours notice. For these cases, the facility will be closed to the public during and a few hours after application.
- If needed, police department escorts will accompany applicator's trucks to announce that adulticiding is about to take place. The police escorts will encourage people to go indoors to reduce pesticide exposures.

5.2 Plan for Public Education Concerning Mosquitoes

Public education is a key component of a successful mosquito control program. Since the appearance of the West Nile Virus in the United States, the City of Denton has produced and aired several public service announcements, given numerous presentations, and provided information on the city web page concerning this disease. In the event of a Risk Level 4 or higher (see Section 5.3 for rating criteria), the following key information will be conveyed to the public:

- The public will be informed about the comprehensive prevention strategies and activities used by the City of Denton to address the threat of West Nile Virus and to minimize the necessity of pesticide applications for adult mosquitoes.
- The public will be advised to eliminate standing water sites by removing all materials that can hold water for longer than 1 week. The public will also be urged to change the water and clean bird baths at least once a week, to clean and chlorinate swimming pools or drain and / or cover if not in use, and to unclog gutters and downspouts.
- The public will be informed about the symptoms of West Nile Virus (headache, high fever, muscle pain, weakness, and disorientation) and that persons over 50 years of age are more likely to experience significant clinical disease from West Nile infection.
- If appropriate, the public will be informed about the importance of reporting dead birds for surveillance purposes and that not all birds that are reported will be picked up. Information about the species of birds being prioritized for testing, how to properly dispose of birds not being retrieved, and the potential association between the high density of dead birds (especially crows) and the potential risk of West Nile virus will be disseminated.

Techniques used to disseminate information may include any of the following:

- Televised public service announcements using Denton's local cable channel

- Radio announcements
- Posters, brochures, and / or door hangers to be distributed in affected communities
- Brochures and / or fact sheets to be distributed to community-based organizations, community boards, elected officials, schools, nursing homes, libraries, outdoor activity sites, etc...
- Presentations to elected officials and / or community groups concerning mosquito breeding reduction and related activities
- Press releases describing West Nile virus response activities.

5.3 City of Denton Response Plan

The purpose of this response plan is to:

1. Minimize human illness through public education and vector control;
2. Map the density of mosquitoes and the incidence of the virus within the City of Denton and examine the relationship between mosquito density and land uses.
3. Identify areas where the incidence of disease is high and post the appropriate warnings to the citizens of Denton.
4. Identify the key vector species that carry diseases within Denton.

The prevention of West Nile virus, as with many diseases, is most efficiently accomplished by ensuring that prompt, accurate information reaches the public. If the appropriate information reaches the public in a timely manner, personal protective measures may be implemented without panic and confusion.

The City of Denton will provide continuous information on the city web page concerning West Nile virus frequently asked questions (FAQs), disease symptoms, personal preventative measures, and points of contact for additional information. If a sampled mosquito pool tests positive for arthropod-borne virus/diseasees, information describing the location of the sampling event, the date, and other pertinent information will be provided.

This response plan is partially based on Texas Department of Health recommendations. The plan is divided into 5 levels based on the risk of human disease. Each risk level is described below, along with specific recommended responses. In accordance with the principals of Integrated Pest Management Control measures are recommended for each level.

5.3.1 Risk level 1 - Normal Response

Condition: Probability of human outbreak is none or remote
Trigger: Normal mosquito activity with no evidence of arthropod-borne virus/disease detected during the past 3 years in vectors, humans, or other hosts.

Recommended Response:

Surveillance:
Surveillance optional. Under the normal response, mosquitoes are considered to be a only a nuisance without a significant influence on public health. Complaint calls and informal surveys of larva and adults will be used to direct mosquito control efforts.

Public Information / Education:
Publicize methods for mosquito reduction and personal protection prior to the main season for mosquito activity and outdoor human activities.

Control Measures
Use public information to promote source reduction and personal protection. Conduct standard larviciding approaches using *Bacillus thuringiensis israelensis* (Bti) and *Gambusia affinis* (mosquito fish).

Rationale:
Larviciding and source reduction / elimination is considered to be the most effective long-term solution for mosquito control. The control measures are designed to accomplish mosquito control by preventing larval mosquitoes from becoming biting adults.

5.3.2 Risk Level 2 - Enhanced Response

Condition: Probability of human outbreak is low
Trigger: Normal mosquito activity with little or no evidence of arthropod-borne virus/disease. Enhanced response level is due to recent historical presence of arthropod-borne virus/disease in vectors, humans, or other hosts within the vicinity of Denton (approximately 100 miles).

Recommended Response:

Surveillance:
Surveillance is optional, but strongly encouraged. If possible, conduct routine surveillance of adult mosquito populations using light traps baited with CO2 and gravid traps (at minimum). Collected mosquito species should be identified to species level and mosquito pools should be screened for the presence of arboviruses. If positive tests are obtained during arthropod-borne virus/disease screening, additional tests should be performed to determine what type of arbovirus is present.

Public Information / Education:
Publicize methods for mosquito reduction and personal protection prior to the main season for mosquito activity and outdoor human activities.

Control Measures
Use public information to promote source reduction and personal protection. Conduct standard larviciding approaches using *Bacillus thuringiensis israelensis* (Bti) and *Gambusia affinis* (mosquito fish).

Rationale:
Larviciding and source reduction / elimination is considered to be the most effective long-term solution for mosquito control. The control measures are designed to accomplish mosquito control by preventing larval mosquitoes from becoming biting adults.

5.3.3 Risk Level 3 - Public Health Concern

Condition: Probability of human outbreak is low to moderate
Trigger: Arthropod-borne virus/disease isolated from mosquitoes collected during trapping activities. Seropositive equine with a history that indicates that exposure likely occurred locally.

Recommended Response:

Surveillance:
Continue to conduct routine surveillance of mosquito populations. If resources allow, increase surveillance in areas were arthropod-borne virus/disease positive samples were collected. If possible, increase dead bird and / or equine surveillance in areas where viruses were isolated. Use geographic information systems to plot the location of positive samples.

Public Information / Education:
Publicize methods for mosquito reduction and personal protection.
Notify medical professionals and veterinarians of the presence of the disease.
Increase public education, emphasizing source reduction, personal protection, and disease symptoms.

Control Measures

Use public information to promote source reduction and personal protection. Conduct standard larviciding approaches using *Bacillus thuringiensis israelensis* (Bti) and *Gambusia affinis* (mosquito fish). Increase efforts in areas where positive mosquito pools were detected. Control measures will be implemented based on the following IPM criteria: time of year, the extent of previous mosquito control activities, the current level of mosquito activity, weather conditions, and surveillance results.

Rationale:
Larviciding and source reduction / elimination is considered to be the most effective long-term solution for mosquito control. Increasing these measures in areas where positive mosquito pools are detected offers an additional degree of risk reduction.

5.3.4 Risk Level 4 - Public Health Warning

Condition: Probability of human outbreak is moderate to high

Trigger: Multiple mosquito pools collected at different times and locations test positive for arthropod-borne virus/diseases.
Multiple wild birds test collected at different times or locations test positive for arthropod-borne virus/diseases.
Probable human or equine cases supported by laboratory testing (see definition).

Recommended Response:

Surveillance:
Continue to conduct routine surveillance of mosquito populations. If resources allow, increase surveillance in areas where arthropod-borne virus/disease positive samples were collected. Use geographic information systems to plot the location of positive samples and confirmed cases.

Public Information / Education:
Alert medical professionals, veterinarians, and public health officials.
Increase public education, emphasizing source reduction, personal protection, and disease symptoms.
Targeted public education concerning vector control methods and personal protection.

Control Measures
Use public information to promote source reduction and personal protection. Intesify larviciding efforts using *Bacillus thuringiensis israelensis* (Bti) and *Gambusia affinis* (mosquito fish) in targeted areas. Consider using insect growth regulators (example methoprene) or monomolecular oils in targeted areas. Increase efforts in areas where positive mosquito pools were detected, if applicable. Control measures will be implemented based on the following IPM criteria: time of year, the extent of previous mosquito control activities, the current level of mosquito activity, weather conditions, and surveillance results.

Rationale:
Larviciding and source reduction / elimination is considered to be the most effective long-term solution for mosquito control. Increasing these measures in areas where positive mosquito pools are detected offers an additional degree of risk reduction.

5.3.5 Risk Level 5 - Public Health Alert

Condition: Human outbreak is confirmed
Trigger: Multiple human cases within a short (1-2 week) timeframe, or clustered human cases. Cases must be confirmed by laboratory testing.

Recommended Response:

Surveillance:
Continue to conduct routine surveillance of mosquito populations. If resources allow, increase surveillance in areas were arthropod-borne virus/disease positive samples were collected. If possible, increase dead bird and / or equine surveillance in areas where viruses were isolated. Use geographic information systems to plot the location of positive samples and confirmed cases.

Public Information / Education:
Alert medical professionals, veterinarians, and public health officials.
Increase public education, emphasizing source reduction, personal protection, and disease symptoms.
Public education should emphasize vector control methods and personal protection.

Control Measures
Use public information to promote source reduction and personal protection. Intensify larviciding efforts using *Bacillus thuringiensis israelensis* (Bti) and *Gambusia affinis* (mosquito fish) in targeted areas. Use insect growth regulators (example methoprene) or monomolecular oils in targeted areas to reduce larvae. If the threat to human health is considered imminent and larvicides appear to be ineffective in reducing the threat, consider highly targeted adulticides using ground-based Ultra-Low Volume (ULV) applications of pyrethroids such as permethrins (preferred). The decision to spray should be made by the City Council of Denton and efforts should be implemented only in the vicinity (approximately 1 mile) of areas where positive human cases were detected. Control measures will be implemented based on the following IPM criteria: time of year, the extent of previous mosquito control activities, the current level of mosquito activity, weather conditions, the species of mosquitoes that test positive for disease, the number of local mosquito pools which test positively for disease, the likely time until a killing frost, the density of roads or other access to mosquito breeding grounds, and the density of human populations. If public health emergencies are declared at the county or state level, the recommended responses associated with the declaration will take precedence over the control plan of the City of Denton.

Rationale:
Larviciding and source reduction / elimination is considered to be the most effective long-term solution for mosquito control. Increasing these measures in areas where positive mosquito pools are detected offers an additional degree of risk reduction. If adulticides are deemed necessary, the pyrethroids are likely to be the most effective and least environmentally damaging compounds available.

References:

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Appendix A. Frequently Asked Questions (FAQs)

Q: What is West Nile virus?
A: West Nile virus is a member of the family Flaviviridae (genus *Flavivirus*), that is closely related to members of the Japanese encephalitis virus complex that includes St. Louis encephalitis (SLE), Japanese encephalitis, Kunjin, and Murray Valley encephalitis viruses, as well as others (1,2)

Q: How many mosquito species are there in the State of Texas? How many of these mosquito species are potential carriers of West Nile Virus?
A: The Texas Department of Health estimates that there are approximately 82-84 mosquito species in the State of Texas. Only about 12 of these mosquito species, however, have been implicated in the transmission of serious diseases. Although it is difficult to determine how many of these species have the potential to carry West Nile virus, approximately 10 of these species have been identified as positive for West Nile Virus in other areas of the country. The mosquitoes most often found positive for WNV are typically *Culex* spp..

Q: Where did West Nile virus come from?
A: West Nile virus has been commonly found in humans and birds and other vertebrates in Africa, Eastern Europe, West Asia, and the Middle East. West Nile virus was first isolated in the West Nile province of Uganda in 1937 (3,4). The first recorded large epidemics occurred in Israel during 1951-1954, and the largest recorded epidemic to date occurred in South Africa during 1974. Large human outbreaks of WN Encephalitis occurred in Israel in 2000 and have occurred in Southern France (1962), southeastern Romania (1996) and in south-central Russia (1999) (5,6). Until 1999, West Nile encephalitis had not been documented in the Western Hemisphere. It is not known where the U.S. WNV originated, but it is most closely related genetically to strains found in the Middle East.

Q: How long has West Nile virus been in the U.S.?
A: It is not known how long it has been in the U.S., but Center for Disease Control and prevention (CDC) scientists believe the virus has probably been in the eastern U.S. since the early summer of 1999, possibly longer.

Q: I understand West Nile virus was found in "overwintering" mosquitoes. What does this mean?
A: One of the species of mosquitoes found to carry West Nile virus is the Culex species which can survive through the winter, or "overwinter," in the adult stage. An infected mosquito can likely harbor the virus during the winter months and can transmit the virus in the following year.

Q: How do people get West Nile encephalitis?
A: People become infected by the bite of a mosquitoes infected with West Nile virus.

Q: What is the basic transmission cycle?
A: Mosquitoes become infected when they feed on infected birds, which will have the virus in their blood. Infected mosquitoes can then transmit West Nile virus to humans and

animals while biting to take blood. The virus is harbored in the mosquito's salivary glands, and during blood feeding the virus may be injected into the animal or human along with mosquito saliva. The virus may then multiply, possibly causing illness.

Q: How far can a mosquito travel?
A: Depending on the species, adult mosquitoes may fly several miles with help from the wind. *Culex* species, which are most commonly associated with the West Nile virus in this area, typically have a maximum travel range of two to three miles and are not considered to be strong fliers.

Q: How long do adult mosquitoes live?
A: Generally, adult female mosquitoes have a life span of 2 weeks to a month while adult male mosquitoes only live a week.

Q: What is the life cycle of a mosquito?
A: A mosquito goes through four distinct stages: egg, larva, pupa and adult.

Q: What is the egg phase of a mosquito?
A: Eggs are laid in clusters and tend to float on the surface of water. They can be stuck together in rafts of hundreds, or laid separately on water or flooded soil. Most eggs hatch into larvae within 48 hours. Adult female mosquitoes can lay eggs every 10-14 days.

Q: What is the larval stage?
A: In general, mosquito larvae live in water from 4 to 14, days depending on the water temperature. They come to the surface frequently to obtain oxygen and feed on algae and small organisms living in the water. The larva sheds its skin four times while it grows. After the fourth time, the larva becomes a pupa, the stage before the mosquito becomes an adult.

Q: What is the pupa stage?
A: The pupal stage is a resting, non-feeding stage. Mosquito pupae must live in water from 1 to 4 days, depending on the species and water temperature. When development is complete, the pupal skin splits and the mosquito emerges as an adult.

Q: What is the adult stage?
A: The newly emerged adult mosquito rests on the surface of the water for a short time to dry and allow all its parts to harden. If nothing eats or kills it, the female adult can live up to a month, the male typically only a week.

Q: What is the City of Denton doing to address the problem of West Nile Virus?
A: The City of Denton has developed a comprehensive plan aimed at reducing the risk of illness due to West Nile Virus. The main goal of this plan is to decrease the number of adult mosquitoes by eliminating mosquito-breeding sites wherever possible. In areas where the elimination of mosquito breeding grounds is not possible, larvicides will be applied. The City has also formed a partnership with the University of North Texas to perform mosquito surveillance activities during times of the year when mosquito

populations are high. The City of Denton's animal control division submits birds suspected of being infected with WNV to the Texas Department of Health for further testing. The City's mosquito control responses will be based on the likelihood of threats to human health from WNV or other mosquito-borne illness.

Q: If I live in an area where birds or mosquitoes with West Nile virus have been reported and a mosquito bites me, am I likely to get sick?
A: No. Even in areas where mosquitoes do carry the virus, very few mosquitoes—much less than 1%—are likely infected. Even if the mosquito is infected, less than 1% of people who get bitten and become infected will get severely ill. The Maine Environmental Policy Institute (MEPI) estimates that in areas where West Nile Virus is endemic, approximately 1 in 1000 mosquitoes actually carry the virus. The MEPI also estimates that only 1 in 300 people bitten by a West Nile Virus infected mosquito will show any signs of sickness. Even if you contract the WNV and become ill, most people will only exhibit mild flu-like symptoms (7). The chances you will become severely ill from any one mosquito bite are extremely small. The greatest risk is to those over the age of 50 or individuals that have compromised immune systems. These members of the population should take the greatest care to prevent exposure to mosquito bites.

Q: How many types of animals have the potential to be infected with West Nile virus?
A: Although the vast majority of infections have been identified in birds, WN virus has been shown to infect horses, cats, bats, chipmunks, skunks, squirrels, and domestic rabbits.

Q: How does West Nile virus actually cause severe illness and death in humans?
A: Following transmission by an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal central nervous system functioning and causes inflammation of brain tissue.

Q: What proportion of people with severe illness due to West Nile virus die?
A: Less than 1% of those infected with West Nile virus will develop severe illness. Among those with severe illness due to West Nile virus, case-fatality rates range from 3% to 15% and are highest among the elderly.

Q: A mosquito has bitten me. Should I be tested for West Nile Virus?
A: No. Illnesses related to mosquito bites are still uncommon in the United States. However, you should see a doctor immediately if you develop symptoms such as high fever, confusion, muscle weakness, severe headache, stiff neck, or light sensitivity.

Q: How long does it take to become sick if bitten by an infected mosquito?
A: Most people who are infected with WNV have no symptoms or only experience mild illness. If illness does occur, symptoms usually appear within 3 to 15 days after being bitten by an infected mosquito.

Q: What should I do if I think I have West Nile encephalitis (the illness from infection from West Nile Virus)?
A: Seek medical care as soon as possible if you develop signs of encephalitis. Signs include fever, muscle weakness, and confusion.

Q: Is there a vaccine against West Nile virus?
A: No, but several companies are working towards developing a vaccine.

Q: What can I do to reduce my risk of becoming infected with West Nile virus?
A:

- Stay indoors at dawn, dusk, and in the early evening.
- Wear long-sleeved shirts and long pants whenever you are outdoors.
- Spray clothing with repellents containing permethrin or DEET, since mosquitoes may bite through thin clothing.
- Apply insect repellent sparingly to exposed skin. An effective repellent will contain 35% DEET (N,N-diethyl-meta-toluamide). DEET in high concentrations (greater than 35%) provides no additional protection.
- Repellents may irritate the eyes and mouth, so avoid applying repellent to the hands of children.
- Whenever you use an insecticide or insect repellent, be sure to read and follow the manufacturer's DIRECTIONS FOR USE, as printed on the product.

Note: “ultrasonic" devices are NOT effective in preventing mosquito bites.

Q: What can I do around my home to help reduce exposure to mosquitoes?
A:

- Repair or replace all screens in your home that have tears or holes.
- Eliminate any standing water that collects on your property.
- Remove discarded tires, tin cans, plastic containers, or similar water-holding containers.
- Make sure gutters drain properly. Clean gutters on a regular basis.
- Clean and chlorinate swimming pools, outdoor saunas, and hot tubs. If not in use, empty or cover.
- Drain the water from pool covers, tarps, etc...
- Change the water in birdbaths at least once a week.
- Turn over plastic wading pools, wheel barrows, etc... when not in use.
- Remind neighbors and / or form neighborhood organizations to help the entire neighborhood eliminate mosquito breeding sites.

Q: What is the status of horse (equine) West Nile Virus Infection?
A: Near the end of December 2002, the Texas Department of Health reported that 1577 horses have tested positive for West Nile Virus within the State of Texas. The total number of organisms that have tested positive for West Nile Virus within the state

(mosquitoes, humans, birds, and horses combined) was 2458. During 2003, the number of infected horses dropped to 663. The decrease is likely due to the widespread use of vaccines.

Q: What is the most effective means of mosquito control?
A: According the Center for Disease Control and Prevention, source reduction is most effective and economical method of providing long-term mosquito control in many habitats. The term source reduction refers to the alteration or elimination of mosquito larval habitat. Source reduction can include activities such as the proper disposal of used tires, cleaning rain gutters, emptying and refilling bird baths on a weekly basis, and any activity which reduces small pools of water. An item as small as a bottle cap can be a potential mosquito breeding ground.

Q: Is larval control an effective means of controlling mosquitoes?
A: Yes. The Center for Disease Control and Prevention considers larviciding, or the application of chemical or biological agents to kill mosquito larva or pupae, as more effective and target-specific than killing adult mosquitoes, but less permanent than source reduction. The objective is to control the immature stages of the insect before adult populations can develop and disperse. If populations of adult mosquitoes are kept at low levels, the risk of arbovirus transmission is small. The *Bacillus thuringiensis israelensis* (Bti) donuts used by the City of Denton are an example of a biological larvicide.

Q: How can I get the Bacillus thuringiensis israelensis (Bti) donuts for my yard?
A: For a limited time, the City of Denton is offering the larvicide (Bti) *Bacillus thuringiensis israelensis* to Denton residents free of charge. The larvicide will be available at the Service Center at 901-A Texas Street, Monday – Friday from 8 am to 5 pm. On Saturdays, the larvicide will be available from 10 am to 2 pm at the compost sales office at the Pecan Creek Water Reclamation Facility. Residents will need to bring a valid driver's license and utility bill for proof of residence. The limit is two donuts per resident. For more info, please call (940) 349-7000.

Q: Is adulticide and effective means of controlling mosquitos?
A: Adulticiding, or the killing of adult mosquitoes by ground or aerial applications of chemicals, is considered by the Center for Disease Control and Prevention to be the least efficient mosquito control method. There are several reasons adulticiding is not highly effective. For example, there are several different types of mosquitoes that have the potential to carry disease, each with its own particular preference for flight times and habitats, which makes timing spray events difficult. In areas where there are many houses, trees, and other obstructions, the chance of actually hitting a mosquito with the spray cloud is greatly diminished. Although it is very difficult to measure the efficacy of a large spray event, the results of trap experiments conducted in Houston and Florida suggest that a large spray event will typically reduce the adult population of mosquitoes by only about 30 percent (8).

Q: Does the City of Denton plan to apply pesticides?
A: If West Nile Virus is found in the community, the City's initial response will be to intensify efforts to reduce mosquito populations through source reduction and larviciding. in those areas where WNV has been found. Reducing the adult mosquito populations through the use of pesticide aerosols (fogging) will only be considered if there are conditions indicative of Risk Level Five (Public Health Alert) **and** if other control measures appear to be ineffective. If adulticiding is implemented, applications will be targeted to only those areas in which the adult mosquito populations have tested positive for the presence of WNV or other mosquito-borne diseases of human health concern. No adulticiding will be used as a means of controlling nuisance populations of mosquitoes.

Q: What risks are associated with applying mosquito adulticides?
A: In the amounts used, the risks to people, pets, and the environment are relatively low. However, some people or pets may be more sensitive to pesticides and should therefore attempt to minimize exposures. Anyone experiencing persistent or significant adverse reactions to pesticides should seek medical care or call the North Texas Poison Center:

North Texas Poison Center
Parkland Memorial Hospital
5201 Harry Hines Blvd.
Dallas, TX 75235
Emergency Phone: (800) 222-1222
http://www3.utsouthwestern.edu/parkland/poison.html

Q: Will the public be notified in advance about spraying activities?
A: Residents can learn about adulticiding schedules in advance through public service announcements, the media, and the City of Denton's web site (www.cityofdenton.com)

Appendix A References:

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7. The Maine Environmental Policy Institute, May 16, 2001 press release, Hallowell, Maine. Available at http://www.meepi.org/wnv/release.htm
8. Fagin, Dan. 2000. Doubts about spraying – some experts call it ineffective against West Nile Virus. Newsday 11/8/2000. Available at http://www.cfe.cornell.edu/erap/wnv/WNV-Larchive/11-8-00.html

Appendix B: Definitions and Glossary

Definitions:

Consideration: Consideration involves the following factors: habitat; time of year; weather conditions; the level of documented viral activity/presence; the distribution, density, and infection rate of the vector population; and the proximity of human populations. In neighborhoods with increased positive surveillance results, green areas (parks, cemeteries, golf courses) will have higher priority for adulticide activity since these areas represent likely habitat for viral amplification via transmission among hosts (birds).

Confirmed case: A confirmed case of West Nile encephalitis is defined as a febrile illness associated with neurological manifestations ranging from headache to aseptic meningitis or encephalitis, plus at least one of the following:

- Isolation of WNV from, or demonstration of WNV antigen or genomic sequences in tissue, blood, CSF, or other body fluid;
- Demonstration of IgM antibody to WNV in CSF by IgM-capture EIA;
- A ≥4-fold serial change in plaque-reduction neutralizing (PRNT) antibody titer to WNV in paired, appropriately timed serum or CSF samples;
- Demonstration of both WNV-specific IgM (by EIA) and IgG (screened by EIA or HI and confirmed by PRNT) antibody in a single serum specimen.

Probable Case: A probable case is defined as a compatible illness (as above) that does not meet any of the above laboratory criteria, plus at least one of the following:

- Demonstration of serum IgM antibody against WMV (by EIA);
- Demonstration of an elevated titer of WNV-specific IgG antibody in convalescent phase serum (screened by EIA or HI and confirmed by PRNT).

Non-Case: A non-case is defined as an illness that does not meet any of the above laboratory criteria, plus:

A negative test for IgM antibody to WNV (by EIA, HI, or PRNT);

and/or

A negative test for IgG antibody to WN virus (by EIA, HI or PRNT) in serum collected ≥22 days after onset of illness.

Glossary:

Adulticide: A type of pesticide designed to kill adult mosquitoes
arbovirus: shortened form of **ar**thropod-**bo**rne **virus.** A virus that is transmitted by arthropods.
Arthropods: A group of animals that do not have a backbone and have jointed walking appendages, such as insects.
***Bacillus thuringiensis israelensis* (BTi)**: a type of biological pesticide used to control mosquito larvae in water (mosquito larvae die after ingesting this material).
bridge vector: For West Nile Virus, an organism (mosquitoes) which serve as a major viral transmission mechanism between the reservoir (birds) and humans.
DEET: The active ingredient in many insect repellant products (N,N-diethyl-meta-toluamide).
Eastern Equine Encephalitis (EEE): A mosquito-borne viral disease that causes inflammation of the brain similar to West Nile Virus.
EIA - Enzyme immunoassay
encephalitis: inflammation of the brain, which can be caused by numerous different bacteria and viruses, including West Nile Virus
gravid traps: mosquito traps designed to attract pregnant female mosquitoes.
HI: Haemagglutination inhibition
IgG: Immunoglobulin G
IgM: Immunoglobulin M
landing rate counts: a measure of the number of adult mosquitoes landing on an individuals body during a predetermined time interval. Used to assess the abundance of host-seeking mosquitoes.
larvae: Immature mosquitoes that live in water; the stage after the egg hatches but before pupation.
larvicide: A type of pesticide used to control immature or larval mosquitoes
light traps: mosquito trap outfitted with a light to attract mosquitoes
malathion: A commonly used organophosphate pesticide used to control adult mosquitoes.
meningitis: Inflammation of the lining of the brain and spinal cord that can be caused by a virus or bacteria
methoprene: a type of insect growth regulator used to control larval mosquitoes; growth regulators prevent mosquito larvae from developing into mature adults.
mosquito breeding site: a location where mosquitoes lay eggs; usually stagnant water with high organic content.
mosquito pools: A group of mosquitoes of the same species, collected in the same area, that are combined in the laboratory to test for West Nile and related diseases.
outbreak: A rapid increase in the frequency or distribution of a disease.
permethrin: a synthetic pyrethroid pesticide used to control adult mosquito populations
pesticide: A substance used to kill pests such as insects, mice, and rats; an insecticide is a form of pesticide.
PRNT: Plaque reduction and neutralization testing
source reduction: the removal or reduction of larval mosquito habitats.

St. Louis encephalitis: mosquito-borne viral disease that causes inflammation of the brain. Very similar to West Nile Virus.
vector: An organism (usually an insect) that is capable of carrying and transmitting a disease causing agent from one host to another.
viral: Of, or relating to, a virus
viral encephalitis: Inflammation of the brain caused by a virus.

Appendix C: Contact Names and Phone Numbers

City of Denton Watershed Protection Program
Kenneth Banks, Ph.D. 940-349-7165
David Hunter, R.S., M.P.A. 940-349-7123

City of Denton Animal Control Office 940-349-7736

Denton County Health Department
Matt Richardson, Coordinator 940-349-2914
Jessica Gullion, Ph.D., Epidemiologist 940-349-2916

Texas Department of Health
Jan Buck Zoonosis Control Division 817 264-4920

Centers for Disease Control and Prevention (CDC)
Division of Vector-Borne Infectious Diseases, Fort Collins, CO
Roger Nascl 970-221-6432

Centers for Disease Control and Prevention (CDC)
Entomology Branch, Atlanta, GA
Robert Wirtz 770-488-4108

RESOLUTION NO. _____

A RESOLUTION AUTHORIZING CONTROL MEASURES TO BE TAKEN BY THE CITY OF DENTON, TEXAS CONCERNING RISK LEVEL 5 OF THE MOSQUITO SURVEILLANCE AND RESPONSE PLAN OF THE CITY OF DENTON; AND DECLARING AN EFFECTIVE DATE.

WHEREAS, the City of Denton has a Mosquito Surveillance and Response Plan (the "Plan");

WHEREAS, the Plan sets forth certain risk levels, as established by the criteria described therein;

WHEREAS, the City of Denton has now entered Risk Level 5, as described and defined in the Plan;

WHEREAS, the Control Measures, as described and defined in the Plan for Risk Level 5, include the ground-based application of targeted mosquito adulticides, as more particularly described therein, upon the "decision" of the City Council of the City of Denton; NOW, THEREFORE,

THE COUNCIL OF THE CITY OF DENTON HEREBY RESOLVES:

SECTION 1. The City Council of the City of Denton hereby finds that the City of Denton has entered Risk Level 5, as described and defined in the Mosquito Surveillance and Response Plan.

SECTION 2. The ground based application of mosquito adulticides, as described in the "Control Measures" of Risk Level 5 of the Mosquito Surveillance and Response Plan, is hereby authorized, so long as the City of Denton shall be in Risk Level 5, for the mosquito season of 2012.

SECTION 3. This resolution shall become effective immediately upon its passage and approval.

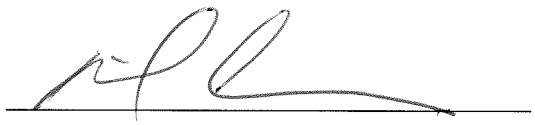
PASSED AND APPROVED this the _____ day of _____, 2012

_____
MARK A. BURROUGHS, MAYOR

ATTEST:
JENNIFER WALTERS, CITY SECRETARY

BY: _____

APPROVED AS TO LEGAL FORM:
ANITA BURGESS, CITY ATTORNEY

BY: 

AGENDA INFORMATION SHEET

AGENDA DATE: June 25, 2012

DEPARTMENT: Utility Administration

ACM: Howard Martin, 349-8232

SUBJECT

Consider approval of a resolution authorizing control measures to be taken by the City of Denton, Texas concerning Risk Level 5 of the Mosquito Surveillance and Response Plan of the City of Denton; and declaring an effective date.

BACKGROUND

The prevalence of West Nile Virus (WNV) has been unusually high during this mosquito season. A total of 16 mosquito monitoring traps have been deployed at approximately weekly intervals since May 15. Mosquitoes captured in these traps are sent to the Texas Department of State Health Services (TDSHS) for identification and viral screening. The City of Denton has received notification of results for all traps collected through the week of June 6, for a total of 64 "trap-nights"(16 traps per week for 4 weeks). Through June 6th, mosquitoes in 12 of these traps have tested positive for WNV. These results have prompted changes to the Mosquito Surveillance and Response Plan (MSRP) Risk Levels from Level 2 "Enhanced Response" at the start of the mosquito season, to Level 3 "Public Health Concern" on June 5, 2012, to Level 4 "Public Health Warning" on June 12, 2012. This year, West Nile Virus appeared in Denton mosquito populations approximately 6 weeks earlier than in previous years, and is particularly widespread.

On June 21, 2012 the City of Denton received notification from the Denton County Health Department of two human cases of West Nile virus in Denton. The locations of these two cases are in close proximity to each other (approximately 0.3 miles). This result places Denton at Risk Level 5, based on the following trigger condition:

5.3.5 Risk Level 5 - Public Health Alert

Condition:	Human outbreak is confirmed
Trigger:	Multiple human cases within a short (1-2 week) timeframe, or clustered human cases.

The Mosquito Surveillance and Response Plan outlines the following control measures for Risk Level 5.

"Use public information to promote source reduction and personal protection. Intensify larviciding efforts. If the threat to human health is considered imminent and larvicides appear to

be ineffective in reducing the threat, consider highly targeted adulticides using ground-based Ultra-Low Volume (ULV) applications of pyrethroids. The decision to spray should be made by the City Council of Denton and efforts should be implemented only in the vicinity (approximately 1 mile) of areas where positive human cases were detected. Control measures will be implemented based on the following IPM (Integrated Pest Management) criteria: time of year, the extent of previous mosquito control activities, the current level of mosquito activity, weather conditions, the species of mosquitoes that test positive for disease, the number of local mosquito pools which test positively for disease, the likely time until a killing frost, the density of roads or other access to mosquito breeding grounds, and the density of human populations. If public health emergencies are declared at the county or state level, the recommended responses associated with the declaration will take precedence over the control plan of the City of Denton".

Staff is providing this information to discuss the topic of ground-based applications of mosquito adulticides with the City Council. If the Council decides to progress with ground based adulticide applications, staff will take the necessary measures to ensure applications are completed in accordance with the MSRP.

EXHIBITS

1. Resolution

Respectfully prepared and submitted by,

Kenneth Banks.
Director, Environmental Services and Sustainability

RESOLUTION NO. _____

A RESOLUTION AUTHORIZING CONTROL MEASURES TO BE TAKEN BY THE CITY OF DENTON, TEXAS CONCERNING RISK LEVEL 5 OF THE MOSQUITO SURVEILLANCE AND RESPONSE PLAN OF THE CITY OF DENTON; AND DECLARING AN EFFECTIVE DATE.

WHEREAS, the City of Denton has a Mosquito Surveillance and Response Plan (the "Plan");

WHEREAS, the Plan sets forth certain risk levels, as established by the criteria described therein;

WHEREAS, the City of Denton has now entered Risk Level 5, as described and defined in the Plan;

WHEREAS, the Control Measures, as described and defined in the Plan for Risk Level 5, include the ground-based application of targeted mosquito adulticides, as more particularly described therein, upon the "decision" of the City Council of the City of Denton; NOW, THEREFORE,

THE COUNCIL OF THE CITY OF DENTON HEREBY RESOLVES:

SECTION 1. The City Council of the City of Denton hereby finds that the City of Denton has entered Risk Level 5, as described and defined in the Mosquito Surveillance and Response Plan.

SECTION 2. The ground based application of mosquito adulticides, as described in the "Control Measures" of Risk Level 5 of the Mosquito Surveillance and Response Plan, is hereby authorized, so long as the City of Denton shall be in Risk Level 5, for the mosquito season of 2012.

SECTION 3. This resolution shall become effective immediately upon its passage and approval.

PASSED AND APPROVED this the _____ day of _____, 2012

_____
MARK A. BURROUGHS, MAYOR

ATTEST:
JENNIFER WALTERS, CITY SECRETARY

BY: _____

APPROVED AS TO LEGAL FORM:
ANITA BURGESS, CITY ATTORNEY

BY: