Fraser Valley Regional District

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Pest Management Plan
Nuisance Mosquito Control

1 May 2019 - 30 April 2024

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DRAFT

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1. INTRODUCTION

1.1 Overview of Mosquito Larvae Control

Mosquitoes are insidious summertime pests that live and breed in and around wet environments. The proximity of mosquito producing areas to human habitation, business, and recreation sites often requires the deployment of programs designed to reduce the mosquito populations to allow the surrounding areas to be more tolerable during the times of year the mosquitoes are out.

There are many different types of mosquitoes, with different species preferring different types of breeding habitats. Some mosquitoes breed in coastal brackish water, some breed in wet forested areas, some breed in water collected in backyard containers. In the Fraser Valley, the greatest source of nuisance mosquitoes is low-lying areas along rivers and streams that experience fluctuating water levels. Floodplain mosquitoes lay their eggs on the wet soil along a riverbank after the water levels have started to recede in the summer. The eggs lay dormant until water levels increase again, which often occurs the following spring during freshet, but the eggs can survive for several years. When eggs go underwater, it triggers them to rapidly hatch into larvae. Mosquito larvae remain within the water where they eat voraciously, grow in size, and go through several molting stages (instars) within approximately one week. After the fourth instar stage, the larvae change into a pupa, and then soon emerge as an adult mosquito, usually 1-2 weeks after the water levels began to rise (Figure 1).

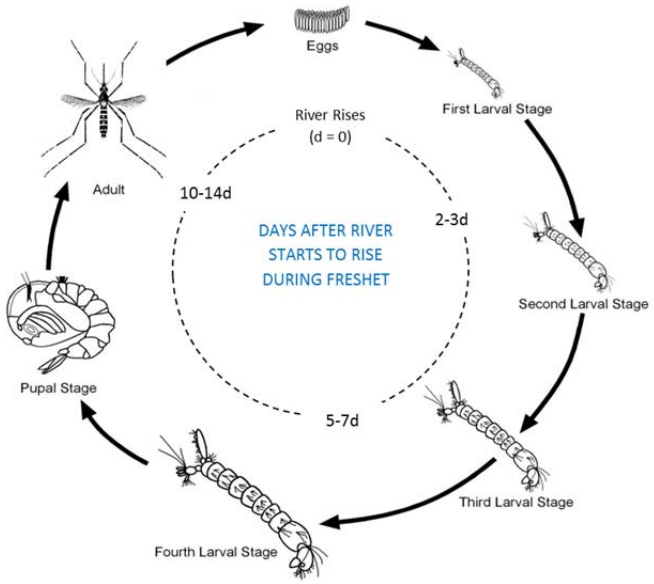

Figure 1. Mosquito life cycle. Note that times provided are approximate and may vary depending on weather conditions and water temperatures.

Unlike historical treatment efforts that attempted to poison adult mosquitoes after they emerged and dispersed, most current mosquito control programs target the mosquito larvae while they are still in the water column. The most common active ingredient used is a bacterium naturally found in soils known as *Bti* (*Bacillus thuringiensis* subspecies *israelensis*). Pesticide products formulated with this bacterium are added directly to the water where the larvae are found. Mosquito larvae ingest the

bacteria and quickly die due to a toxic protein that *Bti* produces when inside the alkaline environment of the mosquito's digestive system. *Bti* is extremely species-specific and does not affect most other insects, honeybees, fish, birds, or mammals[1], even if accidentally ingested. *Bti* has no toxicity to people and can be applied safely to mosquito habitat without negative impacts on food crops or water supplies[2], and can even be used in organic farming operations[3]. Other similar larvicides may also be used for mosquito control purposes, such as *Bacillus sphaericus* (*Bsph*).

Most of the mosquito larvae treatment conducted under this program occurs on public land, as that is where the nuisance mosquito typically becomes active. This requires that all activities be conducted under a Pest Management Plan (PMP) and all application staff to be properly trained and certified within BC.

1.2 Purpose of this Plan

The land base in the Fraser Valley Regional District (FVRD) lends itself to mosquitoes being an historical and significant summertime pest. The Fraser Valley is defined by the presence of the Fraser River, which experiences high water levels each spring due to the snowmelt occurring upstream within the Fraser River Watershed. During this annual freshet, floodwaters and seepage waters wet the adjacent lowland areas, creating a band approximately 5 km wide down the middle of the region, comprising approximately 3,000 ha, that produces huge swarms of nuisance mosquitoes each year. Since these mosquitoes emerge within close proximity of the large number of people that live, work, or recreate within the Fraser Valley, these mosquitoes can result in significant annoyance to residents, businesses, and visitors.

The region continues to grow with regards to population, economic opportunities, and recreation tourism. During years of high mosquito infestation, the impact can be considerable. Consequently, the FVRD has managed a Nuisance Mosquito Control Program since prior to regional district amalgamation in 1995. Rather than eradication, which is neither possible nor ecologically desirable, the goal of this program is to reduce the quantity and duration of nuisance mosquitoes to tolerable levels.

This Pest Management Plan has been prepared to describe the FVRD's Nuisance Mosquito Control Program and to obtain authorization through the Ministry of Environment and Climate Change Strategy under the *Integrated Pest Management Act*.

It is important to note that the target of the FVRD's mosquito control program is nuisance mosquitoes that typically emerge from floodplain waters and seepage areas. While there may be future need for controlling other types of mosquitoes within the region, such as mosquito vectors involved in the transmission of West Nile Virus, doing so would be considered outside the scope of this PMP and would be conducted under the direction and authority of the Minister of Health under their own PMP.

[1] Health Canada, 2013
[2] USEPA, 2016
[3] CGSB, 2018

1.3 Geographic Boundaries of Plan Area

The FVRD covers approximately 115,000 hectares in the southwest corner of BC (Figure 2). The region includes six municipalities (the Districts of Mission, Hope, and Kent, the Cities of Abbotsford and Chilliwack, and the Village of Harrison Hot Springs), and eight Electoral Areas. It is a vast area bisected by the mighty Fraser River. Approximately 296,000 people live within the region, the majority of which are concentrated near the banks of the river or its tributaries, much of which is productive mosquito breeding habitat.

This PMP will cover all public lands throughout the FVRD where nuisance mosquitoes breed[4]. Maps of the larval development sites where pesticides may be considered for mosquito control purposes under this PMP are provided in Appendix I.

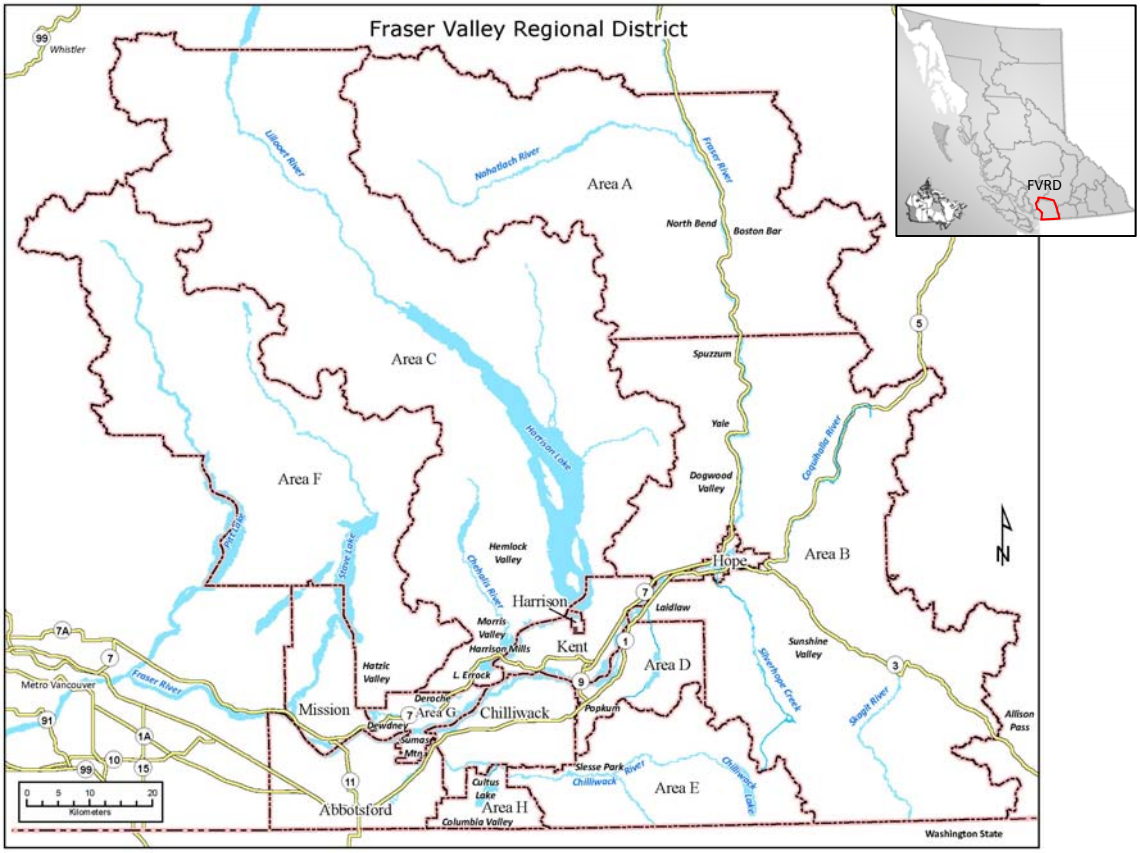

Figure 2. Map of the FVRD.

1.4 Term of Plan

This PMP covers a 5-year term from May 1, 2019 to April 30, 2024. All mosquito control activities carried out by the FVRD and its Contractors will be in accordance with this PMP for its duration.

[4] Floodwaters that occur over private property may also be treated under this program with the approval of the land owner. Treatment may also be conducted on First Nation lands with the approval of the First Nation.

1.5 Contact Information

The FVRD mosquito control program is conducted by mosquito control contractors. Within the FVRD, the primary contact for information related to this Pest Management Plan is:

Lance Lilley, Environmental Planner
45950 Cheam Ave. Chilliwack, B.C. V2P 1N6
Email: llilley@fvrd.ca
Phone: 604-702-5006

2. INTEGRATED PEST MANAGEMENT

The FVRD's Nuisance Mosquito Control Program is based on the principles of Integrated Pest Management (IPM), in that the most environmentally sensitive methods of control are considered first. Over the years, in an effort to eliminate chemical applications, the program's emphasis has shifted from targeting adult mosquito populations to increased monitoring of breeding sites and subsequent treatment of mosquito larvae. By managing potential mosquito breeding sites to prevent mosquitoes from becoming pests, monitoring their populations, and using a biological larvicide to supress mosquito populations to acceptable levels, this program is in keeping with IPM principles.

There are a number of Acts and Guidelines that govern mosquito control, either directly or indirectly. Some of these are at a federal level (e.g., *Pesticide Control Products Act* which summarizes the registration and availability of pesticides and prohibits application under unsafe conditions). Some are at a local level (e.g., *FVRD Mosquito Abatement Bylaw #0468, 2001*, which provides statutory approval to the FVRD under the *Local Government Act* to provide mosquito control services – see Appendix II).

The primary regulatory tool governing the use of pesticides in BC, including requirements for Pest Management Plans, is the *Integrated Pest Management Act* (*IPMA*) and its associated *Regulation* (*IPMR*). Section 58(2) of the *IPMR* identifies the following six elements that are to be included within a PMP:

1. A strategy that will be used to prevent organisms from becoming pests;
2. The process that will be used to accurately identify pests targeted by the plan;
3. A description of the monitoring program that will be implemented;
4. The process for deciding when pesticide treatment is to be conducted;
5. A description of the treatment methods that will be employed; and
6. A method for evaluating effectiveness of the treatments.

Each of these elements is discussed below.

2.1 Prevention

Preventing pests from occurring before they can become pests is the optimal method of pest management. In addition to larviciding, the primary treatment method as part of the FVRD's Nuisance Mosquito Control Program which is discussed in a later section, preventative actions include decreasing mosquito breeding habitat, increasing the abundance of natural mosquito predators, and conducting public education.

Removing mosquito breeding areas

Mosquito breeding habitat is critical for the production of mosquitoes. With respect to floodwater mosquitoes, this habitat typically consists of low-lying floodplain or seepage sites along a river corridor that becomes periodically wetted during freshet or snowmelt conditions. In prior decades, mosquitoes were so devastating that drastic and expensive large-scale measures were taken to reduce their numbers through any means necessary, including draining lakes and filling in wetlands. These large-scale projects are no longer conducted as part of pest control efforts, but smaller scale habitat modifications can still be considered to reduce local mosquito production.

For example, landowners who have floodwater mosquito breeding sites on their property may have the opportunities to reduce standing water by modifying the drainage of the site. These projects are encouraged, if they can be conducted by following all local, provincial, and federal legislative requirements. Other opportunities to reduce mosquito breeding areas is by working with local environmental groups undertaking salmonid enhancement projects that restore or enhance salmon habitat within the region. By incorporating design features into these projects such as steep-sided banks that reduce the surface area of wetted soil exposed to water fluctuations, these projects can benefit local fish species as well as reducing mosquito breeding potential at the site.

In reality though, there are few instances in which habitat modification would be possible and effective at having a measurable impact on the region's mosquito populations. Consequently, this is not considered to be a significant component of the FVRD's mosquito control program.

Increasing the abundance of mosquito predators

Restoring habitat features to increase the presence of natural mosquito predators helps to provide some level of control on local mosquito abundance. A single bat can eat hundreds of mosquitoes each night. Restoring habitat to increase the abundance and diversity of native amphibians, dragon flies, salmonids, etc. would help to reduce the population of mosquitoes by increasing the predation pressure on either adult mosquitoes or their larvae.

The FVRD encourages ecosystem enhancements that improve biodiversity and ecological resilience by controlling invasive species and by partnering with organizations such as the Fraser Valley Watersheds Coalition to restore and enhance habitat values. As with modifying mosquito breeding habitat however, these efforts are encouraged and may result in local benefits on mosquito populations, but do not replace the need for regional larvicide treatments.

Public education

Informing residents about the program, as well as about measures they can undertake for their own protection are important aspects of the FVRD's mosquito control program. Adulticiding, when it was conducted 20+ years ago, was highly visible and done in full view of homeowners. The current program of treating mosquito larvae in remote areas often away from public view requires more active outreach and education to inform the public about the program.

The primary methods for dissemination of information to the public are the media (both traditional and social) and personal communication.

Personal Communication: Personal communication is perhaps the most important method of public relations. In the field and in the office, Mosquito Control Technicians are regularly approached by residents with a variety of questions and challenges. These interactions also provide the opportunity to share information with residents regarding nuisance mosquitoes and their habitat, about the FVRD's Nuisance Mosquito Control Program, and about measures they can take reduce mosquito exposure or reduce mosquito breeding sites on their property, such as emptying containers or tires. Homeowners and residents are also encouraged to consider habitat modifications to restore biodiversity on their property or reduce standing water.

In addition, the FVRD manages a dedicated email (mosquitoes@fvrd.ca) and hotline (1-888-733-2333) for members of the public who would like to report high levels of mosquitoes. This provides an opportunity to not only collect information on hotspots that may indicate new or unknown breeding sites, but also to answer questions or to arrange site visits by field technicians. Contractors may also attend community events or farmers markets to further engage the public.

Media & Social Media: While local newspapers or radio stations are still utilized, social media has become more and more important in disseminating information about the program. The FVRD's mosquito control contractors have active Facebook™ and Twitter™ accounts that are regularly updated with information about current water levels, mosquito larvae conditions, tips for homeowners, and where the mosquito control technicians are conducting treatments. Because monitoring and larval treatments typically occurs out of the public eye, it is important to reassure the public that the FVRD's Mosquito Control Technicians are in the field and active.

2.2 Pest Identification

Accurate identification of the target pest is a critical element of an effective and efficient IPM program that avoids negative impacts on non-target species. There are approximately 3,100 species of mosquitoes world-wide and at least 17 species within the FVRD (Table 1)[5]. The most predominant mosquito species in the Lower Mainland are *Aedes vexans* and *Aedes sticticus*, commonly known as floodwater mosquitoes or nuisance mosquitoes. It is these floodwater mosquitoes that are the focus of the FVRD Nuisance Mosquito Control Program. Mosquitoes that breed in habitats other than the floodplain (e.g., storm drains), such as species of *Culex* which are known vectors of West Nile Virus, will be controlled, if needed, under the authority of Fraser Health.

[5] An 18th species, *Aedes japonicus*, has been recorded within the region but its distribution and abundance remain uncertain.

Table 1. Known mosquito species within the FVRD.

Species	Habitat	Predominant Prey
Aedes atropalpus	rock pools, artificial pools	Mammals
Aedes cinereus	semi-permanent mixed cattail / sedge marsh, sphagnum bog	Mammals
Aedes communis	forest pools / deciduous	Mammals
Aedes fitchii	most semi-permanent pools	Mammals
Aedes sierrensis	tree holes, artificial containers	Mammals
Aedes sticticus	floodwater pools and riparian margins	Large mammals, incl. humans
Aedes vexans	floodwater grasses	Birds/Mammals
Anopheles earlei	wooded areas / pools with floating debris	Mammals
Anopheles punctipennis	wooded areas / pools with floating debris	Mammals
Coquillettidia perturbans	permanently wet marshes, cattails	Birds/Mammals
Culex pipiens	water containers, even sewage and manure polluted water	Birds
Culex tarsalis	permanent / semi-permanent ponds, irrigation, ditches	Birds/Mammals
Culex territans	permanent pools, artificial containers (see *C. tarsalis*)	Amphibians
Culiseta impatiens	semi-permanent pools / bogs, shaded forest pools	Mammals
Culiseta incidens	diverse – open or shaded pools, permanent streams / ditches	Mammals
Culiseta minnesotae	found in most water, containers, pools, ponds	Birds
Culiseta morsitans	found in most water, containers, pools, ponds	Birds

Aedes vexans and *A. sticticus* are active in the summer throughout the spring freshet and successive high water events. A high water event is when water levels exceed the bankfull depth and moves into and/or past the first band of riparian vegetation. Within the Lower Fraser River, river level variation is primarily governed by snowmelt occurring in the upstream portions of the Fraser River Watershed occurring elsewhere in BC. Frequent and large amounts of local precipitation can also affect river levels, though typically to a lesser degree than snowmelt.

As opposed to other mosquitoes, *A. vexans* and *A. sticticus* lay their eggs on damp substrate in areas with a high flooding potential (thus the term 'floodwater mosquitoes'). New hatches of mosquitoes can occur with each successive peak in the Fraser River water level as more soil gets wetted and more mosquito eggs become activated.

The most reliable and effective means of determining whether a mosquito larva is a floodwater species or not is the habitat where the larvae is found and the time of year. The main mosquito habitats within the FVRD are floodwater habitats, seepage habitats, local habitats (e.g., swimming pools, used tires), and standing water habitats (e.g., stagnant ditches or swamps). Only floodwater and seepage habitats are significant for the breeding of nuisance mosquitoes (*A. vexans* and *A. sticticus*) in the Fraser Valley. Mosquito larvae observed in floodwater or seepage sites during the spring or early summer, shortly after river levels has begun rising during the annual freshet, can generally be considered to be one of those two nuisance species.

Floodwater Habitats

As mentioned earlier, floodwater sites are prevalent along the Fraser River corridor of the FVRD, providing abundant mosquito development habitat. As water levels rise, typically during freshet, areas along the banks or the multitude of islands within the Fraser River become saturated.

Of all the habitat types in the FVRD, floodwater habitats are by far the most productive for nuisance mosquitoes. Larval densities can reach more than 4,000 per litre of water, or approximately eighty million per hectare[6]. The mosquito species that breed in these areas are mostly of the genus *Aedes*, common human-biters. This is also the easiest habitat in which to predict activity, as it generally becomes active when the river levels rise.

Seepage Habitats

As the river levels rise, so do the groundwater levels. Higher groundwater can manifest itself as surface water in low-lying areas on the protected sides of the dykes that surround the Fraser River, Vedder River, around Nicomen Slough, and Norrish Creek. It can be challenging to predict mosquito activity within these sites because seepage is not necessarily correlated to Fraser River levels, which can be easily monitored with river gauges. Rainfall can exacerbate the water levels in seepage habitats: if the ground is already saturated, then the rain water will sit on the surface creating even more breeding areas.

Seepage habitats tend to produce similar species of mosquitoes as floodwater habitats (i.e., *Aedes sp.*). These habitats tend to produce fewer overall mosquitoes, but the challenge these sites represent from a treatment perspective is that the water in them is usually warmer. Warmer water leads to faster larval development, and hence decreases the window of opportunity to locate and treat these sites while mosquitoes are still in larval form. Although slightly less productive than floodwater habitats, mosquito annoyance due to seepage sites can be more noticeable due to the fact that the sites are typically closer to residential areas or where people are working outdoors.

2.3 Monitoring

Monitoring of water levels and mosquito larvae development is essential for an efficient and effective floodwater mosquito control program and is the key component that allows field technicians to know where to treat as well as when to treat. If treatments are applied too early, the larvae will not have started feeding yet and the product will be wasted and ineffective; if applied too late, the larvae will be in the pupal stage (i.e., non-feeding stage) or will have already hatched into adults. Monitoring of water levels and larvae development is critical for the judicious and timely application of larvicide and for the flexibility to adjust applications in response to species or environmental conditions as required.

This program conducts three types of monitoring: environmental conditions, larvae development, and adult mosquito presence.

[6] Wood, Dang, and Ellis, 1979.

Monitoring Environmental Conditions

Fraser River levels are indirectly affected by ambient temperature and precipitation accumulation that occur near snow basins associated with the Fraser River. The weather stations at Mission, Hope, and Prince George serve as representative sites that provide up-to-date information on river levels. The Prince George region is a particularly important site to monitor because it is close in proximity to the headwaters of the Fraser River. Typically, weather experienced in Prince George during early spring/early summer will be reflected in Fraser River levels approximately a week later.

High ambient temperatures in snow basins associated with the Fraser River, such as those around Prince George, are also important to monitor as it can result in significant snowmelt in the early portion of the season. As such, a large volume of water is added to the Fraser River, increasing levels, and lending to mosquito development site creation. Precipitation is also important to monitor as it can contribute to water levels, particularly in seepage sites or when the ground is already saturated.

Precipitation can also affect the severity of a mosquito season in a more indirect manner. If precipitation occurs during an aerial campaign, it may result in a delay. Poor visibility will ground the helicopter until it is safe, and pesticide cannot be disseminated during a rain event because the product will coagulate and potentially obstruct the helicopter's hoppers. Wet foliage will also lessen the amount of pesticide that penetrates the canopy and gets into the target waters.

Monitoring Larval Mosquitoes

While environmental conditions provide a valuable indicator of larvae development, actual sampling for, and counting, mosquito larvae is still essential. In order to maximize treatment success, it is imperative to know where precisely nuisance mosquito larvae are located, what their density is, and what stage of development they are in.

All known mosquito development sites are monitored by Mosquito Control Technicians, at a minimum on a weekly basis from May through August, and entered into a database. During high water years, sites may be monitored more frequently, depending on environmental conditions (e.g., precipitation, ambient temperature). Using a standard dipper, field technicians record the number of larvae within the dip sample, describe the larval development stage (instar), the location (using GPS coordinates), the date, relevant weather information, the mosquito species (if possible), and make any field observations that might assist with the site assessment.

From these results, treatment appropriateness and timing can be determined. If the larvae have not yet hatched, or they are too early in their developmental cycle, a return date will be set to continue monitoring.

Monitoring Adult Mosquitoes

There are three main methods used to monitor adult mosquito populations: a) public complaints; b) landing biting counts; and, c) adult trapping. These methods combine to give an idea of mosquito emergence, abundance, and species distribution.

a) ***Public Complaints:*** During years of high water, the greater than normal mosquito activity often elicits a multitude of complaint phone calls to the FVRD's Mosquito Control Hotline. The address and contact information of these callers is recorded so that follow-up can be conducted. The numbers of calls received is often correlated with river levels, which relates to the relative abundance of mosquitoes emerging in a year. The calls can also indicate specific locations where adult mosquitoes are problematic, helping to identify hot spots of mosquito activity to direct staff to new, potentially unmapped, mosquito development sites.

b) ***Landing Biting Counts***: Landing biting counts entails a Mosquito Control Technician counting the number of mosquitoes that land on an exposed forearm in one minute. The standard measure used to signify high annoyance in three bites per minute. While not typically performed as a metric of adult mosquitoes, technicians use this method when discussing mosquito levels with the public as a way of determining relative abundance or trends.

c) ***Adult Mosquito Traps:*** The FVRD utilizes a series of 'New Jersey Light traps' placed strategically around the region which are regularly monitored by field technicians. Traps are monitored every 2-3 weeks throughout the season beginning as soon as adult nuisance mosquitoes emerge, usually in May or June, and continues throughout the summer. The traps help to determine relative mosquito abundance, which acts as a quality assurance/quality control measure for larval mosquito control. The results are also used to compare intra- and inter-annual nuisance levels of mosquitoes, to determine the relative species composition within the region, and to note any changing trends or new species.

2.4 Treatment Thresholds

Determining if mosquito larvicide will be applied to a site, and if so, determining precisely when and where it will be applied, is a critical element of an IPM approach. Mosquito development sites are evaluated for possible treatment based on a number of criteria and treatment thresholds related to productivity, species of mosquito produced, and proximity to people.

Productivity

Productivity is the first determination to be made regarding a mosquito development site during normal conditions. Productivity is measured as the number of mosquitoes produced during peak activity. This number is determined as the potential density of larvae[7] multiplied by the approximate size in hectares of the development site. Higher potential for mosquito infestation equates to a higher treatment priority. Many of the islands in the Fraser River are high priority based solely on size; many are more than 200 hectares and the perfect development grounds for *A. vexans*, and *A. sticticus*. Treatment is considered if greater than five larvae of target mosquito species are recorded per dip.

Target Species Presence

Most mosquitoes found in the FVRD region are not considered a nuisance. The target species of the FVRD Nuisance Mosquito Control Program are part of the floodwater complex belonging to the genus

[7] Density is measured as the number of larvae observed per standard 350 ml dip.

Aedes, known biters of people and livestock. These mosquitoes are found in flood and seepage water areas, mostly those associated with larger systems (Fraser River, Vedder River, Stave Lake, etc.).

Proximity to People

An adult floodwater mosquito has a dispersal limit of approximately 3 km from their larval development site. Consequently, larval development sites within 3km of key residential, tourism, or agricultural areas are considered within the threshold to treat. Prevailing winds may extend this dispersal range and are taken into consideration.

Of the highly productive sites, priority is given to those that are closest to residential areas. For obvious reasons, these sites draw the most public complaint as the mosquitoes reduce enjoyment of their property or their community. Agricultural properties are also prioritized, as mosquitoes can have a profound effect on all areas of agriculture. In years of heavy mosquito infestations, livestock, milk, and poultry production can be adversely affected. Fruit and vegetable production is also affected from the harvesting perspective as many farmers find it difficult to hire and keep workers in a field that is inundated with adult mosquitoes. Also considered is proximity to sites used for recreation or tourism, such as campgrounds, boating, fishing, cycling, walking, or hiking. These activities, and the economic revenue they represent to the region and quality of life it offers, can be impacted during years with large mosquito populations.

Decision Making

As a general guideline, treatment shall be considered in sites that satisfy the above proximity requirements when water dip samples have confirmed the presence of late instar *Aedes sp* mosquito larvae at or greater than the treatment threshold of 5 larvae per 350 ml dip. Exceptions may be made to this threshold however and a certified applicator working for the FVRD will make the final decision as to whether or not larval treatment is justified in an area.

The intent of the following flowchart (Figure 3) is to assist regulators and FVRD staff with decision-making regarding mosquito treatment for common nuisance or floodwater mosquitoes. Note that this chart is not intended for treatment of mosquitoes for purposes of disease reduction or public health, only treatment of nuisance mosquitoes.

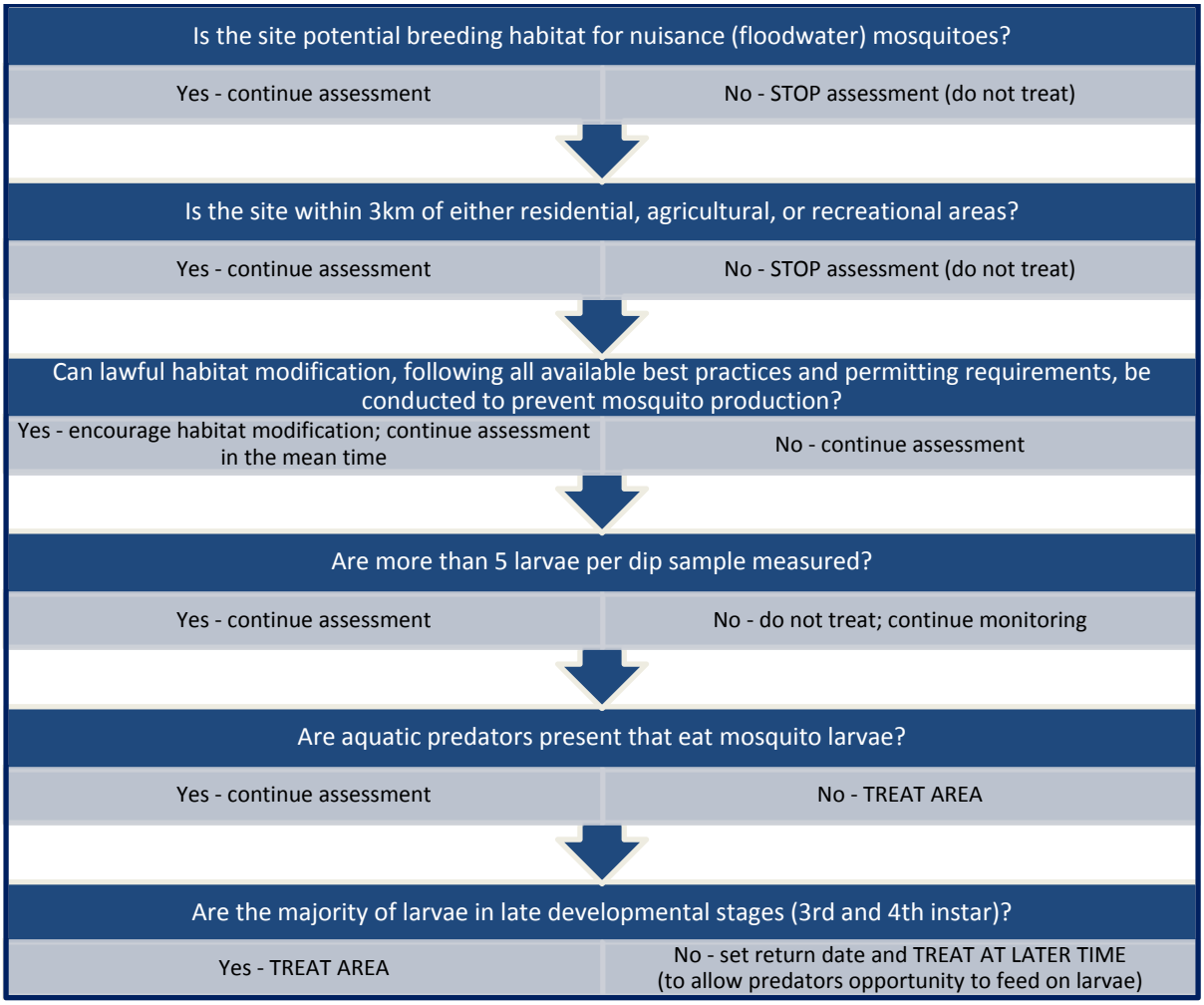

Figure 3. FVRD mosquito control contractors are expected to follow this flowchart when deciding to conduct mosquito treatment in a site or not. Factors or conditions that may require modification to this flowchart include: disease occurrence; unforeseen biological or environmental conditions; new legal requirements; budgetary constraints; or availability of suitable larvicides and susceptibility of mosquito populations to larvicides.

2.5 Treatment Methods

The FVRD Nuisance Mosquito Control Program focusses on controlling floodwater mosquitoes while they are still in a larval stage. Adulticiding, or 'fogging', which is considered the least efficient, least target-specific, and least effective mosquito control treatment and is associated with a plethora of human health and environmental impacts[8], is not utilized as part of this program. Fortunately, modern mosquito control methods that target the mosquito larvae using bacterial agents have much less impact on the environment and are much more effective at controlling the abundance of nuisance mosquitoes.

If treatment thresholds are satisfied, the certified Mosquito Control Technician then has to decide whether ground treatments or aerial treatments are preferred for the particular location.

[8] Culex Environmental Ltd, 2010.

Hand Treatments

Hand, or ground, treatment is the process of applying larvicide into mosquito larvae breeding sites using a calibrated backpack applicator or other handheld device (e.g., bucket). Access to breeding sites is typically by foot or boat. This treatment method is generally highly effective and efficient; however, depending on the site, can be relatively time-consuming and challenging based on access, terrain, and size of area requiring treatment.

Unless conditions require an alternative application method, ground treatments are preferred for a number of reasons: (1) application rates are lowered, thereby reducing pesticide use; (2) application timing can be more specific, thereby increasing efficacy; and (3) application precision is dramatically increased, again reducing pesticide use.

Aerial Treatments

When large areas become active simultaneously, particularly when water temperatures are warmer than usual creating faster larvae development, or when breeding sites are prohibitively difficult to access, treatment can be conducted by air rather than by ground. Aerial application of larvicide within the FVRD must utilize a fixed hopper attached to a helicopter[9], calibrated to release pesticide at a pre-defined rate. This allows larvicide to be applied over large areas in a short amount of time and allows easier access to breeding sites that cannot be accessed by ground or boat. Aerial treatments are effective, but due to costs associated with helicopter usage and higher application rate (to penetrate vegetation hanging over the water) it is only conducted when necessary.

An important emerging technology in the mosquito control field is the application of un-manned aerial vehicles (drones) for larval mosquito control in select locations. Current technology allows for small-scale application of liquid and granular payloads in areas that are deemed too small for traditional aerial applications (helicopters) and too large or otherwise inaccessible to ground treatments. All un-manned aerial vehicle treatments will be conducted strictly adhering to Transport Canada Regulations and certification and training requirements. Only registered *Bti* products can be used for this application.[10]

2.6 Evaluation

Evaluating treatment success is the remaining required element of an IPM approach in order to identify opportunities for improving and refining the program.

The most direct and effective method used to determine the success of mosquito larvicide treatment is to conduct follow-up larval sampling where the larvicide had been applied. Post-treatment monitoring is usually conducted within 24-48 hours of treatment using the same methods described for pre-treatment monitoring. Larvae counts collected post-treatment are compared to monitoring

[9] Equipment classified as a slung load or a jettisonable load will not be utilized to improve application efficiency and reduce pesticide usage.

[10] Un-manned aerial vehicle use, at the time of writing, is not yet a label-permitted activity, but label restrictions are anticipated to be updated and amended to address this emerging application method. Un-manned aerial vehicles may be utilized as part of this program if pesticide labels are updated to permit this application method.

results collected pre-treatment, and depending on the information collected, treatment product or methods could be adjusted, and re-treatments may be conducted as necessary.

Treatment success can also be evaluated, albeit more indirectly, by adult mosquito trap counts and complaint calls received via the hotline. This information can help determine the effectiveness of control efforts and can help identify potentially previously unknown mosquito breeding sites.

As will be described in Section 3, the FVRD's Nuisance Mosquito Control Program's biological bacterial agents belong exclusively to the genus *Bacillus*. As these products have shown very limited or no adverse effects on non-target species when applied according to label directions, post-treatment evaluation of environmental effects is not typically undertaken as part of the program.

3. OPERATIONAL INFORMATION

In addition to the elements described in the previous section, the *Integrated Pest Management Regulations* also require a PMP to include the following critical information: identification of the pesticides proposed under the PMP; methods utilized for safe transport, handling, use, and disposal of the pesticides; and strategies to ensure environmental protection (*IPMR 58(3)*).

Proposed Treatment Products:

The two active ingredients approved for use under this PMP are *Bacillus thuringiensis israelensis* (*Bti*) and *Bacillus sphaericus* (*Bsph*). Both of these active ingredients have been thoroughly studied and are commonly used in IPM programs as alternatives to chemical pesticides.

The primary product in use at the FVRD for controlling mosquitoes is *Bti*, a natural soil-borne bacterium that is specifically toxic to larvae of nuisance mosquitoes. It is added to the water where larvae are present, usually in a granular formulation where it is attached to an inert carrier (typically corn granules). When ingested by the larvae, the endotoxin produced by the bacteria is stimulated by the unusually alkaline conditions of the mosquito gut, resulting in larvae paralysis and death. Because most aquatic invertebrates do not have alkaline guts, ingestion of either the *Bti* pellet or of infected mosquito larvae has no toxic effect. *Bti* only remains active in the water column for a few days however, so accurate monitoring of larvae development is essential so that treatment occurs at the appropriate moment.

Bsph is a secondary product considered by the FVRD. This product has a similar mode of action to *Bti* and is also very specific to mosquitoes; however, it exhibits greater residual activity meaning that it can persist in the receiving environment for much longer. While not previously used as part of the FVRD Nuisance Mosquito Control Program, this longer persistence allows *Bsph* to have potentially useful applications, but its higher cost is a substantial consideration and any use of *Bsph* would need to be justified. Table 2 summarizes the pesticide formulations for *Bti* and *Bsph* that may be used as part of this program. See Appendix III for Material Safety Data Sheets on these products.

Table 2. Pesticides approved for use by the FVRD under this Pest Management Plan [11]

Product Trade Name	Active Ingredient	PCP No.	Active Ingredient Concentration in Product	Application Rate of Product	Area to be Treated (ha)	# of Permitted Applications Per site	Quantity of Product
Vectobac 200G	Bacillus thuringiensis Serotype H-14	18158	200 ITU/mg	3.0-10.0 kg/ha	3,000	15	15,000 kg
Aquabac 200G	Bacillus thuringiensis Serotype H-14	26863	200 ITU/mg	2.5-20.0 kg/ha	3,000	15	15,000 kg
Aquabac XT	Bacillus thuringiensis Serotype H-14	26860	1,200 ITU/mg	300-2,400 ml/ha	3,000	15	5,000 L
Vectobac 1200L	Bacillus thuringiensis Serotype H-14	21062	1200 ITU/mg	0.25-1.0 L/ha	3,000	15	5,000 L
Vectolex CG	Bacillus Sphaericus, Strain 2362	28008	50 ITU/mg	5.6-16.8 kg/ha	3,000	TBD	TBD

Both *Bti* and *Bsph* are considered extremely safe and effective larvicides. In general, the specificity of these larvicides for mosquitoes and their lack of effect on non-target fauna given allowable application rates are well documented.[12] While adverse effects have been recorded on a few invertebrate species, these impacts were only observed when application rates were many hundreds times greater than the allowable application rates.[13] Neither mammals nor fish are adversely affected by either bacterial species.[14]

Pesticide Applications:

The following terms and conditions apply for the application of pesticides as part of this program:

- The use of pesticides shall be for the purpose of controlling larval stages of *Aedes* spp., as well as other nuisance mosquito species including *Culex* spp., *Culiseta* spp., and *Anopheles* spp.

- Pesticide use is approved for the locations shown in the Treatment Area Maps (Appendix I).
    - Aerial use of Aquabac 200G, Vectobac 200G, and Aquabac XT may occur at locations outside the treatment area so long as detailed maps of proposed use areas have been submitted to the Deputy Administrator at least two working days prior to proposed pesticide use, the maps of the proposed use area are posted at the permittee's office, and the Deputy Administrator does not otherwise reject the proposed use.

    - Ground-based use of Aquabac 200G, Vectobac 200G, and Vectobac 1200L may occur at locations outside the treatment area provided that detailed maps of the treated

[11] Product use quantities are based on maximum potential needs and not anticipated needs. The lowest application rates and quantities possible will be used to achieve permit and *IPM Act* objectives.
[12] Mathavan & Velpandi, 1984; Mulla et al., 1984; Ali & Nayar, 1986; Aly & Mulla, 1987; Karch et al., 1990; Lacey & Mulla, 1990; and Mulla, 1990
[13] Lacey and Mulla, 1990
[14] Lacey and Siegel, 2000; Lacey and Merritt, 2003; Brown et al., 2004; Hurst et al., 2007; Sternberg et al., 2009

areas are submitted to the Deputy Administrator and are posted at the permittee's office within two working days after the pesticide use.

- All pesticide use must comply with the directions on the product label and shall be restricted to registered purposes and application approaches.

- Aquabac 200G, Vectobac 200G, Aquabac XT, and Vectobac 1200L shall be applied to water bodies where water dip samples have confirmed the presence of *Aedes* sp mosquito larvae at or greater than the treatment threshold of 5 larvae per 350 ml dip. Records of larvicide use will be kept and post-treatment surveys shall be performed to assess the control efficacy.

- Aquabac 200G, Vectobac 200G, Aquabac XT, and Vectobac 1200L may be used in all water bodies according to the product label with a primary target of 3rd or 4th instar (i.e., late larvae stages) to allow as much natural predation of larvae as possible prior to adult emergence. If the level of the Fraser River passes 4.5m at the Mission gauge, then all instar may be targeted.

- Prior to the start of any control season, and at regular intervals throughout, all equipment used for application will be properly calibrated.

- Contractors will be directed to refer to the product label for appropriate application rates for both ground and aerial applications.

Environmental Protection:

Over the past few decades, environmental regulations have become considerably stronger, more knowledge has been gained about environmental impacts, and the punishment for mismanagement of chemicals and other pollutants has increased. Substantial efforts are made to avoid pollution events and to mitigate the potential impacts of such events. Table 3 outlines potential accidents (including pollution events), potential harm to the environment, and the preventative and mitigation procedures put in place as part of the program. Spills of any material (e.g., fuel) that result in impacts not authorized by or consistent with this permit will be immediately cleaned up and reported to Provincial Emergency Program at 1-800-663-3456. The Deputy Administrator will be provided with reports on the spill, clean-up activities, and decontamination actions.

Table 3. Prevention and mitigative procedures identified to prevent and respond to potential accidents.

Accident	Activity	Impact	Prevention and Mitigation
Spill	Transportation, Storage, or Application	• Site contamination • Soil contamination	• Proper storage facility • Proper transportation equipment • Training all staff in Workplace Hazardous Materials Information System (WHMIS) • Appropriate containers • Minimize movement
Leak	Transportation, Storage, or Application	• Site contamination • Soil contamination	• Proper storage facility • Proper transportation equipment • Training all staff in WHMIS • Appropriate containers • Minimize movement • Complete equipment maintenance

Overspray [15]	Application	• Damage to sensitive habitat • Residential/agricultural intake contamination	• Strict application procedures • All personal holding Pesticide Applicator Certificate (Mosquito and Biting Fly)
Misapplication	Application	• Illegal application • Damage to sensitive habitat	• Strict application procedures • All personal holding Pesticide Applicator Certificate (Mosquito and Biting Fly)

Mixing and handling of pesticides provides an opportunity for accidental spillage. The following instructions will be provided to all personnel involved in the handling of larvicide products to limit the potential for spills and reduce wastage:

- Product will be stored in a dry, temperature-controlled facility that remains locked and with adequate signage.
- ALWAYS read and follow the label before starting. Follow label recommendations for personal protection measures, application rates, and safety procedures.
- Open container bag with a sharp knife (do not tear).
- Transfer product to application equipment in a dry and stable location.
    - Do NOT transfer over water.
    - Do NOT allow product to become wetted before application.
- If any product is spilled STOP IMMEDIATELY and collect the spilled product.
- Any spilled granules should be collected and used first via hand application (to avoid damaging application equipment).
- Dispose of container according to label recommendations.

Additional precautions that will be undertaken to ensure environmental protection include:

- Where treatment areas overlap with identified Species at Risk Critical Habitat, contractors will refer to the appropriate Recovery Strategy or Action Plan and ensure that mosquito larvicide treatments using a *Bacillus* product is not listed as an activity likely to destroy the species' Critical Habitat or one that would likely harm or kill the species.
- The location of any community watersheds or drinking water source intakes within the PMP area will be determined using the Province of BC's Community Watershed website[16]; no pesticide will be stored within the community watershed for more than 24 hours prior to their use and will be removed within 7 days of their use. If pesticide residues are detected at a community watershed water intake, larvicide applications will be discontinued until the local Medical Health Officer has been satisfied that all required measures have been implemented to preserve water quality.
- Due to the physical properties, their application directly to aquatic areas, and the lack of toxicity associated with the mosquito larvicides utilized as part of this PMP, pesticide

[15] The chance of either overspray or misapplication of pesticide has been drastically reduced as part of the FVRD Nuisance Mosquito Control Program since elimination of the chemical control component utilized previously.
[16] https://catalogue.data.gov.bc.ca/dataset/community-watersheds-current

treatments conducted in accordance with this PMP will not cause contamination of food intended for human consumption and do not represent a risk to fish and aquatic organisms (other than mosquito larvae) or wildlife. As per the *Integrated Pest Management Regulations*, due to their low toxicity and limited environmental impacts, bacterial agents belonging to the genus *Bacillus* used for mosquito larviciding programs are exempted from both the no-treatment zones and pesticide-free zones requirements for protection of water sources and bodies of water.

- All treatment is conducted above the high water mark and not considered permanent, fish bearing bodies of water or waters that have permanent, direct, surface-water connections with fish bearing bodies of water (as per s78(1) of IPMR).
- Care will be taken to minimize potential impacts from field technicians working within riparian and wildlife habitat by staying on paths or existing trails and avoiding trampling native vegetation. There will be no re-fueling of machinery or application equipment, no mosquito larvicide mixing, and no disposal of unused larvicide or personal garbage, within 15m of riparian areas or sensitive wildlife habitat or fish bearing bodies of water that have permanent, direct, surface-water connections with fish bearing bodies of water.
- All pesticide application equipment used by FVRD contractors will be kept clean and in good repair and be kept calibrated appropriately for the larvicide being applied. Application equipment shall be re-calibrated when larvicide active ingredients or formulations are changed and immediately when variation in output is noticed.

4. REPORTING, NOTIFICATION, AND CONSULTATION

Under the Integrated Pest Management Regulation, the FVRD or its contractors are required to maintain records of pesticide applications, submit annual records and notices of intent to treat to the Province, and undertake prescribed consultation requirements as part of the PMP.

4.1 Records and Reporting

The FVRD will maintain records of all pesticide applications, including:

- Treatment locations
- Larvae monitoring results (both pre- and post-treatment)
- Treatment date and time
- Pesticide used
- Method of application
- Rate of application
- Total quantity of pesticide used
- Relevant meteorological conditions
- Reasoning if treating is conducted within the 30m non-treatment zone around a water supply intake or well used for domestic or agricultural purposes.

Annual Reports of Pesticide Use will be provided to the Province for all areas treated for mosquitoes under this PMP. Specifically, these reports will include: contractor and client contact information, pesticide application permit number, the pesticide applicator license numbers belonging to all applicators, the dates and times of pesticide applications, the target mosquito species, the pesticide trade name and registration number, the method and rate of application, the total quantity used of each pesticide, environmental conditions during application (i.e., temperature, precipitation, wind velocity, etc.), the mosquito monitoring methods, and treatment triggers. Reporting of all mosquito control activities will be completed by the end of the same calendar year as the activities that took place. Permit non-compliance shall be reported to the Administrator within 48 hours of the infraction's discovery.

4.2 Notification

The FVRD's contractors will submit a 'Notice of Intent to Treat' to the Province prior to the start of each year's mosquito control program. This Notice will contain the name and address of the confirmation holder, a description or map of the proposed treatment locations, a description of the proposed treatment for each area, and the total area proposed for treatment.

In addition, written notification will also be given to the Province when any of the following conditions of this PMP change:

- The area of proposed control activities changes;
- The control methods change;
- The pesticides available to, and used by, this program change;
- Situations emerge that require control beyond the level permitted by the PMP, including but not limited to:
    - Extreme levels of mosquito activity
    - Emergence of vector-related disease
    - Identification of new significant mosquito species that requires treatment.

Notification will be given as soon as the triggering condition arises and program activities will continue status quo until such time as the Ministry has given approval for the change.

4.3 Consultation

The *IPMR* specifies that consultation with First Nations and the public be conducted when a PMP is being prepared. Prior to submitting a Pesticide Use Notice for PMP confirmation, the FVRD will conduct a thorough consultation process to abide by the requirements of the Act including the following process:

- Identify all First Nations potentially affected by the PMP and conduct appropriate consultation as per the 2011 "Ministry of Environment Draft Guidelines for IPM Proponents Conducting Consultations with First Nations";
- Identify all public stakeholders that will be sent direct letters;
- Draft an appropriate newspaper ad, as per the IPMR (S61(1)), and publish (twice) within local newspapers circulated within the communities affected by the PMP;

- Keep a detailed log of all consultation/communications and responses received;
- Prepare Consultation Summary Report and revise PMP if needed.

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6. APPENDICES

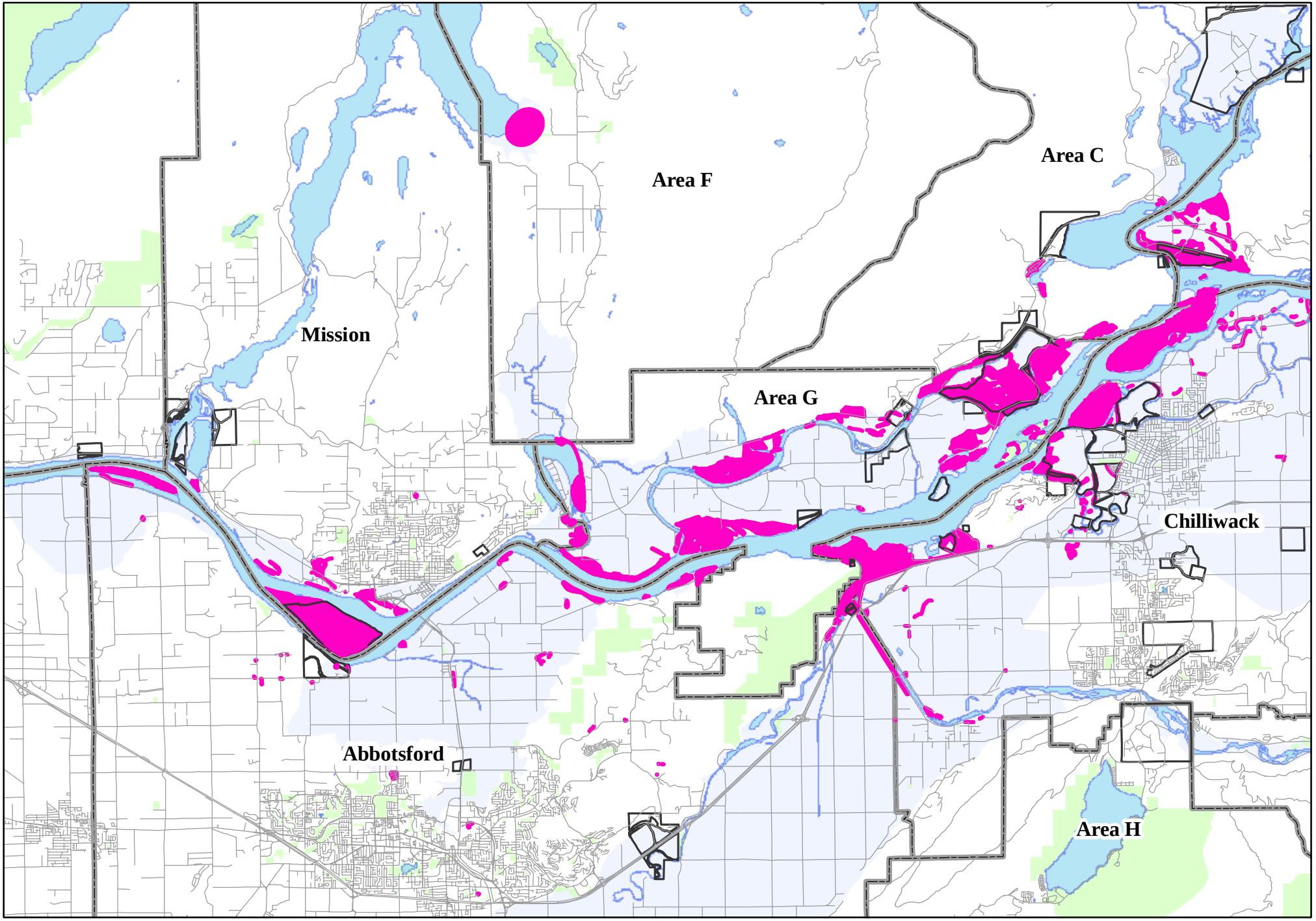
Appendix I: Mosquito Treatment Areas

Appendix II: FVRD Mosquito Abatement Bylaw No. 0468 (2001)

Appendix III: Material Safety Data Sheets (MSDSs)

Appendix IV: Confirmation of Receipt of Pesticide Use Notice

Appendix I: Mosquito Treatment Areas



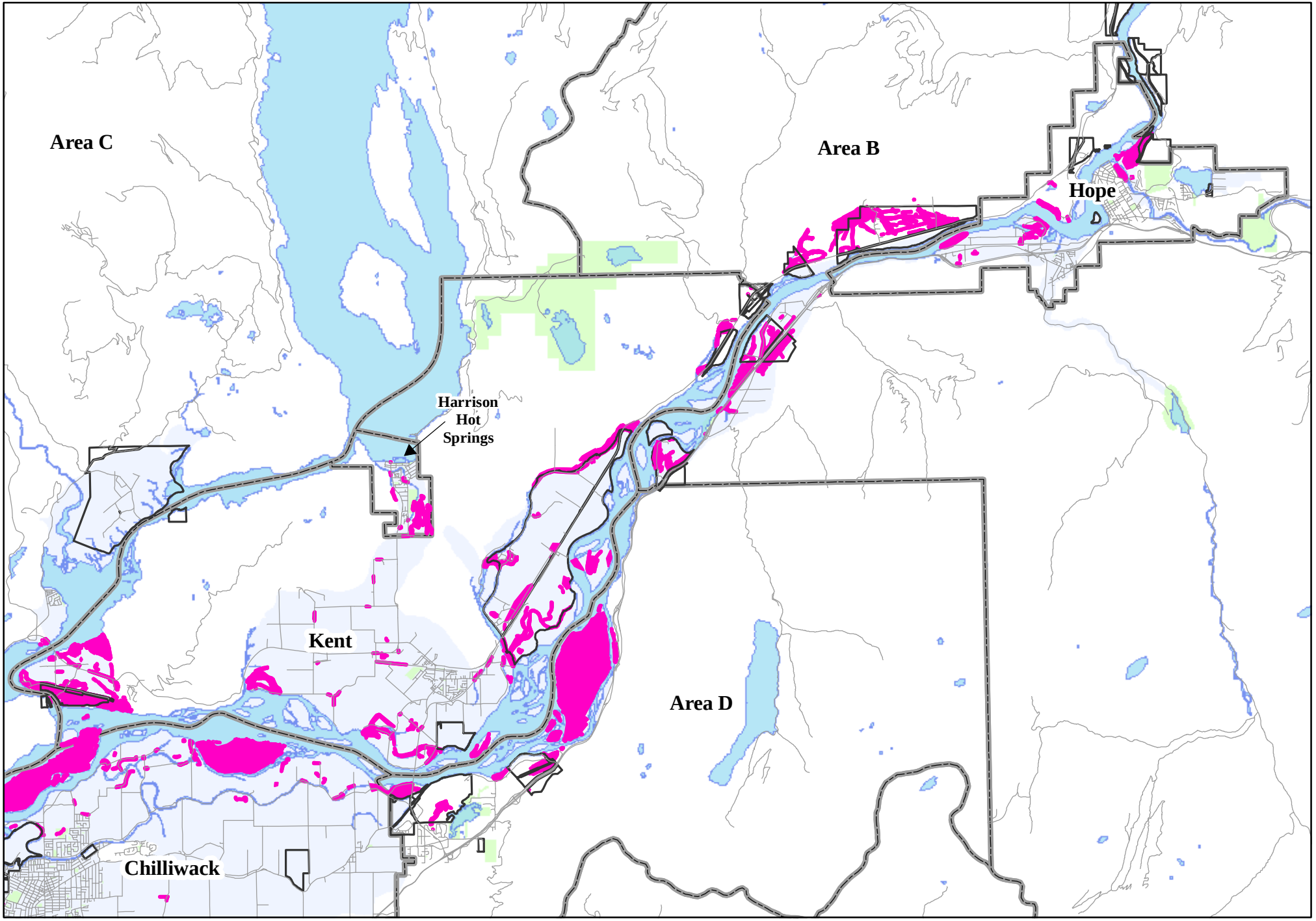
FVRD Mosquito Program Treatments Map 1 of 2

Roads
Treatment Areas
Municipal Boundary
Waterbodies
Parks & Protected Areas
Reserves
Floodplain

N

0 2 4 8
Kilometers

Map produced by the FVRD GIS Department, Nov. 2018
Sources may include: FVRD, GISI Inc.,
BC Ministry of Environment, Morrow BioScience



FVRD Mosquito Program
Treatments Map 2 of 2

Roads
Treatment Areas
Municipal Boundary
Waterbodies
Parks & Protected Areas
Reserves
Floodplain

N

0 2 4 8
Kilometers

Map produced by the FVRD GIS Department, Nov. 2018
Sources may include: FVRD, GISI Inc.,
BC Ministry of Environment, Morrow BioScience

Appendix II: FVRD Mosquito Abatement Bylaw No. 0468 (2001)

FRASER VALLEY REGIONAL DISTRICT

BYLAW NO. 0468, 2001

A Bylaw to convert the former Dewdney Alouette Regional District Mosquito Control function and the former Central Fraser Valley Regional District Mosquito Control Function to separate Service Areas; and to then consolidate and merge the Dewdney Alouette Mosquito Control Service Area, the Central Fraser Valley Mosquito Control Service Area, and the Fraser-Cheam Mosquito Abatement Extended Service Area into one service area

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WHEREAS the Fraser Valley Regional District was incorporated by Letters Patent effective December 12, 1995;

AND WHEREAS Article 11 of the Letters Patent incorporating the Fraser Valley Regional District provides that all services of the former Central Fraser Valley Regional District, Dewdney Alouette Regional District, and Regional District of Fraser-Cheam, in force and effect at the time of dissolution, whether established by legislation, regulation, order in council, letters patent, supplementary letters patent or bylaw pursuant to the former *Municipal Act, RSBC Ch. 290,* are services of the Fraser Valley Regional District, except as to those services described in Section 11.4 of the Letters Patent;

AND WHEREAS the Central Fraser Valley Regional District was granted the Mosquito Control function pursuant to Supplementary Letters Patent dated April 10, 1975 and amendments thereto, said function to include all lands within the current boundaries of the City of Abbotsford and Electoral Area H of the Fraser Valley Regional District;

AND WHEREAS the Dewdney Alouette Regional District was granted the Mosquito Control function pursuant to Supplementary Letters Patent dated January 18, 1973 and amendments thereto, said function to include all lands within the current boundaries of Electoral Areas F and G and portions of C of the Fraser Valley Regional District and the District of Mission;

AND WHEREAS the Regional District of Fraser-Cheam Mosquito Abatement Extended Service Area was established by the Regional District of Fraser Cheam Mosquito Abatement Extended Service Area Establishment Bylaw No. 1030, 1991, said service area to include all lands within the current boundaries of the City of Chilliwack, the District of Kent, the District of Hope, the Village of Harrison Hot Springs and Electoral Areas D, E and portions of Electoral Area B of the Fraser Valley Regional District;

AND WHEREAS the Board of Directors of the Fraser Valley Regional District wishes to extend the boundaries of the Regional District of Fraser Cheam Mosquito Abatement Extended Service Area to include all of Electoral Areas A, B and C of the Fraser Valley Regional District;

AND WHEREAS in accordance with Section 774.2(3) of the *Local Government Act, RSBC Ch. 323, 1996 (the Act)*, the Board of the Fraser Valley Regional District wishes to convert the Dewdney Alouette Regional District and Central Fraser Valley Mosquito Control functions to separate Service Areas;

AND WHEREAS Section 802.1 of the *Act*, provides that the Board may, by Bylaw, provide for changes to the boundaries of a Service Area, including the merger of two or more service areas;

AND WHEREAS the Board of Directors of the Fraser Valley Regional District wishes to consolidate and merge the Dewdney Alouette Mosquito Control Service Area, the Central Fraser Valley Mosquito Control Service Area, and the Fraser-Cheam Mosquito Abatement Extended Service Area into one service area, thereby establishing the Fraser Valley Regional District Mosquito Control Service Area;

AND WHEREAS the consent of at least 2/3 of the participants has been obtained in accordance with Section 802 of the Act;

NOW THEREFORE in open meeting assembled, the Board of Directors of the Fraser Valley Regional District enacts as follows:

1. CITATION

This Bylaw may be officially cited for all purposes as the " Fraser Valley Regional District Mosquito Control Service Area Conversion, Merger and Establishment Bylaw No. 0468, 2001".

2. ENACTMENTS

i) The Dewdney Alouette Regional District Mosquito Control function granted pursuant to Supplementary Letters Patent dated January 27, 1976 is hereby converted to and established as a Service Area;

ii) The Central Fraser Valley Regional District Mosquito Control function granted pursuant to Supplementary Letters Patent dated January 18, 1973 is hereby converted to and established as a Service Area;

iii) The boundaries of the Dewdney Alouette Regional District Mosquito Control Service Area, the Central Fraser Valley Regional District Mosquito Control Service Area, and the Regional District of Fraser Cheam Mosquito Abatement Service Area as extended to include all of Electoral Areas A, B and C of the Fraser Valley Regional District, are hereby consolidated and merged into a separate Service Area hereinafter referred to as the "Fraser Valley Regional District Mosquito Control Service Area";

iv) The boundaries of the Fraser Valley Regional District Mosquito Control Service Area shall be the boundaries of the Fraser Valley Regional District;

v) The participants of the Fraser Valley Regional District Mosquito Control Service Area shall be all of Electoral Areas A, B, C, D, E, F, G, and H of the Fraser Valley Regional District and all of the City of Abbotsford, City of Chilliwack, District of Mission, District of Kent, District of Hope and Village of Harrison Hot Springs.

v) In accordance with Sections 800.1 and 803 of the *Act,* the annual costs of the service may be recovered by:

(a) property value taxes imposed and collected under Part 24, Division 4.3 of the Act; and/or

(b) the imposition of fees and other charges in accordance with Section 797.2.

vi) In accordance with Sections 800.1, 805.1 and 806.1 of the Act, the maximum amount that may be collected or requisitioned for the service shall be $600,000. or $.04 / $1,000.00 of the net taxable value of land and improvements within the service area, whichever is greater.

3. REPEAL

i) Regional District of Fraser Cheam Mosquito Abatement Extended Service Area Establishment Bylaw No. 1030, 1991 and any and all amendments attached thereto are hereby repealed.

4. READINGS AND ADOPTION

READ A FIRST TIME THIS 27th day of NOVEMBER, 2001

READ A SECOND TIME THIS 27th day of NOVEMBER, 2001

READ A THIRD TIME THIS 27th day of NOVEMBER, 2001

APPROVED BY THE INSPECTOR OF MUNICIPALITIES THIS 21st day of JANUARY, 2002.

ADOPTED THIS 26th day of FEBRUARY, 2001.

Chair/Vice Chair

Administrator/Deputy

5. CERTIFICATIONS

I hereby certify the foregoing to be a true and correct copy of the "Fraser Valley Regional District Mosquito Control Service Area Conversion, Merger and Establishment Bylaw No. 0468, 2001"." as read a third time on the 27th day of November, 2001. Dated at Chilliwack, BC this 27th day of November, 2001.

Administrator/Deputy

I hereby certify that this a true and correct copy of the "Fraser Valley Regional District Mosquito Control Service Area Conversion, Merger and Establishment Bylaw No. 0468, 2001 as adopted by the Board of Directors of the Fraser Valley Regional District on the 26th day of February, 2002.

Administrator/Deputy

BRITISH COLUMBIA

No. _____

Statutory Approval

Under the provisions of section 801(1)(a) and 802(3)

of the *Local Government Act*

I hereby approve Bylaw No. 0468

of the Fraser Valley Regional District ,

a copy of which is attached hereto.

Dated this 21st ***day***

of January ***, 2002***

Deputy Inspector of Municipalities

Appendix III: Material Safety Data Sheets (MSDSs)

Material Safety Data Sheets for all of the *Bacillus*-containing mosquito larvacide products identified within this Plan (Aquabac 200G, Aquabac XT, Vectobac 200G, Vectobac 1200L, and Vectolex CG) can be provided upon request. Please contact Lance Lilley at the Fraser Valley Regional District: llilley@fvrd.ca if you would like to request a copy of any or all of these MSDSs.

Appendix IV: Confirmation of Receipt of Pesticide Use Notice

Will be updated upon receipt of Pesticide Use Notice