Integrated Mosquito and Vector Management Programs

APPENDIX

B

ECOLOGICAL & HUMAN HEALTH ASSESSMENT REPORT

Ecological & Human Health Assessment Report

Project Name	Integrated Mosquito and Vector Management Programs for Nine Districts
Date	June 2013, Revision 7

Prepared for:

Alameda County Mosquito Abatement District

Alameda County Vector Control Services District

Contra Costa Mosquito and Vector Control District

Marin/Sonoma Mosquito and Vector Control District

Napa County Mosquito Abatement District

Northern Salinas Valley Mosquito Abatement District

San Mateo County Mosquito and Vector Control District

Santa Clara County Vector Control District

Solano County Mosquito Abatement District

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Acronyms

$\mu g/cm^2$	microgram per square centimeter
2,4-D	2,4-Dichlorophenoxy acetic acid
AA-ITU	*Ae. aegypti* International Toxic Unit
ACMAD	Alameda County Mosquito Abatement District
ACVCSD	Alameda County Vector Control Services District
ae	acid equivalent
AI or a.i.	active ingredient
ALS	acetolactate synthesis
AMPA	aminomethylphosphonic acid
APEs	alkylphenol ethoxylates
ATP	adenosine triphosphate
BCF	bioconcentration factor
BCPC	British Crop Protection Council
BMP	Best Management Practice
Bs	Bacillus sphaericus
Bti	Bacillus thuringiensis subspecies israelensis
bw	body weight
Cal/EPA	California Environmental Protection Agency
CCMVCD	Contra Costa Mosquito and Vector Control District
CDPH	California Department of Public Health
CDPR	California Department of Pesticide Regulation
CEQA	California Environmental Quality Act
CFU	colony forming units
CNS	central nervous system
DCPA	chlorthal dimethyl
DDVP	Dichlorvos
di-acid or TPA	tetrachloroterephthalic acid
DOD	Department of Defense

EbC50	50% reduction of biomass
EC50	Median Effective Concentration
EEC	expected environmental concentrations
EPSP	enzyme 5-enolpyruvylshikimate 3-phosphate
ErC50	50% reduction of growth rate effects
IPCS	International Programme on Chemical Safety
IPM	Integrated Pest Management
ITUs	International Toxic Units
LC	lethal concentration
LC_{50}	median lethal concentration
LD	lethal dose
LD50	median lethal dose
LOAEC	lowest observed adverse effect concentration
LOAEL	lowest observed adverse effect level
LOC	Level of Concern
mo	months
MSMVCD	Marin/Sonoma Mosquito and Vector Control District
MVCAC	Mosquito and Vector Control Association of California Coastal Region
NCMAD	Napa County Mosquito Abatement District
NOAEC	no observed adverse effect concentration
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NOEL	No observed effect level
NPIC	National Pesticide Information Center
NSVMAD	Northern Salinas Valley Mosquito Abatement District
PBO	Piperonyl Butoxide
PEIR	Programmatic Environmental Impact Report
PMDS	polydimethylsiloxane
PPE	personal protective equipment
ppm	parts per million
Programs	Integrated Mosquito and Vector Management Programs
REDs	reregistration eligibility decisions
RUP	restricted-use pesticide
SCCVCD	Santa Clara County Vector Control District
SCMAD	Solano County Mosquito Abatement District
SMCMVCD	San Mateo County Mosquito and Vector Control District
SWRCB	State Water Resources Control Board

TBEE	triclopyr butoxyethyl ester
TEA	triethylamine
TPA or di-acid	tetrachloroterephthalic acid
ULV	Ultra Low Volume
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UV	ultraviolet
ww	wet weight

1 Executive Summary

The nine northern California Districts (members of the Mosquito Vector Control Association of California Coastal Region [MVCAC]) participating in this CEQA compliance effort engage in mosquito and other vector control activities to protect the public health in their respective Program Areas. These activities are being evaluated for compliance with the California Environmental Quality Act (CEQA) based on current CEQA statutes and Guidelines and recent case law. This draft technical report provides an evaluation of the potential hazards (and estimated risks) of the pesticide application activities used, and in some cases, planned, for vector control. The information provided by the Districts has been synthesized and evaluated to identify any potential environmental concerns due to use of potentially hazardous chemicals. This evaluation was based on a review of the documented characteristics of each chemical, including the efficacy, mode of action, candidate target species, reported toxicity to humans and wildlife, and likely fate and transport under application conditions. The information in this report is intended to be used to support the preparation of a Programmatic Environmental Impact Report (PEIR). The term pesticide as used herein refers to all modes of chemical and biological control, including insecticides, herbicides, and adjuvants unless otherwise indicated.

Each of the nine Districts provided extensive information about their pesticide use in support of this Ecological and Human Health Assessment including:

> Pesticides used by each District

> Types of application sites (e.g., habitat types)

> Number of treatments per application site

> Total amount used per treatment for each application site, based on seasonal uses

This information is summarized in Attachment A. This draft technical report provides results of the review and evaluation of 46 active ingredients used and potentially considered for future use by the Districts. The objective was to identify those that may pose potential human health or ecological concern when used by the Districts. Documented toxicity and environmental fate of the pesticides were reviewed and evaluated, based primarily on the active ingredient, and the results are summarized in Chapter 4 (Table 4-1).

The pesticide application scenarios that result in reasonable efficacy with minimal unwanted estimated risk are preferred and are the basis of Integrated Pest Management (IPM)/Integrated Vector Management (IVM) approaches practiced by the Districts.

Using the available information about the active ingredients reviewed, there were several overarching parameters that are known to adversely impact risk. Primary factors considered include the inherent toxicity and mode of action of the chemical. Other important factors that are considered include the possible transport and fate of the chemical in various media, the reported likely exposure routes, and documented ecological and human studies supporting the toxicity data. Several important parameters, such as the retention time (half-life) in various media are also considered, but are dependent on specific conditions at the time of application. Based on these criteria, several pesticides received additional discussion during the workshop with the nine Districts on February 20, 2013.

Using the approach discussed above, select active ingredients were identified (Table 1-1) and discussed during the workshop to supplement the information relevant to the evaluation of potential risk and contained in Chapter 4. Each of these pesticides exhibits at least one parameter that appears to drive potential risk, and the Districts provided additional information on measures employed to minimize potential risk.

Table 1-1 Active Ingredients Identified for Discussion

Active Ingredient	Vector	Potential Issue
Methoprene	Mosquitoes	Prevalent use; toxicity to aquatics and insects
Etofenprox	Mosquitoes	Toxicity to aquatic organisms; no synergist required
Bti	Mosquitoes	Prevalent use; public concerns
Pyrethrins	Mosquitoes/yellow jacket wasps	Prevalent use; requires synergist (PBO)
Resmethrin	Mosquitoes	Requires synergist (e.g., PBO); potential endocrine disruptor
Plant oils (coconut oil)/mix	Weeds/vegetation/mosquitoes	Contains low percentage of petroleum distillate (10%)
Plant oils/mineral oils	Weeds/vegetation/mosquitoes	Surfactants/adjuvants used to enhance the efficacy or application of post emergent herbicides.
Permethrin	Mosquitoes/yellow jacket wasps	Toxicity to aquatic organisms; potential endocrine disruptor
Lambda-cyhalothrin	Yellow jacket wasp	Toxicity to aquatic organisms; potential to bioaccumulate
Bromadiolone	Rats	Toxicity to non-target organisms including mammals, birds, aquatics
Difethialone	Rats	Toxicity to non-target organisms including mammals, birds, aquatics
Alkylphenol ethoxylates	Weeds/vegetation/mosquitoes	Surfactants/adjuvants used to enhance the efficacy or application of post emergent herbicides.
Glyphosate	Weeds/vegetation	Prevalent use; possible endocrine disruptor
Diuron	Weeds/vegetation	Prevalent use; toxicity to freshwater fish
Benfluralin	Weeds/vegetation	Toxicity to aquatics; potential for bioaccumulation/endocrine disruption

The toxicity and adverse effects information collected, reviewed and critiqued for each of the pesticide products evaluated in this document is based primarily on results of laboratory studies that are extrapolated to appropriate potential receptor species. In assessing the toxicity information in this document, it should be remembered that most toxicity data are derived from rigidly controlled laboratory animal studies designed to determine the potential adverse effects of the chemical under several possible routes of exposure. In these studies, the species of interest is exposed to 100 percent chemical at several doses to determine the lowest concentration resulting in a predetermined adverse effect (LOAEL) on numerous physiological and behavioral systems. The second component of these tests is to determine the highest concentration of chemical that results in no measurable adverse effect (NOAEL).

However, these laboratory tests are designed to document the effects of the chemical when there is a continuous, controlled exposure and do not realistically reflect the likely exposures or toxicity in the field application scenarios. In the field, animals can move around, are able to make selections of food and prey and often avoid sprayed areas completely. As such, the toxicity information is intended as guidance for determining the levels of applications that would not adversely impact non-target species. Because the applications are conducted under rigid Best Management Practices (BMPs), using the minimum effective pesticide application concentrations and do not result in continuous exposures, these laboratory derived estimates of potential risk are not appropriate for the actual exposures and effects in the field.

This document provides information in tables and appendices about the parameters used to evaluate 46 active ingredients and a summary of the ecological and human health issues that may indicate a potential concern when used for vector control.

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2 Introduction

This report provides an Ecological and Human Health Assessment of pesticides and herbicides contained in the Integrated Mosquito and Vector Management Programs (Programs) for nine mosquito abatement and/or vector control districts in northern California. The nine districts are: Alameda County Mosquito Abatement District (ACMAD), Alameda County Vector Control Services District (ACVCSD), Contra Costa Mosquito and Vector Control District (CCMVCD), Marin/Sonoma Mosquito and Vector Control District (MSMVCD), Napa County Mosquito Abatement District (NCMAD), Northern Salinas Valley Mosquito Abatement District (NSVMAD), San Mateo County Mosquito and Vector Control District (SMCMVCD), Santa Clara County Vector Control District (SCCVCD), and the Solano County Mosquito Abatement District (SCMAD). The Programs provide for mosquito and/or vector control activities within each District's Program Area. The nine District Program Areas include both the Service Areas within the Districts and the surrounding counties where the Districts may provide mosquito and/or other vector management services when requested by the adjacent county or district.

The immediate nine District Service Areas are located in the following nine counties of the state: Alameda, Contra Costa, Marin, Monterey, Napa, San Mateo, Sonoma, Solano, and Santa Clara. Control activities may also be provided in areas adjacent to the District Service Areas upon request of the adjacent jurisdictions to protect the health and safety of residents within the Program Area. Actions that would be taken within the nine Districts' Program Areas are the same types of actions undertaken within the Districts' Service Areas and in similar types of habitats or sites. Therefore, the nine District Program Areas addressed in this report also include the nine additional surrounding counties: Mendocino, Merced, Lake, Sacramento, San Benito, San Joaquin, Santa Cruz, Stanislaus, Yolo, and the portion of Monterey County south of the NSVMAD.

A health assessment has been conducted to evaluate the potential risks posed by the chemical treatments/pesticide and herbicide formulations to non-target organisms, including humans and sensitive ecological receptors. Pesticides and herbicides are handled separately but in parallel during the evaluation. The first level of investigation was a toxicity/hazards evaluation comprised of a comprehensive literature review for the active ingredients contained in the chemical products and formulations used for vector control. This evaluation was performed to support the Programmatic Environmental Impact Report (PEIR) for each District. Reviewed toxicity literature included peer-reviewed publications, California Department of Pesticide Regulation (CDPR) data and reports, United States Environmental Protection Agency (USEPA) reports, and California Department of Public Health (CDPH) reports. The processes employed for the evaluation and the selection of active ingredients to focus on are described below. Although this document is intended to address the active ingredients most likely to engender some perceived or real concern by the public and regulators, the report includes hazard information about all active ingredients representing products in use or planned for future use by the nine Districts represented in this report.

In general, application scenarios employed by the Districts represented in this report include several basic, yet critical, Best Management Practices (BMPs) to minimize and often negate any potential exposures that might result in unwanted adverse effects to non-target species. Additional integrated pest management (IPM) and BMP practices are utilized by each District.

The results of this assessment are based on assumptions about toxicity and mode of action derived from available information and data, including the published literature. In addition to the documented efficacy (toxicity) to target species and vectors, this assessment also considers the potential risk to sensitive non-target organisms inventoried in a variety of habitat types in the Northern California Coastal Region and presented in the Biological Resources Technical Report (PEIR Appendix A). Application scenarios and other data were evaluated to estimate the potential for exposures to sensitive non-target ecological receptors. Some of the potential pesticide applications that might result in unacceptable estimated risk have been identified. While the majority of the active ingredients representing products used by the Districts are openly available and do not suggest an unacceptable risk, this review addresses the information and assumptions about possible use patterns and possible exposure issues.

2.1 General Issues Associated with the Current Pesticide Use

The Districts currently employ a combination of methods in their IPM programs for vector control, including the application of a variety of pesticide formulations by several mechanisms. These formulations, registered by the USEPA and California Environmental Protection Agency (Cal/EPA) are methodically applied by the Districts to minimize potential impacts to non-target receptors. However, the potential for impact to humans and ecological receptors from these chemicals was examined in order to provide evidence to support conclusions reached about their safety and proper use scenarios.

Application scenarios employed by the Districts represented in this report include several basic, yet critical, BMPs to minimize and often negate any potential exposures that might result in unwanted adverse effects to non-target species. Pesticide application safety is maximized by the Districts by:

- applications according to strict adherence to label instructions
- restricting applications to low wind conditions to minimize drift
- using Ultra Low Volume (ULV) applications whenever possible
- applications late at night when non-target species (e.g., bees, etc.) are not active
- observation and documentation of nearby water sources and adherence to buffer zones
- use of appropriate protective personal equipment (PPE) by applicators and field crews
- careful reporting and tracking of all pesticide uses by the District
- applications only on an “as needed” or “as appropriate” basis

Additional IPM and BMP practices tailored for each District are also utilized.

The objective of this report is to address and evaluate the potential for human and ecological hazards of application scenarios of the active ingredients contained in a variety of products and formulations used by the Districts in their efforts to control and abate mosquito and other vector infestations. The review of toxicity literature and environmental fate information focused on developing a scientific summary of the safety of these applications. If some level of concern or perception about unintended effects of the applications results from the evaluation, approaches will be developed to mitigate or prevent real or perceived adverse effects, including BMPs.

2.2 Human and Ecological Health Evaluations

2.2.1 Human Health Impact Evaluation

Pesticides used by the nine Districts were investigated to provide a preliminary toxicity assessment related to potential impacts to humans. Pesticide formulations, label recommendations, and application procedures were also reviewed to evaluate the potential likelihood for bioaccumulation and/or food item biomagnification. For each pesticide and herbicide evaluated, written explanations are provided regarding the physiochemical characteristics of the product, including absorption, metabolism, and elimination; and any other specific reported evidence of reproductive, developmental, or carcinogenic effects.

2.2.2 Ecological Health Impact Evaluation

A general hazard evaluation was conducted for the pesticides and herbicides used by the nine Districts and reported application scenarios. The potential impacts to representative invertebrates, wildlife, fish, and aquatic plants were considered, and then evaluated using a hazard evaluation of the active ingredients.

The evaluation included a review and evaluation of the current toxicity literature (available field and lab studies) relevant to ecological receptor impacts, and information relevant to the ultimate environmental fate for these active ingredients. The behavior of these materials in the environment (including fate and transport) are evaluated for chemicals reportedly handled by Districts' staffs. The potential effects could be caused by the active ingredients' mechanism of action (potential toxicity), as well as the potential for bioconcentration, bioaccumulation, or biomagnification.

The hazard and risk evaluations of the pesticides and herbicides used by the nine Districts were conducted in separate, but related phases. In the first phase, the objective was to determine and document the chemical characteristics and potential for adverse impacts when used as intended by the Districts. During subsequent evaluation for the PEIR, a tiered sorting technique was used to rank each chemical (active ingredient) according to several criteria: 1) The documented toxicity of the active ingredient as indicated in the open literature; 2) The target species by vector; 3) The non-target species and biota that are likely to be exposed; 4) The likely media to be exposed for each chemical; and 5) Possible sensitive seasonal exposure conditions (Figure 1).

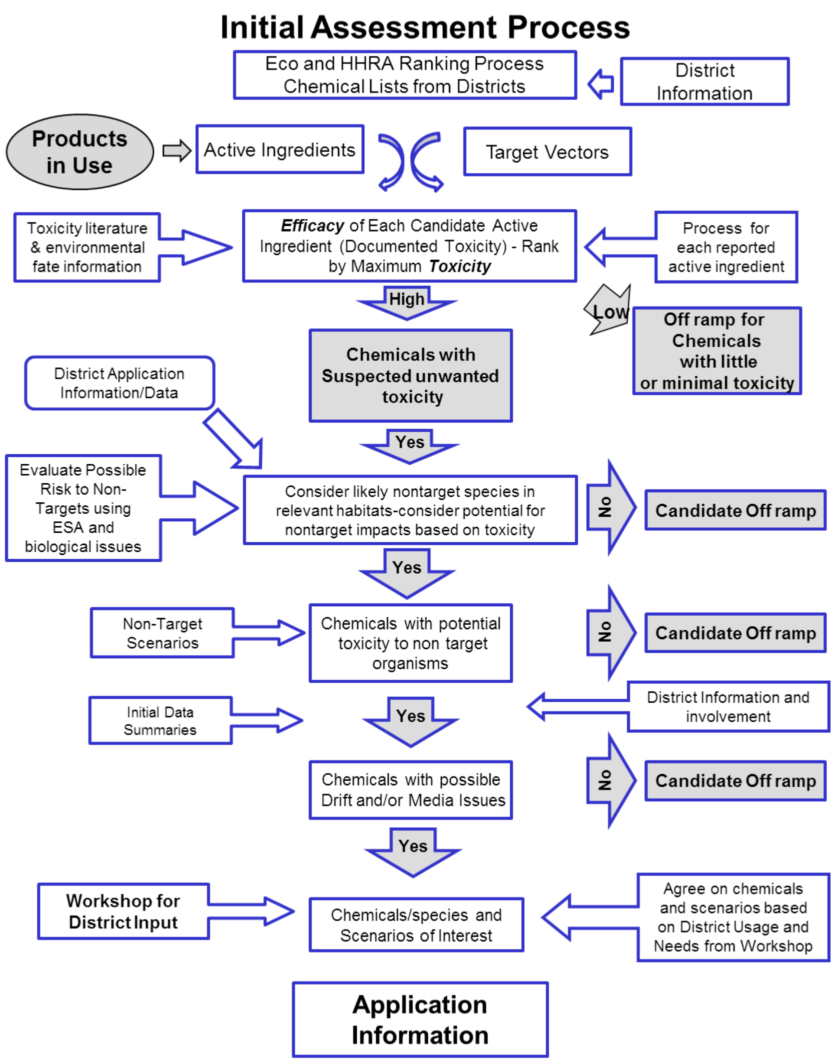

Figure 1 Process to Identify Chemicals for Further Discussion

2.3 Initial Approach

The evaluations conducted for each active ingredient provide a general indication of the potential for human or ecological risk and possible adverse effects to non-target organisms.

This approach was used to develop the list of chemicals used by each District that should be of little or no concern when used according to product labels and to identify those (if any) that may be problematic in certain use scenarios. Pesticides are first reviewed for target vector efficacy, based on both documented laboratory and field studies. Pesticide efficacy is of prime importance in the evaluations, but efficacy is contrasted to potential adverse impacts in the determination of the safety of use. To provide an indication of the possible adverse effects of each pesticide, the characteristics of its application scenarios are scored for relative "safety".

> Pesticides proposed for use with low potential exposure to people including sensitive populations (i.e., children, the elderly).

> Pesticides proposed for use with very low or minimal toxicity (hazard) based on the above analyses.

> Pesticides with the least potential for toxicity when used in or near important habitats for sensitive or non-target species.

> Pesticides showing little or no extraordinary seasonal potential impacts.

2.3.1 Components of a Review

2.3.1.1 Problem Formulation

> Ecological effects characterization

> Identification of the environmental setting and pesticide of interest

> Characterization of pesticide mechanism of action

> Possible transport pathways

> Categories of receptors likely affected

> Identification of application scenarios provided by the Districts

2.3.1.2 Exposure Estimates

> Assumptions about potential exposures, including extent, timing and quantity

> Assumptions about potential species that might be exposed

2.3.1.3 Basic Risk Estimates

This information was used to:

> Identify likely uncertainties in the exposures

> Develop ranges of potential effects using "what if" parameter estimates.

> Determine estimate of risk needed to collect more information

The results of the evaluation for each of the pesticides of interest were used to qualitatively assess the potential for adverse effects of each active ingredient and select candidates for additional evaluation and characterization. These results are summarized immediately following discussion of environmental fate and toxicity for each pesticide throughout Chapter 4. Final conclusions and recommendations are included in Chapter 5.

The pesticide application scenarios that should result in low or “acceptable” results for the estimated risk will remain in the suite of potential control options while those with higher estimated risk estimates are identified. The process is graphically described in the following flow diagram (Figure 2).

At the conclusion of the initial evaluations, and in conjunction with the District managers, the results and possible recommendations for use scenarios based on acceptable risk estimates were the topic of a workshop conducted on February 20, 2013. The objective of the workshop was to discuss, review, and agree to the list of the active ingredients that should be included in this report and information about many of the BMPs used.

Safety evaluations generally follow the USEPA guidance (Figure 2) for pesticide evaluations, with a focus on the relevant uses and exposures identified and agreed upon during the workshop.

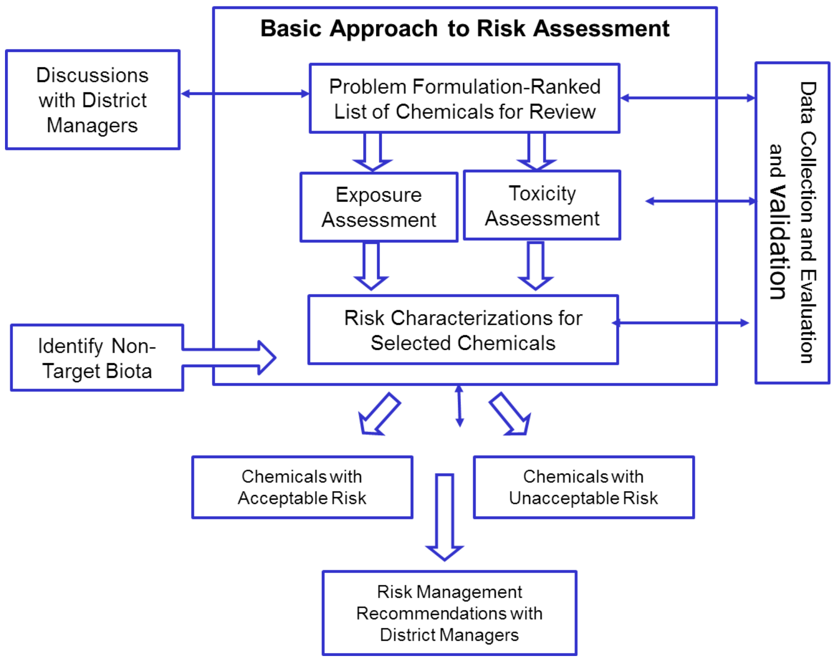

Figure 2 Process Used by USEPA to Evaluate Potential Risk for Chemicals

2.4 Approach to Refinement

The pesticide application scenarios that result in low or acceptable estimated risk as determined in the initial review of hazard information were categorized as lower potential risk, while others with higher potential estimated risk are identified and discussed with a focus on District-specific information about BMPs employed by staff and applicators. The process includes the following:

> Development of the relationships that describe the type of pesticides/herbicides used by the Districts against the target pest(s), the locations of intended uses (water bodies, grasses, forests, urban, residential, etc.), and the likely human and wildlife populations that might be inadvertently exposed.

> Evaluation of the inherent hazard (toxicity) of the pesticide(s)/herbicide(s) to non-target receptors (humans and wildlife).

> As a subsequent task in the PEIR, consider the potential exposure of humans and non-target species to each of the pesticides/herbicides based on the application scenarios, the concentrations used, and the likelihood that the application will reach or contact any populations of concern.

> The information in the PEIR provides estimates of potential “risk” and possible safety issues for each of the typical pesticide application scenarios.

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3 Vector Control Chemical Categories

The chemical products reported by the Districts, application scenarios, and potential new products and formulations for future use were obtained during project initiation and preparation of the PEIR Project Description. Application information provided by the Districts included the number of treatments and total amount applied of each product to specific habitat types during four quarters from Summer 2011 through Spring 2012 (see Attachment A). These data were integral for elucidating the estimated loading and potential exposures to different habitats that support non-target organisms. The evaluation focused on the active ingredients of the products/formulations. The target organisms and primary modes of action for the pesticide and herbicide active ingredients are described below. Tables 3-1 and 3-2 present the pesticide (non-herbicide) and herbicide products, respectively that are currently in use containing active ingredients reported here and the number of Districts using that product.

Table 3-1 Pesticide Products Containing Reported Active Ingredients

Product	Active Ingredient	Vector	Number of Districts
Agnique MMF	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito	6
Agnique MMF G	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito	3
Altosid Briquets 30-Day	Methoprene	Mosquito	6
Altosid Liquid Larvicide SR5	Methoprene	Mosquito	5
Altosid Liquid Larvicide Concentrate (SR20)	Methoprene	Mosquito	5
Altosid Pellets	Methoprene	Mosquito	7
Altosid Pellets WSP	Methoprene	Mosquito	3
Altosid SBG Single Brood Granule	Methoprene	Mosquito	2
Altosid XR-Briquets	Methoprene	Mosquito	7
Altosid XR-G	Methoprene	Mosquito	4
Astro®, Ortho® products, Bonide® products, Tengard® products, etc.	Permethrin	Yellow jacket wasp	1
Bell Terad 3 Blox	Cholecalciferol	Rat	1
BVA-2	Petroleum Distillate	Mosquito	7
Clarke Biomist 4 + 12 ULV	Permethrin and Piperonyl Butoxide (PBO)	Mosquito	1
Contrac 8 oz blk	Bromadiolone	Rat	1
Contrac All-Weather Blox	Bromadiolone	Rat	2
Contrac Super Blox	Bromadiolone	Rat	2
Delta Dust	Deltamethrin	Yellow jacket wasp	2
Ditrac Blox	Diphacinone	Rat	2
Ditrac Tracking Powder	Diphacinone	Rat	1

Table 3-1 Pesticide Products Containing Reported Active Ingredients

Product	Active Ingredient	Vector	Number of Districts
Drione	Pyrethrin and Piperonyl Butoxide and Amorphous Silica Gel	Yellow jacket wasp	5
EcoExempt IC2	Rosemary Oil	Mosquito	1
FirstStrike Soft Bait	Difethialone	Rat	2
FourStar 180 Day Microbial Briquets	*Bacillus sphaericus* and *Bacillus thuringiensis israelensis*	Mosquito	4
FourStar 45 Day Microbial Briquets	*Bacillus sphaericus* and *Bacillus thuringiensis israelensis*	Mosquito	4
FourStar 90 Day Microbial Briquets	*Bacillus sphaericus* and *Bacillus thuringiensis israelensis*	Mosquito	2
FourStar SBG (Single Brood Bti Sand Granule)	*Bacillus thuringiensis israelensis*	Mosquito	1
Golden Bear 1111	Aliphatic Petroleum Hydrocarbons	Mosquito	4
Kontrol 4-4	Permethrin and PBO	Mosquito	1
MetaLarv SP-T	Methoprene	Mosquito	1
MGK Pyrocide 7396	Pyrethrins and PBO	Mosquito	4
Natular 2EC	Spinosad	Mosquito	2
Natular G30	Spinosad	Mosquito	3
Natular XRT	Spinosad	Mosquito	1
Permanone	Permethrin and PBO	Mosquito	1
Pyrenone 25-5	Pyrethrins and PBO	Mosquito	5
Pyrocide Mosquito Adulticiding Concentrate for ULV Fogging 7067	Pyrethrins and PBO	Mosquito	1
Scourge 18% + 12%	Resmethrin and PBO	Mosquito	1
Skeeter Abate	Temephos	Mosquito	2
Spectracide Pro®	Tetramethrin and Permethrin and PBO	Yellow jacket wasp	1
Spectracide®	Prallethrin and Lambda-cyhalothrin	Yellow jacket wasp	1
Summit B.T.I. Briquettes	*Bacillus thuringiensis israelensis*	Mosquito	1
Teknar HP-D	*Bacillus thuringiensis israelensis*	Mosquito	2
Teknar SC	*Bacillus thuringiensis israelensis*	Mosquito	1
VectoBac 12AS	*Bacillus thuringiensis israelensis*	Mosquito	5
VectoBac G	*Bacillus thuringiensis israelensis*	Mosquito	5
VectoBac GS Biological Larvicide	*Bacillus thuringiensis israelensis*	Mosquito	1
VectoBac Technical Powder Biological Larvicide	*Bacillus thuringiensis israelensis*	Mosquito	1
VectoBac WDG Biological Larvicide	*Bacillus thuringiensis israelensis*	Mosquito	1

Table 3-1 Pesticide Products Containing Reported Active Ingredients

Product	Active Ingredient	Vector	Number of Districts
VectoLex CG	*Bacillus sphaericus*	Mosquito	7
VectoLex WDG	*Bacillus sphaericus*	Mosquito	4
VectoLex WSP	*Bacillus sphaericus*	Mosquito	5
VectoMax CG	*Bacillus sphaericus* and *Bacillus thuringiensis israelensis*	Mosquito	3
VectoMax WSP	*Bacillus sphaericus* and *Bacillus thuringiensis israelensis*	Mosquito	2
Wasp-Freeze	Phenothrin and Trans Allethrin	Yellow jacket wasp	3
Zenivex E4	Etofenprox	Mosquito	4
Zenivex E20	Etofenprox	Mosquito	5

Table 3-2 Herbicide Products Containing Reported Active Ingredients

Product	Active Ingredient	Vector	Number of Districts
Alligare Dithiopyr 40	Dithiopyr	Weed	1
Alligare Glyphosate 4-Plus	Glyphosate	Weed	1
Alligare Glyphosate 5.4	Glyphosate	Weed	1
Alligare Imazapyr 2 SL	Imazapyr	Weed	1
Alligare Oryzalin 4	Oryzalin	Weed	1
Alligare Triclopyr 3	Triclopyr	Weed	1
AMVAC Dacthal	DCPA	Weed	1
Aquamaster	Glyphosate	Weed	3
Balan	Benefin	Weed	1
Blazon Pattern Indicator	Polymeric Colorant (proprietary)	Weed	2
Buccaneer	Glyphosate	Weed	1
BullsEye Pattern Indicator	Proprietary Colorant	Weed	2
Competitor	Modified Plant Oil	Weed	2
Dacthal	DCPA	Weed	1
Dimension Ultra 40WP	Dithiopyr	Weed	1
Ecomazapyr 2 SL	Imazapyr	Weed	1
Garlon-3A	Triclopyr	Weed	1
Green Light Amaze XL 2G	Benefit, Oryzalin	Weed	2
Habitat	Imazapyr	Weed	2
Imazapyr 4-SL	Imazapyr	Weed	1

Table 3-2 Herbicide Products Containing Reported Active Ingredients

Product	Active Ingredient	Vector	Number of Districts
Karmex XP	Diuron	Weed	1
Liberate	Lecithin, methyl esters of fatty acids, alcohol ethoxylate	Weed	1
Monterey Nutgrass "Nihilator	Bentazon (sodium salt)	Weed	1
Monterey Turflon Ester, Turflon, Garlon 3®, Renovate®	Triclopyr	Weed	1
Monterey Weed Whacker	2,4-DP (dimethylamine salt)	Weed	1
MOR-ACT	Paraffin base petroleum oil	Weed	1
MSO	Methylated seed oil of Soybean	Weed	1
No Foam A	Alkyl Phenol Ethoxylate / Isopropanol	Weed	1
No Foam Defoamer	Polydimethylsiloxane & Silicon	Weed	1
Oust XP	Sulfometuron Methyl	Weed	2
Pennant Magnum	Metolachlor	Weed	1
Polaris	Imazapyr	Weed	2
Pro-Spreader Activator	Alkyl Phenol Ethoxylate / Isopropanol	Weed	2
R-11 Spreader Activator	Alkyl Phenol Ethoxylate / Butyl alcohol	Weed	1
Renovate 3	Triclopyr	Weed	1
Reward	Diquat dibromide	Weed	1
Roundup Pro Max®	Glyphosate	Weed	2
Roundup Pro®	Glyphosate	Weed	3
Roundup®	Glyphosate	Weed	1
Rodeo®	Glyphosate	Weed	1
RoundupMax	Glyphosate	Weed	1
Scotts Halts Crabgrass Preventer	Pendimethalin	Weed	1
Trimec Lawn Weed Killer, Spectricide® Weed Stop®, Ortho® Weed-b-Gon®, Weed Killer for Lawns, Bayer Advanced™ Southern Weed Killer	2,4-D (2,4-dichlorophenoxy acetic acid)	Weed	1
Tripleline Foam-Away	Polydimethylsiloxane	Weed	1
Turf Trax Blue	Polymeric Colorant (proprietary)	Weed	1
Turfgro NIS	Ethanol 2,2-oxybis	Weed	1
Vigoro Crabgrass Preventer, Monsanto Dimension®	Dithiopyr	Weed	1

3.1 Mosquito Control

3.1.1 Adulticides

Adulticides are generally applied as aerosols using ultra-low-volume (ULV) techniques. Aerial and ground application techniques are used to distribute the insecticides. Adulticide treatments are most frequently timed to correspond with mosquito activity (flying) when exposure is greatest to the insecticide aerosol mist (dusk to dawn) and granular material. In addition, residual barrier treatment applications are used in mosquito resting areas and migratory stops. These treatments are usually applied as large liquid droplets with a sprayer during daylight hours. The primary objective of this type of treatment is the temporary prevention of re-infestation.

3.1.1.1 Pyrethroids

Pyrethroids are synthetic analogs of the naturally occurring pyrethrins (which are from the Chrysanthemum plant) and have similar neurological effects on target organisms. These compounds cause rapid mortality of adult mosquitoes by interfering with sodium channel function in the nervous system.

3.1.1.2 Pyrethrin

Pyrethrins are naturally occurring products distilled from the flowers of Chrysanthemum species. Pyrethrins are composed of a mixture of six compounds: pyrethrin I and II, cinerin I and II, and jasmolin I and II. Pyrethrins are contact poisons that can quickly penetrate the neural system. Pyrethrins act by causing a persistent activation of the sodium channels on insect neurons.

3.1.1.3 Organophosphates

Organophosphates, such as naled, although not currently used by the Districts, is discussed as a possible material for use and is defined in Section 4.2 of this document and in Table 6-1.

3.1.2 Larvicides

Larvicides are used to manage immature life stages of mosquitoes including larvae and pupae in aquatic habitats. Temporary aquatic habitats are usually targeted because permanent water bodies generally support natural mosquito predators such as fish. The larvicides are applied using ground application equipment, fixed wing aircraft and rotary aircraft.

3.1.2.1 Contact Pesticides

(S)-Methoprene is a hormone analogue that interferes with insect larval development (growth regulator). This chemical does not exhibit the nonspecific target effects of neurological toxins such as pyrethrin.

Spinosad is a natural insecticide derived from the fermentation of a common soil microorganism, *Saccharopolyspora spinosa*. Spinosad alters nicotine acetylcholine receptors in insects causing constant involuntary nervous system impacts ultimately leading to paralysis and death.

3.1.2.2 Surface Active Agents

Petroleum- and plant-based (ethoxylated isotearyl alcohols) oils are used as surface-active agents effective against larvae and pupae. These oils are effective against these immature life stages when inhaled at the water surface or by physically forming a surface film that drowns the mosquito. These treatments may also be effective against adult mosquitoes during adult emergence.

3.1.2.3 Stomach Toxins

Bacterial larvicides such as Bti (*Bacillus thuringiensis israelensis*) and Bs (*Bacillus sphaericus*) are highly selective (for mosquitoes) microbial pesticides that when ingested, produce gut toxins that cause destruction of the insect gut wall leading to paralysis and death. These microbial agents are delivered as endospores in granular, powder, or liquid concentrate formulations.

3.2 Other Vector Control

There are a variety of pesticides used for the control of vectors including rats, ticks, yellow jackets wasps, and weeds.

3.2.1 Rats

Toxic baits may be used to achieve adequate control of rats when populations become too large to impact using traps. Federal EPA changes to rodenticide regulations occurred in 2011 (http://www.epa.gov/pesticides/mice-and-rats/) in an effort to reduce the hazard to wildlife, pets and children. The use of baits is confounded by the potential for food web transfer of the bait to other trophic level receptors that might also encounter and eat the raw bait or predate an animal that has ingested the bait.

3.2.1.1 Anticoagulant Rodenticides

Anticoagulant rodenticides cause fatal internal bleeding by thinning the animal's blood and preventing clotting. Two groups of anticoagulants exist including the older "first-generation" compounds effective if consumed over multiple doses and the newer "second-generation" compounds, which are fatal after a single dose. The acute toxicity of second-generation rodenticides presents a greater hazard to wildlife, pets, and children. Products containing second-generation active ingredients are no longer permitted to be sold to the general public. These products remain available to professional pest control personnel, however.

3.2.1.2 Other Rodenticides

Three other rodenticides are available for use in California. Bromethalin and cholecalciferol are chronic rodenticides and achieve successful results similar to those of anticoagulants. Multiple feeding doses are required to induce mortality of rodents. Bromethalin is a neurotoxin, which damages the central nervous system (CNS). Cholecalciferol produces hypercalcemia leading to renal failure and CNS depression, among other generalized symptoms of toxicity. Zinc phosphide is an acute toxicant and causes death within a few hours of consumption. Often, use of this compound requires "pre-baiting" prior to addition of the chemical to rat bait in order to achieve adequate bait acceptance. Zinc phosphide is used to lessen impact on predators in the food web.

3.2.2 Yellow Jacket Wasps

Aerosol insecticides and dusts can be effective when applied directly to yellow jacket wasp nest openings. Most conventional pesticides are either pyrethrin or pyrethroids. Synthetic pyrethroid insecticides act as sodium channel modulators and very effective when used against wasps. Pyrethrin compounds act as paralytics and will immobilize the insect temporarily and may cause mortality.

Short-residual pyrethroids include allethrin, phenothrin, resmethrin, sumithrin, and tetramethrin. Longer-lasting pyrethroid insecticides include lambda-cyhalothrin, deltamethrin, and permethrin.

3.2.3 Tick Control

Although tick surveillance is the recommended method to monitor this vector, there are several pesticides that can be useful if an unwanted tick infestation should occur. Ticks (e.g., deer ticks) act as vectors for bacterial pathogens, such as *Borrelia burgdorferi*, the agent of Lyme disease. Currently, deltamethrin is the only active ingredient that has been used for tick control.

3.2.4 Weed Vegetation Control

Herbicides are classified in several ways. Pre-emergent herbicides are applied to the soil to prevent seedlings from germinating and emerging. Post-emergent herbicides are applied after seedlings have emerged and control actively growing plants via contact damage or systemic impacts. Contact herbicides cause physical injury to the plant upon contact. Systemic herbicides damage the internal functioning of the plant.

3.2.4.1 Herbicides for Broadleaves

Herbicides for use against annual broadleaf weeds are generally post-emergent applications that affect the plant systemically. 2,4-Dichlorophenoxy acetic acid (2,4-D), imazapyr, triclopyr, sulfometuron methyl, bentazon, diuron, oryzalin, DCPA, dithiopyr, and pendimethalin are examples of broadleaf herbicides.

3.2.4.2 Herbicides for Grass Weeds

Herbicides used against annual grasses (e.g. crabgrass, foxtail, etc.) are pre-emergent applications containing ingredients such as pendimethalin. Weed grasses can be treated with post-emergent applications; however, these tend to be less effective than pre-emergent treatments. Some can be eliminated with spot treatments of potent, nonselective herbicides such as glyphosate, which act systemically by inhibiting the synthesis of the aromatic amino acids phenylalanine, tyrosine, and tryptophan.

3.2.4.3 Herbicides for Sedges

Spot treatments with glyphosate are also useful in eliminating sedges (e.g. yellow and purple nutsedge, green kyllinga, etc.). Pre-emergent materials such as DCPA are effective at killing seeds of green kyllinga, but ineffective against nutsedges.

3.2.4.4 Aquatic Invasive Species

Imazapyr is an imidazolinone herbicide (e.g., Habitat®) that inhibits acetolactate synthesis (ALS), an enzyme necessary for the production of essential amino acids in plants. This class of chemicals includes systemic, nonselective, pre- and post-emergent herbicides used for the control of terrestrial and aquatic weeds (e.g., imidazolinoes, pyrimidinyl thiobenzoates, sulfonylureas, sulfonyl amino carbonyl triazolinone, and triazolopyrimidines). In California, these compounds have been used to combat the invasive purple loosestrife plant in aquatic environments. Unfortunately, this species and others appear to have developed resistance to the ALS-inhibiting family of chemicals. In addition, the non-target impacts of these compounds may cause negative effects to threatened or endangered plants.

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4 Evaluation of Active Ingredients-Results

This section presents the supporting information and results of the evaluation that will be incorporated into the each District's PEIR. Information below includes a description of the chemical compound, general pesticide use/application techniques, mode of action, toxicity, environmental fate and transport, and potential impact assessment.

Several insecticides were previously evaluated in the Monitoring Plan for Mosquito Larvicides and Adulticides (2011) prepared by MVCAC. Descriptions of these compounds, pesticide use patterns, and environmental fate and transport were updated in this document as needed. Source information for the fate and transport data include USEPA reregistration eligibility decisions (REDs), USEPA risk evaluations, DPR fate reviews, fate reviews from the scientific community, and data provided by manufacturers. Toxicity information was included for select compounds, including details relevant to ULV applied mosquito adulticides. Table 4-1 provides a summary of the toxicity and fate and transport information associated with the active ingredients. In addition, toxicity values for a variety of receptors (human and ecological) are presented later in Chapter 6 in Table 6-1.

The toxicity data included in the numerous tables and charts in this document are generally derived from rigidly controlled laboratory animal studies designed to determine the potential adverse effects of the chemical under several possible routes of exposure. In these studies, the species of interest is exposed to 100 percent chemical at several doses to determine useful information such as the lowest concentration resulting in a predetermined adverse effect (LOAEL) on numerous selected physiological and behavioral systems. The second component of these tests is to determine the highest concentration of chemical that results in no measurable adverse effect (NOAEL).

However, these, and other, coordinated and focused laboratory tests are designed to document the effects of the chemical when a continuous, controlled, exposure exists and do not realistically reflect the likely exposures or toxicity of District field application scenarios. As such, the toxicity information is intended as an overview of potential issues and guidance for understanding the maximum exposure levels of applications that would not adversely impact humans or non-target plant and animal species.

Although the regulatory community uses this basic information to provide a relative comparison of the potential for a chemical to result in unwanted adverse effects and this information is reflected in the approved usage labels and MSDSs, in actual practice, the amounts actually applied in the District's Program Area are substantially less than the amounts used in the laboratory toxicity studies. Because of the large safety factors used to develop recommended product label application rates, the amount of chemical resulting in demonstrated toxicity in the laboratory is much higher than the low exposure levels associated with an actual application. The application concentrations consistent with the labels or MSDSs are designed to be protective of the health of humans and other non-target species (i.e., low enough to not kill them, weaken them, or cause them to fail to reproduce). However adverse effects may still occur to some non-target organisms.

Chapter 4 provides the results of this review, evaluation, and synthesis of data for each of the selected pesticides in use by the nine Districts. The analysis provides informative results for the Districts that are interested in an evaluation of the potential efficacy and effects of their respective pesticide treatment scenarios. In each case, the evaluations include consideration of four primary parameters:

> Efficacy to target vectors;

> Documented acute and chronic ecological and human toxicity (where available);

> Known media/habitat use scenarios for each pesticide and for each District; and

> Evaluation of potential non-target biota that might be adversely impacted and the associated exposure level.

Using these parameters, the process results in a functional evaluation of the likelihood that each pesticide application scenario (scenarios) could be used safely. At the conclusion of each evaluation process, those scenarios that appear to result in potential unwanted (adverse) impacts were subjected to additional evaluation based on generally accepted "risk evaluation" guidelines.

4.1 Pyrethrin, Pyrethroids, Pyrethroid-like Compounds and Synergists

Pyrethrins are natural organic compounds derived from the plant *Chrysanthemum cinerarifolium*. These compounds have been known for their insecticidal properties for many centuries, and it is believed the Chinese used the powder of crushed chrysanthemum plants as an insecticide as early as 1000 BCE (Gunasekara 2005). Pyrethrins affect the nervous system of insects causing paralysis and death. Pyrethrins are photo unstable, rapidly degrading in the presence of light.

Pyrethroid insecticides are synthetic compounds that are chemically similar to the pyrethrins but have been modified to increase stability and activity against insects. Some synthetic insecticides are similar to pyrethroids, such as etofenprox, but have a slightly different chemical composition. First generation or "Type I" photosensitive pyrethroids include d-allethrin, phenothrin (sumithrin), prallethrin, resmethrin, and tetramethrin. Typically, these pyrethroids are used indoors and around residential areas. The newer second-generation pyrethroids are mostly "Type II" pyrethroids. Chemically, Type II pyrethroids are distinguished from Type I pyrethroids by the presence of anα-cyano group in their structure. The active ingredients that fall into this group include deltamethrin, esfenvalerate, lambda-cyhalothrin, and permethrin. Type II pyrethroids are more toxic (than Type I pyrethroids) because they are less photosensitive and persist longer in the environment.

Pyrethroids affect insect neuroactivity by binding to a protein at the nerve fiber that regulates the voltage-gated sodium channel. This can delay the closing of sodium channels and/or cause a persistent activation of the sodium channels. This often results in repetitive activity (Type I pyrethroid) or blockage of nerve conduction (Type II pyrethroid).

Synergists are substances that enhance the activity of another substance. Piperonyl butoxide (PBO) is a common synergist that is combined with pyrethrins and a number of synthetic pyrethroids that are used in many vector management programs as well as sprays that are available to the general public.

4.1.1 Pyrethrins

Pyrethrins are naturally occurring products distilled from the flowers of Chrysanthemum species. Pyrethrins are composed of a mixture of six compounds: pyrethrin I and II, cinerin I and II, and jasmolin I and II. Pyrethrins are contact poisons that can quickly penetrate the neural system. Pyrethrins act by causing a persistent activation of the sodium channels on insect neurons. Although pyrethrins have an effective "knockdown" action (induction of temporary paralysis), they do not necessarily have high killing properties when used alone. In order to delay the metabolic action (inhibition of microsomal enzymes) so that a lethal dose is assured, the synergist piperonyl butoxide (PBO) is added to mosquito adulticides (USEPA 2006f).

Pyrethrins were first registered in the U.S. for use as an insecticide in the 1950s. Pyrethrins are used on many agricultural crops; on livestock and animal husbandry premises; for treatment of commercial and industrial facilities and storage areas where raw and processed food/feed commodities are stored or processed; and for wide-area mosquito abatement in areas that include aquatic habitats. They are also used on outdoor household areas, pastureland, aquatic area or standing water, and for hospitals, recreational areas, ULV applications, and mosquito abatement programs (USEPA 2006f, CDPR 2010a).

Table 4-1 Summary Characteristics of Active Ingredients

Active Ingredient: Chemical or Biological	Fate & Transport Air (Volatility)	Fate & Transport Water	Fate & Transport Soil	Mode of Action	Human Health[1]	Ecological Health[1]
Pyrethrins	> n/a	> Major route of dissipation is photolysis. > Quickly adsorb to suspended solids in the water column and partition to the sediment.	> Major route of dissipation is photolysis. > Pyrethrins are likely to persist under anaerobic conditions. > Generally immobile in soils, therefore the potential to leach to groundwater is low.	> Insecticide: > Naturally occurring products distilled from Chrysanthemum spp. flowers. > Contact poisons that act by causing persistent activation of the sodium channels on insect neurons resulting in "knock-down" agent. > The synergist PBO is added to ensure a lethal dose.	> Low to moderate acute toxicity via the oral, dermal, and inhalation routes. > Chronic exposure effects include neurobehavioral, thyroid, and liver effects.	> Very highly toxic to freshwater fish and invertebrates. > Practically nontoxic to birds.
Allethrins and d-trans allethrin	> When used in coils and mats, allethrins are released into the air where they will be degraded by sunlight or be distributed in low concentrations to nearby surfaces.	> Not water soluble. > Photolysis half-life is <8 hrs.	> Adheres moderately to soil containing organic matter.	> Insecticide: Synthetic pyrethroid structurally similar to cinerin I in naturally occurring pyrethrum. > d-trans stereoisomer is the most insecticidally active. > Typically used as a "knock-down" agent. > Synergists such as PBO are added to ensure a lethal dose.	> Slightly to moderately acute toxicity via oral, dermal, and inhalation routes. > Toxicity varies with the amounts of different isomers present. > Not known to cause reproductive, teratogenic, mutagenic, or carcinogenic effects to mammals.	> Highly toxic to fish and invertebrates. > Very toxic to non-target insects. > Practically nontoxic to birds. > Bioaccumulation potential is unknown.
Phenothrin (sumithrin or d-phenothrin)	> n/a	> Low water solubility. > Major routes of dissipation are photolysis and anaerobic metabolism.	> High affinity for binding to soils and moderate persistence in surface soils. > Low leaching potential, therefore phenothrin is relatively immobile in soils or sediments. > Moderately persistent under aerobic conditions and persistent under anaerobic conditions.	> Insecticide: Adult mosquitoes.	> Low acute toxicity by oral, dermal, and inhalation routes. > Mild eye irritant but not a skin irritant.	> Highly toxic to fish and freshwater invertebrates. > Practically nontoxic to birds.
Prallethrin	> n/a	> Major route of dissipation is photolysis.	> Major route of dissipation is photolysis. > Readily sorbs to soils and sediments.	> Insecticide: Synthetic pyrethroid with fast "knock-down" activity against insect pests. > Has a neural exciting effect on mosquitoes. > In California, prallethrin is combined with phenothrin in the product Duet (the only prallethrin adulticide used in California).	> Low to moderate acute toxicity via oral, dermal, or inhalation routes. > Mild eye irritant but not a skin irritant.	> Highly toxic to fish and freshwater invertebrates. > Practically nontoxic to birds. > Very toxic to honey bees. > Low toxicity to algae.
Deltamethrin	> n/a	> Degrades via hydrolysis, photolysis, and microbial action. > May persist in aquatic environments, particularly in the sediment.	> Most persistent in soils with high clay or organic matter content. > Moderately to highly persistent in terrestrial environments.	> Insecticide: Synthetic pyrethroid. > Induce long-lasting inhibition of the sodium ion channel activation gate, resulting in repetitive nerve signals in sensory organs, nerves, and muscles.	> Low to moderate acute toxicity via oral, dermal, or inhalation routes. > Chronic exposure of humans results in choreoathetosis, hypotension, prenatal damage, and shock. > No reported teratogenic, mutagenic, or carcinogenic effects.	> Very highly toxic to fish and invertebrates. Potential bioaccumulation in fish. > Practically nontoxic to birds. > Nonselective insecticide and is highly toxic to non-target insects, including honey bees.

[1] Toxicity levels (e.g., slight, low, moderate, high, etc.) are used prevalently in the published literature but are not standardized or representative of specific criteria. They qualitatively describe toxicity in relative terms.
n/a = not applicable

Table 4-1 Summary Characteristics of Active Ingredients

Active Ingredient: Chemical or Biological	Fate & Transport Air (Volatility)	Fate & Transport Water	Fate & Transport Soil	Mode of Action	Human Health[1]	Ecological Health[1]
Esfenvalerate	> n/a	> Practically insoluble in water. > Extremely hydrophobic. > When present in surface water, expected to be bind to suspended particulates and organic matter. > Degrades via photolysis and aerobic metabolism.	> Strong tendency to bind to soil. > Relatively immobile in soil and has low tendency to leach. > Degrades via photolysis and aerobic metabolism.	> Insecticide: > Broad spectrum, nonselective, voltage-dependent sodium-channel agonist. > Causes repetitive firing of neurons.	> Moderately toxic via acute routes. > Possible endocrine-disruptor.	> Highly toxic to fish and aquatic invertebrates. Bioaccumulates rapidly in fish. > Moderately toxic to birds. > Highly toxic to honey bees.
Lambda-cyhalothrin*	> n/a	> Extremely hydrophobic and rapidly adsorbs to soils and sediments. > Primary degradation pathways include photolysis and aerobic metabolism.	> Primary degradation pathways include photolysis and aerobic metabolism.	> Insecticide: Synthetic pyrethroid. > Induces long-lasting inhibition of the sodium ion channel activation gate, resulting in repetitive nerve signals in sensory organs, nerves, and muscles.	> Moderately toxic via acute oral, dermal, and inhalation routes. > Mild eye irritant but not a skin irritant.	> Highly toxic to fish. Potential to bioaccumulate in fish. > Low toxicity to birds. > Highly toxic to honey bees.
Resmethrin	> n/a	> Primary degradation pathways include photolysis and aerobic metabolism.	> Primary degradation pathways include photolysis and aerobic metabolism. > Low mobility in soil/sediments. > Environmentally persistent in absence of light.	> Insecticide: Synthetic pyrethroid. > Induces long-lasting inhibition of the sodium ion channel activation gate, resulting in repetitive nerve signals in sensory organs, nerves, and muscles.	> Low toxicity via acute oral, dermal, and inhalation routes. > Possible endocrine-disruptor.	> Highly toxic to fish and aquatic invertebrates.
Tetramethrin	> n/a	> Not persistent in the environment. > Decomposes rapidly by photolysis and hydrolysis in shallow, nonturbid water.	> Slightly mobile in soil.	> Insecticide: Synthetic pyrethroid. > Induces long-lasting inhibition of the sodium ion channel activation gate, resulting in repetitive nerve signals in sensory organs, nerves, and muscles.	> Slightly toxic via acute oral and dermal routes. > Possible human carcinogen.	> Highly toxic to fish and aquatic invertebrates. > Practically nontoxic to birds. > Highly toxic to honey bees.
Permethrin	> n/a	> Hydrophobic with low water solubility. > Primary degradation pathways include photolysis and aerobic metabolism.	> Tends to partition to soil and sediment.	> Insecticide > Synthetic pyrethroid. > Induces long-lasting inhibition of the sodium ion channel activation gate, resulting in repetitive nerve signals in sensory organs, nerves, and muscles.	> Slightly toxic via acute oral and dermal routes. > Acute ingestion exposure causes nausea, vomiting, headache, dizziness, anorexia, and hypersalivation. > Possible endocrine-disruptor.	> Highly toxic to fish and aquatic invertebrates. > Practically nontoxic to birds.* > Highly toxic to honey bees. > Dermal exposure can cause life-threatening effects to cats.
Etofenprox	> n/a	> Virtually insoluble in water. > Stable to hydrolysis. > Susceptible to photolysis.	> Not likely to persist.	> Insecticide: Pyrethroid-like chemical. > Acts on ion channels of the insect nervous system.	> Low toxicity via acute oral, dermal, and inhalation routes.	> Highly toxic to fish and aquatic invertebrates.
Piperonyl butoxide (PBO)	> n/a	> Degrades by photolysis. > Moderately mobile in soil-water systems.	> Degrades rapidly in the environment by photolysis and metabolism by soil microbes. > Moderately mobile in soil-water systems.	> Synergist: added to insecticides. > Enhances the pesticidal properties of other active ingredients, such as pyrethrins and synthetic pyrethroids, by directly binding to microsomal enzymes in the target organism, thereby inhibiting the breakdown of the other pesticides.	> Low toxicity via acute oral, dermal, and inhalation routes. > Possible endocrine-disruptor.	> Moderately toxic to most fish, highly toxic to some fish. > Highly toxic to aquatic invertebrates.

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Table 4-1 Summary Characteristics of Active Ingredients

Active Ingredient: Chemical or Biological	Fate & Transport Air (Volatility)	Fate & Transport Water	Fate & Transport Soil	Mode of Action	Human Health[1]	Ecological Health[1]
Naled	> Readily degraded in air. > Can volatilize.	> Readily degraded in water. > Degrades by photolysis. > Low water solubility.	> Readily degraded in soil under aerobic and anaerobic conditions. > Most mobile in soil of low organic content such as sandy loam.	> Insecticide: Organophosphate for control of adult mosquitoes.	> Moderately toxic via acute oral, dermal, and inhalation routes. > Rapidly absorbed by oral and inhalation exposure and distributes quickly to all tissues.	> Moderately toxic to fish and aquatic invertebrates. > Lethal effects found for birds and honey bees.
Temephos	> n/a	> Breaks down via photolysis and microbial degradation. > Extremely hydrophobic with low solubility.	> Adsorbs rapidly to organic material in water and binds strongly to soils.	> Insecticide: Cholinesterase inhibitor for control of mosquito larvae.	> Moderately toxic via acute oral, dermal, and inhalation routes.	> Slightly to moderately toxic to fish. > Highly toxic to aquatic invertebrates. > Toxic to stoneflies and mayflies.
Bacillus sphaericus (Bs)	> n/a	> Dormant spores persist for several weeks or months. > The δ-endotoxins generally persist for 2 to 4-weeks but are degraded by sunlight and soil microbes.	> Does not percolate through the soil and readily binds to sediments when in water column.	> Mosquito larvicide. > Bacterium contains microscopic protein pro-toxins which paralyzes the gut of larvae when consumed, resulting in starvation.	> Not pathogenic and does not demonstrate any systemic toxicity.	> Not acutely toxic to birds, mammals, fish or invertebrates. > Mosquito predators not affected by secondary exposure.
Bacillus thuringiensis israelensis (Bti)	> n/a	> Degrade rapidly after exposure to UV light. > The δ-endotoxins are degraded by sunlight and soil microbes.	> Spores may persist in soil for several months.	> Mosquito larvicide. > Bacterium containing microscopic protein pro-toxins that paralyzes the gut.	> Not pathogenic and does not demonstrate any systemic toxicity.	> Not acutely toxic to birds, mammals, fish or invertebrates.
Spinosad	> Persists for a few hours in air.	> Persists for a few hours in water. > Binds readily to organic matter in water.	> Binds readily to organic matter in soil. Readily photo degrades. > Unlikely to leach to groundwater. > Quickly metabolized by soil microbes under aerobic conditions.	> Insecticide: Biologically derived from fermentation of a naturally occurring soil microbe. > Activates the CNS of insects through interaction with neuro-receptors causing continuous stimulation of the nervous system.	> Acute toxicity is low by all routes of exposure. > Not carcinogenic.	> Acute toxicity is low for fish, aquatic invertebrates, amphibians, and birds. > Very highly toxic to moths and butterflies.
Methoprene and s-Methoprene	> n/a	> Rapidly degrades in aqueous solution. > Degrades via photolysis and microbial metabolism.	> Relatively immobile in soil. > Metabolized in soil under aerobic and anaerobic conditions via photolysis and microbial metabolism.	> Insecticide: Long chain hydrocarbon ester. > Interferes with normal maturation process during insect life cycles, preventing reproduction.	> Very low toxicity via all acute routes.	> Moderately toxic to fish. > Very highly toxic to aquatic invertebrates. > Practically nontoxic to birds and amphibians.
Alcohol ethoxylated surfactant (monomolecular film)	> n/a	> Half-life in water is from 5 to 22 days.	> n/a	> Larvicide > Spread a thin film on the surface of the water that makes it difficult for larval pests to attach to the water surface, causing them to drown.	> n/a	> No observable effects to amphibians, fish, or non-target aquatic organisms (e.g., shrimp, snails, worms, mayfly naiad). > Surface-breathing insects may be temporarily impacted.
Aliphatic solvents (mineral oils, aliphatic hydrocarbons, petroleum distillates)	> Very low vapor pressure. > Low potential for volatility.	> Very low solubility. > Breakdown in 2 to 3 days.	> High sorption to organic matter.	> Larvicide > Creates a top-coating on water to drown larvae, pupae, and emerging adult mosquitoes.	> No deaths due to any acute doses.	> Practically nontoxic to fish, birds, and honey bees. > Rapid breakdown minimizes impact to non-target organisms.
Potassium Salts (soap salts)	> n/a	> n/a	> Degrade quickly by microbes and do not persist.	> Insecticide: > Fatty acids penetrate insect body coverings, disrupting cell membranes and causing dehydration and death.	> Low oral and dermal toxicity, but may cause stomach upset. > May be irritating to the skin and eyes.	> Slightly toxic to fish. > Highly toxic to aquatic invertebrates. > Practically nontoxic to birds.

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n/a = not applicable

Table 4-1 Summary Characteristics of Active Ingredients

Active Ingredient: Chemical or Biological	Fate & Transport Air (Volatility)	Fate & Transport Water	Fate & Transport Soil	Mode of Action	Human Health[1]	Ecological Health[1]
Chlorophacinone	> Volatizes slowly.	> Low water solubility. > Degrades slowly by acid hydrolysis.	> Degrades slowly by photo degradation. > Moderately persistent and immobile. > Major route of dissipation is aerobic metabolism.	> Rodenticide: > First-generation anticoagulant. Acts by blocking vitamin the K cycle, resulting in the inability to produce blood-clotting factors. Damages capillaries, causing diffuse internal hemorrhaging. Death occurs from hypovolemic shock or severe anemia.	> Highly toxic by all acute exposure routes.	> Toxic to wildlife and fish. > Toxic via primary and secondary ingestion routes.
Diphacinone	> n/a	> Low water solubility. > Stable to photolysis.	> Volatizes slowly from water to soil. > Susceptible to aerobic soil metabolism. > Binds tightly to soil.	> Rodenticide: > First-generation anticoagulant. Acts by blocking vitamin the K cycle, resulting in the inability to produce blood-clotting factors. Damages capillaries, causing diffuse internal hemorrhaging. Death occurs from hypovolemic shock or severe anemia.	> Highly toxic by all acute exposure routes.	> Slightly to moderately toxic to fish and aquatic invertebrates. Does not accumulate in fish > Slightly toxic to birds. > Possible secondary risk to avian predators and scavengers.
Brodifacoum	> Nonvolatile.	> Low water solubility. > Stable to hydrolysis.	> Relatively persistent. > Immobile in soil.	> Rodenticide: > Second-generation anticoagulant. Acts by blocking vitamin the K cycle, resulting in the inability to produce blood-clotting factors. Damages capillaries, causing diffuse internal hemorrhaging. Death occurs from hypovolemic shock or severe anemia.	> Highly toxic by all acute exposure routes.	> Very highly toxic to fish. > Toxic to birds via primary and secondary ingestion exposure. > Nontoxic to honey bees.
Bromadiolone	> n/a	> Stable to hydrolysis.	> Moderately persistent in soil. > Immobile in soil with high organic and clay content. > Susceptible to aerobic soil metabolism.	> Rodenticide > Second-generation anticoagulant. Acts by blocking vitamin the K cycle, resulting in the inability to produce blood-clotting factors. Damages capillaries, causing diffuse internal hemorrhaging. Death occurs from hypovolemic shock or severe anemia.	> Highly toxic by all acute exposure routes.	> Moderately toxic to fish. > Toxic to birds via primary and secondary ingestion exposure.
Difethialone	> n/a	> Adsorbs to suspended solids and sediments. > Can slowly volatize from water surfaces.	> Immobile in soil.	> Rodenticide > Second-generation anticoagulant. Acts by blocking vitamin the K cycle, resulting in the inability to produce blood-clotting factors. Damages capillaries, causing diffuse internal hemorrhaging. Death occurs from hypovolemic shock or severe anemia.	> Highly toxic by all acute exposure routes. > No genotoxic or carcinogenic effects have been noted.	> Highly toxic to fish and aquatic invertebrates. > Very likely toxic to most mammals. > Likely to adversely affect snakes, non-target rodents, carnivorous mammals. > Highly toxic to birds via primary and secondary routes.

[1] Toxicity levels (e.g., slight, low, moderate, high, etc.) are used prevalently in the published literature but are not standardized or representative of specific criteria. They qualitatively describe toxicity in relative terms.
n/a = not applicable

Table 4-1 Summary Characteristics of Active Ingredients

Active Ingredient: Chemical or Biological	Fate & Transport Air (Volatility)	Fate & Transport Water	Fate & Transport Soil	Mode of Action	Human Health[1]	Ecological Health[1]
Cholecalciferol (vitamin D)	> Expected to be nonvolatile.	> Essentially insoluble.	> Immobile in soil.	> Rodenticide > Ingestion results in hypercalcemia from mobilization of calcium from bone matrix to blood plasma leading to metastatic calcification of soft tissues.	> Toxic by all acute exposure routes.	> Considered of low hazard to avian and canine species. > May impact non-target rodents. > Not expected to bioconcentrate in mammals because it is metabolized.
Sulfur (fumigant)	> n/a	> n/a	> Elemental sulfur becomes incorporated into the natural sulfur cycle. Oxidizes into sulfate and reduces into sulfide. Mediated by microbes.	> Rodenticide > Fumigant. Ignited cartridges produce toxic gases, displacing oxygen in burrows, and causing asphyxiation.	> Low toxicity by acute exposure routes. > No known oncogenic, teratogenic, or reproductive effects.	> Practically nontoxic to fish and aquatic invertebrates. > Nontoxic to birds. > Nontoxic to bees.
Sodium Nitrate (fumigant)	> n/a	> n/a	> Sodium nitrates are naturally occurring substances.	> Rodenticide > Fumigant. Pyrolysis of cartridge products results in simple organic and inorganic compounds, such as nitrous oxide and carbon monoxide, which diffuse through burrows causing organisms to die of asphyxiation.	> Low acute oral toxicity. > May cause eye irritation and slight dermal irritation.	> Any non-target organism in the burrow at treatment time will likely be killed. > USEPA recommends that applicators observe signs around burrows carefully for presence of non-targets.
Imazapyr	> Nonvolatile.	> Degradation by photolysis. > Stable to hydrolysis. > Stable to aerobic and anaerobic aquatic metabolism.	> Persistent in soil. > Mobile in soil. > Stable to aerobic and anaerobic soil degradation. > Leaches to groundwater.	> Herbicide > Prevents the synthesis of branched-chain amino acids.	> Slightly toxic via acute oral, dermal, and inhalation routes. > No evidence of carcinogenicity or mutagenicity.	> Practically nontoxic to birds, fish, aquatic invertebrates, and honey bees. > Poses a risk to non-target vascular plants. > Not expected to bioaccumulate.
Glyphosate	> n/a	> Highly water soluble. > In aquatic systems, sediment appears to be the major sink for glyphosate residue. > Broken down by microbial degradation.	> Resistant to chemical degradation and sunlight and is fairly unleachable. > Relatively immobile in soil and does not move vertically below the six inch soil layer. > Low tendency to runoff. > Inactivated and biodegraded by microbes under aerobic and anaerobic conditions.	> Herbicide > Plants: Works via the shikimic pathway by inhibiting the enzyme EPSP synthase. Results in stunted growth, malformation, tissue death, etc. > Animals: Shikimic pathway absent in mammals.	> Very low toxicity via oral and dermal routes. > No evidence of carcinogenic or mutagenic effects. > Possible endocrine-disruptor.	> Practically nontoxic to birds, honey bees, fish, and freshwater invertebrates. > No evidence of bioaccumulation.

[1] Toxicity levels (e.g., slight, low, moderate, high, etc.) are used prevalently in the published literature but are not standardized or representative of specific criteria. They qualitatively describe toxicity in relative terms.
n/a = not applicable

Table 4-1 Summary Characteristics of Active Ingredients

Active Ingredient: Chemical or Biological	Fate & Transport Air (Volatility)	Fate & Transport Water	Fate & Transport Soil	Mode of Action	Human Health[1]	Ecological Health[1]
Triclopyr	> Nonvolatile.	> Highly soluble. > Primary loss via photodegradation. > Triclopyr triethylamine (TEA) rapidly dissociates in water to the acid/anion and triethanolamine. > Triclopyr butoxyethanol ester (TBEE) rapidly hydrolyses to the triclopyr acid/anion and butoxyethanol.	> Slightly mobile with sorption to soil increasing with time. > Primary loss via microbial degradation. > Moderately persistent, with persistence increasing with soil depth and anaerobic conditions.	> Herbicide > Pyridine-based synthetic auxin, which causes the plant to overdose on auxin resulting in epinasty, abnormal leaf formation, stem swelling, and death.	> (Technical triclopyr acid) Slightly toxic via acute oral, dermal, and inhalation routes. > (TEA and TBEE) slightly toxic by acute oral and dermal routes. Practically nontoxic by inhalation. > Not carcinogenic.	> (Triclopyr acid) Slightly toxic to birds and practically nontoxic to insects, fish, and aquatic invertebrates. > (TEA) Practically nontoxic to birds and invertebrates. Slightly toxic to fish. > (TBEE) Slightly toxic to birds, moderately to highly toxic to fish and invertebrates. > Does not bioaccumulate rapidly. > Triclopyr has low toxicity to grasses, but can injure conifers.
2,4-D (2,4-dichlorophenoxy acetic acid)	> n/a	> Found as a free anion in aqueous environments.	> Dissipation due to oxidative microbial mineralization, photodegradation, and leaching.	> Herbicide > Auxin-mimic. > Phenoxy or phenoxyacetic acid which acts as an herbicide, plant growth regulator, and fungicide.	> Low toxicity via oral and dermal routes. > Dose-dependent damage to eyes, thyroid, kidney, adrenals, ovaries, and testes have been observed in chronic studies of rats. > Possible endocrine disruptor.	> Slightly to moderately toxic to birds. > Some formulations highly toxic to fish. Bioconcentrates in fish. > Practically nontoxic to honey bees.
Sulfometuron methyl	> Low potential to volatilize.	> Hydrolysis, photolysis, and microbial degradation are major routes of transformation. > Low tendency to sorb to sediments.	> Hydrolysis, photolysis, and microbial degradation are major routes of transformation. > Potential to leach.	> Herbicide > Inhibits acetolactate synthase, which inhibits the production of amino acids required for cells growth. Retards shoot and root development.	> Low toxicity via oral, dermal, and inhalation routes.	> Nontoxic to birds, aquatic invertebrates, and bees. > Slightly toxic to fish. > Low potential to bioaccumulate. > Phytotoxic to duckweed and a broad range of terrestrial plants.
Bentazon	> n/a	> Photolysis, and microbial degradation are major routes of dissipation.	> Photolysis, microbial degradation, leaching, and runoff are major routes of dissipation. > Low binding affinity to soil.	> Herbicide: > On contact, bentazon interferes with the ability of plants to use sunlight for photosynthesis by inhibiting electron transport.	> Slightly toxic via oral, dermal, and inhalation routes.	> Slightly toxic to birds and small mammals. > Practically nontoxic to fish and aquatic invertebrates. > Low risk to aquatic plants.
Diuron	> n/a	> Major routes of dissipation are microbial degradation.	> Sorption highly correlated with soil organic matter. > Mobile and persistent. > Potential to leach to groundwater and contaminate surface waters.	> Herbicide > Substituted urea that inhibits photosynthesis by limiting the production of ATP, and other necessary metabolic processes. > One of the most commonly used herbicides in California.	> Low toxicity via oral, dermal, and inhalation routes. > Metabolism occurs through hydroxylation and dealkylation. > Known/likely carcinogen based on bladder cancer in rats.	> Slightly to practically nontoxic to birds. > Practically nontoxic to bees. > Moderately to highly toxic to fish and aquatic invertebrates. > Low bioaccumulation potential.
Benfluralin (benefin)	> Volatizes rapidly.	> Major routes of dissipation are photolysis and anaerobic metabolism.	> Low mobility and variable persistence.	> Herbicide > Inhibits growth by acting as a mitotic disruptor.	> Practically nontoxic by acute oral and dermal routes. > Possible endocrine disruptor.	> Practically nontoxic to birds, small mammals, and honey bees. > Highly toxic to fish and aquatic invertebrates. > Considered to be bioaccumulative.

[1] Toxicity levels (e.g., slight, low, moderate, high, etc.) are used prevalently in the published literature but are not standardized or representative of specific criteria. They qualitatively describe toxicity in relative terms.
n/a = not applicable

Table 4-1 Summary Characteristics of Active Ingredients

Active Ingredient: Chemical or Biological	Fate & Transport Air (Volatility)	Fate & Transport Water	Fate & Transport Soil	Mode of Action	Human Health[1]	Ecological Health[1]
Oryzalin	> n/a	> Primary degradation process is photolysis.	> Primary degradation process is photolysis. > Not mobile. > Anaerobic conditions in soil cause chemical reduction.	> Herbicide > Disrupts growth processes during germination by inhibiting cell division in plants.	> Practically nontoxic by acute oral route. > Moderately toxic by acute dermal and inhalation routes. > Possible human carcinogen.	> Slightly toxic to practically nontoxic to birds. > Moderately toxic to fish and freshwater invertebrates. > Practically nontoxic to honey bees. > Does not accumulate in fish.
DCPA (chlorthal dimethyl) [metabolite is tetrachloroterephthalic acid (TPA)]	> Volatilization from soil a major route of dissipation.	> Stable to hydrolysis and photolysis.	> Low persistence and mobility. > The DCPA metabolite TPA is unusually mobile and persistent and will leach to groundwater.	> Herbicide > Kills germinating seeds by disrupting microtubule formation in exposed cells, causing abnormal cell division.	> Slightly toxic to practically nontoxic by all acute exposure routes. > Possible human carcinogen. > Possible endocrine disruptor.	> Practically nontoxic to birds on an acute basis, but persistent enough to result in chronic exposure to birds. > Practically nontoxic to bees. > Slightly toxic to practically nontoxic to fish and aquatic invertebrates.
Dithiopyr	> Volatilization contributes more to dissipation than any other route.	> Degrades slowly in water. > Resistant to photolysis and hydrolysis.	> Immobile in soil.	> Herbicide	> Low acute toxicity. > No known mutagenic or carcinogenic effects.	> na
Metolachlor	> n/a	> Stable under hydrolysis.	> Degradation dependent on microbially-mediated and abiotic processes. Photolysis in soil. > Moderately persistent and mobile. Potential to leach to groundwater.	> Herbicide > Inhibits seedling development by acting as a growth inhibitor by suppressing synthesis of chlorophyll, proteins, fatty acids/lipids, isoprenoids, and flavonoids.	> Slightly toxic via acute routes. > Possible endocrine disruptor.	> Practically nontoxic to birds. > Moderately toxic to fish. > Slightly toxic to aquatic invertebrates. > Low potential for bioaccumulation.
Pendimethalin	> Volatilizes from soil.	stable to hydrolysis, but may be degraded by sunlight in aquatic systems	> Dissipates into the environment by binding to soil, microbially-mediated metabolism, and volatilization. > Persistence decreases with increased temperature and moisture and/or decreased soil organic carbon.	> Herbicide > Disrupts microtubules.	> Low acute toxicity. > Possible human carcinogen.	> Slightly toxic to birds. > Practically nontoxic to honey bees. > Highly toxic to fish and aquatic invertebrates. > High potential to bioaccumulate.
Alkylphenol ethoxylate (APE)	> n/a	> Degrades faster in water than in soil.	> Bind strongly to particulates and are persistent in sediments.* > Aerobic conditions facilitate biotransformation.	> Adjuvant: > Enhance activity of active ingredients in herbicides or offset any problems associated with spray application. > Toxicity of APEs to aquatic organisms increases with alkyl chain length.	> Nonylphenol is of low acute and dermal toxicity. > Possible estrogen-mimics.	> Nonylphenol is persistent in the environment, moderately bioaccumulative, and extremely toxic to aquatic organisms.
Polydimethylsiloxane Fluids	> Volatile.	> Insoluble.	> Typically sorb to particulate matter and become associated with soils and sediments. > Degradation is slow in moist soils and quick in dry soils.	> Adjuvant > Enhance activity of active ingredients in herbicides or offset any problems associated with spray application.	> n/a	> Appear to be relatively nontoxic to benthic invertebrates. > Exhibits little bioaccumulation potential.

[1] Toxicity levels (e.g., slight, low, moderate, high, etc.) are used prevalently in the published literature but are not standardized or representative of specific criteria. They qualitatively describe toxicity in relative terms.
n/a = not applicable

Table 4-1 Summary Characteristics of Active Ingredients

Active Ingredient: Chemical or Biological	Fate & Transport Air (Volatility)	Fate & Transport Water	Fate & Transport Soil	Mode of Action	Human Health[1]	Ecological Health[1]
Modified Plant Oils and Methylated Seed Oil	> n/a	> n/a	> n/a	> Adjuvant > Enhance activity of active ingredients in herbicides or offset any problems associated with spray application.	n/a	> Slightly toxic to fish (Competitor™). > Practically nontoxic to Daphnia (Competitor™). > Generally inert or essentially nonphytotoxic.
Lecithin	> n/a	> n/a	> n/a	> Adjuvant > Enhance activity of active ingredients in herbicides or offset any problems associated with spray application.	n/a	> Slightly toxic to fish (Liberate™). > Moderately toxic to Daphnia (Liberate™).

[1] Toxicity levels (e.g., slight, low, moderate, high, etc.) are used prevalently in the published literature but are not standardized or representative of specific criteria. They qualitatively describe toxicity in relative terms.
n/a = not applicable

4.1.1.1 Environmental Fate

The major routes of dissipation for pyrethrins in the environment are photolysis (both in water and soil, with half lives of less than 1 day in both cases) and to a lesser degree, aerobic soil metabolism (Table 4-2). Hydrolysis under alkaline conditions is an important route of dissipation for pyrethrins in water (half-life at pH 9 is 14-to 17 hours); however, this reaction appears to be relatively slow under neutral or acidic conditions, which are more likely to occur in the environment. Pyrethrins are likely to persist under anaerobic conditions. Pyrethrins quickly adsorb to suspended solids in the water column, and partition into the sediment. They adsorb strongly to soil surfaces and are generally considered immobile in soils; therefore, the potential to leach into groundwater is considered low (USEPA 2006f).

Table 4-2 Degradation of Pyrethrins

Degradation Method	Half-life	Reference
Hydrolysis, pH 9 (water)	14 to 17 Hours	USEPA 2006f
Hydrolysis, neutral or acidic	Slow	USEPA 2006f
Photolysis (water and soil)	<1 Day	USEPA 2006f
Volatilization (soil)	1.8 to 97 Days	Gunasekara 2005
Aerobic metabolism (soil)	10.5 Days	USEPA 2006f
Anaerobic metabolism (soil)	86.1 Days	USEPA 2006f

4.1.1.2 Human Toxicity

Pyrethrins have low to moderate acute toxicity via the oral, dermal, and inhalation routes (Category III and IV). They are a moderate eye irritant (Category III), a mild dermal irritant (Category IV), and not a skin sensitizer. The oral median lethal concentration (LD50) was found to be 1400 mg/kg in rats, the dermal LD50 was found to be greater than 2000 mg/kg in rabbits, and the inhalation LD50 was found to be 3.4 mg/L in rats (USEPA 2006f).

The critical toxicological effects of pyrethrins are (1) neurobehavioral effects (tremors, labored breathing, hyperactivity, secretory signs, matted coats), following acute, short-term, and chronic exposure, with nervous system lesions observed in the rat and mouse following acute exposure; (2) thyroid effects, following chronic exposure in the rat and dog; and (3) liver effects, following short- and long-term exposure in the rat, dog, and mouse. Following inhalation exposure, neurobehavioral effects were observed initially, and respiratory tract lesions were observed at all dose levels. The neurobehavioral effects and the mode of action on the sodium channel are considered relevant to humans because the effects are observed in both the rat and mouse, and the mode of action affects a basic function of the nervous system that is common to all animals (USEPA 2006f).

4.1.1.3 Ecological Toxicity

The results of the toxicity testing with the technical grade active ingredient suggest that pyrethrins are very highly toxic to freshwater fish (LC50 = 5.1 µg/L) and invertebrates (median effect concentration [EC50] = 11.6 µg/L), as well as to estuarine/marine fish (LC50 = 16.0 µg/L) and invertebrates (LC50 = 1.4 µg/L) on an acute basis. Chronic toxicity studies show that pyrethrins impair growth (length and weight) of freshwater fish (lowest observed adverse effect concentration [LOAEC] of 3.0 µg/L) and reproduction of freshwater invertebrates (LOAEC of 2.0 µg/L). The chronic no observed adverse effect concentrations (NOAECs) for freshwater fish and invertebrates were reported as 1.9 and 0.86 µg/L, respectively (USEPA 2006f).

Pyrethrins were practically nontoxic to avian species on an acute oral and dietary basis (oral LD50 >2,000 mg/kg bw; dietary LC50 >5,620 mg/kg diet) (USEPA 2006f).

SWRCB has evaluated freshwater aquatic life toxicity data from USEPA's Office of Pesticides' Ecotoxicity Database and has identified the lowest LC50 for pyrethrins as 1.4 µg/L. This value is based on toxicity to scuds and mysid shrimp during 96-hour tests (SWRCB 2012).

4.1.1.4 Ecological Toxicity Associated with ULV Application for Mosquito Abatement

The active ingredients used for control of adult mosquitoes have been deliberately selected for lack of persistence and minimal effects on non-target organisms when applied at label rates for ULV mosquito control. The products applied as ULV sprays for adult mosquito control are not formulated for persistence, because their purpose is to kill active adult mosquitoes in flight.

Three of the studies discussed below investigated aquatic toxicity following ULV applications of pyrethrins. One study using laboratory toxicity tests on samples after aerial application found no significant mortality to *Ceriodaphnia dubia* following aerial application, and inconclusive results for *Hyalella azteca* (sediment collected prior to application was toxic to *H. azteca*) (Weston et al. 2006). Another study found no significant mortality in caged mosquito larvae or mosquitofish after truck application, and no significant difference in macroinvertebrate abundance, biomass, or species diversity (Jensen et al. 1999). Another study (Lawler et al. 2008) used caged organisms (*Daphnia magna* and *Callibaetis californicus*) to evaluate toxicity after multiple applications, and found no significant difference in mortality.

Following aerial applications of Evergreen Crop Protection EC 60-6 (6 percent pyrethrins, 60 percent PBO) in Sacramento for West Nile virus, Larry Walker and Associates (2006) reported results of water testing on samples from 10 waterways within the treatment area. Treated areas were sprayed nightly for 3 days. One additional application occurred 9 days prior to the 3-day event at selected locations. Samples were taken immediately after application (within 1 to 6 hours), and the next day (16 to 23 hours after the application). Pyrethrins concentrations were detected between 0.234 and 3.77 µg/L from 9 of 26 samples collected immediately after the application. The average concentration for samples collected 1 to 6 hours after application was 0.270 µg/L. Pyrethrins were not detected (<0.2 µg/L) 16 to 23 hours after each spray event.

Testing was also carried out by Weston et al. (2006) following the same applications. Prior to aerial spraying, pyrethrins were not detected in water or sediment samples. Pyrethrins were not detected in water samples taken 10 to 34-hours after the spray applications; however, pyrethrins were detected in sediment samples after aerial spraying at concentrations ranging from 93.1 to 403 micrograms per kilogram [µg/kg] in 4-of 6 samples. Neither water nor sediment was tested at later intervals, so the duration of persistence could not be determined in this study. Laboratory tests were conducted to determine the effects of short-term chronic exposure of *Ceriodaphnia dubia* to water collected after the spray events, following USEPA protocol. No significant differences in mortality were observed. In addition, sediment toxicity tests were performed with the amphipod *Hyalella azteca,* and toxicity was observed in samples collected both before and after application. The authors concluded that pyrethrins should present little risk to aquatic organisms due to the low toxicity and lack of long-term persistence.

Water and soil deposition of pyrethrins following aerial applications was evaluated at two sites in California by Schleier et al. (2008). Water was sampled after aerial applications of pyrethrins and PBO in irrigation ditches at one site (Princeton) and in static ponds at another (Colusa). Pyrethrins were not detected following spray events at either site (the reporting limit was 0.5 µg/L or less). The authors concluded that the amounts of pyrethrins and PBO deposited on the ground and in water after aerial ULV insecticide applications are probably lower than those estimated by previously published studies to predict exposure and risk.

Deposition of pyrethrins following truck-mounted application was evaluated in large seasonal wetlands in California (Jensen et al. 1999). Pyrethrins were not detected (<20 µg/L) in surface waters one hour after ULV applications. The authors found no significant differences in macroinvertebrate abundance and biomass or species diversity in areas treated with any of the materials when compared with untreated ponds. No mortality occurred in mosquitofish held in water (in sentinel cages in treated ponds). Similarly, no difference in mortality was observed for mosquito larvae held in water (in sentinel cages in treated ponds) when compared with untreated ones. The authors concluded that ULV applications for adult mosquito control were not likely to significantly affect aquatic insects or fish in these habitats.

Lawler et al. (2008) evaluated pyrethrins and PBO in sediment following multiple applications of pyrethrins from truck-mounted equipment in the Colusa and Sacramento National Wildlife Refuges in California. Stock tanks were filled with a layer of soil overlain with 1,150 liters of water. Zooplankton (*Daphnia magna*) were held in sentinel cages in the water column and mayfly larvae (*Callibaetis californicus*) were placed in cages at the bottom of each tank, where they were in contact with sediment. ULV applications of pyrethrins were made from truck-mounted equipment twice weekly for six weeks. Pyrethrins concentration in sediments and sentinel survival were evaluated after 5 and 11 spray event applications. Pyrethrins were found at low concentrations (23.1 and 33.1 µg/kg) in 2 of 6 tanks after five spray events, but there was no evidence of accumulation in sediments. After 11 spray events, sediment in 4 of 6 tanks (including one that had held residues after spray 5) contained no detectable amount of pyrethrins (<2 µg/kg), one tank had pyrethrins concentrations at 4 µg/kg, and another at 34.5 µg/kg. There was no significant difference in mortality for mayfly larvae held in sentinel cages on the sediment. Likewise, there was no significant difference in mortality seen in *D. magna* held in the water column. PBO-synergized pyrethrins had no detectable effect on the survival of *D. magna* held in tanks in the spray area, even after 11 biweekly spray events. They concluded that applications of pyrethrins and PBO at rates used for mosquito control did not have detectable effects on the indicator species.

Several papers were published documenting that ULV-applied mosquito adulticides do not accumulate in water or sediment during repeated applications. Chemical testing was conducted following multiple spray events by Amweg et al (2006). There was no increase in the level of pyrethrins or PBO following multiple daily spray events, and the concentration had returned to background level when samples taken one week after the last application were tested. Similarly, Lawler et al. (2008) reported that the concentration of pyrethrins and PBO in tanks within a treated area were not significantly higher after 11 applications than in samples taken after the fifth application. In many cases, the concentrations were actually lower following the 11th spray event than after the fifth spray event.

4.1.1.5 Summary of Toxicity and Potential Effects

Pyrethrins readily degrade in water and soil, but may persist under anoxic conditions. They tend to strongly adsorb to soil surfaces, and hence have low potential to leach into groundwater. These chemicals may have low to moderate acute toxicity to mammals; however, proper personal protective equipment would alleviate potential for human exposure, especially when delivered via ULV techniques. Pyrethrins may be highly toxic to fish (freshwater, estuarine, marine) and invertebrates, although, exposures would likely be low during and following ULV applications, which are designed to prevent environmental persistence and potential impacts to non-target ecological receptors.

Pyrethrin is used for both mosquito (five Districts) and yellow jacket wasp (three Districts) control. For yellow jacket wasp control, pyrethrin (1 percent of the formulation) was applied around parks, landscaping, and directly into ground nests. A single product was applied several hundred times throughout the reporting year at approximately one-ounce doses. For mosquito control, pyrethrin is applied to manmade and natural sites including ditches, and moving and standing water. Three products containing pyrethrin (5 percent) were applied several hundred times throughout the reporting year.

In addition to the toxicity values referenced in Sections 4.1.1.3 and 4.1.1.4, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the Districts.

4.1.2 Allethrins and *d-trans* allethrin

Allethrins are synthetic pyrethroids that are structurally very similar to cinerin I in naturally occurring pyrethrum. There are three asymmetric carbons and, thus, eight potential isomers; however, four isomers are present in the greatest concentration for product formulations. One of the stereoisomers, d trans of d isomer (d-trans allethrin), is recognized as being the most insecticidally active and toxicologically important of the four isomers. Allethrins are typically used as a “knock-down” agent and a different, residual pesticide is co-formulated with allethrins in the end-use products to kill the target pests (USEPA 2007e). D-trans allethrin is usually combined with synergists such as PBO.

Allethrins are used to control flying and crawling insects in a number of commercial, horticultural and residential applications. Commercial applications include space, broadcast and crack and crevice treatments in a variety of commercial, industrial, residential, and institutional sites. Horticultural applications include foliar and fogger treatment on nonfood plants. Residential uses include pest control in homes and outdoor domestic structures, on gardens, and direct application to pets. Allethrins are also approved for use in commercial animal premise (indoor) misting systems (USEPA 2007e).

4.1.2.1 Environmental Fate

Allethrins were the first pyrethroids developed and they differ from more recently developed pyrethroids in their high photolability (USEPA 2007e). The photolysis half-life is less than 8 hours (WHO 1989). Allethrins (and the d-trans allethrin component) are not soluble in water and are expected to adhere moderately to soil containing organic matter. When used in mosquito coils and mats, allethrins are released into the air where they will either be degraded by sunlight or be distributed in low concentrations to nearby surfaces.

4.1.2.2 Human Toxicity

The toxicity of allethrin varies with the amounts of different isomers present. The LD50 of allethrin in male rats is 1,100 mg/kg (685 mg/kg in female rats) while the LD50 of *d-trans* allethrin in rats is 860 mg/kg. Allethrin is slightly toxic to moderately toxic by dermal absorption and ingestion. The dermal LD50 of allethrin in rabbits is 11,332 mg/kg. Dermal exposure results in itching, burning, tingling, and numbness. Large doses by any route can cause physical symptoms such as nausea, vomiting, diarrhea, tremors, convulsions, and coma. A chronic dosage of 50 mg/kg/day for two years produced no detectable effect in dogs. Allethrin is not known to cause reproductive, teratogenic, mutagenic, or carcinogenic effects to mammals (EXTOXNET 1993a).

4.1.2.3 Ecological Toxicity

The chemical is practically nontoxic to birds but highly toxic to fish and invertebrates with the *d-trans* isomer exhibiting greater toxicity to non-target insects than allethrin (EXTOXNET 1993a). The LC50 for fish ranges from 0.0026 to 0.08 mg/L (USEPA 2007e). The bioaccumulation potential of allethrin is unknown.

4.1.2.4 Summary of Toxicity and Potential Effects

Allethrins readily degrade via photolysis especially when released into the air following coil deployment. Residual released material may deposit to soil surfaces and moderately adhere to organic matter. Allethrins may be highly toxic to fish, invertebrates, and non-target insects, but they are unstable in the environment and likely do not pose unacceptable risk to ecological receptors.

Allethrins, including *d-trans* allethrin are intermittently used to target yellow jacket wasp nests. Allethrin (*d-trans* isomer) is combined with another active ingredient, phenothrin in a single product used by two Districts for wasp and yellow jacket control. This product was used in 12 applications of 37.5 ounces (volume) (<0.1 ounces of active ingredients) during the summer of 2011 (of the reporting year). Because allethrins are used in localized, low-volume applications, environmental persistence is not expected nor is unwanted exposure to non-target ecological or human receptors.

In addition to the toxicity values referenced in Sections 4.1.2.2 and 4.1.2.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the Districts.

4.1.3 Phenothrin (sumithrin or d-phenothrin)

Phenothrin has been registered by the EPA since 1976, and is used to control adult mosquitoes, and as an insecticide in transport vehicles such as aircraft, ships, railroad cars, and truck trailers. It is also used as an insecticide and miticide in commercial, industrial, and institutional nonfood areas, in homes and gardens, in greenhouses, and in pet quarters and on pets, and is used in urban areas, outdoor residential areas, around buildings and structures, at recreational areas, golf courses, zoos, and for agricultural crops (CDPR 2010a).

4.1.3.1 Environmental Fate

Phenothrin has a relatively high affinity for binding to soils, moderate persistence in surface soils, and low solubility. Its low leaching potential means that it is likely to remain immobile once it binds to soil sediments. The major routes of dissipation of phenothrin in the environment are photolysis in water (half-life at 6.5 days) and aerobic metabolism (in soil from 18.6 to 25.8 days, and in aquatic environments at 36.1 days) (Table 4-3). Even though phenothrin is likely to undergo photolysis in water, its high affinity for binding to particulate matter makes photolysis less likely to happen, except during the brief period in which the chemical is suspended in water before binding to sediment. Phenothrin is moderately persistent under aerobic conditions and is persistent under anaerobic conditions (USEPA 2008b).

Table 4-3 Degradation of Phenothrin

Degradation Method	Half-life	Reference
Hydrolysis, all pH levels	Stable	USEPA 2008b
Photolysis (water)	6.5 Days	USEPA 2008b
Aerobic metabolism (water)	36.1 Days	USEPA 2008b
Aerobic metabolism (soil)	18.6 to 25.8 Days	USEPA 2008b
Anaerobic metabolism (water)	173.3 Days	USEPA 2008b

4.1.3.2 Human Toxicity

Phenothrin is not known to be acutely toxic at high exposure levels to humans or mammals. Phenothrin exhibits low acute toxicity by oral (Category III), dermal (Category III), and inhalation (Category IV) routes of exposure. Phenothrin is a mild eye irritant (Category III) but is not a skin irritant or a skin sensitizer. The oral LD50 was found to be greater than 5,000 mg/kg in rats, the dermal LD50 was found to be greater than 2,000 mg/kg in rats and the inhalation LC50 was found to be greater than 2.1 mg/L in rats (USEPA 2008b).

Neurotoxic effects were observed in developmental toxicity studies but not observed in other acute, chronic, and subchronic toxicity studies done in rats and dogs up to the limit dose of 20,000 mg/kg/day. Maternal toxicity in rats was evidenced by the appearance of generalized clinical effects in dosed individuals; these effects included decreased maternal weight gain and decreased food consumption at the highest dosage tested of 3000 mg/kg/day (USEPA 2008b).

4.1.3.3 Ecological Toxicity

Phenothrin technical grade active ingredient is highly toxic on an acute basis, with the LC50 ranging from 15.8 to 18.3 µg/L for freshwater fish. Phenothrin is also highly toxic to estuarine/marine fish on an acute basis. The LC50 for estuarine and marine fish ranges from 38.3 to 94.2 µg/L. Phenothrin is very highly toxic to freshwater invertebrates. The EC50 for freshwater invertebrates is 4.4 µg/L. Chronic data for phenothrin show adverse reproductive effects for freshwater invertebrates at a NOAEC of 0.47 µg/L. This indicates a potential for chronic reproductive effects to freshwater invertebrates as a result of phenothrin exposure. Additional chronic effects to estuarine and marine invertebrates are expected based on the chronic reproductive toxicity to freshwater invertebrates and the acute effects to estuarine and marine invertebrates (USEPA 2008b).

Based on studies of avian acute dietary toxicity, phenothrin can be classified as practically nontoxic to avian species. The LC50 for avian dietary toxicity is above 5,000 parts per million (ppm) (USEPA 2008b).

SWRCB has evaluated freshwater aquatic life toxicity data from USEPA's Office of Pesticides' Ecotoxicity Database and has identified the lowest LC50 for phenothrin as 0.025 µg/L. This value is based on toxicity to mysid shrimp during a 96 hour test (SWRCB 2012).

4.1.3.4 Ecological Toxicity associated with ULV Application for Mosquito Abatement

Davis and Peterson (2008) measured family diversity, richness, and evenness at 1, 7, 14, and 28 days after truck application of phenothrin applied as Anvil 10+10 ULV. Most response variables showed no significant treatment effect, although there were some reductions in number of individuals. The authors concluded that the reductions in aquatic non-target populations did not suggest any trends or persistent deleterious biological effects following a single adulticide application.

New York City Department of Health sampled 32 locations for phenothrin and PBO before and after spray events during mosquito adulticide applications that occurred during July through September 2000. Out of the 68 post-application samples collected by the city, only two had concentrations of either phenothrin or PBO greater than the 0.5 µg/L reporting limit: 1.10 µg/L for phenothrin on August 18, 2000, at Mt. Loretto Pond on Staten Island; and 1.03 µg/L for PBO and 0.55 µg/L for phenothrin for a sample collected on August 5, 2000, at Alley Park Pond in Queens (Suffolk County 2006).

Zulkosky et al. (2005) evaluated phenothrin applied as Anvil. In 2002, phenothrin was not detected in either spray event (detection limit of 0.0005 µg/L). In 2003, phenothrin was detected at 0.0011 µg/L immediately after spray application, but was not detected in samples collected 1 to 10 days after spraying Anvil.

The Massachusetts Department of Agricultural Resources (2010) conducted a study where phenothrin was applied aerially as Anvil 10+10 ULV to six sites. There were no detections of phenothrin during this study (Massachusetts Department of Agricultural Resources 2010).

4.1.3.5 Summary of Toxicity and Potential Effects

Phenothrin is generally applied using ULV techniques, which encourages dissipation rather than persistence in the environment. It is not expected to pose unacceptable risk to human or ecological receptors, because it is handled in small amounts using proper personal protective equipment (by the applicator) and its low potential for exposure to non-targets.

As stated above, phenothrin and *d-trans* allethrins are used in conjunction for yellow jacket wasp control. One phenothrin product that contained *d-trans* allethrins was used in limited amounts by two districts during the reporting year. Phenothrins are used in localized, low-volume applications, therefore environmental persistence and meaningful exposure to non-target ecological receptors is not expected.

In addition to the toxicity values referenced in Sections 4.1.3.3 and 4.1.3.4, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British

Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.4 Prallethrin

Prallethrin is a synthetic pyrethroid with fast knock-down activity against household insect pests. It is used in household insecticide products against mosquitoes, houseflies, and cockroaches. Prallethrin also has veterinary uses in the treatment of domestic pets. Prallethrin has been applied in urban areas, outdoor residential areas, recreational areas, golf courses, around building and structures and at areas of standing water (CDPR 2010a). Prallethrin has an exciting effect on mosquitoes, and is added to Duet (the only prallethrin-containing adulticide product used in California) primarily for this property rather than its inherent toxicity. The other active ingredient in Duet is phenothrin.

4.1.4.1 Environmental Fate

Prallethrin readily sorbs to soils and sediments. The major route of dissipation of prallethrin in the environment is photolysis in both water (half-life at 13.6 hours) and soil (at 25 days) (Sumitomo Chemical 2009).

4.1.4.2 Human Toxicity

Prallethrin has low to moderate acute toxicity via the oral and dermal (Category II), and inhalation (Category IV) routes. It is a moderate eye irritant (Category III), not a dermal sensitizer, and is nonirritating to skin. The oral LD50 was found to be 460 to 640 mg/kg to rats, the dermal LD50 was found to be greater than 5000 mg/kg, and the inhalation LC50 (rats nose exposure) was found to be 288 to 333 mg/ml (USEPA 2003a) and 0.855 mg/L for males and 0.658 mg/L for females (MacBean 2012).

4.1.4.3 Ecological Toxicity

Prallethrin is highly toxic to fish (LC50 of 17.6 µg/L based on a 96 hour acute toxicity test to zebrafish (*Danio rerio*) and aquatic invertebrates (EC50 of 19 µg/L based on a 48 hour acute toxicity test to *Daphnia magna*). Prallethrin has low toxicity to algae (EC50 of 4.9 mg/L based on a 72 hour acute toxicity test to *Scenedesmus subspicatus*) and birds (LD50 of 1171 mg/kg for bobwhite quail). It is very toxic to bees (Agro-allianace Pty Ltd nd).

SWRCB has evaluated freshwater aquatic life toxicity data from USEPA's Office of Pesticides' Ecotoxicity Database and has identified the lowest LC50 for prallethrin as 3.9 µg/L. This value is based on toxicity to mysid shrimp during a 96 hour test (SWRCB 2012).

4.1.4.4 Summary of Toxicity and Potential Effects

Like other Type 1 pyrethroids, prallethrin is readily degraded via photolysis and is less environmentally persistent than the Type 2 variety. Prallethrin is used to treat domestic pets and is therefore, not expected to cause significant mammalian toxicity. Prallethrin is practically nontoxic to birds but is highly toxic to non-target organisms including, fish, aquatic invertebrates, and honey bees.

Prallethrin is intermittently used to target yellow jacket and paper wasp nests. Because this active ingredient is used in localized, low-volume applications, it is not expected to persist in the environment or pose unwanted toxicity to non-target ecological or human receptors.

In addition to the toxicity values referenced in Sections 4.1.4.2 and 4.1.4.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.5 Deltamethrin

Deltamethrin is a pyrethroid that kills insects on contact and through ingestion. Type II pyrethroids such as deltamethrin induce long-lasting inhibition of the sodium ion channel activation gate. This results in prolonged permeability of the nerve to sodium and produces a series of repetitive nerve signals in sensory organs, nerves, and muscles. The mechanism is the same for target and non-target organisms (National Pesticide Information Center 2010). The primary use of deltamethrin (approximately 85 percent of the total production) is for crop protection. Deltamethrin is also used to protect stored commodities such as cereals, grains, and coffee beans. Other uses include insect control for public health concerns, pest control in forestry, pest control in animal facilities, parasite control on animals, and as a wood preservative (CDPR 2000). Deltamethrin is used as a mosquito adulticide to a limited extent in California, but public health uses typically target other vectors such as yellow jackets. It is used as a barrier application and not a ULV application and it is not used over or adjacent to water bodies. Formulations used for mosquitoes include Suspend SC Insecticide (primarily used), and K-Othrine SC Insecticide, while Delta Dust, a powdered formulation, is used to control yellow jackets and wasps.

4.1.5.1 Environmental Fate

Deltamethrin degrades via hydrolysis, photolysis, and microbial action (Table 4-4) and is more persistent in soils with a high clay or organic matter content. The half-life of deltamethrin is approximately 25 to 33 days under aerobic conditions (CDPR 2000, FAO-WHO 2002a).

Table 4-4 Degradation of Deltamethrin

Degradation Method	Half-life	Reference
Hydrolysis, pH 8	31 Days	FAO-WHO 2002a
Hydrolysis, pH 9	2.5 Days	FAO-WHO 2002a
Photolysis (water)	<21 Days	FAO-WHO 2002a
Photolysis (soil)	48 Days	FAO-WHO 2002a
Aerobic metabolism (soil)	25 to 33 Days	FAO-WHO 2002a
Anaerobic metabolism (soil)	32 to 36 Days	FAO-WHO 2002a
Field conditions (soil)	14 to <150 Days	FAO-WHO 2002a

4.1.5.2 Human Toxicity

Deltamethrin is of low to moderate acute toxicity. The oral LD50 for rats is 30 mg/kg in an oil vehicle or >5,000 mg/kg in a water vehicle. The LD50 for dogs is 300 mg/kg (MacBean 2012). The acute dermal LD50 for rabbits is >2,000 mg/kg and no skin irritation and slight eye irritation were reported (EXTOXNET 1995a). Symptoms of acute exposure in humans include ataxia, convulsions, dermatitis, edema, diarrhea, headache, irritability, among others (EXTOXNET 1995a). Symptoms of chronic exposure of humans to deltamethrin include choreoathetosis, hypotension, prenatal damage, and shock (EXTOXNET 1995a). Deltamethrin has no reported teratogenic, mutagenic, or carcinogenic effects. Mice fed doses of deltamethrin during gestation showed no changes in the number of implants, fetal mortality, fetal weight, or malformations (EXTOXNET 1995a).

4.1.5.3 Ecological Toxicity

Deltamethrin is very highly toxic to fish and aquatic invertebrates. It is practically nontoxic to birds (USEPA 2010a). Of particular importance when using pyrethroids in general is to note that non-target insects may have the same approximate sensitivity as mosquito larvae (Mian and Mulla 1992). These include mayflies, stoneflies, whirligig beetle, caddisflies, and the snipefly. The water boatman and backswimmer have low sensitivity to some pyrethroids. See Table 2 of Mian and Mulla (1992). Deltamethrin is very highly toxic to honey bees (USEPA 2010a).

4.1.5.4 Summary of Toxicity and Potential Effects

Deltamethrin may be persistent in high organic matter soils and aquatic sediments. It is nonselective and therefore, may pose risk to non-target organisms such as honey bees. Deltamethrin is highly toxic to fish (and bioaccumulative) and invertebrates, however, it is generally not applied to aquatic systems. It is not expected to pose risk to aquatic receptors under the prescribed application usage by the nine Districts.

One product containing deltamethrin (0.05 percent) is used by two Districts for yellow jacket wasp control. It is primarily used in the summer months to specifically target yellow jacket wasp ground nests. It was applied almost 300 times during the summer of 2011. There are a range of limited exposure and localized and limited usage patterns and potential unwanted effects are dependent on the use.

In addition to the toxicity values referenced in Sections 4.1.5.2 and 4.1.5.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.6 Esfenvalerate

Esfenvalerate is a broad-spectrum nonselective insecticide applied as needed for the control of a wide selection of arthropod pests. Esfenvalerate is a mixture of four stereoisomers, enriched with the S,S-isomer, the most insecticidally active isomer. (The parent mixture, fenvalerate, is a mixture of the same four isomers in relatively equal proportions.) Esfenvalerate containing products registered for use in California are applied for home/garden consumer use, commercial pesticide application use, and agricultural production use (Kelley 2003). Esfenvalerate is a voltage-dependent sodium-channel agonist. Esfenvalerate works against the insect nervous system, resulting in repetitive firing of neurons.

4.1.6.1 Environmental Fate

Esfenvalerate is practically insoluble in water, extremely hydrophobic and has a strong tendency to bind to soil particles. Esfenvalerate, as a result of these characteristics, is relatively immobile in soil and shows a low tendency to leach. Esfenvalerate, when present in surface waters, is expected to be bound to suspended particulates (clay, soil, and sediment particles) and to organic matter (Kelley 2003). Primary degradation pathways include photolysis and aerobic metabolism (Table 4-5). (FAO-WHO 2002b)

Table 4-5 Degradation of Esfenvalerate

Degradation Method	Half-life	Reference
Hydrolysis, pH 5–9	64 to 130 Days	FAO-WHO 2002b, Kelley 2003
Photolysis (water)	6 to 17.2 Days	FAO-WHO 2002b, Kelley 2003
Photolysis (soil)	3 to 15.8 Days	FAO-WHO 2002b, Kelley 2003
Aerobic metabolism (water)	4 to 72.3 Days	Kelley 2003
Aerobic metabolism (soil)	35 to 546 Days	FAO-WHO 2002b, Kelley 2003
Anaerobic metabolism (water)	65 to 79 Days	Kelley 2003
Anaerobic metabolism (soil)	104 to 203 Days	Kelley 2003

4.1.6.2 Human Toxicity

Esfenvalerate is relatively new compared to other pesticides on the market; therefore, the usage history for this compound is incomplete. The oral LD50 of esfenvalerate in rats is 75 to 88 mg/kg (Table 6-1). The dermal LD50 in rabbits is 2,000 mg/kg (considered moderately toxic) (Table 6-1). The inhalation LC50 in rats is greater than 2.93 mg/L (EXTOXNET 1994, (Table 6-1). Esfenvalerate has not been implicated in cancer or birth defects in mammal studies. Esfenvalerate is included in the final list of candidate chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.1.6.3 Ecological Toxicity

Esfenvalerate is moderately toxic to birds. The acute oral LD50 for mallard ducks is 9,932 mg/kg. The compound is highly toxic to fish and aquatic invertebrates. Esfenvalerate is highly toxic to bees (EXTOXNET 1994) (Table 6-1). The compound tends to repel bees for a day or two after application. Most intoxicated bees die in the field before they can return to the hive (EXTOXNET 1994). The 96-hr LC50 is 0.00026 mg/L for bluegill and rainbow trout and 0.00024 µg/L for *Daphnia magna* (EXTOXNET 1994). Esfenvalerate rapidly bioaccumulates in fish. The bioaccumulation factor in rainbow trout is about 400 times the background esfenvalerate water concentrations.

4.1.6.4 Summary of Toxicity and Potential Effects

Esfenvalerate is insoluble in water and tends to bind to organic matter in soils and sediment with low leaching potential. Degradation occurs through photolysis and aerobic metabolism, therefore it does not appear to persist in the environment. This pesticide is generally deployed in bait stations above the ground, which limits its release to the soil surface and aquatic systems. Esfenvalerate is considered moderately toxic to mammals and birds; and highly toxic to aquatic invertebrates and honey bees. In addition, it is both highly toxic to and bioaccumulative in fish.

Esfenvalerate was not used by the MVCAC districts during the reporting year. As a result, potential loading scenarios to different habitats types could not be determined. Potential non-target biological receptors could also not be surmised due to the lack of habitat-specific application data. However, as noted above, honey bees could be at risk from this pesticide. There pesticide also demonstrates a lack of persistence potential.

In addition to the toxicity values referenced in Sections 4.1.6.2 and 4.1.6.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.7 Lambda-cyhalothrin

Lambda-cyhalothrin is a synthetic pyrethroid insecticide used for controlling pest insects in agriculture, public health, and in construction and households. Lambda-cyhalothrin is a 1:1 mixture of two of the four enantiomers, which constitute cyhalothrin. Insecticidal products containing lambda-cyhalothrin have been widely used to control insect pests in agriculture, public health, and homes and gardens (He et al. 2008).

4.1.7.1 Environmental Fate

Lambda-cyhalothrin is an extremely hydrophobic compound and has rapid and strong adsorption to soils and sediments. Lambda-cyhalothrin residues dissolved in water decrease rapidly if suspended solids and/or organic materials are present because lambda-cyhalothrin molecules are strongly adsorbed by particulates and plants (He et al. 2008). Primary degradation pathways include photolysis and aerobic metabolism (Table 4-6). (FAO-WHO 2008)

Table 4-6 Degradation of Lambda-cyhalothrin

Degradation Method	Half-life	Reference
Hydrolysis, pH 5	Stable	FAO-WHO 2008
Hydrolysis, pH 7	454 to Days	FAO-WHO 2008
Hydrolysis, pH 9	7.3 Days	FAO-WHO 2008
Photolysis	24 Days	FAO-WHO 2008
Aerobic metabolism (soil)	22 to 83 Days	FAO-WHO 2008
Microcosm (water)	<1 Day	He, et al. 2008

4.1.7.2 General Toxicity

In 2005, a pyrethroid insecticide analysis report was completed for the Sacramento, San Joaquin, and Central valleys to summarize existing information on pyrethroid usage patterns, fate and transport, and toxicity (Oros and Werner 2005). The report identified lambda-cyhalothrin as one of the top five pyrethroids used in these areas to manage pests in a variety of settings and applications. According to Oros and Werner (2005), lambda-cyhalothrin has been found in sediments at levels that are known to be toxic to the several representative invertebrate species in the Sacramento, San Joaquin, and Central valleys.

4.1.7.3 Human Toxicity

Lambda-cyhalothrin is moderately toxic via the acute oral, dermal, and inhalation routes (NPIC 2001).The median lethal oral dose (LD50) of lambda-cyhalothrin has been reported at 56 to 79 mg/kg for female and male rats (MacBean 2012), respectively or as high as 144-mg/kg (Ray 1991) (Table 6-1). Technical-grade lambda-cyhalothrin is less toxic when exposure occurs dermally, given its relatively poor absorption by this route; dermal LD50s of 632 mg/kg and 696 mg/kg for male and female rats have been cited (Table 6-1). One of the formulated products, Karate®, can cause significant skin and eye irritation (Ray 1991).

Acute exposure to lambda-cyhalothrin has been linked with changes in neurological function when administered at a single dose of 0, 2.5, 10, or 35 mg/kg-d, a result consistent with its action on sodium channel permeability (USEPA 2002). Rats exposed for 4-hours to an aerosol of cyhalothrin at concentrations of 3.68 to 68 mg/m^3 exhibited a concentration-dependent increase in signs of neurotoxicity. Effects ranged from lethargy and salivation at the lowest concentration, to death (shortly after termination of exposure) at the highest concentration (Curry and Bennet 1985).

Chronic studies of lambda-cyhalothrin and cyhalothrin have repeatedly and consistently documented decreased body weight gain and reduced food consumption exposure levels as low as 0.9 mg/kg/day, with numerous study results yielding NOAELs of 1 to 2.5 mg/kg/day. Signs of neurotoxicity and changes in organ weights are also common effects of chronic exposure to lambda-cyhalothrin and cyhalothrin (USEPA 2002, 2004a, 2007a,b).

Although little research on the developmental toxicity of lambda-cyhalothrin is publically available, the information provided by the USEPA indicates that the maternal NOAEL was 10 mg/kg-d for both species (USEPA 2002, 2004a). The developmental NOAEL was the highest dose tested in each study; in rats, it was 15 mg/kg-d, and in rabbits, 30 mg/kg-d. A study of the reproductive effects of this compound over three generations indicated a LOAEL of 5.0 mg/kg-d which elicited adverse effects in both the parents and pups, with toxicity manifested as reduced body weight and body weight gain in the parents, and reduced pup weight and reduced pup weight gain during lactation (USEPA 2002, 2004a). No genotoxicity data for cyhalothrin or lambda-cyhalothrin were identified in recent USEPA pesticide tolerance documents

(USEPA 2002, 2004a, 2007b). A chronic feeding study of cyhalothrin in the diets of rats resulted in no oncogenic effects (USEPA 2002).

4.1.7.4 Ecological Toxicity

Lambda-cyhalothrin is of low toxicity to birds. The oral LD50 for the mallard duck is >3,950 mg/kg and the dietary LC50 for the bobwhite quail is 5,300 mg/kg (WHO 2007, MacBean 2012). A 1-year neurotoxicity study on the dog where lambda-cyhalothrin was administered by gavage, derived a NOAEL of 0.5 mg/kg bw per day and a LOAEL of 3.5 mg/kg bw per/day. Systemic neurotoxicity (i.e., ataxia, tremors, and occasionally convulsions) was observed, with an overall NOAEL of 0.5 mg/kg bw per day. Signs of systemic neurotoxicity were observed from the first week and generally occurred within a few hours after treatment (PMRA 2003). In 2007, the USEPA released a revised Pesticide Tolerance for lambda-cyhalothrin, published in the Federal Register Volume 72, Number 157, indicating that the dog is known as the most vulnerable to toxic effects.

Lambda-cyhalothrin is highly toxic to aquatic organisms, including fish, shellfish, shrimp, crabs and clams (He et al. 2008). The 96-hr LC50 is 0.21 µg/L for bluegill (WHO 2007) and 0.24 µg/L for rainbow trout (He et al. 2008). The 48-hr LC50 for *Daphnia magna* is 0.26 µg/L (MacBean 2012).

Lambda-cyhalothrin is known to be toxic to honey bees. As presented by IPCS, honey bees have an oral LD50 of 0.97 µg/bee. Additionally, He et al. (2008) and MacBean 2012 reported an oral LD50 over 48-hours and contact LD50 of 0.038 µg/bee and 0.909 µg/bee, respectively.

4.1.7.5 Summary of Toxicity and Potential Effects

Lambda-cyhalothrin may be persistent in the absence of light and has been found at concentrations known to be toxic to aquatic invertebrates. The potential for persistence of this chemical and its toxicity to mammals, aquatic organisms (vertebrates and invertebrates), and non-target insects such as honey bees is of concern from a potential human and ecological risk perspective.

Lambda-cyhalothrin is available to the public in commonly-used products for residential wasp control. Lambda-cyhalothrin is used by one district for targeted application to yellow jacket and paper wasp nests. This product (0.01 percent lambda-cyhalothrin) is used throughout the year and exceeded 2,000 ounces (volume) of product and less than one ounce of active ingredient during the reporting year. Some of the Districts use products containing this active ingredient as a courtesy to the public to assist with wasp control at residences (restricted to yards, gardens, and home exteriors). The amount applied directly to wasp nests (by the public and the Districts) is minute and there is little to no potential for non-target organism exposures. The potential for human exposure (public and trained professionals [e.g., District staff]) is extremely low when product label instructions are properly followed.

Although there is a potential for environmental persistence and exposure to domestic pets and non-target receptors, this a.i. is readily available as an insect spray and the uses by the Districts are generally focused, and very localized to minimize or eliminate those exposures.

In addition to the toxicity values referenced in Sections 4.1.7.3 and 4.1.7.4, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.8 <u>Resmethrin</u>

Resmethrin has been registered by the EPA since 1967, and is used to control flying and crawling insects in the home, lawn, garden, and industrial sites. It can also be used to control insects on ornamental plants (outdoor and greenhouse use), on pets and horses, and as a mosquitocide. Resmethrin is also used at commercial and industrial areas, warehouses, urban areas, and golf courses, and on aquatic areas or standing water, and selected agricultural crops. Because of its toxicity to fish, resmethrin is a restricted-use pesticide (RUP) for the purpose of public health mosquito abatement, and is available for this use only by certified pesticide applicators or persons under their direct supervision. Resmethrin works by interacting with sodium channels in the peripheral and central nervous system of target organisms (USEPA 2006g).

4.1.8.1 Environmental Fate

Resmethrin degrades rapidly when exposed to light; however, when not subject to photolysis, resmethrin tends to be environmentally persistent (Table 4-7). Reported half-lives in water range from 22 minutes (photolysis in seawater) to 37 days (aerobic metabolism). Resmethrin has low mobility and has a high affinity to bind to soils/sediments and organic carbon (USEPA 2006g).

Table 4-7 Degradation of Resmethrin

Degradation Method	Half-life	Reference
Hydrolysis, pH 5 – 9	>89 Days	USEPA 2006g
Photolysis (distilled water)	47 minutes	USEPA 2006g
Photolysis (seawater)	22 minutes	USEPA 2006g
Aerobic metabolism (water)	37 Days	USEPA 2006g
Aerobic metabolism (soil)	198 Days	USEPA 2006g
Anaerobic metabolism (soil)	Stable	USEPA 2006g

4.1.8.2 Human Toxicity

Resmethrin has low acute toxicity via the oral (Category III), dermal (Category III), and inhalation (Category IV) routes of exposure. It is not an eye or skin irritant nor is it a skin sensitizer. The oral LD50 was 4639 to 6091 mg/kg in rats, the dermal LD50 was found to be greater than 2000 mg/kg in rabbits, and the inhalation LC50 was found to be 5.28 mg/L in rats (USEPA 2006g). Lower oral LD50 and inhalation LC50 values have been reported by MacBean (2012) and have been used in Table 6-1. Resmethrin is included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.1.8.3 Ecological Toxicity

Resmethrin is moderately toxic to birds. The oral LD50 for red-winged blackbirds is 75 mg/kg. Resmethrin technical grade active ingredient is very highly toxic to freshwater fish and invertebrates and to estuarine/marine fish and invertebrates. The LC50 or EC50 ranges from 0.28 to 1.3 µg/L for rainbow trout (*Oncorhynchus mykiss*), water flea (*Daphnia magna*), sheepshead minnow (*Cyprinodon variegatus*), and pink shrimp (*Penaeus duorarum*). Both freshwater fish and estuarine/marine fish early life-stage chronic toxicity tests were used to evaluate the chronic toxicity of resmethrin. Results from the freshwater fish early life-stage toxicity test indicated a NOAEC of 0.32 µg/L and an LOAEC of 0.59 µg/L (EPA 2006g). Resmethrin is very highly toxic to honey bees (LD50 = 0.063 µg/bee) (USEPA 2006g).

SWRCB has evaluated aquatic life toxicity data from USEPA’s Office of Pesticides’ Ecotoxicity Database and has identified the lowest LC50 for resmethrin of 0.28 µg/L (SWRCB 2012). This value is based on toxicity to rainbow trout during a 96-hour test.

4.1.8.4 Ecological Toxicity associated with ULV Application for Mosquito Abatement

Abbene et al. (2005) evaluated deposition of resmethrin in formulation with PBO (Scourge) following truck-mounted applications in fresh and salt water marshes at 6 sites. Resmethrin was not detected in water samples from any site (<0.005 µg/L). Deposition of resmethrin following aerial applications by helicopter was assessed in the same report (Abbene et al. 2005). Applied materials were detected in some water samples taken within 30 minutes of the application. The average concentration of resmethrin following helicopter applications was 0.037 µg/L. The highest concentrations were found in some samples collected from surface water within 1 hour of helicopter applications (0.293 µg/L resmethrin). The authors carried out a series of sample collections after two spray events to evaluate the persistence of the material in water. Resmethrin displayed an exponential decrease and was not detected (<0.005 µg/L) within 9 hours of the application. One site included two repeat weekly applications of resmethrin following an application of methoprene the prior week. Concentrations of resmethrin and PBO measured after the second application were lower than those measured after the first application.

The same study included effects of aerial applications of resmethrin and PBO on two aquatic organisms: the sheepshead minnow (*Cyprinodon variegatus*) and the estuarine grass shrimp (*Palaemonetes pugio*) (Suffolk County 2006). The field study faced problems with low dissolved oxygen and high temperature, which compromised their ability to detect toxicity that may have been due to pesticide exposure. Therefore, dosing experiments and prey capture tests were conducted in the laboratory to measure toxicity of the applied products. These tests demonstrated that the doses used in the spray were not directly toxic to grass shrimp and did not affect their ability to capture prey under controlled conditions. Further laboratory experiments demonstrated that all of the mortality seen in the field could have been caused by low dissolved oxygen alone, using a USEPA time-to-death approach. Furthermore, their data showed that the chemicals used had very low persistence in the water column, as discussed above. Resmethrin was never detected in sediment and was not detected in samples from surface water taken more than 2 hours after the spray.

A related study evaluated benthic community structure, and found that benthic population differences could not be attributed to the application of pesticides, but were more likely due to environmental differences (Suffolk County 2006).

Zulkosky et al. (2005) sampled freshwater ponds, salt marshes, tidal inlets and embayments, and marine coastal water off Staten Island, New York within an hour after mosquito control applications of resmethrin (Scourge). In 2002, resmethrin was detected in five of ten locations at concentrations ranging from 0.0017 to 0.98 µg/L (detection limit of 0.0005 µg/L). No information was provided on application methods at each site.

4.1.8.5 Summary of Toxicity and Potential Effects

Resmethrin may also be persistent in environments free of light (e.g., bound to organic matter in anoxic soils and sediments). Due the potential for persistence and high toxicity to both aquatic and estuarine/marine fish and invertebrates, as well as the potential for endocrine disruption, this RUP may be of concern from a potential ecological risk perspective.

Resmethrin is contained in one product (18.5 percent) used by one of the Districts. It is applied to habitats with tree holes, residential areas near reclaimed marshes, and industrial areas for mosquito control. Seven applications during the spring and summer (2012 and 2011, respectively) resulted in the use of almost two gallons of product (<0.5 gallons of resmethrin). Studies have shown rapid dissipation/low persistence and no observed aquatic fish and invertebrate toxicity following aerial ULV applications.

Scourge® is being phased out and replaced with a nonresmethrin alternative, making this product less problematic.

In addition to the toxicity values referenced in Sections 4.1.8.2 and 4.1.8.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.9 <u>Tetramethrin</u>

Tetramethrin is part of the pyrethroid class of pesticides and was first registered in 1968. It is a broad spectrum, nonsystemic, synthetic pyrethroid used to control flying and crawling insects in a number of commercial, horticultural and residential applications. Commercial applications include space, broadcast and crack-and-crevice treatment in a variety of commercial, industrial, residential, and institutional sites. Horticultural applications include foliar and fogger treatment on nonfood plants. Residential uses include pest control in homes and outdoor domestic structures, on gardens and direct application to cats, dogs and horses. Tetramethrin is a mixture of four stereoisomers designated as 1R-trans, 1R-cis, 1S-trans, and 1S-cis in an approximate ratio of 4:1:4:1. The first two isomers are the most insecticidally active (USEPA 2010c).

4.1.9.1 Environmental Fate

Tetramethrin is not a persistent pyrethroid in the environment (Table 4-8). It may be co-formulated with synergists, other active ingredients such as pyrethrins and pyrethroids, and growth inhibitors. These other ingredients are more persistent than tetramethrin and provide residual activity against insects not initially exposed. Tetramethrin decomposes rapidly by photolysis and hydrolysis in shallow, nonturbid water. Tetramethrin is slightly mobile in soil (USEPA 2010c).

Table 4-8 Degradation of Tetramethrin

Degradation Method	Half-life	Reference
Hydrolysis, pH 5	15.9 to 19.7 Days	USEPA 2010c
Hydrolysis, pH 7	0.89 to 1.06 Days	USEPA 2010c
Hydrolysis, pH 9	13 to 20 minutes	USEPA 2010c
Photolysis (air)	30 minutes	USEPA 2010c

4.1.9.2 Human Toxicity

The USEPA considers tetramethrin to be slightly toxic via the oral and dermal routes (Category IV and III respectively) and classifies it as a Category III eye irritant. The oral LD50 for rats is >5,000 mg/kg. The dermal LD50 for rabbits is >2,000 mg/kg. Tetramethrin meets the criteria for classification as a possible human carcinogen (USEPA 2010c) (Table 6-1).

4.1.9.3 Ecological Toxicity

The USEPA evaluated the potential ecological risk posed by use of tetramethrin both indoors and outdoors and concluded that exposure to non-target organisms is unlikely. Tetramethrin is considered practically nontoxic to birds and terrestrial mammals. The oral LD50 for bobwhite quail is >2,250 mg/kg bw (USEPA 2010c). Tetramethrin is considered highly toxic to aquatic organisms. The 96-hr LC50 of tetramethrin for rainbow trout is 3.7 µg/L. The 48-hr EC50 for immobilization of *Daphnia magna* is 45 µg/L (USEPA 2010c). Tetramethrin is also highly toxic to honey bees. The contact 48-hr LD50 is 0.155 µg/bee (Table 6-1).

4.1.9.4 Summary of Toxicity and Potential Effects

Tetramethrin is not persistent in the environment and degrades rapidly (photolysis and hydrolysis) in surface waters. It is only slightly mobile in saturated soils and is highly toxic to fish and aquatic invertebrates, as well as honeybees. Tetramethrin does not appear to pose a risk to humans; however, it has been classified as a possible human carcinogen.

Tetramethrin is used by one district during the spring, summer, and fall for yellow jacket and paper wasp control. A single product (containing 0.1 percent tetramethrin) was applied directly to more than 80 nests, which corresponded to approximately 2,000 ounces (volume) of product, or approximately 2 ounces of active ingredient used during the reporting year. Although there is a potential for effects to fish and aquatic invertebrates, the uses by the Districts are generally focused, and very localized to minimize or eliminate those potential non-target exposures.

In addition to the toxicity values referenced in Sections 4.1.9.2 and 4.1.9.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.10 Permethrin

Permethrin is a Type I pyrethroid (i.e., it lacks a cyano group at the alpha-carbon position of the alcohol moiety) that primarily targets the nervous system of insects, causing muscle spasms, paralysis, and death (USEPA 2006d). Permethrin has been registered by the EPA since 1979, and is currently registered and sold in a number of products such as household insect foggers and sprays, tick and flea sprays for yards, flea dips and sprays for cats and dogs, termite treatments, agricultural and livestock products, and mosquito abatement products. Permethrin is also used at urban areas, household gardens, recreation areas, golf courses, hospitals, zoos, pastureland, and animal husbandry areas (CDPR 2010a).

4.1.10.1 Environmental Fate

Permethrin has very low mobility, is moderately persistent and has a high affinity to bind to soils/sediments and organic carbon. The relatively low water solubility and hydrophobic nature of permethrin leads to strong soil adsorption and a tendency to partition to sediment in aquatic systems. It is also slow to hydrolyze and biodegrade. Reported half-lives in surface water range from 1.8 hours to <2.5 days (Imgrund 2003). Major degradation pathways include photolysis and microbial metabolism (Table 4-9).

Table 4-9 Degradation of Permethrin

Degradation Method	Half-life	Reference
Hydrolysis	Stable (pH 3-6), 125–350 Days (pH 9)	CDPR 2010a, USEPA 2009a
Photolysis, ponds (water)	19.6 to 27.1 Hours	Imgrund 2003
Photolysis (soil)	104 to 324-Days	Imgrund 2003
Aerobic metabolism (soil)	3.5 to 113 Days	Imgrund 2003
Anaerobic metabolism (water)	113 to 175 Days	USEPA 2009a
Anaerobic metabolism (soil)	<3 to 197 Days	Imgrund 2003
Sediment/seawater degradation	<2.5 Days	Imgrund 2003
Streams, pH 7.0 to 7.5, 13 to 15°C	1.8 to 20.4 Hours	Imgrund 2003

4.1.10.2 Human Toxicity

Acute oral studies conducted with rats by the Department of Defense (DOD 1977) showed that exposure to permethrin caused tremors, weight loss, and increased liver and kidney weights starting at 185 mg/kg. The NOAELs in the DOD studies ranged from 92 to 210 mg/kg.

Oral LD50 values in rats range from 220 mg/kg to 8900 mg/kg and in mice, from 230 mg/kg to 1,700 mg/kg (IPCS 1999). The lethal dose of permethrin depended both on the vehicle in which permethrin was administered, as well as the cis/trans composition of the mixture. Permethrin is only slightly toxic via the dermal route, with an LD50 >2,000 mg/kg in rabbits (Braun and Killeen 1975b, Sauer 1980a). Permethrin of various cis/trans formulations has caused only very mild irritation when applied to either intact or abraded skin of rabbits (Braun and Killeen 1975b, a, Sauer 1980 b). Dermal exposure in humans can cause tingling and pruritus with blotchy erythema on exposed skin, and has caused transient paresthesia (ATSDR 2003).

In humans, acute effects observed subsequent to ingestion of permethrin included nausea, vomiting, abdominal pain, headache, dizziness, anorexia, and hypersalivation. Reports of severe poisoning are rare and usually follow ingestion of substantial, but poorly described, amounts of permethrin. Symptoms of severe poisoning include impaired consciousness, muscle fasciculation, convulsions, and noncardiogenic pulmonary edema (ATSDR 2003). Dermal exposure in humans can cause tingling and pruritus (itchy sensation) with blotchy erythema (reddening of the skin) on exposed skin. Systemic effects are similar to those seen in acute and chronic ingestion with prolonged contact or contact with high concentrations of permethrin. Acute toxicity to permethrin via inhalation has been shown to be very small. The 4-hour LC50 was 23.5 mg/L for inhalation in rats (Kidd and James 1991).

The USEPA (2006a) has classified permethrin as category III for acute oral and acute dermal toxicity; category III for eye irritation potential, and category IV for dermal irritation potential. Technical grade permethrin is not considered a skin sensitizer (USEPA 2006a). Permethrin is included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.1.10.3 Ecological Toxicity

Permethrin can be toxic to wildlife at high doses and it should not be applied or allowed to drift to crops or weeds where active foraging takes place (USEPA 2006d). However, in controlled toxicity tests with rats as mammalian surrogates permethrin is considered to have low mammalian toxicity (Cantalamess 1993). Permethrin has low toxicity to dogs (Richardson 1999), gerbils, guinea pigs, hamsters, mice and rats (Cantalamessa 1993, Sutton et al. 2007); however, dermal exposure in cats of 100 mg/kg of permethrin (equivalent to 1 mL of a 45 percent PSO in a 4.5 kg cat) has resulted in life-threatening effects (Hansen 2006).

Permethrin is practically nontoxic to birds (USEPA 2006d). The acute 5-day dietary LC50 for mallard ducks is >10,000 mg/kg/day.

Permethrin is very highly toxic to fish and aquatic invertebrates. The 96-hr LC50 for bluegill sunfish is 0.79 µg/L. The EC50 for *Hexagenia bilineata* is 0.1 µg/L (USEPA 2006d).

Permethrin is highly toxic to bees in laboratory conditions from contact exposure. Acute contact and oral toxicity reported by USEPA (USEPA 2006d), was an LD50 of 0.13 µg/bee and 0.024-µg/bee, respectively. MacBean (2012) has reported a higher contact effects value of 0.029 µg/bee. Theiling and Croft (1988) indicate that severe losses may be expected if bees are present at the time of treatment, or within a day thereafter. However, when used properly, permethrin has a strong repellent effect in the environment and has been considered to pose little risk to bees (USEPA 2006d).

4.1.10.4 Ecological Toxicity associated with ULV Application for Mosquito Abatement

Deposition of permethrin following truck-mounted application was evaluated in large seasonal wetlands in California (Jensen et al. 1999). Permethrin was not detected (<20 µg/L) in surface waters 1 hour after ULV applications. The authors found no significant differences in macroinvertebrate abundance and biomass or species diversity in areas treated with any of the materials when compared with untreated ponds. No mortality occurred in mosquitofish held in sentinel cages in treated ponds. Similarly, no difference in mortality was observed for mosquito larvae held in sentinel cages in treated ponds when compared with untreated ones. The authors concluded that ULV applications for adult mosquito control were not likely to significantly affect aquatic insects or fish in these habitats.

Davis and Peterson (2008) measured family diversity, richness, and evenness at 1, 7, 14, and 28 days after truck application of permethrin. Most response variables showed no significant treatment effect, although there were some reductions in number of individuals. The authors concluded that the reductions in aquatic non-target populations did not suggest any trends or persistent deleterious biological effects following a single adulticide application. Significant differences for the pond study were found on the dates closest to the spray event.

Pierce et al. (2005) evaluated deposition after two permethrin ULV applications made with truck-mounted equipment on Key Largo, Florida. They collected samples in the Atlantic Ocean and Florida Bay on either side of the treated area, including measurement of pesticide residues on glass fiber pads set on floats above the water surface, and water collected from the surface microlayer and 20 centimeters below the surface. Water was sampled from a canal running through the treated area following a third application. With the exception of a 0.07 µg/L sample from the bay, permethrin was not detected in the offshore samples; however, permethrin was detected in samples of the water surface microlayer taken from the canal. Detection of permethrin occurred in samples of the surface microlayer taken 2 to 4 hours after the applications (5.1 to 9.4-µg/L). Samples taken below the water surface did not contain detected residues. Within 12 hours of the application, permethrin was undetected in either surface microlayer or subsurface water. The application was carried out shortly before the arrival of a hurricane, and droplet size was not reported. This is the only published study in which significant amounts of pesticide were detected following an application by truck-mounted equipment. This study did not measure PBO concentrations.

4.1.10.5 Summary of Toxicity and Potential Effects

Permethrin may also be persistent in environments free of light (e.g., bound to organic matter in anoxic soils and sediments). Due the potential for persistence and high toxicity to both aquatic and estuarine/marine fish and invertebrates, as well as the potential for endocrine disruption, this RUP may be of concern from a potential ecological risk perspective.

Permethrin is used by three Districts for mosquito or yellow jacket wasp control during the spring, summer, and fall. Four products containing permethrin were used during the reporting year. Some Districts reported permethrin use in volume while others reported use by weight. For the reporting year, approximately 3 ounces (weight) and approximately 20 ounces (volume) of permethrin were applied. These products were used in reclaimed marshes, around residences, and applied directly to yellow jacket ground nests. Three of the products used contain between 2.5 and 4.6 percent permethrin. The fourth and most commonly used product contains 0.25 percent permethrin.

Studies have shown rapid dissipation/low persistence and no observed aquatic fish and invertebrate toxicity following aerial ULV applications; however, these studies are limited and inconclusive. Based on its potential for endocrine disruption, usage patterns, as well as the availability of safer alternatives for wasp control this product is generally used with careful and strict BMP applications.

In addition to the toxicity values referenced in Sections 4.1.10.2 and 4.1.10.3, several toxicity values for Dother species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.11 <u>Etofenprox</u>

Etofenprox is a pyrethroid-like insecticide registered by the EPA since 2001. Similar to pyrethroids, etofenprox acts on ion channels of the insect nervous system. It is used as an insecticide with contact and stomach action against many pests on a broad range of crops. Etofenprox differs in structure from pyrethroids in that it lacks a carbonyl group and has an ether moiety, whereas pyrethroids contain ester moieties. It is used as an indoor nonfood crack and crevice insecticide, a spot treatment for pets, and as an outdoor fogger to control a variety of insect pests. Etofenprox is used in backyards, patios, barns, picnic areas, and other areas where flying and crawling insects are a problem. It is also used as a mosquito adulticide.

4.1.11.1 Environmental Fate

Etofenprox is virtually insoluble in water, stable to hydrolysis, and is rapidly degraded with light (Table 4-10). In water/sediment systems, etofenprox degrades relatively quickly. Residues of etofenprox are not likely to persist in the environment (FAO-WHO 2011).

Table 4-10 Degradation of Etofenprox

Degradation Method	Half-life	Reference
Hydrolysis	Stable	FAO-WHO 2011
Photolysis (water)	1.7 to 7.9 Days	FAO-WHO 2011
Photolysis (soil)	4.4 Day	FAO-WHO 2011
Water/sediment systems (water)	1 to 10 Days	FAO-WHO 2011
Water/sediment systems (sediment)	6 to 20 Days	FAO-WHO 2011

4.1.11.2 Human Toxicity

Etofenprox has low acute toxicity via the oral, dermal, and inhalation routes. It is not an acute eye or skin irritant and is not a dermal sensitizer, however etofenprox does cause skin irritation after repeated exposure (USEPA 2008a).The acute oral and dermal LD50 values in rats are both greater than 2,000 mg/kg (Table 6-1). The acute oral LD50 value in the dog is greater than 5,000 mg/kg (Table 6-1). The acute 4-hour inhalation LC50 value in the rat is greater than 5.88 mg/L (Table 6-1. Etofenprox did not exhibit irritation to rabbit skin or rabbit eyes. Etofenprox was not a skin sensitizer in the guinea-pig maximization test (FAO-WHO 2011). The major target organs of etofenprox are the liver, thyroid, kidney, and hematopoietic system (EPA 2008a). In rats the target organs are the liver and thyroid. The NOAEL for chronic toxicity is 3.7 mg/kg/day for male rats. The target organ in mice is the kidney. The NOAEL is 3.1 mg/kg/day for mice (Wellmark International 2010).

4.1.11.3 Ecological Toxicity

Etofenprox is toxic to aquatic organisms, including fish and invertebrates. The LC50 for rainbow trout is 3.3 µg/L and the LC50 for bluegill is 8.5 µg/L. Product formulations are toxic to bees exposed to direct treatment on blooming crops and weeds (Wellmark International 2010). MacBean (2012) reports oral and contact LD50 values of 0.27 and 0.13 µg/bee respectively.

SWRCB has evaluated freshwater aquatic life toxicity data from USEPA Office of Pesticides' Ecotoxicity Database and has identified the lowest LC50 for etofenprox as 0.019 µg/L. This value is based on toxicity to mysid shrimp during a 96 hour test (SWRCB 2012).

4.1.11.4 Summary of Toxicity and Potential Effects

Etofenprox does not tend to persist in the environment or appear to pose a risk to mammals as it is frequently applied to backyards and patios, and sometimes directly to domestic pets. It does exhibit some toxicity to fish and aquatic invertebrates; however, it degrades rapidly in surface waters thereby reducing the potential for long-term exposures and adverse effects.

Etofenprox was applied as a single application to a waste treatment plant in both fall and summer by one District during the reporting year. Approximately 14-ounces (volume) of etofenprox was used for the two treatments. It is generally applied during the nighttime hours when sensitive receptors such as honeybees are not active. Etofenprox is available in a new product, Zenivex that does not require synergists such as PBO. Therefore, it likely exhibits less toxicity than others that require co-application with other chemicals, including synergists to increase its efficacy for mosquito control. Based on toxicity, environmental fate, and usage patterns, etofenprox, using BMPs, is not likely to result in unwanted adverse impacts.

In addition to the toxicity values referenced in Sections 4.1.11.2 and 4.1.11.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British

Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.1.12 Piperonyl Butoxide

PBO was first registered in the 1950s and acts as a synergist. Synergists are chemicals that primarily enhance the pesticidal properties of other active ingredients, such as pyrethrins and synthetic pyrethroids. PBO is a registered active ingredient in products used to control many different types of flying and crawling insects and arthropods, although there are no products that contain only PBO. It is registered for use in agricultural, residential, commercial, industrial, and public health sites. PBO interferes with the insect's ability to detoxify pyrethrins and pyrethroids, thus enhancing the product's effectiveness. PBO inhibits microsomal enzymes in target organisms by direct binding to these enzymes and inhibits the breakdown of other pesticides including pyrethrins and pyrethroids (USEPA 2006e).

4.1.12.1 Environmental Fate

PBO degrades rapidly in the environment by photolysis in water and is metabolized by soil microorganisms (Table 4-11). Other tested routes of degradation, such as hydrolysis, aerobic and anaerobic aqueous metabolism, are very slow or have questionable rates due to experimental difficulties, as in the case of soil photodegradation. PBO is moderately mobile in soil-water systems (USEPA 2006e).

Table 4-11 Degradation of Piperonyl Butoxide

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	Stable	USEPA 2006e
Photolysis (water)	8.4 Hours	USEPA 2006e
Aerobic metabolism (water/sediment)	>30 Days	USEPA 2006e
Anaerobic metabolism (water/sediment)	>181 Days	USEPA 2006e
Terrestrial dissipation (soil)	1 to 14 Days	USEPA 2006e

4.1.12.2 Human Toxicity

PBO has a low acute toxicity by oral, inhalation and dermal routes. It has been assigned toxicity USEPA Category III by oral and dermal and Category IV by inhalation exposure routes. In the acute studies, PBO has been identified as minimally irritating to eyes and skin, and is a dermal sensitizer. The oral LD50 was 4,570 to 7,220 mg/kg in rats, the dermal LD50 was found to be greater than 2,000 mg/kg in rabbits, and the inhalation LC50 was found to be greater than 5.9 mg/L in rats (USEPA 2006e) (Table 6-1). The major target organ for PBO is the liver. Subchronic studies in rats showed PBO treatment caused increases in liver weight and clinical parameters such as cholesterol and enzyme activity compared to controls (USEPA 2006e). PBO is included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.1.12.3 Ecological Toxicity

PBO is moderately toxic to freshwater fish on an acute basis (LC50 = 1.9 mg/L) based on studies of rainbow trout (*Oncorhynchus mykiss*). PBO ranges from moderately toxic (LC50 = 12.0 mg/L) to highly toxic (LC50 = 0.51 mg/L for waterflea, *Daphnia magna*) to freshwater invertebrates on an acute basis. PBO is moderately toxic to estuarine/marine fish (LC50 = 3.94 mg/L) based on observed effects to sheepshead minnow (*Cyprinodon variegatus*) on an acute basis. PBO is highly toxic to estuarine invertebrates (LC50 = 0.49 mg/L) based on studies with mysid shrimp (*Mysidopsis bahia*). PBO is highly toxic to amphibians on an acute basis (LC50 = 0.21 mg/L) based on studies with western chorus frog tadpoles (*Pseudacris triseriata*) (USEPA 2006e).

A chronic early life stage of fish study with fathead minnow evaluated embryo survival at hatch and length and weight of larvae. This study found a LOEC of 0.11 mg/L. A study with water fleas found a LOEC of 0.047 mg/L (USEPA 2006e)

SWRCB has evaluated toxicity data from U.S. EPA's Office of Pesticides' Ecotoxicity Database for PBO when applied in formulation with pyrethrins. The lowest LC50 was 0.14-µg/L, based on toxicity to mysid shrimp during a 96-hour test. Toxicity data was also evaluated for PBO when applied in formulation with resmethrin. SWRCB identified the lowest LC50 as 1.3 µg/L based on toxicity to pink shrimp during a 96-hour test. For PBO applied in formulations other than pyrethrins or resmethrin, SWRCB identified the lowest LC50 as 490 µg/L based on toxicity to mysid shrimp during a 96-hour test (SWRCB 2012). PBO is practically nontoxic to honey bees on an acute oral basis (LD50 >25 µg/bee) (USEPA 2006e).

4.1.12.4 Ecological Toxicity associated with ULV Application for Mosquito Abatement

Following aerial applications of Evergreen Crop Protection EC 60-6 (6 percent pyrethrins, 60 percent PBO) in Sacramento for West Nile virus, Larry Walker Assoc. (2006) reported results of water testing on samples from 10 waterways within the treatment area. Treated areas were sprayed nightly for 3 days. One additional application occurred 9 days prior to the 3-day event at selected locations. Samples were taken immediately after application (within 1 to 6 hours), and the next day (16 to 23 hours after the application). Piperonyl butoxide was detected in water from 14-of the 25 samples collected after the application. Concentration of PBO ranged from <1.0 to 20 µg/L (average 2.036 µg/L) immediately after application. PBO concentrations ranged from <1.0 to 4.2 µg/L with an average of 0.853 µg/L in samples taken between 16 and 23 hours after application. Of the 31 samples taken between 16 and 23 hours after application, PBO was detected in 11 samples. Water samples were tested eight days following aerial applications, from four sites. No PBO was detected in any of these samples, therefore, the duration of persistence of PBO appears to be greater than 16 hours, but less than 1 week.

Testing was also carried out by Weston et al. (2006) following the same applications. Prior to aerial spraying, PBO was not detected in sediment samples; however, PBO was detected at 0.2 µg/L in 2 of 4 water samples. PBO was detected in water (0.44-to 3.92 µg/L, all 7 samples) and sediment (16 to 61.4 µg/kg, for 4-of 6 samples) at 10 to 34-hours after application. Neither water nor sediment was tested at later intervals, so the duration of persistence could not be determined in this study. Laboratory tests were conducted to determine the effects of short-term chronic exposure of *Ceriodaphnia dubia* to water collected after the spray events, following USEPA protocol. No significant differences in mortality were observed. In addition, sediment toxicity tests were performed with the amphipod *Hyalella azteca,* and toxicity was observed in samples collected both before and after application. The authors concluded that pyrethrins and PBO should present little risk to aquatic organisms due to the low toxicity and lack of long-term persistence, but that PBO had the potential to enhance toxicity of other pesticides, especially pyrethroids, already present in the environment. Weston et al. (2006) performed additional laboratory tests to determine the effect of PBO on toxicity of pyrethroids present on sediment, and found that even by removing 80 percent of the overlying water and replacing it with fresh PBO solution daily, within 24-hours, over 30 percent of PBO is lost, most likely to photo degradation. The results indicated that most sediments present at the creeks used for this study already contained concentrations of pyrethroids acutely lethal to *H. azteca* from urban uses not related to mosquito control activities.

Water and soil deposition of pyrethrins and PBO following aerial applications was evaluated at two sites in California (Schleier III et al. 2008). Water was sampled after aerial applications of pyrethrins and PBO in irrigation ditches at one site (Princeton) and in static ponds at another (Colusa). PBO was detected at low levels and decreased exponentially with time. Average PBO concentrations were 0.0125 to 0.0199 microgram per square centimeter (µg/cm^2) on ground deposition pads and 0.1723 to 1.274-µg/L in water samples, immediately following the applications. Within 36 hours of the applications, PBO had decreased to background levels in water. Concentrations of PBO decreased 77 percent between 1 and 12 hours after the spray event. The authors concluded that the amounts of pyrethrins and PBO deposited on the ground and in water after aerial ULV insecticide applications are probably lower than those estimated by previously published studies to predict exposure and risk.

Lawler et al. (2008) evaluated pyrethrins and PBO in sediment following multiple applications of pyrethrins formulated with PBO from truck-mounted equipment in the Colusa and Sacramento National Wildlife Refuges in California. Stock tanks were filled with a layer of soil overlain with 1,150 liters of water. Zooplankton (*Daphnia magna*) were held in sentinel cages in the water column and mayfly larvae (*Callibaetis californicus*) were placed in cages at the bottom of each tank, where they were in contact with sediment. ULV applications of pyrethrins formulated with PBO were made from truck-mounted equipment twice weekly for six weeks. Concentration in sediments and sentinel survival were evaluated after application 5 and 11. PBO concentrations ranging from 8.37 to 14.9 µg/kg were seen in 5 of 6 tanks after five applications, but in only 2 of 6 tanks after 11 applications (1.93 and 2.55 µg/kg). There was no significant difference in mortality for mayfly larvae held in sentinel cages on the sediment. Likewise, there was no significant difference in mortality seen in *D. magna* held in the water column. They concluded that applications of pyrethrins and PBO at rates used for mosquito control did not have detectable effects on the indicator species. The persistence of PBO in sediment was not evaluated in this study. PBO-synergized pyrethrins had no detectable effect on the survival of *D. magna* held in tanks in the spray area, even after 11 biweekly spray events.

Amweg et al. (2006) evaluated deposition of PBO in water and sediment following truck-mounted applications of synergized pyrethrins to a freshwater wetland in Colusa County in 2004. PBO was detected in 2 of 18 sediment samples above the reporting limit of 2.0 µg/kg, at 3.27 and 3.0 µg/kg, respectively. PBO was detected in 3 of 10 samples of water at concentrations above the reporting limit of 0.01 µg/L, ranging from 0.04-to 0.08 µg/L. The highest concentrations of PBO were observed in samples obtained within 12 hours of spraying; concentrations in water and sediment were below the reporting limit in samples taken one week after the last ULV application (Amweg et al. 2006).

Several papers were published documenting that ULV-applied mosquito adulticides do not accumulate to any significant degree in water or sediment during repeated applications. Chemical testing was conducted following multiple spray events in 2006 by Amweg et al. There was no increase in the level of pyrethrins or PBO following multiple daily spray events, and the concentration had returned to background level when samples taken one week after the last application were tested. Similarly, Lawler et al. (2008), reported that the concentration of pyrethrins and PBO in tanks within a treated area were not significantly higher after 11 applications than in samples taken after the fifth application. In many cases, the concentrations were actually lower following the 11th spray event than after the fifth spray event. Accumulation of PBO was evaluated by Amweg et al. (2006). PBO did not accumulate in water or sediment, even after eight biweekly applications by truck-mounted equipment over the course of two months.

ULV applications of the resmethrin formulated with PBO in Suffolk County New York have been evaluated (Abbene et al. 2005). Deposition of resmethrin and PBO following truck-mounted applications in fresh and salt water marshes was assessed at 6 sites. PBO was detectable at low levels (0.008 µg/L and 0.017 µg/L) in 2 of 6 water samples taken immediately after the application. Deposition of resmethrin and PBO following aerial applications by helicopter was assessed in the same report (Abbene et al. 2005). Applied materials were detected in some water samples taken within 30 minutes of the application. PBO was detected more frequently than resmethrin, and detection of PBO was more common after helicopter applications (83 percent) than following those carried out by truck (33.3 percent). The average concentration of PBO was 4.361 µg/L. The highest concentrations were found in some samples collected from surface water within 1 hour of helicopter applications (59.8 µg/L PBO). The authors carried out a series of sample collections after two spray events to evaluate the persistence of the materials in water. PBO was not detected (<0.005 µg/L) in samples taken 96 hours after the application (Abbene et al. 2005). One site included two repeat weekly applications of resmethrin following an application of methoprene the prior week. Concentrations of resmethrin and PBO measured after the second application were lower than those measured after the first application.

The same study included effects of aerial applications of resmethrin and PBO on two aquatic organisms: the sheepshead minnow (*Cyprinodon variegatus*) and the estuarine grass shrimp (*Palaemonetes pugio*) (Suffolk County 2006). The field study faced problems with low dissolved oxygen and high temperature, which compromised their ability to detect toxicity that may have been due to pesticide exposure. Therefore, dosing experiments and prey capture tests were conducted in the laboratory to measure toxicity of the applied products. These tests demonstrated that the doses used in the spray were not directly toxic to grass shrimp and did not affect their ability to capture prey under controlled conditions. Further laboratory experiments demonstrated that all of the mortality seen in the field could have been caused by low dissolved oxygen alone, using a USEPA time-to-death approach. Furthermore, their data showed that the chemicals used had very low persistence in the water column, as discussed above. PBO was last detected in samples taken 48 hours after the spray.

Another related study evaluated benthic community structure, and found that benthic population differences could not be attributed to the application of pesticides, but were more likely due to environmental differences (Suffolk County 2006).

Zulkosky et al. (2005) sampled freshwater ponds, salt marshes, tidal inlets and embayments, and marine coastal water off Staten Island, New York within an hour after mosquito control applications of resmethrin formulated with PBO (Scourge). PBO was detected in all but one location at concentrations ranging from 0.0006 to 15 µg/L. PBO was still present at three locations in samples collected three days after a Scourge spray. No information was provided on application methods at each site. Zulkosky et al. (2005) also evaluated phenothrin (in formulation with PBO) applied as Anvil. In 2002, PBO was detected in all samples at concentrations ranging from 0.0003 to 0.0007 µg/L. In 2003, PBO was detected at 0.020 µg/L immediately after spraying Anvil and was found at concentrations ranging from <0.0005 to 0.007 µg/L 10 days later.

New York City Department of Health sampled 32 locations for phenothrin formulated with PBO before and after spray events during mosquito adulticide applications that occurred during July through September 2000. Out of the 68 post-application samples collected by the city, only one sample had concentrations of PBO greater than the 0.5 µg/L reporting limit: 1.03 µg/L for PBO for a sample collected on August 5, 2000, at Alley Park Pond in Queens (Suffolk County 2006).

The Massachusetts Department of Agricultural Resources conducted a study where phenothrin formulated with PBO was applied aerially as Anvil 10+10 ULV to six sites. There were no detections of phenothrin during this study; however, PBO was detected at 0.12 µg/L. (Massachusetts Department of Agricultural Resources 2010).

Davis and Peterson (2008) also evaluated phenothrin formulated with PBO and applied as Anvil 10+10 ULV. The authors concluded that the reductions in aquatic non-target populations did not suggest any trends or persistent deleterious biological effects following a single adulticide application.

4.1.12.5 Summary of Toxicity and Potential Effects

PBO has been an effective synergist used in mixtures with other insecticidal active ingredients since the 1950s. It degrades rapidly in soil and water and, therefore, does not tend to persist in the environment. PBO may be highly toxic to some species of fish and aquatic invertebrates and is being evaluated as a possible endocrine disruptor.

PBO is contained as a secondary ingredient along with pyrethrin, resmethrin, and permethrin in several products used by eight Districts. These products are used throughout the year in manmade and natural sites with standing and moving water, as well as tree holes, ditches, and residential areas. There were several hundred applications during the reporting year. It is generally applied using ULV techniques, which are designed for low chemical persistence and toxicity to non-target receptors. PBO is not expected to pose risk to aquatic organisms especially when applied using ULV techniques; however, it has been shown to have the potential to enhance toxicity of other pesticides and should be considered when it is an additive to a pesticide formulation.

In addition to the toxicity values referenced in Sections 4.1.12.2 and 4.1.12.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.2 Organophosphate Insecticides

4.2.1 Naled

Naled is an organophosphate insecticide that has been registered since 1959 for use in the U.S. It is used in rotation with pyrethrins or pyrethroids for control of adult mosquitos to avoid the development of resistance. In addition to use for controlling adult mosquitoes, naled also has indoor and outdoor general use, and is used on food and feed crops, farms, dairies, pastureland, and in greenhouses and over standing water (CDPR 2010a). Dichlorvos (DDVP), a registered OP insecticide, is a metabolite of naled (USEPA 2006c).

4.2.1.1 Environmental Fate

Naled is readily degraded in water, under sunlight, in soil under aerobic and anaerobic conditions (Table 4-12), in the air, and on plants. On plant surfaces, naled is degraded to DDVP. Naled is more mobile in soil of low organic content such as sandy loam when compared with other soil types (CDPR 1999). Naled has low water solubility and can volatilize (CDPR 1999, 2001).

Table 4-12 Degradation of Naled

Degradation Method	Half-life	Reference
Hydrolysis, pH 5 (water)	96 Hours	CDPR 1999
Hydrolysis, pH 7 (water)	15.4 to 17 Hours	CDPR 1999
Hydrolysis, pH 9 (water)	1.6 to 1.7 Hours	CDPR 1999
Photolysis (water)	3.7 to 4.4-Days	CDPR 1999
Photolysis (plant surfaces)	<5 Days	CDPR 1999
Aerobic metabolism (soil)	3 Days	CDPR 1999
Anaerobic metabolism (soil)	6 Days	CDPR 1999

4.2.1.2 Human Toxicity

Naled is rapidly absorbed by all routes (oral, inhalation, and intraperitoneal) and distributes to all tissues in the rat, chicken, goat, and cow. The oral LD50 for naled technical grade active ingredient is 81 to 336 mg/kg in rats or mice, the dermal LD50 is 354-to 800 mg/kg in rats or rabbits, and the nose exposure inhalation LC50 is as low as 0.19 in rats (CDPR 1999).

4.2.1.3 Ecological Toxicity

Naled technical grade active ingredient was found to be moderately toxic to highly toxic to wide range of species including rainbow trout (LC50 = 0.08 mg/L), blue gill (LC50 = 2.2 mg/L), sheepshead minnow (LC50 = 1.2 mg/L), mullet (LC50 = 0.55 mg/L), daphnia (LC50 = 0.35 µg/L), pink shrimp

(EC50 = 5.5 µg/L), grass shrimp (LC50 = 8.9 mg/L), and eastern oyster (EC50 = 0.19 mg/L). Lethal effects were also found in honey bees (LD50 = 0.48 µg/bee) and mallards (LD50 = 52 mg/kg) (CDPR 1999).

SWRCB has evaluated the U.S. EPA's Office of Pesticides' Ecotoxicity Database to access toxicity of naled to freshwater aquatic life and has identified LC50 values that range from 0.14 to 3,300 µg/L (SWRCB 2012).

4.2.1.4 Ecological Toxicity associated with ULV Application for Mosquito Abatement

Tucker et al. (1987) evaluated deposition and non-target effects for truck-mounted and aerial applications of naled. The maximum concentration of naled in water samples following truck applications (0.71 µg/L) occurred 15 minutes after the application. The concentration in water decreased exponentially after this; detected concentrations persisted for 4-hours. No significant mortality was observed in copepods or fish exposed from truck-mounted applications. The same study evaluated deposition of these materials following applications made from aircraft (Tucker et al. 1987). The maximum concentration of naled in water samples following aerial applications (20.15 µg/L) occurred 27 minutes after the application. The concentration in water decreased exponentially after this; detected concentrations persisted for 9 hours. Deposition rates for naled from aerial applications were much higher (47 to 68 percent) than those resulting from ground applications (21 to 22 percent). The authors reported significant mortality in copepods held in sentinel cages in the treated area and exposed to naled by aerial application. No significant mortality was observed for juvenile fish held in the treated area. This is the only report of significant mortality in aquatic organisms following a ULV application. The size of droplets released is not given and the amount of material recovered from glass filter pads placed on the ground was unusually high. Perhaps the conditions of the applications resulted in a greater proportion of the product reaching the ground.

In what may have been the same study, Wang et al. (1987) also investigated the fate of naled after aerial ULV applications of mosquito adulticides at a salt marsh in Florida. Approximately 30 minutes after application, the concentration of naled in the water was 20.15 µg/L, decreasing to 0.2 µg/L at 6.45 hours, and was not detected at 12.45 hours (detection limit of 0.05 µg/L). The peak concentration of dichlorvos (a breakdown product of naled) was 2.22 µg/L approximately 30 minutes after application, and was still detectable at 12.45 hours (0.28 µg/L).

Deposition of naled during aerial applications was also evaluated (Pierce et al. 2005). Naled was detected in low concentrations (0.19 µg/L) in the water surface microlayer at 1 of 18 sites. It was not detected in subsurface water (detection limit 0.05 µg/L). Residues were not detectable in the water surface microlayer 12 hours after the application. Dichlorvos, a breakdown product of naled, and itself a registered pesticide, was detected at 2 to 4 hours after the application. Trace amounts were still detectable at 10 to 12 hours post-treatment.

4.2.1.5 Summary of Toxicity and Potential Effects

Naled has low water solubility and is mobile in some soils. It is moderately toxic to mammals, fish, and aquatic vertebrates. Naled was not used by the Districts during the reporting year.

In addition to the toxicity values referenced in Sections 4.2.1.2 and 4.2.1.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.2.2 Temephos

Temephos is a cholinesterase inhibitor registered by the EPA in 1965 to control mosquito larvae (USEPA 2000). Temephos is the only organophosphate with larvicidal use and is often used to help prevent mosquitoes from developing resistance to the bacterial larvicides. Temephos is used on lakes, ponds, reservoirs, swamps, marshes, tidal areas, intermittently flooded areas, catch basins, drainage systems, irrigation systems, ornamental ponds, wastewater, polluted and stagnant water, and is applied by mosquito abatement Districts (CDPR 2010a). MVCAC member agencies primarily apply temephos to manmade sources such as tire piles, utility vaults, and cemetery urns. Mosquito control products containing temephos are not labeled for application to agricultural lands or pasture and are not used in such sites. Temephos provides effective control of mosquito larvae in highly polluted water (containing high levels of decaying organic matter, such as rotting leaves or manure).

Temephos is a broad-spectrum insecticide and has also been used operationally to control midges and black flies for many years. However, the concentration that effectively controls mosquito larvae is well below that needed for control of other insects. In addition, midges and black flies are found in different habitats than larval mosquitoes. The larval stage of most midges develop in sediment at the bottom of water bodies, while black flies develop attached to hard surfaces in swift moving rivers and streams. Materials commercially available for midge control are heavy and designed to release their active ingredients on the floor of the water body and those for control of black flies are placed in flowing streams and allowed to move down with the current.

4.2.2.1 Environmental Fate

The presence of microorganisms in aquatic environments and exposure to sunlight are likely to be the predominant means of transformation/dissipation of temephos (Table 4-13) (USEPA 1998a). Temephos is an extremely hydrophobic material with low solubility. It adsorbs rapidly onto organic material in the water and binds strongly to soils. Temephos breaks down in water through photodegradation and bacterial degradation (USEPA 2000).

Table 4-13 Degradation of Temephos

Degradation Method	Half-life	Reference
Hydrolysis	>86 Days	USEPA 1998a
Photolysis (water)	15 Days	USEPA 1998a
Aerobic metabolism (water)	17.2 Days	USEPA 1998a
Anaerobic metabolism (water)	12.2 to 27.2 Days	USEPA 1998a

The RED cites a study submitted by the registrant in which temephos was monitored in sediments following field applications for mosquito control over a 3-year period. The active ingredient became undetectable in sediment after 24 hours (USEPA 2000). Lores et al. (1985) found that concentrations in water of 15 to 60 ppb immediately following the application declined to 2 to 5 ppb within 24 hours. Sanders et al. (1981) reported similar results. Pierce et al. (1989) examined aerial application of liquid formulation of temephos to a mangrove swamp in Florida, and found the material had become undetectable 4-hours after the application in intertidal water. It persisted in simulated intertidal pools for 72 hours. The liquid and BG formulation products are designed to deliver the active ingredient to the water surface in order to maximize exposure of mosquito larvae.

4.2.2.2 Human Toxicity

Temephos is moderately toxic via the oral, dermal, and inhalation routes. The oral LD50 in rats is 444-mg/kg. The dermal LD50 in rabbits is 970 mg/kg. The inhalation LC50 in rats is 1.3 mg/L (USEPA 2012). MacBean (2012) reports significantly different values with the oral LD50 for male and female rats being 4204 and >10000 mg/kg respectively, the dermal LD50 for rats being 2,181 mg/kg, and the inhalation LC50 being 4.79 mg/L. (Table 6-1).

4.2.2.3 Ecological Toxicity

Temephos has low toxicity for vertebrates at the levels used for mosquito control (USEPA 2000). However, it is toxic to insects and some other invertebrates (Brown et al. 1996), and the margin of safety between concentrations effective for mosquito control and levels at which non-target impacts occur is much narrower than that of s-methoprene or the bacterial larvicides (Brown et al. 1999, Lawler et al. 1999, Hurst et al. 2007).

Temephos is slightly to moderately toxic to fish (USEPA 2000); however, field applications result in concentrations of temephos far lower than that at which fish are affected. Field studies have repeatedly demonstrated a lack of impact on fish inhabiting treated sites. Mulla et al. (1964) reported that temephos was nontoxic to mosquito fish that were confined in screened cages for one week in artificial ponds treated with 0.1 pound per acre AI. Similarly, no significant mortality was observed in juvenile snook (*Centropomis undecimalis*) or sheepshead minnow (*Cyprinodon variegatus*) caged in a mangrove swamp treated with aerial applications of liquid temephos (Pierce et al. 1989). Tietze et al. (1991) demonstrated laboratory tests that liquid formulations of temephos were nontoxic to young mosquitofish (3 to 5 days old) at field application rates. Mosquitofish exhibited no mortality when exposed to up to 100 times field application rates.

Temephos is highly toxic to aquatic invertebrates, but many groups are only impacted at concentrations far above those used for mosquito control applications (USEPA 2000). Von Windeguth and Patterson (1966) conducted laboratory tests on temephos and fenthion (another organophosphate) to determine margin of safety for treatment of midges in a lake. The dose of fenthion used for midges was above that which caused mortality in shrimp and amphipods. Abate (temephos) was less toxic to most aquatic non-target organisms than fenthion and not toxic to shrimp (*Palaemonetes paludosus*) and amphipods (*Hyalella azteca*) at concentrations used for mosquito control applications (LD50 was 1 mg/L and 0.65 mg/L, respectively). Neither product was toxic to fish at levels necessary to kill midge larvae (0.25 lb active ingredient per acre). In field tests, they reported that no noticeable mortality was observed for Odonates (dragonflies), copepods, ostracods, or shrimp (Von Windeguth and Patterson 1966).

Temephos does have an immediate impact on some groups of planktonic crustaceans, with copepods and brachiopods (*cladocera*) being more sensitive than amphipods or ostracods. Fortin et al. (1987) studied the impact of temephos on non-target organisms in rectangular manmade ponds. Application of temephos resulted in an immediate reduction in populations of copepods and cladocerans, but populations began to recover within 3 days and had reached pre-treatment levels within 2 to 3 weeks. Ostracods in the ponds were not affected. Helgen et al. (1988) also reported sharp reductions in populations of calanoid copepods (*Diaptomus leptopus*) and cladocerans (*Daphnia pulex*, *Simocephalus* sp., and *Chydoridae*) following applications of temephos. Copepods exhibited varying degrees of recovery. However, some cladocerans remained absent from the treated area for up to 35 days. In an open field setting, Lawler et al. (1999) reported that aerial applications of temephos to a mangrove swamp in Florida resulted in no observable effect on survival of amphipods (*Talitridae*), the primary non-target organism present.

Several studies have evaluated effects on non-target insects. A field study of repeated applications of temephos to a saltmarsh in New Jersey concluded that species richness, diversity, and community structure of aquatic insects was unaffected (Campbell and Denno 1976). Stoneflies and mayflies are particularly susceptible to temephos and the label carries a prohibition against applying Abate in habitats containing these organisms.

Among the materials available for control of mosquito larvae, temephos has the narrowest margin of impact and the greatest potential for effects to non-target organisms. However, it is an effective method of control in isolated sources that may be difficult to treat by other means, such as sources with high concentrations of organic material, and ones in which other less toxic alternatives have failed to produce adequate levels of control. Temephos was in widespread use in California for control of larval mosquitoes from 1965 into the mid-1980s. The microbial pesticides, methoprene, and surface oils are used much more frequently now and have largely replaced temephos as the method of choice for larval sources in water of the U.S. Temephos is more widely used in other parts of the U.S. such as Delaware, New Jersey, New York, Maryland, and Florida.

4.2.2.4 Summary of Toxicity and Potential Effects

Temephos has extremely low water solubility and binds strongly to soils. It is moderately acutely toxic to mammals and fish, but highly toxic to non-target aquatic invertebrates (e.g., stoneflies, mayflies). The USEPA (2000) states that there is likely no exposure of people to temephos in drinking water or from residential use. It is not expected to have direct impact on terrestrial animals and the use of temephos has declined over time (USEPA 2000). Temephos was used in one product by two Districts during the reporting year. It is typically applied in all four quarters of the year resulting in the use of over 1,000 pounds of product. Active ingredient concentration in this product is 5 percent resulting in a total use of about 50 pounds of AI. Based upon the environmental fate, toxicity, and BMP approaches, the use patterns for temephos should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.2.2.2 and 4.2.2.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.3 Mosquito Larvicides

4.3.1 Bacillus sphaericus (Bs)

Microbial larvicides are bacteria that are registered as pesticides for control of mosquito larvae in outdoor areas such as irrigation ditches, flood water, standing ponds, woodland pools, pastures, tidal water, fresh- or saltwater marshes, and stormwater retention areas (USEPA 2007c). The microbial larvicides concentrates registered for use in California include *Bacillus sphaericus* (Bs) and *Bacillus thuringiensis* subspecies *israelensis* (Bti). These concentrates include fermentation solids, bacterial spores, and insecticidal toxins. Their mode of action requires that they be ingested to be effective, which means they cannot be used to control mosquitoes at some life stages (late 4th instar larvae, pupae, and adults). Bs spores contain a protein that damages and paralyzes the gut of mosquito larvae that ingest the *spores*, thus starving the larvae (USEPA 1999). A standard bioassay similar to that used for Bti has been developed to determine preparation potencies.

Bs was first registered by the EPA in 1991 for use against mosquito larvae. Bs can control mosquito larvae in highly organic aquatic environments, including sewage waste lagoons, animal waste ponds, and septic ditches. Bs is used on rice, fruit trees, walnuts, almonds, corn, asparagus, cotton, dates, and other crops. It is also applied to alfalfa, pastures, agricultural drainage systems, animal drinking water, fodder grasses, irrigation systems, swimming pools, ornamental ponds and fountains, catch basins, wastewater, bilge water, industrial processing water, industrial waste disposal systems, solid wastes sites, garbage dumps, and on tidal areas, swamps, marshes, bogs, intermittently flooded areas, standing water, and by mosquito abatement Districts (CDPR 2010a).

4.3.1.1 Environmental Fate

Dormant Bs spores may persist in the environment for several weeks to months; however, the δ-endotoxins generally persist for 2 to 4 weeks following application. Factors affecting its persistence include the formulation of the *B. sphaericus* product, agitation of the waterbody, receiving water quality and temperature. The δ-endotoxins produced by Bs degrade rapidly in sunlight as a result of exposure to ultraviolet radiation and are degraded by soil microorganisms. Bs, as with other soil microbes, does not percolate through the soil and readily binds to sediments within the water column, and is, therefore, not available to contaminate ground water (Maine Department of Environmental Protection 2010). Field evaluations of VectoLex-CG (a commercial formulation of *B. sphaericus*) have shown environmental persistence for several weeks (Mulla et al. 1988).

4.3.1.2 Human Toxicity

Bs is not pathogenic and does not demonstrate any systemic toxicity. An acute oral toxicity/pathogenicity study was conducted with Bs technical material in rats. An oral dose of approximately 1 x 10^8 colony forming units (CFU) administered to rats resulted in no mortalities, no evidence of pathogenicity or treatment related toxicity in rats given an oral, intratracheal installation or intravenous dose. In an acute oral toxicity study, Bs technical material caused no deaths in rats given a dose of 5,000 mg/kg; therefore the acute oral LD50 was greater than 5,000 mg/kg. There was no mortality in rabbits over the 14-day observation period following a 2,000 mg/kg dermal application for 24-hours; thus, the acute dermal LD50 was greater than 2,000 mg/kg. In a 4-hour acute inhalation toxicity study in rats, the maximum attainable concentration was 0.09 mg/L, with 13.3 percent of the particles having a mass median aerodynamic diameter of >10 microns. Since there was no mortality or no clinical signs during exposure or the 14-day observation period, the 4-hour inhalation LC50 was greater than 0.09 mg/L. Dermal irritation of Bs technical material was moderately irritating to rabbit skin at 72 hours. Irritation and iridal effects following a 100 mg aliquot of Bs placed in the eye of rabbits were no longer present at day 10 post-treatment (USEPA 1997a) (Table 6-1).

4.3.1.3 Ecological Toxicity

Available literature indicates that Bs is not acutely toxic to non-target species, including birds, mammals, fish and invertebrates. Bs has a very low toxicity for fish, and all aquatic invertebrates. Amounts that effectively control mosquito larvae are many levels of magnitude below those, which affect other organisms. Acute aquatic freshwater organism toxicity tests were conducted on bluegill sunfish, rainbow trout and daphnids. The 96-hour LC50 and No Observable Effect Concentration (NOEC) value for bluegill sunfish and rainbow trout was greater than 15.5 mg/L; the 48-hour EC 50 and NOEC value for daphnids was greater than 15.5 mg/L. Acute aquatic saltwater organism toxicity tests were conducted on sheepshead minnows, shrimp and oysters. The 96-hour LC50 value for both sheepshead minnows and shrimp was 71 mg/L, while the NOEC value was 22 mg/L for sheepshead minnows and 50 mg/L for shrimp. The 96-hour EC50 value for oysters was 42 mg/L with an NOEC of 15 mg/L. The LC50 and NOEC value for immature mayflies was 15.5 mg/L. Additional studies on various microorganisms and invertebrates, specifically cladocerans, copepods, ostracods, mayflies, chironomid midges, water beetles, backswimmers, water boatmen, giant water bugs, and crawfish, have shown no adverse effects or negative impacts (Miura et al. 1981, Holck and Meek 1987, Key and Scott 1992, Tietze et al. 1993). Furthermore, Ali (1991) states that although *B. sphaericus* is known to be highly toxic to mosquito larvae, Bs does not offer any potential for midge control.

Applications of Bs also leave populations of mosquito predators intact and do not cause secondary effects when treated larvae are consumed by other insects. Key and Scott (1992) conducted laboratory studies with Bs on the grass shrimp *Palaemonetes pugio* and the mummichog *Fundulus heteroclitus*. Their study indicated that both Bti and Bs larvicides have large margins of safety. In a study by Aly and Mulla (1987), aquatic mosquito predators were fed with *Cx. quinquefasciatus* 4th instar larvae intoxicated with either Bti or Bs preparations. Although the mosquito larvae contained large amounts of the bacterial preparations in their gut, no effect upon longevity or ability to molt was observed in the backswimmer *Notonecta undulata*, in naiads of the dragonfly *Tarnetrum corruptum*, or in naiads of the damselfly *Enallagma civile*. Equally, the reproduction of *N. undulata* and the predation rate and ability to emerge normally in *T. corruptum* and *E. civile* were not affected by ingestion of large amounts of bacterial toxins.

Bs has not been found to have adverse effects on chironomids or any other aquatic species at levels used for mosquito control.

4.3.1.4 Summary of Toxicity and Potential Effects

Bs is an effective microbial pesticide specifically targeted at mosquito larvae. A common member of microbial communities and a natural biological enemy of mosquito larvae, Bs does not exhibit toxicity or risk to non-target organisms. This microbial active ingredient is used by eight of the Districts, typically throughout the year, including during each quarter of the reporting year. Bs is contained in nine products, which are applied to both standing and moving water at natural and manmade sites. Several thousand applications occurred during the reporting year. Concentrations of the active ingredient in these products range from 6 to 51.2 percent.

Based upon the environmental fate, toxicity, and use patterns by the districts during the reporting year, it should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.3.1.2 and 4.3.1.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.3.2 Bacillus thuringiensis subspecies israelensis (Bti)

Bti concentrates are made up of the dormant spore form of the bacterium and an associated pure toxin. The toxin disrupts the gut in mosquito larvae by binding to receptor cells (USEPA 2007c). *Bti* organisms produce five different microscopic protein pro-toxins packaged inside one larger protein container or crystal. The crystal is commonly referred to as delta (δ-) endotoxin. This toxin consists of five proteins that are released only under extremely alkaline conditions. Mosquitoes are unique in having very alkaline conditions within the midgut (the stomach of vertebrates contains acid). When a mosquito larva ingests the δ -endotoxin, the five proteins are released in the alkaline environment of the insect larval gut. The five proteins are converted into five different toxins by specific enzymes present in the gut of mosquito larvae. Once converted, these toxins destroy the gut wall, which leads to paralysis and death of the larvae. Bti is toxic to larval stages of all genera of mosquitoes, and to black flies (*Simuliidae*). The dependence on alkaline conditions and the presence of specific enzymes gives this material a high degree of specificity for mosquitoes and black flies. Bti is also used for control of chironomids, but much higher levels are needed for effective control.

An isolate of Bt was first registered by the EPA in 1961 for use as an insecticide (USEPA 1998f). The subspecies israelensis (Bti) was first registered as an insecticide in 1983. One formulation of Bti is used in California for controlling gnats on greenhouse crops, peppers, tomatoes, celery, cabbage, leafy vegetables, cauliflower, walnuts, almonds, dates, corn, asparagus, bananas, fruit trees, and other crops. It is applied for mosquito control on rice, alfalfa, pastures, animal drinking water, ornamental nurseries, ornamental ponds, irrigation systems, swimming pools, drainage systems, lakes, streams, swamps, marshes, tidal areas, standing water, polluted or stagnant water, sewage systems, intermittently flooded areas, catch basins, domestic dwellings, and by mosquito abatement Districts and by ULV application (CDPR 2010a).

4.3.2.1 Environmental Fate

Bti toxins degrade rapidly in the phyllosphere as a result of exposure to ultraviolet (UV) light. Bti toxins may persist in soil for several months, yet a half-life for typical Bti products on foliage is approximately 1 to 4-days (USEPA 1998g).

Generally, Bti persists in the environment for periods measured in days. Factors that affect persistence and efficacy of Bti in the environment may include, but are not limited to, the formulation of the Bti product, agitation of the waterbody, receiving water quality and temperature. Solid and granule formulations, which act through a slow release action, generally persist for longer periods than liquid formulations. Agitation of sediments in the water column acts to resuspend Bti and, therefore, causes the bacterium to persist as an available pesticide for longer periods. Waters with higher organic content generally require higher doses of Bti due to lower ingestion rates by mosquito larvae. Similarly, lower water temperatures reduce the feeding rate of mosquito larvae and, therefore, may result in a longer persistence of the solid and granule formulations (Maine Department of Environmental Protection 2010).

Toxins produced by Bti degrade rapidly in sunlight as a result of exposure to ultraviolet radiation. Persistence of Bti is low in the environment, usually lasting 1 to 4-days due to sensitivity to UV light. The δ-endotoxins produced by Bti degrade by soil microorganisms with soil half-lives of 3 to 6 days. The bacterium is moderately persistent in soil with a half-life of 4-months. Bti, as with other soil microbes, does not percolate through the soil and readily binds to sediments within the water column, and is, therefore, not available to contaminate ground water (Maine Department of Environmental Protection 2010).

4.3.2.2 Human Toxicity

No known mammalian health effects have been demonstrated in any infectivity/pathogenicity study. Studies for acute oral toxicity have found no adverse toxic effects, infectivity, or pathogenicity at doses up to $4.7x10^{11}$ spores/kg. Studies on acute pulmonary toxicity have found no adverse toxic effects, infectivity, or pathogenicity at doses up to $2.6x10^{7}$ spores/kg. Studies on acute intraperitoneal toxicity have found Bti to be nontoxic at dose levels below 10^{8} CFU per animal (USEPA 1998g).

4.3.2.3 Ecological Toxicity

Due to the relatively short insecticidal half-life of Bti spores and crystals, the exposure and subsequent risk to non-target wildlife is limited to the time immediately after application. Toxicity and infectivity risks due to δ-endotoxins effects to non-target avian, freshwater fish, freshwater aquatic invertebrates, estuarine and marine animals, arthropod predators/parasites, honey bees, annelids and mammalian wildlife will be minimal to nonexistent at the label use rates of registered Bti active ingredients.
Bti δ-endotoxin has a direct adverse effect on the target insect orders (*Lepidoptera, Coleoptera, Diptera*), but susceptibility varies widely among individual species. Any one registered product has a narrow susceptible insect range (USEPA 1998g).

The amount of toxins contained within Bti products is reported indirectly as the result of at least two different bioassays, and is difficult to equate to one another. Prepared volumes of toxins are applied to living mosquito larvae and the resulting mortality produces through formulae numerical measures known as International Toxic Units (ITUs) and *Ae. aegypti* International Toxic Units (AA-ITUs). These measures are only roughly related to observed efficacy in the field, and are therefore inappropriate to consolidate and report on like other toxicants (active ingredients). There is currently no chemical test that will differentiate Bti mosquito control products from other spore forming bacilli existing in the environment.

Bti applied at label rates has virtually no adverse effects on applicators, livestock, or wildlife, including beneficial insects, annelid worms, flatworms, crustaceans, mollusks, fish, amphibians, reptiles, birds, or mammals (Garcia et al. 1981, Holck and Meek 1987, Gharib and Hilsenhoff 1988, Miura et al. 1980, Mulla et al. 1982, Reish et al. 1985, Siegel and Shadduck 1987, Knepper and Walker 1989, Merritt et al. 1989, Tietze et al. 1991, Molloy 1992, Tietze et al. 1992, Tietze et al. 1993, La Clair et al. 1998). However, non-target activity on larvae of some insect species closely related to mosquitoes and found with mosquito larvae in aquatic habitats has been observed. There have been reported impacts in larvae belonging to the midge families Chironomidae, Ceratopogonidae, and Dixidae (Mulla et al. 1990, Molloy 1992, Anderson et al. 1996). These non-target insect species, taxonomically closely related to mosquitoes and black flies, apparently contain the necessary gut pH and enzymes to activate delta-endotoxins. However, the concentration of Bti required to cause these effects is 10 to 1,000 times higher than maximum allowed label rates for mosquito control.

Bacterial spores of Bti are uniquely toxic to nematoceran Diptera (mosquitoes, midges, blackflies, psychodids, and ceratopogonids) (Lacey and Mulla 1990). That result was reported after reviewing Bti studies conducted using a variety of Bti formulations, and under a variety of test conditions. Lacey and

Mulla (1990) concluded that Bti was a highly selective larvicide that produced minimal adverse impact on the environment. Garcia et al. (1981) tested a total of 23 species of aquatic organisms other than mosquito larvae using various formulations of Bti in his laboratory. No mortality was observed for these species with the exception of *Chironomus maturus* and a *Simulium* sp. (black fly), which showed a degree of susceptibility similar to that of mosquito larvae. Miura et al. (1980) found Bti at rates used for mosquito control to be very safe to organisms associated with mosquito breeding habitats. A total of 28 species or species groups were treated with the bacterium under simulated or field conditions, with no adverse effects observed, except for chironomid larvae, which were slightly affected. However, the effect was so light that the population in the field continuously increased after the treatment. Miura et al. (1981) found Bti and Bs, when applied at rates used for mosquito control, was very safe to organisms associated with mosquito breeding habitats, including the natural enemies of mosquito larvae. When various aquatic organisms were exposed to the bacteria under laboratory or field conditions, no adverse effect was noted on the organisms, with the exceptions of chironomid and psychodid larvae. Chironomid larvae were slightly affected by Bti treatment at a rate used for mosquito control, but pyschodid larvae were only affected at the higher concentration (50 mg/L).

Exposure of brook trout (*Salvelinus fontinalis)* fry to 4,500 and 6,000 milligrams per liter (mg/L) Teknar (a liquid formulation of Bti) (more than 50 times the allowed label rate for mosquito control) for 45 minutes resulted in 20 and 86.4-percent mortality, respectively (Fortin et al. 1986). Some species of chironomids are also susceptible to Bti, but at doses much higher than those used to control mosquito larvae (Mulla et al., 1990). Bti has been used extensively for control of mosquitoes in Germany without affecting populations of chironomids (Becker and Margalit 1993)

A number of Bti fermentation-based products tested at high-dose levels have shown intrinsic toxicity to non-target organisms. Investigations conducted to determine the source of the non-target activity have implicated heat-labile soluble substances contaminating the technical material. Toxic effects have been seen in aquatic invertebrate *Daphnia magna*, the honeybee, some beneficial insects and fish (rainbow trout, bluegill) studies, with Daphnia being the most sensitive indicator of toxicity. The impurities are found in the supernatant fluids separate from the delta-endotoxins. The toxicity does not appear to be due to the heat-stable β-exotoxin, because autoclaving of the test material renders the supernatant fluids innocuous. The heat-labile, soluble toxic impurities have thus far been seen in Bt subspecies *kurstaki*, *aizawai*, and *israelensis*, but may possibly be present in other Bt varieties. Damgaard (1995) reported varying levels of at least one soluble exotoxin in all commercial Bti products tested (Damgaard 1995). Bt subspecies *aizawai*-based products show the greatest negative effects on non-target organisms. With Bt subspecies *kurstaki*, the manifestation of the toxin(s) appears to be at least partly related to production methodology, especially the composition of the growth media used in industrial fermentation. In response to concerns, the manufacturer of VectoBac has completed continuous 10-day exposure tests on *Daphnia magna* with the active ingredients found in VectoBac products (fermentation solids and solubles produced by *Bti* strain AM65-52). Results indicated that the LC50 is higher than 50 mg/L for *Daphnia magna* when exposed continuously for 10 days. Based on maximum label rates of VectoBac products, expected environmental concentrations (EEC) of active ingredients do not exceed 1 mg/L immediately following application, based on a conservative assumption of a water depth of 10 cm. Therefore, application of VectoBac at label rates will not result in active ingredient concentrations approaching 10 percent of the LC50 for *Daphnia magna* (DeChant 2010).

Evidence indicates that some species of chironomid larvae (which are closely related to mosquitoes) are the only non-target aquatic species that may be affected at concentrations of Bti used for mosquito control. Observed effects on chironomids were slight and populations in the field continuously increased after the treatment.

4.3.2.4 Summary of Toxicity and Potential Effects

Bti is an effective microbial pesticide specifically targeted at mosquito larvae. Bti is a natural enemy of mosquito larvae and, therefore does not pose risk to non-target organisms, including humans and ecological receptors. This microbial larvicide is used by eight of the districts, typically throughout the year (all quarters during the reporting year). Bti is contained in 12 products used by the Districts during the reporting year. Proper PPE is used during handling, loading, and applying of the liquid form of Bti. Bti is an important component of any IPM program for mosquito larvae control.

It is important to distinguish this subspecies from Bt, which is frequently used in corn. In addition, Bti is a microbial gut toxin product and not a “live” bacterium. Bti is considered one of the safest natural forms of mosquito control.

In addition to the toxicity values referenced in Sections 4.3.2.2 and 4.3.2.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.3.3 Spinosad

Spinosad was first registered for use in California in 1996 for use as an agricultural insecticide, and more recently, registration has been approved for the use of mosquito control in California in areas such as dormant rice fields, wastewater, and temporary standing water (CDPR 2010b). Spinosad is used on a variety of crops, ornamental plants, greenhouses, ornamental lawns, and gardens; rangeland, pastures, animal husbandry premises, dairy barns, silos, and cattle; industrial sites, cracks and crevices, rights-of-way, recreation areas, golf courses, outdoor buildings and structures, and household or domestic dwellings (CDPR 2010a).

Spinosad is a biologically derived insecticide produced from the fermentation of *Saccharopolyspora spinosa*, a naturally occurring soil organism. Spinosad is a mixture of spinosyn A and spinosyn D; commercial formulations contain a spinosyn A to spinosyn D ratio of approximately 85:15. Spinosad activates the central nervous system of insects through interaction with neuro-receptors and causes continuous stimulation of the insect nervous system (Kollman 2002, Clarke Mosquito Control 2009). The EPA has classified spinosad as a “reduced risk” compound because it is an alternative to more toxic, organophosphate insecticides (CDPR 2002).

4.3.3.1 Environmental Fate

The routes of spinosad dissipation and transformation in the environment include photodegradation and biotransformation on plant surfaces, aqueous photolysis, photodegradation on soil, and biotransformation via soil microorganisms (Table 4-14). Aqueous photolysis is rapid in natural sunlight, and is the primary route of degradation in aquatic systems exposed to sunlight. In the soil environment, spinosad adsorbs strongly to soil particles and is unlikely to leach to great depths. It is photodegraded quickly on soil exposed to sunlight, but the degradation rate is decreased at longer exposure times. Spinosad is quickly metabolized by soil microorganisms under aerobic condition. Under anaerobic conditions, the degradation rate is slower (Kollman 2002). Photolysis results in degradates that are orders of magnitude less toxic than Spinosad.

Table 4-14 Degradation of Spinosad

Degradation Method	Half-life	Reference
Hydrolysis, pH 7-9 (water)	Stable	Kollman 2002
Photolysis (water)	0.84 to 0.96 Day	Kollman 2002
Photolysis (soil)	8.68 to 9.44-Days	Kollman 2002

Table 4-14 Degradation of Spinosad

Degradation Method	Half-life	Reference
Aerobic metabolism (soil)	14.5 to 17.3 Days	Kollman 2002
Anaerobic metabolism (soil)	161 to 250 Days	Kollman 2002

4.3.3.2 Human Toxicity

Spinosad is of low acute toxicity by all exposure routes. The oral LD50 for rats is >5,000 mg/kg. The dermal LD50 for rabbits is >2,800 mg/kg. The inhalation LC50 for rats is >5.18 mg/L (USDA 1999, Table 6-1). There has been no evidence of mutagenic or carcinogenic effects in chronic studies.

4.3.3.3 Environmental Toxicity

Spinosad is slightly to moderately toxic to fish and most aquatic invertebrates (USDA 1999). Acute LC50 values for bluegill and sheepshead minnow are greater than 5,000 µg/L and 7,000 µg/L, respectively, and the chronic NOAEC values for trout and sheepshead minnow are both greater than 1,000 µg/L (Goudie 2010). Hertlein et al. (2010) stated that no negative impacts were observed for individual mosquito fish held in water containing up to 50,000 µg/L of spinosad. This material also has low acute toxicity for fresh and saltwater invertebrates, with an acute EC 50 of greater than 10,000 µg/L for daphnia (Goudie 2010). The acute EC50 for oysters was greater than 300 µg/L (Goudie 2010). Laboratory studies demonstrate some toxicity for some aquatic invertebrates under chronic exposure, but residues dissipate rapidly and are rapidly degraded by photolysis with a half-life in water of less than half a day (Goudie 2010). Stark and Vargas (2003) reported a decline in *Daphnia pulex* when exposed to Spinosad in the laboratory. However, the organisms were held in a continuous renewal system, with fresh Spinosad added every 24 hours. Mortality also occurred in daphnia held in plexiglass enclosures at a field site during applications of Spinosad (Duchet et al. 2008). However, mortality occurred immediately after the applications and the authors also noted that the Spinosad dissipated rapidly from the water column and was detected at 4 to 13 percent of the initial concentrations (8 to 33 µg/L) in water 4-days after its application (Duchet et al. 2008). Hertlein et al. (2010), reporting an unpublished study by Laddoni (2006, no citation available) noted slight impacts on nonmosquito insects (*Dyticsidae, Histeridae, Libellulidae, Notonectidae*) were observed in an artificial pond treated with 50 ppb or 50 g/ha of spinosad. However, this is above field use rates and the authors concluded that Spinosad was minimally disruptive to non-targets when applied near field use rates (15 to 25 ppb).

Spinosad is practically nontoxic to birds. The acute oral LD50 for bobwhite quail and mallard ducks is >2,000 mg/kg (MacBean 2012, USDA 1999).

While high doses and/or chronic exposure of Spinosad may adversely affect some aquatic invertebrates, the short-term exposure at levels used for mosquito control is unlikely to have unwanted effects.

4.3.3.4 Summary of Toxicity and Potential Effects

Spinosad readily degrades by a number of chemical and biological processes and is not environmentally persistent. Although toxicity is low to mammals, fish, invertebrates, and birds, non-target insects (e.g., some species of moths and butterflies) could be at risk. However, low amounts typically used for mosquito control would not likely pose a significant risk to potential ecological receptors.

Spinosad is used by four of the Districts throughout the year, including during each quarter of the reporting year. It is applied in three different products (0.5 to 20 percent Spinosad) to standing and moving water in natural and anthropogenic sites. These products were applied several thousand times throughout the reporting year.

Based on the environmental fate, human and ecological toxicity, and usage patterns, using BMP application practices, spinosad should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.3.3.2 and 4.3.3.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.3.4 Methoprene and s-Methoprene

Methoprene is a long chain hydrocarbon ester classified as an insect growth regulator and selective larvicide. Methoprene consists of two enantiomers: S-methoprene and R-methoprene. S-methoprene is the biologically active enantiomer in the racemic compound (FAO-WHO 2005). Fate and transport characteristics of the s-enantiomer and the mixture are similar, but toxicity differs. Methoprene is used principally against mosquitoes, but is effective against a range of insects, including the orders Diptera, Lepidoptera and Coleoptera. Methoprene is an insect growth regulator that interferes with the normal maturation process of insects, preventing them from completing their life cycle and reaching adulthood, thus ultimately preventing them from reproduction (Csondes 2004).

Methoprene was first registered by the EPA in 1975 (USEPA 1991e). Methoprene is used indoors and outdoors at domestic dwellings, in flea and tick treatments for cats and dogs, for crack and crevice treatments, and on outdoor buildings and structures, recreation areas, swimming pools, golf courses, ornamental lawns, ornamental ponds, and shrubs. Methoprene is used at animal husbandry premises, on cattle, barnyards, rangeland, pastures, fallow land, and in animal drinking water. It is used at industrial sites, on highway rights-of-way, industrial waste disposal systems, industrial/commercial ponds, wastewater, and bilge water. Methoprene can be applied to irrigation systems, orchards, crops, berries, fruit trees, and rice. It is also used in drainage systems, swamps, marshes, intermittently flooded areas, catch basins, polluted stagnant water, sewage systems, and applied by mosquito abatement Districts (CDPR 2010a).

Methoprene products used in mosquito control are applied as briquets, pellets, sand granules, and liquids. The liquid and pelletized formulations can be applied by helicopter and fixed-wing aircraft or ground-based equipment. Methoprene is applied either in response to observed high populations of mosquito larvae at a site, or as a sustained-release product that can persist for 4-months or longer if a site has limited accessibility, limited flushing and water outflow, and has regularly produced immature mosquitoes in the past.

4.3.4.1 Environmental Fate

When methoprene is released into water, it sorbs to suspended solids and sediments. When applied to soil, methoprene is relatively immobile, tending to reside in the top few centimeters of the soil (Csondes 2004). Methoprene (and s-methoprene) is a very short-lived material in nature (Table 4-15). It rapidly degrades in aqueous solution and on inert surfaces by photolysis. It is metabolized in soil under both aerobic and anaerobic conditions. Degradation in the aquatic environment is due to both microbial metabolism and photolysis (USEPA 1991e).

Table 4-15 Degradation of Methoprene/s-Methoprene

Degradation Method	Half-life	Reference
Hydrolysis (water)	Stable	FAO-WHO 2005
Photolysis (thin film)	6 Hours	FAO-WHO 2005
Photolysis (water/sediment system)	<1 Day	FAO-WHO 2005
Aerobic metabolism (pond water)	30 to 40 Hours	FAO-WHO 2005
Aerobic metabolism (soil)	10 Days	FAO-WHO 2005; USEPA 1991e

Table 4-15 Degradation of Methoprene/s-Methoprene

Degradation Method	Half-life	Reference
Anaerobic metabolism (soil)	14 Days	USEPA 1991e
Field dissipation (pond water)	13 Days	Csondes 2004

4.3.4.2 Human Toxicity

Methoprene is of very low acute toxicity by all routes (USEPA 1991c). The oral LD50 for rats is >10,000 mg/kg. The dermal LD50 for rabbits is >2,000 mg/kg. The inhalation LC50 for rats is >210 mg/L (USEPA 1991c, 2001) (Table 6-1).

4.3.4.3 Ecological Toxicity

Methoprene is practically nontoxic to birds. The oral LD50 for mallard ducks is >2,000 mg/kg. It is moderately toxic to freshwater fish. The 96-hr LC50 for bluegill sunfish is 1.52 µg/L. Methoprene is highly toxic to aquatic invertebrates. The 48-hr EC50 of technical methoprene for *Daphnia magna* is 89 µg/L (USEPA 1991c).

Methoprene is applied at very low concentrations for mosquito control. The manufacturer has developed a number of formulations to maintain an effective level of the active material in the mosquito habitat (0.5 to 3.0 parts per billion [ppb]; (Scientific Peer Review Panel 1996) for a practical duration, thus minimizing the cost and potential impacts associated with high-frequency repeat applications. Rate of release and data generated under laboratory and field conditions with methoprene mosquito product formulations, including slow release briquet formulations, indicate a maximal rate of release of ≤4-ppb (USEPA 2001). Ross et al. (1994) conducted microcosm studies, which applied 5 sustained release methoprene formulations at maximum label application rates to tanks containing water 6 inches deep. Methoprene concentrations were measured 1, 2, 4, 7, 14, 21, 28, and 35 days after treatment, and the highest resulting microcosm methoprene concentration measured was 6 ppb.

Exhaustive reviews of the published literature on this material attest to its lack of adverse environmental impact (Mian and Mulla 1992, Scientific Peer Review Panel 1996, Glare and O'Callaghan 1999, State of Minnesota 1999, USEPA 2001). The acute, short-term toxicity of ZR-515 (methoprene) was also tested on 35 aquatic organisms, including Protozoa, Platyhelminths, Rotatoria, Annelida, Arthropoda, Mollusca, Chordata and Thallophyta, and LC50 values of 0.9 to 5.0 mg/L were calculated (250 to 1,000 times label rates) (Miura and Takahashi 1973). Dosages used for larval mosquito control produced no adverse effect on the organisms tested, except for some sensitivity in the aquatic Diptera (flies) in the families Chironomidae, Ephydridae, and Psychodidae.

Bircher and Ruber (1988) assessed the toxicity of methoprene to all lifecycle stages of the salt marsh copepod (*Apocyclops spartinus*) at concentrations ranging from 100 to 10,000 µg/L. In general, the copepods were resistant to concentrations of methoprene used to control mosquitoes, but early larval stages did show some mortalities in the test series. The calculated 48-hr LC50, adjusted for control mortality, was 800 µg/L which is about 400 times greater than the typical application rate. Christiansen et al. (1977) showed a reduction in survival of larvae of the mud-crab *Rhithropanopeus harrisii* (Gould) in the laboratory under a range of salinity and temperature conditions, when exposed to 10, 100, and 1,000 µg/L methoprene, levels 5 to 500 times field application rates. McKenney and Mathews (1988) reported that larval survival, growth, and energy metabolism of an estuarine shrimp *Palaemonetes pugio* were altered by exposure to 100 µg/L of methoprene (50 times greater than application rates). However, Wirth et al. (2001) reported no observed differences in the percent successfully hatching or larval mortality 3 days post hatch in *P. pugio* exposed for 96 hours to 1,000 µg/L. In addition, in 2004, Suffolk County conducted 4-day static renewal toxicity tests on grass shrimp (*Palaemonetes pugio*) using water collected

30 minutes after aerial application of methoprene for mosquito control and observed no toxicity (Turner et al., 2006). Similar investigations have been carried out with *Leander tenuicornis*, an estuary shrimp that occurs in Australian intertidal marshes. Methoprene was nontoxic at field application levels in 96-hour toxicity tests (Brown et al. 1996). The LC50 of methoprene for *L tenuicornis* (14,320 µg/L) in these tests was 1,790 times field concentrations when applied at label rates. The authors concluded that methoprene could be safely applied in situations where the shrimp were present and that no mortality of shrimp was likely at the levels applied for mosquito control. Further laboratory work (Brown et al. 2000) found that the dose lethal to mosquitoes (*Culex annulirostris*) was 3,000 times below the LC_{95} for shrimp (*Caradina indistincta)*. Zulkosky et al. (2005) investigated the potential effect of methoprene runoff to larval lobsters (*Homarus americanus*) in continuous flow-through systems for 48 hours: methoprene was not toxic at the highest concentration tested (10 micrograms per liter [µg/L] or 10 µg/L). Laboratory studies with fish demonstrated that methoprene had no effect on the survival of adult and juvenile rainbowfish (*Melanotaenia duboulayi*) (Brown et al. 2002). No effect was observed on swimming performance of rainbowfish when exposed to up to ten times effective field concentrations of applications made for mosquito control (Hurst et al. 2007).

Methoprene studies have not shown adverse effects on amphibians. Tests conducted on various life stages of different amphibian species (*Bufo woodhousei*, *Rana catesbeiana* and *Rana pipiens*) found no adverse effects from acute or chronic exposures at the highest dose tested. Acute studies on *R. catesbeiana* and *R. pipiens* larvae indicate LC50 values >10,000 µg/L and *B. woodhousei* adult LC50 values >1,000 µg/L (highest dose tested). Chronic studies on *B. woodhousei* indicate a 22-day LC50 >1,000 µg/L and LC50 >1,000 µg/L for *R. catesbeiana* and *R. pipiens* (USEPA 2001).

One early field study assessing applications of technical (pure powdered) methoprene on a Louisiana coastal marsh yielded ambiguous results (Breaud et al. 1977). Highly significant declines were observed in the occurrence of 14-invertebrates immediately following the application, including selected life stages and species of amphipods, shrimp, mayflies, dance flies, midges, freshwater snails, damselflies and dragonflies, and water beetles. However, the abundance of five other invertebrates significantly increased including water boatmen, moth flies, two species of crawfish, and predaceous diving beetles. No statistically significant difference was seen between the test and control populations of another 28 aquatic organisms. Interpretation of this study is difficult in part because of the mixed nature of the results, which may simply indicate the complexity of ecosystem dynamics in marshlands. Also, the application rate (28 gm active ingredient/ha technical powder) was at least twice the highest label rate of active ingredient allowed today, and was effectively much higher when the encapsulation and other coatings on modern formulations are considered. The relevance of Breaud et al.'s entire experiment as a legitimate field study may be called into question, as the properties of technical grade methoprene powder render it unfit for any type of direct field application under current label restrictions.

Since the publication of Breaud et al. (1977), there have been numerous field studies using currently available mosquito control products containing methoprene, in which no detectable effect was observed in aquatic invertebrates. For example, no detectable mortality occurred in Talitrid amphipods exposed to aerial applications of Altosid to a Florida mangrove swamp in 1999 (Lawler et al. 1999). A similar study assessed applications of a sustained release formulation of methoprene and a combined liquid formulation of *Bti* and methoprene (duplex) to tidal wetlands of San Francisco Bay. No difference was seen in growth or development of water boatman, and no difference in the number of non-target insects inhabiting treated versus untreated plots (Lawler et al. 2000). The authors also monitored brine flies at treated and untreated sites using sentinel cages, and sampled populations with sweep nets. No decline was observed in flies relative to controls collected by sweep nets. Caging of sentinels was unsuccessful at assessing impacts, since none of the caged flies survived at untreated sites or treated ones.

Aerial applications of liquid methoprene on saltmarsh habitat have also been assessed in Australia (Russell et al. 2009). Changes in assemblages of invertebrates through time were observed in both treated and untreated (control) plots. No significant effects were seen on arthropods in ephemeral pools.

There was no significant difference in abundance of nonmosquito dipterans (flies), heteropterans (true bugs), and hymenopterans (primarily ants) in treated versus untreated sites. Some differences were observed in copepod populations during the treatment period, but these were short-term or inconsistent between localities or between sampling method. The authors concluded that applications of *Bti* and methoprene to salt marshes do not affect the structure or composition of assemblages of non-target arthropods (Russell et al. 2009).

Published studies on non-target impacts of methoprene for mosquito control were reviewed recently (Davis 2007, Davis and Peterson 2008). The authors also carried out an ecological risk evaluation of mosquito larvicides in a series of ponds at the Benton Lakes National Wildlife Refuge in Montana. *Bti* and methoprene were applied directly to water as liquids, and aquatic arthropods were sampled following the applications. No overall treatment effects were observed on aquatic non-target invertebrates collected in D-shaped net samples. A linear model was then fitted to each of the response variables to determine multivariate treatment effects. Data indicated a possible acute impact on amphipods immediately following application, but no significant effect at 7 to 28 days. No trend was seen across dependent groups of non-target organisms, and there were no persistent biological effects.

Careful review of these and other studies, and the recent reviewers listed above leads to the conclusion that: 1) applications of methoprene (especially technical powder) at rates significantly higher than allowed by the label can adversely impact a number of aquatic animals; 2) animal species are not extirpated (locally eliminated) by repeated methoprene use except at application rates far higher than those used and allowed for mosquito control; 3) emergence of adults of some fly species (specifically, some types of midges) can be temporarily reduced at application rates similar to those used for mosquito control; 4) larval flies affected by methoprene are not killed at label application rates, but are prevented from becoming adults; 5) for species that are affected by methoprene, recolonization and reestablishment of populations from neighboring sites is fast once intense control was relaxed; 6) the patchy distribution of mosquito larvae leads to maintenance of untreated refugia for non-targets, speeding recolonization; and 7) no bioaccumulation of methoprene has been seen in animals that have eaten mosquito or midge larvae treated with methoprene.

The concentrations of methoprene applied for mosquito larvae control are unlikely to affect non-target aquatic species, except for some fly species closely related to mosquitos. For species that are affected by methoprene, recolonization and reestablishment of populations from neighboring sites is fast once intense control is relaxed.

4.3.4.4 Summary of Toxicity and Potential Effects

Methoprene readily degrades in soil and water by a variety of processes. It may exhibit toxicity to fish and aquatic invertebrates, as well as non-target insects including moths, butterflies, and beetles, but these concentrations are much higher than would be experienced in the application scenarios currently in use.

Methoprene is longer-lasting than some of the other larvicides on the market and, therefore requires fewer applications of low amounts. Methoprene is effective at much lower concentrations than alternative larvicide products, which correlates with reduced acute exposures to non-target organisms, as well as potential effects to a lower diversity of midges and chironomids. Extended release forms including granular and briquette varieties are also available, including 30 and 90-day briquettes. This product may be more residual in the environment, however, the methoprene active ingredient in this formulation has a short half-life in water and does not migrate through soil, significantly reducing the potential for groundwater impacts.

Considered the safest of all larvicide alternatives, methoprene is used prevalently by the nine Districts during each season, including all four quarters of the reporting year. There are 12 methoprene-containing products (0.2 to 8.62 percent methoprene) that are applied to natural and anthropogenic standing and moving water bodies. Many of these products are Altosid formulations (Wellmark) and one is MetaLarv SP-T (see Table 3-1). These products were applied several thousand times during the reporting year.

Liquid and granular forms are most prevalently used in residential and ornamental pond application scenarios. Treatments to wetlands including marshes require the granular form (e.g. Altosid XRG with *Bacillus sphaericus*) to penetrate dense aquatic vegetation including cattails and tules. Methoprene is also sometimes co-applied with Bti. Drift is almost irrelevant for hand and aerial (e.g., helicopter) applications since treatments are restricted at moderate to high wind speeds. Methoprene is highly effective against mosquitoes at low concentrations and degrades quickly in the environment, thereby reducing the potential exposure and risk to non-target organisms. When handled and applied using appropriate BMPs, methoprene is one of the safest (human and ecological) and most effective mosquito control products used by the Districts. Based on toxicity, environmental fate, and usage patterns, methoprene, using BMPs is not likely to result in unwanted adverse impacts.

In addition to the toxicity values referenced in Sections 4.3.4.2 and 4.3.4.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.3.5 Alcohol Ethoxylated Surfactant (Monomolecular Film)

The monomolecular film used in California for the control of mosquito larvae is alpha-isooctadecyl-omega-hydroxypoly (oxyethylene). Agnique is the trade name for this recently reissued surface film larvicide. Monomolecular films are alcohol ethoxylated surfactants, which are low-toxicity pesticides that spread a thin film on the surface of the water that makes it difficult for mosquito larvae, pupae, and emerging adults to attach to the water's surface, and cause them to drown (USEPA 2007c). It also disrupts respiration of some other classes of air-breathing aquatic insects.

Monomolecular films are used on ornamental ponds, pastures, irrigation systems, drainage systems, drinking water systems, intermittently flooded areas, catch basins, lakes, ponds, reservoirs, tidal areas, marshes, and standing water, industrial waste disposal systems, polluted and stagnant water, and sewage systems (CDPR 2010a).

4.3.5.1 Environmental Fate

Reported half-lives of monomolecular films in water range from 5 to 22 days and Agnique has an average persistence in the environment of 5 to 21 days at label application rates (Oester 2010).

4.3.5.2 Human Toxicity

Because of the mode of action and likely exposure scenarios of these products, there is little to no indication of potential for adverse effects to humans.

4.3.5.3 Ecological Toxicity

A number of efficacy and non-target studies had been conducted on this material when it was registered under the name Aerosurf. Minor proprietary changes in preparation did not apparently change any of the material's potential environmental impacts; therefore, the earlier literature is referenced.

Most published studies conducted with this larvicide tested application rates of 3 to 100 times the maximum label rate. At these rates, no observable effect on mortality or development was noted in tests on green tree frogs, seven species of fresh and salt water fish, two species of shrimp, five species of water beetle, or one species each of fairy shrimp, crayfish, snail, polychaete worm, mayfly naiad, copepod, ostracod, or midge. In addition, no effect was seen on five species of plants. Air (surface) breathing insects were temporarily adversely impacted. Water boatmen, backswimmers, and one species of water beetle exhibited increased mortality at application rates above label limits. In addition, a clam shrimp, a crab, an amphipod, and one species of isopod exhibited minor to significant increases in mortality at levels several times the highest application rate allowed by the label (Oester 2010).

Although evidence indicates that application of monomolecular films and petroleum distillates may result in reductions to populations of surface-breathing insects at the time of treatment, it is unlikely that overall populations of invertebrate species are affected as populations recover quickly due to recolonization from neighboring sites.

4.3.5.4 Summary of Toxicity and Potential Effects

Alcohol ethoxylated surfactants exert no lasting or observable effect on most non-target organisms, so that using BMP application practices, these chemicals should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.3.5.2 and 4.3.5.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.3.6 Aliphatic Solvents (Mineral Oils and Aliphatic Petroleum Hydrocarbons)

Specially-derived aliphatic solvents (e.g., mineral oils and aliphatic petroleum hydrocarbons such as GB-1111 and BVA-2) are used to form a coating on top of water to drown larvae, pupae, and emerging adult mosquitoes. These products of petroleum distillation processes have been used for many years nationwide to kill aphids on crops and orchard trees, and to control mosquitoes (USEPA 2007d). They are applied to a wide variety of crops, trees and ornamental plants; to swamps, marshes and intermittently flooded areas. These compounds are also used as an adjuvant for pesticides to increase efficacy and/or application efficiency. These compounds, with appropriate BMPs are applied by mosquito abatement districts (CDPR 2010a). Dormant oils are widely used in the Central Valley on tree crops.

CocoBear Mosquito Larvicide Oil is a plant based oil (also see Section 4.7.3). This product consists mostly of a modified coconut oil (75 percent or more by volume) combined with 10 percent by volume mineral oil and a very small amount of nonionic surfactant and other proprietary ingredients. This material can be used in various waterbodies such as ditches, stagnant pools, swamps, marshes, temporary rainwater pools and intermittently flooded areas, ponds, catch basins and manmade containers for the management of immature mosquitoes.

4.3.6.1 Environmental Fate

Petroleum distillates are effective in many situations in which monomolecular films do not give sufficient control. These materials also break down much more rapidly than monomolecular films (2 to 3 days as opposed to 21 days), which decreases their impact to non-target organisms.

4.3.6.2 Human Toxicity

These chemicals have a low degree of acute toxicity to mammals. There was no mortality in rats at an acute oral dose of 28,000 mg/kg bw. They are virtually nontoxic via dermal and inhalation routes (USEPA 2007d) (Table 6-1).

4.3.6.3 Ecological Toxicity

The safety of petroleum distillates for non-targets has been demonstrated by both laboratory and field studies. Three studies (Tietze et al. 1991, Tietze et al. 1992, Tietze et al. 1994) tested three species of fish (Inland Silversides, Mosquitofish, and Sheepshead Minnows), and a range of microorganisms and concluded that petroleum distillate formulation GB-1111 is not toxic to the tested organisms at label application rates. Mulla and Darwazeh (1981) tested GB-1111 in small experimental ponds and found that benthic invertebrates (including mayflies, dragonflies, and damselflies) were unaffected, while populations of surface-breathing insects were temporarily reduced, following application of this larvicide. Miles et al. (2002) completed an independent study of non-target effects of GB-1111, with financial assistance from the U.S. Fish and Wildlife Service (USFWS), on the tidal marshes of the Don Edwards National Wildlife

Refuge in San Francisco Bay near Newark, California, and observed the following effects: 1) surface-breathing insect populations were reduced at the time of treatment; 2) this effect did not persist beyond a few days (no residual pesticide effects); 3) those potentially affected animals with high mobility left the site, while some of those that could not leave died (especially water boatmen [*Corixidae*]); and 4) overall populations of invertebrate species were not affected, apparently because of recolonization from neighboring untreated sites.

Although evidence indicates that application of monomolecular films and petroleum distillates may result in reductions to populations of surface-breathing insects at the time of treatment, it is unlikely that overall populations of invertebrate species are affected as populations recover quickly due to recolonization from neighboring sites.

4.3.6.4 Summary of Toxicity and Potential Effects

Aliphatic solvents have very low water solubility and high sorption to organic matter. They are practically nontoxic to most non-target organisms and rapidly break down in the environment, reducing their impact on susceptible non-targets so that, using BMP application practices, these products should not result in unwanted adverse effects. These products are used for both mosquito control and adjuvants to some pesticides to increase or improve efficacy and/or application efficiency. Golden bear and BVA-2 oils are pesticides used in controlling immature mosquito populations and is used to suppress mosquito related issues, including suppression of potential West Nile virus. Some white mineral oil based compounds are nontoxic food products and are used in numerous cosmetic products. No general direct toxicity has been reported. When added to other compounds as a surfactant, the toxicity of the primary chemical is the issue but not the oil product. A recent development is the use of plant based food grade oils such as coconut oil that is combined with a small amount of mineral oil (e.g. CoCoBear Oil) CoCoBear has no reported significant toxicity to any receptors likely to be exposed during or after use as a larvicide. Acute oral toxicity to rats is >5000 mg/kg, acute dermal toxicity to rats is > 5050 mg/kg, and acute inhalation toxicity to rats is > 2.16 mg/L (Clarke 2014).

Therefore, the Districts rely on toxicology data for mineral oil as well as the product formulation, and this is reflected accordingly in the data found in Table 6-1. In addition to the toxicity values referenced in Sections 4.3.6.2 and 4.3.6.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.4 Other Insecticides

4.4.1 Potassium Salts

Potassium salts of fatty acids are used as insecticides, acaricides, herbicides and algaecides. They are used to control a variety of insects and mosses, algae, lichens, liverworts and other weeds, in or on many food and feed crops, ornamental flower beds, house plants, trees, shrubs, walks and driveways, and on dogs and cats. Potassium salts of fatty acids include potassium laureate, potassium myristate, potassium oleate, and potassium ricinoleate. Once applied, however, these salts are degraded quickly in soil by microbes, and do not persist in the environment (USEPA 1992).

4.4.1.1 General Toxicity

Commonly referred to as “soap salts”. They are produced by adding potassium hydroxide to fatty acids found in plant or animal oils. Fatty acids are extracted from palm, coconut, olive, castor, and cottonseed plants (National Pesticide Information Center 2001). Fatty acids penetrate an insect’s body covering and disrupt the cell membranes. The insect dies of dehydration. Soft-bodied insects, such as aphids, are more susceptible as are immature insects.

4.4.1.2 Human Toxicity

Soap salts have low oral and dermal toxicity to mammals but may cause general stomach upset in humans. They may be irritating to the skin and eyes (USEPA 1992). These products are generally considered safe by the FDA. The USEPA classifies soap salts as Category IV (lowest level of toxicity) for acute effects (Table 6-1).

4.4.1.3 Ecological Toxicity

Soap salts are practically nontoxic to birds but slightly toxic to fish and highly toxic to aquatic invertebrates (USEPA 1992). Pesticides containing potassium salts of fatty acids are used in a wide array of outdoor sites; however, the compounds degrade very quickly in soil. Because soap salts are not applied directly to water, they pose little threat to sensitive aquatic invertebrates (USEPA 1992).

4.4.1.4 Summary of Toxicity and Potential Effects

Potassium salts degrade quickly in the environment. They are of low toxicity to birds and mammals, but highly toxic to fish aquatic non-target invertebrates. The Districts did not use potassium salt products during the reporting year; therefore, when needed, using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.4.1.2 and 4.4.1.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.5 Rodenticides

These chemicals are for the control of mammal pests, particularly commensal rats and mice (e.g., Norway rat, roof rat, and house mouse) but also a variety of field rodents.

The anticoagulant rodenticides are typically grouped into “first-generation” (e.g., chlorophacinone, diphacinone) and “second-generation” (e.g., brodifacoum, bromadiolone, difethialone) compounds. Second-generation anticoagulants tend to be more acutely toxic than are the first-generation anticoagulants, and they are retained much longer in body tissues of primary consumers. In contrast, the first-generation compounds are less acutely toxic and more rapidly metabolized and/or excreted (USEPA 1998e). Both classes have the same mode of action but second generation anticoagulants have a significantly longer liver half-life than first generation anticoagulants (USEPA 1998e).

4.5.1 Chlorophacinone

Chlorophacinone is used to control a variety of vertebrate pests, mainly rodents, but also jackrabbits (lagomorphs), and moles (insectivores). It is a first-generation anticoagulant and is formulated as tracking powder, as loose-grain bait, paraffinized pellets, rat and mouse bait ready-to-use place packs, and paraffin blocks. Chlorophacinone is currently registered for the control of rodents in and around buildings, households and domestic dwellings, uncultivated agricultural and nonagricultural areas, commercial transportation facilities; industrial areas, and food processing, handling, and storage areas and facilities. Both general use and restricted use chlorophacinone products are currently registered (USEPA 1998e).

4.5.1.1 Environmental Fate

Chlorophacinone is readily degradable by photolysis in the environment. It has low water solubility, is very susceptible to direct photolysis in water and is moderately susceptible to photodegradation on soil (Table 4-16; USEPA, 1998e). Chlorophacinone volatilizes slowly from water and soil and degrades slowly by acid hydrolysis with no measurable hydrolysis at higher pHs. Chlorophacinone is considered to be moderately persistent and immobile in soil. The major route of dissipation in soil appears to be aerobic soil metabolism (USEPA 1998e, Hartless and Jones 2011).

Table 4-16 Degradation of Chlorophacinone

Degradation Method	Half-life	Reference
Hydrolysis, pH 5	232 Days	Hartless & Jones 2011
Hydrolysis, pH 7-9	Stable	USEPA 1998e, Hartless & Jones 2011
Photolysis (water)	37 minutes	USEPA 1998e
Photolysis (soil)	4 Days	USEPA 1998e
Aerobic metabolism (soil)	17 to 47.2 Days	USEPA 1998e, Hartless & Jones 2011

4.5.1.2 Human Toxicity

The USEPA classifies chlorophacinone as Category I (highly toxic) for oral, dermal, and inhalation toxicity to mammals (USEPA 1998e). The oral LD50 of chlorophacinone is 3.15 mg/kg for male rats and 0.329 mg/kg for male rabbits (USEPA 1998e). Human volunteers were able to tolerate a single dose of 20 mg active ingredient with an uneventful recovery and no treatment (EXTOXNET 1985c). The dermal LD50 for rabbits is 200 mg/kg. The inhalation LC50 for male rats is 7.0 µg/L. MacBean (2012) reports additional oral and dermal LD50 values of 6.26 and 0.007 mg/kg respectively, and an inhalation LC50 of 0.0093 mg/L for rats. Chlorophacinone is not known to cause skin or eye irritation (USEPA 1998e) (Table 6-1).

4.5.1.3 Ecological Toxicity

Chlorophacinone is toxic to wildlife and fish. The 96-hr LC50 for rainbow trout is 450 µg/L. The use of food bait (aerial or ground broadcast or hand applied pellets) may present an exposure risk to seed-eating birds (USEPA 1998e). The oral LD50 is 258 mg/kg for bobwhite quail (USEPA 1998e). The oral LD50 for carnivorous mammals, including carnivores (e.g., mountain lions, bobcats, coyotes) is 2.1 to 50 mg/kg (Hosea 2000). Data are lacking to assess potential secondary risks to avian predators and scavengers, which may feed on poisoned rodents. The USEPA presumes high risks to any non-target small mammals. Primary risks to larger mammals are reduced by proper use of bait stations. Secondary risk to predatory mammals such as coyotes has been demonstrated. The USEPA indicates that chlorophacinone poses minimal risk to freshwater organisms (USEPA 1998e) (Table 6-1).

4.5.1.4 Summary of Toxicity and Potential Effects

Chlorophacinone has low water solubility and is moderately persistent in soils. Loose-grain baits may present a risk to non-target foraging animals, including seed-eating birds. This first-generation rodenticide is highly toxic to mammals, including humans, domestic pets, and non-target mammalian wildlife. However, since it is generally applied as solid bait blocks, significant release and environmental impact is not anticipated. In addition, chlorophacinone was not used by the MVCAC Districts during the reporting year. For these reasons, and when needed, using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.5.1.2 and 4.5.1.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District

4.5.2 Diphacinone

Diphacinone and diphacinone salt products are first-generation anticoagulants formulated predominantly as food baits (loose bait, feeder boxes, place packs, or paraffinized bait blocks) for control of commensal rats (Norway rat, roof rat) and mice (house mouse). One product is registered as a tracking powder for control of rats and mice indoors and at burrows located along the periphery of buildings. Because diphacinone salt is highly soluble, it is also used to prepare water baits for indoor control of rats and mice. Use sites for rat and mouse food baits are predominantly in and around buildings and similar man-made structures. Some labels include sewers or other wet or damp sites such as dumps, irrigation ditches, along fences, gullies, and other such areas. Diphacinone salt has special local needs registration in California for control of deer mice, jackrabbits, chipmunks, muskrats, woodrats, voles, and commensal rats and mice (USEPA 1998e).

4.5.2.1 Environmental Fate

Diphacinone has low water solubility and volatilizes slowly from water and soil. Diphacinone is stable to hydrolysis at pH 7-9 and stable to photolysis. One clearly established route of transformation for diphacinone is aerobic soil metabolism (Table 4-17). Because diphacinone binds tightly to soil, most of the chemical would remain in the top soil layers and its potential to reach ground water is low (USEPA 1998e, Federoff and Lin 2011).

Table 4-17 Degradation of Diphacinone

Degradation Method	Half-life	Reference
Hydrolysis, pH 5	44 Days	USEPA 1998e
Hydrolysis, pH 7-9	Stable	USEPA 1998e
Photolysis (water)	Stable	Federoff & Lin 2011
Photolysis (soil)	Stable	Federoff & Lin 2011
Aerobic metabolism (water)	180 Days	Federoff & Lin 2011
Aerobic metabolism (soil)	28 to 32 Days	USEPA 1998e, Federoff & Lin 2011

4.5.2.2 Human Toxicity

The USEPA has rated diphacinone as Category I for oral, dermal, and inhalation toxicity to mammals. Oral LD50s for rats were 2.3 mg/kg and 7.0 mg/kg in two separate studies (USEPA 1998e). The dermal LD50 for rabbits is 3.6 mg/kg. The inhalation LC50 for rats is <0.6 µg/L (USEPA 1998e). Diphacinone is listed as Category III for eye irritation and Category IV for skin irritation (USEPA 1998e). Given the exclusively nonfood uses of diphacinone, chronic toxicity and carcinogenicity, USEPA has not conducted chronic toxicity and carcinogenicity studies (USEPA 1998e). The use of rodenticides can sometimes pose risks to domestic animals via primary or secondary exposure. The oral LD50 is 3 to 7.5 mg/kg for dogs and 14.7 mg/kg for cats. The oral LD50 for swine is 150 mg/kg (EXTOXNET 1993b).

4.5.2.3 Ecological Toxicity

Diphacinone is slightly toxic to birds, and the use of food bait (aerial or ground broadcast or hand applied pellets) may present an exposure risk to seed-eating birds (USEPA 1998e). The oral LD50 is 3,158 mg/kg for mallard duck and 1,630 mg/kg for bobwhite quail (EXTOXNET 1993b). There is potential secondary risk to avian predators and scavengers, which may feed on poisoned rodents. The lowest observed lethal single dose to screech owls was 130 mg/kg bw (Rattner et al. 2012). The lowest observed lethal 7-day dose to screech owls was 0.82 mg/kg owl/day (Rattner et al. 2012). Primary risks to larger mammals are reduced by proper use of bait stations. The USEPA expects minimal risk to aquatic organisms from the current uses of diphacinone (USEPA 1998e). However, diphacione is slightly to moderately toxic to fish and invertebrates. The 96-hr LC50 is 7.5 mg/L for bluegill and 2.8 mg/L for trout. The 48-hr LC50 for *Daphnia magna* is 1.8 mg/L (USEPA 1998e). It is not known to bioaccumulate in fish readily (USEPA 1998e).

4.5.2.4 *Summary of Toxicity and Potential Effects*

Diphacinone technical material has low water solubility and is generally applied as food bait blocks; however, diphacinone salt is highly soluble and is used to prepare water baits for indoor applications. Diphacinone salt has special local needs registration in California for control of deer mice, jackrabbits, chipmunks, muskrats, woodrats, voles, and commensal rats and mice (USEPA 1998e). It is highly toxic to mammals, including humans, domestic pets, and non-target mammalian wildlife. However, since it is generally applied as solid bait blocks or in-home water treatments, significant release and environmental impact is not anticipated.

Diphacinone is used by three Districts in tree holes, burrows, creeks, and parks. Districts use two different products. Diphacinone is applied over 80 times a year and application occurs in all four quarters, including during the reporting year. Active ingredient concentrations in these products are 0.2 and 0.005 percent, respectively. Based on the limited use patterns by the Districts and low potential exposure to non-target species, it is not likely that these products would result in adverse effects. For likely future uses, USEPA has released a list of new, more protective rodenticide products, including tamper-resistant and weather-resistant bait stations (http://www.epa.gov/pesticides/mice-and-rats/rodent-bait-station.html).

In addition to the toxicity values referenced in Sections 4.5.2.2 and 4.5.2.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.5.3 <u>Brodifacoum</u>

Brodifacoum is a second generation anticoagulant pesticide for rodent control against commensal rats and mice (Housenger and Melendez 2012). It is formulated as meal bait, paraffinized pellets, rat and mouse bait ready-to-use place packs, and paraffin blocks. Brodifacoum is currently registered for the control of rats and mice in and around farm structures, households and domestic dwellings, uncultivated agricultural and nonagricultural areas, inside transport vehicles, commercial transportation facilities, industrial areas, sewage systems, aircraft, ships, boats, railway cars, and food processing, handling, and storage areas and facilities. Only general-use brodifacoum products are currently registered (USEPA 1998e).

4.5.3.1 *Environmental Fate*

Brodifacoum has low solubility and is nonvolatile. It is stable to hydrolysis at pH 5, 7, and 9, relatively persistent in soil (half-life of 157 days), and immobile in soil columns. Photolysis by sunlight in aqueous media is potentially important, if exposure to aquatic environments occur. Brodifacoum is persistent in soil, but little, if any, contamination of surface and ground waters is expected because of its use pattern and immobility in soil (USEPA 1998e, Housenger and Melendez 2012).

4.5.3.2 *Human Toxicity*

Brodifacoum is listed as Category I for oral, dermal, and inhalation exposure by the USEPA. The oral LD50 for rats is 0.418 to 0.561 mg/kg. The dermal LD50 for rabbits is 3.16 to 5.21 mg/kg. The inhalation LC50 for rats is 3.05 to 4.86 µg/L. Brodifacoum is listed as Category III for eye irritation and is unlikely to cause skin irritation (USEPA 1998e) (Table 6-1).

4.5.3.3 *Ecological Toxicity*

Like other common rodenticides, brodifacoum is often found in tissues of wildlife. The LD50 for carnivores such as coyotes, foxes, and mountain lions is 0.27 to 25.0 mg/kg (Stone et al. 1999, Hosea 2000).

Eastern gray squirrels, white-tailed deer, raccoons, and red foxes have been recovered and determined to have died from exposure to anticoagulant rodenticides (first or second generation) (Stone et al. 1999). Domestic animals may accidentally ingest bait. The oral LD50 is 100 g of bait for cats and 355 to 1,000 g of bait for dogs (EXTOXNET 1985a).

The LD50 for wild birds, including some birds of prey ranges from 2 to 100 mg/kg (Stone et al. 1999, Hosea 2000).). The LD50 for mallard ducks is 0.26 mg/kg (USEPA 1998e). Scavenging birds may also be exposed to brodifacoum. Howald (1997) reported common ravens removed and consumed bait blocks from bait stations on Langara Island during a rat eradication program. Bald eagles captured and tested have also shown blood plasma residues of brodifacoum (Howald et al. 1999). Similar results have been demonstrated for northwestern crows (Howald 1997, Howald et al. 1999) and eastern screech owls (Merson et al. 1984) with some fatalities recorded. The level of concern (LOC) for predatory birds is >100 ng/g ww (hepatic concentration) with >200 ng/g considered potentially lethal (Christensen et al. 2012). Brodifacoum (in combination with bromadiolone and difethialone) was indicated in the mortality of three red-tailed hawks in Manhattan in 2012 (New York State Department of Environmental Conservation 2012). In a recent study of raptors and owls in Denmark, 92 percent of all birds contained detectable hepatic concentrations of anticoagulant rodenticides, with second-generation anticoagulants (brodifacoum, bromadiolone, and difenacoum the most prevalent) (Christensen et al. 2012).

The California Department of Fish and Game Pesticide Investigations Unit identified wildlife losses possibly due to pesticide exposure (Hosea 2000). Clinical signs consistent with anticoagulant toxicosis were observed during necropsies of 43 percent of the animals with anticoagulant residues. Of the 74-animals examined in this study, 69 percent had been exposed to anticoagulant rodenticides, indicating that urban use of anticoagulant rodenticides may be important in California. The primary compound identified in this study was brodifacoum (61 percent of mammals and 55 percent of birds). This compound was only registered for use in, or adjacent to, structures. Due to the feeding behaviors of some of the exposed non-target wildlife (i.e., birds of prey do not eat pelletized or grain foods, bobcats and mountain lions are carnivores) the authors concluded that it was unlikely for these species to consume rodenticide baits directly. Raccoons, canids, kangaroo rats, and wild turkeys were thought to have been exposed via the primary route. Acute LD50 data indicated that brodifacoum has the highest toxicity of the four identified rodenticides.

Brodifacoum is also very highly toxic to aquatic organisms, but due to its extremely low solubility, the USEPA does not believe the chemical poses a hazard to non-target aquatic organisms. The 96-hr LC50 is 0.025 mg/L for bluegill and 0.015 mg/L for rainbow trout (USEPA 1998e). Additionally, the USEPA has determined that brodifacoum does not pose a risk to honey bees (USEPA 1998e).

4.5.3.4 Summary of Toxicity and Potential Effects

Brodifacoum has low water solubility and is generally applied as food bait blocks or pellets. This second-generation rodenticide is highly toxic to mammals, including humans, domestic pets, and non-target mammalian wildlife. Brodifacoum is often found in the tissues of wildlife, including avian and mammalian predators. Compared to other rodenticides reviewed herein, brodifacoum has the greatest acute toxicity and is one of the most commonly identified poisons in tissues of non-target wildlife. Brodifacoum was not used by the Districts during the reporting year. Due to its limited use by the Districts, brodifacoum does not appear to be an active ingredient of concern, and using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.5.3.2 and 4.5.3.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.5.4 Bromadiolone

Bromadiolone is an anticoagulant rodenticide that is used to control Norway rats (*Rattus norvegicus*), roof rats (*Rattus rattus*), and house mice (*Mus musculus*) in and around buildings and in transport vehicles (ships, trains, and aircraft), alleys, and sewers. Formulation types include meal bait, pellets, ready-to-use place packs, and paraffinized blocks (USEPA 1998e, Sternberg et al. 2011).

4.5.4.1 Environmental Fate

Bromadiolone is moderately persistent in soil and is immobile in soil with high organic and clay content. Bromadiolone is stable to hydrolysis at pH 5, 7, and 9. The major route of dissipation appears to be aerobic soil metabolism (half-life of 14-days).Two of the major degradates identified in the aerobic soil metabolism study are persistent (USEPA 1998e, Sternberg et al. 2011).

4.5.4.2 Human Toxicity

Bromadiolone is highly toxic to mammals by acute oral, dermal, and inhalation exposure. The oral LD50 is between 0.56 and 0.84 mg/kg for rats, although MacBean (2012) indicates the oral LD50 upper limit for rats is 1.31 mg/kg. The dermal LD50 is 1.71 mg/kg for rabbits. The inhalation LC50 is 0.43 µg/kg for rats. Bromadiolone is listed as Category III for eye irritation and IV for skin dermal irritation (USEPA 1998e).

4.5.4.3 Ecological Toxicity

Because bromadiolone is a rodenticide, risk is presumed for any small mammals that ingest bait containing the chemical (USEPA 1998e). Like other common rodenticides, bromadiolone is often found in tissues of wildlife. The LD50 for carnivores such as coyotes, foxes, and mountain lions is 1.125 to 25.0 mg/kg (Stone et al. 1999, Hosea 2000). Domestic animals may accidentally ingest bait. Acute toxicity for dogs (hemorrhages fatal if not treated) occurs at 10 mg/kg. For a 10 kg dog that would correspond to 100 mg of pure bromadiolone (2 kg bait at a typical application of 0.005 percent) (EXTOXNET 1985b). The maximum tolerated oral dosage for cats is 25 mg/kg (EXTOXNET 1985b).

The LD50 for wild birds, including birds of prey is 16.93 mg/kg (Stone et al. 1999, Hosea 2000). The LD50 is 138 mg/kg for bobwhite quail (USEPA 1998e). Bromadiolone (in combination with brodifacoum and difethialone) was indicated in the mortality of three red-tailed hawks in Manhattan in 2012 (New York State Department of Environmental Conservation 2012). In a recent study of raptors and owls in Denmark, 92 percent of all birds contained detectable hepatic concentrations of anticoagulant rodenticides, with second-generation anticoagulants (brodifacoum, bromadiolone, and difenacoum the most prevalent) (Christensen et al. 2012).

Bromadiolone bioconcentration factors (BCF) of 160X and 1,658X were determined for edible and nonedible tissues in bluegill sunfish, respectively (USEPA 1998e). The 96-hr LC50 is 0.24-mg/L for rainbow trout and 3.0 mg/L for bluegill (USEPA 1998e). The 24-hr LC50 for *Daphnia magna* is 8.8 mg/L (EXTOXNET 1985b). Due to the methods of bromadiolone application, little if any of the chemical is expected in water bodies. Additionally, bromadiolone is extremely insoluble and therefore is not expected to pose a major risk to aquatic organisms (USEPA 1998e).

4.5.4.4 Summary of Toxicity and Potential Effects

Bromadiolone is moderately persistent in soils and is generally applied as food bait blocks or pellets. This second-generation rodenticide is highly toxic to mammals, including humans, domestic pets, and non-target mammalian wildlife. Bromadiolone is often found in the tissues of wildlife, including avian and mammalian predators. Mortalities of raptors have been associated with secondary bromadiolone poisoning.

Bromadiolone is being used in and around manmade and natural standing and moving water, including during the reporting year. There are currently four Districts using a total of five products that contain bromadiolone (0.005 percent) for rodent control. These products were applied during all four quarters of the reporting year. One product alone accounts for approximately 5 lbs AI applied per year (over 1,000 lbs of product). When deployed in sewers, bromadiolone blocks are sometimes attached to a string or wire and hung below manhole covers. This method of bait deployment reduces the probability of exposure (by multiple routes) to humans and non-target wildlife, especially dietary exposure (ingestion route) to ground-foraging birds and mammals. In addition, this rodenticide causes rapid mortality of targeted rats, therefore poisoned individuals tend to expire in the sewers and not represent prey for secondary consumers in the terrestrial environment. Further, bromadiolone is usually wax-encased (e.g., Contrac Blox) in block form, which has exceptionally low water solubility and low leaching potential.

Outside of sewers, bromadiolone is typically contained in tamper-proof bait stations, which are most frequently deployed at residential locations, and not near aquatic systems, open lands, or woodlands. Residential treatments involve bait station deployment generally within 50 feet of homes. Bait stations are anchored to treatment locations (e.g., wires, stakes, etc.) to ensure that they cannot be dragged away by wildlife. In addition, bait stations have small openings that prevent the entrance and exposure to non-rodent mammals (e.g., squirrels, skunks, etc.). Residents are properly educated regarding the location of deployed tamper-proof bait stations and potential risks to children and pets.

Bromadiolone is a single-dose rodenticide that when used properly (such as in the absence of food competition), causes rapid knock-down of rat populations and very limited potential for impacting aquatic systems and resulting in exposure to humans and non-target wildlife. If use is expanded by the Districts in the future or additional issues arise regarding the use of this rodenticide, new, more protective rodenticide bait station alternatives reported by the USEPA could be considered (http://www.epa.gov/pesticides/mice-and-rats/rodent-bait-station.html). Based on toxicity, environmental fate, and usage patterns, bromadiolone, using BMPs is not likely to result in unwanted adverse impacts.

In addition to the toxicity values referenced in Sections 4.5.4.2 and 4.5.4.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.5.5 Bromethalin

Bromethalin is often used to exterminate rodents resistant to first generation anticoagulant rodenticides. Bromethalin is easily confused with second generation anticoagulant rodenticides (brodifacoum, bromadiolone) due to naming similarities. After ingestion, bromethalin is rapidly absorbed and undergoes N-demethylation in the liver, forming desmethyl bromethalin, which is thought to be the major toxic metabolite. The plasma half-life of bromethalin is about six days in rats. Excretion occurs mainly in bile and enterohepatic resuspension is suspected. The mode of action is the uncoupling of oxidative phosphorylation, which leads to decreased cellular ATP production and failure of Na+, K+-ATPase pumps. The cells lose osmotic control and swell. Cerebral and spinal cord edema elevates cerebrospinal fluid pressures and leads to neurologic dysfunction. Bromethalin toxicosis in dogs manifests as either paralytic or convulsant syndrome. Cats develop paralytic syndrome at all doses (Dunayer 2003).

Some bromethalin products meet the USEPA's new, more protective risk reduction standards. When applied properly, these products present a lower risk of accidental exposure to children, pets, and wildlife. They are applied in tamper-resistant and weather-resistant bait stations (USEPA 2013).

4.5.5.1 Environmental Fate

Bromethalin is stable to hydrolysis and is persistent to aerobic soils. In addition, a major degradate, desnitrobromethalin, also appears to be persistent and its mobility has not been characterized. However, because bromethalin is formulated as pelleted food bait, total usage of the active ingredient is low and ground water leaching and surface runoff is expected to be minimal (USEPA 2011).

Table 4-18 Degradation of Bromethalin

Degradation Method	Half-life	Reference
Hydrolysis	Stable	USEPA 2011
Aerobic metabolism (soil)	178 Days	USEPA 2011

4.5.5.2 Human Toxicity

Bromethalin is classified as very highly toxic to mammals on an acute oral basis. The acute oral (14-day) LD50 of bromethalin is 2.11 mg/kg for rats (USEPA 2011). The oral LD50 is 2.38 to 5.6 mg/kg for dogs and 0.54-mg/kg for cats (USEPA 2011). The minimum lethal oral dose for cats is 0.45 mg/kg (USEPA 2011). The acute percutaneous LD50 for male rabbits is 1000 mg/kg and the one hour inhalation LC50 for rats is 0.24 mg/L (MacBean 2012).

4.5.5.3 Ecological Toxicity

Bromethalin is classified by the USEPA as highly toxic to birds and mammals on an acute oral basis and as highly toxic to birds on a subacute dietary basis. The acute oral (14-day) LD50 for bobwhite quail is 4.56 mg/kg (USEPA 2011). Data are not available to characterize the toxicity of bromethalin to non-target invertebrates such as honey bees. Very little research has been conducted to directly measure the secondary poisoning hazard of bromethalin. Aquatic exposure is expected to be negligible based on the use patterns of bromethalin and there are currently limited data available on the toxicity of this rodenticide to fish or aquatic invertebrates. The LC50 for bluegill and trout has been reported as 0.598 and 0.038 mg/L respectively. The EC50 for Daphnia has been reported as 2 µg/L (www. pesticideinfo.org). The USEPA has listed bromethalin as “may affect” and “likely to adversely affect” the federally threatened Alameda whipsnake and the endangered salt marsh harvest mouse in California (USEPA 2011).

4.5.5.4 Summary of Toxicity and Potential Effects

Due to its acute toxicity to rodents and mammals, and the potential for exposure to non-target pets and wildlife, use of bromethalin requires a thorough understanding of possible routes of exposure. Placement and amounts of bromethalin used are critical factors in reducing potential unwanted secondary exposures and effects. Many uses of this product include subterranean placement to poison moles and voles (usually in worm-like commercial products). Some recent bromethalin products meet the USEPA’s new, more protective risk reduction standards; and using proper application techniques they can result in a lower risk of accidental exposure to children, pets, and wildlife. They can also be applied in tamper-resistant and weather-resistant bait stations. Use of these products should always include appropriate BMPs and prior evaluation of the potential predators and non-targets that might consume this product.

In addition to the toxicity values referenced in Sections 4.5.5.2 and 4.5.5.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.5.6 Difethialone

Difethialone is an anti-coagulant rodenticide that is registered for use only in baits for control of three commensal rodents: the Norway rat (*Rattus norvegicus*), the roof rat (*Rattus rattus*), and the house mouse (*Mus musculus*). Formulation types registered include pellets, pellet packs, blocks, mini blocks, paraffin blocks, meal, packs or pouches, paste and bait stations. Currently, labeled uses of difethialone include in and around homes, and agricultural, industrial and commercial buildings, transport vehicles and associated ports, alleys and sewers (Housenger and Melendez 2011).

Difethialone was introduced as a second-generation rodenticide in 1986 for the control of commensal rats and mice including those resistant to first-generation anticoagulants. Difethialone inhibits the vitamin K-dependent step in the synthesis of a number of blood coagulation factors, disrupts normal blood-clotting mechanisms, and induces capillary damage (Housenger and Melendez 2011).

4.5.6.1 Environmental Fate

Difethialone adsorbs to suspended solids and sediment and is immobile in soil. Difethialone can slowly volatilize from water surfaces. The compound is relatively stable to hydrolysis and aerobic metabolism, but degrades rapidly by photolysis (Table 4-19).

Table 4-19 Degradation of Difethialone

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	154 to 211 Days	Housenger & Melendez 2011
Photolysis, pH 5-9 (water)	57 to 62 minutes	Housenger & Melendez 2011
Aerobic metabolism (soil)	204 Days	Housenger & Melendez 2011

4.5.6.2 Human Toxicity

Difethialone is very toxic to mammals by all acute exposure routes. The LD50 for male rats is 0.55 mg/kg bw. The LD50 for mice is 1.29 mg/kg bw. The dermal LD50 is 6.5 mg/kg bw for rats. The inhalation LC50 is ≥ 5.0 µg/L in 4 hrs but ≤19.3 µg/L in 4-hrs for rats (Annex I - Norway 2007). Difethialone is not known to cause skin or eye irritation. No genotoxic or carcinogenic effects have been noted (Annex I - Norway 2007).

4.5.6.3 Ecological Toxicity

Difethialone is likely very toxic to most mammals. Domestic animals are somewhat less susceptible than rats and mice. The LD50 is 11.8 mg/kg bw for dogs and ≥ 16 mg/kg bw for cats. A dog would have to ingest 400 g of bait for mortality to occur (Lechevin and Poche 1988). The LD50 for domestic pigs is between 2.0 and 3.0 mg/kg bw (Annex I - Norway 2007). Difethialone is also acutely toxic by dermal and inhalation exposure. The dietary LC50 for ferrets is 97.7 mg active ingredient/kg (Savarie 2005). USEPA studies concluded that, based on the best available information, difethialone is “likely to adversely affect” Alameda whipsnake, salt marsh harvest mouse, and San Joaquin kit fox (Housenger and Melendez 2011) Risk evaluation indicated that the registered uses of difethialone exceed acute LOCs for the small mammalian weight class of salt marsh harvest mouse. Kit fox are likely to be affected via secondary exposure as well as indirectly from reduced prey availability (small mammals). The whipsnake may be affected as the acute Risk Quotients exceed the LOC for both primary and secondary exposure and habitat modification would also occur (fewer small mammal burrows) (Housenger and Melendez 2011). The recommended action was that a formal consultation with USFWS under Section 7 of the ESA be initiated.

Difethialone is very highly toxic to birds on an acute oral and subacute dietary exposure basis (Housenger and Melendez 2011). Difethialone is acutely toxic to birds. The LD50 for bobwhite quail is 0.264-mg/kg bw (Annex I - Norway 2007). The dietary LC50 for magpies is 4.48 mg active ingredient/kg diet (Savarie 2005). Secondary exposure of birds of prey has been demonstrated. A study of barn owls gave a low LD100 between 0.27 and 0.39 mg/kg bw (Annex I - Norway 2007). There are no data to characterize chronic toxicity to birds and mammals (Housenger and Melendez 2011). Difethialone is highly toxic to aquatic organisms. The 96-hr LC50 for rainbow trout is 51 µg/L. The 48-hr EC50 for *Daphnia magna* is 4.4-µg/L. There are no data to characterize toxicity of difethialone to the honey bee.

4.5.6.4 Summary of Toxicity and Potential Effects

Difethialone is persistent in soils and is generally applied as food bait blocks or pellets. This second-generation rodenticide is highly toxic to mammals, including humans, domestic pets, and non-target mammalian wildlife. Difethialone is often found in the tissues of wildlife, including avian and mammalian predators. Difethialone has been categorized as “likely to adversely affect” several species of sensitive California wildlife and registered uses of difethialone exceed the LOC for both primary and secondary exposure. Indirect effects to habitat have been suggested for areas where difethialone is used for pest control (Housenger and Melendez 2011).

One product containing difethialone (0.0025 percent) is used by two Districts for rat control and is applied around creeks, parks, and landscaping. Application typically occurs in the fall, winter, and spring, including 19 applications during the reporting year.

Difethialone is used in areas frequented by humans and domestic animals (parks, landscaped areas) during much of the year. The availability of new, more protective rodenticide bait stations reported by the USEPA, should be considered when available. (http://www.epa.gov/pesticides/mice-and-rats/rodent-bait-station.html).

In addition to the toxicity values referenced in Sections 4.5.6.2 and 4.5.6.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.5.7 Cholecalciferol

Cholecalciferol is used to control Norway rats (*Rattus norvegicus*), roof rats (*Rattus rattus*), and house mice (*Mus musculus*) in and around homes, industrial buildings and similar man-made structures, in and around agricultural buildings, including swine, poultry, cattle and dairy facilities, warehouses and food storage areas; in transport vehicles (ships, trains and aircraft) and in and around related port and terminal buildings; and in alleys. Formulation types include pellets and blocks (Clock-Rust and Sutton 2011). Cholecalciferol is a sterol (vitamin D3) and its ingestion results in hypercalcemia from mobilization of calcium from bone matrix into blood plasma leading to metastatic calcification of soft tissues (Clock-Rust and Sutton 2011).

4.5.7.1 Environmental Fate

The environmental fate of cholecalciferol is not well described. Based on physical/chemical properties of cholecalciferol, it is expected to be nonvolatile, essentially insoluble in water and immobile in soil (Clock-Rust and Sutton 2011). Information on biotic and abiotic degradation was not available.

4.5.7.2 General Toxicity

The parent compound and metabolites are fat soluble and stored in adipose tissue. Enterohepatic recirculation of cholecalciferol and metabolites occurs. After a massive intake of cholecalciferol, excess calcifediol is produced in the liver. Because of their high lipid solubility, cholecalciferol and its metabolites are eliminated from the body very slowly (primarily through bile and feces). Two mechanisms occur with consumption of large doses of cholecalciferol. First, more calcium is absorbed from the intestines. Second, cholecalciferol metabolites stimulate phosphorus transfer from bone to plasma. The increased plasma calcium concentrations result in vomiting, lethargy, and muscle weakness. Specific organ effects include acute renal tubular necrosis, gastrointestinal stasis, gastric acid secretion, decreased skeletal muscle responsiveness, and decreased neural tissue responsiveness. The increase in plasma calcium causes soft tissue mineralization resulting in loss of functionality of kidneys, cardiac muscle, etc. (Morrow 2001).

4.5.7.3 Human Toxicity

Cholecalciferol is acutely toxic to target rodents. The oral LD50 for cholecalciferol dissolved in corn oil is 42.5 mg/kg for mice and 43.6 mg/kg for rats (Marshall 1984). The dermal LD50 of the finished bait product (0.075 percent cholecalciferol) is 2,000 mg/kg for rabbits (Marshall 1984) (Table 6-1).

4.5.7.4 Ecological Toxicity

Cholecalciferol is considered of low hazard to avian and canine species. The oral LD50 for dogs is 88 mg/kg. The oral LD50 for mallard ducks and bobwhite quail is 2,000 mg/L (Marshall 1984). When used in bait form, cholecalciferol may directly impact sensitive species such as non-target rodents (Clock-Rust and Sutton 2011). Cholecalciferol is not expected to bioconcentrate since it is metabolized in mammals (Clock-Rust and Sutton 2011)

4.5.7.5 Summary of Toxicity and Potential Effects

Cholecalciferol is essentially insoluble in water and immobile in soils. It is generally applied as food bait blocks or pellets. The mode of action of cholecalciferol differs from the other rodenticides examined herein in that it is not an anticoagulant. Rather, cholecalciferol baits deliver a toxic dose of vitamin D to pests. Although it is highly toxic to target rodents, cholecalciferol is considered of low hazard to non-targets such as birds or domestic dogs.

Cholecalciferol is used in one product (0.075 percent) by one District. It is used along creeks, parks, and waterfronts in the fall, winter, and spring. Cholecalciferol was used on 26 occasions accounting for total application of 37 ounces of product (2.8 oz. active ingredient). Based on the reported usage, using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.5.7.3 and 4.5.7.4, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.5.8 Sulfur (fumigant)

Elemental sulfur is a naturally occurring component of the earth’s core and crust and is ubiquitous in the environment. Sulfur has been used as a pesticide in the United States since the 1920s, and is currently registered for use as an insecticide and fungicide on a wide range of field and greenhouse-grown food and feed crops, livestock (and livestock quarters), and indoor and outdoor residential sites. Sulfur is also one of the active ingredients in four fumigant (gas-producing) cartridge products (e.g., PROFUME etc.) which are used for rodent control on lawns, golf courses, and in gardens. Carbon, sodium and potassium nitrates, sawdust, and sulfur are used in the pyrotechnic fumigant gas producing cartridge products. After the cartridges are ignited, they produce toxic gases that cause asphyxiation of the pests. These toxic gases, not the active ingredients, are the stressors for these products. The gases displace the oxygen in the burrows, creating an un-breathable atmosphere, causing asphyxiation of the target organisms (MSDS 007736, PROFUME, Dow AgroSciences 2004)

4.5.8.1 Human Toxicity

Elemental sulfur is known to be of low toxicity and poses little, if any, risk to human health. The USEPA classifies sulfur as Category IV (least toxic) for acute oral toxicity (EXTOXNET 1995b). The oral LD50 for rats is >5,000 mg/kg. The dermal LD50 for rats is also >2,000 mg/kg. Acute inhalation exposure can cause respiratory irritation. The inhalation LC50 for 98 percent sulfur in rats is >2.56 mg/L. Sulfur is not a skin sensitizer. No known risks of oncogenic, teratogenic, or reproductive effects are associated with the use of sulfur (EXTOXNET 1995b).

4.5.8.2 Ecological Toxicity

Sulfur is nontoxic to birds (EXTOXNET 1995b). The 8-day dietary LC50 for bobwhite quails is >5,620 mg/L for 95 percent sulfur wettable powder. Sulfur is of practically nontoxic to aquatic organisms (EXTOXNET 1995b). The 96-hr LC50 for bluegill and rainbow trout is >180 mg/L using a 99.5 percent sulfur dust formulation. The 48-hr LC50 for *Daphnia magna* is >5,000 mg/L using 90 percent sulfur. Sulfur is considered nontoxic to bees (EXTOXNET 1995b).

4.5.8.3 Summary of Toxicity and Potential Effects

Sulfur fumigants are of low toxicity prior to activation of sulfur-containing cartridges. Elemental sulfur will become incorporated back into the natural sulfur cycle after deployment. Sulfur fumigant cartridges are placed in pest burrow and produce toxic gases, which will negatively impact any animal in the burrow. Therefore, sulfur fumigants should not be applied when there is evidence of non-target animal presence. Sulfur fumigants were not used by the Districts during the reporting year and risk to non-targets is readily avoided by inspecting application sites thoroughly, therefore; using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.5.8.1 and 4.5.8.2, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.5.9 <u>Sodium Nitrate (fumigant)</u>

Sodium nitrate is used with other components as an active ingredient to control mammals such as woodchucks, ground squirrels, and coyotes in open fields, noncrop areas, rangelands, lawns and golf courses. End-use products containing sodium nitrate are used as fumigant gas cartridges designed to be placed in burrows. The sodium nitrate supports the combustion of charcoal in the formulation of each product. Pyrolysis of sodium nitrate products results in release of simple organic and inorganic compounds, such as nitrous oxide and carbon monoxide. These gases eventually diffuse through burrow openings or into the soil causing organisms to die of asphyxiation (USEPA 1991d).

4.5.9.1 Human Toxicity

Available acute toxicity studies indicate that sodium nitrate may cause eye irritation (Category II) and slight dermal irritation (Category IV) to mammals, but pose relatively low acute oral toxicity (Category III) hazard (USEPA 1991b). The only people exposed to sodium nitrates should be pesticide applicators and they should be exposed only minimally (USEPA 1991b). The USEPA believes that sodium nitrates, when used as indicated, do not present any unreasonable adverse effects to humans.

4.5.9.2 Ecological Toxicity

Sodium nitrates are naturally occurring substances and exposure of the environment is limited and localized when the products are used as fumigants in burrows (USEPA 1991b). When used as indicated by the product label, any organism inside of a treated burrow would likely be killed by the toxic fumes. The nonselective nature of this pesticide is particularly problematic when protected species are present. Nontarget species such as burrowing owls, black-footed ferrets, kangaroo rats, or desert tortoises often inhabit pest burrows and may be at risk (Keefover-Ring 2009). USEPA recommends that applicators observe signs around burrows indicating the presence of non-target species and use caution.

4.5.9.3 Summary of Toxicity and Potential Effects

Sodium nitrate fumigants are of low toxicity prior to activation of the cartridges. Sodium nitrates are naturally occurring substances. Sodium nitrate fumigant cartridges are placed in pest burrow and produce toxic gases, which will negatively impact any animal in the burrow. Therefore, sodium nitrate fumigants should not be applied when there is evidence of non-target animal presence. Sodium nitrate fumigants were not used by the Districts during the reporting year and risk to non-targets is readily avoided by inspecting application sites thoroughly; therefore, using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.5.9.1 and 4.5.9.2, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6 Herbicides

4.6.1 Imazapyr

Imazapyr is part of the imidazolinone chemical class. Imazapyr is a systemic, nonselective, pre- and post-emergent herbicide used for the control of a broad range of terrestrial and aquatic weeds, and controls plant growth by preventing the synthesis of branched-chain amino acids. Imazapyr is applied either as an acid or as the isopropylamine salt. Imazapyr is used for pre- and post-emergence control of a broad range of weeds, including terrestrial annual and perennial grasses, broadleaf herbs, woody species, and riparian and emergent aquatic species. Agricultural uses of imazapyr include field corn and grass. Imazapyr is also registered for use on a variety of commercial and residential use sites, including forestry sites, rights-of-way, fence rows, hedge rows, drainage systems, outdoor industrial areas, outdoor buildings and structures, domestic dwellings, paved areas, driveways, patios, parking areas, walkways, various water bodies (including ponds, lakes, streams, swamps, wetlands, stagnant water, and urban areas) (USEPA 2006b).

4.6.1.1 Environmental Fate

Imazapyr is an anionic, organic acid that is nonvolatile and is both persistent and mobile in soil. Commercial formulations contain either imazapyr acid or the imazapyr isopropylamine salt, both of which are dissolved in a water solution. Imazapyr is mainly in ionic form at typical environmental pH levels, and the behavior of the acid and salt forms are similar. Upon direct application, or indirect release into surface water, photolysis is the only identified mechanism for imazapyr degradation in the environment (Table 4-20), with a half-life of approximately 3 to 5 days in surface water. Laboratory studies show imazapyr is essentially stable to hydrolysis, aerobic and anaerobic soil degradation, as well as aerobic and anaerobic aquatic metabolism. Field dissipation study observations are consistent with imazapyr's intrinsic ability to persist in soils and move via runoff to surface water and to leach to groundwater (USEPA 2006b).

Table 4-20 Degradation of Imazapyr

Degradation Method	Half-life	Reference
Hydrolysis	Stable	USEPA 2006b
Photolysis (water)	3 to 5 Days	USEPA 2006b
Aerobic metabolism (water and soil)	Stable	USEPA 2006b
Anaerobic metabolism (water and soil)	Stable	USEPA 2006b

4.6.1.2 Human Toxicity

Imazapyr is slightly toxic to mammals via oral, dermal, and inhalation exposure. The oral LD50 for rats is >5,000 mg/kg. The dermal LD50 for rabbits is >2,000 mg/kg. The inhalation LC50 for rats is >1.3 mg/L (USDOE-Bonneville Power Administration 2000). MacBean (2012) reports the inhalation LC50 for rats is greater than 5.1 mg/L (Table 6-1). There is no evidence that imazapyr is carcinogenic or mutagenic

(USDOE-Bonneville Power Administration 2000). The USEPA has determined that the risk to humans of dietary and incidental exposure is below the level of concern (USEPA 2006b). Imazapyr is classified as a Category I primary eye irritant (USEPA 2006b).

4.6.1.3 Ecological Toxicity

Imazapyr is practically nontoxic to birds, fish, *Daphnia*, and honey bees. The oral LD50 for mallard ducks is >2,150 mg/kg. The 96-hr LC50 for rainbow trout is >100 mg/L. The 48-hr LC50 for *Daphnia magna* is >1,000 mg/kg. The LD50 for honey bees is >100 µg/bee (USDOE-Bonneville Power Administration 2000). Although there are no risks of concern to terrestrial birds, mammals, and bees or aquatic invertebrates and fish, imazapyr does pose an ecological risk to non-target terrestrial and aquatic vascular plants (USEPA 2006b). Imazapyr is not expected to bioaccumulate in aquatic organisms because it exists as an anion at typical environmental pHs (USEPA 2006b).

4.6.1.4 Summary of Toxicity and Potential Effects

Imazapyr is persistent in soil and also tends to leach to groundwater. It is of low acute toxicity to mammals and practically nontoxic to birds, fish, and invertebrates. Non-target plants may be at risk from imazapyr application. Based upon the toxicity and environmental fate of imazapyr, and using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.1.2 and 4.6.1.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.2 Glyphosate

Glyphosate is a nonselective, post-emergent, and systemic herbicide registered for use in agricultural and nonagricultural areas. It is applied to agricultural drainage systems, irrigation systems, sewage systems, forest trees, greenhouses, outside of household/domestic dwellings, and to a variety of feed and food crops. When applied at lower rates, glyphosate is a plant growth regulator (USEPA 1993). It works by inhibiting the synthesis of the enzyme 5-enolpyruvylshikimate-3-phosphate synthase (EPSP), which is needed for production of amino acids. These amino acids aid in synthesis of proteins that link primary and secondary metabolism. Glyphosate is not effective on submerged or mostly submerged foliage and therefore is only applied to control emergent foliage (Schuette 1998, Siemering 2005).

4.6.2.1 Environmental Fate

Glyphosate is highly water-soluble. Glyphosate is broken down by microbial degradation to its metabolite aminomethylphosphonic acid (AMPA) and carbon dioxide. The rate of degradation in water is generally slower than the rate in soil because there are fewer microorganisms in water than in most soils. For all aquatic systems, sediment appears to be the major sink for glyphosate residue. Even though glyphosate is highly water soluble it appears that parent glyphosate and AMPA have a low potential to move to groundwater due to their strong soil adsorptive characteristics (USEPA 1993, Schuette 1998, Siemering 2005).

In the soil environment, glyphosate is resistant to chemical degradation, is stable to sunlight, is relatively nonleachable, and has a low tendency to runoff (except as adsorbed to colloidal matter and sediment). It is relatively immobile in most soil environments as a result of its strong adsorption to soil particles and does not move vertically below the 6 inch soil layer. Glyphosate’s primary route of decomposition in the environment is through microbial degradation in soil (Table 4-21). The herbicide is inactivated and biodegraded by soil microbes at rates of degradation related to microbial activity in the soil and factors that affect this activity. The biological degradation process is carried out under both aerobic and anaerobic conditions by soil microflora (USEPA 1993, Schuette 1998).

Table 4-21 Degradation of Glyphosate

Degradation Method	Half-life	Reference
Hydrolysis	>35 Days, Stable	USEPA 1993 Schuette 1998
Photolysis (water)	Stable (pH 5,7 and 9)	USEPA 1993
Photolysis (soil)	Stable	USEPA 1993
Aerobic metabolism (water)	7 Days	USEPA 1993
Aerobic metabolism (soil)	1.85 to 25 Days	USEPA 1993
Anaerobic metabolism (soil)	8.1 to 22.1 Days	USEPA 1993, Schuette 1998
Field dissipation (soil)	44 to 60 Days	Schuette 1998
Streams, ponds, natural waters	1.5 to 63 Days	Schuette 1998

4.6.2.2 General Toxicity

Glyphosate is an herbicide designed to specifically affect plants via the shikimic acid pathway. Glyphosate inhibits the enzyme 5-enolpyruvylshikimate 3-phosphate (EPSP) synthase, which is absent in mammals (Miller et al. 2010). The resulting deficiency in EPSP production leads to reductions in aromatic amino acids necessary for plant protein synthesis and growth. Glyphosate is absorbed directly across the leaves and stems and is translocated throughout the plant, concentrating in the meristem (Miller et al. 2010). The effects of the herbicide are generally visible between 4 and 20 days post-application and include stunted growth, loss of pigmentation, malformation or wrinkling of leaves, and ultimately tissue death (Miller et al. 2010). There are several formulations of glyphosate, including an acid, monoammonium salt, diammonium salt, isopropylamine salt, potassium salt, sodium salt, and trimethylsulfonium or trimesium salt. The commonly used Roundup™ products are isopropylamine salt formulations. The salts do not contribute to the weed control activity; therefore, the acid equivalent (ae) of glyphosate acid is the most accurate method of expressing and comparing concentrations.

4.6.2.3 Human Toxicity

The shikimic acid pathway is specific to plants and some microorganisms; therefore, glyphosate is thought to have very low toxicity to mammals (USEPA 1993). The USEPA classifies glyphosate as Category III for oral and dermal toxicity (USEPA 1993). The oral LD50 for technical grade glyphosate for rats is 4,320 mg/kg (USEPA 1993). The dermal LD50 for technical grade glyphosate in rabbits is ≥2000 mg/kg (USEPA 1993). Technical grade glyphosate is nonvolatile and the LC50 for rats is ≥4.43 mg/L based on a 4-hr, nose-only inhalation study (USEPA 1993, Miller et al. 2010).

The isopropylamine and ammonium salts exhibit low toxicity to mammals via the oral and dermal routes. The oral LD50 for the isopropylamine salt in rats is ≥ 5,000 mg/kg. The oral LD50 for the ammonium salt form in rats is 4,613 mg/kg. The dermal LD50 for rabbits is ≥ 5,000 mg/kg for both salts (Miller et al. 2010). The salt formulations of glyphosate also exhibit low toxicity via the inhalation route. The 4-hr LC50 for rats exposed to the isopropylamine form is >1.3 mg/L air. The LC50 for rats exposed to the ammonium salt form was >1.9 mg/L in a whole-body exposure (Miller et al. 2010).

A one-year feeding study resulted in no chronic effects in beagle dogs at daily doses of 500 mg/kg (USEPA 1993). There is currently no published scientific evidence indicating that glyphosate is carcinogenic or mutagenic unless workers are exposed to extended, unrealistic industrial uses (USEPA 1993, Gertsberg, 2011). Experimental evidence has shown that neither glyphosate nor its major breakdown product (aminomethylphosphonic acid [AMPA]) bioaccumulates in any animal tissue (Williams et al. 2000). Glyphosate is poorly biotransformed in rats and is excreted mostly unchanged in the feces and urine (Williams et al. 2000).

Despite the apparent lack of toxicity to mammals, concerns have been raised about the long-term safety of glyphosate. In one study, glyphosate has been shown to alter the respiratory and hepatic systems of rats and to cause damage to reproductive functions and fetal development (Clair et al. 2012). Additionally, a recent study found significant contamination in all urine samples taken from an urban human population in Germany. The levels of glyphosate in the subjects' urine were 5 to 20 times the maximum allowable limit for drinking water (Brandli and Reinacher 2012). In another study, rats and mice were fed a diet containing glyphosate for 13 weeks. The two highest dose groups of male rats (25,000 and 50,000 mg/kg of 99 percent pure glyphosate) had significant reductions in sperm concentrations (Chan and Mahler 1992). Female rats in the 50,000 mg/kg group had slightly longer estrus cycles than the control group (Chan and Mahler 1992). Although still in review, glyphosate is included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.6.2.4 Ecological Toxicity

Glyphosate is practically nontoxic to birds. The oral LD50 for bobwhite quail is >2,000 mg/kg. It is also practically nontoxic to freshwater fish. The 48-hr LC50 for bluegill sunfish is >24-mg/L (USEPA 1993). Maximum bioconcentration factors were 0.52 times for whole fish (USEPA 1993). MacBean reports the 96-hr LC50 values for the isopropyl ammonium formulation is greater than 1,000 mg/L for both bluegill and trout. Technical grade glyphosate is slightly toxic to practically nontoxic to freshwater invertebrates with 48-hr LC50s ranging from 55 to 780 mg/L. LC50 values have also been obtained for several species of frogs and the American toad. The reported 24-hr LC50 for amphibians ranged from 6.6 to 18.1 mg/L (Howe et al. 2004). No significant acute toxicity to amphibians was observed with the technical material or the products (e.g., Roundup Original). Glyphosate is practically nontoxic to honey bees. The acute oral LD50 is >100 µg/bee (USEPA 1993) (Table 6-1).

4.6.2.5 Summary of Toxicity and Potential Effects

Products currently available containing glyphosate include Roundup, Rodeo, Pondmaster, ProMax, Proud 3®, Aquamaster, Alligare, and Buccaneer Plus. Each has a formulation with a slight variation of toxicity and environmental characteristics. This summary is focused on the active ingredient, N-(phosphonomethyl) glycine.

Using BMP approaches, applications of glyphosate can be used safely when an adequate buffer to water sources is maintained. Although there has been some recent concerns expressed about possible sub-lethal effects of glyphosate products, it is virtually nontoxic to mammals and practically nontoxic to birds, fish, and invertebrates. Glyphosate has been identified as a candidate by USEPA for evaluation as a potential endocrine disruptor (USEPA 2009a). Based on these issues, it is likely that USEPA will provide an updated review of its potential risks in 2015, but until then, glyphosate products are effective products used for weed control. Concerns about endocrine disruption by glyphosate are not verified and this chemical is only one of the dozens of chemicals USEPA is suggesting may have an EDC role. No significant indication of this mode of action has been reported at this time. Some reports of sub-lethal effects on disease resistance, biological diversity, enzyme activity, and increased use of genetically engineered foods are interesting but without clear mechanisms that can be related directly to glyphosate (Gertsberg 2011).

In addition to the toxicity values referenced in Sections 4.6.2.3 and 4.6.2.4, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.3 Triclopyr

Triclopyr is a pyridine-based herbicide used for the control of woody plants and annual and perennial broadleaf weeds. The two registered formulations are triclopyr triethylamine salt (TEA) and triclopyr butoxyethyl ester (TBEE). Triclopyr TEA rapidly dissociates in water to the triclopyr acid/anion and triethanolamine. Triclopyr BEE rapidly hydrolyses in the environment to the triclopyr acid/anion and butoxyethanol. It is the triclopyr acid (known simply as triclopyr) that causes phytotoxicity. Triclopyr is used at railroad or other rights-of-way, for commercial and residential use, and on rice, pasture, and woodlands. Triclopyr is absorbed by leaves and roots and is moved throughout the plant. The triclopyr TEA formulation is also used to control aquatic plant species. Triclopyr is a pyridine-based herbicide that acts as a synthetic auxin, giving a plant an auxin overdose 1,000 times natural levels (Ganapathy 1997). Triclopyr is absorbed by leaves and roots and is moved through the plant into the foliage rapidly. The effects occur at the cellular level first when ethylene and protein production in the plant increases first, followed by epinasty, abnormal leaf formation, and stem swelling, and death. Triclopyr has low phytotoxicity to grasses, but can cause injury to conifers at high application rates (Ganapathy 1997).

4.6.3.1 Environmental Fate

Triclopyr is nonvolatile and highly soluble. Triclopyr is “slightly mobile” with sorption to soil increasing with time. Triclopyr is moderately persistent, with persistence increasing as it reaches deeper soil levels and anaerobic conditions. The predominant degradation pathway for triclopyr in water is photodegradation and the predominant degradation pathway in soil is microbial degradation (Table 4-22) (Ganapathy 1997, USEPA 1998h).

Table 4-22 Degradation of Triclopyr

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	270 Days, Stable	USEPA 1998c,h, Ganapathy 1997
Photolysis (water)	0.36 to 1.7 Days	USEPA 1998c,h
Aerobic metabolism (water)	142 Days	USEPA 1998c,h
Aerobic metabolism (soil)	8 to 18 Days	USEPA 1998c,h
Anaerobic metabolism (water)	>365 Days	USEPA 1998c,h
Field dissipation (water)	0.5 to 3.5 Days	USEPA 1998c,h, Ganapathy 1997
Field dissipation (soil)	10.4 to 33 Days	USEPA 1998c,h, Ganapathy 1997

4.6.3.2 Human Toxicity

Triclopyr is slightly toxic to mammals by oral and dermal routes and has been classified as Category III by the USEPA (USEPA 1998c). The TBEE formulation is slightly toxic by the oral and dermal route (Category III) and practically nontoxic by inhalation (Category IV) (USEPA 1998c). The oral LD50 for technical triclopyr in rats is 630 mg/kg for females and 729 for males (USEPA 1998c). Triclopyr is not carcinogenic. The dermal LD50 in rabbits has been reported to be greater than 2000 mg/kg. The inhalation LC50 in rats has been reported to be greater than 256 mg/L (MacBean 2012).

4.6.3.3 Ecological Toxicity

Triclopyr is rapidly absorbed by animals and then excreted by the kidney, primarily in the unmetabolized form. Aquatic organisms are more susceptible to triclopyr. Triclopyr acid is slightly toxic to birds and practically nontoxic to insects, freshwater fish, and aquatic invertebrates. The oral LD50 of triclopyr acid for mallard ducks is 1,698 mg/kg. The 96-hr LC50 for rainbow trout is 117 mg/L. The 96-hr LC50 for

Daphnia magna is 132 mg/L. The LD50 for honey bees is 60.4-µg/bee (Ganapathy 1997), although MacBean (2012) reports the contact LD50 is greater than 100 µg/bee. Triclopyr does not bioaccumulate rapidly (Ganapathy 1997, USEPA 1998c).

The TBEE formulation is slightly toxic to birds, moderately toxic to highly toxic to freshwater fish and slightly to moderately toxic to freshwater invertebrates. The 96-hr LC50 of TBEE to bluegill sunfish is 0.36 mg/L (Ganapathy 1997). The TEA formulation is practically nontoxic to birds and invertebrates and moderately to highly toxic to fish (USEPA 1998c).

4.6.3.4 Summary of Toxicity and Potential Effects

Triclopyr is highly soluble and slightly mobile in soil. Technical triclopyr, TEA, and TBEE have similar slight toxicity to mammals, birds, fish, and invertebrates. It also has low toxicity to non-target grasses, but can cause injury to conifers. Based upon the toxicity and environmental fate of triclopyr, and using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.3.2 and 4.6.3.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.4 2,4-Dichlorophenoxy acetic acid (2,4-D)

The compound 2, 4-dichlorophenoxyacetic acid (2,4-D) is an herbicide in the phenoxy or phenoxyacetic acid family. Although it is classified as an herbicide, a plant growth regulator, and a fungicide, it is mainly used as a selective post emergence herbicide for the control of broadleaf weed species and aquatic weeds. 2,4-D is registered for use on pasture/rangeland, turf, wheat, corn, soybeans, fallow land, hay other than alfalfa, non-cropland (roadways, rights-of-way, ditches, industrial sites, etc.), forestry, rice, sugarcane, pome fruits, stone fruits, nut orchards, filberts, grass grown for seed and sod, aquatic weed control, potatoes, asparagus, strawberries, blueberries, grapes, cranberries, and citrus (USEPA 2005).

2,4-D is generally not applied as the acid, but is applied as one of several formulations, which quickly break down into 2,4-D acid (e.g., chemical formulations of 2,4-D amine salts and 2,4-D esters). 2,4-D mimics the effect of auxins, or other plant growth regulating hormones, and thus stimulates growth, rejuvenates old cells, and overstimulates young cells leading to abnormal growth patterns and death in some plants (Walters 1999). 2,4-D is thought to increase cell-wall plasticity, biosynthesis of proteins and the production of ethylene. The abnormal increase in these processes results in uncontrolled cell division and growth which damages vascular tissue (USEPA 2005).

4.6.4.1 Environmental Fate

In the aqueous environment, 2,4-D is most commonly found as the free anion (the amine salt formulations dissociate to the anion and ester formulations hydrolyze to the anion, usually within 1 day) (Walters 1999). The dissipation of 2,4-D is dependent on oxidative microbial-mediated mineralization, photodegradation in water, and leaching (USEPA 2005). 2,4-D has low persistence in soil, primarily due to degradation by soil microbes, and microorganisms also readily degrade 2,4-D in aquatic environments (Table 4-23). In water, 2,4-D will biodegrade at a rate dependent upon the level of nutrients present, temperature, availability of oxygen, and whether or not the water has been previously contaminated with 2,4-D or other phenoxyacetic acids (Walters 1999, Siemering 2005).

Table 4-23 Degradation of 2,4-D

Degradation Method	Half-life	Reference
Hydrolysis (water)	Stable	USEPA 2005
Hydrolysis (soil)	39 Days	Walters 1999
Photolysis (water)	12.9 to 13 Days	USEPA 2005, Walters 1999
Photolysis (soil)	68 to 393 Days	USEPA 2005, Walters 1999
Aerobic metabolism (water)	15 Days	USEPA 2005, Walters 1999
Aerobic metabolism (soil)	6.2 to 66 Days	USEPA 2005, Walters 1999
Anaerobic metabolism (water)	41 to 333 Days	USEPA 2005, Walters 1999
Field dissipation (soil)	59.3 Days	Walters 1999

4.6.4.2 Human Toxicity

The modes of toxicity to mammals from the acid, ester, and salt forms of 2,4-D are similar, although the acid and salt forms can also be eye irritants. The oral LD50 for rats ranges from 639 to 1,646 mg/kg, depending on the chemical form of 2,4-D used. All forms of 2,4-D are considered of low acute dermal toxicity. The dermal LD50 in rabbits ranges from 1,829 to >2,000 mg/kg. All forms of 2,4-D are considered of low inhalation toxicity. The inhalation LC50 for rats ranges from 0.78 to >5.4 mg/L, depending on the formulation used (Gervais et al. 2008).

In mammals, 2,4-D is actively secreted by the proximal tubules of the kidney and toxicity appears to result when renal clearance capacity is exceeded. Dose-dependent toxic effects, including damage to the eyes, thyroid, kidney, adrenals, ovaries, and testes, have been observed in rats at 15 mg/kg/day (Charles et al. 1996). Additionally, reproductive toxicity, neurotoxicity, and developmental toxicity have also been observed (Gervais et al. 2008). Because 2,4-D has been associated with effects on the thyroid and gonads following exposure, it has been included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.6.4.3 Ecological Toxicity

2,4-D is slightly to moderately toxic to birds. The LD50 is 1,000 mg/kg in mallards (EXTOXNET 1996a). The LD50 for acute oral exposure for pheasants is 472 mg/kg (Gervais et al. 2008). Some formulations are highly toxic to fish while others are less toxic. The LC50 for cutthroat trout ranges from 1.0 to 100 mg/L, depending on the formulation tested (EXTOXNET 1996a). The 24-hr LC50 for honey bees has been estimated as between 104 and 115 µg/bee and therefore 2,4-D is considered practically nontoxic to bees (USEPA 2005). 2,4-D has been shown to accumulate in fish at up to 18X the ambient concentrations within 2 days of exposure (Wang et al. 1994) as cited by (Tu et al. 2001).

4.6.4.4 Summary of Toxicity and Potential Effects

2,4-D has low persistence in soil and leaches to groundwater. 2,4-D is of low to moderate toxicity to mammals and birds; however, some formulations are highly toxic to fish and invertebrates. In addition, 2,4-D has been associated with dose-dependent damage to eyes, thyroid, kidneys, adrenals, ovaries, and testes in chronic studies of rats. It has been included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a). Although 2,4-D has been characterized as a potential candidate for the banned chemical list (based upon the high toxicity of 2,4-D to some fish, the potential of 2,4-D to runoff, and other factors), USEPA has not yet banned it based on its efficacy and documented need by agriculture and industry. Therefore, the status of 2,4, D should be monitored by the Districts for updates by the regulatory community.

In addition to the toxicity values referenced in Sections 4.6.4.2 and 4.6.4.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.5 Sulfometuron Methyl

Sulfometuron methyl was originally registered as a pesticide active ingredient in the U.S. in February 1982. Sulfometuron methyl is a broad-spectrum sulfonylurea herbicide recommended for preemergence and post-emergence control of annual, biennial, and perennial grasses and broadleaf weeds. The herbicide is used for general weed control on industrial noncrop sites and for selective weed control on turf grasses on industrial sites. It is also used for selective weed control in forest site preparation and in the release of several types of pines and certain hardwoods (O'dell 1999). Similar to other sulfonylurea herbicides, sulfometuron's mode of action involves inhibiting the activity of the enzyme acetolactate synthase, which inhibits the production of amino acids required for cell growth in plants (USEPA 2008c). The result is growth inhibition followed by a decline in plant vigor, discoloration, chlorosis, and terminal bud death. Although seed development is not inhibited, sulfometuron methyl effectively retards or stops root and shoot development (O'dell 1999).

4.6.5.1 Environmental Fate

Hydrolysis, photolysis and microbially-mediated degradation are major routes of transformation of sulfometuron methyl in water, soil, and water-sediment systems (Table 4-24). The degradation in soil and water appears to be enhanced in the presence of an active microbial population (aerobic and anaerobic degradation both proceed more slowly under sterile conditions) (USEPA 2008c). Sulfometuron methyl has a low tendency to sorb to sediments. Partitioning of sulfometuron methyl and its breakdown products between water and sediment is dependent on pH and organic content of the solids (O'dell 1999). Sulfometuron methyl has the potential to leach to ground water and/or reach surface water during runoff events (USEPA 2008c).

Table 4-24 Degradation of Sulfometuron methyl

Degradation Method	Half-life	Reference
Hydrolysis, pH 5	5 to 14 Days	O'dell 1999,
Hydrolysis, pH 7	>30 Days	O'dell 1999
Photolysis (water)	12 Days	O'dell 1999
Photolysis (soil)	11 Days	O'dell 1999
Aerobic metabolism (soil)	53 Days	O'dell 1999
Anaerobic metabolism (soil)	283 Days	O'dell 1999
Field dissipation (soil)	14 Days	O'dell 1999

4.6.5.2 Human Toxicity

Sulfometuron methyl is classified as Category IV to mammals for oral and inhalation toxicity and Category III for dermal toxicity by the USEPA (USEPA 2008c). The oral LD50 for rats is >5,000 mg/kg. The dermal LD50 for rabbits is >2,000 mg/kg. The inhalation LC50 for rats is >5.0 mg/L (USEPA 2008c) and greater than 11 mg/L according to MacBean (2012) (Table 6-1).

4.6.5.3 Ecological Toxicity

Sulfometuron methyl is nontoxic to birds, slightly toxic to fish, and practically nontoxic to *Daphnia* and honey bees (EXTOXNET 1996d). The avian oral LD50 is >4,650 mg/kg (MacBean 2012, reports LD50 values greater than 5000 mg/kg for both mallards and bobwhite quail). No sublethal effects have been observed during acute toxicity studies of birds (USEPA 2008c). The LC50 for fish is >100 mg/L, although MacBean (2012) reports LC50 values for bluegill and trout are greater than 12.5 mg/L. The LC50 for *Daphnia magna* is 125 mg/L (technical material) and >1,000 mg/L (dispersible granule). The 48-hr contact LC50 for honey bees is >100 µg active ingredient/bee (USEPA 2008c). Sulfometuron methyl has low potential to volatilize from soil or water or to bioaccumulate (USEPA 2008c).

Sulfometuron methyl is phytotoxic to duckweed (*Lemna gibba*) at concentrations of ≥ 0.59 µg/L but the effects appear to be reversible given sufficient recovery periods (USEPA 2008c). The chemical is toxic to a broad range of terrestrial plants. EC25 values have been established for sorghum, sugar beets, corn, and soybeans. In all cases, the most sensitive endpoints were seedling emergence and vegetative vigor (USEPA 2008c).

4.6.5.4 Summary of Toxicity and Potential Effects

Sulfometuron methyl tends to sorb to soils but has the potential to leach to groundwater. It is of low toxicity to mammals, birds, and bees. It is slightly toxic to fish. The chemical is phytotoxic to non-target aquatic plants such as duckweed. Based upon the toxicity and environmental fate of sulfometuron methyl**,** and using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.5.2 and 4.6.5.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.6 Bentazon

Bentazon, also known by its trade name *Basagran*, is a selective herbicide that is used after seedlings have emerged to control broadleaf weeds and sedges among food and feed crops including alfalfa, beans, corn, peanuts, peas, peppers, peppermint, rice, sorghum, soybeans and spearmint. Bentazon also is registered for use on ornamental lawns and turf. Most bentazon used in the U.S. (73 percent) is applied to soybean crops. Based on chemical affinities, bentazon is considered a member of the thiadiazine group, containing nitrogen and sulfur atoms. It is a benzothiadiazinone contact herbicide and photosynthetic electron transport inhibitor. Bentazon is formulated and used as the sodium salt alone or in combination with atrazine (USEPA 1994c). The chemical interferes with the ability of susceptible plants to use sunlight for photosynthesis and visible injury to the plants occurs within 4 to 8 hours of application followed by death of the plant.

4.6.6.1 Environmental Fate

Dissipation of bentazon is dependent on photolysis, microbe-induced degradation, leaching and surface water runoff (Table 4-25). Degradation in aquatic environments is dependent on photolysis. Degradation in soil is controlled by processes involving microbes in the presence of oxygen. Bentazon has a low binding affinity to soil and therefore may leach into ground water and runoff into surface waters. Leaching did not appear to be a major route of dissipation in field studies, however. Bentazon dissipates rapidly under typical use conditions. The soil degradates of bentazon include 2-amino-n-isopropylbenzamide (AIBA), which is very mobile but not persistent (half-life 1 to 10 days), and N-methylbentazon which is not mobile (USEPA 1994c).

Table 4-25 Degradation of Bentazon

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	Stable	USEPA 1994c
Photolysis (water)	2.6 Days	USEPA 1994c
Photolysis (soil)	>39 Days	USEPA 1994c
Aerobic metabolism (water)	Stable	USEPA 1994c
Aerobic metabolism (soil)	24 to 98 Days	USEPA 1994c
Anaerobic metabolism (water)	Stable	USEPA 1994c
Anaerobic metabolism (soil)	89 Days	USEPA 1994c
Field dissipation (soil)	7 to 33 Days	USEPA 1994c

4.6.6.2 Human Toxicity

Bentazon is slightly toxic (Category III) to mammals via the oral, dermal, and inhalation routes and is a skin sensitizer (USEPA 1994a, EXTOXNET 1996e). The oral LD50 for rats is 1,100 mg/kg. The dermal LD50 for rabbits is 4,000 mg/kg. Bentazon has not been associated with carcinogenic effects but causes some developmental toxicity effects in rats and rabbits (USEPA 1994a). The inhalation LC50 for rats has been reported at 5.1 mg/L (MacBean 2012).

4.6.6.3 Ecological Toxicity

Bentazon is slightly toxic to birds on an acute oral and subacute dietary basis and exceeds the level of concern for avian chronic reproductive effects. The risk to birds can be reduced by lowering the maximum seasonal application rate from four to two pounds per acre, as recommended by the USEPA (USEPA 1994a). The oral LD50 for bobwhite quail is 1,171 mg/kg. Bentazon is slightly toxic to small mammals and practically nontoxic to fish and invertebrates. MacBean (2012) reports the LC50 for bluegill and trout is greater than 100 mg/L and the EC50 for Daphnia is 125000 µg/L. The contact LD50 for bees is greater than 100 µg/bee. Bentazon poses a low risk to aquatic plants but may present a hazard to terrestrial plants (USEPA 1994a).

4.6.6.4 Summary of Toxicity and Potential Effects

Bentazon has low binding affinity to soil and leaches to groundwater or tends to runoff. Bentazon is slightly toxic or practically nontoxic to mammals, birds, and bees, fish, aquatic invertebrates, and aquatic plants. Based upon its low toxicity, and using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.6.2 and 4.6.6.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.7 Diuron

Diuron is a substituted urea herbicide used for the control of a wide variety of annual and perennial broad leaved and grassy weeds on both crop and noncrop sites. The mechanism of herbicidal action is the inhibition of photosynthesis. It is rapidly translocated into the stems and leaves of plants. Diuron primarily acts by inhibiting the Hill reaction in photosynthesis, limiting the production of high-energy compounds like adenosine triphosphate (ATP) which are necessary for various metabolic processes. Diuron is registered for pre- and post-emergent herbicide treatment of both crop and noncrop areas, as a mildewcide and preservative in paints and stains, and as an algaecide in commercial fish production, residential ponds and aquariums. Products containing diuron are intended for both occupational and residential uses. Occupational uses include agricultural food (such as citrus, berries, asparagus, pineapple, and oranges) and nonfood crops (such as cotton); ornamental trees, flowers, and shrubs; paints and coatings; ornamental fish ponds, and catfish production; rights-of-way and industrial sites. Residential uses include ponds, aquariums, and paints (USEPA 2003b). Diuron is one of the most commonly used pesticides in California. It is often used in rights of way (Moncada 2004).

4.6.7.1 Environmental Fate

The major route of dissipation for diuron in the environment is microbial degradation in water (Table 4-26). Diuron also degrades through photolysis in both water and soil, but at a slower rate. Sorption of diuron to soil is highly correlated with soil organic matter. However, relative to other pesticides diuron is generally considered both mobile and persistent. Diuron has the potential to leach to ground water and to contaminate surface waters (USEPA 2003b, Moncada 2004).

Table 4-26 Degradation of Diuron

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	>1,240 Days, Stable	USEPA 2003b, Moncada 2004
Photolysis (water)	43 to 2,180 Days	USEPA 2003b, Moncada 2004
Photolysis (soil)	173 Days	USEPA 2003b, Moncada 2004
Aerobic metabolism (water)	33 Days	USEPA 2003b
Aerobic metabolism (soil)	372 Days	USEPA 2003b, Moncada 2004
Anaerobic metabolism (water)	5 Days	USEPA 2003b
Anaerobic metabolism (soil)	995 Days	USEPA 2003b, Moncada 2004
Field dissipation (soil)	73 to 134 Days	USEPA 2003b, Moncada 2004

4.6.7.2 Human Toxicity

Diuron has low acute toxicity (Category III or IV) to mammals by the oral, dermal, or inhalation exposure routes. It is not irritating to eyes or skin. Diuron is rapidly absorbed and metabolized by rats and is mostly excreted in the urine (USEPA 2003b). In mammals, metabolism occurs through hydroxylation and dealkylation (Moncada 2004). The oral LD50 for rats is 4,721 mg/kg for males and >5,000 mg/kg for females. The dermal LD50 for rabbits is >2,000 mg/kg. The inhalation LC50 is >7.0 mg/L. Diuron has been classified as a “known/likely” human carcinogen based on urinary bladder carcinomas in rats. Tumors occurred at doses >600 mg/kg/day (USEPA 2003b).

4.6.7.3 Ecological Toxicity

Diuron is slightly to practically nontoxic to birds. The oral LD50 for mallard ducks is >2,000 mg/kg (USEPA 2003b). It is practically nontoxic to honey bees (48-hr LC50 = 145 µg/bee). Diuron is moderately toxic to most aquatic organisms; however, it is highly toxic to cutthroat trout. The 96-hr LC50 for bluegill sunfish is 5.9 mg/L but only 0.71 mg/L for cutthroat (USEPA 2003b), although MacBean (2012) reports the 96-hr LC50 for rainbow trout is 14.7 mg/L. The 48-hr LC50 for *Daphnia magna* is 1.4-mg/L. The bioconcentration factor (BCF) for diuron predicted from its water solubility indicates low bioaccumulation potential (EXTOXNET 1996c).

4.6.7.4 Summary of Toxicity and Potential Effects

Diuron is mobile and persistent in soil. It leaches to groundwater and can contaminate surface waters when transported from the application areas. It is of low toxicity to mammals and birds, practically nontoxic to bees, but moderately toxic to fish and aquatic invertebrates. In spite of these specific toxicity issues, Districts, when using BMP application practices for diuron should not encounter unwanted adverse effects when maintaining adequate buffer zones and care in applications.

In addition to the toxicity values referenced in Sections 4.6.7.2 and 4.6.7.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.8 Benfluralin (Benefin)

Benfluralin is a pre-emergent dinitroaniline herbicide used to control grasses on commercial and residential turf. Benfluralin also has four food/feed use sites that include lettuce, alfalfa, clover, and birdsfoot trefoil. Other nonfood/nonfeed sites include nonbearing fruit and nut trees, nonbearing berries, nonbearing vineyards, turf, ornamentals, rights of way, fence rows/hedgerows, and Christmas tree plantations. Benfluralin works by inhibiting growth acts as a mitotic disruptor (USEPA 2004d).

4.6.8.1 Environmental Fate

Primary degradation pathways for benfluralin include photolysis and anaerobic metabolism in water (Table 4-27). Benfluralin has low mobility in soils. Benfluralin is of variable soil persistence with different mechanisms of degradation. Benfluralin volatilizes rapidly, but application practices and granular formulations are designed to slow volatilization (USEPA 2004d).

Table 4-27 Degradation of Benfluralin

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	Stable	USEPA 2004b,d
Photolysis (water)	5.5 to 9.9 Hours	USEPA 2004b,d
Photolysis (soil)	12.5 Days	USEPA 2004b,d
Aerobic metabolism (soil)	20 to 86 Days	USEPA 2004b,d
Anaerobic metabolism (water)	38 Hours	USEPA 2004b,d
Anaerobic metabolism (soil)	12 Days	USEPA 2004b,d
Field dissipation (soil)	22 to 79 Days	USEPA 2004b,d

4.6.8.2 Human Toxicity

Benfluralin is classified as practically nontoxic (Category IV) to mammals by acute oral and dermal routes and low toxicity (Category III) for primary skin and eye irritation. Acute oral LD50 values for rats and mice are greater than 5000 mg/kg. The dermal LD50 for rabbits is greater than 500 mg/kg and the inhalation LC50 for rats is greater than 2.31 mg/L (MacBean 2012). The chemical is toxic to the kidneys, liver, and thyroid in longer-term studies. It has not been assessed for carcinogenicity in humans. Benfluralin is included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.6.8.3 Ecological Toxicity

Benfluralin is practically nontoxic to birds on an acute and sub-acute basis (LD50 >2,000 mg/kg), but has been associated with reproductive effects in chronic studies (USEPA 2004d). It is considered practically nontoxic to small mammals (LD50 >10,000 mg/kg) and honey bees (LD50 >10 µg/bee) but highly toxic to freshwater fish (USEPA 2004d). The LC50 for typical end-use product is <100 µg/L for bluegill sunfish and trout (MacBean 2012, USEPA 2004d). Preliminary toxicity data indicates that benfluralin is highly toxic to estuarine and marine invertebrates (USEPA 2004b). Benfluralin is considered to be bioaccumulative. The BCF for whole fish is 1580 (USEPA 2004d).

4.6.8.4 Summary of Toxicity and Potential Effects

Benfluralin has low mobility and variable persistence in soils. It volatilizes rapidly, but application methods are meant to slow volatilization. Benfluralin is practically nontoxic to mammals, birds, and bees on an acute basis. It is highly toxic to fish and aquatic invertebrates and is bioaccumulative. Additionally, benfluralin has been included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a). When benfluralin is applied to water bodies, it generally binds to sediments. It also photodegrades when exposed to sunlight, and does not persist in soil and sediments. Benfluralin does not generally leach into groundwater from soil applications due to its low mobility in soil. Benfluralin when used according to label guidelines and BMP application techniques, should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.8.2 and 4.6.8.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.9 Oryzalin

Oryzalin is a selective, preemergent surface-applied herbicide used for control of annual grasses and small-seeded broadleaf weeds. Oryzalin is a dinitroaniline herbicide that controls weeds by disrupting the growth process during seed germination by inhibiting cell division in plants; it does not control established weeds. It is used to control annual grasses, broadleaf weeds, woody shrubs and vines in grapes, berries and orchard crops, including both fruits and nuts. It also is used on residential and commercial/industrial lawns and turf, golf course turf, ornamentals and shade trees, Christmas tree plantations, fencerows/hedgerows, nonagricultural rights-of-way, and uncultivated areas including patios, paths, paved areas and power stations. Oryzalin is used most on turf, almond orchards and grapes (USEPA 1994d).

4.6.9.1 Environmental Fate

The primary degradation pathways for oryzalin is photolysis (Table 4-28), otherwise oryzalin biodegrades slowly with a half-life of approximately 2 months. Oryzalin is not mobile under field conditions and most of the applied oryzalin either binds to soil or is fully mineralized. Oryzalin is most mobile in coarse, wet, alkaline soils with little organic matter. However, oryzalin would not be stable if it were to leach to groundwater. Anaerobic conditions below the soil surface would cause the chemical reduction of the compound (USEPA 1994d).

Table 4-28 Degradation of Oryzalin

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	Stable	USEPA 1994d
Photolysis (water)	1.4 Hours	USEPA 1994d
Photolysis (soil)	3.9 Days	USEPA 1994d
Aerobic metabolism (water)	Moderate	USEPA 1994d
Aerobic metabolism (soil)	2.1 Months	USEPA 1994d
Anaerobic metabolism (water)	Moderate	USEPA 1994d
Field dissipation (soil)	58 to 146 Days	USEPA 1994d

4.6.9.2 Human Toxicity

Formulations include granular, wettable powder, water dispersible granules, emulsifiable concentrate, flowable concentrate, and liquid. In acute toxicity studies using laboratory animals, oryzalin is practically nontoxic by the oral route (USEPA 1994b). It is of moderate dermal and inhalation toxicity and causes slight eye irritation (USEPA 1994b). Oryzalin is generally of moderate acute toxicity, but is carcinogenic in animal studies; therefore, oryzalin has been classified as a possible human carcinogen. The oral LD50 for rats is >10,000 mg/kg. The dermal LD50 for rabbits is >2,000 mg/kg. The inhalation LC50 is >3.1 mg/L.

4.6.9.3 Ecological Toxicity

Oryzalin is slightly toxic to practically nontoxic to birds. The oral LD50 for bobwhite quail is 506.7 mg/kg. The dietary LC50 for mallard ducks is >5,000 mg/kg. Oryzalin is moderately toxic to fish and freshwater invertebrates. The 96-hr LC50 for fish is between 2.88 and 3.26 mg/L. The 48-hr LC50 for *D. magna* is 1.4-mg/L. Oryzalin is practically nontoxic to honey bees. The 48-hr contact LD50 for honey bees is >11 µg/bee (USEPA 2004c). Oryzalin does not accumulate significantly in fish. The BCF is 66.1 in whole bluegill sunfish (USEPA 2004c).

4.6.9.4 Summary of Toxicity and Potential Effects

Oryzalin is immobile in soils and is not of concern for ground or surface water contamination (USEPA 2004c). It is practically nontoxic to mammals, birds, and bees. It is moderately toxic to fish but does not accumulate in them. Oryzalin is a possible human carcinogen; however, proper personal protective equipment is thought to be sufficient to protect handlers from the chemical. Based upon the low toxicity and environmental fate of oryzalin, and using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.9.2 and 4.6.9.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.10 DCPA

DCPA (or chlorthal dimethyl) is a pre-emergent herbicide used to control annual grasses and broadleaf weeds on ornamental turf and plants, strawberries, seeded and transplanted vegetables, cotton, and field beans. Use practice limitations prohibit applying DCPA directly to water or wetlands (swamps, bogs, marshes, and potholes) or through any type of irrigation system (USEPA 1998d). This herbicide kills germinating seeds by disrupting microtubule formation in exposed cells, causing abnormal cell division.

4.6.10.1 Environmental Fate

DCPA is stable to hydrolysis and photolysis. Biodegradation is the primary dissipation process for DCPA (Table 4-29). Under laboratory conditions, the half-life is approximately 15-30 days, but longer half-lives have been reported in the field. DCPA is not especially persistent or mobile. Volatilization from soil is also a major dissipation route for DCPA. Tetrachloroterephthalic acid (TPA or di-acid) is the only significant DCPA metabolite. TPA is unusually mobile and persistent in the field. Data suggest that TPA will leach to groundwater wherever DCPA is used, regardless of soil properties (USEPA 1998d).

Table 4-29 Degradation of DCPA

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	Stable	USEPA 1998b,d
Photolysis (water)	Stable	USEPA 1998b,d
Photolysis (soil)	Stable	USEPA 1998b,d
Aerobic metabolism (soil)	18 to 37 Days	USEPA 1998b,d
Anaerobic metabolism (soil)	37 to 59 Days	USEPA 1998b,d
Field dissipation (soil)	44 to 126 Days	USEPA 1998b,d

4.6.10.2 Human Toxicity

DCPA has been classified as practically nontoxic for acute-oral toxicity and dermal irritation. DCPA has been classified as slightly toxic for dermal LD50, inhalation LC50, and eye sensitivity. The chemical has been classified as a possible human carcinogen based on increased incidence of thyroid tumors and liver tumors in rats (USEPA 1998b). The oral LD50 for rats is ≥ 5,000 mg/kg and has been reported by MacBean (2012) as being greater than 10,000 mg/kg. The oral LD50 for beagle dogs is >10,000 mg/kg. The dermal LD50 for rabbits is >2,000 mg/kg. The 4-hr inhalation LC50 for rats is >4.48 mg/L (USEPA 1998d). DCPA is included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.6.10.3 Ecological Toxicity

DCPA is practically nontoxic to birds on an acute basis. The oral LD50 for bobwhite quail is >2,250 mg/kg; however, DCPA is persistent enough to result in chronic exposure to birds (USEPA 1998d). It is practically nontoxic to bees (LD50 >230 µg/bee) (USEPA 1998d). DCPA is slightly toxic to practically nontoxic to fish and aquatic invertebrates. The 96-hr LC50 for rainbow trout is between 4.7 and >180 mg/L, depending on the study (MacBean 2012, USEPA 1998d).

4.6.10.4 Summary of Toxicity and Potential Effects

DCPA is not mobile in soil and has low persistence; however, the metabolite TPA is unusually mobile and persistent and will leach to groundwater. DCPA is of low acute toxicity to most receptors, but is classified as a possible human carcinogen and a possible endocrine disruptor. Despite the potential for chronic effects from DCPA exposure, its low persistence and low toxicity and using BMP application practices, DCPA applications should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.10.2 and 4.6.10.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.11 Dithiopyr

Dithiopyr is a pre-emergent and post-emergent herbicide used for control of annual grasses and broad leaf weeds in established ornamental turf (USEPA 1991a).

4.6.11.1 Environmental Fate

Dithiopyr degrades slowly in water. Hydrolysis is not a significant route of degradation. Dithiopyr is slightly mobile to relatively immobile in soil. Photodegradation is not a significant route of degradation in soil. Volatization contributed more to dissipation than soil aerobic metabolism. Field dissipation for turf grass had a half-life of 17-61 days (USEPA 1991a).

4.6.11.2 Human Toxicity

Dithiopyr has low acute toxicity to mammals. The oral LD50 and 24-hr dermal LD50 for rats is >5,000 mg/kg. The 4-hr inhalation LC50 for rats is 5.98 mg/L (Ward 1993). The NOELs for systemic and reproductive toxicity in rats are 25 and 2,500 mg/L, respectively (Ward 1993). Dithiopyr is not known to have mutagenic or carcinogenic effects.

4.6.11.3 Ecological Toxicity

The University of California Agriculture and Natural Resources (2012) reports that no information is readily available on the potential ecological effects of dithiopyr. However, MacBean (2012), reports the following data: LD50 for bobwhite quail is greater than 2250 mg/kg, the 5-day LC50 for bobwhite quail and mallard is greater than 5620 mg/kg, the 96-hr LC50 for bluegill and carp is 0.7 mg/L, the 96-hr LC50 for trout is 0.5 mg/L, the 48-hr EC50 for Daphnia is 1100 µg/L, the 14-day LC50 for worms is greater than 1000 mg/kg, and the contact LD50 for bees is 80 µg/bee.

4.6.11.4 Summary of Toxicity and Potential Effects

Dithiopyr degrades slowly in water and is immobile in water. It is of low acute toxicity to mammals and has not been associated with carcinogenic or mutagenic effects. Little is known about the environmental impacts of dithiopyr use. However, using continuous monitoring of the literature for documented effects of dithiopyr and BMP application practices, proper application of dithiopyr should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.11.2 and 4.6.11.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.12 Metolachlor

Metolachlor, a broad-spectrum herbicide, was first registered in 1976 for general weed control in noncrop areas. Since first registered for use on turf, it is now also registered for use on corn, cotton, peanuts, pod crops, potatoes, safflowers, sorghum, soybeans, stone fruits, tree nuts, nonbearing citrus, nonbearing grapes, cabbage, peppers (bell, chili, Cubanelle, tabasco), buffalograss, guymon bermudagrass for seed production, nurseries, hedgerows/fencerows and landscape plantings. Metolachlor's major use sites are corn, soybeans, and sorghum. Metolachlor is a chloracetanilide herbicide that inhibits seedling development (USEPA 1995). When absorbed through the roots and shoots just above the seed of the target weeds, it acts as a growth inhibitor by suppressing synthesis of chlorophyll, proteins, fatty acids and lipids, isoprenoids (including gibberellins), and flavonoids (including anthocyanins) (Rivard 2003).

4.6.12.1 Environmental Fate

Metolachlor degradation appears to be dependent on microbially-mediated and abiotic processes (Table 4-30). Metolachlor is stable to hydrolysis under normal environmental conditions, but subject to photolysis in soils (USEPA 1995). Metolachlor ethane sulfonic acid and metolachlor oxanilic acid are the two most common degradates of metolachlor (Rivard 2003). Metolachlor is moderately persistent and mobile. Extensive leaching can occur in soils with low organic carbon content, and is greatest if soil texture is coarse (Rivard 2003). Substantial amounts of metolachlor could be available for runoff to surface water for several months post-application (USEPA 1995).

Table 4-30 Degradation of Metolachlor

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	Stable, >30 Days	USEPA 1995
Photolysis (water)	70 Days (natural sunlight), 4 Hours (artificial sunlight)	USEPA 1995
Photolysis (soil)	8 Days (natural sunlight) 37 Days (artificial sunlight)	USEPA 1995, Rivard 2003
Aerobic metabolism (water)	47 Days	USEPA 1995
Aerobic metabolism (soil)	26 to 67 Days	USEPA 1995, Rivard 2003
Anaerobic metabolism (water)	78 Days	USEPA 1995
Anaerobic metabolism (soil)	37 to 81 Days	USEPA 1995, Rivard 2003
Field dissipation (soil)	7 to 292 Days	USEPA 1995, Rivard 2003

4.6.12.2 Human Toxicity

The chemical has displayed low-level toxicity in acute tests. It is slightly toxic via the oral, dermal, and inhalation routes but is nonirritating to eyes and skin (USEPA 1995). MacBean (2012) reports the following data: acute oral LD50 for rats 1063 to 1936 mg/kg, dermal LD50 for rats is greater than 5050 mg/kg, and the inhalation LC50 is greater than 2.02 mg/L. Metolachlor is included in the final list of chemicals for screening under the USEPA Endocrine Disruptor Screening Program (USEPA 2009a).

4.6.12.3 Ecological Toxicity

Metolachlor is practically nontoxic to birds on an acute basis. The oral LD50 for mallard ducks is 4,640 mg/kg (USEPA 1995). Technical metolachlor is moderately toxic to freshwater fish. The LC50s for fish range from 3.9 to 10 mg/L. Metolachlor is slightly toxic to aquatic invertebrates (EC50 = 25.1 mg/L) (USEPA 1995). The chemical has low potential to bioaccumulate in fish with a whole fish BCF of 69X and whole body elimination after 14-days depuration (USEPA 1995).

4.6.12.4 Summary of Toxicity and Potential Effects

Metolachlor is moderately persistent in soil and mobile, potentially leaching to groundwater. It is slightly toxic to mammals and a potential endocrine disruptor. It is moderately toxic to fish and has low potential for bioaccumulation. Based upon the low toxicity, and using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.12.2 and 4.6.12.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.6.13 Pendimethalin

Pendimethalin is a selective herbicide registered for control of broadleaf weeds and grassy weed species. It is used on various agricultural and nonagricultural sites in crop and noncrop areas. It is applied to soil pre-plant, pre-emergence, and post-emergence with ground and aerial equipment (USEPA 1997b). It is also used in aquatic rice culture and in nonagricultural, residential outdoor weed controls, such as grounds plantings, ornamentals, and turf grass (e.g., residential, golf course, landscape, sod farms) Pendimethalin acts as a microtubule disruptor (USEPA 1997b).

4.6.13.1 Environmental Fate

Pendimethalin dissipates in the environment by binding to soil, microbially-mediated metabolism, and volatilization (Table 4-31). Persistence decreases with increased temperature, increased moisture and decreased soil organic carbon. Pendimethalin residues are tightly bound to soil and sediment particles. Pendimethalin has a low potential to leach to ground water in most soils (USEPA 1997b).

Table 4-31 Degradation of Pendimethalin

Degradation Method	Half-life	Reference
Hydrolysis, pH 5-9	28 to >30 Days	USEPA 1997b
Hydrolysis (water with soil fungi)	10 to 11 Days	USEPA 1997b
Photolysis (water)	16.5 to 60 Days	USEPA 1997b
Photolysis (soil)	Stable	USEPA 1997b
Aerobic metabolism (soil)	42 to 1,322 Days	USEPA 1997b
Anaerobic metabolism (water)	6 to 105 Days	USEPA 1997b
Anaerobic metabolism (soil)	>60 Days	USEPA 1997b
Field dissipation (soil)	34 Days	USEPA 1997b

4.6.13.2 Human Toxicity

Pendimethalin has low acute toxicity to mammals. It is listed as Category III for oral toxicity and Category IV for dermal and inhalation exposure. It is nonirritating to skin and slightly irritating to eyes. The oral LD50 for rats is between 1,050 and 1,250 mg/kg, although MacBean (2012) reports the LD50 value being greater than 5,000 mg/kg. The dermal LD50 for rabbits is >2,000 mg/kg. The inhalation LC50 for rats is >320 mg/L. The LOEL for reproductive effects in rats is 346 mg/kg/day for male rats and 436 mg/kg/day for female rats (USEPA 1997b). Pendimethalin has been classified as a possible human carcinogen because it has caused thyroid follicular cell adenomas in rats (USEPA 1997b).

4.6.13.3 Ecological Toxicity

Pendimethalin is slightly acutely toxic to birds. The oral LD50 for mallard ducks is 1,421 mg/kg. Avian chronic toxicity studies have not yet been completed. Pendimethalin is practically nontoxic to honey bees (LD50 >49.7 µg/bee) and MacBean (2012) reports both contact and oral LD50 values are greater than 100 µg/bee. It is highly toxic to fish and has high potential to bioaccumulate in fish (USEPA 1997b). The LC50 for rainbow trout is 0.138 mg/L (technical pendimethalin) and 0.52 mg/L (formulated pendimethalin product) (USEPA 1997b). Reproductive effects to fish (reduced egg production, reduced hatch success) occur at exposure >6.3 µg/L. Technical pendimethalin is also highly toxic to aquatic invertebrates (LC50 for *D. magna* is 0.28 µg/L). The formulated product is moderately toxic to these organisms (LC50 for *D. magna* is 5.1 µg/L) (Table 6-1).

4.6.13.4 Summary of Toxicity and Potential Effects

Pendimethalin is of varying persistence in soil, depending on temperature and moisture. It is of low toxicity to mammals, birds, and bees. It is toxic to fish and aquatic invertebrates and has a potential to bioaccumulate. Pendimethalin is classified as a possible human carcinogen; however, the USEPA has determined that all uses of pendimethalin (as prescribed) will not cause unreasonable risks to humans or the environment (USEPA 1997b). Based upon this evaluation and the USEPA literature, using BMP application practices with these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.6.13.2 and 4.6.13.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.7 Adjuvants

An adjuvant is any compound that is added to an herbicide or pesticide formulation or tank mix to facilitate the mixing, application or effectiveness of that herbicide. There are two primary types of adjuvants discussed in the chapter: 1) alkylphenol ethoxylates (APEs) and 2) plant-derived oils. APEs are synthetic surfactants found in detergents, cleaning products, pesticides, lubricants, hair dyes and other hair care products. The most common APEs are nonylphenol ethoxylates. Plant-derived oils (from soybeans, cottonseeds, etc.) decrease surface tension, but are less effective than other surfactants at increasing spreading, sticking, or penetration. Plant oils are generally of two types: triglycerides or methylated oils. Both of these are surfactants, as they typically enhance activity of an herbicide’s active ingredient (activator adjuvant) or offset any problems associated with spray application, such as adverse water quality or wind (special purpose or utility modifiers). Activator adjuvants include surfactants, wetting agents, sticker-spreaders, and penetrants. Nonionic alkylphenol ethoxylate-based and silicone-based adjuvants are wetter/spreaders. Adjuvants can also be primarily oil-based. Oil additives function to increase herbicide absorption through plant tissues and increase spray retention. Oil adjuvants are made up of either petroleum, plant, or methylated plant or seed oils plus an emulsifier for dispersion in water (Bakke 2007).

Adjuvants are not under the same registration guidelines as are pesticides. EPA regulates the inclusion of certain ingredients in adjuvant formulations, but it does not stringently test and regulate the manufacture and use of adjuvant products (as they do for pesticides). As such, there is little information on the effects of different adjuvants, other than that provided by the manufacturer or published by the scientific community (Tu et al. 2001, Bakke 2007). CDPR does require the registration of adjuvants that are considered to increase the action of the pesticide it is used with (Bakke 2007).

The long-term fates of most adjuvants in soils and elsewhere in the environment are largely unknown, partially because of the lack of long-term monitoring data, but also because the ingredients in most adjuvants are not disclosed (Tu et al. 2001).

4.7.1 Alkylphenol Ethoxylates

Alkylphenol ethoxylates (APEs) can be used as detergents, wetting agents, dispersants, emulsifiers, solubilizers and foaming agents. Alkylphenol ethoxylates are widely in domestic detergents, pesticide formulations and industrial products. Industrial applications include pulp and paper, textiles, coatings, agricultural pesticides, lube oils and fuels, metals and plastics. Primary degradation of alkylphenol ethoxylates in the environment generates more persistent shorter chain alkylphenol ethoxylates and alkylphenols (i.e., nonylphenol, octylphenol, and mono- to triethoxylates), some of which may mimic natural hormones and disrupt endocrine function in wildlife and humans (Ying et al. 2002).

4.7.1.1 Environmental Fate

Alkylphenol ethoxylates degrade faster in the water column than in sediment. Alkylphenol ethoxylates bind strongly to aquatic particles in river and coastal environments and are persistent in sediments. Aerobic conditions further facilitate biotransformation of alkylphenol ethoxylate metabolites as compared to anaerobic conditions (Ying et al. 2002).

4.7.1.2 Human Toxicity

Nonylphenol (NP) is of low acute oral and dermal toxicity but is highly irritating and corrosive to the skin and eyes (USEPA 2010b). Depending on formulation, the APE oral LD50 for rats ranges from 600 to more than 10000 mg/kg. The dermal LD50 has been reported as 0.22 mg/kg and the inhalation LC50 as greater than 2000 mg/L for rats. Concern exists regarding the estrogen-mimicking behaviors of alkyl phenol ethoxylate (USEPA 2010b). The compounds nonylphenol (NP) and nonylphenol ethoxylate (NPE) are of particular interest and concern to the public and the EPA. NPs and NPEs are produced in large volumes and are widely used.

4.7.1.3 Ecological Toxicity

NP is persistent in the environment, moderately bioaccumulative, and extremely toxic to aquatic organisms. NPE, though less toxic than NP, is also highly toxic to fish, aquatic invertebrates, and aquatic plants (USEPA 2010b). Toxicity of APEs to aquatic organisms increases with alkyl chain length. The LC50 for trout ranges from 1.5 to 6.4 mg/l. The EC50 for daphnia ranges from 460 to 740 µg/L. An LC50 of 774 µg/L has been reported for snails. The toxicity of a variety of APEs are discussed in detail by Bakke (2003) and Staples, et al. (1998).

4.7.1.4 Summary of Toxicity and Potential Effects

APEs include a broad range of chemicals that tend to bind strongly to particulates and persist in sediments. Nonylphenol and short-chain NPEs are moderately bioaccumulative and extremely toxic to aquatic organisms. Aside from use in agricultural herbicide mixtures, APEs are commonly present in detergents, cleaners, food packaging, and cosmetics. The acute toxicity of APEs to mammals is low. They are possible estrogen-mimics. Nonylphenol has been detected in human breast milk, umbilical cord blood, and urine (USEPA 2010b).

The USEPA (USEPA 2010b) has recently recommended that this suite of chemicals be evaluated further due to their wide-spread use (past and present), persistence, and possible estrogen-mimicking behavior.

In addition to the toxicity values referenced in Sections 4.7.1.2 and 4.7.1.3, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.7.2 Polydimethylsiloxane Fluids

Most polydimethylsiloxane (PMDS) fluids are nonvolatile polymeric organosilicon materials consisting of ([CH3]2SiO) structural units. Various polydimethylsiloxane fluids ranging from low to high viscosity are used in a wide range of industrial applications, such as manufacturing textiles, paper, and leather goods and serve as antifoams, softeners, or water repellents. In consumer applications, polydimethylsiloxane fluids can be found in personal, household and automotive care products. They are used as softeners in skin care products, conditioners in hair care, additives in polish formulations, and as waterproofers and other surface treatments. Some polydimethylsiloxane materials are also sold as end products (usually in the industrial market), such as transformer dielectric fluids and heat transfer liquids (Dow Corning Corp. 1998).

4.7.2.1 *Environmental Fate*

Polydimethylsiloxane fluids are insoluble in water and have a high adsorption coefficient. Volatile, low molecular weight dimethyl siloxanes will evaporate into the atmosphere where they undergo indirect photolytic degradation. However, high molecular weight polydimethylsiloxanes typically sorb to particulate matter when in water and become associated with soil and sediments (Griessbach and Lehmann 1999).

Polydimethylsiloxanes degrade into lower molecular weight siloxanes and finally into dimethylsilanediol. Significant degradation to lower molecular weight compounds have been noted a few weeks after application to some soils. The actual rate and extent of degradation vary as a function of soil moisture content and clay type (Dow Corning Corp. 1998). The degradation rate of polydimethylsiloxanes is highly influenced by soil moisture. Degradation is slow on moist soils (3 percent within 6 months) but quite rapid on dry soil (50 percent within several days) (Griessbach and Lehmann 1999).

4.7.2.2 *General Toxicity*

Polydimethylsiloxanes are reported to be relatively nontoxic to benthic invertebrates and exhibit little bioaccumulation potential (Henry et al. 2001).

4.7.2.3 *Summary of Toxicity and Potential Effects*

Polydimethylsiloxanes are insoluble in water and typically sorb to particulates. Degradation time varies depending on moisture in soils. These chemicals appear to be relatively nontoxic to most organisms, but adequate toxicity data are not available. Although only limited information is available regarding the toxicity and environmental fate of polydimethylsiloxanes, using BMP application practices, these products should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Sections 4.7.2.2, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.7.3 Plant-Derived Oil and Methylated Seed Oil

Plant-derived oils, whether vegetable or fruit, can be used as adjuvants that enhance the effectiveness of herbicides or as a surfactant for the management of vectors, especially immature mosquitoes. Plant-derived oils are generally of two types: triglycerides or methylated oils. CocoBear Mosquito Larvicide Oil (also see Section 4.3.6.4) consists mostly of a modified coconut oil (75 percent or more by volume) combined with 10 percent by volume mineral oil and a very small amount of nonionic surfactant and other proprietary ingredients. This material can be used in various waterbodies such as ditches, stagnant pools, swamps, marshes, temporary rainwater pools and intermittently flooded areas, ponds, catch basins and manmade containers for the management of immature mosquitoes.

4.7.3.1 *General Toxicity*

Modified plant and methylated seed oil adjuvants are generally considered inert or essentially nonphytotoxic (Tu et al. 2001).Toxicity information is available for one product, Competitor™ (modified plant oil, polyethylene glycol fatty acid ester, polyoxyethylene sorbitan fatty acid ester) (Washington State Department of Agriculture 2009). The 96-hr LC50 for rainbow trout is 95 mg/L (slightly toxic). The 48-hr EC50 for daphnids is >100 mg/L (practically nontoxic) (Table 6-1).

CoCoBear has no reported significant toxicity to any receptors likely to be exposed during or after use as a larvicide. Acute oral toxicity to rats is >5000 mg/kg, acute dermal toxicity to rats is > 5050 mg/kg, and acute inhalation toxicity to rats is > 2.16 mg/L (Clarke 2014).

4.7.3.2 Summary of Toxicity and Potential Effects

Modified plant oils and methylated seed oils are essentially nontoxic to most organisms, including plants (Tu et al. 2001). Little is known of the environmental fate of these adjuvants. Although there is a paucity of toxicity and environmental fate information for these oils, using BMP application practices, these products should not result in unwanted adverse effects. The marketed products of coconut oils should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Section 4.7.3.1, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

4.7.4 Lecithin

Lecithin (phosphatidylcholine) is a commonly used amphoteric surfactant, which is derived from soybeans. Amphoteric surfactants contain both a positive and negative charge and typically function similarly to nonionic surfactants. There is little published research on the use and efficacy of amphoteric surfactants (Tu et al. 2001).

4.7.4.1 General Toxicity

Lecithin is a general term used to describe yellow-brownish fatty substances occurring in animal and plant tissues. When used with herbicide applications, lecithin acts as an amphoteric surfactant and functions similarly to nonionic surfactants (Tu et al. 2001). Toxicity information exists for the product, Liberate™ (lecithin, alcohol ethoxylate, modified plant oil) (Washington State Department of Agriculture 2009, Loveland Products Inc Liberate MSDS 2014). The male rat oral LD50 is greater than 5000 mg/kg. The dermal LD 50 for rabbits is greater than 2000 mg/kg. The 96-hr LC50 for rainbow trout is 17.6 mg/L (slightly toxic) and the 48-hr LC50 for daphnids is 9300 µg/L (moderately toxic). Little is known about the fate of lecithins in the environment or their effect on non-target organisms (Tu et al. 2001).

4.7.4.2 Summary of Toxicity and Potential Effects

Little is known about the toxicity or environmental fate of lecithins. Lecithins are naturally occurring phospholipids in biological cell membranes (Bakke 2007). Although there is limited information on these products, their natural occurrence and the use of BMP application practices should not result in unwanted adverse effects.

In addition to the toxicity values referenced in Section 4.7.4.1, several toxicity values for other species and tests are included in Table 6-1 from the "The Pesticide Manual" published by the British Crop Protection Council (BCPC) to supplement the published range of available toxicity values for the species of interest to the District.

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5 Evaluations of Active Ingredients

While the majority of the active ingredients reviewed do not suggest an unacceptable risk when used properly, some became the focus of additional discussion concerning actual use patterns and BMPs employed. The results of the assessments are based on preliminary assumptions about toxicity and mode of action derived from available information and data published by the manufacturers, researchers, and other published literature.

Using the available information about the active ingredients reviewed, there were several overarching parameters that are known to adversely impact risk. Primary factors considered include the inherent toxicity and mode of action of the chemical that can imply toxicity to non-target species. Other important factors that are considered include the possible transport and fate of the chemical in various media, the reported likely exposure routes, and documented ecological and human studies supporting the toxicity data. Several important parameters, such as the retention time (half-life) in various media are considered, but are based only on available information about regional conditions. Several pesticides received additional discussion during the nine Districts' workshop on February 20, 2013.

Using the approach discussed above, select active ingredients were identified (Table 5-1) and discussed during the workshop to supplement the information relevant to the evaluation of potential risk. Each of these pesticides exhibits at least one parameter that appears to drive potential risk.

Table 5-1 Active Ingredients Identified for Discussion

Active Ingredient	Vector	Potential Issue
Methoprene	Mosquitoes	Prevalent use; toxicity to aquatics and insects
Etofenprox	Mosquitoes	Toxicity to aquatic organisms; no synergist required
Bti	Mosquitoes	Prevalent use; public concerns
Pyrethrins	Mosquitoes/yellow jacket wasps	Prevalent use; requires synergist (PBO)
Resmethrin	Mosquitoes	Requires synergist (e.g., PBO); potential endocrine disruptor
Aliphatic solvents, Plant Oils as surfactants (e.g., coconut oil) mix	Weeds/vegetation/mosquitoes	Increases herbicide absorption through plant tissues and as a surface Newer products contain substantially lower percentage of petroleum distillate (10%). Older products exceed 90% petroleum distillates (e.g. BVA-2 Mosquito Larvicide Oil)
Permethrin	Mosquitoes/yellow jacket wasps	Toxicity to aquatic organisms; potential endocrine disruptor
Lambda-cyhalothrin	Yellow jacket wasps	Toxicity to aquatic organisms; potential to bioaccumulate
Bromadiolone	Rats	Toxicity to non-target organisms including mammals, birds, aquatics
Difethialone	Rats	Toxicity to non-target organisms including mammals, birds, aquatics
Alkylphenol ethoxylates (surfactants)	Weeds/vegetation/mosquitoes	Used as wetter spreader adjuvants to enhance efficacy of herbicides to enter plant tissue and surface water as larvicide. Toxicity to aquatic organisms; moderately bioaccumulative

Active Ingredient	Vector	Potential Issue
Glyphosate	Weeds/vegetation	Prevalent use; possible endocrine disruptor
Diuron	Weeds	Prevalent use; toxicity to freshwater fish
Benfluralin	Weeds	Toxicity to aquatics; potential for bioaccumulation/endocrine disruption

Table 5-2 Chemicals Employed for Larval Mosquito Abatement

Chemical Classification	Active Ingredient	Appendix B
Organophosphate	Temephos	Section 4.2.2
Bacterial larvicide	Bs	Section 4.3.1
Bacterial larvicide	Bti	Section 4.3.2
Bacterial larvicide	Spinosad	Section 4.3.3
Hydrocarbon ester	Methoprene	Section 4.3.4
Adjuvants / Surfactants	Alkylphenol Ethoxylate (APE)	Section 4.7.1
	Aliphatic Solvent (Mineral Oil)	Section 4.7.2
	Plant oil mix	Section 4.7.3
	Lecithin	Section 4.7.4

6 Toxicity Summary: All Active Ingredients

Toxicity information gathered from the published literature and regulatory sources is included in Table 6-1 below. The table includes information such as LD50, LC50, USEPA toxicity rating and other relevant toxicity information.

Most of the chemical active ingredients listed in Table 6-1 below, and in the narrative sections, have undergone several levels of testing to determine potential toxicity to humans, wildlife and vegetation. The intended and expected use of each chemical and its likely target and non-target receptors are usually included in the tests. While each listed chemical has had numerous toxicity values generated for a multitude of animal and plant species and human receptors, it would not be feasible to include all the possible data published for all species/receptors in Table 6-1. The values in this table have been included to represent a realistic set of potential species that might be affected by exposure to typical applications used for vector control by the Districts. Numerous additional toxicity data are available in a multitude of publications, particularly the several compendia produced by the USEPA, the European Union, Canada and the many state and national environmental regulatory agencies. (Chapter 7, References, includes a list of many of those additional sources.) As in all determinations of the potential toxic effects of a chemical, the key is the exposure to the chemical, regardless of the potential hazard (toxicity) demonstrated in laboratory tests

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Table 6-1 Toxicity Values Reported in the Literature for Active Ingredients

Active Ingredient	Mammalian Oral LD50 (mg/kg) Unless otherwise specified, values are for rats	Mammalian Dermal LD50 (mg/kg) Unless otherwise specified, values are for rabbits	Mammalian Inhalation LC50 (mg/L) Unless otherwise specified, values are for rats	USEPA Toxicity Rating	Avian LD50 (mg/kg) Unless otherwise specified, values are for mallard duck or bobwhite quail	Fish LC50 (mg/L) Unless otherwise specified, values are for rainbow trout or bluegill sunfish	Aquatic Invert EC50 (µg/L) Values are for *Daphnia* or similar species	Honeybee LD50 (µg/bee)	Other Receptors
Pyrethrins	2370 male rats 1030 female rats 273-796 mice	>1500 rats 5000 rabbits	3.4 rats	oral and dermal (III), inhalation (IV)	>5620 mallard	0.01 bluegill 0.0052 trout	12 daphnia (LC50)	0.13-0.29 contact/bee. 0.022 oral. Toxic but exhibits repellent effect	LC50 worms 47 mg/kg soil Algae EC50 >1.27 mg/L
Allethrins and *d-trans* allethrin	2150 male rats 900 female rats	2660 (allethrin) male rabbits 4390 female rabbits	>3.875 rats	oral and dermal (III), inhalation (IV)	>2000 (allethrin) >5620 (d-trans) 5620 LC50 bobwhite quail and mallard	0.134 carp	8.9 daphnia (LC50)	no clear data, likely toxic	EbC50 algae 2.9 µg/L
Phenothrin (sumithrin or d-phenothrin)	>5000 (no deaths)	>2000 (no deaths)	>2.1 (no deaths)	oral and inhalation (IV), dermal (III)	>2500 bobwhite quail	0.016 bluegill 0.0027 trout	4.3 daphnia	toxic to bees	1 year NOEL Dogs 7.1 mg/kg b.w.
Prallethrin	>640 male rats 460 female rats >300 dogs	>5000 rats	0.855 male rats 0.658 female rats	oral and dermal (III)	>2000 mallard 1171 bobwhite quail >5620 LC50 mallard and bobwhite quail	0.022 bluegill 0.012 trout	6.2 daphnia	Highly toxic to bees	EbC50 algae 2.0 mg/L NOEL (1 yr) dogs 5 mg/kg b.w.
Deltamethrin	87 - 5000 rats depending on carrier and study conditions	>2000 rats and rabbits	0.6 rats	Oral and dermal (II)	>2250 bobwhite quail >5620 LC50 bobwhite quail	0.0014 bluegill 0.00091 trout	0.56 daphnia (LC50)	0.012 contact/bee 0.023 oral	Oral LD50 dogs >300 mg/kg LC50 worms >1290 mg/kg soil EC50 algae >9.1 mg/L NOEL (2 yr) dogs 1 mg/kg b.w.
Esfenvalerate	75-88 rats	>5000 rats >2000 rabbits	2.93 rats	Oral (II)	381 bobwhite quail 5247 LC50 mallard 5620 LC50 bobwhite quail	0.00026 bluegill 0.00026 trout 0.00069 fathead minnow	0.9 daphnia	0.017 contact/bee	ErC50 algae 10 µg/L
Lambda-cyhalothrin	79 male rats 56 female rats	632 to 696 (rats)	0.06 rats	EPA (II)	>3950 mallard >5300 LC50 bobwhite quail	0.00021 bluegill 0.00036 trout	0.26 daphnia	0.038 contact/bee 0.909 oral	LC50 worms >1000 mg/kg soil ErC50 algae >1000 µg/L NOEL (1 yr) dogs 0.5 mg/kg b.w.
Resmethrin	>2500 rats	>3000 rats >2000 rabbits	>0.01 rats USEPA reports 5.28	Oral/dermal (III) Inhalation (IV)	>2000 CA quail 75 blackbird	0.017 bluegill 0.011 sheepshead minnow	3.7 daphnia (LC50)	0.015 contact/bee 0.069 oral	LC50 pink shrimp 1.3 µg/L
Tetramethrin	>5,000 rats	>2,000 rabbits	>2.73 rats	oral / dermal (IV)	>2250 bobwhite quail >5620 LC50 mallard and bobwhite quail	0.016 bluegill 0.0037 trout	110 daphnia	0.155 contact/bee	NOEL (13 wk) dogs 5000 mg/kg feeding
Permethrin	540-2690 mice 430-4000 rats	>2500 rats >2000 rabbits	>0.685 rats and mice	oral and dermal (III), inhalation (IV)	>9800 mallard >13500 Japanese quail >3000 chickens	0.0018 bluegill 0.00025 trout	0.1 (mayfly) 0.6 daphnia (LC50)	0.029 contact/bee 0.098 oral	May be toxic to cats via dermal route

Each of the chemicals listed in Table 6-1 has been tested to determine toxicity to humans and wildlife. While each listed chemical has had numerous values generated for a multitude of species and receptors, it would not be feasible to include all the possible toxicity data published for all species. The values in this table represent a portion of the toxicity data that the District uses as a guideline when considering the use of a pesticide as a part of its Integrated Vector Management Program. Toxicity values were taken from a range of sources, especially USEPA, CDPR, EXTOXNET, peer reviewed literature, and "*The Pesticide Manual*" published by the British Crop Protection Council (BCPC). The toxicity values included in table 6-1 are meant to provide a sense of the variety and range of values presented in the peer reviewed literature and other reference documents. .

Table 6-1 Toxicity Values Reported in the Literature for Active Ingredients

Active Ingredient	Mammalian Oral LD50 (mg/kg) Unless otherwise specified, values are for rats	Mammalian Dermal LD50 (mg/kg) Unless otherwise specified, values are for rabbits	Mammalian Inhalation LC50 (mg/L) Unless otherwise specified, values are for rats	USEPA Toxicity Rating	Avian LD50 (mg/kg) Unless otherwise specified, values are for mallard duck or bobwhite quail	Fish LC50 (mg/L) Unless otherwise specified, values are for rainbow trout or bluegill sunfish	Aquatic Invert EC50 (µg/L) Values are for *Daphnia* or similar species	Honeybee LD50 (µg/bee)	Other Receptors
Etofenprox	>42880 rats >107200 female mice	>2,140 rats and mice	>5.9 rats	Formulation (IV)	>2000 mallard >5000 LC50 mallard and bobwhite quail	0.0033 trout 0.0085 bluegill 0.14 carp	>40000 daphnia (LC50)	0.13 contact 0.27 oral	7-day LC50 worms 43.1 ppm Oral LD50 dogs >5000 mg/kg
Piperonyl butoxide (PBO)	4570 - 7220 rats 7500 rabbits	>7950 rats 1880 rabbits	>5.9 rats	oral and dermal (III), inhalation (IV)	>2250 bobwhite quail	1.9 trout 3.94 sheepshead minnow 5.3 carp	510 to >2950 daphnia (LC50)	>25	LC50 Western Chorus Frog 0.21 mg/L LC50 Tadpole 0.21 mg/L LC50 mysid shrimp 0.49mg/L NOEL (1 yr) dogs 16 mg/kg b.w. daily
Naled	430 rats 81 - 336 (tech) rats	1100 rabbits 354 - 800 (tech) rats	>1.5 mg/L mice	formulation (I)	27-111 mallard, Canada geese, sharp-tailed grouse	0.08 trout 1.2 sheepshead minnow 2.2 bluegill 2 - 4 goldfish	0.3 daphnia	0.48 contact/bee	LC50 grass shrimp 8.9mg/L LC50 crabs 0.33 mg/L EC50 pink shrimp 5.5 µg/L
Temephos	444 rats (USEPA) 4204 male rats >10000 female rats	>4000 rats 970 - 2181 rabbits	1.3 (USEPA) 4.79 rats	oral and dermal (III), inhalation (III)	1200 LC50 mallard 170 LC50 pheasant	9.6 trout 3.49 bluegill	10 daphnia	1.55 contact/bee	no documented toxicity
Bacillus sphaericus (Bs)	>5000 rats	>2000 rabbits	>0.09 rats	Technical (III)	>9000 mallard	>15.5 bluegill & trout >100 sheepshead minnow	15500 daphnia	No effects at 10^8 spores	LC50 (30 d) worms >1000 ppm dry soil EC50 Chironomus tentans >260 mg/L EC50 oysters 42 mg/L EC50 algae >2.2 mg/L
Bacillus thuringiensis israelensis (Bti)	>1x10^{11} spores/kg rats >5000 mg/kg rats > 2 x 10^9 rabbits	>4.6x10^{10} spores/kg rats >2000 mg/kg rats >6.28 g/kg rabbits	8x10^7 spores/kg rats 2.84 rats	all acute (IV)	>3077	>600 mg/l bluegill >370 trout	>25000 daphnia (LC50)	No effects 14 day exposure	LC50 copepod >50 mg/kg
Spinosad	3783 male rats >5000 female rats	>2000 rabbits	>5.18 rats	oral and dermal (IV)	>2000 mallard & bobwhite quail >5156 LC50 mallard & bobwhite quail	5.9 bluegill 30 trout 5 carp 7.9 sheepshead minnow	14000 daphnia	0.0029 contact/bee 0.053 (tech) oral LC50	Butterfly/moth LD50 = 0.022 mg/kg. LC50 worms >1000 mg/kg soil EC50 grass shrimp >9.76 ppm No effect on amphibians, lacewings, or ladybirds.
Methoprene and s-Methoprene	>10000 rats >5050 (s-methoprene)	>2000 rabbits >5050 rabbits (s-methoprene)	210 rats >2.38 rats (s-methoprene)	oral and inhalation (IV)	>2000 mallard >4640 chickens	>0.37 bluegill 0.76 trout	89 daphnia 380 daphnia (s-methoprene)	>1000 contact/bee >1000 oral	Frog LC50 >10,000 µg/L EC50 algae 1.33 mg/L NOEL (18 mo) mice 1000 ppm

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Alcohol Ethoxylated Surfactant (monomolecular film)	>20000 rats (Agnique™)	>2000 rabbits (Agnique™)	29 rats (Agnique™)	no documented toxicity	>2000 mallard (Agnique™) >5000 LC50 bobwhite quail (Agnique™)	290 bluegill (Agnique™) 98 trout (Agnique™)	51000 daphnia (Agnique™) No observable effects to shrimp, snails, worms, or mayfly naiads	no documented toxicity	No observable effects to amphibians.
Aliphatic solvents (mineral oils, aliphatic hydrocarbons, petroleum distillates)	>28000 (no deaths observed)	>2000 rats >5,000 rabbits	3.9 rats	oral & dermal (IV) inhalation (III)	>2250 bobwhite quail and mallard	no documented toxicity	<900 daphnia	no documented toxicity	EC50 oysters 6 mg/L
Potassium Salts (soap salts) (M-Pede™ & Insecticidal Soap™, MSDS)	>5000 rats (M-Pede™ & Insecticidal Soap™)	>2000 rabbits (M-Pede™ & Insecticidal Soap™)	0.853 rat (M-Pede™)	all acute effects (IV)	no documented toxicity	no documented toxicity	no documented toxicity	no documented toxicity	no documented toxicity
Chlorophacinone	3.15 - 6.26 rats 0.329 male rabbits	200 rabbits	0.007 rats (USEPA) 0.0093 rats	all acute effects (I) oral, dermal and inhalation	258 bobwhite quail 204 LC50 mallard 95 LC50 bobwhite quail	0.62 bluegill 0.35 trout	420 daphnia (LC50)	Not toxic to bees	Carnivorous mammals LD50 = 2.1 to 50 mg/kg Worms LC50 >1000 ppm
Diphacinone	2.3 rats 50-300 mice 35 rabbits	<200 rats 3.6 rabbits	<2.0 rats	all acute effects (I)	1630 bobwhite quail 3158 mallard	7.5 bluegill 2.8 trout 2.1 catfish	1800 daphnia (LC50)	no documented toxicity	Dog oral LD50 = 3 to 7.5 mg/kg, Cat oral LD50 14.7 mg/kg, Pig oral LD50 150 mg/kg
Brodifacoum	0.418 male rats 0.21 male rabbits 0.25 - 25 large mammals	3.16 female rats 5.21 male rats	0.00305 female rats 0.00486 male rats	all acute effects (I)	11.6 Japanese quail 4.5 chickens 0.26 - 0.31 mallard 2.7 LC50 mallard	0.025 - 0.165 bluegill 0.04 - 0.05 trout	450 daphnia (LC50)	Not toxic to bees	LD50 carnivores 0.27 to 25 mg/kg LC50 worms >994 mg/kg soil ErC50 algae >0.27 mg/L
Bromadiolone	1.31 rats 1.75 mice 1.0 rabbits	23.31 rats 1.71 rabbits	<0.02 rats 0.43 µg/kg	all acute effects (I)	134 Japanese quail 138 bobwhite quail	3.0 bluegill 0.24 - 2.89 trout	5790 daphnia 8800 daphnia (LC50)	Not toxic to bees	Carnivorous mammals LD50 1.125 to 25 mg/kg LC50 worms >1054 mg/kg dry weight ErC50 algae 1.14 mg/L
Bromethalin	2.11 rats 2.38-5.6 dogs 0.54 cats	1,000 male rabbits	0.024 rats	oral and inhalation (II)	4.56 bobwhite quail	0.038 trout 0.598 bluegill	2.0	no documented toxicity	NOEL rats and dogs 0.025 mg/kg/day
Difethialone	0.56 rats 1.29 mice	7.9 male rats 5.3 female rats	0.005 -0.0193 rats	Oral and dermal (I)	0.264 bobwhite quail 0.56 LC50 bobwhite quail 1.94 LC50 mallard ducklings	0.075 bluegill 0.051 trout	4.4 daphnia	no documented toxicity	Oral LD50 dog 4 to 11.8mg/kg Oral LD 50 cat <16 mg/kg Oral LD50 pig 2 to 3 mg/kg

Each of the chemicals listed in Table 6-1 has been tested to determine toxicity to humans and wildlife. While each listed chemical has had numerous values generated for a multitude of species and receptors, it would not be feasible to include all the possible toxicity data published for all species. The values in this table represent a portion of the toxicity data that the District uses as a guideline when considering the use of a pesticide as a part of its Integrated Vector Management Program. Toxicity values were taken from a range of sources, especially USEPA, CDPR, EXTOXNET, peer reviewed literature, and "*The Pesticide Manual*" published by the British Crop Protection Council (BCPC). The toxicity values included in table 6-1 are meant to provide a sense of the variety and range of values presented in the peer reviewed literature and other reference documents. .

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Cholecalciferol (vitamin D)	43.6 rats 42.5 mice	61 male rats 185 female rats >2000 rabbits	0.13-0.38 rats	Oral and dermal (III)	>2,000 mallard >2000 bobwhite quail	no documented toxicity	no documented toxicity	no documented toxicity	Oral LD50 dog 88 mg/kg
Sulfur (fumigant)	>5000 rats	>2000 rats	>5.43 rats 2.56 rats (98% sulfur)	Oral and dermal (IV)	>5000 bobwhite quail	>180 bluegill and trout	>665000 daphnia (LC50)	nontoxic	LC50 (14 d) worms >1600 mg/L soil Nontoxic to lacewings and ladybirds
Sodium Nitrate (fumigant)	3700 rats	<2000 rats	no documented toxicity	oral (III) dermal (IV)	no documented toxicity	no documented toxicity	no documented toxicity	no documented toxicity	Nontargets in burrow susceptible.
Imazapyr	>5000 rats 4800 rabbits >2000 female mice	>2000 rabbits >2000 rats	>5.1 rats	Formulation (IV) Eye (I)	>2150 bobwhite quail >2150 mallard >5000 LC50 bobwhite quail and mallard	>100 bluegill, trout, and catfish	>100000 daphnia (LC50)	>100 contact/bee	EC50 algae 59-85 µg/L NOEL (1 yr) dogs 250 mg/kg b.w.
Glyphosate	4300 (tech) rats >5000 rats >10,000 mice 3530 goats	≥ 2000 rats (tech) ≥ 5000 rabbits (salts)	≥4.43 (tech) rats >1.3 (salts) rats	oral and dermal (III)	>2000 bobwhite quail >4640 LC50 quail and duck	86 trout 120 bluegill 130 catfish >1000 sheepshead minnow	55000 to 780000 daphnia (LC50)	>100 contact/bee	LC50 Frogs 6.6 to 18.1mg/L EC50 frogs 111 to 343mg/L
Triclopyr	577 female rats 692 male rats 630 (tech) female rats 729 (tech) male rats	>2000 rabbits	>256 rats	oral and dermal (III) inhalation (IV) TBEE	1698 (tech) mallard >5000 LC50 mallard 2935 bobwhite quail	148 bluegill 117 (tech) trout 0.36 (TBEE)-bluegill	132000 daphnia (LC50)	>100 contact/bee	EC50 algae 45 mg/L NOEL (2 yr) mice 35.7mg/kg b.w.
2,4-D (2,4-dichlorophenoxy acetic acid)	639 to 1,646 rats 138 mice	>1600 rats 1829 to 2000 rabbits	0.78 - >5.4 rats, depending on formulation	Formulation (II)	>1000 mallard 668 Japanese quail & pigeon 472 pheasant	1 to >100 trout	235000 daphnia (LC50)	104.5 oral 104 to 115 LC50	LC50 (7 d) worms 860mg/kg soil NOEL (1 yr) dogs 1mg/kg b.w. EC50 algae 33.2 mg/L
Sulfometuron methyl	>5000 male rats	>2000 rabbits	5.0 rats	oral and inhalation (IV), dermal (III)	>5000 mallard >5620 bobwhite quail	>12.5 bluegill and trout	>12500 daphnia (LC50)	>100 contact/bee	EC25 values available for many non-target plants
Bentazon	>1000 rats >750 rabbits >500 dogs and cats	>2500 rats >4000 rabbits	5.1 rats	formulation (III) oral, dermal, inhalation (III)	1140 bobwhite quail >5000 LC50 bobwhite quail and mallard	>100 bluegill >100 trout	125000 daphnia (LC50)	>100 contact/bee	EC50 worms >1000mg/kg soil NOEL (1 yr) dog 13.1mg/kg b.w. Harmless to ground beetles EC50 algae 47.3 mg/L
Diuron	>4,721 male rats >5000 female rats	>2000 rabbits	>7.0 rats	Formulation (III)	>2000 mallard 1104 bobwhite quail 5000 LC50 mallard 1730 LC50 bobwhite quail	0.71 cutthroat trout 5.9 bluegill 14 fathead minnow 14.7 rainbow trout	1400 daphnia	>145 mg/kg contact/bee	LC50 worms >400 mg/kg soil EC50 scud 0.16 mg/L EC50 brown shrimp 1.0mg/L

Each of the chemicals listed in Table 6-1 has been tested to determine toxicity to humans and wildlife. While each listed chemical has had numerous values generated for a multitude of species and receptors, it would not be feasible to include all the possible toxicity data published for all species. The values in this table represent a portion of the toxicity data that the District uses as a guideline when considering the use of a pesticide as a part of its Integrated Vector Management Program. Toxicity values were taken from a range of sources, especially USEPA, CDPR, EXTOXNET, peer reviewed literature, and "*The Pesticide Manual*" published by the British Crop Protection Council (BCPC). The toxicity values included in table 6-1 are meant to provide a sense of the variety and range of values presented in the peer reviewed literature and other reference documents. .

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Active Ingredient	Mammalian Oral LD50 (mg/kg) Unless otherwise specified, values are for rats	Mammalian Dermal LD50 (mg/kg) Unless otherwise specified, values are for rabbits	Mammalian Inhalation LC50 (mg/L) Unless otherwise specified, values are for rats	USEPA Toxicity Rating	Avian LD50 (mg/kg) Unless otherwise specified, values are for mallard duck or bobwhite quail	Fish LC50 (mg/L) Unless otherwise specified, values are for rainbow trout or bluegill sunfish	Aquatic Invert EC50 (µg/L) Values are for *Daphnia* or similar species	Honeybee LD50 (µg/bee)	Other Receptors
Benfluralin (benefin)	>10000 rats >5000 mice >2000 dogs and rabbits	>5000 rabbits	>2.31 rats	oral & dermal (IV) formulation (II)	>2000 mallard, bobwhite quail, and chickens	0.065 bluegill 0.081 trout >1.1 sheepshead minnow	2180 daphnia (LC50)	Up to 100 ppm no effect	LC50 mysid shrimp 0.043 mg/L
Oryzalin	>10000 rats & gerbils >1000 dogs & cats	>2000 rabbits	>3.1 rats	Formulation (III)	>500 mallard and bobwhite quail >1000 chickens > 5000 LC50 mallard	2.88 bluegill 3.26 trout	1400 daphnia (LC50)	>11 contact/bee 25 oral	NOEC worms >102.6mg/kg soil
DCPA (chlorthal dimethyl) [metabolite is tetrachloroterephthalic acid (TPA)]	>10000 rats	>2000 rabbits	>4.48 rats	formulation (IV)	>2250 bobwhite quail >5620 LC50 bobwhite quail and mallard	>5.4 bluegill >4.7 trout	4600 daphnia (LC50)	>230 contact/bee	Oral LD50 10000 mg/kg dog
Dithiopyr	>5000 rats	>5,000 rats & rabbits	>5.98 rats	Formulation (III)	>2250 bobwhite quail >5620 LC50 bobwhite quail and mallard	0.7 bluegill & carp 0.5 trout	1100 daphnia (LC50)	>80 contact/bee	LC50 worms >1000mg/kg NOEL (1 yr) dogs <0.5mg/kg b.w.
Metolachlor	1936 male rats 1063 female rats	> 5050 rats	>2.02 rats	formulation (III)	>2150 bobwhite quail & mallard >10000 LC50 bobwhite quail & mallard	10 bluegill 4.9 carp 3.9 trout	25,000 daphnia (LC50)	>110 contact and oral/bee	LC50 worms 140 mg/kg soil NOEL (90 d) 300 mg/kg EC50 algae 0.1 mg/L
Pendimethalin	1050 to >5000 rats >2900 mice >5000 rabbits and dogs	>2000 rabbits	>320 rats	Oral (III) Dermal and inhalation (IV) formulation (III)	1,421 mallard 4187 LC50 bobwhite quail	0.138 – 0.89 trout 0.707 sheepshead minnow	400 daphnia 0.28 (tech) daphnia LC50 5.1 (formulation) daphnia LC50	>100 contact/bee 101.2 oral	EC50 worms >1000mg/kg soil NOEC (30 d) Chironomus riparius 0.138 mg/L EbC50 algae 0.018mg/L
Alkylphenol ethoxylate (APE)	600 to >10,000 rats	>0.22 rats	>2000 rats	low acute (III)	no documented toxicity	8.9 minnow 1.5 to 6.4 trout	460 to 740 daphnia	no documented toxicity	LC50 snails 774 µg/L
Polydimethyl-siloxane Fluids	>5000 rat	>10000 rabbit	>535 rats	no documented toxicity	no documented toxicity	no documented toxicity	>1000 mg/kg in sediment	no documented toxicity	Relatively nontoxic to benthic invertebrates.
Modified Plant Oils and Methylated Seed Oil (Competitor™ & MSO™, MSDS)	>5000 rats (Competitor™ & MSO™)	>4000 rats (MSO™) >5000 rabbits (Competitor™)	2.01 rats (MSO™)	no documented toxicity	No documented toxicity	95 rainbow trout (Competitor™)	>100 daphnia (Competitor™)	no documented toxicity	no documented toxicity
Coconut oil (MSDS COCOBEAR, >80% fatty acids 10% mineral oil)	>5000 mg/kg rats	>5050 mg/kg rats	>2.16 mg/L	No documented toxicity	>2250 mg/kg	>1000 mg/L	> 10000 mg/L microbes	no documented toxicity	no documented toxicity
Lecithin (Liberate™, MSDS)	>5000 male rat (Liberate™)	>2000 rabbit (Liberate™)	no documented toxicity	no documented toxicity	no documented toxicity	17.6 trout (Liberate™)	9300 daphnia (Liberate™)	no documented toxicity	no documented toxicity

Each of the chemicals listed in Table 6-1 has been tested to determine toxicity to humans and wildlife. While each listed chemical has had numerous values generated for a multitude of species and receptors, it would not be feasible to include all the possible toxicity data published for all species. The values in this table represent a portion of the toxicity data that the District uses as a guideline when considering the use of a pesticide as a part of its Integrated Vector Management Program. Toxicity values were taken from a range of sources, especially USEPA, CDPR, EXTOXNET, peer reviewed literature, and "*The Pesticide Manual*" published by the British Crop Protection Council (BCPC). The toxicity values included in table 6-1 are meant to provide a sense of the variety and range of values presented in the peer reviewed literature and other reference documents. .

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Ecological & Human Health
Assessment Report

ATTACHMENT

A

CHEMICAL USE DATA SUBMITTED
BY DISTRICTS

List of Tables

Table A1. Pesticide Application Data for Summer 2011 – ACMAD

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	Altosid Liquid conc. - # Treatments	Total Amount Used11	Total Amount Type12
Canals						8	40.5	Product	Pounds									
Catchbasins						2	15	Product	Pounds		116	6.3	Product	Gallons		2	1	Product
Containers	1	0.5	Product	Ounces (volume)		3	10	Product	Pounds									
Creeks						9	51.6	Product	Pounds									
Ditches						5	12.3	Product	Pounds									
Gutters																		
Leaks						2	0.9	Product	Pounds									
Marshes, fresh						1	3	Product	Pounds									
Marshes, reclaimed						7	64	Product	Pounds									
Marshes, tidal						8	99	Product	Pounds									
Mixed CB/UV/Sumps						15	7.8	Product	Pounds									
Natural Ponds						7	43.5	Product	Pounds									
Ornamental Ponds						21	6.4	Product	Pounds									
Overwatering																		
Rainwater						4	8.1	Product	Pounds									
Sanitary																		
Seepages						14	6.7	Product	Pounds									
Spas																		
Stormdrains																		
Swimming Pools						4	3.6	Product	Pounds									
Tires																		
TreeHoles																		
Under building						1	0.6	Product	Pounds									
Vaults																		
Wells																		
Totals	1	0.5				111	373	Product	Pounds		116	6.3	Product	Gallons		2	1	Product

Table A1.

Application Sites:	Total Amount_Unit12	Altosid Liquid conc. Comments	Altosid Briquets - # Treatments	Total Amount_Used13	Total Amount_Type14	Total Amount Unit14	Altosid Briquets Comments	BVA-2 - # Treatments	Total Amount_Used17	Total Amount_Type18	Total Amount_Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount_Used19	Total Amount_Type20	Total Amount_Unit20	VectoLex CG Comments	Pyrenone 25-5 - # Treatments
Canals			5	10.7	Product	Ounces (weight)		13	54.4	Product	Gallons		6	216.5	Product	Pounds		
Catchbasins	Ounces (volume)		11	35.4	Product	Ounces (weight)		33	20.6	Product	Gallons							
Containers													1	0.03				
Creeks			6	13.7	Product	Ounces (weight)		13	2.5	Product	Gallons		14	43.1	Product	Pounds		
Ditches			5	7.2	Product	Ounces (weight)		5	1.1	Product	Gallons		7	43.2	Product	Pounds		1
Gutters																		
Leaks													2	0.9	Product	Pounds		
Marshes, fresh								3	41.3	Product	Gallons		1	3	Product	Pounds		
Marshes, reclaimed								1	2	Product	Gallons		7	72	Product	Pounds		
Marshes, tidal																		
Mixed CB/UV/Sumps			3	4.4	Product	Ounces (weight)		5	2.7	Product	Gallons		14	3.8	Product	Pounds		
Natural Ponds			2	2.1	Product	Ounces (weight)		3	0.7	Product	Gallons		7	40.5	Product	Pounds		
Ornamental Ponds			5	10.9	Product	Ounces (weight)		9	0.2	Product	Gallons		19	6.4	Product	Pounds		
Overwatering								1	0.02	Product	Gallons							
Rainwater			1	0.2	Product	Ounces (weight)		3	4.5	Product	Gallons		4	24.1	Product	Pounds		
Sanitary			1	4.8	Product	Ounces (weight)		7	1.44	Product	Gallons		7	68	Product	Pounds		
Seepages			2	3.8	Product	Ounces (weight)		2	0.69	Product	Gallons		16	9.7	Product	Pounds		
Spas								1	0.004									
Stormdrains			1	3.8	Product	Ounces (weight)							1	5	Product	Pounds		
Swimming Pools								17	0.4	Product	Gallons		2	0.1	Product	Pounds		
Tires																		
TreeHoles																		
Under building													1	0.6	Product	Pounds		
Vaults								2	0.02									
Wells								1	0.02									
Totals	Ounces (volume)		42	97	Product	Ounces (weight)		119	132.594	Product	Gallons		109	536.93	Product	Pounds		1

Table A1.

Application Sites:	Total Amount_Used29	Total Amount_Type30	Total Amount_Unit30	Pyrenone 25-5 Comments	Altosid XR-Briquets - # Treatments	Total Amount_Used37	Total Amount_Type38	Total Amount_Unit38	Altosid XR-Briquets Comments	FourStar 180 Bs - # Treatments	Total Amount Used1315	Total Amount Type1416	Total Amount Unit1417	FourStar 180 Bs Comments	Natular G30 - # Treatments	Total Amount Used1924	Total Amount Type2025	Total Amount Unit2026
Canals					2	3.9	Product	Ounces (weight)		3	1.6	Product	Pounds		3	16	Product	Pounds
Catchbasins					8	37.4	Product	Ounces (weight)		11	4.8	Product	Pounds					
Containers					1	2.6	Product	Ounces (weight)		3	0.4	Product	Pounds					
Creeks					2	21.9	Product	Ounces (weight)		6	4.8	Product	Pounds		1	4	Product	Pounds
Ditches	5	Product	Ounces (volume)							4	3.4	Product	Pounds					
Gutters																		
Leaks																		
Marshes, fresh					1	7.7	Product	Ounces (weight)										
Marshes, reclaimed										2	3.1	Product	Pounds					
Marshes, tidal																		
Mixed CB/UV/Sumps					2	14.2	Product	Ounces (weight)		4	1.2	Product	Pounds					
Natural Ponds										3	1	Product	Pounds		2	21	Product	Pounds
Ornamental Ponds					13	42.5	Product	Ounces (weight)		5	0.9	Product	Pounds					
Overwatering																		
Rainwater																		
Sanitary										1	1.3	Product	Pounds					
Seepages																		
Spas										1	0.1	Product	Pounds					
Stormdrains																		
Swimming Pools					8	119.9	Product	Ounces (weight)		9	4.6	Product	Pounds					
Tires																		
TreeHoles																		
Under building										1	0.1	Product	Pounds					
Vaults					1	1.3	Product	Ounces (weight)										
Wells																		
Totals	5	Product	Ounces (volume)		38	251.4	Product	Ounces (weight)		42	27.3	Product	Pounds		109	41	Product	Pounds

Table A1.

Application Sites:	Natular G30 Comments	Natular XRT - # Treatments	Total Amount Used2127	Total Amount Type2228	Total Amount Unit2229	Natular XRT Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Altosid Pellets - # Treatments	Total Amount_Used	Total Amount_Type	Total Amount_Unit	Altosid Pellets Comments	Golden Bear Oil - # Treatments	Total Amount_Used
Canals		2	2.8	Product	Pounds												2	0.3
Catchbasins		69	218	Product	Pounds		168	111.6	Product	Pounds							14	2.4
Containers												4	192	Product	Ounces (weight)		5	0.8
Creeks		7	4.2	Product	Pounds							1	32	Product	Ounces (weight)			
Ditches		4	7.5	Product	Pounds												2	5
Gutters		1	0.5	Product	Pounds												1	0.2
Leaks																		
Marshes, fresh																		
Marshes, reclaimed																		
Marshes, tidal												1	240	Product	Ounces (weight)			
Mixed CB/UV/Sumps		7	3.1	Product	Pounds												4	0.3
Natural Ponds		1	1.1	Product	Pounds													
Ornamental Ponds		10	7.5	Product	Pounds												5	0.3
Overwatering												1	4	Product	Ounces (weight)			
Rainwater		1	1	Product	Pounds												1	0.001
Sanitary		4	13.9	Product	Pounds												2	0.5
Seepages		1	0.7	Product	Pounds							1	48	Product	Ounces (weight)		2	0.02
Spas																		
Stormdrains		1	1.1	Product	Pounds												1	3
Swimming Pools		16	21.1	Product	Pounds												8	0.8
Tires																		
TreeHoles																		
Under building																	4	0.1
Vaults																		
Wells		1	0.4	Product	Pounds													
Totals		125	282.9	Product	Pounds		168	111.6	Product	Pounds		8	516	Product	Ounces (weight)		51	13.721

Table A1.

Application Sites:	Total Amount Type	Total Amount Unit	Golden Bear Oil Comments	Vectolex WSP - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectolex WSP Comments	VectoMAX CG - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	VectoMAX CG Comments
Canals	Product	Gallons		1	1.5	Product	Pounds		3	7	Product	Pounds	
Catchbasins	Product	Gallons		23	6.1	Product	Pounds						
Containers	Product	Gallons		4	0.7	Product	Pounds						
Creeks				3	1.5	Product	Pounds		3	8	Product	Pounds	
Ditches	Product	Gallons							3	10	Product	Pounds	
Gutters	Product	Gallons		1	0.1	Product	Pounds						
Leaks													
Marshes, fresh									3	13	Product	Pounds	
Marshes, reclaimed													
Marshes, tidal													
Mixed CB/UV/Sumps	Product	Gallons		2	0.2	Product	Pounds						
Natural Ponds									1	5	Product	Pounds	
Ornamental Ponds	Product	Gallons		27	2.5	Product	Pounds						
Overwatering				2	0.2	Product	Pounds						
Rainwater				4	0.5	Product	Pounds		1	3	Product	Pounds	
Sanitary	Product	Gallons		4	1.6	Product	Pounds						
Seepages				10	0.8	Product	Pounds						
Spas													
Stormdrains	Product	Gallons		1	0.9	Product	Pounds						
Swimming Pools	Product	Gallons		10	2.4	Product	Pounds						
Tires													
TreeHoles													
Under building	Product	Gallons		3	0.7	Product	Pounds						
Vaults													
Wells													
Totals	Product	Gallons		95	19.7	Product	Pounds		11	46	Product	Pounds	

Table A2. Pesticide Application Data for Fall 2011 – ACMAD

Application Sites:	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	Altosid Briquets - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid Briquets Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18
Canals	5	45	Product	Pounds							1	2.7	Product	Ounces (weight)		4	6	Product	Gallons
Catchbasins						16	1.1	Product	Gallons		2	0.8	Product	Ounces (weight)		6	10.2	Product	Gallons
Containers	1	6	Product	Pounds															
Creeks	5	16.5	Product	Pounds												3	5	Product	Gallons
Ditches	6	83	Product	Pounds															
Gutters																			
Leaks																			
Marshes, fresh	1	10	Product	Pounds															
Marshes, reclaimed	17	261	Product	Pounds		1	0.1	Product	Gallons							7	89.1	Product	Gallons
Marshes, tidal	5	25	Product	Pounds															
Mixed CB/UV/Sumps	3	0.8	Product	Pounds															
Natural Ponds	3	9.5	Product	Pounds															
Ornamental Ponds	8	38.2	Product	Pounds							3	1.1	Product	Ounces (weight)					
Overwatering																			
Rainwater	6	48	Product	Pounds												2	2	Product	Gallons
Sanitary																1	0.2	Product	Gallons
Seepages	1	0.25	Product	Pounds							1	2.9	Product	Ounces (weight)					
Spas																			
Stormdrains											1	1	Product	Ounces (weight)					
Swimming Pools	1	0.16	Product	Pounds												1	0.02	Product	Gallons
Tires																			
TreeHoles																			
Under building	2	1	Product	Pounds							2	1.9	Product	Ounces (weight)					
Vaults																			
Wells																			
Totals	64	544.41	Product	Pounds		17	1.2	Product	Gallons		10	10.4	Product	Ounces (weight)		24	112.52	Product	Gallons

Table A2.

Application Sites:	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	Altosid XR-Briquets - # Treatments	Total Amount Used37	Total Amount Type38	Total Amount Unit38	Altosid XR-Briquets Comments	FourStar 180 Bs - # Treatments	Total Amount Used1315	Total Amount Type1416	Total Amount Unit1417	FourStar 180 Bs Comments	Natular XRT - # Treatments
Canals		1	2	Product	Pounds												
Catchbasins																	1
Containers												1	0.1	Product	Pounds		
Creeks		1	0.5	Product	Pounds		1	2.6	Product	Ounces (weight)		1	0.3	Product	Pounds		3
Ditches		3	53	Product	Pounds												
Gutters																	
Leaks																	
Marshes, fresh		1	10	Product	Pounds												
Marshes, reclaimed		6	169	Product	Pounds												
Marshes, tidal		4	200	Product	Pounds												
Mixed CB/UV/Sumps		3	0.8	Product	Pounds		1	5.2	Product	Ounces (weight)							
Natural Ponds		2	13.5	Product	Pounds												1
Ornamental Ponds		5	4.2	Product	Pounds		3	9	Product	Ounces (weight)		1	0.1	Product	Pounds		1
Overwatering																	
Rainwater		1	9	Product	Pounds		1	2.6	Product	Ounces (weight)		2	0.6	Product	Pounds		
Sanitary		3	35	Product	Pounds												
Seepages		1	0.3	Product	Pounds												
Spas																	
Stormdrains							1	3.9	Product	Ounces (weight)							
Swimming Pools		1	0.2	Product	Pounds		2	20.6	Product	Ounces (weight)		2	0.8	Product	Pounds		4
Tires																	
TreeHoles																	
Under building		2	1	Product	Pounds												
Vaults																	
Wells																	
Totals		34	498.5	Product	Pounds		9	43.9	Product	Ounces (weight)		7	1.9	Product	Pounds		10

Table A2.

Application Sites:	Total Amount Used2127	Total Amount Type2228	Total Amount_Unit2229	Natular XRT Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Golden Bear Oil - # Treatments	Total Amount_Used	Total Amount_Type	Total Amount_Unit	Golden Bear Oil Comments	Vectolex WSP - # Treatments	Total Amount_Used	Total Amount_Type	Total Amount_Unit	Vectolex WSP Comments
Canals															5	2.6	Product	Pounds	
Catchbasins	0.7	Product	Pounds		16	8.7	Product	Pounds		1	0.03	Product	Gallons		10	0.3	Product	Pounds	
Containers										4	0.47	Product	Gallons		3	0.1	Product	Pounds	
Creeks	1.5	Product	Pounds													0.1	Product	Pounds	
Ditches															2	0.2	Product	Pounds	
Gutters																			
Leaks																			
Marshes, fresh																			
Marshes, reclaimed					1	0.5	Product	Pounds		1	1	Product	Gallons		2	1.6	Product	Pounds	
Marshes, tidal																			
Mixed CB/UV/Sumps										4	0.21	Product	Gallons		1	1.2	Product	Pounds	
Natural Ponds	0.1	Product	Pounds																
Ornamental Ponds	0.2	Product	Pounds							5	0.02	Product	Gallons		7	0.9	Product	Pounds	
Overwatering															1	0.2	Product	Pounds	
Rainwater															2	1.2	Product	Pounds	
Sanitary															1	3.3	Product	Pounds	
Seepages																			
Spas																			
Stormdrains										1	0.02	Product	Gallons						
Swimming Pools	5.2	Product	Pounds							3	0.3	Product	Gallons		6	1.7	Product	Pounds	
Tires																			
TreeHoles																			
Under building										1	0.01	Product	Gallons		2	0.1	Product	Pounds	
Vaults																			
Wells																			
Totals	7.7	Product	Pounds		17	9.2	Product	Pounds		20	2.06	Product	Gallons		42	13.5	Product	Pounds	

Table A2.

Application Sites:	VectoMAX CG - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	VectoMAX CG Comments	Skeeter Abate - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Skeeter Abate Comments
Canals	5	5	Product	Pounds		1	10	Product	Pounds	
Catchbasins										
Containers										
Creeks	4	19	Product	Pounds						
Ditches	2	4	Product	Pounds						
Gutters										
Leaks										
Marshes, fresh	1	1	Product	Pounds						
Marshes, reclaimed										
Marshes, tidal										
Mixed CB/UV/Sumps										
Natural Ponds	1	5	Product	Pounds						
Ornamental Ponds	3	1.7	Product	Pounds						
Overwatering										
Rainwater	3	2.8	Product	Pounds		1	7	Product	Pounds	
Sanitary						1	10	Product	Pounds	
Seepages										
Spas										
Stormdrains										
Swimming Pools										
Tires										
TreeHoles										
Under building										
Vaults										
Wells										
Totals	19	38.5	Product	Pounds		3	27	Product	Pounds	

Table A3. Pesticide Application Data for Winter 2012 – ACMAD

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	Altosid Liquid conc. - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit12
Canals						8	45.8	Product	Pounds										
Catchbasins																			
Containers						2	0.1	Product	Pounds										
Creeks						8	44.5	Product	Pounds										
Ditches						6	36.3	Product	Pounds		1	0.4	Product	Gallons					
Gutters																			
Leaks																			
Marshes, fresh						2	25	Product	Pounds										
Marshes, reclaimed						10	114	Product	Pounds		31	17.5	Product	Gallons		27	123.5	Product	Ounces (volume)
Marshes, tidal						9	118	Product	Pounds										
Mixed CB/UV/Sumps						6	1.6	Product	Pounds										
Natural Ponds						6	50.9	Product	Pounds		3	0.6	Product	Gallons		3	4.9	Product	Ounces (volume)
Ornamental Ponds	1	0.5	Product	Ounces (volume)		8	2.2	Product	Pounds										
Overwatering																			
Rainwater						16	117.2	Product	Pounds										
Sanitary																			
Seepages						2	4.5	Product	Pounds										
Spas																			
Stormdrains																			
Swimming Pools																			
Tires																			
TreeHoles						1	0.1	Product	Pounds										
Under building																			
Vaults																			
Wells																			
Totals	1	0.5	Product	Ounces (volume)		84	560.2	Product	Pounds		35	18.5	Product	Gallons		30	128.4	Product	Ounces (volume)

Table A3.

Application Sites:	Altosid Liquid conc. Comments	Altosid Briquets - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid Briquets Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	Altosid WSP (pellets) - # Treatments	Total Amount Used23	Total Amount Type24
Canals												7	5.8	Product	Pounds				
Catchbasins							1	0.01	Product	Gallons									
Containers		2	38.3	Product	Ounces (weight)							2	0.1	Product	Pounds				
Creeks		2	13.5	Product	Ounces (weight)		1	3	Product	Gallons		6	19.5	Product	Pounds		1	2.5	Product
Ditches		2	6.5	Product	Ounces (weight)		1	3	Product	Gallons		4	6.3	Product	Pounds		1	8.6	Product
Gutters																			
Leaks																			
Marshes, fresh							1	0.2	Product	Gallons									
Marshes, reclaimed							3	9.2	Product	Gallons		2	45	Product	Pounds				
Marshes, tidal							1	0.1	Product	Gallons		6	50	Product	Pounds		1	61.6	Product
Mixed CB/UV/Sumps		2	0.8	Product	Ounces (weight)							6	1.6	Product	Pounds				
Natural Ponds							1	1	Product	Gallons		5	11	Product	Pounds		1	12.3	Product
Ornamental Ponds		5	1.9	Product	Ounces (weight)		10	0.1	Product	Gallons		9	2.1	Product	Pounds		1	0.2	Product
Overwatering																			
Rainwater							3	9.8	Product	Gallons		11	71.1	Product	Pounds				
Sanitary							1	0.2	Product	Gallons		2	13.5	Product	Pounds				
Seepages							1	0.01	Product	Gallons		2	10.5	Product	Pounds				
Spas																			
Stormdrains																			
Swimming Pools							6	0.2	Product	Gallons									
Tires																			
TreeHoles							8	0.2	Product	Gallons		1	0.1	Product	Pounds				
Under building																			
Vaults																			
Wells																			
Totals		13	61	Product	Ounces (weight)		38	27.02	Product	Gallons		63	236.6	Product	Pounds		5	85.2	Product

Table A3.

Application Sites:	Total Amount Unit24	Altosid WSP (pellets) Commnets	Altosid XR-Briquets - # Treatments	Total Amount Used37	Total Amount Type38	Total Amount Unit38	Altosid XR-Briquets Comments	FourStar 180 Bs - # Treatments	Total Amount Used1315	Total Amount Type1416	Total Amount Unit1417	FourStar 180 Bs Comments	Natular G30 - # Treatments	Total Amount Used1924	Total Amount Type2025	Total Amount Unit2026	Natular G30 Comments
Canals																	
Catchbasins			2	14.2	Product	Ounces (weight)											
Containers			2	16.8	Product	Ounces (weight)		1	0.3	Product	Pounds						
Creeks	Ounces (weight)		1	1.3	Product	Ounces (weight)							1	0.3	Product	Pounds	
Ditches	Ounces (weight)												1	10	Product	Pounds	
Gutters																	
Leaks																	
Marshes, fresh																	
Marshes, reclaimed																	
Marshes, tidal	Ounces (weight)																
Mixed CB/UV/Sumps			1	2.6	Product	Ounces (weight)											
Natural Ponds	Ounces (weight)																
Ornamental Ponds	Ounces (weight)		7	11.6	Product	Ounces (weight)		4	1	Product	Pounds		1	0.5	Product	Pounds	
Overwatering																	
Rainwater								1	0.9	Product	Pounds						
Sanitary																	
Seepages													1	3	Product	Pounds	
Spas																	
Stormdrains																	
Swimming Pools			3	28.4	Product	Ounces (weight)		2	0.9	Product	Pounds						
Tires																	
TreeHoles																	
Under building																	
Vaults																	
Wells																	
Totals	Ounces (weight)		16	74.9	Product	Ounces (weight)		13	61	Product	Pounds		63	236.6	Product	Pounds	

Table A3.

Application Sites:	Natular XRT - # Treatments	Total Amount Used2127	Total Amount Type2228	Total Amount Unit2229	Natular XRT Comments	Altosid Pellets - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Pellets Comments	Golden Bear Oil - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Golden Bear Oil Comments	Vectolex WSP - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit
Canals																			
Catchbasins	1	0.1	Product	Pounds							1	0.3	Product	Gallons		1	0.04	Product	Pounds
Containers	1	0.4	Product	Pounds		1	0.5	Product	Ounces (weight)							3	0.3	Product	Pounds
Creeks	1	2.9	Product	Pounds		4	157	Product	Ounces (weight)										
Ditches						2	60	Product	Ounces (weight)		1	1.5	Product	Gallons					
Gutters																			
Leaks																			
Marshes, fresh																			
Marshes, reclaimed	1	1.2	Product	Pounds												3	1.3	Product	Pounds
Marshes, tidal											1	0.3	Product	Gallons		2	0.3	Product	Pounds
Mixed CB/UV/Sumps																			
Natural Ponds	1	3.7	Product	Pounds															
Ornamental Ponds	5	1.6	Product	Pounds							2	0.05	Product	Gallons		9	0.9	Product	Pounds
Overwatering																			
Rainwater						1	3	Product	Ounces (weight)							2	1	Product	Pounds
Sanitary											1	0.03	Product	Gallons		1	0.04	Product	Pounds
Seepages																3	0.3	Product	Pounds
Spas																			
Stormdrains																			
Swimming Pools	8	9.2	Product	Pounds		1	15	Product	Ounces (weight)							1	0.04	Product	Pounds
Tires																			
TreeHoles						12	18.5	Product	Ounces (weight)		3	0.7	Product	Gallons		1	0.02	Product	Pounds
Under building																			
Vaults																			
Wells																			
Totals	18	19.1	Product	Pounds		21	254	Product	Ounces (weight)		9	2.88	Product	Gallons		26	4.24	Product	Pounds

Table A3.

Application Sites:	Vectolex WSP Comments	VectoMAX CG - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	VectoMAX CG Comments
Canals		5	9	Product	Pounds	
Catchbasins						
Containers						
Creeks		2	3.5	Product	Pounds	
Ditches		2	2.5	Product	Pounds	
Gutters						
Leaks						
Marshes, fresh						
Marshes, reclaimed						
Marshes, tidal						
Mixed CB/UV/Sumps						
Natural Ponds						
Ornamental Ponds						
Overwatering						
Rainwater		1	14	Product	Pounds	
Sanitary						
Seepages		1	2	Product	Pounds	
Spas						
Stormdrains						
Swimming Pools						
Tires						
TreeHoles						
Under building						
Vaults						
Wells						
Totals		11	31	Product	Pounds	

Table A4. **Pesticide Application Data for Spring 2012 – ACMAD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	Altosid Liquid conc. - # Treatments	Total Amount Used11	Total Amount Type12
Canals						10	22	Product	Pounds		1	0.6	Product	Gallons		1	4.9	Product
Catchbasins											29	0.9	Product	Gallons				
Containers						6	2.4	Product	Pounds									
Creeks						12	82.6	Product	Pounds									
Ditches						7	31	Product	Pounds		3	0.9	Product	Gallons		1	1	Product
Gutters																		
Leaks																		
Marshes, fresh						4	84.5	Product	Pounds		1	0.2	Product	Gallons				
Marshes, reclaimed						12	104.5	Product	Pounds		21	11.5	Product	Gallons		15	69.7	Product
Marshes, tidal						14	238.5	Product	Pounds		1	0.6	Product	Gallons		1	4.9	Product
Mixed CB/UV/Sumps						5	0.9	Product	Pounds									
Natural Ponds						6	35.5	Product	Pounds									
Ornamental Ponds	1	1	Product	Ounces (volume)		37	8.5	Product	Pounds									
Overwatering																		
Rainwater						18	152.7	Product	Pounds		1	0.6	Product	Gallons		1	4.9	Product
Sanitary						1	2	Product	Pounds									
Seepages						4	5.7	Product	Pounds									
Spas																		
Stormdrains																		
Swimming Pools						6	1.5	Product	Pounds									
Tires																		
TreeHoles																		
Under building																		
Vaults																		
Wells																		
Totals	1	1	Product	Ounces (volume)		142	772.3	Product	Pounds		57	15.3	Product	Gallons		19	85.4	Product

Table A4.

Application Sites:	Total Amount Unit12	Altosid Liquid conc. Comments	Altosid Briquets - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid Briquets Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	Altosid WSP (pellets) - # Treatments
Canals	Ounces (volume)		1	11	Product	Ounces (weight)		8	3.1	Product	Gallons		9	21	Product	Pounds		
Catchbasins			2	51.4	Product	Ounces (weight)		88	19.6	Product	Gallons							
Containers			1	1	Product	Ounces (weight)		4	0.1	Product	Gallons		5	2.3	Product	Pounds		
Creeks			1	9.5	Product	Ounces (weight)		6	9.4	Product	Gallons		6	21.6	Product	Pounds		
Ditches	Ounces (volume)							4	61	Product	Gallons		7	56	Product	Pounds		1
Gutters																		
Leaks																		
Marshes, fresh								1	0.2	Product	Gallons		1	4.5	Product	Pounds		
Marshes, reclaimed	Ounces (volume)							21	476.3	Product	Gallons		4	25.5	Product	Pounds		
Marshes, tidal	Ounces (volume)							2	6	Product	Gallons		1	10	Product	Pounds		
Mixed CB/UV/Sumps			3	5.9	Product	Ounces (weight)		11	15.6	Product	Gallons		5	0.9	Product	Pounds		
Natural Ponds			1	11.4	Product	Ounces (weight)		5	35.5	Product	Gallons		4	24.5	Product	Pounds		
Ornamental Ponds			4	2.3	Product	Ounces (weight)		25	2.7	Product	Gallons		24	6.3	Product	Pounds		
Overwatering																		
Rainwater	Ounces (volume)		2	5	Product	Ounces (weight)		4	6.8	Product	Gallons		11	50.2	Product	Pounds		
Sanitary								5	0.5	Product	Gallons		6	13.6	Product	Pounds		
Seepages			1	1	Product	Ounces (weight)		2	0.02	Product	Gallons		2	4.5	Product	Pounds		
Spas								2	0.01	Product	Gallons							
Stormdrains								10	0.3	Product	Gallons							
Swimming Pools			2	3.6	Product	Ounces (weight)		31	1	Product	Gallons		4	1.1	Product	Pounds		
Tires																		
TreeHoles													2	0.1	Product	Pounds		
Under building								1	0.03	Product	Gallons							
Vaults								2	0.05	Product	Gallons							
Wells																		
Totals	Ounces (volume)		18	102.1	Product	Ounces (weight)		232	638.21	Product	Gallons		91	242.1	Product	Pounds		1

Table A4.

Application Sites:	Total Amount_Used23	Total Amount_Type24	Total Amount_Unit24	Altosid WSP (pellets) Commnets	Altosid XR-Briquets - # Treatments	Total Amount_Used37	Total Amount_Type38	Total Amount_Unit38	Altosid XR-Briquets Comments	FourStar 180 Bs - # Treatments	Total Amount Used1315	Total Amount Type1416	Total Amount Unit1417	FourStar 180 Bs Comments	Natular G30 - # Treatments	Total Amount Used1924	Total Amount Type2025
Canals															1	12	Product
Catchbasins					17	226.8	Product	Ounces (weight)		6	2	Product	Pounds		1	1.3	Product
Containers					4	33.5	Product	Ounces (weight)									
Creeks					3	55.4	Product	Ounces (weight)							5	11.3	Product
Ditches	7.4	Product	Ounces (weight)														
Gutters																	
Leaks																	
Marshes, fresh																	
Marshes, reclaimed																	
Marshes, tidal					1	58	Product	Ounces (weight)									
Mixed CB/UV/Sumps					1	2.6	Product	Ounces (weight)		7	4.2	Product	Pounds				
Natural Ponds					1	15.5	Product	Ounces (weight)							2	14	Product
Ornamental Ponds					12	19.3	Product	Ounces (weight)		6	0.9	Product	Pounds		1	0.6	Product
Overwatering																	
Rainwater					3	24.5	Product	Ounces (weight)							1	4	Product
Sanitary										1	0.5	Product	Pounds				
Seepages															1	2	Product
Spas																	
Stormdrains					3	41.2	Product	Ounces (weight)		1	0.2	Product	Pounds				
Swimming Pools					2	19.3	Product	Ounces (weight)		4	2.4	Product	Pounds				
Tires																	
TreeHoles																	
Under building																	
Vaults					1	5.2	Product	Ounces (weight)									
Wells																	
Totals	7.4	Product	Ounces (weight)		48	501.3	Product	Ounces (weight)		18	102.1	Product	Pounds		91	242.1	Product

Table A4.

Application Sites:	Total Amount Unit2026	Natular G30 Comments	Natular XRT - # Treatments	Total Amount Used2127	Total Amount Type2228	Total Amount Unit2229	Natular XRT Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Altosid Pellets - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Pellets Comments	Golden Bear Oil - # Treatments
Canals	Pounds		6	7.7	Product	Pounds							1	48	Product	Ounces (weight)		
Catchbasins	Pounds		86	59.6	Product	Pounds		29	7.3	Product	Pounds							1
Containers			6	3.1	Product	Pounds												
Creeks	Pounds		11	25.8	Product	Pounds							4	272	Product	Ounces (weight)		
Ditches			3	1.2	Product	Pounds							1	16	Product	Ounces (weight)		
Gutters																		
Leaks																		
Marshes, fresh																		
Marshes, reclaimed			1	0.4	Product	Pounds							5	928	Product	Ounces (weight)		
Marshes, tidal													13	2744	Product	Ounces (weight)		
Mixed CB/UV/Sumps			10	12.4	Product	Pounds												
Natural Ponds	Pounds		3	3.3	Product	Pounds												
Ornamental Ponds	Pounds		34	18.3	Product	Pounds												4
Overwatering																		
Rainwater	Pounds		1	1	Product	Pounds												1
Sanitary			3	12.1	Product	Pounds												
Seepages	Pounds		3	0.4	Product	Pounds							3	3.2	Product	Ounces (weight)		
Spas			1	0.1	Product	Pounds												
Stormdrains			9	6.3	Product	Pounds												
Swimming Pools			67	66.8	Product	Pounds												
Tires																		
TreeHoles													1	1.5	Product	Ounces (weight)		1
Under building			2	1	Product	Pounds												
Vaults			2	0.2	Product	Pounds												
Wells																		
Totals	Pounds		248	219.7	Product	Pounds		29	7.3	Product	Pounds		28	4012.7	Product	Ounces (weight)		7

Table A4.

Application Sites:	Total Amount Used	Total Amount Type	Total Amount Unit	Golden Bear Oil Comments	Vectolex WSP - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectolex WSP Comments
Canals					2	0.8	Product	Pounds	
Catchbasins	0.01	Product	Gallons		4	5.1	Product	Pounds	
Containers					2	0.1	Product	Pounds	
Creeks									
Ditches					2	0.2	Product	Pounds	
Gutters									
Leaks									
Marshes, fresh									
Marshes, reclaimed									
Marshes, tidal									
Mixed CB/UV/Sumps					1	0.3	Product	Pounds	
Natural Ponds									
Ornamental Ponds	0.04	Product	Gallons		10	0.4	Product	Pounds	
Overwatering									
Rainwater	0.04	Product	Gallons		1	0.1	Product	Pounds	
Sanitary					1	0.1	Product	Pounds	
Seepages					3	0.2	Product	Pounds	
Spas									
Stormdrains									
Swimming Pools					2	0.3	Product	Pounds	
Tires									
TreeHoles	0.2	Product	Gallons						
Under building									
Vaults									
Wells									
Totals	0.29	Product	Gallons		28	7.6	Product	Pounds	

Table A5. Pesticide Product Key – ACMAD

Product	AI	Vector
Agnique MMF	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito
Altosid Briquets	Methoprene	Mosquito
Altosid Liquid conc.	Methoprene	Mosquito
Altosid Pellets	Methoprene	Mosquito
Altosid WSP (pellets)	Methoprene	Mosquito
Altosid XR-Briquets	Methoprene	Mosquito
BVA 2	Petroleum Distillate	Mosquito
FourStar 180 Bs	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
Natular G30	Spinosad	Mosquito
Natular XRT	Spinosad	Mosquito
Pyrenone 25-5	Pyrethrins and Piperonyl Butoxide	Mosquito
VectoBac 12AS	Bacillus Thuringiensis Israelensis	Mosquito
VectoBac G	Bacillus Thuringiensis Israelensis	Mosquito
VectoLex CG Biologic	Bacillus Sphaericus	Mosquito
VectoLex WDG	Bacillus Sphaericus	Mosquito
VectoLex WSP	Bacillus Sphaericus	Mosquito
VectoMax CG	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
Golden Bear	Aliphatic Petroleum Hydrocarbons	Mosquito
Skeeter Abate	Temephos	Mosquito

Table A6. Pesticide Application Data for Summer 2011 – ACVCSD

Application Sites:	Contrac Super Blox - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Contrac Super Blox Comments	Ditrac Tracking Powder - # Treatments	Total Amount Used43	Total Amount Type54	Total Amount Unit55	Ditrac Tracking Powder Comments
Backyard Standing Water Sources										
Rodent Burrows						1	10	Product	Ounces (weight)	
Saintary Sewers	1	246.5	Product	Pounds						
Totals	1	246.5	Product	Pounds		1	10	Product	Ounces (weight)	

Table A7. **Pesticide Application Data for Fall 2011 – ACVCSD**

Application Sites:	Contrac Super Blox - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Contrac Super Blox Comments	Ditrac Tracking Powder - # Treatments	Total Amount Used43	Total Amount Type54	Total Amount Unit55	Ditrac Tracking Powder Comments
Backyard Standing Water Sources										
Rodent Burrows						1	12	Product	Ounces (weight)	
Saintary Sewers	1	134	Product	Pounds						
Totals	1	134	Product	Pounds		1	12	Product	Ounces (weight)	

Table A8. **Pesticide Application Data for Winter 2012 – ACVCSD**

Application Sites:	Contrac Super Blox - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Contrac Super Blox Comments	Ditrac Tracking Powder - # Treatments	Total Amount Used43	Total Amount Type54	Total Amount Unit55	Ditrac Tracking Powder Comments
Backyard Standing Water Sources										
Rodent Burrows						1	6	Product	Ounces (weight)	
Saintary Sewers	1	15.5	Product	Pounds						
Totals	1	15.5	Product	Pounds	0	1	6	Product	Ounces (weight)	

Table A9. Pesticide Application Data for Spring 2012 – ACVCSD

Application Sites:	Altosid XR-Briquets - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR-Briquets Comments	Contrac Super Blox - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Contrac Super Blox Comments	Ditrac Tracking Powder - # Treatments	Total Amount Used43	Total Amount Type54	Total Amount Unit55	Ditrac Tracking Powder Comments
Backyard Standing Water Sources	1	3	Product	Ounces (weight)											
Rodent Burrows											1	13	Product	Ounces (weight)	
Saintary Sewers						1	672.5	Product	Pounds						
Totals	1	3	Product	Ounces (weight)		1	672.5	Product	Pounds		1	13	Product	Ounces (weight)	

Table A10. Pesticide Product Key – ACVCSD

Product	AI	Vector
Altosid XR-Briquets	Methoprene	Mosquito
Ditrac Tracking Powder	Diphacinone	Rat
Contrac Super Blox	Bromadiolone	Rat

Table A11. **Pesticide Application Data for Summer 2011 – CCMVCD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments
Canals															
Containers	6	5.09	Product	Ounces (volume)							26	14.65	Active Ingredient	Ounces (weight)	
Creeks	1	1.16	Product	Ounces (volume)		1	2.5	Product	Pounds		382	88.5	Active Ingredient	Ounces (volume)	
Ditches															
Intermittent	1	0.18	Product	Ounces (volume)							28	1368.37	Active Ingredient	Ounces (volume)	
Marshes						1	12	Product	Pounds		12	624	Active Ingredient	Ounces (volume)	
Natural Ponds						1	10	Product	Pounds		31	27.22	Active Ingredient	Ounces (volume)	
Ornamental Ponds															
Other															
Parks/Landscape															
Rainwater															
Sanitary															
Seepages															
Swimming Pools	22	12.78	Product	Ounces (volume)							46	8.41	Active Ingredient	Ounces (volume)	
Tires															
TreeHoles															
Urban Underground Water	2	5.3	Product	Ounces (volume)							15	2.01	Active Ingredient	Ounces (volume)	
Waterfront															
Wells															
Totals	32	24.51	Product	Ounces (volume)		3	24.5	Product	Pounds		540	2133.16	Active Ingredient	Ounces (volume)	

Table A11.

Application Sites:	Altosid Liquid conc. - # Treatments	Total Amount_Used11	Total Amount_Type12	Total Amount_Unit12	Altosid Liquid conc. Comments	Altosid Briquets - # Treatments	Total Amount_Used13	Total Amount_Type14	Total Amount Unit14	Altosid Briquets Comments	BVA-2 - # Treatments	Total Amount_Used17	Total Amount_Type18	Total Amount_Unit18	BVA-2 Comments
Canals															
Containers						28	3.42	Product	Ounces (volume)		45	398.98	Product	Ounces (volume)	
Creeks	11	0.54	Active Ingredient	Ounces (volume)		3	0.33	Product	Ounces (volume)		49	4119.53	Product	Ounces (volume)	
Ditches															
Intermittent	22	141.19	Active Ingredient	Ounces (volume)							51	90039	Product	Ounces (volume)	
Marshes	11	48	Active Ingredient	Ounces (volume)							3	146	Product	Ounces (volume)	
Natural Ponds	4	0.064				4	0.27	Product	Ounces (volume)		11	183	Product	Ounces (volume)	
Ornamental Ponds															
Other															
Parks/Landscape											1	6	Product	Ounces (volume)	
Rainwater															
Sanitary						1	0.03	Product	Ounces (volume)		3	130	Product	Ounces (volume)	
Seepages															
Swimming Pools	10	0.1	Active Ingredient	Ounces (volume)		2	0.27	Product	Ounces (volume)		30	73.25	Product	Ounces (volume)	
Tires															
TreeHoles															
Urban Underground Water	2	0.005				28	10.44	Product	Ounces (volume)		89	4283.49	Product	Ounces (volume)	
Waterfront															
Wells															
Totals	60	189.899	Active Ingredient	Ounces (volume)		66	14.76	Product	Ounces (volume)		282	99379.25	Product	Ounces (volume)	

Table A11.

Application Sites:	VectoLex CG - # Treatments	Total Amount_Used19	Total Amount_Type20	Total Amount_Unit20	VectoLex CG Comments	Altosid WSP (pellets) - # Treatments	Total Amount_Used23	Total Amount_Type24	Total Amount_Unit24	Altosid WSP (pellets) Commnets	FourStar SR Briquet - # Treatments	Total Amount_Used27	Total Amount_Type28	Total Amount_Unit28
Canals														
Containers	21	563.73	Product	Ounces (volume)		10	9.12	Product	Ounces (volume)		8	18	Product	Ounces (volume)
Creeks	67	1404.98	Product	Ounces (volume)		8	3.36	Product	Ounces (volume)		6	12.9	Product	Ounces (volume)
Ditches														
Intermittent	7	880.18	Product	Ounces (volume)							1	1.1	Product	Ounces (volume)
Marshes	2	288	Product	Ounces (volume)										
Natural Ponds	34	2866.1	Product	Ounces (volume)		1	1.44	Product	Ounces (volume)		2	8.8	Product	Ounces (volume)
Ornamental Ponds														
Other														
Parks/Landscape														
Rainwater														
Sanitary											1	9.9	Product	Ounces (volume)
Seepages														
Swimming Pools	42	38.92	Product	Ounces (volume)										
Tires														
TreeHoles														
Urban Underground Water						8	3.36	Product	Ounces (volume)		31	549.4	Product	Ounces (volume)
Waterfront														
Wells														
Totals	173	6041.91	Product	Ounces (volume)		27	17.28	Product	Ounces (volume)		49	600.1	Product	Ounces (volume)

Table A11.

Application Sites:	FourStar SR Briquet Comments	Bell Contrac Super-Size Blox - # Treatments	Total Amount_Used35	Total Amount_Type36	Total Amount_Unit36	Bell Contrac Super-Size Blox Comments	Altosid XR-Briquets - # Treatments	Total Amount_Used37	Total Amount_Type38	Total Amount_Unit38	Altosid XR-Briquets Comments	Drione - # Treatments	Total Amount_Used1112
Canals													
Containers							27	156	Product	Ounces (volume)		2	1.5
Creeks		43	344	Product	Ounces (volume)		6	21	Product	Ounces (volume)			
Ditches													
Intermittent							1	3	Product	Ounces (volume)			
Marshes													
Natural Ponds							12	27	Product	Ounces (volume)			
Ornamental Ponds													
Other													
Parks/Landscape		23	184	Product	Ounces (volume)							682	855.55
Rainwater													
Sanitary		84	1360	Product	Ounces (volume)								
Seepages													
Swimming Pools							17	37.5	Product	Ounces (volume)			
Tires													
TreeHoles													
Urban Underground Water							133	2365.5	Product	Ounces (volume)			
Waterfront		10	88	Product	Ounces (volume)								
Wells													
Totals		160	1976	Product	Ounces (volume)		196	2610	Product	Ounces (volume)		684	857.05

Table A11.

Application Sites:	Total Amount_Type1213	Total Amount_Unit1214	Drione Comments	Natular 2EC - # Treatments	Total Amount_Used1721	Total Amount_Type1822	Total Amount_Unit1823	Natular 2EC Comments	Pyrocide 7396 - # Treatments	Total Amount_Used2939	Total Amount_Type3040	Total Amount_Unit3041	Pyrocide 7396 Comments	VectoLex CG Biologic - # Treatments
Canals														
Containers	Product	Ounces (volume)												21
Creeks														67
Ditches														
Intermittent														7
Marshes				5	360	Product	Ounces (volume)							2
Natural Ponds														34
Ornamental Ponds														
Other									28	1871.18	Product	Ounces (volume)		
Parks/Landscape	Product	Ounces (volume)												
Rainwater														
Sanitary														
Seepages														
Swimming Pools														42
Tires														
TreeHoles														
Urban Underground Water														
Waterfront														
Wells														
Totals	Product	Ounces (volume)		5	360	Product	Ounces (volume)		28	1871.18	Product	Ounces (volume)		173

Table A11.

Application Sites:	Total Amount Used3142	Total Amount Type3243	Total Amount Unit3244	VectoLex CG Biologic Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Ditrac Blox - # Treatments	Total Amount Used3	Total Amount Type	Total Amount Unit4	Ditrac Blox Comments	Vectolex WSP - # Treatments
Canals															
Containers	563.73	Product	Ounces (volume)												3
Creeks	1404.98	Product	Ounces (volume)		3	1.5	Active Ingredient	Ounces (volume)		28	448	Product	Ounces (volume)		7
Ditches															
Intermittent	880.18	Product	Ounces (volume)		1	160	Active Ingredient	Ounces (volume)							
Marshes	288	Product	Ounces (volume)												
Natural Ponds	2866.1	Product	Ounces (volume)												2
Ornamental Ponds															
Other															
Parks/Landscape										12	192	Product	Ounces (volume)		
Rainwater															
Sanitary															
Seepages															
Swimming Pools	38.92	Product	Ounces (volume)												3
Tires															
TreeHoles															
Urban Underground Water					43	94.27	Product	Ounces (volume)							8
Waterfront															
Wells															
Totals	6041.91	Product	Ounces (volume)		47	255.77	Product	Ounces (volume)		40	640	Product	Ounces (volume)		23

Table A11.

Application Sites:	Total Amount_Used5	Total Amount_Type6	Total Amount_Unit8	Vectolex WSP Comments	Altosid Pellets - # Treatments	Total Amount Used	Total Amount Type9	Total Amount Unit	Altosid Pellets - Comments
Canals									
Containers	17.48	Product	Ounces (volume)		4	40.36	Product	Ounces (volume)	
Creeks	12.16	Product	Ounces (volume)		38	1307.82	Product	Ounces (volume)	
Ditches									
Intermittent					60	6919.61	Product	Ounces (volume)	
Marshes					33	1632	Product	Ounces (volume)	
Natural Ponds	2.28	Product	Ounces (volume)		16	768	Product	Ounces (volume)	
Ornamental Ponds									
Other									
Parks/Landscape					2	9	Product	Ounces (volume)	
Rainwater									
Sanitary					2	56	Product	Ounces (volume)	
Seepages									
Swimming Pools	7.6	Product	Ounces (volume)						
Tires									
TreeHoles									
Urban Underground Water	225.72	Product	Ounces (volume)		1	0.55	Active Ingredient	Ounces (volume)	
Waterfront									
Wells									
Totals	265.24	Product	Ounces (volume)		156	10733.34	Mix	Ounces (volume)	

Table A12. **Pesticide Application Data for Fall 2011 – CCMVCD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments
Canals															
Containers	5	14.72	Product	Ounces (volume)		2	28	Product	Ounces (volume)		11	2.51	Active Ingredient	Ounces (volume)	
Creeks	2	1	Product	Ounces (volume)		2	64	Product	Ounces (volume)		81	8.48	Active Ingredient	Ounces (volume)	
Ditches															
Intermittent	1	5	Product	Ounces (volume)							4	209.34	Active Ingredient	Ounces (volume)	
Marshes															
Natural Ponds						3	272	Product	Ounces (volume)		6	5.28	Active Ingredient	Ounces (volume)	
Ornamental Ponds															
Other															
Park/Landscape	1	0.25	Product	Ounces (volume)											
Rainwater															
Sanitary	1	15	Product	Ounces (volume)											
Seepages															
Swimming Pools	10	7.35	Product	Ounces (volume)							17	2.93	Active Ingredient	Ounces (volume)	
Tires															
TreeHoles															
Urban Underground Water											6	1.05	Active Ingredient	Ounces (volume)	
Waterfront															
Wells															
Totals	20	43.32	Product	Ounces (volume)		7	364	Product	Ounces (volume)		125	229.59	Active Ingredient	Ounces (volume)	

Table A12.

Application Sites:	Altosid Liquid conc. - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit12	Altosid Liquid conc. Comments	Altosid Briquets - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid Briquets Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18
Canals														
Containers	1	0.0023	Active Ingredient	Ounces (volume)		8	1.77	Product	Ounces (volume)		16	193.09	Product	Ounces (volume)
Creeks	9	0.1	Active Ingredient	Ounces (volume)		1	0.06	Product	Ounces (volume)		16	2431	Product	Ounces (volume)
Ditches														
Intermittent	4	21.66	Active Ingredient	Ounces (volume)							6	9354	Product	Ounces (volume)
Marshes											3	5121	Product	Ounces (volume)
Natural Ponds	1	0.007	Active Ingredient	Ounces (volume)		2	0.12	Product	Ounces (volume)		8	439.8	Product	Ounces (volume)
Ornamental Ponds														
Other														
Park/Landscape						2	0.93	Product	Ounces (volume)					
Rainwater														
Sanitary											1	384	Product	Ounces (volume)
Seepages														
Swimming Pools	8	0.06	Active Ingredient	Ounces (volume)		9	0.72	Product	Ounces (volume)		7	25	Product	Ounces (volume)
Tires														
TreeHoles														
Urban Underground Water						7	6.72	Product	Ounces (volume)		22	1024.1	Product	Ounces (volume)
Waterfront														
Wells														
Totals	23	21.8293	Active Ingredient	Ounces (volume)		29	10.32	Product	Ounces (volume)		79	18971.99	Product	Ounces (volume)

Table A12.

Application Sites:	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	Altosid WSP (pellets) - # Treatments	Total Amount Used23	Total Amount Type24	Total Amount Unit24	Altosid WSP (pellets) Commnets	FourStar SR Briquet - # Treatments	Total Amount Used27	Total Amount Type28
Canals														
Containers		20	352.93	Product	Ounces (volume)		9	9.84	Product	Ounces (volume)		2	2.2	Product
Creeks		24	428.94	Product	Ounces (volume)		1	0.24	Product	Ounces (volume)		1	1.1	Product
Ditches														
Intermittent		3	176.36	Product	Ounces (volume)									
Marshes														
Natural Ponds		17	1266.82	Product	Ounces (volume)		2	3.84	Product	Ounces (volume)				
Ornamental Ponds														
Other														
Park/Landscape														
Rainwater														
Sanitary														
Seepages														
Swimming Pools		33	23.75	Product	Ounces (volume)		1	0.48	Product	Ounces (volume)		1	1.1	Product
Tires														
TreeHoles														
Urban Underground Water		1	1.85	Product	Ounces (volume)		2	0.96	Product	Ounces (volume)		17	317.9	Product
Waterfront														
Wells														
Totals		98	2250.65	Product	Ounces (volume)		15	15.36	Product	Ounces (volume)		21	322.3	Product

Table A12.

Application Sites:	Total Amount Unit28	FourStar SR Briquet Comments	Bell Contrac Super-Size Blox - # Treatments	Total Amount Used35	Total Amount Type36	Total Amount Unit36	Bell Contrac Super-Size Blox Comments	Altosid XR-Briquets - # Treatments	Total Amount Used37	Total Amount Type38	Total Amount Unit38	Bell Contrac Small Blox - # Treatments
Canals												
Containers	Ounces (volume)							15	60	Product	Ounces (volume)	
Creeks	Ounces (volume)		30	248	Product	Ounces (volume)						15
Ditches												
Intermittent												
Marshes												
Natural Ponds								2	9	Product	Ounces (volume)	
Ornamental Ponds												
Other												
Park/Landscape			24	192	Product	Ounces (volume)						7
Rainwater												
Sanitary			43	528	Product	Ounces (volume)						
Seepages												
Swimming Pools	Ounces (volume)							24	54	Product	Ounces (volume)	
Tires												
TreeHoles												
Urban Underground Water	Ounces (volume)							12	180	Product	Ounces (volume)	
Waterfront			11	88	Product	Ounces (volume)						2
Wells												
Totals	Ounces (volume)		108	1056	Product	Ounces (volume)		53	303	Product	Ounces (volume)	24

Table A12.

Application Sites:	Total Amount Used69	Total Amount Type710	Total Amount Unit711	Bell Contrac Small Blox Comments	Drione - # Treatments	Total Amount Used1112	Total Amount Type1213	Total Amount Unit1214	Drione Comments	Bell Terad 3 Blox - # Treatments	Total Amount Used1315	Total Amount Type1416	Total Amount Unit1417	Bell Terad 3 Blox Comments
Canals														
Containers														
Creeks	16	Product	Ounces (volume)							8	8	Product	Ounces (volume)	
Ditches														
Intermittent														
Marshes														
Natural Ponds														
Ornamental Ponds														
Other														
Park/Landscape	7	Product	Ounces (volume)		107	146.75	Product	Ounces (volume)		5	5	Product	Ounces (volume)	
Rainwater														
Sanitary														
Seepages														
Swimming Pools														
Tires														
TreeHoles														
Urban Underground Water														
Waterfront	2	Product	Ounces (volume)							2	2	Product	Ounces (volume)	
Wells														
Totals	25	Product	Ounces (volume)		107	146.75	Product	Ounces (volume)		15	15	Product	Ounces (volume)	

Table A12.

Application Sites:	First Strike - # Treatments	Total Amount Used1518	Total Amount Type1619	Total Amount Unit1620	First Strike Comments	Natular 2EC - # Treatments	Total Amount Used1721	Total Amount Type1822	Total Amount Unit1823	Natular 2EC Comments	Pyrocide 7396 - # Treatments	Total Amount Used2939	Total Amount Type3040	Total Amount Unit3041
Canals														
Containers														
Creeks	6	6	Product	Ounces (volume)										
Ditches														
Intermittent														
Marshes														
Natural Ponds														
Ornamental Ponds														
Other											1	6	Product	Ounces (volume)
Park/Landscape	5	5.6	Product	Ounces (volume)										
Rainwater														
Sanitary														
Seepages														
Swimming Pools						1	0.027	Product	Ounces (volume)					
Tires														
TreeHoles														
Urban Underground Water														
Waterfront														
Wells														
Totals	11	11.6	Product	Ounces (volume)		1	0.027	Product	Ounces (volume)		1	6	Product	Ounces (volume)

Table A12.

Application Sites:	Pyrocide 7396 Comments	VectoLex CG Biologic - # Treatments	Total Amount Used3142	Total Amount Type3243	Total Amount Unit3244	VectoLex CG Biologic Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Ditrac Blox - # Treatments	Total Amount Used3	Total Amount Type
Canals														
Containers		20	352.93	Product	Ounces (volume)									
Creeks		24	428.94	Product	Ounces (volume)							20	320	Product
Ditches														
Intermittent		3	176.36	Product	Ounces (volume)		3	480	Active Ingredient	Ounces (volume)				
Marshes														
Natural Ponds		17	1266.82	Product	Ounces (volume)									
Ornamental Ponds														
Other														
Park/Landscape												5	80	Product
Rainwater														
Sanitary														
Seepages														
Swimming Pools		33	23.75	Product	Ounces (volume)									
Tires														
TreeHoles														
Urban Underground Water		1	1.85	Product	Ounces (volume)									
Waterfront														
Wells														
Totals		98	2250.65	Product	Ounces (volume)		3	480	Active Ingredient	Ounces (volume)		25	400	Product

Table A12.

Application Sites:	Total Amount Unit4	Ditrac Blox Comments	Vectolex WSP - # Treatments	Total Amount Used5	Total Amount Type6	Total Amount Unit8	Vectolex WSP Comments	Altosid Pellets - # Treatments	Total Amount Used	Total Amount Type9	Total Amount Unit	Altosid Pellets - Comments
Canals												
Containers			10	55.48	Product	Ounces (volume)		1	10	Product	Ounces (volume)	
Creeks	Ounces (volume)		2	3.04	Product	Ounces (volume)		5	102	Product	Ounces (volume)	
Ditches												
Intermittent								7	165	Product	Ounces (volume)	
Marshes								2	32	Product	Ounces (volume)	
Natural Ponds								3	57	Product	Ounces (volume)	
Ornamental Ponds												
Other												
Park/Landscape	Ounces (volume)											
Rainwater												
Sanitary												
Seepages												
Swimming Pools			2	3.8	Product	Ounces (volume)						
Tires												
TreeHoles												
Urban Underground Water			8	23.56	Product	Ounces (volume)		1	1	Product	Ounces (volume)	
Waterfront												
Wells												
Totals	Ounces (volume)		22	85.88	Product	Ounces (volume)		19	367	Product	Ounces (volume)	

Table A13. **Pesticide Application Data for Winter 2012 – CCMVCD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	Agnique MMF G - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Agnique MMF G Comments
Canals															
Containers															
Creeks						2	80	Product	Ounces (volume)						
Ditches															
Intermittent															
Marshes															
Natural Ponds						2	512	Product	Ounces (volume)		1	56	Product	Ounces (volume)	
Ornamental Ponds															
Park/Landscape															
Rainwater															
Sanitary															
Seepages															
Swimming Pools	9	5.06	Product	Ounces (volume)											
Tires															
TreeHoles															
Urban Underground Water															
Waterfront															
Wells															
Totals	9	5.06	Product	Ounces (volume)		4	592	Product	Ounces (volume)		1	56	Product	Ounces (volume)	

Table A13.

Application Sites:	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	Altosid Liquid conc. - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit12	Altosid Liquid conc. Comments	Altosid Briquets - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid Briquets Comments
Canals															
Containers	3	0.63	Active Ingredient	Ounces (volume)		3	0.066	Active Ingredient	Ounces (volume)		7	0.48	Product	Ounces (volume)	
Creeks	15	52.51	Active Ingredient	Ounces (volume)		12	5.04	Active Ingredient	Ounces (volume)		1	0.09	Product	Ounces (volume)	
Ditches															
Intermittent	11	360.1	Active Ingredient	Ounces (volume)		9	37.13	Active Ingredient	Ounces (volume)						
Marshes	7	158.03	Active Ingredient	Ounces (volume)		7	16.38	Active Ingredient	Ounces (volume)						
Natural Ponds	31	64.68	Active Ingredient	Ounces (volume)		22	4.38	Active Ingredient	Ounces (volume)		2	0.12	Product	Ounces (volume)	
Ornamental Ponds															
Park/Landscape															
Rainwater															
Sanitary															
Seepages															
Swimming Pools	31	3.44	Active Ingredient	Ounces (volume)		25	0.25	Active Ingredient	Ounces (volume)		7	0.72	Product	Ounces (volume)	
Tires															
TreeHoles											1	0.03	Product	Ounces (volume)	
Urban Underground Water															
Waterfront															
Wells															
Totals	98	639.39	Active Ingredient	Ounces (volume)		78	63.246	Active Ingredient	Ounces (volume)		18	1.44	Product	Ounces (volume)	

Table A13.

Application Sites:	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	VectoMax WSP - # Treatments	Total Amount Used21	Total Amount Type22	Total Amount Unit22	VectoMax WSP Comments
Canals															
Containers	2	15.5	Product	Ounces (volume)		1	0.18	Product	Ounces (volume)						
Creeks	1	4	Product	Ounces (volume)											
Ditches															
Intermittent															
Marshes	1	12	Product	Ounces (volume)		1	48	Product	Ounces (volume)		3	608	Product	Ounces (volume)	
Natural Ponds	1	15	Product	Ounces (volume)		4	208	Product	Ounces (volume)		1	80	Product	Ounces (volume)	
Ornamental Ponds															
Park/Landscape															
Rainwater															
Sanitary															
Seepages															
Swimming Pools	3	6	Product	Ounces (volume)		4	2.35	Product	Ounces (volume)		2	0.85	Product	Ounces (volume)	
Tires															
TreeHoles															
Urban Underground Water															
Waterfront															
Wells															
Totals	8	52.5	Product	Ounces (volume)		10	258.53	Product	Ounces (volume)		6	688.85	Product	Ounces (volume)	

Table A13.

Application Sites:	Altosid WSP (pellets) - # Treatments	Total Amount Used23	Total Amount Type24	Total Amount Unit24	Altosid WSP (pellets) Commnets	Bell Contrac Super-Size Blox - # Treatments	Total Amount Used35	Total Amount Type36	Total Amount Unit36	Bell Contrac Super-Size Blox Comments	Altosid XR-Briquets - # Treatments	Total Amount Used37	Total Amount Type38
Canals													
Containers	3	2.64	Product	Ounces (volume)							4	61.5	Product
Creeks	1	1.68	Product	Ounces (volume)		24	208	Product	Ounces (volume)		2	6	Product
Ditches													
Intermittent													
Marshes	1	1.68	Product	Ounces (volume)									
Natural Ponds	7	8.88	Product	Ounces (volume)							1	1.5	Product
Ornamental Ponds													
Park/Landscape						8	64	Product	Ounces (volume)				
Rainwater													
Sanitary						22	336	Product	Ounces (volume)				
Seepages													
Swimming Pools	2	1.92	Product	Ounces (volume)							24	46.5	Product
Tires													
TreeHoles													
Urban Underground Water											2	15	Product
Waterfront						8	64	Product	Ounces (volume)				
Wells													
Totals	14	16.8	Product	Ounces (volume)		62	672	Product	Ounces (volume)		33	130.5	Product

Table A13.

Application Sites:	Total Amount Unit38	Altosid XR-Briquets Comments	Bell Contrac Small Blox - # Treatments	Total Amount Used69	Total Amount Type710	Total Amount Unit711	Bell Contrac Small Blox Comments	Drione - # Treatments	Total Amount Used1112	Total Amount Type1213	Total Amount Unit1214	Drione Comments	Bell Terad 3 Blox - # Treatments	Total Amount Used1315
Canals														
Containers	Ounces (volume)													
Creeks	Ounces (volume)		5	5	Product	Ounces (volume)							3	3
Ditches														
Intermittent														
Marshes														
Natural Ponds	Ounces (volume)													
Ornamental Ponds														
Park/Landscape			2	2	Product	Ounces (volume)		1	1.5	Product	Ounces (volume)		5	12
Rainwater														
Sanitary														
Seepages														
Swimming Pools	Ounces (volume)													
Tires														
TreeHoles														
Urban Underground Water	Ounces (volume)													
Waterfront														
Wells														
Totals	Ounces (volume)		7	7	Product	Ounces (volume)		1	1.5	Product	Ounces (volume)		8	15

Table A13.

Application Sites:	Total Amount Type1416	Total Amount Unit1417	Bell Terad 3 Blox Comments	First Strike - # Treatments	Total Amount Used1518	Total Amount Type1619	Total Amount Unit1620	First Strike Comments	VectoLex CG Biologic - # Treatments	Total Amount Used3142	Total Amount Type3243	Total Amount Unit3244	VectoLex CG Biologic Comments	VectoLex WDG - # Treatments
Canals														
Containers									1	0.18	Product	Ounces (volume)		
Creeks	Product	Ounces (volume)		2	1.41	Product	Ounces (volume)							6
Ditches														
Intermittent														6
Marshes									1	48	Product	Ounces (volume)		
Natural Ponds									4	208	Product	Ounces (volume)		
Ornamental Ponds														
Park/Landscape	Product	Ounces (volume)		2	3.88	Product	Ounces (volume)							
Rainwater														
Sanitary														
Seepages														
Swimming Pools									4	2.35	Product	Ounces (volume)		
Tires														
TreeHoles														
Urban Underground Water														
Waterfront														
Wells														
Totals	Product	Ounces (volume)		4	5.29	Product	Ounces (volume)		10	258.53	Product	Ounces (volume)		12

Table A13.

Application Sites:	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Ditrac Blox - # Treatments	Total Amount Used3	Total Amount Type	Total Amount Unit4	Ditrac Blox Comments	Vectolex WSP - # Treatments	Total Amount Used5	Total Amount Type6	Total Amount Unit8	Vectolex WSP Comments	Altosid Pellets - # Treatments
Canals															
Containers										1	3.04	Product	Ounces (volume)		2
Creeks	96	Active Ingredient	Ounces (volume)		8	128	Product	Ounces (volume)							3
Ditches															
Intermittent	672	Active Ingredient	Ounces (volume)												1
Marshes										1	5.32	Product	Ounces (volume)		4
Natural Ponds															12
Ornamental Ponds															
Park/Landscape					1	16	Product	Ounces (volume)							
Rainwater															
Sanitary															
Seepages															
Swimming Pools										6	25.84	Product	Ounces (volume)		
Tires															
TreeHoles															
Urban Underground Water										1	0.76	Product	Ounces (volume)		
Waterfront															
Wells															
Totals	768	Active Ingredient	Ounces (volume)		9	144	Product	Ounces (volume)		9	34.96	Product	Ounces (volume)		22

Table A13.

Application Sites:	Total Amount Used	Total Amount Type9	Total Amount Unit	Altosid Pellets - Comments
Canals				
Containers	32	Product	Ounces (volume)	
Creeks	36	Product	Ounces (volume)	
Ditches				
Intermittent	8	Product	Ounces (volume)	
Marshes	100	Product	Ounces (volume)	
Natural Ponds	424	Product	Ounces (volume)	
Ornamental Ponds				
Park/Landscape				
Rainwater				
Sanitary				
Seepages				
Swimming Pools				
Tires				
TreeHoles				
Urban Underground Water				
Waterfront				
Wells				
Totals	600	Product	Ounces (volume)	

Table A14. **Pesticide Application Data for Spring 2012 – CCMVCD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments
Canals															
Containers	6	27.41	Product	Ounces (volume)		3	34.29	Product	Ounces (volume)		13	4.03	Active Ingredient	Ounces (volume)	
Creeks	1	2.56	Product	Ounces (volume)		14	894.87	Product	Ounces (volume)		183	214.85	Active Ingredient	Ounces (volume)	
Ditches															
Intermittent						1	128	Product	Ounces (volume)		21	406.4	Active Ingredient	Ounces (volume)	
Marshes						3	264	Product	Ounces (volume)		26	853.77	Active Ingredient	Ounces (volume)	
Natural Ponds	2	0.51	Product	Ounces (volume)		11	496	Product	Ounces (volume)		83	344.37	Active Ingredient	Ounces (volume)	
Ornamental Ponds															
Other															
Park/Landscape															
Rainwater															
Sanitary	1	1.5	Product	Ounces (volume)											
Seepages															
Swimming Pools	21	11.26	Product	Ounces (volume)		2	3.59	Product	Ounces (volume)		66	7.85	Active Ingredient	Ounces (volume)	
Tires															
TreeHoles															
Urban Underground Water											3	0.44	Active Ingredient	Ounces (volume)	
Waterfront															
Wells															
Totals	31	43.24	Product	Ounces (volume)		34	1820.75	Product	Ounces (volume)		395	1831.71	Active Ingredient	Ounces (volume)	

Table A14.

Application Sites:	Altosid Liquid conc. - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit12	Altosid Liquid conc. Comments	Altosid Briquets - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid Briquets Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18
Canals														
Containers	3	0.13	Active Ingredient	Ounces (volume)		21	2.7	Product	Ounces (volume)		21	66	Product	Ounces (volume)
Creeks	16	15.5	Active Ingredient	Ounces (volume)							16	123	Product	Ounces (volume)
Ditches														
Intermittent	11	41.32	Active Ingredient	Ounces (volume)		1	0.3	Product	Ounces (volume)		22	20744	Product	Ounces (volume)
Marshes	18	85.57	Active Ingredient	Ounces (volume)							3	52	Product	Ounces (volume)
Natural Ponds	50	33.94	Active Ingredient	Ounces (volume)		3	0.12	Product	Ounces (volume)		15	2713.5	Product	Ounces (volume)
Ornamental Ponds														
Other														
Park/Landscape											2	2	Product	Ounces (volume)
Rainwater														
Sanitary														
Seepages														
Swimming Pools	29	0.23	Active Ingredient	Ounces (volume)		10	1.83	Product	Ounces (volume)		31	53	Product	Ounces (volume)
Tires														
TreeHoles														
Urban Underground Water						19	4.77	Product	Ounces (volume)		110	1639.25	Product	Ounces (volume)
Waterfront														
Wells														
Totals	127	176.69	Active Ingredient	Ounces (volume)		54	9.72	Product	Ounces (volume)		220	25392.75	Product	Ounces (volume)

Table A14.

Application Sites:	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	VectoMax WSP - # Treatments	Total Amount Used21	Total Amount Type22	Total Amount Unit22	VectoMax WSP Comments	Altosid WSP (pellets) - # Treatments	Total Amount Used23	Total Amount Type24
Canals														
Containers		12	304.76	Product	Ounces (volume)							7	9.36	Product
Creeks		56	2001.27	Product	Ounces (volume)		1	16	Product	Ounces (volume)		7	3.36	Product
Ditches														
Intermittent		5	160.18	Product	Ounces (volume)									
Marshes		5	368	Product	Ounces (volume)							1	1.68	Product
Natural Ponds		58	4325.69	Product	Ounces (volume)		2	162	Product	Ounces (volume)		2	1.44	Product
Ornamental Ponds														
Other		1	0.36	Product	Ounces (volume)									
Park/Landscape														
Rainwater														
Sanitary		1	1	Product	Ounces (volume)									
Seepages														
Swimming Pools		27	20.23	Product	Ounces (volume)							1	0.96	Product
Tires														
TreeHoles														
Urban Underground Water		1	40	Product	Ounces (volume)							5	1.92	Product
Waterfront														
Wells														
Totals		166	7221.49	Product	Ounces (volume)		3	178	Product	Ounces (volume)		23	18.72	Product

Table A14.

Application Sites:	Total Amount Unit24	Altosid WSP (pellets) Commnets	MetaLarv SP-T - # Treatments	Total Amount Used25	Total Amount Type26	Total Amount Unit26	MetaLarv SP-T Comments	FourStar SR Briquet - # Treatments	Total Amount Used27	Total Amount Type28	Total Amount Unit28	FourStar SR Briquet Comments	Bell Contrac Super-Size Blox - # Treatments
Canals													
Containers	Ounces (volume)							6	8.8	Product	Ounces (volume)		
Creeks	Ounces (volume)												21
Ditches													
Intermittent			2	3072	Product	Ounces (volume)							
Marshes	Ounces (volume)												
Natural Ponds	Ounces (volume)							1	1.1	Product	Ounces (volume)		1
Ornamental Ponds													
Other													
Park/Landscape													20
Rainwater													
Sanitary													40
Seepages													
Swimming Pools	Ounces (volume)							11	22	Product	Ounces (volume)		
Tires													
TreeHoles													
Urban Underground Water	Ounces (volume)							179	3388	Product	Ounces (volume)		
Waterfront													20
Wells													
Totals	Ounces (volume)		2	3072	Product	Ounces (volume)		197	3419.9	Product	Ounces (volume)		102

Table A14.

Application Sites:	Total Amount Used35	Total Amount Type36	Total Amount Unit36	Bell Contrac Super-Size Blox Comments	Altosid XR-Briquets - # Treatments	Total Amount Used37	Total Amount Type38	Total Amount Unit38	Altosid XR-Briquets Comments	Bell Contrac Small Blox - # Treatments	Total Amount Used69	Total Amount Type710	Total Amount Unit711
Canals													
Containers					35	244.5	Product	Ounces (volume)					
Creeks	184	Product	Ounces (volume)		16	88.5	Product	Ounces (volume)		4	10	Product	Ounces (volume)
Ditches													
Intermittent					2	31.5	Product	Ounces (volume)					
Marshes					4	24	Product	Ounces (volume)					
Natural Ponds	24	Product	Ounces (volume)		14	42	Product	Ounces (volume)		2	21	Product	Ounces (volume)
Ornamental Ponds													
Other										1	1	Product	Ounces (volume)
Park/Landscape	160	Product	Ounces (volume)							1	3	Product	Ounces (volume)
Rainwater													
Sanitary	472	Product	Ounces (volume)										
Seepages													
Swimming Pools					27	58.5	Product	Ounces (volume)					
Tires													
TreeHoles													
Urban Underground Water					177	4824	Product	Ounces (volume)					
Waterfront	160	Product	Ounces (volume)							1	8	Product	Ounces (volume)
Wells													
Totals	1000	Product	Ounces (volume)		275	5313	Product	Ounces (volume)		9	43	Product	Ounces (volume)

Table A14.

Application Sites:	Bell Contrac Small Blox Comments	Drione - # Treatments	Total Amount Used1112	Total Amount Type1213	Total Amount Unit1214	Drione Comments	Bell Terad 3 Blox - # Treatments	Total Amount Used1315	Total Amount Type1416	Total Amount Unit1417	Bell Terad 3 Blox Comments	First Strike - # Treatments	Total Amount Used1518	Total Amount Type1619
Canals														
Containers		1	0.5	Product	Ounces (volume)									
Creeks							3	7	Product	Ounces (volume)		2	2.12	Product
Ditches														
Intermittent														
Marshes														
Natural Ponds														
Ornamental Ponds														
Other														
Park/Landscape		46	26.55	Product	Ounces (volume)							2	4.94	Product
Rainwater														
Sanitary														
Seepages														
Swimming Pools														
Tires														
TreeHoles														
Urban Underground Water														
Waterfront														
Wells														
Totals		47	27.05	Product	Ounces (volume)		3	7	Product	Ounces (volume)		4	7.06	Product

Table A14.

Application Sites:	Total Amount Unit1620	First Strike Comments	Pyrocide 7396 - # Treatments	Total Amount Used2939	Total Amount Type3040	Total Amount Unit3041	Pyrocide 7396 Comments	VectoLex CG Biologic - # Treatments	Total Amount Used3142	Total Amount Type3243	Total Amount Unit3244	VectoLex CG Biologic Comments	VectoLex WDG - # Treatments
Canals													
Containers								12	304.76	Product	Ounces (volume)		
Creeks	Ounces (volume)							56	2001.27	Product	Ounces (volume)		
Ditches													
Intermittent			12	193.39	Product	Ounces (volume)		5	160.18	Product	Ounces (volume)		13
Marshes								5	368	Product	Ounces (volume)		
Natural Ponds								58	4325.69	Product	Ounces (volume)		2
Ornamental Ponds													
Other								1	0.36	Product	Ounces (volume)		
Park/Landscape	Ounces (volume)		2	15.75	Product	Ounces (volume)							
Rainwater													
Sanitary								1	1	Product	Ounces (volume)		
Seepages													
Swimming Pools								27	20.23	Product	Ounces (volume)		
Tires													
TreeHoles													
Urban Underground Water								1	40	Product	Ounces (volume)		3
Waterfront													
Wells													
Totals	Ounces (volume)		14	209.14	Product	Ounces (volume)		166	7221.49	Product	Ounces (volume)		18

Table A14.

Application Sites:	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Ditrac Blox - # Treatments	Total Amount Used3	Total Amount Type	Total Amount Unit4	Ditrac Blox Comments	Vectolex WSP - # Treatments	Total Amount Used5	Total Amount Type6	Total Amount Unit8	Vectolex WSP Comments	Altosid Pellets - # Treatments
Canals															
Containers										5	15.2	Product	Ounces (volume)		3
Creeks					14	224	Product	Ounces (volume)		4	8.36	Product	Ounces (volume)		32
Ditches															
Intermittent	1168	Active Ingredient	Ounces (volume)												52
Marshes															28
Natural Ponds	24	Active Ingredient	Ounces (volume)												22
Ornamental Ponds															
Other															
Park/Landscape					4	64	Product	Ounces (volume)							
Rainwater															
Sanitary															1
Seepages															
Swimming Pools										3	13.68	Product	Ounces (volume)		
Tires															
TreeHoles															
Urban Underground Water	3.31	Product	Ounces (volume)							1	1.52	Product	Ounces (volume)		1
Waterfront															
Wells															
Totals	1195.31	Product	Ounces (volume)		18	288	Product	Ounces (volume)		13	38.76	Product	Ounces (volume)		139

Table A14.

Application Sites:	Total Amount Used	Total Amount Type9	Total Amount Unit	Altosid Pellets - Comments
Canals				
Containers	17.15	Product	Ounces (volume)	
Creeks	766	Product	Ounces (volume)	
Ditches				
Intermittent	10209.5	Product	Ounces (volume)	
Marshes	1144	Product	Ounces (volume)	
Natural Ponds	531	Product	Ounces (volume)	
Ornamental Ponds				
Other				
Park/Landscape				
Rainwater				
Sanitary	10	Product	Ounces (volume)	
Seepages				
Swimming Pools				
Tires				
TreeHoles				
Urban Underground Water	1	Product	Ounces (volume)	
Waterfront				
Wells				
Totals	12678.65	Product	Ounces (volume)	

Table A15. Pesticide Product Key CCMVCD

Product	AI	Vector
Agnique MMF	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito
Agnique MMF G	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito
Altosid Briquets	Methoprene	Mosquito
Altosid Liquid conc.	Methoprene	Mosquito
Altosid Pellets	Methoprene	Mosquito
Altosid WSP (pellets)	Methoprene	Mosquito
Altosid XR-Briquets	Methoprene	Mosquito
Bell Contrac Small Blox	Bromadiolone	Rat
Bell Contrac Super-Size Blox	Bromadiolone	Rat
Bell Terad 3 Blox	Cholecalciferol	Rat
BVA 2	Petroleum Distillate	Mosquito
Drione	Pyrethrin and Piperonyl Butroxide and Amorphous Silica Gel	Yellow Jacket / Wasp
First Strike	Difethialone	Rat
FourStar SR Briquet 180-90-45	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
MetaLarv SP-T	Methoprene	Mosquito
Natular 2EC	Spinosad	Mosquito
Pyrocide 7396	Pyrethrins and Piperonyl Butoxide	Mosquito
VectoBac 12AS	Bacillus Thuringiensis Israelensis	Mosquito
VectoBac G	Bacillus Thuringiensis Israelensis	Mosquito
VectoLex CG Biologic	Bacillus Sphaericus	Mosquito
VectoLex WDG	Bacillus Sphaericus	Mosquito
VectoLex WSP	Bacillus Sphaericus	Mosquito
VectoMax WSP	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
Ditrac Blox	Difethialone	Rat

Table A16. Pesticide Application Data for Summer 2011 – MSMVCD

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	Agnique MMF G - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Agnique MMF G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoBac Technical Powder - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoBac Technical Powder Comments	Delta Dust - # Treatments	Total Amount Used31	Total Amount Type32	Total Amount Unit32
Anthropogenic Sources	120	0.736	Product	Gallons												71	4.506	Product	Gallons		1	0.0035	Product	Pounds		1	0.063	Product	Pounds
Drainage Ditch Man Made	8	0.024	Product	Gallons												4	2.127	Product	Gallons		1	0.0017	Product	Pounds					
Manmade Wetlands	1	0.01	Product	Gallons																									
Manmade Wetlands Seasonal	1	0.012	Product	Gallons							4	32.754	Product	Gallons															
Wetland Permanent Treated Effluent																													
Natural Wetlands																													
Natural Wetlands Seasonal											2	16.5	Product	Gallons															
Vernal Pool																													
Vernal Pool Manmade																													
Mitigated Wetlands Seasonal																													
Wildlife Refuge																													
Pond	60	0.144	Product	Gallons							5	1.315	Product	Gallons		19	3.101	Product	Gallons		5	0.253	Product	Pounds					
Wildlife Pond																													
Rain Pond	3	0.153	Product	Gallons																									
Natural Spring	3	0.006	Product	Gallons												1	0.025	Product	Gallons										
Low Area	10	0.217	Product	Gallons							14	2.72	Product	Gallons		3	0.034	Product	Gallons		1	0.002	Product	Pounds					
Waterways																													
Creeks	11	0.048	Product	Gallons							7	0.493	Product	Gallons		1	0.0012	Product	Gallons		10	0.106	Product	Pounds					
Treehole																													
Culvert	1	0.001	Product	Gallons																	1	0.005	Product	Pounds					
Natural Ditch	2	0.112	Product	Gallons							3	98.512	Product	Gallons		5	0.897	Product	Gallons							1	0.063	Product	Pounds
Flood Control Ditch											1	0.008	Product	Gallons		1	0.001	Product	Gallons										
Marshes (Fresh Water)											1	0.75	Product	Gallons															
Marsh - Seasonal											5	27.284	Product	Gallons		1	1	Product	Gallons										
Marsh - Tidal	2	0.024	Product	Gallons							8	190.943	Product	Gallons		2	0.075	Product	Gallons		1	0.006	Product	Pounds					
Residential Areas																													
Industrial Areas																													
Recreational Areas																													
Agricultural Areas																													
Aeration Pond																3	0.9	Product	Gallons										
Waste Pond	19	1.074	Product	Gallons							2	1	Product	Gallons		36	219.271	Product	Gallons										
Reservoir											1	0.125	Product	Gallons															
Settling Pond	6	0.03	Product	Gallons												1	1	Product	Gallons										
Hayfield Ditch											3	3	Product	Gallons															
Pastures																													
Irrigated Reservoir	1	0.014	Product	Gallons																									
Swamps																													
Overgrown Waste Areas																													
Roadsides																													
Roadside Ditch	16	0.086	Product	Gallons												12	4.42	Product	Gallons		3	0.003	Product	Pounds					
Woodlands																													
Gardens																													
Playgrounds																													
Campsites																													
Athletic Fields																													
Municipalities																													
Catch Basin	14	0.033	Product	Gallons												117	5.86	Product	Gallons		5	0.006	Product	Pounds					
Waste Treatment Plant	7	0.419	Product	Gallons		4	1980	Product	Pounds		1	3.626	Product	Gallons		12	0.769	Product	Gallons										
Water Treatment Plant	2	0.017	Product	Gallons												23	61.16	Product	Gallons										
Wildlife Refuge Treated Effluent											6	7.751	Product	Gallons															
Overland Flow																													
Waste Water Irrigation (e.g. pastures)																2	1.422	Product	Gallons										
Storm Sewer Line																													
Storm Water BMP																													
Retention Basin	1	0.002	Product	Gallons																	1	0.006	Product	Pounds					
Sewer Pond	2	0.545	Product	Gallons							6	2.373	Product	Gallons		9	6.961	Product	Gallons										
Indoors																													
Total	290	3.707	Product	Gallons		4	1980	Product	Pounds		69	389.154	Product	Gallons		323	313.5302	Product	Gallons		29	0.3922	Product	Pounds		2	0.126	Product	Pounds

Table A16.

Application Sites:	Delta Dust Comments	Wasp Freeze - # Treatments	Total Amount Used33	Total Amount Type34	Total Amount Unit34	Wasp Freeze Comments	Drione - # Treatments	Total Amount Used1112	Total Amount Type1213	Total Amount Unit1214	Drione Comments	FourStar 45 - # Treatments	Total Amount Used2127	Total Amount Type2228	Total Amount Unit2229	FourStar 45 Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Zenivex - # Treatments	Total Amount Used3548	Total Amount Type3649	Total Amount Unit3650	Zenivex Comments	Pyrocide fogging concentrate 7396 - # Treatments	Total Amount Used3144	Total Amount Type3245
Anthropogenic Sources		1	0.016	Product	Gallons		14	1.377	Product	Pounds							3	0.037	Product	Pounds							17	0.325	Product
Drainage Ditch Man Made																	5	1.199	Product	Pounds									
Manmade Wetlands																													
Manmade Wetlands Seasonal																	5	4.3	Product	Pounds									
Wetland Permanent Treated Effluent																													
Natural Wetlands																													
Natural Wetlands Seasonal																	1	1	Product	Pounds									
Vernal Pool																													
Vernal Pool Manmade																													
Mitigated Wetlands Seasonal																													
Wildlife Refuge																													
Pond							11	1.25	Product	Pounds		1	0.21	Active Ingredient	Pounds		6	6.45	Product	Pounds							5	0.304	Product
Wildlife Pond																													
Rain Pond																													
Natural Spring																													
Low Area																	7	10.753	Product	Pounds									
Waterways																													
Creeks							1	0.063	Product	Pounds							1	0.2	Product	Pounds							5	0.313	Product
Treehole																											1	2.078	Product
Culvert																													
Natural Ditch							2	0.438	Product	Pounds							6	9.8	Product	Pounds									
Flood Control Ditch																													
Marshes (Fresh Water)																	1	3	Product	Pounds									
Marsh - Seasonal																	1	5	Product	Pounds									
Marsh - Tidal																													
Residential Areas																													
Industrial Areas																													
Recreational Areas																													
Agricultural Areas																													
Aeration Pond																													
Waste Pond																	9	3.938	Product	Pounds									
Reservoir																	1	0.5	Product	Pounds									
Settling Pond																													
Hayfield Ditch																	15	30.127	Product	Pounds									
Pastures																													
Irrigated Reservoir							3	1	Product	Pounds																			
Swamps																													
Overgrown Waste Areas																													
Roadsides																													
Roadside Ditch																	1	0.2	Product	Pounds									
Woodlands																													
Gardens																													
Playgrounds																													
Campsites																													
Athletic Fields																													
Municipalities																													
Catch Basin							1	0.063	Product	Pounds							1	0.007	Product	Pounds								0.004	Product
Waste Treatment Plant							1	0.063	Product	Pounds							2	0.01	Product	Pounds		1	0.266	Product	Gallons		7	0.035	Product
Water Treatment Plant																													
Wildlife Refuge Treated Effluent																	6	31	Product	Pounds									
Overland Flow																													
Waste Water Irrigation (e.g. pastures)																	8	2.75	Product	Pounds									
Storm Sewer Line																													
Storm Water BMP																													
Retention Basin																													
Sewer Pond																	5	8.6	Product	Pounds									
Indoors																													
Total		1	0.016	Product	Gallons		33	4.254	Product	Pounds		1	0.21	Active Ingredient	Pounds		84	118.871	Product	Pounds		1	0.266	Product	Gallons		35	3.059	Product

Table A16.

Application Sites:	Total Amount Unit3246	Pyrocide fogging concentrate 7396 Comments	VectoBac GS - # Treatments	Total Amount Used3347	Total Amount Type3448	Total Amount Unit3449	VectoBac GS Comments	Altosid Liquid Concentrate - # Treatments	Total Amount Used6966	Total Amount Type71067	Total Amount Unit71168	Altosid Liquid Concentrate Comments	Altosid Pellets - # Treatments	Total Amount Used111269	Total Amount Type121370	Total Amount Unit121471	Altosid Pellets Comments	Altosid SBG - # Treatments	Total Amount Used131572	Total Amount Type141673	Total Amount Unit141774	Altosid SBG Comments	Altosid XR Briquets - # Treatments	Total Amount Used151875	Total Amount Type161976	Total Amount Unit162077	Altosid XR Briquets Comments	Altosid Briquettes (Standard) -# Treatments
Anthropogenic Sources	Gallons												95	32.217	Product	Pounds							332	111.218	Product	Pounds	each	25
Drainage Ditch Man Made													4	0.159	Product	Pounds							4	1	Product	Pounds	each	2
Manmade Wetlands																												
Manmade Wetlands Seasonal																												
Wetland Permanent Treated Effluent																												
Natural Wetlands																												
Natural Wetlands Seasonal																												
Vernal Pool																												
Vernal Pool Manmade																												
Mitigated Wetlands Seasonal																												
Wildlife Refuge																												
Pond	Gallons		1	0.034	Product	Pounds							13	1.958	Product	Pounds							199	35.333	Active Ingredient	Pounds	each	6
Wildlife Pond													1	0.01	Product	Pounds												
Rain Pond			1	2.25	Product	Pounds							1	0.028	Product	Pounds							1	0.444	Product	Pounds	each	
Natural Spring													1	0.2	Product	Pounds							2	0.889	Product	Pounds	each	
Low Area													12	3.669	Product	Pounds							3	0.667	Product	Pounds	each	1
Waterways																												
Creeks	Gallons												44	7.877	Product	Pounds							6	1.222	Product	Pounds	each	3
Treehole	Gallons																						1	0.111	Product	Pounds	each	
Culvert													1	0.007	Product	Pounds							1	0.111	Product	Pounds	each	
Natural Ditch													7	0.948	Product	Pounds							4	1.222	Product	Pounds	each	
Flood Control Ditch													3	0.062	Product	Pounds												
Marshes (Fresh Water)																												
Marsh - Seasonal								3	1.692	Product	Gallons		5	108.14	Product	Pounds												
Marsh - Tidal			3	10.011	Product	Pounds		4	12.713	Product	Gallons		31	223.782	Product	Pounds												
Residential Areas																												
Industrial Areas																												
Recreational Areas																												
Agricultural Areas																												
Aeration Pond																												
Waste Pond			2	1.092	Product	Pounds							1	4.5	Product	Pounds												
Reservoir													1	0.01	Product	Pounds												
Settling Pond																							1	0.222	Product	Pounds	each	
Hayfield Ditch													1	1	Product	Pounds												
Pastures																												
Irrigated Reservoir																												
Swamps																												
Overgrown Waste Areas																												
Roadsides																												
Roadside Ditch			1	0.625	Product	Pounds																	1	0.111	Product	Pounds	each	6
Woodlands																												
Gardens																												
Playgrounds																												
Campsites																												
Athletic Fields																												
Municipalities																												
Catch Basin	Gallons												7	0.012	Product	Pounds							327	7,104.37	Product	Pounds	each	19
Waste Treatment Plant	Gallons							1	0.242	Product	Gallons		3	1.12	Product	Pounds							3	0.444	Product	Pounds	each	
Water Treatment Plant																							2	2.111	Product	Pounds	each	
Wildlife Refuge Treated Effluent																												
Overland Flow																												
Waste Water Irrigation (e.g. pastures)													1	0.009	Product	Pounds							2	1.333	Product	Pounds	each	
Storm Sewer Line																												
Storm Water BMP																												
Retention Basin													1	0.003	Product	Pounds		1	0.48	Product	Pounds							
Sewer Pond													3	0.758	Product	Pounds												
Indoors																												
Total	Gallons		8	14.012	Product	Pounds		8	14.647	Product	Gallons		236	386.469	Product	Pounds		1	0.48	Product	Pounds		889	7260.812	Product	Pounds	each	62

Table A16.

Application Sites:	Total Amount Used	Total Amount Type2	Total Amount Unit	Altosid Briquettes Comments	Vectolex CG - # Treatments	Total Amount Used3	Total Amount Type4	Total Amount Unit5	Vectolex CG Comments	Vectomax CG - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit8	Vectomax CG Comments	VectoLex WSP - # Treatments	Total Amount Used5	Total Amount Type6	Total Amount Unit7	VectoLex WSP Comments	Altosid Liquid (non-concentrate) - # Treatments	Total Amount Used8	Total Amount Type9	Total Amount Unit10	Altosid Liquid (non-concentrate) comments
Anthropogenic Sources	1.63	Product	Pounds	each	28	6.767	Product	Pounds		18	3.934	Product	Pounds		23	0.858	Product	Pounds	each					
Drainage Ditch Man Made	0.029	Product	Pounds	each	8	53.919	Product	Pounds		6	13.057	Product	Pounds		1	0.088	Product	Pounds	each					
Manmade Wetlands																								
Manmade Wetlands Seasonal					2	38	Product	Pounds												4	4.09	Product	Gallons	
Wetland Permanent Treated Effluent										5	45	Product	Pounds											
Natural Wetlands																				1	0.062	Product	Gallons	
Natural Wetlands Seasonal										1	1200	Product	Pounds											
Vernal Pool																								
Vernal Pool Manmade																								
Mitigated Wetlands Seasonal																								
Wildlife Refuge																								
Pond	0.186	Product	Pounds	each	16	63.027	Product	Pounds		14	82.525	Product	Pounds		12	0.308	Product	Pounds	each					
Wildlife Pond										1	160	Product	Pounds											
Rain Pond					3	10.1	Product	Pounds		7	95.114	Product	Pounds											
Natural Spring					1	0.45	Product	Pounds		2	0.206	Product	Pounds											
Low Area	0.014	Product	Pounds	each	5	108.05	Product	Pounds		8	20.524	Product	Pounds		1	0.022	Product	Pounds	each					
Waterways																								
Creeks	0.186	Product	Pounds	each						2	13	Product	Pounds											
Treehole																								
Culvert					2	0.041	Product	Pounds																
Natural Ditch					9	57.96	Product	Pounds		1	0.5	Product	Pounds							1	11.988	Product	Gallons	
Flood Control Ditch					5	20.771	Product	Grams		1	2	Product	Pounds											
Marshes (Fresh Water)					2	1.2	Product	Pounds																
Marsh - Seasonal					1	20	Product	Pounds																
Marsh - Tidal					2	0.207	Product	Pounds		7	17.092	Product	Pounds											
Residential Areas																								
Industrial Areas																								
Recreational Areas																								
Agricultural Areas																								
Aeration Pond										4	12.404	Product	Pounds											
Waste Pond					14	185.15	Product	Pounds		36	142.387		Pounds		2	0.198	Product	Pounds	each					
Reservoir					1	60	Product	Pounds																
Settling Pond																								
Hayfield Ditch					8	115.97	Product	Pounds												1	0.187	Product	Gallons	
Pastures																								
Irrigated Reservoir					2	20	Product	Pounds																
Swamps																								
Overgrown Waste Areas																								
Roadsides																								
Roadside Ditch	0.143	Product	Pounds	each	1	0.037	Product	Pounds		10	3.151	Product	Pounds		2	0.066	Product	Pounds	each					
Woodlands																								
Gardens																								
Playgrounds																								
Campsites																								
Athletic Fields																								
Municipalities																								
Catch Basin	0.557	Product	Pounds	each	3	0.018	Product	Pounds		3	0.011	Product	Pounds		109	6.622	Product	Pounds	each					
Waste Treatment Plant					3	0.638	Product	Pounds		3	2360	Product	Pounds		8	0.418	Product	Pounds	each					
Water Treatment Plant															1	0.022	Product	Pounds	each					
Wildlife Refuge Treated Effluent					4	600	Product	Pounds												5	0.656	Product	Gallons	
Overland Flow																								
Waste Water Irrigation (e.g. pastures)					70	1748.723	Product	Pounds		20	211.4	Product	Pounds		3	0.176	Active Ingredient	Pounds	each					
Storm Sewer Line																								
Storm Water BMP																								
Retention Basin					3	11.3	Product	Pounds		1	0.8	Product	Pounds											
Sewer Pond					5	32	Product	Pounds		11	382.1	Product	Pounds											
Indoors																								
Total	2.745	Product	Pounds	each	198	3154.328	Product	Pounds		161	4765.205	Product	Pounds		162	8.778	Mix	Pounds	each	12	16.983	Product	Gallons	

Table A17. **Pesticide Application Data for Fall 2011 – MSMVCD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoBac Technical Powder - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoBac Technical Powder Comments	Drione - # Treatments	Total Amount Used1112	Total Amount Type1213	Total Amount Unit1214	Drione Comments	VectoLex WDG - # Treatments
Anthropogenic Sources	72	0.738	Product	Gallons							24	3.448	Product	Gallons		2	0.011	Product	Pounds		7	0.69	Product	Pounds		1
Drainage Ditch Man Made						1	0.004	Product	Gallons		3	0.824	Product	Gallons		4	0.041	Product	Pounds							
Manmade Wetlands																										
Manmade Wetlands Seasonal																										
Wetlands Permanent Treated Effluent																										
Natural Wetlands																										
Natural Wetlands Seasonal																										
Vernal Pool																										
Vernal Pool Manmade																										
Mitigated Wetlands Seasonal																										
Wildlife Refuge																										
Pond	34	0.074	Product	Gallons							5	1.039									1	0.063	Product	Pounds		2
Wildlife Pond											1	0.018	Product	Gallons												
Rain Pond	1	0.007	Product	Gallons							1	0.012	Product	Gallons												
Natural Spring	1	0.005	Product	Gallons																						
Low Area	5	0.505	Product	Gallons							1	0.164	Product	Gallons		1	0.001	Product	Pounds							
Waterways																										
Creeks	8	0.047	Product	Gallons												10	0.253	Product	Pounds		2	0.125	Product	Pounds		
Treehole																										
Culvert	2	0.002	Product	Gallons							1	0.014	Product	Gallons												
Natural Ditch	7	0.105	Product	Gallons							3	0.524	Product	Gallons							1	0.063	Product	Pounds		2
Flood Control Ditch																										
Marshes (Fresh Water)						1	0.5	Product	Gallons																	
Marsh - Seasonal						3	7	Product	Gallons																	
Marsh - Tidal	2	0.014	Product	Gallons		2	0.109	Product	Gallons		1	0.046	Product	Gallons		5	0.226	Product	Pounds							
Cracked Ground																										
Residential Areas																										
Industrial Areas																										
Recreational Areas																										
Agricultural Areas																										
Aeration Pond											4	2.149	Product	Gallons												
Waste Pond	7	2.807	Product	Gallons							19	30.305	Product	Gallons							1	0.063	Product	Pounds		6
Reservoir																										
Settling Pond											6	1.844	Product	Gallons												
Hayfield Ditch	1	0.01	Product	Gallons																						
Pastures																										1
Irrigated Reservoir																					1	0.063	Product	Pounds		
Swamps																										
Overgrown Waste Areas																										
Roadsides																										
Roadside Ditch	5	0.044	Product	Gallons		1	0.005	Product	Gallons		10	1.233	Product	Gallons		4	0.083	Product	Pounds		1	0.063	Product	Pounds		
Woodlands																										
Gardens																										
Playgrounds																										
Campsites																										
Athletic Fields																										
Municipalities																										
Catch Basin	6	0.008	Product	Gallons							35	0.633	Product	Gallons		1	0.002	Product	Pounds							
Waste Treatment Plant											1	0.002	Product	Gallons												
Water Treatment Plant											30	52.823	Product	Gallons												
Wildlife Refuge Treated Effluent																										
Overland Flow																										
Waste Water Irrigation (e.g. pastures)	1	0.25	Product	Gallons		3	16.25	Product	Gallons		3	6.3	Product	Gallons												7
Storm Sewer Line											1	0.012	Product	Gallons												
Storm Water BMP																										
Retention Basin	1	0.01	Active Ingredient	Gallons																						
Sewer Pond	4	1.163	Product	Gallons		1	0.25	Product	Gallons		3	6	Product	Gallons												1
Indoors																										
Total																										
Totals	157	5.789	Mix	Gallons		12	24.118	Product	Gallons		152	107.39	Product	Gallons		27	0.617	Product	Pounds		14	1.13	Product	Pounds		20

Table A17.

Application Sites:	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Zenivex - # Treatments	Total Amount Used3548	Total Amount Type3649	Total Amount Unit3650	Zenivex Comments	Pyrocide fogging concentrate 7396 - # Treatments	Total Amount Used3144	Total Amount Type3245	Total Amount Unit3246	Pyrocide fogging concentrate 7396 Comments	VectoBac GS - # Treatments	Total Amount Used3347	Total Amount Type3448	Total Amount Unit3449	VectoBac GS Comments	Altosid Pellets - # Treatments	Total Amount Used111269	Total Amount Type121370	Total Amount Unit121471	Altosid Pellets Comments	Altosid XR Briquets - # Treatments
Anthropogenic Sources	0.063	Product	Pounds							13	0.012	Product	Gallons							55	24.506	Product	Pounds		199
Drainage Ditch Man Made															1	0.2	Product	Gallons		2	0.026	Product	Pounds		1
Manmade Wetlands																									
Manmade Wetlands Seasonal																									
Wetlands Permanent Treated Effluent																									
Natural Wetlands																									
Natural Wetlands Seasonal																									
Vernal Pool																									
Vernal Pool Manmade																									
Mitigated Wetlands Seasonal																									
Wildlife Refuge																									
Pond	0.225	Product	Pounds																	4	0.029	Product	Pounds		103
Wildlife Pond																									
Rain Pond																									
Natural Spring																				2	0.029	Product	Pounds		
Low Area																				5	0.749	Product	Pounds		4
Waterways																									
Creeks																				8	5.469	Product	Pounds		1
Treehole																									
Culvert																									
Natural Ditch	0.813	Product	Pounds																	3	2.39	Product	Pounds		2
Flood Control Ditch																									
Marshes (Fresh Water)																									
Marsh - Seasonal																				1	4.5	Product	Pounds		
Marsh - Tidal															4	2.845	Product	Pounds		5	30.554	Product	Pounds		
Cracked Ground																									
Residential Areas																									
Industrial Areas																									
Recreational Areas																									
Agricultural Areas																									
Aeration Pond																									
Waste Pond	1.25	Product	Pounds												1	0.069	Product	Pounds		2	0.178	Product	Pounds		
Reservoir																									
Settling Pond																									1
Hayfield Ditch																									
Pastures	0.188	Product	Pounds																						
Irrigated Reservoir																									
Swamps																									
Overgrown Waste Areas																									
Roadsides																									
Roadside Ditch																				4	0.35	Product	Pounds		2
Woodlands																									
Gardens																									
Playgrounds																									
Campsites																									
Athletic Fields																									
Municipalities																									
Catch Basin																				6	0.104	Product	Pounds		17
Waste Treatment Plant					1	0.295	Product	Gallons		5	1.173	Product	Gallons							1	0.15	Product	Pounds		2
Water Treatment Plant																									
Wildlife Refuge Treated Effluent																									
Overland Flow																									
Waste Water Irrigation (e.g. pastures)	1.5	Product	Pounds																						1
Storm Sewer Line																									
Storm Water BMP																									1
Retention Basin																				1	0.007	Product	Pounds		1
Sewer Pond	0.86	Product	Pounds																	1	0.415	Product	Pounds		1
Indoors																									
Total																									
Totals	4.899	Product	Pounds		1	0.295	Product	Gallons		18	1.185	Product	Gallons		6	3.114	Product	Pounds		100	69.456	Product	Pounds		336

Table A17.

Application Sites:	Total Amount Used151875	Total Amount Type161976	Total Amount Unit162077	Altosid XR Briquets Comments	Altosid Briquettes (Standard) -# Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit	Altosid Briquettes Comments	Vectolex CG - # Treatments	Total Amount Used3	Total Amount Type4	Total Amount Unit5	Vectolex CG Comments	Vectomax CG - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit8	Vectomax CG Comments	VectoLex WSP - # Treatments	Total Amount Used5	Total Amount Type6	Total Amount Unit7	VectoLex WSP Comments
Anthropogenic Sources	69.547	Product	Pounds	each	24	1.841	Product	Pounds	each	6	0.8	Product	Pounds		10	0.785	Product	Pounds		16	1.034	Product	Pounds	each
Drainage Ditch Man Made	0.111	Product	Pounds	each	1	0.029	Product	Pounds	each	2	0.095	Product	Pounds		1	5	Product	Pounds		1	0.132	Product	Pounds	each
Manmade Wetlands																								
Manmade Wetlands Seasonal																								
Wetlands Permanent Treated Effluent															2	11.6	Product	Pounds						
Natural Wetlands																								
Natural Wetlands Seasonal																								
Vernal Pool																								
Vernal Pool Manmade																								
Mitigated Wetlands Seasonal																								
Wildlife Refuge																								
Pond	18.111	Product	Pounds	each	4	0.086	Product	Pounds	each	4	23.367	Product	Pounds		11	5.304	Product	Pounds		8	0.308	Product	Pounds	each
Wildlife Pond																								
Rain Pond										1	0.5	Product	Pounds		1	1.25	Product	Pounds						
Natural Spring										1	0.8	Product	Pounds											
Low Area	0.667	Product	Pounds	each						1	0.04	Product	Pounds		3	23	Product	Pounds		3	0.066	Product	Pounds	each
Waterways																								
Creeks	0.111	Product	Pounds	each	1	0.029	Product	Pounds	each	3	1.3	Product	Pounds		7	45.93	Product	Pounds		1	0.044	Product	Pounds	each
Treehole																								
Culvert																								
Natural Ditch	0.556	Product	Pounds	each	1	0.014	Product	Pounds	each	1	2	Product	Grams											
Flood Control Ditch																								
Marshes (Fresh Water)																								
Marsh - Seasonal										2	160.5	Product	Pounds		1	1	Product	Pounds						
Marsh - Tidal										1	0.009	Product	Pounds		5	24.75	Product	Pounds						
Cracked Ground																								
Residential Areas																								
Industrial Areas																								
Recreational Areas																								
Agricultural Areas																								
Aeration Pond															1	1.2	Product	Pounds						
Waste Pond										2	22.5	Product	Pounds		21	160.262	Product	Pounds						
Reservoir																								
Settling Pond	0.222	Product	Pounds	each																				
Hayfield Ditch										1	0.5	Product	Pounds											
Pastures										1	5	Product	Pounds											
Irrigated Reservoir																								
Swamps																								
Overgrown Waste Areas																								
Roadsides																								
Roadside Ditch	1	Product	Pounds	each	3	0.057	Product	Pounds	each	3	0.145	Product	Pounds		1	0.046	Product	Pounds		5	0.22	Product	Pounds	each
Woodlands																								
Gardens																								
Playgrounds																								
Campsites																								
Athletic Fields																								
Municipalities																								
Catch Basin	4.611	Product	Pounds	each	30	1.4	Product	Pounds	each	2	0.2	Product	Pounds							28	2.728	Product	Pounds	each
Waste Treatment Plant	0.889	Product	Pounds	each	1	0.014	Product	Pounds	each						2	980.069	Product	Pounds		1	0.022	Product	Pounds	each
Water Treatment Plant																								
Wildlife Refuge Treated Effluent										1	320	Product	Pounds											
Overland Flow																								
Waste Water Irrigation (e.g. pastures)	1.111	Product	Pounds	each						10	197.5	Product	Pounds		1	10	Product	Pounds		1	0.022	Product	Pounds	each
Storm Sewer Line																								
Storm Water BMP	0.111	Product	Pounds	each	1	0.014	Product	Pounds	each															
Retention Basin	0.444	Product	Pounds	each						4	15.772	Product	Pounds		1	0.48	Product	Pounds		1	0.022	Product	Pounds	each
Sewer Pond	0.444	Product	Pounds	each											2	7	Product	Pounds						
Indoors																								
Total																								
Totals	97.935	Product	Pounds	each	66	3.484	Product	Pounds	each	46	751.028	Product	Pounds		70	1277.676	Product	Pounds		65	4.598	Product	Pounds	each

Table A18. **Pesticide Application Data for Winter 2012 – MSMVCD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoBac Technical Powder - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20
Anthropogenic Sources	93	2.381	Product	Gallons							40	11.166	Product	Gallons		9	0.151	Product	Gallons					
Drainage Ditch Man Made	1	0.003	Product	Gallons							12	5.663	Product	Gallons										
Manmade Wetlands																								
Manmade Wetlands Seasonal	1	0.05	Product	Gallons							1	0.031	Product	Gallons										
Wetlands Permanent Treated Effluent											1	1.25	Product	Gallons										
Natural Wetlands																								
Natural Wetlands Seasonal											2	7.75	Product	Gallons		1	25	Product	Gallons					
Vernal Pool	1	0.05	Product	Gallons							4	0.844	Product	Gallons										
Vernal Pool Manmade											3	0.75	Product	Gallons										
Mitigated Wetlands - Seasonal											5	7.925	Product	Gallons										
Wildlife Refuge											1	0.75	Product	Gallons										
Pond	31	0.247	Product	Gallons							17	8.602	Product	Gallons		1	0.25	Product	Gallons					
Dredge Pond											1	1.25	Product	Gallons										
Wildlife Pond																								
Rain Pond	5	0.106	Product	Gallons							23	14.025	Product	Gallons										
Natural Spring	3	0.114	Product	Gallons							1	0.25	Product	Gallons										
Low Area	20	5.114	Product	Gallons							121	80.573	Product	Gallons		4	3.555	Product	Gallons					
Waterways																								
Creeks	5	0.085	Product	Gallons																				
Treehole																								
Culvert											1	0.004	Product	Gallons										
Natural Ditch	2	0.089	Product	Gallons		1	0.18	Product	Pounds		17	8.637	Product	Gallons										
Flood Control Ditch																								
Marshes (Fresh Water)											7	3.779	Product	Gallons										
Marsh - Seasonal											36	93.909	Product	Gallons		2	0.077	Product	Gallons					
Marsh - Tidal	3	0.129	Product	Gallons							15	19.937	Product	Gallons										
Cracked Ground											4	10.001	Product	Gallons										
Residential Areas	661	21.355		0		0	0		0		170	522.089		0		257	98.639				28	0.573		
Industrial Areas																								
Recreational Areas																								
Agricultural Areas																								
Aeration Pond																								
Waste Pond	10	0.324	Product	Gallons							1	0.05	Product	Gallons		2	0.395	Product	Gallons					
Reservoir	1	0.031	Product	Gallons																				
Settling Pond																								
Hayfield Ditch											24	22.5	Product	Gallons										
Pastures																								
Irrigated Reservoir																								
Swamps																								
Overgrown Waste Areas																								
Roadsides																								
Roadside Ditch	11	0.091	Product	Gallons							25	3.704	Product	Gallons		3	0.545	Product	Gallons					
Woodlands																								
Gardens																								
Playgrounds																								
Campsites																								
Athletic Fields																								
Municipalities																								
Catch Basin	1	0.001																						
Waste Treatment Plant	12	0.171	Product	Gallons							3	0.25	Product	Gallons							2	0.645	Product	Pounds
Water Treatment Plant																								
Wildlife Refuge Treated Effluent											1	5.001	Product	Gallons										
Overland Flow																								
Waste Water Irrigation (e.g. pastures)											6	0.422	Product	Gallons										
Storm Sewer Line																								
Storm Water BMP																								
Retention Basin											4	0.519	Product	Gallons										
Sewer Pond																1	2.5	Product	Gallons					
Indoors																								
Total	200	8.986	Product	Gallons		1	0.18	Product	Pounds		376	309.542	Product	Gallons		23	32.473	Product	Gallons		2	0.645	Product	Pounds

Table A18.

Application Sites:	VectoBac Technical Powder Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Pyrocide fogging concentrate 7396 - # Treatments	Total Amount Used3144	Total Amount Type3245	Total Amount Unit3246	Pyrocide fogging concentrate 7396 Comments	VectoBac GS - # Treatments	Total Amount Used3347	Total Amount Type3448	Total Amount Unit3449	VectoBac GS Comments	Altosid Liquid Concentrate - # Treatments	Total Amount Used6966	Total Amount Type71067	Total Amount Unit71168	Altosid Liquid Concentrate Comments	Altosid Pellets - # Treatments
Anthropogenic Sources		4	1.1	Product	Pounds		9	0.027	Product	Gallons		1	0.17	Product	Pounds							24
Drainage Ditch Man Made		1	0.198	Product	Pounds							1	0.028	Product	Pounds							2
Manmade Wetlands																						
Manmade Wetlands Seasonal																						2
Wetlands Permanent Treated Effluent																						
Natural Wetlands																						
Natural Wetlands Seasonal																						
Vernal Pool		1	0.188	Product	Pounds																	
Vernal Pool Manmade		2	1.12	Product	Pounds							1	30	Product	Pounds							
Mitigated Wetlands - Seasonal																						
Wildlife Refuge																						
Pond		1	1.25	Product	Pounds																	3
Dredge Pond																						
Wildlife Pond																						
Rain Pond												1	0.092	Product	Pounds							1
Natural Spring												1	0.068	Product	Pounds							
Low Area		5	4.938	Product	Pounds							6	23.01	Product	Pounds							17
Waterways																						
Creeks																						5
Treehole																						
Culvert																						
Natural Ditch												1	0.092	Product	Pounds							3
Flood Control Ditch																						1
Marshes (Fresh Water)																						1
Marsh - Seasonal																						1
Marsh - Tidal																						10
Cracked Ground																						1
Residential Areas		2	0.133				0	0				2	0.133				5	660		0		170
Industrial Areas																						
Recreational Areas																						
Agricultural Areas																						
Aeration Pond																						
Waste Pond		4	0.54	Product	Pounds																	1
Reservoir																						
Settling Pond																						
Hayfield Ditch		3	13	Product	Pounds												16	2.045	Product	Gallons		2
Pastures																						1
Irrigated Reservoir																						
Swamps																						
Overgrown Waste Areas																						
Roadsides																						
Roadside Ditch												1	0.057	Product	Pounds		2	0.101	Product	Gallons		9
Woodlands																						
Gardens																						
Playgrounds																						
Campsites																						
Athletic Fields																						
Municipalities																						
Catch Basin																						
Waste Treatment Plant																						
Water Treatment Plant																						
Wildlife Refuge Treated Effluent																	1	0.624	Product	Gallons		
Overland Flow																						
Waste Water Irrigation (e.g. pastures)		10	1.469	Product	Pounds																	
Storm Sewer Line																						
Storm Water BMP																						
Retention Basin																						
Sewer Pond																						
Indoors																						
Total		31	23.803	Product	Pounds		9	0.027	Product	Gallons		13	53.517	Product	Pounds		19	2.77	Product	Gallons		84

Table A18.

Application Sites:	Total Amount Used111269	Total Amount Type121370	Total Amount Unit121471	Altosid Pellets Comments	Altosid XR Briquets - # Treatments	Total Amount Used151875	Total Amount Type161976	Total Amount Unit162077	Altosid XR Briquets Comments	Altosid XR-G - # Treatments	Total Amount Used172178	Total Amount Type182279	Total Amount Unit182380	Altosid XR-G Comments	Altosid Briquettes (Standard) -# Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit	Altosid Briquettes Comments	Vectolex CG - # Treatments	Total Amount Used3	Total Amount Type4	Total Amount Unit5	Vectolex CG Comments
Anthropogenic Sources	26.411	Product	Pounds		182	49.769	Product	Pounds	each	1	0.05	Product	Pounds		1	0.014	Product	Pounds	each	4	3.83	Product	Pounds	
Drainage Ditch Man Made	0.206	Product	Pounds																	1	5	Product	Pounds	
Manmade Wetlands																								
Manmade Wetlands Seasonal	0.052	Product	Pounds																	1	50	Product	Pounds	
Wetlands Permanent Treated Effluent																								
Natural Wetlands																								
Natural Wetlands Seasonal																								
Vernal Pool																				7	159.25	Product	Pounds	
Vernal Pool Manmade																				8	309.968	Product	Pounds	
Mitigated Wetlands - Seasonal																				3	112	Product	Pounds	
Wildlife Refuge																								
Pond	1.018	Product	Pounds		73	14.111	Product	Pounds	each											10	146.24	Product	Pounds	
Dredge Pond																								
Wildlife Pond																								
Rain Pond	1.5	Product	Pounds		5	2	Product	Pounds	each											3	90	Product	Pounds	
Natural Spring					1	0.333	Product	Pounds	each															
Low Area	10.064	Product	Pounds		3	1.111	Product	Pounds	each											24	231.205	Product	Pounds	
Waterways							Product	Pounds	each															
Creeks	22.267	Product	Pounds		2	0.222	Product	Pounds	each															
Treehole					1	0.111	Product	Pounds	each															
Culvert																								
Natural Ditch	0.208	Product	Pounds																	2	2.203	Product	Pounds	
Flood Control Ditch	0.113	Product	Pounds																					
Marshes (Fresh Water)	3	Product	Pounds																	2	60	Product	Pounds	
Marsh - Seasonal	44	Product	Pounds																					
Marsh - Tidal	47.868	Product	Pounds																					
Cracked Ground	0.09	Product	Pounds																					
Residential Areas	522.089		0		0	0		0		0	0													
Industrial Areas																								
Recreational Areas																								
Agricultural Areas																								
Aeration Pond																								
Waste Pond	0.3	Product	Pounds																	2	17.9	Product	Pounds	
Reservoir																								
Settling Pond																								
Hayfield Ditch	0.117	Product	Pounds																					
Pastures	0.034	Product	Pounds																					
Irrigated Reservoir																								
Swamps																								
Overgrown Waste Areas																								
Roadsides																								
Roadside Ditch	0.405	Product	Pounds																	8	15.065	Product	Pounds	
Woodlands																								
Gardens																								
Playgrounds																								
Campsites																								
Athletic Fields																								
Municipalities																								
Catch Basin					13	2.556	Active Ingredient	Pounds																
Waste Treatment Plant																								
Water Treatment Plant																								
Wildlife Refuge Treated Effluent																								
Overland Flow																								
Waste Water Irrigation (e.g. pastures)																								
Storm Sewer Line																								
Storm Water BMP																								
Retention Basin																								
Sewer Pond					1	0.222	Active Ingredient	Pounds																
Indoors																								
Total	157.653	Product	Pounds		281	70.435	Active Ingredient	Pounds		1	0.05	Product	Pounds		1	0.014	Product	Pounds		75	1202.661	Product	Pounds	

Table A18.

Application Sites:	Vectomax CG - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit8	Vectomax CG Comments	VectoBac WDG - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit4	VectoBac WDG comments	VectoLex WSP - # Treatments	Total Amount Used5	Total Amount Type6	Total Amount Unit7	VectoLex WSP Comments	Altosid Liquid (non-concentrate) - # Treatments	Total Amount Used8	Total Amount Type9	Total Amount Unit10	Altosid Liquid (non-concentrate) comments
Anthropogenic Sources	1	0.12	Product	Pounds												3	0.788	Product	Gallons	
Drainage Ditch Man Made	4	16.255	Product	Pounds												5	0.531	Active Ingredient	Gallons	
Manmade Wetlands																				
Manmade Wetlands Seasonal	1	10	Product	Pounds							3	0.22	Product	Pounds	each					
Wetlands Permanent Treated Effluent	1	10	Product	Pounds												1	0.156	Product	Gallons	
Natural Wetlands																				
Natural Wetlands Seasonal																				
Vernal Pool	1	10	Product	Pounds																
Vernal Pool Manmade	3	70	Product	Pounds																
Mitigated Wetlands - Seasonal																				
Wildlife Refuge																				
Pond	4	3.748	Product	Pounds							2	0.154	Product	Pounds	each	3	0.765	Product	Gallons	
Dredge Pond																				
Wildlife Pond	1	0.688	Product	Pounds																
Rain Pond	8	69.175	Product	Pounds												5	1.353	Product	Gallons	
Natural Spring	1	0.023	Product	Pounds																
Low Area	45	342.341	Product	Pounds		3	3.565	Product	Pounds							25	5.15	Product	Gallons	
Waterways																				
Creeks																				
Treehole																				
Culvert	1	0.045	Product	Pounds																
Natural Ditch	2	0.2	Product	Pounds												3	0.273	Product	Gallons	
Flood Control Ditch																				
Marshes (Fresh Water)	6	132.05	Product	Pounds												4	0.406	Product	Gallons	
Marsh - Seasonal																6	2.314	Product	Gallons	
Marsh - Tidal	16	163.219	Product	Pounds												7	1.936	Product	Gallons	
Cracked Ground																				
Residential Areas																				
Industrial Areas																				
Recreational Areas																				
Agricultural Areas																				
Aeration Pond																				
Waste Pond	8	24.75	Product	Pounds																
Reservoir																				
Settling Pond	1	0.7	Product	Pounds																
Hayfield Ditch																16	2.045	Product	Gallons	
Pastures																				
Irrigated Reservoir	1	0.1	Product	Pounds																
Swamps																				
Overgrown Waste Areas																				
Roadsides																				
Roadside Ditch	10	21.68	Product	Pounds												2	0.101	Product	Gallons	
Woodlands																				
Gardens																				
Playgrounds																				
Campsites																				
Athletic Fields																				
Municipalities																				
Catch Basin							1	0.198	Product	Pounds	each									
Waste Treatment Plant																				
Water Treatment Plant																				
Wildlife Refuge Treated Effluent																1	0.624	Product	Gallons	
Overland Flow																				
Waste Water Irrigation (e.g. pastures)	4	5.6	product	pounds																
Storm Sewer Line																				
Storm Water BMP																				
Retention Basin																				
Sewer Pond	5	56.25	Product	pounds																
Indoors																				
Total	124	936.944	Product	Pounds		3	3.565	Product	Pounds		6	0.572	Product	Pounds	each	81	16.442	Product	Gallons	

Table A19. Pesticide Application Data for Spring2012 – MSMVCD

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	Agnique MMF G - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Agnique MMF G Comments	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoBac Technical Powder - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20
Anthropogenic Sources	212	1.434	Product	Gallons							9	11.952	Product	Gallons		44	1.758	Product	Gallons		2	0.025	Product	Pounds
Drainage Ditch Man Made	9	0.24	Product	Gallons							7	40.625	Product	Gallons		6	0.21	Product	Gallons		2	0.001	Product	Pounds
Manmade Wetlands																								
Manmade Wetlands Seasonal											5	4.925	Product	Gallons										
Wetlands Permanent Treated Effluent						4	399	Product	Pounds		1	1.25	Product	Gallons										
Natural Wetlands																								
Natural Wetlands Seasonal																								
Vernal Pool											1	0.063	Product	Gallons										
Vernal Pool Manmade	1	0.009									2	0.896	Product	Gallons		1	5	Product	Gallons					
Mitigated Wetlands Seasonal																								
Wildlife Refuge											2	4.367	Product	Gallons										
Pond	225	4.985	Product	Gallons							6	5.666	Product	Gallons		5	5.018	Product	Gallons					
Dredge Pond																								
Wildlife Pond																								
Rain Pond	6	0.628	Product	Gallons							11	27.484	Product	Gallons		1	1	Product	Gallons		1	0.059	Product	Pounds
Natural Spring	3	0.04	Product	Gallons																				
Low Area	35	8.908	Product	Gallons							53	147.205	Product	Gallons		13	14.807	Product	Gallons		2	0.004	Product	Pounds
Waterways																								
Creeks	22	0.753	Product	Gallons							8	0.568	Product	Gallons		4	0.188	Product	Gallons		6	0.089	Product	Pounds
Treehole	1	0.005	Product	Gallons																				
Culvert	1	0.001	Product	Gallons												1	0.035	Product	Gallons					
Natural Ditch	10	0.533	Product	Gallons							8	2.854	Product	Gallons		10	5.966	Product	Gallons					
Flood Control Ditch																1	0.006	Product	Gallons					
Marshes (Fresh Water)	3	0.033	Product	Gallons							5	2.41	Product	Gallons							1	0.086	Product	Pounds
Marsh - Seasonal											17	105.89	Product	Gallons		1	0.469	Product	Gallons		2	0.215	Product	Pounds
Marsh - Tidal	4	0.059	Product	Gallons							8	156.029	Product	Gallons							4	0.035	Product	Pounds
Cracked Ground																								
Residential Areas																								
Industrial Areas																								
Recreational Areas																								
Agricultural Areas																								
Aeration Pond	2	0.002	Product	Gallons																				
Waste Pond	31	1.758	Product	Gallons							1	0.031	Product	Gallons		22	44.661	Product	Gallons					
Reservoir																								
Settling Pond	2	0.11	Product	Gallons												1	0.023	Product	Gallons					
Hayfield Ditch											11	6.25	Product	Gallons										
Pastures																								
Irrigated Reservoir																								
Swamps																								
Overgrown Waste Areas																								
Roadsides																								
Roadside Ditch	25	0.473	Product	Gallons							8	1.323	Product	Gallons		26	2.755	Product	Gallons		8	0.059	Product	Pounds
Woodlands																								
Gardens																								
Playgrounds																								
Campsites																								
Athletic Fields																								
Municipalities																								
Catch Basin	28	0.048	Product	Gallons							2	0.001	Product	Gallons		110	4.835	Product	Gallons					
Waste Treatment Plant	35	0.709	Product	Gallons												2	0.163	Product	Gallons					
Water Treatment Plant																6	10.62	Product	Gallons					
Wildlife Refuge Treated Effluent																								
Overland Flow																								
Waste Water Irrigation (e.g. pastures)	2	0.007	Product	Gallons							2	0.2	Product	Gallons										
Storm Sewer Line																								
Storm Water BMP																								
Retention Basin											2	1.35	Product	Gallons										
Sewer Pond	4	0.62	Product	Gallons		1	261	Product	Pounds		1	0.75	Product	Gallons		3	1.125	Product	Gallons					
Indoors																								
Totals	661	21.355	Product	Gallons		5	660	Product	Pounds		170	522.089	Product	Gallons		257	98.639	Product	Gallons		28	0.573	Product	Pounds

Table A19.

Application Sites:	VectoBac Technical Powder Comments	Wasp Freeze - # Treatments	Total Amount Used33	Total Amount Type34	Total Amount Unit34	Wasp Freeze Comments	Drione - # Treatments	Total Amount Used1112	Total Amount Type1213	Total Amount Unit1214	Drione Comments	FourStar 45 - # Treatments	Total Amount Used2127	Total Amount Type2228	Total Amount Unit2229	FourStar 45 Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Pyrocide fogging concentrate 7067 - # Treatments	Total Amount Used2535	Total Amount Type2636
Anthropogenic Sources		1	0.008	Product	Pounds							1	0.21	Active Ingredient	Pounds		5	3.5	Product	Pounds		9	0.22	Product
Drainage Ditch Man Made																	3	0.255	Product	Pounds		2	0.328	Product
Manmade Wetlands																								
Manmade Wetlands Seasonal																								
Wetlands Permanent Treated Effluent																						8	0.938	Product
Natural Wetlands																								
Natural Wetlands Seasonal																								
Vernal Pool																	2	0.563	Product	Pounds				
Vernal Pool Manmade																	3	3.725	Product	Pounds				
Mitigated Wetlands Seasonal																								
Wildlife Refuge																								
Pond							2	0.125	Product	Pounds												7	0.375	Product
Dredge Pond																								
Wildlife Pond																								
Rain Pond																								
Natural Spring																								
Low Area																	1	0.325	Product	Pounds		10	0.483	Product
Waterways																								
Creeks																	8	1.506	Product	Pounds		2	0.288	Product
Treehole																						1	2.082	Product
Culvert																	1	0.01	Product	Pounds				
Natural Ditch																								
Flood Control Ditch																	1	0.015	Product	Pounds				
Marshes (Fresh Water)																	1	2	Product	Pounds				
Marsh - Seasonal		1	0.125	Product	Pounds												1	0.5	Product	Pounds				
Marsh - Tidal																								
Cracked Ground																								
Residential Areas																								
Industrial Areas																								
Recreational Areas																								
Agricultural Areas																								
Aeration Pond																								
Waste Pond																	4	2.838	Product	Pounds				
Reservoir																								
Settling Pond																								
Hayfield Ditch																	3	32	Product	Pounds		1	0.563	Product
Pastures																								
Irrigated Reservoir																								
Swamps																								
Overgrown Waste Areas																								
Roadsides																								
Roadside Ditch																								
Woodlands																								
Gardens																								
Playgrounds																								
Campsites																								
Athletic Fields																								
Municipalities																								
Catch Basin																								
Waste Treatment Plant																						4	0.859	Product
Water Treatment Plant																								
Wildlife Refuge Treated Effluent																								
Overland Flow																								
Waste Water Irrigation (e.g. pastures)																	10	1.625	Product	Pounds				
Storm Sewer Line																								
Storm Water BMP																								
Retention Basin																								
Sewer Pond																	2	3.248	Product	Pounds		4	0.656	Product
Indoors																								
Totals		2	0.133	Product	Pounds		2	0.125	Product	Pounds		1	0.21	Active Ingredient	Pounds		45	52.11	Product	Pounds		48	6.792	Product

Table A19.

Application Sites:	Total Amount Unit2637	Pyrocide fogging concentrate 7067 Comments	VectoBac GS - # Treatments	Total Amount Used3347	Total Amount Type3448	Total Amount Unit3449	VectoBac GS Comments	Altosid Liquid Concentrate - # Treatments	Total Amount Used6966	Total Amount Type71067	Total Amount Unit71168	Altosid Liquid Concentrate Comments	Altosid Pellets - # Treatments	Total Amount Used111269	Total Amount Type121370	Total Amount Unit121471	Altosid Pellets Comments	Altosid SBG - # Treatments	Total Amount Used131572	Total Amount Type141673	Total Amount Unit141774	Altosid SBG Comments	Altosid XR Briquets - # Treatments	Total Amount Used151875
Anthropogenic Sources	Gallons												73	37.604	Product	Pounds							484	127.783
Drainage Ditch Man Made	Gallons							1	2.465	Product	Gallons												5	1.222
Manmade Wetlands																								
Manmade Wetlands Seasonal													1	0.103	Product	Pounds								
Wetlands Permanent Treated Effluent	Gallons																							
Natural Wetlands																								
Natural Wetlands Seasonal			1	800	Product	Pounds																		
Vernal Pool																								
Vernal Pool Manmade																								
Mitigated Wetlands Seasonal													1	2.5	Product	Pounds								
Wildlife Refuge																								
Pond	Gallons							1	0.322	Product	Gallons		14	0.52	Product	Pounds							414	76.777
Dredge Pond																								
Wildlife Pond																								
Rain Pond			2	6.5	Product	Pounds		2	1.013	Product	Gallons		6	3.359	Product	Pounds							4	1.333
Natural Spring													2	1.046	Active Ingredient	Pounds							1	0.222
Low Area	Gallons		4	22.557	Product	Gallons		2	4.366	Product	Gallons		36	101.037	Product	Pounds		1	40	Product	Pounds			
Waterways																								
Creeks	Gallons		1	1.25	Product	Pounds							47	33.522	Product	Pounds							11	3.778
Treehole	Gallons																						1	0.111
Culvert													3	0.042	Product	Pounds							1	0.222
Natural Ditch			2	1.046	Product	Pounds							5	1.196	Product	Pounds							3	0.667
Flood Control Ditch			2	1.7									3	0.246	Product	Pounds								
Marshes (Fresh Water)			1	14	Product	Pounds							5	6.25	Product	Pounds								
Marsh - Seasonal			4	12.5	Product	Pounds		5	5.799	Product	Gallons		8	436.75	Product	Pounds		1	120	Product	Pounds			
Marsh - Tidal			2	10	Product	Pounds		3	5.059	Product	Gallons		40	1243.028	Product	Pounds								
Cracked Ground													1	9	Product	Pounds		1	40	Product	Pounds			
Residential Areas																								
Industrial Areas																								
Recreational Areas																								
Agricultural Areas																								
Aeration Pond																								
Waste Pond													3	1.055	Product	Pounds							1	0.222
Reservoir													2	0.135	Product	Pounds								
Settling Pond																								
Hayfield Ditch	Gallons																							
Pastures																								
Irrigated Reservoir																								
Swamps																								
Overgrown Waste Areas																								
Roadsides																								
Roadside Ditch			2	0.16	Product	Pounds							21	2.873	Product	Pounds							3	0.333
Woodlands																								
Gardens																								
Playgrounds																								
Campsites																								
Athletic Fields																								
Municipalities																								
Catch Basin													10	0.055	Product	Pounds							529	186.465
Waste Treatment Plant	Gallons												2	0.75	Product	Pounds							1	0.778
Water Treatment Plant																								
Wildlife Refuge Treated Effluent																								
Overland Flow																								
Waste Water Irrigation (e.g. pastures)													3	6.45	Product	Pounds								
Storm Sewer Line																								
Storm Water BMP																								
Retention Basin			1	5	Product	Pounds							1	0.2	Product	Pounds								
Sewer Pond	Gallons		2	8.3	Product	Pounds							4	4.05	Product	Pounds							1	0.667
Indoors																								
Totals	Gallons		24	883.013	Product	Pounds		14	19.024	Product	Gallons		291	1891.771	Product	Pounds		3	200	Product	Pounds		1459	400.58

Table A19.

Application Sites:	Total Amount Type161976	Total Amount Unit162077	Altosid XR Briquets Comments	Altosid XR-G - # Treatments	Total Amount Used172178	Total Amount Type182279	Total Amount Unit182380	Altosid XR-G Comments	Altosid Briquettes (Standard) -# Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit	Altosid Briquettes Comments	Vectolex CG - # Treatments	Total Amount Used3	Total Amount Type4	Total Amount Unit5	Vectolex CG Comments	Vectomax CG - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit8	Vectomax CG Comments	VectoBac WDG - # Treatments
Anthropogenic Sources	Product	Pounds	each						9	0.172	Product	Pounds	each	13	40.11	Product	Pounds		18	32.151	Product	Pounds		
Drainage Ditch Man Made	Product	Pounds	each						1	0.014	Product	Pounds	each	8	23.991	Product	Pounds		5	425.04	Product	Pounds		2
Manmade Wetlands																								
Manmade Wetlands Seasonal									8	1.8	Product	Pounds	each	18	440.5	Product	Pounds		1	60	Product	Pounds		
Wetlands Permanent Treated Effluent																			17	897.6	Product	Pounds		
Natural Wetlands																								
Natural Wetlands Seasonal														5	1092.5	Product	Pounds		3	1560	Product	Pounds		
Vernal Pool														9	184	Product	Pounds		2	60	Product	Pounds		
Vernal Pool Manmade														29	1422.5	Product	Pounds		1	30	Product	Pounds		
Mitigated Wetlands Seasonal														2	190	Product	Pounds		1	2.5	Product	Pounds		
Wildlife Refuge																			1	160	Product	Pounds		
Pond	Product	Pounds	each	1	0.001	Product	Pounds		14	0.286	Product	Pounds	each	10	23.086	Product	Pounds		9	4.951	Product	Pounds		
Dredge Pond																								
Wildlife Pond																								
Rain Pond	Product	Pounds	each											5	89.75	Product	Pounds		4	33.046	Product	Pounds		
Natural Spring	Product	Pounds	each											2	20	Product	Pounds		4	0.318	Product	Pounds		
Low Area														59	808.762	Product	Pounds		29	319.209	Product	Pounds		
Waterways																								
Creeks	Product	Pounds	each						2	0.057	Product	Pounds	each	6	34.213	Product	Pounds		9	22.7	Product	Pounds		
Treehole	Product	Pounds	each																					
Culvert	Product	Pounds	each																					
Natural Ditch	Product	Pounds	each											9	78.637	Product	Pounds		6	31.004	Product	Pounds		
Flood Control Ditch																								
Marshes (Fresh Water)														6	250	Product	Pounds		1	2.3	Product	Pounds		
Marsh - Seasonal														2	20	Product	Pounds		1	0.04	Product	Pounds		
Marsh - Tidal														1	10	Product	Pounds		6	85.758	Product	Pounds		
Cracked Ground																								
Residential Areas																								
Industrial Areas																								
Recreational Areas																								
Agricultural Areas																								
Aeration Pond																								
Waste Pond	Product	Pounds	each											7	45.956	Product	Pounds		22	124.3	Product	Pounds		3
Reservoir																								
Settling Pond														1	2.5	Product	Pounds							
Hayfield Ditch														1	15	Product	Pounds		2	40	Product	Pounds		
Pastures														1	15	Product	Pounds							
Irrigated Reservoir														3	20.013	Product	Pounds							
Swamps																								
Overgrown Waste Areas																								
Roadsides																								
Roadside Ditch	Product	Pounds	each						2	0.043	Product	Pounds	each	8	4.416	Product	Pounds		10	0.943	Product	Pounds		
Woodlands																								
Gardens																								
Playgrounds																								
Campsites																								
Athletic Fields																								
Municipalities																								
Catch Basin	Product	Pounds	each						9	0.457	Product	Pounds	each	1	0.01	Product	Pounds							
Waste Treatment Plant	Product	Pounds	each											3	22.5	Product	Pounds							
Water Treatment Plant																								
Wildlife Refuge Treated Effluent																								
Overland Flow																								
Waste Water Irrigation (e.g. pastures)														15	107.9	Product	Pounds		27	125.3	Product	Pounds		
Storm Sewer Line																								
Storm Water BMP																								
Retention Basin														4	26.48	Product	pounds		2	45.04	Product	pounds		
Sewer Pond	Product	Pounds	each																10	1918	Product	Pounds		
Indoors																								
Totals	Product	Pounds	each	1	0.001	Product	Pounds		45	2.829	Product	Pounds		228	4987.824	Product	Pounds		191	5980.2	Product	Pounds		5

Table A19.

Application Sites:	Total Amount Used2	Total Amount Type3	Total Amount Unit4	VectoBac WDG comments	VectoLex WSP - # Treatments	Total Amount Used5	Total Amount Type6	Total Amount Unit7	VectoLex WSP Comments	Altosid Liquid (non-concentrate) - # Treatments	Total Amount Used8	Total Amount Type9	Total Amount Unit10	Altosid Liquid (non-concentrate) comments	FourStar SBG - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit13	FourStar SBG comments
Anthropogenic Sources					22	1.122	Product	Pounds	each	1	1.369	Product	Gallons						
Drainage Ditch Man Made	0.188	Product	Pounds		1	0.0025	Product	Pounds	each	1	0.203	Product	Gallons						
Manmade Wetlands																			
Manmade Wetlands Seasonal										1	0.053	Product	Gallons						
Wetlands Permanent Treated Effluent										1	0.156	Product	Gallons						
Natural Wetlands																			
Natural Wetlands Seasonal																			
Vernal Pool																			
Vernal Pool Manmade										1	0.018	Product	Gallons						
Mitigated Wetlands Seasonal																			
Wildlife Refuge										2	0.545	Product	Gallons						
Pond					15	0.385	Product	Pounds	each	1	0.008	Product	Gallons						
Dredge Pond																			
Wildlife Pond																			
Rain Pond										7	1.454	Product	Gallons						
Natural Spring																			
Low Area					1	0.022	Product	Pounds	each	33	9.133	Product	Gallons						
Waterways																			
Creeks					2	0.154	Product	Pounds	each	2	0.031	Product	Gallons						
Treehole																			
Culvert																			
Natural Ditch										5	0.437	Product	Gallons						
Flood Control Ditch					1	0.044	Product	Pounds	each										
Marshes (Fresh Water)										3	0.254	Product	Gallons						
Marsh - Seasonal										6	1.267	Product	Gallons		3	120	Product	Pounds	
Marsh - Tidal										3	1.717	Product	Gallons						
Cracked Ground										1	0.156	Product	Gallons						
Residential Areas																			
Industrial Areas																			
Recreational Areas																			
Agricultural Areas																			
Aeration Pond																			
Waste Pond	0.613	Product	Pounds																
Reservoir																			
Settling Pond																			
Hayfield Ditch										11	101.144	Product	Pounds						
Pastures																			
Irrigated Reservoir																			
Swamps																			
Overgrown Waste Areas																			
Roadsides																			
Roadside Ditch					1	0.022	Product	Pounds	each	2	0.156	Product	Gallons						
Woodlands																			
Gardens																			
Playgrounds																			
Campsites																			
Athletic Fields																			
Municipalities																			
Catch Basin					24	1.958	Product	Pounds	each										
Waste Treatment Plant																			
Water Treatment Plant																			
Wildlife Refuge Treated Effluent										1	0.078	Product	Gallons						
Overland Flow																			
Waste Water Irrigation (e.g. pastures)																			
Storm Sewer Line																			
Storm Water BMP																			
Retention Basin										1	0.156	Product	Gallons						
Sewer Pond										1	0.094	Product	Gallons						
Indoors																			
Totals	0.801	Product	Pounds		67	3.7095	Product	Pounds	each	84	118.429	Product	Gallons		3	120	Product	Pounds	

Table A20. Pesticide Product Key – MSMVCD

Product	AI
Agnique MMF G	Biodegradable Alcohol Ethoxylated Surfactant
Agnique MMF Mosquito Larvicide & Pupicide	Biodegradable Alcohol Ethoxylated Surfactant
BVA 2 Mosquito Larvicide Oil	Petroleum Distillate
Delta Dust Insecticide	Deltamethrin
Drione Insecticide	Pyrethrin and Piperonyl Butroxide and Amorphous Silica Gel
FourStar 45	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis
FourStar SBG	Bacillus Thuringiensis Israelensis
Pyrocide Mosquito Adulticiding Concentrate for ULV Fogging 7067	Pyrethrin and Piperonyl Butoxide
Pyrocide Mosquito Adulticiding Concentrate for ULV Fogging 7396	Pyrethrin and Piperonyl Butoxide
VectoBac 12AS Biological Larvicide	Bacillus Thuringiensis Israelensis
VectoBac G Biological Larvicide	Bacillus Thuringiensis Israelensis
VectoBac GS Biological Larvicide	Bacillus Thuringiensis Israelensis
VectoBac Technical Powder Biological Larvicide	Bacillus Thuringiensis Israelensis
VectoBac WDG Biological Larvicide	Bacillus Thuringiensis Israelensis
VectoLex WDG Biological Larvicide	Bacillus Sphaericus
VectoLex WSP Biological Larvicide	Bacillus Sphaericus
VectoMax CG Biological Larvicide	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis
Wasp Freeze	Phenothrin and Trans Allethrin
Zenivex E20	Etofenprox
Zoecon Altosid Briquets	Methoprene
Zoecon Altosid Liquid Larvicide Concentrate	Methoprene
Zoecon Altosid Liquid Larvicide Mosquito Growth Regulator	Methoprene
Zoecon Altosid Pellets	Methoprene
Zoecon Altosid SBG Single Brood Granule	Methoprene
Zoecon Altosid XR Entended Residual Briquets	Methoprene
Zoecon Altosid XR-G	Methoprene

Table A21. **Pesticide Application Data for Summer 2011 – NCMAD**

Application Sites:	5% Skeeter Abate - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	5% Skeeter Abate Comments	Teknar HP-D - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Teknar HP-D Comments	Altosid Liquid SR5 - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit12	Altosid Liquid SR5 Comments	Altosid Pellets - # Treatments	Total Amount Used15	Total Amount Type16
1. Tidal marsh						4	800	Product	Ounces (volume)		4	200	Product	Ounces (volume)				
2. Fresh water marsh	3	360	Product	Ounces (weight)		3	320	Product	Ounces (volume)		3	80	Product	Ounces (volume)		2	400	Product
2A. Reclaimed Marsh						3	560	Product	Ounces (volume)		3	140	Product	Ounces (volume)				
3. Diked marsh																		
4. Seasonal wetland	5	109	Product	Ounces (weight)		4	240	Product	Ounces (volume)		4	60	Product	Ounces (volume)		4	141	Product
4A. Seasonal Vineyard Water/Pothole																		
5. Natural seep																		
6. River margin																		
7. Creek																		
8. Seasonal creek pools	2	6	Product	Ounces (weight)														
9. Channel (unlined)	16	176	Product	Ounces (weight)		13	880	Product	Ounces (volume)		13	220	Product	Ounces (volume)		11	174	Product
10. Ditch																		
10A. Agricultural Ditch						1	160	Product	Ounces (volume)		1	40	Product	Ounces (volume)		2	176	Product
11. Vernal pool																		
12. Flooded/irrigated pasture	1	4	Product	Ounces (weight)														
13. Storm drain/catch basin	15	44	Product	Ounces (weight)		22	1166	Product	Ounces (volume)		22	296	Product	Ounces (volume)		7	21	Product
14. Waste water pond	3	181	Product	Ounces (weight)							1	4	Product	Ounces (volume)		1	32	Product
14A. Waste Water Spray Field/Marsh						3	240	Product	Ounces (volume)		4	70	Product	Ounces (volume)		4	624	Product
15. Winery waste pond																		
16. Stock pond																		
17. Irrigation pond/Vineyard Pond																		
18. Storm water detention basin																2	56	Product
19. Sump	6	40	Product	Ounces (weight)												3	365	Product
20. Septic tank	6	36	Product	Ounces (weight)												7	65	Product
21. Ornamental water garden/fish pond	1	10	Product	Ounces (weight)														
22. Swimming pool																		
23. Spa/hot tub																		
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	22	147	Product	Ounces (weight)												9	126	Product
24A. Agrcultural Containers (e.g. bins, etc.)																		
25. Tree holes																		
26. Horse/livestock watering troughs																		
27. Water under buildings	2	13	Product	Ounces (weight)														
28. Utility vaults																		
29. Dredge Disposal Pond																		
30. Wells/Water Storage Tanks/Pumps																		
31. Water Main Leaks	1	80	Product	Ounces (weight)														
32. Other Natural Water Sources	1	10	Product	Ounces (weight)														
33. Other Commercial Sources																		
34. Other																		
35. Fresh Water Pond (Natural)	6	704	Product	Ounces (weight)												1	8	Product
36. Cess Pool																		
Total	90	1920	Product	Ounces (weight)		53	4366	Product	Ounces (volume)		55	1110	Product	Ounces (volume)		53	2188	Product

Table A21.

Application Sites:	Total Amount_Unit16	Altosid Pellets Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount_Unit20	VectoLex CG Comments	VectoMax WSP - # Treatments	Total Amount Used21	Total Amount Type22	Total Amount_Unit22	VectoMax WSP Comments	Altosid Briquets 30-day - # Treatments
1. Tidal marsh																		
2. Fresh water marsh	Ounces (weight)																	
2A. Reclaimed Marsh																		
3. Diked marsh																		
4. Seasonal wetland	Ounces (weight)																	
4A. Seasonal Vineyard Water/Pothole																		
5. Natural seep																		
6. River margin																		
7. Creek																		
8. Seasonal creek pools																		
9. Channel (unlined)	Ounces (weight)							3	21	Product	Ounces (weight)		5	18	Product	her (specify in comments secti	Each	1
10. Ditch																		
10A. Agricultural Ditch	Ounces (weight)																	
11. Vernal pool																		
12. Flooded/irrigated pasture																		
13. Storm drain/catch basin	Ounces (weight)		3	16	Product	Ounces (volume)							43	2261	Product	her (specify in comments secti	Each	25
14. Waste water pond	Ounces (weight)		1	128	Product	Ounces (volume)							2	24	Product	her (specify in comments secti	Each	
14A. Waste Water Spray Field/Marsh	Ounces (weight)		1	1280	Product	Ounces (volume)												
15. Winery waste pond																		
16. Stock pond																		
17. Irrigation pond/Vineyard Pond																		
18. Storm water detention basin	Ounces (weight)																	1
19. Sump	Ounces (weight)												1	15	Product	her (specify in comments secti	Each	1
20. Septic tank	Ounces (weight)												3	1	Product	her (specify in comments secti	Each	1
21. Ornamental water garden/fish pond													1	1	Product	her (specify in comments secti	Each	
22. Swimming pool													1	16	Product	her (specify in comments secti	Each	
23. Spa/hot tub			2	18	Product	Ounces (volume)												
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	Ounces (weight)		2	5	Product	Ounces (volume)							13	106	Product	her (specify in comments secti	Each	13
24A. Agrcultural Containers (e.g. bins, etc.)																		
25. Tree holes																		
26. Horse/livestock watering troughs																		
27. Water under buildings			2	28	Product	Ounces (volume)												
28. Utility vaults																		1
29. Dredge Disposal Pond																		
30. Wells/Water Storage Tanks/Pumps																		
31. Water Main Leaks																		
32. Other Natural Water Sources																		6
33. Other Commercial Sources																		7
34. Other																		
35. Fresh Water Pond (Natural)	Ounces (weight)																	
36. Cess Pool			2	134	Product	Ounces (volume)							1	1	Product	her (specify in comments secti	Each	
Total	Ounces (weight)		13	1609	Product	Ounces (volume)		3	21	Product	Ounces (weight)		70	2443	Product	her (specify in comments secti	Each	56

Table A21.

Application Sites:	Total Amount Used23	Total Amount Type24	Total Amount Unit24	Altosid Briquets 30 Day Commnets	Permanone - # Treatments	Total Amount Used25	Total Amount Type26	Total Amount Unit26	Permanone Comments	MGK Pyrocide 7396 - # Treatments	Total Amount Used27	Total Amount Type28	Total Amount Unit28	MGK Pyrocide 7396 Comments	Pyrenone 25-5 - # Treatments	Total Amount Used29	Total Amount Type30	Total Amount Unit30
1. Tidal marsh																		
2. Fresh water marsh																		
2A. Reclaimed Marsh					1	375	Product	Ounces (volume)										
3. Diked marsh																		
4. Seasonal wetland																		
4A. Seasonal Vineyard Water/Pothole																		
5. Natural seep																		
6. River margin																		
7. Creek																		
8. Seasonal creek pools																		
9. Channel (unlined)	5	Product	er (specify in comments sect	Each														
10. Ditch																		
10A. Agricultural Ditch																		
11. Vernal pool																		
12. Flooded/irrigated pasture																		
13. Storm drain/catch basin	4092	Product	er (specify in comments sect	Each														
14. Waste water pond																		
14A. Waste Water Spray Field/Marsh																		
15. Winery waste pond																		
16. Stock pond																		
17. Irrigation pond/Vineyard Pond																		
18. Storm water detention basin	10	Product	er (specify in comments sect	Each														
19. Sump	4	Product	er (specify in comments sect	Each														
20. Septic tank	6	Product	er (specify in comments sect	Each														
21. Ornamental water garden/fish pond																		
22. Swimming pool																		
23. Spa/hot tub																		
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	69	Product	er (specify in comments sect	Each														
24A. Agrcultural Containers (e.g. bins, etc.)																		
25. Tree holes										38	2140	Product	Ounces (volume)		2	80	Product	Ounces (volume)
26. Horse/livestock watering troughs																		
27. Water under buildings															2	2	Product	Ounces (volume)
28. Utility vaults	5	Product	er (specify in comments sect	Each														
29. Dredge Disposal Pond																		
30. Wells/Water Storage Tanks/Pumps																		
31. Water Main Leaks																		
32. Other Natural Water Sources	17	Product	er (specify in comments sect	Each														
33. Other Commercial Sources	55	Product	er (specify in comments sect	Each														
34. Other																		
35. Fresh Water Pond (Natural)																		
36. Cess Pool																		
Total	4263	Product	er (specify in comments sect	Each	1	375	Product	Ounces (volume)		38	2140	Product	Ounces (volume)		4	82	Product	Ounces (volume)

Table A21.

Application Sites:	Pyrenone 25-5 Comments	Wasp Freeze - # Treatments	Total Amount Used33	Total Amount Type34	Total Amount Unit34	Wasp Freeze Comments	Drione Insecticide - # Treatments	Total Amount Used35	Total Amount Type36	Total Amount Unit36	Drione Comments	Contrac All-Weather Blox - # Treatments	Total Amount Used39	Total Amount Type40	Total Amount Unit40	Contrac Blox Comments	GB1111 Larv. Oil # Treatments	Total Amount Used
1. Tidal marsh																		
2. Fresh water marsh																		
2A. Reclaimed Marsh																		
3. Diked marsh																		
4. Seasonal wetland																		
4A. Seasonal Vineyard Water/Pothole																		
5. Natural seep																		
6. River margin																		
7. Creek																		
8. Seasonal creek pools																		
9. Channel (unlined)																	2	33
10. Ditch																		
10A. Agricultural Ditch																		
11. Vernal pool																		
12. Flooded/irrigated pasture																		
13. Storm drain/catch basin																	4	16
14. Waste water pond																	7	1200
14A. Waste Water Spray Field/Marsh																	3	2304
15. Winery waste pond																		
16. Stock pond																		
17. Irrigation pond/Vineyard Pond																		
18. Storm water detention basin																	2	25
19. Sump																	1	3
20. Septic tank																	4	22
21. Ornamental water garden/fish pond																	1	6
22. Swimming pool																	2	13
23. Spa/hot tub																		
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)																	7	21
24A. Agrcultural Containers (e.g. bins, etc.)																		
25. Tree holes																		
26. Horse/livestock watering troughs																		
27. Water under buildings																		
28. Utility vaults																		
29. Dredge Disposal Pond																		
30. Wells/Water Storage Tanks/Pumps																		
31. Water Main Leaks																		
32. Other Natural Water Sources																		
33. Other Commercial Sources												1	50	Product	er (specify in comments secti	Each		
34. Other		7	34	Product	Ounces (volume)		233	465	Product	Ounces (weight)		22	288	Product	er (specify in comments secti	Each		
35. Fresh Water Pond (Natural)																		
36. Cess Pool																		
Total		7	34	Product	Ounces (volume)		233	465	Product	Ounces (weight)		23	338	Product	er (specify in comments secti	Each	33	3643

Table A21.

Application Sites:	Total Amount Type2	Total Amount Unit	GB1111 Larv Oil. Comments
1. Tidal marsh			
2. Fresh water marsh			
2A. Reclaimed Marsh			
3. Diked marsh			
4. Seasonal wetland			
4A. Seasonal Vineyard Water/Pothole			
5. Natural seep			
6. River margin			
7. Creek			
8. Seasonal creek pools			
9. Channel (unlined)	Product	Ounces (volume)	
10. Ditch			
10A. Agricultural Ditch			
11. Vernal pool			
12. Flooded/irrigated pasture			
13. Storm drain/catch basin	Product	Ounces (volume)	
14. Waste water pond	Product	Ounces (volume)	
14A. Waste Water Spray Field/Marsh	Product	Ounces (volume)	
15. Winery waste pond			
16. Stock pond			
17. Irrigation pond/Vineyard Pond			
18. Storm water detention basin	Product	Ounces (volume)	
19. Sump	Product	Ounces (volume)	
20. Septic tank	Product	Ounces (volume)	
21. Ornamental water garden/fish pond	Product	Ounces (volume)	
22. Swimming pool	Product	Ounces (volume)	
23. Spa/hot tub			
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	Product	Ounces (volume)	
24A. Agrcultural Containers (e.g. bins, etc.)			
25. Tree holes			
26. Horse/livestock watering troughs			
27. Water under buildings			
28. Utility vaults			
29. Dredge Disposal Pond			
30. Wells/Water Storage Tanks/Pumps			
31. Water Main Leaks			
32. Other Natural Water Sources			
33. Other Commercial Sources			
34. Other			
35. Fresh Water Pond (Natural)			
36. Cess Pool			
Total	Product	Ounces (volume)	

Table A22. **Pesticide Application Data for Fall 2011 – NCMAD**

Application Sites:	5% Skeeter Abate - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	5% Skeeter Abate - Comments	Teknar HP-D - # Treatments	Total Amount Used4	Total Amount Type4	Total Amount Unit5	Teknar HP-D - Comments	Altosid Liquid SR5 - # Treatments	Total Amount Used11	Total Amount Type11	Total Amount Unit12	Altosid Liquid SR5 - Comments	Altosid Pellets - # Treatments	Total Amount Used15	Total Amount Type15	Total Amount Unit16
1. Tidal marsh																			
2. Fresh water marsh	5	1072	Product	Ounces (weight)															
2A. Reclaimed Marsh																			
3. Diked marsh																			
4. Seasonal wetland																			
4A. Seasonal Vineyard Water/Pothole																			
5. Natural seep																			
6. River margin																			
7. Creek																			
8. Seasonal creek pools																			
9. Channel (unlined)	4	82	Product	Ounces (weight)		2	208	Product	Ounces (volume)		1	52	Product	Ounces (volume)		1	4	Product	Ounces (weight)
10. Ditch																			
11. Vernal pool																			
12. Flooded/irrigated pasture	1	16	Product	Ounces (weight)															
13. Storm drain/catch basin	2	22	Product	Ounces (weight)															
14. Waste water pond	2	48	Product	Ounces (weight)															
14A. Waste Water Spray Field/Marsh																			
15. Winery waste pond																			
16. Stock pond																			
17. Irrigation pond/Vineyard Pond																			
18. Storm water detention basin																			
19. Sump	1	6	Product	Ounces (weight)												1	2	Product	Ounces (weight)
20. Septic tank																			
21. Ornamental water garden/fish pond																			
22. Swimming pool																			
23. Spa/hot tub																			
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	8	36	Product	Ounces (weight)															
24A. Agricultural Containers (e.g. bins, etc.)																			
25. Tree holes																			
26. Horse/livestock watering troughs																			
27. Water under buildings																			
28. Utility vaults																			
29. Dredge Disposal Pond																			
30. Wells/Water Storage Tanks/Pumps																			
31. Water Main Leaks	2	12	Product	Ounces (weight)												1	24	Product	Ounces (weight)
32. Other Natural Water Sources	4	38	Product	Ounces (weight)															
33. Other Commercial Sources																			
34. Other																			
Total	29	1332	Product	Ounces (weight)		2	208	Product	Ounces (volume)		1	52	Product	Ounces (volume)		3	30	Product	Ounces (weight)

Table A22.

Application Sites:	Altosid Pellets - Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type19	Total Amount Unit20	VectoLex CG - Comments	VectoMax WSP - # Treatments	Total Amount Used21	Total Amount Type21	Total Amount Unit22	VectoMax WSP - Comments	Altosid Briquets 30-day - # Treatments	Total Amount Used23	Total Amount Type23	Total Amount Unit24	Altosid Briquets 30-day - Comments	Drione Insecticide - # Treatments	Total Amount Used35	Total Amount Type35
1. Tidal marsh																			
2. Fresh water marsh																			
2A. Reclaimed Marsh																			
3. Diked marsh																			
4. Seasonal wetland																			
4A. Seasonal Vineyard Water/Pothole																			
5. Natural seep																			
6. River margin																			
7. Creek																			
8. Seasonal creek pools																			
9. Channel (unlined)																			
10. Ditch																			
11. Vernal pool																			
12. Flooded/irrigated pasture																			
13. Storm drain/catch basin																			
14. Waste water pond																			
14A. Waste Water Spray Field/Marsh																			
15. Winery waste pond																			
16. Stock pond																			
17. Irrigation pond/Vineyard Pond																			
18. Storm water detention basin																			
19. Sump																			
20. Septic tank							2	14	Product	(specify in comments s	Each								
21. Ornamental water garden/fish pond																			
22. Swimming pool																			
23. Spa/hot tub																			
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)		1	3	Product	Ounces (weight)		3	10	Product	(specify in comments s	Each	1	3	Product	(specify in comments s	Each			
24A. Agricultural Containers (e.g. bins, etc.)																			
25. Tree holes																			
26. Horse/livestock watering troughs																			
27. Water under buildings																			
28. Utility vaults							1	5	Product	(specify in comments s	Each								
29. Dredge Disposal Pond																			
30. Wells/Water Storage Tanks/Pumps																			
31. Water Main Leaks							1	11	Product	(specify in comments s	Each								
32. Other Natural Water Sources																			
33. Other Commercial Sources																			
34. Other																	54	112	Product
Total		1	3	Product	Ounces (weight)		7	40	Product	(specify in comments s	Each	1	3	Product	(specify in comments s	Each	54	112	Product

Table A22.

Application Sites:	Total Amount Unit36	Drione Insecticide - Comments	Contrac All-Weather Blox - # Treatments	Total Amount Used39	Total Amount Type39	Total Amount Unit40	Contrac All-Weather Blox - Comments	GB1111 Larv. Oil # Treatment	Total Amount Used	Total Amount Type2	Total Amount Unit	GB1111 Larv. Oil Comments
1. Tidal marsh												
2. Fresh water marsh												
2A. Reclaimed Marsh												
3. Diked marsh												
4. Seasonal wetland												
4A. Seasonal Vineyard Water/Pothole												
5. Natural seep												
6. River margin												
7. Creek												
8. Seasonal creek pools												
9. Channel (unlined)												
10. Ditch												
11. Vernal pool												
12. Flooded/irrigated pasture												
13. Storm drain/catch basin												
14. Waste water pond								5	75	Product	Ounces (volume)	
14A. Waste Water Spray Field/Marsh												
15. Winery waste pond								1	16	Product	Ounces (volume)	
16. Stock pond												
17. Irrigation pond/Vineyard Pond												
18. Storm water detention basin												
19. Sump								1	2	Product	Ounces (volume)	
20. Septic tank								2	18	Product	Ounces (volume)	
21. Ornamental water garden/fish pond												
22. Swimming pool												
23. Spa/hot tub												
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)								2	6	Product	Ounces (volume)	
24A. Agricultural Containers (e.g. bins, etc.)												
25. Tree holes												
26. Horse/livestock watering troughs												
27. Water under buildings												
28. Utility vaults												
29. Dredge Disposal Pond												
30. Wells/Water Storage Tanks/Pumps												
31. Water Main Leaks												
32. Other Natural Water Sources												
33. Other Commercial Sources			2	20	Product	(specify in comments s	Each					
34. Other	Ounces (weight)		16	142	Product	(specify in comments s	Each					
Total	Ounces (weight)		18	162	Product	(specify in comments s	Each	11	117	Product	Ounces (volume)	

Table A23. **Pesticide Application Data for Winter 2012 – NCMAD**

Application Sites:	5% Skeeter Abate - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	5% Skeeter Abate - Comments	Teknar HP-D - # Treatments	Total Amount Used4	Total Amount Type4	Total Amount Unit5	Teknar HP-D - Comments	Altosid Liquid SR5 - # Treatments	Total Amount Used11	Total Amount Type11	Total Amount Unit12	Altosid Liquid SR5 - Comments	Altosid Pellets - # Treatments	Total Amount Used15	Total Amount Type15	Total Amount Unit16
1. Tidal marsh						2	176	Product	Ounces (volume)		2	44	Product	Ounces (volume)		1	352	Product	Ounces (weight)
2. Fresh water marsh	3	832	Product	Ounces (weight)		4	520	Product	Ounces (volume)		4	130	Product	Ounces (volume)		1	352	Product	Ounces (weight)
2A. Reclaimed Marsh	1	704	Product	Ounces (weight)												1	704	Product	Ounces (weight)
3. Diked marsh																			
4. Seasonal wetland	20	1332	Product	Ounces (weight)		4	240	Product	Ounces (volume)		3	40	Product	Ounces (volume)		16	1584	Product	Ounces (weight)
4A. Seasonal Vineyard Water/Pothole																			
5. Natural seep																			
6. River margin																			
7. Creek																			
8. Seasonal creek pools																			
9. Channel (unlined)	4	148	Product	Ounces (weight)		4	560	Product	Ounces (volume)		5	160	Product	Ounces (volume)		5	224	Product	Ounces (weight)
10. Ditch																			
11. Vernal pool																			
12. Flooded/irrigated pasture	1	16	Product	Ounces (weight)															
13. Storm drain/catch basin	1	3	Product	Ounces (weight)															
14. Waste water pond																			
14A. Waste Water Spray Field/Marsh						1	320	Product	Ounces (volume)		1	80	Product	Ounces (volume)		1	704	Product	Ounces (weight)
15. Winery waste pond																			
16. Stock pond																			
17. Irrigation pond/Vineyard Pond																			
18. Storm water detention basin						2	400	Product	Ounces (volume)		2	100	Product	Ounces (volume)		3	728	Product	Ounces (weight)
19. Sump	2	7	Product	Ounces (weight)															
20. Septic tank																			
21. Ornamental water garden/fish pond																			
22. Swimming pool																1	4	Product	Ounces (weight)
23. Spa/hot tub																			
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	11	91	Product	Ounces (weight)												1	3	Product	Ounces (weight)
24A. Agricultural Containers (e.g. bins, etc.)																			
25. Tree holes	1	16	Product	Ounces (weight)												1	16	Product	Ounces (weight)
26. Horse/livestock watering troughs																			
27. Water under buildings																			
28. Utility vaults																			
29. Dredge Disposal Ponds																			
30. Wells/Water Storage Tanks/Pumps																			
31. Water Main Leaks	1	160	Product	Ounces (weight)															
32. Other Natural Water Sources																			
33. Other Commercial Sources																			
34. Other																			
35. Fresh Water Pond (Natural)																1	352	Product	Ounces (weight)
36. Fish Pond/Water Garden																			
Total	45	3309	Product	Ounces (weight)		17	2216	Product	Ounces (volume)		17	554	Product	Ounces (volume)		32	5023	Product	Ounces (weight)

Table A23.

Application Sites:	Altosid Pellets - Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type17	Total Amount Unit18	BVA-2 - Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type19	Total Amount Unit20	VectoLex CG - Comments	VectoMax WSP - # Treatments	Total Amount Used21	Total Amount Type21	Total Amount Unit22	VectoMax WSP - Comments	Altosid Briquets 30-day - # Treatments	Total Amount Used23	Total Amount Type23
1. Tidal marsh																			
2. Fresh water marsh												1	14	Product	(specify in comments s	Each			
2A. Reclaimed Marsh																			
3. Diked marsh																			
4. Seasonal wetland		7	1084	Product	Ounces (volume)		1	8	Product	Ounces (weight)		9	122	Product	(specify in comments s	Each	5	93	Product
4A. Seasonal Vineyard Water/Pothole																			
5. Natural seep																			
6. River margin																			
7. Creek																			
8. Seasonal creek pools		1	384	Product	Ounces (volume)														
9. Channel (unlined)		3	928	Product	Ounces (volume)							2	28	Product	(specify in comments s	Each	2	10	Product
10. Ditch																			
11. Vernal pool																			
12. Flooded/irrigated pasture																			
13. Storm drain/catch basin		1	384	Product	Ounces (volume)							1	2	Product	(specify in comments s	Each			
14. Waste water pond																			
14A. Waste Water Spray Field/Marsh		2	2560	Product	Ounces (volume)							1	5	Product	(specify in comments s	Each			
15. Winery waste pond																			
16. Stock pond																			
17. Irrigation pond/Vineyard Pond																			
18. Storm water detention basin		1	256	Product	Ounces (volume)		1	32	Product	Ounces (weight)							1	15	Product
19. Sump																			
20. Septic tank												1	4	Product	(specify in comments s	Each			
21. Ornamental water garden/fish pond																			
22. Swimming pool																			
23. Spa/hot tub																			
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)		6	12	Product	Ounces (volume)		1	4	Product	Ounces (weight)		7	86	Product	(specify in comments s	Each	5	82	Product
24A. Agricultural Containers (e.g. bins, etc.)																			
25. Tree holes																			
26. Horse/livestock watering troughs																			
27. Water under buildings																			
28. Utility vaults												2	20	Product	(specify in comments s	Each	1	10	Product
29. Dredge Disposal Ponds																			
30. Wells/Water Storage Tanks/Pumps																			
31. Water Main Leaks																			
32. Other Natural Water Sources																			
33. Other Commercial Sources																			
34. Other																			
35. Fresh Water Pond (Natural)																			
36. Fish Pond/Water Garden												1	4	Product	(specify in comments s	Each			
Total		21	5608	Product	Ounces (volume)		3	44	Product	Ounces (weight)		25	285	Product	(specify in comments s	Each	14	210	Product

Table A23.

Application Sites:	Total Amount Unit24	Altosid Briquets 30-day - Comments	Contrac All-Weather Blox - # Treatments	Total Amount Used39	Total Amount Type39	Total Amount Unit40	Contrac All-Weather Blox - Comments	GB1111 Larv. Oil # Treatments	Total Amount Used	Total Amount Type3	Total Amount Unit	GB1111 Larv. Oil Comments
1. Tidal marsh												
2. Fresh water marsh												
2A. Reclaimed Marsh												
3. Diked marsh												
4. Seasonal wetland	(specify in comments s	Each						4	640	Product	Ounces (volume)	
4A. Seasonal Vineyard Water/Pothole												
5. Natural seep												
6. River margin												
7. Creek												
8. Seasonal creek pools												
9. Channel (unlined)	(specify in comments s	Each						1	32	Product	Ounces (volume)	
10. Ditch												
11. Vernal pool												
12. Flooded/irrigated pasture												
13. Storm drain/catch basin												
14. Waste water pond												
14A. Waste Water Spray Field/Marsh								1	128	Product	Ounces (volume)	
15. Winery waste pond												
16. Stock pond												
17. Irrigation pond/Vineyard Pond												
18. Storm water detention basin	(specify in comments s	Each						3	768	Product	Ounces (volume)	
19. Sump												
20. Septic tank												
21. Ornamental water garden/fish pond												
22. Swimming pool												
23. Spa/hot tub												
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	(specify in comments s	Each						2	12	Product	Ounces (volume)	
24A. Agricultural Containers (e.g. bins, etc.)												
25. Tree holes												
26. Horse/livestock watering troughs												
27. Water under buildings												
28. Utility vaults	(specify in comments s	Each										
29. Dredge Disposal Ponds												
30. Wells/Water Storage Tanks/Pumps												
31. Water Main Leaks												
32. Other Natural Water Sources												
33. Other Commercial Sources			2	110	Product	(specify in comments s	Each					
34. Other			29	351	Product	(specify in comments s	Each					
35. Fresh Water Pond (Natural)												
36. Fish Pond/Water Garden												
Total	(specify in comments s	Each	31	461	Product	(specify in comments s	Each	11	1580	Product	Ounces (volume)	

Table A24. Pesticide Application Data for Spring 2012 – NCMAD

Application Sites:	5% Skeeter Abate - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	5% Skeeter Abate - Comments	Teknar HP-D - # Treatments	Total Amount Used4	Total Amount Type4	Total Amount Unit5	Teknar HP-D - Comments	Altosid Liquid SR5 - # Treatments	Total Amount Used11	Total Amount Type11	Total Amount Unit12	Altosid Liquid SR5 - Comments	Altosid Pellets - # Treatments	Total Amount Used15	Total Amount Type15	Total Amount Unit16
1. Tidal marsh	1	96	Product	Ounces (weight)		6	2480	Product	Ounces (volume)		5	320	Product	Ounces (volume)		1	1408	Product	Ounces (weight)
2. Fresh water marsh						7	2480	Product	Ounces (volume)		7	620	Product	Ounces (volume)		2	992	Product	Ounces (weight)
2A. Reclaimed Marsh											4	44	Product	Ounces (volume)					
3. Diked marsh	1	160	Product	Ounces (weight)															
4. Seasonal wetland/Rain Water	30	1657	Product	Ounces (weight)		23	1538	Product	Ounces (volume)		22	344	Product	Ounces (volume)		24	1660	Product	Ounces (weight)
4A. Seasonal Vineyard Water/Pothole						2	800	Product	Ounces (volume)							1	704	Product	Ounces (weight)
5. Natural seep	1	15	Product	Ounces (weight)															
6. River margin																			
7. Creek						1	32	Product	Ounces (volume)		1	8	Product	Ounces (volume)					
8. Seasonal creek pools																			
9. Channel (unlined)	14	487	Product	Ounces (weight)		22	1056	Product	Ounces (volume)		18	202	Product	Ounces (volume)		7	466	Product	Ounces (weight)
10. Ditch																			
11. Vernal pool																			
12. Flooded/irrigated pasture	1	64	Product	Ounces (weight)												1	32	Product	Ounces (weight)
13. Storm drain/catch basin	1	13	Product	Ounces (weight)		6	408	Product	Ounces (volume)		6	102	Product	Ounces (volume)		1	6	Product	Ounces (weight)
14. Waste water pond																			
14A. Waste Water Spray Field/Marsh						2	200	Product	Ounces (volume)		2	50	Product	Ounces (volume)					
15. Winery waste pond											5	188	Product	Ounces (volume)					
16. Stock pond																			
17. Irrigation pond/Vineyard Pond																			
18. Storm water detention basin						4	480	Product	Ounces (volume)		4	120	Product	Ounces (volume)		2	80	Product	Ounces (weight)
19. Sump																2	4	Product	Ounces (weight)
20. Septic tank	2	10	Product	Ounces (weight)															
21. Ornamental water garden/fish pond																			
22. Swimming pool	1	3	Product	Ounces (weight)															
23. Spa/hot tub																			
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	15	134	Product	Ounces (weight)												3	8	Product	Ounces (weight)
24A. Agricultural Containers (e.g. bins, etc)											1	40	Product	Ounces (volume)					
25. Tree holes																			
26. Horse/livestock watering troughs																			
27. Water under buildings																			
28. Utility vaults																			
29. Dredge Disposal Pond	1	160	Product	Ounces (weight)												1	160	Product	Ounces (weight)
30. Wells/Water Storage Tanks/Pumps																			
31. Water Main Leaks																			
32. Other Natural Water Sources											1	40	Product	Ounces (volume)		1	64	Product	Ounces (weight)
33. Other Commercial Sources																			
34. Other																			
Total	68	2799	Product	Ounces (weight)		73	9474	Product	Ounces (volume)		76	2078	Product	Ounces (volume)		46	5584	Product	Ounces (weight)

Table A24.

Application Sites:	Altosid Pellets - Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type17	Total Amount Unit18	BVA-2 - Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type19	Total Amount Unit20	VectoLex CG - Comments	VectoMax WSP - # Treatments	Total Amount Used21	Total Amount Type21	Total Amount Unit22	VectoMax WSP - Comments	Altosid Briquets 30-day - # Treatments	Total Amount Used23	Total Amount Type23
1. Tidal marsh																			
2. Fresh water marsh		2	1280	Product	Ounces (volume)														
2A. Reclaimed Marsh																			
3. Diked marsh																			
4. Seasonal wetland/Rain Water		24	2538	Product	Ounces (volume)		18	1092	Product	Ounces (weight)		11	204	Product	(specify in comments s	Each	4	114	Product
4A. Seasonal Vineyard Water/Pothole		2	2176	Product	Ounces (volume)		5	672	Product	Ounces (weight)									
5. Natural seep		3	520	Product	Ounces (volume)														
6. River margin																			
7. Creek												1	2	Product	(specify in comments s	Each			
8. Seasonal creek pools		1	2	Product	Ounces (volume)														
9. Channel (unlined)		3	1600	Product	Ounces (volume)		1	13	Product	Ounces (weight)		5	0	Product	(specify in comments s	Each	3	16	Product
10. Ditch																			
11. Vernal pool																			
12. Flooded/irrigated pasture																			
13. Storm drain/catch basin		3	386	Product	Ounces (volume)		2	14	Product	Ounces (weight)		31	1263	Product	(specify in comments s	Each	5	2246	Product
14. Waste water pond		1	256	Product	Ounces (volume)		1	64	Product	Ounces (weight)		1	12	Product	(specify in comments s	Each			
14A. Waste Water Spray Field/Marsh		1	256	Product	Ounces (volume)														
15. Winery waste pond																			
16. Stock pond																			
17. Irrigation pond/Vineyard Pond		1	6	Product	Ounces (volume)		2	320	Product	Ounces (weight)		1	18	Product	(specify in comments s	Each			
18. Storm water detention basin		2	640	Product	Ounces (volume)														
19. Sump		3	21	Product	Ounces (volume)							3	1	Product	(specify in comments s	Each	2	54	Product
20. Septic tank		2	12	Product	Ounces (volume)		1	4	Product	Ounces (weight)		1	5	Product	(specify in comments s	Each			
21. Ornamental water garden/fish pond																			
22. Swimming pool												1	8	Product	(specify in comments s	Each			
23. Spa/hot tub																			
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)		16	107	Product	Ounces (volume)		6	75	Product	Ounces (weight)		30	249	Product	(specify in comments s	Each	14	138	Product
24A. Agricultural Containers (e.g. bins, etc)		1	32	Product	Ounces (volume)														
25. Tree holes												1	2	Product	(specify in comments s	Each			
26. Horse/livestock watering troughs												1	4	Product	(specify in comments s	Each			
27. Water under buildings																			
28. Utility vaults		1	128	Product	Ounces (volume)							3	46	Product	(specify in comments s	Each			
29. Dredge Disposal Pond																			
30. Wells/Water Storage Tanks/Pumps		1	6	Product	Ounces (volume)														
31. Water Main Leaks												1	10	Product	(specify in comments s	Each			
32. Other Natural Water Sources												1	48	Product	(specify in comments s	Each			
33. Other Commercial Sources																			
34. Other																			
Total		67	9966	Product	Ounces (volume)		36	2254	Product	Ounces (weight)		92	1872	Product	(specify in comments s	Each	28	2568	Product

Table A24.

Application Sites:	Total Amount Unit24	Altosid Briquets 30-day - Commments	MGK Pyrocide 7396 - # Treatments	Total Amount Used27	Total Amount Type27	Total Amount Unit28	MGK Pyrocide 7396 - Comments	Drione Insecticide - # Treatments	Total Amount Used35	Total Amount Type35	Total Amount Unit36	Drione Insecticide - Comments	Contrac All-Weather Blox - # Treatments	Total Amount Used39	Total Amount Type39	Total Amount Unit40	Contrac All-Weather Blox -Comments
1. Tidal marsh																	
2. Fresh water marsh																	
2A. Reclaimed Marsh																	
3. Diked marsh																	
4. Seasonal wetland/Rain Water	(specify in comments s	Each															
4A. Seasonal Vineyard Water/Pothole																	
5. Natural seep																	
6. River margin																	
7. Creek																	
8. Seasonal creek pools																	
9. Channel (unlined)	(specify in comments s	Each															
10. Ditch																	
11. Vernal pool																	
12. Flooded/irrigated pasture																	
13. Storm drain/catch basin	(specify in comments s	Each															
14. Waste water pond																	
14A. Waste Water Spray Field/Marsh																	
15. Winery waste pond																	
16. Stock pond																	
17. Irrigation pond/Vineyard Pond																	
18. Storm water detention basin																	
19. Sump	(specify in comments s	Each															
20. Septic tank																	
21. Ornamental water garden/fish pond																	
22. Swimming pool																	
23. Spa/hot tub																	
24. Man-made container (e.g. buckets, tires, cemetery urns, wading pools, wheel barrow, etc)	(specify in comments s	Each															
24A. Agricultural Containers (e.g. bins, etc)																	
25. Tree holes			132	7879	Product	Ounces (volume)											
26. Horse/livestock watering troughs																	
27. Water under buildings																	
28. Utility vaults																	
29. Dredge Disposal Pond																	
30. Wells/Water Storage Tanks/Pumps																	
31. Water Main Leaks																	
32. Other Natural Water Sources																	
33. Other Commercial Sources																	
34. Other								12	24	Product	Ounces (weight)		21	295	Product	(specify in comments s	Each
Total	(specify in comments s	Each	132	7879	Product	Ounces (volume)		12	24	Product	Ounces (weight)		21	295	Product	(specify in comments s	Each

Table A25. Pesticide Product Key – NCMAD

Product	AI	Vector
5% Skeeter Abate	Temephos	Mosquito
Altosid Briquets 30-day	Methoprene	Mosquito
Altosid Liquid SR5	Methoprene	Mosquito
Altosid Pellets	Methoprene	Mosquito
BVA-2	Petroleum Distillate	Mosquito
Contrac All-Weather Blox	Bromadiolone	Rat
Drione Insecticide	Pyrethrin and Piperonyl Butroxide and Amorphous Silica Gel	Yellow Jacket / Wasp
MGK Pyrocide 7396	Pyrethrins and Piperonyl Butoxide	Mosquito
Permanone	Permethrin and Piperonyl Butoxide	Mosquito
Pyrenone 25-5	Pyrethrins and Piperonyl Butoxide	Mosquito
Teknar HP-D	Bacillus Thuringiensis Israelensis	Mosquito
VectoLex CG	Bacillus Sphaericus	Mosquito
VectoMax WSP	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
Wasp Freeze	Phenothrin and Trans Allethrin	Yellow Jacket / Wasp

Table A26. Pesticide Application Data for Summer 2011 – NSVMAD

Application Sites:	Agnique MMF - # Treatments	Total Amount_Used	Total Amount Type	Total Amount_Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount_Used2	Total Amount_Type3	Total Amount_Unit3	VectoBac G Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount_Unit18	BVA-2 Comments
Storm Drains			Product	Ounces (volume)				Product	Pounds		500	20	Product	Gallons	
Catch Basins			Product	Ounces (volume)				Product	Pounds		500	20	Product	Gallons	
Troughs			Product	Ounces (volume)				Product	Pounds						
Water Features	3	6	Product	Ounces (volume)	Swimming pools			Product	Pounds						
Containers			Product	Ounces (volume)				Product	Pounds						
Standing / Flood Water			Product	Ounces (volume)		3	800	Product	Pounds						
Pastures			Product	Ounces (volume)				Product	Pounds						
Salt Marsh			Product	Ounces (volume)		5	2000	Product	Pounds						
Estuaries			Product	Ounces (volume)		5	1000	Product	Pounds						
Tidal / Woodland Pools			Product	Ounces (volume)		5	1000	Product	Pounds						
Wastewater			Product	Ounces (volume)		3	300	Product	Pounds		1	50	Product	Gallons	
Ditches			Product	Ounces (volume)		2	300	Product	Pounds		1	50	Product	Gallons	
Sewer / Dairy lagoons			Product	Ounces (volume)				Product	Pounds						
Retention / Detention Ponds			Product	Ounces (volume)				Product	Pounds		1	50	Product	Gallons	
Rural / Urban Residences			Product	Ounces (volume)				Product	Pounds						
Totals	3	6	Product	Ounces (volume)		23	5400	Product	Pounds		1003	190	Product	Gallons	

Table A26.

Application Sites:	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	Natular G30 - # Treatments	Total Amount Used1924	Total Amount Type2025	Total Amount Unit2026	Natular G30 Comments
Storm Drains			Product	Pounds						
Catch Basins			Product	Pounds						
Troughs			Product	Pounds						
Water Features			Product	Pounds						
Containers			Product	Pounds						
Standing / Flood Water			Product	Pounds						
Pastures			Product	Pounds						
Salt Marsh	1	120	Product	Pounds		1	300	Product	Pounds	works well in colder temps
Estuaries			Product	Pounds						
Tidal / Woodland Pools			Product	Pounds						
Wastewater	1	80	Product	Pounds						
Ditches	1	80	Product	Pounds						
Sewer / Dairy lagoons			Product	Pounds						
Retention / Detention Ponds			Product	Pounds						
Rural / Urban Residences			Product	Pounds						
Totals	3	280	Product	Pounds		1	300	Product	Pounds	

Table A27. Pesticide Application Data for Fall 2011 – NSVMAD

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments
Storm Drains															
Catch Basins															
Troughs															
Water Features	1	1	Product	Ounces (weight)	swimming pool										
Containers															
Standing / Flood Water															
Pastures															
Salt Marsh															
Estuaries															
Tidal / Woodland Pools															
Wastewater						1	40	Product	Pounds		2	10	Product	Gallons	
Ditches											2	10	Product	Gallons	
Sewer / Dairy lagoons											2	10	Product	Gallons	
Retention / Detention Ponds											1	20	Product	Gallons	
Rural / Urban Residences															
Totals	1	1	Product	Ounces (weight)		1	40	Product	Pounds		7	50	Product	Gallons	

Table A27.

Application Sites:	Altosid XR-G (granules)- # Treatments	Total Amount Used39	Total Amount Type40	Total Amount Unit40	Altosid XR-G (granules) Blox Comments	Kontrol 4-4 - # Treatments	Total Amount Used1315	Total Amount Type1416	Total Amount Unit1417	Kontrol 4-4 Comments
Storm Drains	1	2	Product	Ounces (weight)						
Catch Basins										
Troughs										
Water Features										
Containers										
Standing / Flood Water										
Pastures										
Salt Marsh										
Estuaries										
Tidal / Woodland Pools										
Wastewater										
Ditches										
Sewer / Dairy lagoons										
Retention / Detention Ponds										
Rural / Urban Residences						1	78	Product	Ounces (weight)	
Totals	1	2	Product	Ounces (weight)		1	78	Product	Ounces (weight)	

Table A28. **Pesticide Application Data for Winter 2012 – NSVMAD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	VectoBac G - # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit3	VectoBac G Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments
Storm Drains											500	20	Product	Gallons	
Catch Basins											500	20	Product	Gallons	
Troughs															
Water Features															
Containers															
Standing / Flood Water															
Pastures															
Salt Marsh						2	300	Product	Pounds						
Estuaries						1	40	Product	Pounds						
Tidal / Woodland Pools															
Wastewater											1	10	Product	Gallons	
Ditches															
Sewer / Dairy lagoons															
Retention / Detention Ponds		8													
Rural / Urban Residences	9														
Totals	9	8		0		3	340	Product	Pounds		1001	50			

Table A28.

Application Sites:	Natular 2EC - # Treatments	Total Amount Used1721	Total Amount Type1822	Total Amount Unit1823	Natular 2EC Comments	Natular G30 - # Treatments	Total Amount Used1924	Total Amount Type2025	Total Amount Unit2026	Natular G30 Comments
Storm Drains										
Catch Basins										
Troughs										
Water Features										
Containers										
Standing / Flood Water										
Pastures										
Salt Marsh	2	3	Active Ingredient	Gallons	mixed @ 10oz/gal	1	40	Product	Pounds	
Estuaries	3	5	Active Ingredient	Gallons	mixed @ 10oz/gal	5	1000	Product	Pounds	
Tidal / Woodland Pools	2	3	Active Ingredient	Gallons	mixed @ 10oz/gal	3	500	Product	Pounds	
Wastewater										
Ditches										
Sewer / Dairy lagoons										
Retention / Detention Ponds										
Rural / Urban Residences										
Totals	7	11	Active Ingredient	Gallons	mixed @ 10oz/gal	9	1540	Product	Pounds	

Table A29. Pesticide Application Data for Spring 2012 – NSVMAD

Application Sites:	VectoBac G - # Treatments	Total Amount_Used2	Total Amount_Type3	Total Amount_Unit3	VectoBac G Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount_Unit18	BVA-2 Comments	Teknar HP-D - # Treatments	Total Amount Used27	Total Amount Type28	Total Amount_Unit28	Teknar HP-D Comments
Storm Drains						1500	50	Product	Gallons						
Catch Basins						1500	50	Product	Gallons						
Troughs															
Water Features															
Containers															
Standing / Flood Water						5	35	Product	Gallons		5	3	Active Ingredient	Gallons	16 oz / gallon water
Pastures															
Salt Marsh	2	120	Product			5	40	Product	Gallons		3	10	Active Ingredient	Gallons	16 oz / gallon water
Estuaries	2	120	Product			5	50	Product	Gallons		3	10	Active Ingredient	Gallons	16 oz / gallon water
Tidal / Woodland Pools	2	120	Product			5	50	Product	Gallons						
Wastewater															
Ditches											5	3	Active Ingredient	Gallons	16 oz / gallon water
Sewer / Dairy lagoons											5	3	Active Ingredient	Gallons	16 oz / gallon water
Retention / Detention Ponds	2	40	Product								5	3	Active Ingredient	Gallons	16 oz / gallon water
Rural / Urban Residences															
Totals	8	400	Product	0		3020	275	Product	Gallons		26	32	Active Ingredient	Gallons	16 oz / gallon water

Table A29.

Application Sites:	FourStar 45 Bti - # Treatments	Total Amount Used35	Total Amount Type36	Total Amount Unit36	FourStar 45 Bti Comments	Natular G30 - # Treatments	Total Amount Used1924	Total Amount Type2025	Total Amount Unit2026	Natular G30 Comments
Storm Drains										
Catch Basins										
Troughs										
Water Features										
Containers										
Standing / Flood Water						3	250	Product	Pounds	
Pastures										
Salt Marsh	10	5000				3	250	Product	Pounds	
Estuaries	10	5000				3	250	Product	Pounds	
Tidal / Woodland Pools	5	3000				3	250	Product	Pounds	
Wastewater	10	1000				5	100	Product	Pounds	
Ditches										
Sewer / Dairy lagoons	5	1000								
Retention / Detention Ponds										
Rural / Urban Residences										
Totals	40	15000				17	1100	Product	Pounds	

Table A30. Pesticide Product Key – NSVMAD

Product	AI	Vector
VectoLex CG Biologic	Bacillus Sphaericus	Mosquito
FourStar 45 Bti	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
Teknar HP-D	Bacillus Thuringiensis Israelensis	Mosquito
VectoBac G	Bacillus Thuringiensis Israelensis	Mosquito
Agnique MMF	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito
Altosid XR-G (granules)	Methoprene	Mosquito
Kontrol 4-4	Permethrin and Piperonyl Butoxide	Mosquito
BVA 2	Petroleum Distillate	Mosquito
Natular G30	Spinosad	Mosquito
Natular 2EC	Spinosad	Mosquito

Table A31. Pesticide Application Data for Summer 2011 – SCCVCD

Application Sites:	Agnique MMF-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	AGNIQUE MMF G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	AGNIQUE MMF G Comments	Altosid Briquets 30-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Briquets 30 Comments
	7	0.03998	Product	Gallons		1	0.6916	Product	Pounds		2	0.045	Product	Pounds	
Bird Bath			Product	Gallons				Product	Pounds		1	0.03	Product	Pounds	
Catch Basin	5	0.008035	Product	Gallons				Product	Pounds				Product	Pounds	
Cemetery vases	4	0.004591	Product	Gallons				Product	Pounds				Product	Pounds	
Channel	2	0.092961	Product	Gallons		1	0.8398	Product	Pounds				Product	Pounds	
Clean Pool	3	0.022507	Product	Gallons				Product	Pounds				Product	Pounds	
Commercial			Product	Gallons				Product	Pounds				Product	Pounds	
Container			Product	Gallons				Product	Pounds				Product	Pounds	
Creek	16	0.914632	Product	Gallons		15	33.341	Product	Pounds		1	0.33	Product	Pounds	
Curbs	51	0.850476	Product	Gallons		10	43.918875	Product	Pounds				Product	Pounds	
Dairy Drain	1	0.001148	Product	Gallons				Product	Pounds				Product	Pounds	
Diked Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Drain			Product	Gallons				Product	Pounds				Product	Pounds	
Fish Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Flooded Area	2	0.002525	Product	Gallons				Product	Pounds				Product	Pounds	
FW Marsh			Product	Gallons		1	0.1	Product	Pounds				Product	Pounds	
Impound			Product	Gallons		1	0.4199	Product	Pounds				Product	Pounds	
Lake			Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station			Product	Gallons				Product	Pounds				Product	Pounds	
Neglected Pool	84	0.431675	Product	Gallons		9	0.8022	Product	Pounds				Product	Pounds	
Ornamental Pond	5	0.01033	Product	Gallons		1	0.07	Product	Pounds				Product	Pounds	
Park			Product	Gallons				Product	Pounds				Product	Pounds	
Parking garage			Product	Gallons				Product	Pounds				Product	Pounds	
Pond	5	0.401396	Product	Gallons		3	3.9026	Product	Pounds				Product	Pounds	
Residential	2	0.014357	Product	Gallons				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Seepage			Product	Gallons				Product	Pounds				Product	Pounds	
Sewer Pond	66	0.422688	Product	Gallons		20	4.3892	Product	Pounds				Product	Pounds	
Tires			Product	Gallons				Product	Pounds				Product	Pounds	
Utility Vault			Product	Gallons				Product	Pounds				Product	Pounds	
Watering Trough	1	0.00023	Product	Gallons				Product	Pounds				Product	Pounds	
Totals	254	3.217531	Product	Gallons		62	88.475175	Product	Pounds		4	0.405	Product	Pounds	

Table A31.

Application Sites:	Altosid XR Briquets-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR Briquets Comments	Altosid XR-G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR-G Comments	BVA 2 Mosquito Larvi-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	BVA 2 Mosquito Larvi Comments
			Product	Pounds				Product	Pounds				Product	Gallons	
Bird Bath			Product	Pounds				Product	Pounds		1	0.00825	Product	Gallons	
Catch Basin	1	1.2075	Product	Pounds				Product	Pounds		42	0.34625	Product	Gallons	
Cemetery vases	2	1.127	Product	Pounds				Product	Pounds		7	0.681875	Product	Gallons	
Channel	1	0.0805	Product	Pounds				Product	Pounds		3	0.018375	Product	Gallons	
Clean Pool			Product	Pounds				Product	Pounds		7	0.099609	Product	Gallons	
Commercial			Product	Pounds				Product	Pounds		1	0.0055	Product	Gallons	
Container			Product	Pounds				Product	Pounds		1	0.003906	Product	Gallons	
Creek	6	1.932	Product	Pounds		5	16.138	Product	Pounds		56	4.28474	Product	Gallons	
Curbs	10	2.9785	Product	Pounds		1	0.046	Product	Pounds		150	2.041118	Product	Gallons	
Dairy Drain			Product	Pounds				Product	Pounds				Product	Gallons	
Diked Marsh			Product	Pounds				Product	Pounds				Product	Gallons	
Drain			Product	Pounds				Product	Pounds		1	0.003906	Product	Gallons	
Fish Pond			Product	Pounds				Product	Pounds				Product	Gallons	
Flooded Area			Product	Pounds				Product	Pounds		10	0.476295	Product	Gallons	
FW Marsh			Product	Pounds				Product	Pounds				Product	Gallons	
Impound			Product	Pounds				Product	Pounds		4	0.111563	Product	Gallons	
Lake			Product	Pounds				Product	Pounds				Product	Gallons	
Lift Station			Product	Pounds				Product	Pounds				Product	Gallons	
Neglected Pool			Product	Pounds				Product	Pounds		31	0.170385	Product	Gallons	
Ornamental Pond			Product	Pounds				Product	Pounds				Product	Gallons	
Park			Product	Pounds				Product	Pounds				Product	Gallons	
Parking garage			Product	Pounds				Product	Pounds				Product	Gallons	
Pond			Product	Pounds		1	0.15	Product	Pounds		4	0.889188	Product	Gallons	
Residential			Product	Pounds				Product	Pounds		3	0.041313	Product	Gallons	
Salt Marsh			Product	Pounds				Product	Pounds		1	0.020625	Product	Gallons	
Seepage			Product	Pounds				Product	Pounds				Product	Gallons	
Sewer Pond			Product	Pounds				Product	Pounds		31	0.469939	Product	Gallons	
Tires			Product	Pounds				Product	Pounds				Product	Gallons	
Utility Vault			Product	Pounds				Product	Pounds		4	0.070313	Product	Gallons	
Watering Trough			Product	Pounds				Product	Pounds				Product	Gallons	
Totals	20	7.3255	Product	Pounds		7	16.334	Product	Pounds		357	9.74315	Product	Gallons	

Table A31.

Application Sites:	Drione Insecticide-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Drione Insecticide Comments	EcoExempt IC2-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	EcoExempt IC2 Comments	Fourstar 180 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 180 briq Comments
			Product	Pounds				Product	Gallons		1	0.125	Product	Pounds	
Bird Bath			Product	Pounds				Product	Gallons		1	0.0625	Product	Pounds	
Catch Basin			Product	Pounds				Product	Gallons		2	0.4375	Product	Pounds	
Cemetery vases			Product	Pounds				Product	Gallons				Product	Pounds	
Channel			Product	Pounds				Product	Gallons		3	0.5625	Product	Pounds	
Clean Pool			Product	Pounds				Product	Gallons		3	1.0625	Product	Pounds	
Commercial			Product	Pounds				Product	Gallons				Product	Pounds	
Container			Product	Pounds				Product	Gallons		2	0.875	Product	Pounds	
Creek			Product	Pounds				Product	Gallons		19	5.3125	Product	Pounds	
Curbs			Product	Pounds				Product	Gallons		5	0.8125	Product	Pounds	
Dairy Drain			Product	Pounds				Product	Gallons				Product	Pounds	
Diked Marsh			Product	Pounds				Product	Gallons				Product	Pounds	
Drain			Product	Pounds				Product	Gallons				Product	Pounds	
Fish Pond			Product	Pounds				Product	Gallons				Product	Pounds	
Flooded Area			Product	Pounds				Product	Gallons		2	0.1875	Product	Pounds	
FW Marsh			Product	Pounds				Product	Gallons				Product	Pounds	
Impound			Product	Pounds				Product	Gallons				Product	Pounds	
Lake			Product	Pounds				Product	Gallons				Product	Pounds	
Lift Station			Product	Pounds				Product	Gallons		1	0.125	Product	Pounds	
Neglected Pool			Product	Pounds				Product	Gallons		64	8.5625	Product	Pounds	
Ornamental Pond			Product	Pounds				Product	Gallons				Product	Pounds	
Park	2	0.04375	Product	Pounds				Product	Gallons				Product	Pounds	
Parking garage	1	0.0125	Product	Pounds				Product	Gallons				Product	Pounds	
Pond			Product	Pounds				Product	Gallons		1	0.125	Product	Pounds	
Residential			Product	Pounds				Product	Gallons		1	0.0625	Product	Pounds	
Salt Marsh			Product	Pounds				Product	Gallons				Product	Pounds	
Seepage			Product	Pounds				Product	Gallons				Product	Pounds	
Sewer Pond			Product	Pounds		4	0.070314	Product	Gallons		16	9.5625	Product	Pounds	
Tires			Product	Pounds				Product	Gallons		1	0.25	Product	Pounds	
Utility Vault			Product	Pounds				Product	Gallons				Product	Pounds	
Watering Trough			Product	Pounds				Product	Gallons				Product	Pounds	
Totals	3	0.05625	Product	Pounds		4	0.070314	Product	Gallons		122	28.125	Product	Pounds	

Table A31.

Application Sites:	Fourstar 45 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 45 briq Comments	Fourstar 90 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 90 briq Comments	Golden Bear 1111 Oil-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Golden Bear 1111 Oil Comments
			Product	Pounds				Product	Pounds				Product	Gallons	
Bird Bath			Product	Pounds				Product	Pounds				Product	Gallons	
Catch Basin			Product	Pounds				Product	Pounds				Product	Gallons	
Cemetery vases	2	0.210938	Product	Pounds				Product	Pounds				Product	Gallons	
Channel	1	0.28125	Product	Pounds				Product	Pounds				Product	Gallons	
Clean Pool			Product	Pounds				Product	Pounds				Product	Gallons	
Commercial			Product	Pounds				Product	Pounds				Product	Gallons	
Container			Product	Pounds				Product	Pounds		1	0.011719	Product	Gallons	
Creek	23	2.828127	Product	Pounds		4	1.375	Product	Pounds				Product	Gallons	
Curbs	2	0.03125	Product	Pounds				Product	Pounds		22	0.0825	Product	Gallons	
Dairy Drain			Product	Pounds				Product	Pounds				Product	Gallons	
Diked Marsh			Product	Pounds				Product	Pounds				Product	Gallons	
Drain			Product	Pounds				Product	Pounds				Product	Gallons	
Fish Pond			Product	Pounds				Product	Pounds				Product	Gallons	
Flooded Area			Product	Pounds				Product	Pounds		1	0.25	Product	Gallons	
FW Marsh			Product	Pounds				Product	Pounds				Product	Gallons	
Impound			Product	Pounds				Product	Pounds				Product	Gallons	
Lake	1	0.15625	Product	Pounds				Product	Pounds				Product	Gallons	
Lift Station			Product	Pounds				Product	Pounds				Product	Gallons	
Neglected Pool	3	0.019532	Product	Pounds		7	0.289063	Product	Pounds		5	0.154219	Product	Gallons	
Ornamental Pond	1	0.015625	Product	Pounds				Product	Pounds				Product	Gallons	
Park			Product	Pounds				Product	Pounds				Product	Gallons	
Parking garage			Product	Pounds				Product	Pounds				Product	Gallons	
Pond	1	0.0625	Product	Pounds				Product	Pounds				Product	Gallons	
Residential			Product	Pounds		2	0.09375	Product	Pounds				Product	Gallons	
Salt Marsh			Product	Pounds				Product	Pounds				Product	Gallons	
Seepage			Product	Pounds				Product	Pounds				Product	Gallons	
Sewer Pond			Product	Pounds				Product	Pounds				Product	Gallons	
Tires			Product	Pounds				Product	Pounds				Product	Gallons	
Utility Vault			Product	Pounds				Product	Pounds				Product	Gallons	
Watering Trough			Product	Pounds				Product	Pounds				Product	Gallons	
Totals	34	3.605472	Product	Pounds		13	1.757813	Product	Pounds		29	0.498438	Product	Gallons	

Table A31.

Application Sites:	Pyrenone 25-5-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Pyrenone 25-5 Comments	Vectobac 12AS-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectobac 12AS Comments	Vectobac G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectobac G Comments
	13	77.58	Product	Gallons		1	0.000287	Product	Gallons		1	0.23	Product	Pounds	
Bird Bath			Product	Gallons				Product	Gallons				Product	Pounds	
Catch Basin			Product	Gallons				Product	Gallons		4	0.207	Product	Pounds	
Cemetery vases			Product	Gallons				Product	Gallons		4	0.92	Product	Pounds	
Channel			Product	Gallons		3	0.252294	Product	Gallons		16	34.548	Product	Pounds	
Clean Pool			Product	Gallons		4	0.051122	Product	Gallons				Product	Pounds	
Commercial	1	7.5	Product	Gallons		2	2.138189	Product	Gallons				Product	Pounds	
Container			Product	Gallons		1	0.000313	Product	Gallons		2	1.175	Product	Pounds	
Creek			Product	Gallons		61	3.602547	Product	Gallons		172	382.6285	Product	Pounds	
Curbs			Product	Gallons		11	2.929331	Product	Gallons		14	21.311313	Product	Pounds	
Dairy Drain			Product	Gallons				Product	Gallons		4	0.115	Product	Pounds	
Diked Marsh			Product	Gallons				Product	Gallons		1	25	Product	Pounds	
Drain			Product	Gallons				Product	Gallons				Product	Pounds	
Fish Pond			Product	Gallons		1	0.00172	Product	Gallons				Product	Pounds	
Flooded Area			Product	Gallons		5	0.205854	Product	Gallons		7	11.132	Product	Pounds	
FW Marsh			Product	Gallons				Product	Gallons		3	41	Product	Pounds	
Impound			Product	Gallons				Product	Gallons		2	0.5405	Product	Pounds	
Lake			Product	Gallons		1	0.019784	Product	Gallons				Product	Pounds	
Lift Station			Product	Gallons		3	0.026092	Product	Gallons				Product	Pounds	
Neglected Pool			Product	Gallons		15	1.103133	Product	Gallons		4	1.555	Product	Pounds	
Ornamental Pond			Product	Gallons		2	0.001798	Product	Gallons		2	0.09	Product	Pounds	
Park			Product	Gallons				Product	Gallons				Product	Pounds	
Parking garage			Product	Gallons				Product	Gallons				Product	Pounds	
Pond			Product	Gallons		7	0.237349	Product	Gallons		7	53.826	Product	Pounds	
Residential	4	19.8	Product	Gallons		1	0.00172	Product	Gallons		1	0.138	Product	Pounds	
Salt Marsh			Product	Gallons		4	11	Product	Gallons		16	104.203	Product	Pounds	
Seepage			Product	Gallons				Product	Gallons		1	0.23	Product	Pounds	
Sewer Pond			Product	Gallons		18	0.021757	Product	Gallons		15	11.408	Product	Pounds	
Tires			Product	Gallons				Product	Gallons				Product	Pounds	
Utility Vault			Product	Gallons				Product	Gallons				Product	Pounds	
Watering Trough			Product	Gallons				Product	Gallons				Product	Pounds	
Totals	18	104.88	Product	Gallons		140	21.59329	Product	Gallons		276	690.257313	Product	Pounds	

Table A31.

Application Sites:	Vectolex CG-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectolex CG Comments	Vectolex WSP-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectolex WSP Comments	Vectomax CG-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectomax CG Comments
	1	0.23	Product	Pounds				Product	Pounds				Product	Pounds	
Bird Bath			Product	Pounds				Product	Pounds				Product	Pounds	
Catch Basin			Product	Pounds				Product	Pounds				Product	Pounds	
Cemetery vases			Product	Pounds				Product	Pounds				Product	Pounds	
Channel	2	8.5	Product	Pounds				Product	Pounds				Product	Pounds	
Clean Pool			Product	Pounds				Product	Pounds				Product	Pounds	
Commercial			Product	Pounds				Product	Pounds				Product	Pounds	
Container			Product	Pounds				Product	Pounds				Product	Pounds	
Creek	86	116.5627	Product	Pounds				Product	Pounds				Product	Pounds	
Curbs	2	0.0345	Product	Pounds				Product	Pounds				Product	Pounds	
Dairy Drain			Product	Pounds				Product	Pounds				Product	Pounds	
Diked Marsh			Product	Pounds				Product	Pounds				Product	Pounds	
Drain			Product	Pounds				Product	Pounds				Product	Pounds	
Fish Pond			Product	Pounds				Product	Pounds				Product	Pounds	
Flooded Area	2	3.1004	Product	Pounds		1	0.5	Product	Pounds				Product	Pounds	
FW Marsh			Product	Pounds				Product	Pounds				Product	Pounds	
Impound	1	0.0115	Product	Pounds				Product	Pounds				Product	Pounds	
Lake			Product	Pounds				Product	Pounds				Product	Pounds	
Lift Station			Product	Pounds				Product	Pounds				Product	Pounds	
Neglected Pool	9	1.886	Product	Pounds		1	0.12	Product	Pounds		1	0.09	Product	Pounds	
Ornamental Pond	2	0.046	Product	Pounds				Product	Pounds				Product	Pounds	
Park			Product	Pounds				Product	Pounds				Product	Pounds	
Parking garage			Product	Pounds				Product	Pounds				Product	Pounds	
Pond	1	0.529	Product	Pounds				Product	Pounds				Product	Pounds	
Residential			Product	Pounds				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Pounds				Product	Pounds				Product	Pounds	
Seepage	1	10	Product	Pounds				Product	Pounds				Product	Pounds	
Sewer Pond	2	0.046	Product	Pounds				Product	Pounds				Product	Pounds	
Tires			Product	Pounds				Product	Pounds				Product	Pounds	
Utility Vault			Product	Pounds				Product	Pounds				Product	Pounds	
Watering Trough			Product	Pounds				Product	Pounds				Product	Pounds	
Totals	109	140.9461	Product	Pounds		2	0.62	Product	Pounds		1	0.09	Product	Pounds	

Table A32. Pesticide Application Data for Fall 2011 – SCCVCD

Application Sites:	Agnique MMF-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	AGNIQUE MMF G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	AGNIQUE MMF G Comments	Altosid Briquets 30-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Briquets 30 Comments
	1	0.009766	Product	Gallons				Product	Pounds				Product	Pounds	
Catch Basin	1	0.002295	Product	Gallons				Product	Pounds				Product	Pounds	
Cemetery vases	1	0.001148	Product	Gallons				Product	Pounds				Product	Pounds	
Channel			Product	Gallons				Product	Pounds				Product	Pounds	
Clean Pool			Product	Gallons				Product	Pounds				Product	Pounds	
Commercial			Product	Gallons				Product	Pounds				Product	Pounds	
Container	1	0.004591	Product	Gallons				Product	Pounds				Product	Pounds	
Creek	7	0.209313	Product	Gallons		4	1.2817	Product	Pounds		3	0.165	Product	Pounds	
Curbs	4	0.17554	Product	Gallons		2	3.1996	Product	Pounds		1	0.045	Product	Pounds	
Dairy Drain			Product	Gallons				Product	Pounds				Product	Pounds	
Diked Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Drain			Product	Gallons		1	0.0247	Product	Pounds				Product	Pounds	
Duck Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Flooded Area	3	0.079189	Product	Gallons		2	0.4486	Product	Pounds				Product	Pounds	
FW Marsh			Product	Gallons		1	0.1976	Product	Pounds				Product	Pounds	
Impound			Product	Gallons				Product	Pounds				Product	Pounds	
Lake			Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station			Product	Gallons				Product	Pounds				Product	Pounds	
Neglected Pool	3	0.025686	Product	Gallons		1	0.09	Product	Pounds				Product	Pounds	
Ornamental Pond	1	0.002289	Product	Gallons				Product	Pounds				Product	Pounds	
Pond	1	0.001148	Product	Gallons		1	5.928	Product	Pounds				Product	Pounds	
Residential	1	0.001148	Product	Gallons				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Sewer Pond	7	0.018227	Product	Gallons		1	1.1856	Product	Pounds				Product	Pounds	
Tires	1	0.000156	Product	Gallons				Product	Pounds				Product	Pounds	
Treehole			Product	Gallons				Product	Pounds				Product	Pounds	
Utility Vault			Product	Gallons				Product	Pounds				Product	Pounds	
Watering Trough			Product	Gallons				Product	Pounds				Product	Pounds	
Totals	32	0.530496	Product	Gallons		13	12.3558	Product	Pounds		4	0.21	Product	Pounds	

Table A32.

Application Sites:	Altosid Pellets-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Pellets Comments	Altosid XR Briquets-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR Briquets Comments	Altosid XR-G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR-G Comments
			Product	Pounds				Product	Pounds				Product	Pounds	
Catch Basin			Product	Pounds		2	0.4025	Product	Pounds				Product	Pounds	
Cemetery vases			Product	Pounds				Product	Pounds				Product	Pounds	
Channel			Product	Pounds				Product	Pounds				Product	Pounds	
Clean Pool			Product	Pounds				Product	Pounds				Product	Pounds	
Commercial			Product	Pounds				Product	Pounds				Product	Pounds	
Container			Product	Pounds				Product	Pounds				Product	Pounds	
Creek	1	8	Product	Pounds		2	0.253575	Product	Pounds		5	1.725	Product	Pounds	
Curbs			Product	Pounds		2	0.161	Product	Pounds				Product	Pounds	
Dairy Drain			Product	Pounds				Product	Pounds				Product	Pounds	
Diked Marsh			Product	Pounds				Product	Pounds				Product	Pounds	
Drain			Product	Pounds				Product	Pounds				Product	Pounds	
Duck Pond			Product	Pounds				Product	Pounds				Product	Pounds	
Flooded Area			Product	Pounds				Product	Pounds				Product	Pounds	
FW Marsh			Product	Pounds				Product	Pounds				Product	Pounds	
Impound			Product	Pounds				Product	Pounds				Product	Pounds	
Lake			Product	Pounds				Product	Pounds				Product	Pounds	
Lift Station			Product	Pounds				Product	Pounds				Product	Pounds	
Neglected Pool			Product	Pounds		2	0.322	Product	Pounds				Product	Pounds	
Ornamental Pond			Product	Pounds				Product	Pounds				Product	Pounds	
Pond			Product	Pounds				Product	Pounds				Product	Pounds	
Residential			Product	Pounds		1	0.161	Product	Pounds				Product	Pounds	
Salt Marsh			Product	Pounds				Product	Pounds				Product	Pounds	
Sewer Pond			Product	Pounds				Product	Pounds				Product	Pounds	
Tires			Product	Pounds				Product	Pounds				Product	Pounds	
Treehole			Product	Pounds				Product	Pounds				Product	Pounds	
Utility Vault			Product	Pounds				Product	Pounds				Product	Pounds	
Watering Trough			Product	Pounds				Product	Pounds				Product	Pounds	
Totals	1	8	Product	Pounds		9	1.300075	Product	Pounds		5	1.725	Product	Pounds	

Table A32.

Application Sites:	BVA 2 Mosquito Larvi-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	BVA 2 Mosquito Larvi Comments	Contrac 8oz blk-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Contrac 8oz blk Comments	Diphacinone-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Diphacinone Comments
			Product	Gallons				Product					Product	Pounds	
Catch Basin	2	0.054875	Product	Gallons				Product					Product	Pounds	
Cemetery vases	3	0.148875	Product	Gallons				Product					Product	Pounds	
Channel	2	0.013313	Product	Gallons				Product					Product	Pounds	
Clean Pool	4	0.035157	Product	Gallons				Product					Product	Pounds	
Commercial	1	0.006875	Product	Gallons				Product					Product	Pounds	
Container			Product	Gallons				Product					Product	Pounds	
Creek	24	0.53222	Product	Gallons				Product					Product	Pounds	
Curbs	18	1.219219	Product	Gallons				Product					Product	Pounds	
Dairy Drain	1	0.004125	Product	Gallons				Product					Product	Pounds	
Diked Marsh			Product	Gallons				Product					Product	Pounds	
Drain			Product	Gallons				Product					Product	Pounds	
Duck Pond			Product	Gallons				Product					Product	Pounds	
Flooded Area	5	0.29975	Product	Gallons				Product					Product	Pounds	
FW Marsh	2	0.011	Product	Gallons				Product					Product	Pounds	
Impound	2	0.03675	Product	Gallons				Product					Product	Pounds	
Lake			Product	Gallons				Product					Product	Pounds	
Lift Station			Product	Gallons				Product					Product	Pounds	
Neglected Pool	8	0.099126	Product	Gallons				Product					Product	Pounds	
Ornamental Pond	1	0.006875	Product	Gallons				Product					Product	Pounds	
Pond			Product	Gallons				Product					Product	Pounds	
Residential			Product	Gallons		2		Product			1		Product	Pounds	
Salt Marsh	2	3.5825	Product	Gallons				Product					Product	Pounds	
Sewer Pond	2	0.221375	Product	Gallons				Product					Product	Pounds	
Tires			Product	Gallons				Product					Product	Pounds	
Treehole			Product	Gallons				Product					Product	Pounds	
Utility Vault	1	0.015625	Product	Gallons				Product					Product	Pounds	
Watering Trough			Product	Gallons				Product					Product	Pounds	
Totals	78	6.28766	Product	Gallons		2		Product			1		Product	Pounds	

Table A32.

Application Sites:	Drione Insecticide-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Drione Insecticide Comments	FirstStrike Soft Bai-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	FirstStrike Soft Bai Comments	Fourstar 180 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 180 briq Comments
			Product	Pounds				Product			1	0.0625	Product	Pounds	
Catch Basin			Product	Pounds				Product			1	1.5	Product	Pounds	
Cemetery vases			Product	Pounds				Product					Product	Pounds	
Channel			Product	Pounds				Product			1	0.625	Product	Pounds	
Clean Pool			Product	Pounds				Product					Product	Pounds	
Commercial			Product	Pounds		1		Product			1	0.125	Product	Pounds	
Container			Product	Pounds				Product					Product	Pounds	
Creek			Product	Pounds				Product			32	9.625	Product	Pounds	
Curbs			Product	Pounds				Product			3	0.75	Product	Pounds	
Dairy Drain			Product	Pounds				Product					Product	Pounds	
Diked Marsh			Product	Pounds				Product					Product	Pounds	
Drain			Product	Pounds				Product					Product	Pounds	
Duck Pond			Product	Pounds				Product					Product	Pounds	
Flooded Area			Product	Pounds				Product			1	0.0625	Product	Pounds	
FW Marsh			Product	Pounds				Product			1	0.25	Product	Pounds	
Impound			Product	Pounds				Product					Product	Pounds	
Lake			Product	Pounds				Product					Product	Pounds	
Lift Station			Product	Pounds				Product					Product	Pounds	
Neglected Pool			Product	Pounds				Product					Product	Pounds	
Ornamental Pond			Product	Pounds				Product			2	0.125	Product	Pounds	
Pond			Product	Pounds				Product			3	0.375	Product	Pounds	
Residential	2	0.0625	Product	Pounds		1		Product					Product	Pounds	
Salt Marsh			Product	Pounds				Product					Product	Pounds	
Sewer Pond			Product	Pounds				Product			1	0.0625	Product	Pounds	
Tires			Product	Pounds				Product					Product	Pounds	
Treehole	1	0.015625	Product	Pounds				Product					Product	Pounds	
Utility Vault			Product	Pounds				Product					Product	Pounds	
Watering Trough			Product	Pounds				Product			1	0.3125	Product	Pounds	
Totals	3	0.078125	Product	Pounds		2		Product			48	13.875	Product	Pounds	

Table A32.

Application Sites:	Fourstar 45 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 45 briq Comments	Fourstar 90 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 90 briq Comments	Golden Bear 1111 Oil-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Golden Bear 1111 Oil Comments
			Product	Pounds				Product	Pounds				Product	Gallons	
Catch Basin	1	0.03125	Product	Pounds				Product	Pounds				Product	Gallons	
Cemetery vases			Product	Pounds				Product	Pounds				Product	Gallons	
Channel			Product	Pounds		1	0.1875	Product	Pounds				Product	Gallons	
Clean Pool			Product	Pounds				Product	Pounds				Product	Gallons	
Commercial			Product	Pounds				Product	Pounds				Product	Gallons	
Container			Product	Pounds				Product	Pounds				Product	Gallons	
Creek	4	0.320313	Product	Pounds		2	0.1875	Product	Pounds		2	0.028875	Product	Gallons	
Curbs	1	0.007813	Product	Pounds		2	0.09375	Product	Pounds				Product	Gallons	
Dairy Drain			Product	Pounds				Product	Pounds				Product	Gallons	
Diked Marsh			Product	Pounds				Product	Pounds				Product	Gallons	
Drain			Product	Pounds				Product	Pounds				Product	Gallons	
Duck Pond			Product	Pounds				Product	Pounds				Product	Gallons	
Flooded Area			Product	Pounds				Product	Pounds				Product	Gallons	
FW Marsh			Product	Pounds		1	0.03125	Product	Pounds				Product	Gallons	
Impound			Product	Pounds				Product	Pounds				Product	Gallons	
Lake			Product	Pounds				Product	Pounds				Product	Gallons	
Lift Station	1	0.015625	Product	Pounds				Product	Pounds				Product	Gallons	
Neglected Pool			Product	Pounds				Product	Pounds				Product	Gallons	
Ornamental Pond			Product	Pounds				Product	Pounds				Product	Gallons	
Pond			Product	Pounds				Product	Pounds				Product	Gallons	
Residential			Product	Pounds				Product	Pounds				Product	Gallons	
Salt Marsh			Product	Pounds				Product	Pounds				Product	Gallons	
Sewer Pond	6	0.703127	Product	Pounds				Product	Pounds				Product	Gallons	
Tires			Product	Pounds				Product	Pounds				Product	Gallons	
Treehole			Product	Pounds				Product	Pounds				Product	Gallons	
Utility Vault			Product	Pounds				Product	Pounds				Product	Gallons	
Watering Trough			Product	Pounds				Product	Pounds				Product	Gallons	
Totals	13	1.078128	Product	Pounds		6	0.5	Product	Pounds		2	0.028875	Product	Gallons	

Table A32.

Application Sites:	Vectobac 12AS-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectobac 12AS Comments	Vectobac G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectobac G Comments	Vectolex CG-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectolex CG Comments
			Product	Gallons		1	0.15	Product	Pounds				Product	Pounds	
Catch Basin	1	0.004014	Product	Gallons				Product	Pounds				Product	Pounds	
Cemetery vases			Product	Gallons		2	0.598	Product	Pounds				Product	Pounds	
Channel	3	0.094783	Product	Gallons		4	12.788	Product	Pounds				Product	Pounds	
Clean Pool			Product	Gallons				Product	Pounds				Product	Pounds	
Commercial	1	0.000287	Product	Gallons				Product	Pounds				Product	Pounds	
Container			Product	Gallons				Product	Pounds				Product	Pounds	
Creek	25	0.970037	Product	Gallons		58	71.9533	Product	Pounds		22	19.3485	Product	Pounds	
Curbs	7	51.349999	Product	Gallons		4	47.107	Product	Pounds		1	40	Product	Pounds	
Dairy Drain			Product	Gallons				Product	Pounds				Product	Pounds	
Diked Marsh	5	0.802525	Product	Gallons				Product	Pounds				Product	Pounds	
Drain			Product	Gallons				Product	Pounds				Product	Pounds	
Duck Pond	2	0.15	Product	Gallons				Product	Pounds				Product	Pounds	
Flooded Area	1	0.014623	Product	Gallons		6	5.236	Product	Pounds				Product	Pounds	
FW Marsh			Product	Gallons		5	146.58	Product	Pounds		2	16	Product	Pounds	
Impound			Product	Gallons		1	0.092	Product	Pounds				Product	Pounds	
Lake	1	0.011755	Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station	1	0.00172	Product	Gallons		1	0.138	Product	Pounds				Product	Pounds	
Neglected Pool	1	0.001094	Product	Gallons		2	0.98	Product	Pounds		1	0.253	Product	Pounds	
Ornamental Pond			Product	Gallons		2	0.0276	Product	Pounds		2	0.0276	Product	Pounds	
Pond	1	0.000573	Product	Gallons				Product	Pounds				Product	Pounds	
Residential			Product	Gallons		1	0.092	Product	Pounds				Product	Pounds	
Salt Marsh	1	0.03928	Product	Gallons		5	12.65	Product	Pounds		2	0.46	Product	Pounds	
Sewer Pond	6	3.085915	Product	Gallons		1	4.002	Product	Pounds				Product	Pounds	
Tires			Product	Gallons				Product	Pounds				Product	Pounds	
Treehole			Product	Gallons				Product	Pounds				Product	Pounds	
Utility Vault			Product	Gallons				Product	Pounds				Product	Pounds	
Watering Trough			Product	Gallons				Product	Pounds				Product	Pounds	
Totals	56	56.526605	Product	Gallons		93	302.3939	Product	Pounds		30	76.0891	Product	Pounds	

Table A32.

Application Sites:	Vectomax CG-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectomax CG Comments
			Product	Pounds	
Catch Basin			Product	Pounds	
Cemetery vases			Product	Pounds	
Channel			Product	Pounds	
Clean Pool			Product	Pounds	
Commercial			Product	Pounds	
Container			Product	Pounds	
Creek			Product	Pounds	
Curbs	1	1.311	Product	Pounds	
Dairy Drain			Product	Pounds	
Diked Marsh			Product	Pounds	
Drain			Product	Pounds	
Duck Pond			Product	Pounds	
Flooded Area			Product	Pounds	
FW Marsh			Product	Pounds	
Impound			Product	Pounds	
Lake			Product	Pounds	
Lift Station			Product	Pounds	
Neglected Pool			Product	Pounds	
Ornamental Pond			Product	Pounds	
Pond			Product	Pounds	
Residential			Product	Pounds	
Salt Marsh			Product	Pounds	
Sewer Pond	3	1.541	Product	Pounds	
Tires			Product	Pounds	
Treehole			Product	Pounds	
Utility Vault			Product	Pounds	
Watering Trough			Product	Pounds	
Totals	4	2.852	Product	Pounds	

Table A33. Pesticide Application Data for Winter 2012 – SCCVCD

Application Sites:	Agnique MMF-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	AGNIQUE MMF G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	AGNIQUE MMF G Comments	Altosid Briquets 30-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Briquets 30 Comments
			Product	Gallons				Product	Pounds				Product	Pounds	
Channel			Product	Gallons				Product	Pounds				Product	Pounds	
Clean Pool			Product	Gallons				Product	Pounds				Product	Pounds	
Commercial			Product	Gallons				Product	Pounds				Product	Pounds	
Container	1	0.004591	Product	Gallons		1	0.0494	Product	Pounds				Product	Pounds	
Creek			Product	Gallons		3	2.2477	Product	Pounds		1	0.075	Product	Pounds	
Curbs	1	0.001148	Product	Gallons		3	0.3705	Product	Pounds				Product	Pounds	
Diked Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Fish Pond	1	0.001148	Product	Gallons				Product	Pounds				Product	Pounds	
Flooded Area	1	0.036725	Product	Gallons				Product	Pounds				Product	Pounds	
FW Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Impound	1	0.040168	Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station			Product	Gallons				Product	Pounds				Product	Pounds	
Neglected Pool	3	0.029839	Product	Gallons				Product	Pounds				Product	Pounds	
Ornamental Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Pond	2	0.004591	Product	Gallons		1	0.0247	Product	Pounds				Product	Pounds	
Residential			Product	Gallons				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Seepage			Product	Gallons				Product	Pounds				Product	Pounds	
Sewer Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Watering Trough			Product	Gallons				Product	Pounds				Product	Pounds	
Totals	10	0.11821	Product	Gallons		8	2.6923	Product	Pounds		1	0.075	Product	Pounds	

Table A33.

Application Sites:	Altosid Liquid SR5-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Liquid SR5 Comments	Altosid XR Briquets-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR Briquets Comments	Altosid XR-G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR-G Comments
			Product	Gallons				Product	Pounds				Product	Pounds	
Channel			Product	Gallons		2	0.7245	Product	Pounds				Product	Pounds	
Clean Pool			Product	Gallons				Product	Pounds				Product	Pounds	
Commercial			Product	Gallons				Product	Pounds				Product	Pounds	
Container			Product	Gallons		1	0.2415	Product	Pounds				Product	Pounds	
Creek			Product	Gallons		4	0.8855	Product	Pounds		2	0.851	Product	Pounds	
Curbs			Product	Gallons		1	0.161	Product	Pounds		4	0.943	Product	Pounds	
Diked Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Fish Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Flooded Area			Product	Gallons				Product	Pounds		1	0.184	Product	Pounds	
FW Marsh	1	0.3125	Product	Gallons				Product	Pounds				Product	Pounds	
Impound			Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station			Product	Gallons				Product	Pounds				Product	Pounds	
Neglected Pool			Product	Gallons		2	0.161	Product	Pounds				Product	Pounds	
Ornamental Pond			Product	Gallons		1	0.0805	Product	Pounds				Product	Pounds	
Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Residential			Product	Gallons				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Seepage			Product	Gallons				Product	Pounds				Product	Pounds	
Sewer Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Watering Trough			Product	Gallons				Product	Pounds				Product	Pounds	
Totals	1	0.3125	Product	Gallons		11	2.254	Product	Pounds		7	1.978	Product	Pounds	

Table A33.

Application Sites:	BVA 2 Mosquito Larvi-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	BVA 2 Mosquito Larvi Comments	Fourstar 180 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 180 briq Comments	Fourstar 45 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 45 briq Comments
			Product	Gallons				Product	Pounds		1	0.101563	Product	Pounds	
Channel	3	0.132813	Product	Gallons				Product	Pounds		4	0.468751	Product	Pounds	
Clean Pool			Product	Gallons		1	0.0625	Product	Pounds				Product	Pounds	
Commercial			Product	Gallons				Product	Pounds				Product	Pounds	
Container	2	0.0165	Product	Gallons		1	0.1875	Product	Pounds				Product	Pounds	
Creek	15	0.829595	Product	Gallons		13	5.25	Product	Pounds		21	14.76563	Product	Pounds	
Curbs	4	0.197063	Product	Gallons		4	0.5625	Product	Pounds		9	0.656252	Product	Pounds	
Diked Marsh	1	1.375	Product	Gallons				Product	Pounds				Product	Pounds	
Fish Pond			Product	Gallons		2	0.125	Product	Pounds				Product	Pounds	
Flooded Area	2	0.188375	Product	Gallons		1	1	Product	Pounds				Product	Pounds	
FW Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Impound	1	0.041323	Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station			Product	Gallons				Product	Pounds				Product	Pounds	
Neglected Pool	4	0.198125	Product	Gallons				Product	Pounds		2	0.054688	Product	Pounds	
Ornamental Pond	1	0.001375	Product	Gallons		2	0.125	Product	Pounds		1	0.03125	Product	Pounds	
Pond			Product	Gallons				Product	Pounds		2	0.031251	Product	Pounds	
Residential			Product	Gallons				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Seepage			Product	Gallons				Product	Pounds				Product	Pounds	
Sewer Pond			Product	Gallons				Product	Pounds		1	0.15625	Product	Pounds	
Watering Trough			Product	Gallons				Product	Pounds				Product	Pounds	
Totals	33	2.980169	Product	Gallons		24	7.3125	Product	Pounds		41	16.265635	Product	Pounds	

Table A33.

Application Sites:	Fourstar 90 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 90 briq Comments	Golden Bear 1111 Oil-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Golden Bear 1111 Oil Comments	Vectobac 12AS-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectobac 12AS Comments
			Product	Pounds				Product	Gallons		1	0.023438	Product	Gallons	
Channel			Product	Pounds				Product	Gallons		1	0.006021	Product	Gallons	
Clean Pool			Product	Pounds				Product	Gallons				Product	Gallons	
Commercial			Product	Pounds				Product	Gallons		1	0.072827	Product	Gallons	
Container	1	0.03125	Product	Pounds		1	0.000156	Product	Gallons		1	0.000016	Product	Gallons	
Creek	2	0.15625	Product	Pounds				Product	Gallons		20	0.656871	Product	Gallons	
Curbs			Product	Pounds				Product	Gallons		2	0.036987	Product	Gallons	
Diked Marsh			Product	Pounds		1	0.776875	Product	Gallons		10	1.138848	Product	Gallons	
Fish Pond			Product	Pounds				Product	Gallons				Product	Gallons	
Flooded Area			Product	Pounds				Product	Gallons		3	1.250578	Product	Gallons	
FW Marsh			Product	Pounds				Product	Gallons		1	2.5	Product	Gallons	
Impound			Product	Pounds				Product	Gallons				Product	Gallons	
Lift Station			Product	Pounds				Product	Gallons		1	0.00172	Product	Gallons	
Neglected Pool	1	0.0625	Product	Pounds				Product	Gallons				Product	Gallons	
Ornamental Pond			Product	Pounds				Product	Gallons		1	0.000573	Product	Gallons	
Pond			Product	Pounds				Product	Gallons		4	0.332021	Product	Gallons	
Residential			Product	Pounds				Product	Gallons				Product	Gallons	
Salt Marsh			Product	Pounds				Product	Gallons		22	34.329229	Product	Gallons	
Seepage			Product	Pounds				Product	Gallons				Product	Gallons	
Sewer Pond			Product	Pounds				Product	Gallons		6	0.524981	Product	Gallons	
Watering Trough	1	0.15625	Product	Pounds				Product	Gallons				Product	Gallons	
Totals	5	0.40625	Product	Pounds		2	0.777031	Product	Gallons		74	40.87411	Product	Gallons	

Table A33.

Application Sites:	Vectobac G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectobac G Comments	Vectolex CG-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectolex CG Comments	Vectomax CG-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectomax CG Comments
	1	1.012	Product	Pounds				Product	Pounds				Product	Pounds	
Channel			Product	Pounds				Product	Pounds				Product	Pounds	
Clean Pool			Product	Pounds				Product	Pounds				Product	Pounds	
Commercial			Product	Pounds				Product	Pounds				Product	Pounds	
Container	1	0.046	Product	Pounds				Product	Pounds				Product	Pounds	
Creek	3	2.047	Product	Pounds				Product	Pounds				Product	Pounds	
Curbs	2	0.207	Product	Pounds				Product	Pounds				Product	Pounds	
Diked Marsh	1	38	Product	Pounds				Product	Pounds				Product	Pounds	
Fish Pond			Product	Pounds				Product	Pounds				Product	Pounds	
Flooded Area	6	5.865	Product	Pounds				Product	Pounds				Product	Pounds	
FW Marsh	5	25.98	Product	Pounds		5	25.98	Product	Pounds				Product	Pounds	
Impound	1	1.1433	Product	Pounds				Product	Pounds				Product	Pounds	
Lift Station	2	25	Product	Pounds				Product	Pounds				Product	Pounds	
Neglected Pool	1	0.23	Product	Pounds				Product	Pounds				Product	Pounds	
Ornamental Pond	1	0.069	Product	Pounds				Product	Pounds				Product	Pounds	
Pond	4	5.497	Product	Pounds				Product	Pounds				Product	Pounds	
Residential	1	0.046	Product	Pounds				Product	Pounds				Product	Pounds	
Salt Marsh	21	164.855	Product	Pounds		5	7.427	Product	Pounds		2	26	Product	Pounds	
Seepage	1	0.506	Product	Pounds				Product	Pounds				Product	Pounds	
Sewer Pond	2	9.085	Product	Pounds				Product	Pounds				Product	Pounds	
Watering Trough			Product	Pounds				Product	Pounds				Product	Pounds	
Totals	53	279.5883	Product	Pounds		10	33.407	Product	Pounds		2	26	Product	Pounds	

Table A34. Pesticide Application Data for Spring 2012 – SCCVCD

Application Sites:	Agnique MMF-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	AGNIQUE MMF G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	AGNIQUE MMF G Comments	Altosid Briquets 30-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Briquets 30 Comments
			Product	Gallons				Product	Pounds				Product	Pounds	
Channel			Product	Gallons				Product	Pounds				Product	Pounds	
Clean Pool			Product	Gallons				Product	Pounds				Product	Pounds	
Commercial			Product	Gallons				Product	Pounds				Product	Pounds	
Container	1	0.004591	Product	Gallons		1	0.0494	Product	Pounds				Product	Pounds	
Creek			Product	Gallons		3	2.2477	Product	Pounds		1	0.075	Product	Pounds	
Curbs	1	0.001148	Product	Gallons		3	0.3705	Product	Pounds				Product	Pounds	
Diked Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Fish Pond	1	0.001148	Product	Gallons				Product	Pounds				Product	Pounds	
Flooded Area	1	0.036725	Product	Gallons				Product	Pounds				Product	Pounds	
FW Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Impound	1	0.040168	Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station			Product	Gallons				Product	Pounds				Product	Pounds	
Neglected Pool	3	0.029839	Product	Gallons				Product	Pounds				Product	Pounds	
Ornamental Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Pond	2	0.004591	Product	Gallons		1	0.0247	Product	Pounds				Product	Pounds	
Residential			Product	Gallons				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Seepage			Product	Gallons				Product	Pounds				Product	Pounds	
Sewer Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Watering Trough			Product	Gallons				Product	Pounds				Product	Pounds	
Totals	10	0.11821	Product	Gallons		8	2.6923	Product	Pounds		1	0.075	Product	Pounds	

Table A34.

Application Sites:	Altosid Liquid SR5-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid Liquid SR5 Comments	Altosid XR Briquets-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR Briquets Comments	Altosid XR-G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Altosid XR-G Comments
			Product	Gallons				Product	Pounds				Product	Pounds	
Channel			Product	Gallons		2	0.7245	Product	Pounds				Product	Pounds	
Clean Pool			Product	Gallons				Product	Pounds				Product	Pounds	
Commercial			Product	Gallons				Product	Pounds				Product	Pounds	
Container			Product	Gallons		1	0.2415	Product	Pounds				Product	Pounds	
Creek			Product	Gallons		4	0.8855	Product	Pounds		2	0.851	Product	Pounds	
Curbs			Product	Gallons		1	0.161	Product	Pounds		4	0.943	Product	Pounds	
Diked Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Fish Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Flooded Area			Product	Gallons				Product	Pounds		1	0.184	Product	Pounds	
FW Marsh	1	0.3125	Product	Gallons				Product	Pounds				Product	Pounds	
Impound			Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station			Product	Gallons				Product	Pounds				Product	Pounds	
Neglected Pool			Product	Gallons		2	0.161	Product	Pounds				Product	Pounds	
Ornamental Pond			Product	Gallons		1	0.0805	Product	Pounds				Product	Pounds	
Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Residential			Product	Gallons				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Seepage			Product	Gallons				Product	Pounds				Product	Pounds	
Sewer Pond			Product	Gallons				Product	Pounds				Product	Pounds	
Watering Trough			Product	Gallons				Product	Pounds				Product	Pounds	
Totals	1	0.3125	Product	Gallons		11	2.254	Product	Pounds		7	1.978	Product	Pounds	

Table A34.

Application Sites:	BVA 2 Mosquito Larvi-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	BVA 2 Mosquito Larvi Comments	Fourstar 180 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 180 briq Comments	Fourstar 45 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 45 briq Comments
			Product	Gallons				Product	Pounds		1	0.101563	Product	Pounds	
Channel	3	0.132813	Product	Gallons				Product	Pounds		4	0.468751	Product	Pounds	
Clean Pool			Product	Gallons		1	0.0625	Product	Pounds				Product	Pounds	
Commercial			Product	Gallons				Product	Pounds				Product	Pounds	
Container	2	0.0165	Product	Gallons		1	0.1875	Product	Pounds				Product	Pounds	
Creek	15	0.829595	Product	Gallons		13	5.25	Product	Pounds		21	14.76563	Product	Pounds	
Curbs	4	0.197063	Product	Gallons		4	0.5625	Product	Pounds		9	0.656252	Product	Pounds	
Diked Marsh	1	1.375	Product	Gallons				Product	Pounds				Product	Pounds	
Fish Pond			Product	Gallons		2	0.125	Product	Pounds				Product	Pounds	
Flooded Area	2	0.188375	Product	Gallons		1	1	Product	Pounds				Product	Pounds	
FW Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Impound	1	0.041323	Product	Gallons				Product	Pounds				Product	Pounds	
Lift Station			Product	Gallons				Product	Pounds				Product	Pounds	
Neglected Pool	4	0.198125	Product	Gallons				Product	Pounds		2	0.054688	Product	Pounds	
Ornamental Pond	1	0.001375	Product	Gallons		2	0.125	Product	Pounds		1	0.03125	Product	Pounds	
Pond			Product	Gallons				Product	Pounds		2	0.031251	Product	Pounds	
Residential			Product	Gallons				Product	Pounds				Product	Pounds	
Salt Marsh			Product	Gallons				Product	Pounds				Product	Pounds	
Seepage			Product	Gallons				Product	Pounds				Product	Pounds	
Sewer Pond			Product	Gallons				Product	Pounds		1	0.15625	Product	Pounds	
Watering Trough			Product	Gallons				Product	Pounds				Product	Pounds	
Totals	33	2.980169	Product	Gallons		24	7.3125	Product	Pounds		41	16.265635	Product	Pounds	

Table A34.

Application Sites:	Fourstar 90 briq-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Fourstar 90 briq Comments	Golden Bear 1111 Oil-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Golden Bear 1111 Oil Comments	Vectobac 12AS-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectobac 12AS Comments
			Product	Pounds				Product	Gallons		1	0.023438	Product	Gallons	
Channel			Product	Pounds				Product	Gallons		1	0.006021	Product	Gallons	
Clean Pool			Product	Pounds				Product	Gallons				Product	Gallons	
Commercial			Product	Pounds				Product	Gallons		1	0.072827	Product	Gallons	
Container	1	0.03125	Product	Pounds		1	0.000156	Product	Gallons		1	0.000016	Product	Gallons	
Creek	2	0.15625	Product	Pounds				Product	Gallons		20	0.656871	Product	Gallons	
Curbs			Product	Pounds				Product	Gallons		2	0.036987	Product	Gallons	
Diked Marsh			Product	Pounds		1	0.776875	Product	Gallons		10	1.138848	Product	Gallons	
Fish Pond			Product	Pounds				Product	Gallons				Product	Gallons	
Flooded Area			Product	Pounds				Product	Gallons		3	1.250578	Product	Gallons	
FW Marsh			Product	Pounds				Product	Gallons		1	2.5	Product	Gallons	
Impound			Product	Pounds				Product	Gallons				Product	Gallons	
Lift Station			Product	Pounds				Product	Gallons		1	0.00172	Product	Gallons	
Neglected Pool	1	0.0625	Product	Pounds				Product	Gallons				Product	Gallons	
Ornamental Pond			Product	Pounds				Product	Gallons		1	0.000573	Product	Gallons	
Pond			Product	Pounds				Product	Gallons		4	0.332021	Product	Gallons	
Residential			Product	Pounds				Product	Gallons				Product	Gallons	
Salt Marsh			Product	Pounds				Product	Gallons		22	34.329229	Product	Gallons	
Seepage			Product	Pounds				Product	Gallons				Product	Gallons	
Sewer Pond			Product	Pounds				Product	Gallons		6	0.524981	Product	Gallons	
Watering Trough	1	0.15625	Product	Pounds				Product	Gallons				Product	Gallons	
Totals	5	0.40625	Product	Pounds		2	0.777031	Product	Gallons		74	40.87411	Product	Gallons	

Table A34.

Application Sites:	Vectobac G-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectobac G Comments	Vectolex CG-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectolex CG Comments	Vectomax CG-# Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Vectomax CG Comments
	1	1.012	Product	Pounds				Product	Pounds				Product	Pounds	
Channel			Product	Pounds				Product	Pounds				Product	Pounds	
Clean Pool			Product	Pounds				Product	Pounds				Product	Pounds	
Commercial			Product	Pounds				Product	Pounds				Product	Pounds	
Container	1	0.046	Product	Pounds				Product	Pounds				Product	Pounds	
Creek	3	2.047	Product	Pounds				Product	Pounds				Product	Pounds	
Curbs	2	0.207	Product	Pounds				Product	Pounds				Product	Pounds	
Diked Marsh	1	38	Product	Pounds				Product	Pounds				Product	Pounds	
Fish Pond			Product	Pounds				Product	Pounds				Product	Pounds	
Flooded Area	6	5.865	Product	Pounds				Product	Pounds				Product	Pounds	
FW Marsh	5	25.98	Product	Pounds		5	25.98	Product	Pounds				Product	Pounds	
Impound	1	1.1433	Product	Pounds				Product	Pounds				Product	Pounds	
Lift Station	2	25	Product	Pounds				Product	Pounds				Product	Pounds	
Neglected Pool	1	0.23	Product	Pounds				Product	Pounds				Product	Pounds	
Ornamental Pond	1	0.069	Product	Pounds				Product	Pounds				Product	Pounds	
Pond	4	5.497	Product	Pounds				Product	Pounds				Product	Pounds	
Residential	1	0.046	Product	Pounds				Product	Pounds				Product	Pounds	
Salt Marsh	21	164.855	Product	Pounds		5	7.427	Product	Pounds		2	26	Product	Pounds	
Seepage	1	0.506	Product	Pounds				Product	Pounds				Product	Pounds	
Sewer Pond	2	9.085	Product	Pounds				Product	Pounds				Product	Pounds	
Watering Trough			Product	Pounds				Product	Pounds				Product	Pounds	
Totals	53	279.5883	Product	Pounds		10	33.407	Product	Pounds		2	26	Product	Pounds	

Table A35. Pesticide Product Key – SCCVCD

Product	AI	Vector
Agnique MMF	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito
Agnique MMF G	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito
Altosid Briquets 30	Methoprene	Mosquito
Altosid Liquid SR5	Methoprene	Mosquito
Altosid Pellets	Methoprene	Mosquito
Altosid XR Briquets	Methoprene	Mosquito
Altosid XR-G	Methoprene	Mosquito
BVA 2	Petroleum Distillate	Mosquito
Contrac 8 oz blk	Bromadiolone	Rat
Drione Insecticide	Pyrethrin	Yellow Jacket / Wasp
FirstStrike Soft Bait	Difethialone	Rat
FourStar 180 Bs	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
FourStar 45 Bti	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
FourStar 90 briq	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
Pyrenone 25-5	Pyrethrins and Piperonyl Butoxide	Mosquito
VectoBac 12AS	Bacillus Thuringiensis Israelensis	Mosquito
VectoBac G	Bacillus Thuringiensis Israelensis	Mosquito
VectoLex CG Biologic	Bacillus Sphaericus	Mosquito
VectoLex WSP	Bacillus Sphaericus	Mosquito
VectoMax CG	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
Diphacinone	Active Ingredient in Ditrac blox for rats	
EcoExempt IC2	Rosemary Oil	Mosquito
Golden Bear 1111	Aliphatic Petroleum Hydrocarbons	Mosquito

Table A36. **Pesticide Application Data for Summer 2011 – SCMAD**

Application Sites:	Altosid Liquid SR5 - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Altosid Liquid SR5 Comments	Altosid XR Extended Residual - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid XR Extended Residual Comments	Altosid SBG - # Treatments	Total Amount Used15	Total Amount Type16	Total Amount Unit16	Altosid SBG Comments	Scourge 18%+12% - # Treatments	Total Amount Used25	Total Amount Type26	Total Amount Unit26	Scourge 18%+54% Comments	FourStar 180 Bs/Bti - # Treatments	Total Amount Used35	Total Amount Type36	Total Amount Unit36	FourStar 180 Bs/Bti Comments	MGK Pyrocide Fogging Concentrate 7396 - # Treatments
1. Swimming pool **(00100)**						41	41.770	Product	Pounds												2	0.727	Product	Pounds		
2. Ponds **(00385)**						1	0.960	Product	Pounds																	
3. Water trough **(00390)**																										
4. Retention basin **(00400)**																										
5. Manmade pond **(00480)**																										
6. Fish pond **(01096)**																										
7. Dredge spoil pond **(01276)**																										
8. Permanent pond **(03240)**																										
9. Alfalfa **(00020)**																										3
10. Row crop **(00050)**																										
11. Contour pasture **(00435)**																										7
12. Pasture ditch **(00440)**																										
13. Flooded pasture **(00470)**																										55
14. Strip check pasture **(00495)**																										4
15. Sump (**00500)**																					1	0.132	Product	Pounds		
16. Tail water drain **(00505)**																										
17. Septic tank **(01038)**																										
18. Container **(01045)**																										
19. Tires **(01060)**																										
20. Waterline leak **(01288)**																										2
21. Electrical box **(01624)**																										
22. Catch basin **(01699)**																					1	0.132	Product	Pounds		
23. Valve box **(02460)**																										
24. Waste/sewer pond **(02480)**																										
25. Roadside ditch **(01705)**																										
26. Depression/swale **(03120)**																										2
27. Duck Club/seasonal waterfowl habitat **(00700)**	13	31.4375	Product	Gallons							2	840.000	Product	Pounds												65
28. Tidal marsh **(03130)**	1	5.9375	Product	Gallons																						
29. Reclaimed marsh **(03230)**																										
30A. Reclaimed marsh/other **(03231)**																										
31. Streams/creeks **(03440)**																										
32. Treehole **(03480)**																										3
33. Vernal pools																										
34A. Upland/other **(03330)**																										
35A. Residential/other **(00200)**																										
36A. Industrial/other **(02500)**																3	1.379	Product	Gallons							
Totals	14	37.375	Product	Gallons		42	42.73	Product	Pounds		2	840	Product	Pounds		3	1.379	Product	Gallons		4	0.991	Product	Pounds		141

Table A36.

Application Sites:	Total Amount Used1518	Total Amount Type1619	Total Amount Unit1620	MGK Pyrocide Fogging Concentrate 7396 Comments	VectoLex WSP # Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit	VectoLex WSP Comments	Altosid Pellets # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit2	Altosid Pellets Comments	Mosquito Larvicide GB1111 # Treatments	Total Amount Used3	Total Amount Type4	Total Amount Type Unit
1. Swimming pool **(00100)**										1	6.000	Product	Pounds		2	0.102	Product	Gallons
2. Ponds **(00385)**															1	0.030	Product	Gallons
3. Water trough **(00390)**																		
4. Retention basin **(00400)**																		
5. Manmade pond **(00480)**																		
6. Fish pond **(01096)**										1	15.000	Product	Pounds					
7. Dredge spoil pond **(01276)**																		
8. Permanent pond **(03240)**																		
9. Alfalfa **(00020)**	0.803	Product	Gallons															
10. Row crop **(00050)**																		
11. Contour pasture **(00435)**	3.859	Product	Pounds												4	35.000	Product	Gallons
12. Pasture ditch **(00440)**										1	0.150	Product	Pounds					
13. Flooded pasture **(00470)**	14.037	Product	Gallons							3	228.000	Product	Pounds					
14. Strip check pasture **(00495)**	1.99	Product	Gallons															
15. Sump (**00500)**																		
16. Tail water drain **(00505)**																		
17. Septic tank **(01038)**																		
18. Container **(01045)**																		
19. Tires **(01060)**																		
20. Waterline leak **(01288)**	0.003	Product	Gallons							1	0.003	Product	Pounds					
21. Electrical box **(01624)**																		
22. Catch basin **(01699)**					4	52	Product	Other	52 Pouches	2	0.330	Product	Pounds					
23. Valve box **(02460)**																		
24. Waste/sewer pond **(02480)**																		
25. Roadside ditch **(01705)**															1	5.000	Product	Gallons
26. Depression/swale **(03120)**	0.042	Product	Gallons		1	80	Product	Other	80 Pouches	2	2.400	Product	Pounds					
27. Duck Club/seasonal waterfowl habitat **(00700)**	46.559	Product	Gallons							2	99.000	Product	Pounds		2	15.000	Product	Gallons
28. Tidal marsh **(03130)**										7	179.500	Product	Pounds					
29. Reclaimed marsh **(03230)**																		
30A. Reclaimed marsh/other **(03231)**																		
31. Streams/creeks **(03440)**																		
32. Treehole **(03480)**	0.528	Product	Gallons															
33. Vernal pools																		
34A. Upland/other **(03330)**																		
35A. Residential/other **(00200)**																		
36A. Industrial/other **(02500)**																		
Totals	67.821	Product	Gallons		5	132	Product	Other	Pouches	20	530.383	Product	Pounds		10	55.132	Product	Gallons

Table A37. Pesticide Application Data for Fall 2011 – SCMAD

Application Sites:	Altosid Liquid SR5 - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Altosid Liquid SR5 Comments	Altosid XR Extended Residual - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid XR Extended Residual Comments	Altosid SBG - # Treatments	Total Amount Used15	Total Amount Type16	Total Amount Unit16	Altosid SBG Comments	Pyrenone 25-5 - # Treatments	Total Amount Used29	Total Amount Type30	Total Amount Unit30	Pyrenone 25-5 Comments	FourStar 180 Bs/Bti - # Treatments	Total Amount Used35	Total Amount Type36	Total Amount Unit36
1. Swimming pool **(00100)**						14	13.840	Product	Pounds															
2. Ponds **(00385)**																								
3. Water trough **(00390)**																								
4. Retention basin **(00400)**																								
5. Manmade pond **(00480)**																								
6. Fish pond **(01096)**																								
7. Dredge spoil pond **(01276)**																								
8. Permanent pond **(03240)**																								
9. Alfalfa **(00020)**																								
10. Row crop **(00050)**																								
11. Contour pasture **(00435)**																								
12. Pasture ditch **(00440)**																								
13. Flooded pasture **(00470)**																								
14. Strip check pasture **(00495)**																								
15. Sump (**00500)**																								
16. Tail water drain **(00505)**																								
17. Septic tank **(01038)**																								
18. Container **(01045)**																								
19. Tires **(01060)**																								
20. Waterline leak **(01288)**																								
21. Electrical box **(01624)**																								
22. Catch basin **(01699)**																					1	0.0661	Product	Pounds
23. Valve box **(02460)**																								
24. Waste/sewer pond **(02480)**																								
25. Roadside ditch **(01705)**																								
26. Depression/swale **(03120)**																								
27. Duck Club/seasonal waterfowl habitat **(00700)**	33	135.625	Product	Gallons							2	1,316.00	Product	Pounds		12	10.156	Product	Gallons					
28. Tidal marsh **(03130)**																								
29. Reclaimed marsh **(03230)**																								
30A. Reclaimed marsh/other **(03231)**																								
31. Streams/creeks **(03440)**																								
32. Treehole **(03480)**																								
33. Vernal pools																								
34A. Upland/other **(03330)**																								
35A. Residential/other **(00200)**																								
36A. Industrial/other **(02500)**																								
Totals	33	135.625	Product	Gallons		14	13.84	Product	Pounds		2	1316	Product	Pounds		12	10.156	Product	Gallons		1	0.0661	Product	Pounds

Table A37.

Application Sites:	FourStar 180 Bs/Bti Comments	MGK Pyrocide Fogging Concentrate 7396 - # Treatments	Total Amount Used1518	Total Amount Type1619	Total Amount Unit1620	MGK Pyrocide Fogging Concentrate 7396 Comments	Altosid Pellets # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit2	Altosid Pellets Comments	Mosquito Larvicide GB-1111 # Treatments	Total Amount Used3	Total Amount Type4	Total Amount Unit3	Mosquito Larvicide GB-1111 Comments
1. Swimming pool **(00100)**												1	0.119	Product	Gallons	
2. Ponds **(00385)**																
3. Water trough **(00390)**																
4. Retention basin **(00400)**																
5. Manmade pond **(00480)**																
6. Fish pond **(01096)**																
7. Dredge spoil pond **(01276)**																
8. Permanent pond **(03240)**																
9. Alfalfa **(00020)**																
10. Row crop **(00050)**																
11. Contour pasture **(00435)**																
12. Pasture ditch **(00440)**																
13. Flooded pasture **(00470)**		2	1.462	Product	Gallons											
14. Strip check pasture **(00495)**																
15. Sump **(00500)**							2	9.000	Product	Pounds						
16. Tail water drain **(00505)**																
17. Septic tank **(01038)**																
18. Container **(01045)**																
19. Tires **(01060)**																
20. Waterline leak **(01288)**																
21. Electrical box **(01624)**																
22. Catch basin **(01699)**																
23. Valve box **(02460)**																
24. Waste/sewer pond **(02480)**																
25. Roadside ditch **(01705)**												1	5.000	Product	Gallons	
26. Depression/swale **(03120)**		1	0.650	Product	Gallons											
27. Duck Club/seasonal waterfowl habitat **(00700)**		80	41.139	Product	Gallons											
28. Tidal marsh **(03130)**																
29. Reclaimed marsh **(03230)**																
30A. Reclaimed marsh/other **(03231)**																
31. Streams/creeks **(03440)**																
32. Treehole **(03480)**																
33. Vernal pools																
34A. Upland/other **(03330)**																
35A. Residential/other **(00200)**																
36A. Industrial/other **(02500)**																
Totals		83	43.251	Product	Gallons		2	9	Product	Pounds		2	5.119	Product	Gallons	

Table A38. **Pesticide Application Data for Winter 2012 – SCMAD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	Altosid Liquid SR5 - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Altosid Liquid SR5 Comments	Altosid XR Extended Residual - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid XR Extended Residual Comments	FourStar 180 Bs/Bti - # Treatments	Total Amount Used35	Total Amount Type36	Total Amount Unit36	FourStar 180 Bs/Bti Comments	VectoLex WSP # Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit
1. Swimming pool **(00100)**	3	0.170	Product	Gallons							49	45.490	Product	Pounds		1	1.322	Product	Pounds		1	5	Product	Other
2. Ponds **(00385)**											1	0.240	Product	Pounds										
3. Water trough **(00390)**																								
4. Retention basin **(00400)**																								
5. Manmade pond **(00480)**											3	1.440	Product	Pounds										
6. Fish pond **(01096)**																								
7. Dredge spoil pond **(01276)**																								
8. Permanent pond **(03240)**																								
9. Alfalfa **(00020)**																								
10. Row crop **(00050)**																								
11. Contour pasture **(00435)**																								
12. Pasture ditch **(00440)**																								
13. Flooded pasture **(00470)**																								
14. Strip check pasture **(00495)**																								
15. Sump (**00500)**																								
16. Tail water drain **(00505)**																								
17. Septic tank **(01038)**																								
18. Container **(01045)**																								
19. Tires **(01060)**																								
20. Waterline leak **(01288)**																								
21. Electrical box **(01624)**																								
22. Catch basin **(01699)**											22	30.960	Product	Pounds										
23. Valve box **(02460)**																								
24. Waste/sewer pond **(02480)**											1	1.760	Product	Pounds										
25. Roadside ditch **(01705)**																								
26. All Other Drains **(01702)**																								
26. Depression/swale **(03120)**																								
27. Duck Club/seasonal waterfowl habitat **(00700)**																								
28. Tidal marsh **(03130)**						5	23.125	Product	Gallons															
29. Reclaimed marsh **(03230)**																								
30A. Reclaimed marsh/other **(03231)**																								
31. Streams/creeks **(03440)**																								
32. Treehole **(03480)**																								
33. Vernal pools																								
34A. Upland/other **(03330)**																								
35A. Residential/other **(00200)**																								
36A. Industrial/other **(02500)**																								
Totals	3	0.17	Product	Gallons		5	23.125	Product	Gallons		76	79.89	Product	Pounds		1	1.322	Product	Pounds		1	5	Product	Other

Table A38.

Application Sites:	VectoLex WSP Comments	Altosid Pellets # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit2	Altosid Pellets Comments	Mosquito Larvicide GB-1111 # Treatments	Total Amount Used3	Total Amount Type4	Total Amount Unit3	Mosquito Larvicide GB-1111 Comments
1. Swimming pool **(00100)**	Pouches						1	0.090	Product	Gallons	
2. Ponds **(00385)**		3	9.810	Product	Pounds						
3. Water trough **(00390)**											
4. Retention basin **(00400)**											
5. Manmade pond **(00480)**											
6. Fish pond **(01096)**											
7. Dredge spoil pond **(01276)**											
8. Permanent pond **(03240)**											
9. Alfalfa **(00020)**											
10. Row crop **(00050)**											
11. Contour pasture **(00435)**											
12. Pasture ditch **(00440)**		1	6.000	Product	Pounds						
13. Flooded pasture **(00470)**											
14. Strip check pasture **(00495)**											
15. Sump **(00500)**											
16. Tail water drain **(00505)**											
17. Septic tank **(01038)**											
18. Container **(01045)**											
19. Tires **(01060)**											
20. Waterline leak **(01288)**											
21. Electrical box **(01624)**											
22. Catch basin **(01699)**											
23. Valve box **(02460)**											
24. Waste/sewer pond **(02480)**											
25. Roadside ditch **(01705)**											
26. All Other Drains **(01702)**		3	1.003	Product	Pounds						
26. Depression/swale **(03120)**		4	60.000	Product	Pounds						
27. Duck Club/seasonal waterfowl habitat **(00700)**											
28. Tidal marsh **(03130)**		8	199.000	Product	Pounds						
29. Reclaimed marsh **(03230)**		1	15.000	Product	Pounds						
30A. Reclaimed marsh/other **(03231)**											
31. Streams/creeks **(03440)**		1	0.041	Product	Pounds						
32. Treehole **(03480)**											
33. Vernal pools											
34A. Upland/other **(03330)**											
35A. Residential/other **(00200)**											
36A. Industrial/other **(02500)**											
Totals	Pouches	21	290.854	Product	Pounds		1	0.09	Product	Gallons	

Table A39. **Pesticide Application Data for Spring 2012 – SCMAD**

Application Sites:	Agnique MMF - # Treatments	Total Amount Used	Total Amount Type	Total Amount Unit	Agnique MMF Comments	Altosid Liquid SR5 - # Treatments	Total Amount Used4	Total Amount Type5	Total Amount Unit5	Altosid Liquid SR5 Comments	Altosid XR Extended Residual - # Treatments	Total Amount Used13	Total Amount Type14	Total Amount Unit14	Altosid XR Extended Residual Comments	Scourge 18%+12% - # Treatments	Total Amount Used25	Total Amount Type26	Total Amount Unit26	Scourge 18%+12% Comments	FourStar 180 Bs/Bti - # Treatments	Total Amount Used35	Total Amount Type36	Total Amount Unit36
1. Swimming pool **(00100)**	1	0.010	Product	Gallons							60	61.050	Product	Pounds							1	1.322	Product	Pounds
2. Ponds **(00385)**	2	0.001	Product	Gallons							4	0.480	Product	Pounds										
3. Water trough **(00390)**																								
4. Retention basin **(00400)**																								
5. Manmade pond **(00480)**																								
6. Fish pond **(01096)**																								
7. Dredge spoil pond **(01276)**						2																		
8. Permanent pond **(03240)**																								
9. Alfalfa **(00020)**																								
10. Row crop **(00050)**																								
11. Contour pasture **(00435)**																								
12. Pasture ditch **(00440)**																								
13. Flooded pasture **(00470)**																								
14. Strip check pasture **(00495)**																								
15. Sump (**00500)**																								
16. Tail water drain **(00505)**																								
17. Septic tank **(01038)**																								
18. Container **(01045)**																								
19. Tires **(01060)**																								
20. Waterline leak **(01288)**																								
21. Electrical box **(01624)**																								
22. Catch basin **(01699)**											3	1.280	Product	Pounds										
23. Valve box **(02460)**																								
24. Waste/sewer pond **(02480)**											1	2.400	Product	Pounds										
25. Roadside ditch **(01705)**	1	0.001	Product	Gallons																				
26. All Other Drains **(01702)**																								
26. Depression/swale **(03120)**						2	0.593	Product	Gallons		1	1.680	Product	Pounds										
27. Duck Club/seasonal waterfowl habitat **(00700)**						1	4.687	Product	Gallons		1	3.200	Product	Pounds										
28. Tidal marsh **(03130)**						5	35.468	Product	Gallons															
29 A. Upland within vicinity of Tidal Marsh **(03131)**																								
30.A Residential within vicinity of Tidal Marsh **(03132)**																								
31 A. Industrial within vicinity of Tidal Marsh **(02500)**																								
32. Reclaimed marsh **(03230)**						10	3.062	Product	Gallons															
33A. Residential within vicinity of Reclaimed marsh **(03231)**																2	0.976	Product	Gallons					
34 A.Upland within vicinity of Reclaimed marsh **(03232)**																								
35.A. Residential/other **(02200)**																								
35. Streams/creeks **(03440)**																								
36. Treehole **(03480)**																2	0.585	Product	Gallons					
Totals	4	0.012	Product	Gallons		20	43.81	Product	Gallons		70	70.09	Product	Pounds		4	1.561	Product	Gallons		1	1.322	Product	Pounds

Table A39.

Application Sites:	FourStar 180 Bs/Bti Comments	Biomist 4+12 ULV - # Treatments	Total Amount Used22	Total Amount Type33	Total Amount Unit35	Biomist 4+12 ULV Comments	MGK Pyrocide Fogging Concentrate 7396 - # Treatments	Total Amount Used1518	Total Amount Type1619	Total Amount Unit1620	MGK Pyrocide Fogging Concentrate 7396 Comments	VectoLex WSP # Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit	VectoLex WSP Comments	Altosid Pellets # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit2	Altosid Pellets Comments	Mosquito Larvicide GB-1111 # Treatments	Total Amount Used3	Total Amount Type4	Total Amount Unit3
1. Swimming pool **(00100)**												1	5	Product	Other	Pouches						2	0.001	Product	Gallons
2. Ponds **(00385)**																	3	9.810	Product	Pounds					
3. Water trough **(00390)**																									
4. Retention basin **(00400)**																									
5. Manmade pond **(00480)**																									
6. Fish pond **(01096)**																									
7. Dredge spoil pond **(01276)**																									
8. Permanent pond **(03240)**																									
9. Alfalfa **(00020)**																									
10. Row crop **(00050)**																									
11. Contour pasture **(00435)**							5	2.559	Product	Gallons												1	10.000	Product	Gallons
12. Pasture ditch **(00440)**																	1	6.000	Product	Pounds					
13. Flooded pasture **(00470)**							9	1.669	Product	Gallons															
14. Strip check pasture **(00495)**							11	5.118	Product	Gallons															
15. Sump **(00500)**							2	0.771	Product	Gallons															
16. Tail water drain **(00505)**																									
17. Septic tank **(01038)**																									
18. Container **(01045)**																									
19. Tires **(01060)**																									
20. Waterline leak **(01288)**																									
21. Electrical box **(01624)**																									
22. Catch basin **(01699)**							1	0.126	Product	Gallons															
23. Valve box **(02460)**																									
24. Waste/sewer pond **(02480)**																						5	4.750	Product	Gallons
25. Roadside ditch **(01705)**																						1	0.500	Product	Gallons
26. All Other Drains **(01702)**																	3	1.003	Product	Pounds					
26. Depression/swale **(03120)**							5	0.694	Product	Gallons							4	60.000	Product	Pounds					
27. Duck Club/seasonal waterfowl habitat **(00700)**																									
28. Tidal marsh **(03130)**																	8	199.000	Product	Pounds					
29 A. Upland within vicinity of Tidal Marsh **(03131)**																									
30.A Residential within vicinity of Tidal Marsh **(03132)**		1	0.004	Product	Gallons		3	0.880	Product	Gallons															
31 A. Industrial within vicinity of Tidal Marsh **(02500)**							1	0.334	Product	Gallons															
32. Reclaimed marsh **(03230)**																	1	15.000	Product	Pounds					
33A. Residential within vicinity of Reclaimed marsh **(03231)**																									
34 A.Upland within vicinity of Reclaimed marsh **(03232)**							13	7.518	Product	Gallons															
35.A. Residential/other **(02200)**							2	0.023	Product	Gallons															
35. Streams/creeks **(03440)**																	1	0.041	Product	Pounds					
36. Treehole **(03480)**																									
Totals		1	0.004	Product	Gallons		52	19.692	Product	Gallons		1	5	Product	Other	Pouches	21	290.854	Product	Pounds		9	15.251	Product	Gallons

Table A40. Pesticide Product Key – SCMAD

Product	AI	Vector
Agnique MMF	Biodegradable Alcohol Ethoxylated Surfactant	Mosquito
Altosid Liquid SR5	Methoprene	Mosquito
Altosid Pellets	Methoprene	Mosquito
Altosid SBG Single Brood Granule	Methoprene	Mosquito
Altosid XR Extended Residual	Methoprene	Mosquito
Bayer Pyrenone 25-5 Public Health Insecticide	Pyrethrins and Piperonyl Butoxide	Mosquito
Clarke Biomist 4 + 12 ULV	Permethrin and Piperonyl Butoxide	Mosquito
FourStar 180 Bs/Bti	Bacillus Sphaericus and Bacillus Thuringiensis Israelensis	Mosquito
MGK Pyrocide Mosquito Adulticiding Concentrate for ULV Fogging 7396	Pyrethrins and Piperonyl Butoxide	Mosquito
Scourge 18% + 12%*	Resmethrin and Piperonyl Butoxide	Mosquito
VectoLex WSP Bs	Bacillus Sphaericus	Mosquito
GB-1111	Aliphatic Petroleum Hydrocarbons	Mosquito

Table A41. Pesticide Application Data for Summer 2011 – SMCMVCD

Application Sites:	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	Astro, Ortho, Bonide, Tengard, etc. Products - # Treatments	Total Amount Used23	Total Amount Type24	Total Amount Unit24	Astro, Ortho, Bonide, Tengard, etc. Products Commnets	Delta Dust - # Treatments	Total Amount Used31	Total Amount Type32	Total Amount Unit32
Aerial yellowjacket nest																			
Bird Bath	7	1.75	Product			2	0.5	Product	Ounces (weight)										
Catch Basin	675	214012	Product	Ounces (volume)		5	1.25	Product	Ounces (weight)										
Creek	9	159.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Culvert	5	3.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Ditch	36	3318.5	Product	Ounces (volume)		5	5.25	Product	Ounces (weight)										
Drain Line	12	37	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Drain Pipes	4	500.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Fish Pond	325	154	Product	Ounces (volume)		42	15	Product	Ounces (weight)										
Fountain	142	50.75	Product	Ounces (volume)		23	5.75	Product	Ounces (weight)										
Fresh H2O Marsh	0	0	Product	Ounces (volume)		4	47680	Product	Ounces (weight)										
Ground yellowjacket nest			Product	Ounces (volume)		0	0	Product	Ounces (weight)		4	67.5	Product	Ounces (volume)		263	224.75	Product	Ounces (weight)
H20 under Bldg	22	1401.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Horse Trough	1	0.25	Product	Ounces (volume)		3	0.75	Product	Ounces (weight)										
Hot tub	20	7.25	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)										
Imp H2O	44	133.5	Product	Ounces (volume)		2	5.25	Product	Ounces (weight)										
Misc container	43	13.75	Product	Ounces (volume)		6	1.5	Product	Ounces (weight)										
Multiple			Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Pond (natural)	5	2.25	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)										
Pothole	2	10.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Reservoir	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Salt Marsh	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Seepage	4	2.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Septic Seepage	1	10	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Septic Tank	4	2.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Sewage Treatment Plant	35	17572	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Slough	2	1600	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Spring	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Storm Drain	1	0.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Street Gutter	22	238.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Sump	39	13.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Swim Pool	32	115.5	Product	Ounces (volume)		3	8	Product	Ounces (weight)										
Swim pool cover	2	1.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Swim Pool Drain	1	0.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Tank	3	20.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Tire	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Treehole	1	0.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Vault	16	163	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Water meter box	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)										
Waterfall	22	9.25	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)										
Well	2	0.5	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)										
Total	1539	239557	Product	Ounces (volume)		102	47725	Product	Ounces (weight)		4	67.5	Product	Ounces (volume)		263	224.75	Product	Ounces (weight)

Table A41.

Application Sites:	Delta Dust Comments	Wasp Freeze - # Treatments	Total Amount Used33	Total Amount Type34	Total Amount Unit34	Wasp Freeze Comments	Drione - # Treatments	Total Amount Used1112	Total Amount Type1213	Total Amount Unit1214	Drione Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Spectracide - # Treatments	Total Amount Used33452
Aerial yellowjacket nest		1	0.5	Product	Other (specify in comments section)	per can											2	7.5
Bird Bath												0	0					
Catch Basin												0	0					
Creek												0	0					
Culvert												0	0					
Ditch												0	0					
Drain Line												4	368	Product	Ounces (weight)			
Drain Pipes												0	0					
Fish Pond												0	0					
Fountain												0	0					
Fresh H2O Marsh												0	0					
Ground yellowjacket nest		4	3	Product	Other (specify in comments section)	per can	4	1.75	Product	Ounces (weight)		0	0				93	1545
H20 under Bldg												0	0					
Horse Trough												0	0					
Hot tub												0	0					
Imp H2O												0	0					
Misc container												0	0					
Multiple												0	0					
Pond (natural)												0	0					
Pothole												0	0					
Reservoir												0	0					
Salt Marsh												0	0					
Seepage												0	0					
Septic Seepage												0	0					
Septic Tank												0	0					
Sewage Treatment Plant												0	0					
Slough												0	0					
Spring												0	0					
Storm Drain												0	0					
Street Gutter												0	0					
Sump												0	0					
Swim Pool												0	0					
Swim pool cover												0	0					
Swim Pool Drain												0	0					
Tank												0	0					
Tire												0	0					
Treehole												0	0					
Vault												0	0					
Water meter box												0	0					
Waterfall												0	0					
Well												0	0					
Total		5	3.5	Product	Other (specify in comments section)	per can	4	1.75	Product	Ounces (weight)		4	368	Product	Ounces (weight)		95	1552.5

Table A41.

Application Sites:	Total Amount Type34463	Total Amount Unit34474	Spectracide Comments	Larvicide GB-1111 - # Treatments	Total Amount Used611	Total Amount Type712	Total Amount Unit713	Larvicide GB-1111 Comments	Natular G30 - # Treatments	Total Amount Used1317	Total Amount Type1418	Total Amount Unit1419	Natular G30 Comments	Spectracide Pro # Treatments	Total Amount Used1723	Total Amount Type1824	Total Amount Unit1825	Spectracide Pro Comments	Teknar SC - # Treatments
Aerial yellowjacket nest	Product	Ounces (volume)																	
Bird Bath				0	0	Product	Ounces (volume)		3	0.75	Product	Ounces (weight)							
Catch Basin				4	1	Product	Ounces (volume)		96	80.5	Product	Ounces (weight)							
Creek				1	1.5	Product	Ounces (volume)		47	2439.75	Product	Ounces (weight)							
Culvert				0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)							
Ditch				3	6.5	Product	Ounces (volume)		27	27.75	Product	Ounces (weight)							
Drain Line				1	0.25	Product	Ounces (volume)		3	1	Product	Ounces (weight)							
Drain Pipes				0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)							
Fish Pond				4	1	Product	Ounces (volume)		40	10	Product	Ounces (weight)							
Fountain				2	0.5	Product	Ounces (volume)		32	11.75	Product	Ounces (weight)							
Fresh H2O Marsh				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Ground yellowjacket nest	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)		63	1436.25	Product	Ounces (volume)		
H20 under Bldg				0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)							
Horse Trough				1	0.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Hot tub				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Imp H2O				2	50.25	Product	Ounces (volume)		26	369.5	Product	Ounces (weight)							1
Misc container				0	0	Product	Ounces (volume)		23	6	Product	Ounces (weight)							
Multiple				0	0	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)							
Pond (natural)				0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)							
Pothole				0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)							
Reservoir				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Salt Marsh				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Seepage				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Septic Seepage				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Septic Tank				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Sewage Treatment Plant				0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)							
Slough				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Spring				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Storm Drain				0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)							
Street Gutter				0	0	Product	Ounces (volume)		39	10.25	Product	Ounces (weight)							
Sump				0	0	Product	Ounces (volume)		34	8.5	Product	Ounces (weight)							
Swim Pool				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Swim pool cover				0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)							
Swim Pool Drain				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Tank				0	0	Product	Ounces (volume)		1	4	Product	Ounces (weight)							
Tire				1	0.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Treehole				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Vault				0	0	Product	Ounces (volume)		42	12	Product	Ounces (weight)							
Water meter box				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Waterfall				0	0	Product	Ounces (volume)		12	3	Product	Ounces (weight)							
Well				0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)							
Total	Product	Ounces (volume)		19	61.5	Product	Ounces (volume)		435	2987.25	Product	Ounces (weight)		63	1436.25	Product	Ounces (volume)		1

Table A41.

Application Sites:	Total Amount Used3144	Total Amount Type3245	Total Amount Unit3246	Teknar SC Comments	Altosid Briquets - # Treatments	Total Amount Used4663	Total Amount Type5764	Total Amount Unit5865	Atlosid Briquets Comments	Altosid Liquid Concentrate - # Treatments	Total Amount Used6966	Total Amount Type71067	Total Amount Unit71168	Altosid Liquid Concentrate Comments	Altosid Pellets - # Treatments	Total Amount Used111269
Aerial yellowjacket nest																
Bird Bath					16	16	Product	her (specify in comments secti	per briq						2	0.5
Catch Basin					381	880	Product	her (specify in comments section)							42	584.75
Creek					5	127	Product	her (specify in comments section)							11	44.25
Culvert					4	7	Product	her (specify in comments section)							0	0
Ditch					14	31	Product	her (specify in comments section)							27	12
Drain Line					8	18	Product	her (specify in comments section)							3	0.75
Drain Pipes					0	0	Product	her (specify in comments section)							0	0
Fish Pond					624	942	Product	her (specify in comments section)							7	2
Fountain					375	598	Product	her (specify in comments section)							7	4.25
Fresh H2O Marsh					0	0	Product	her (specify in comments section)							0	0
Ground yellowjacket nest					0	0	Product	her (specify in comments section)								
H20 under Bldg					5	22	Product	her (specify in comments section)							1	2
Horse Trough					6	30	Product	her (specify in comments section)							0	0
Hot tub					26	27	Product	her (specify in comments section)							0	0
Imp H2O	8	Product	Ounces (volume)	Our product was Teknar HPD	34	57	Product	her (specify in comments section)		1	1	Product	Ounces (volume)	5%	20	5.25
Misc container					93	147	Product	her (specify in comments section)							8	6.75
Multiple							Product	her (specify in comments section)							0	0
Pond (natural)					10	24	Product	her (specify in comments section)							0	0
Pothole					0	0	Product	her (specify in comments section)							0	0
Reservoir					0	0	Product	her (specify in comments section)							0	0
Salt Marsh					0	0	Product	her (specify in comments section)							2	200
Seepage					0	0	Product	her (specify in comments section)							1	0.25
Septic Seepage					0	0	Product	her (specify in comments section)							0	0
Septic Tank					2	8	Product	her (specify in comments section)							0	0
Sewage Treatment Plant					1	1	Product	her (specify in comments section)							0	0
Slough					0	0	Product	her (specify in comments section)							0	0
Spring					0	0	Product	her (specify in comments section)							0	0
Storm Drain					1	1	Product	her (specify in comments section)							0	0
Street Gutter					1	1	Product	her (specify in comments section)							15	3.75
Sump					94	128	Product	her (specify in comments section)							5	1.25
Swim Pool					34	130	Product	her (specify in comments section)							2	0.5
Swim pool cover					0	0	Product	her (specify in comments section)							0	0
Swim Pool Drain					2	3	Product	her (specify in comments section)							0	0
Tank					10	31	Product	her (specify in comments section)							1	10
Tire					0	0	Product	her (specify in comments section)							1	0.25
Treehole					0	0	Product	her (specify in comments section)							7	1.75
Vault					66	161	Product	her (specify in comments section)							0	0
Water meter box					1	1	Product	her (specify in comments section)							0	0
Waterfall					40	89	Product	her (specify in comments section)							0	0
Well					12	16	Product	her (specify in comments section)							0	0
Total	8	Product	Ounces (volume)		1865	3496	Product	her (specify in comments secti	per briq	1	1	Product	Ounces (volume)		162	880.25

Table A41.

Application Sites:	Total Amount Type121370	Total Amount Unit121471	Altosid Pellets Comments	Altosid XR Briquets - # Treatments	Total Amount Used151875	Total Amount Type161976	Total Amount Unit162077	Altosid XR Briquets Comments	Altosid XR-G - # Treatments	Total Amount Used172178	Total Amount Type182279	Total Amount Unit182380	Altosid XR-G Comments	Pyrenone 25-5 # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit8
Aerial yellowjacket nest																	
Bird Bath				3	1.5	Product	Other (specify in comments section)		1	0.25	Product	Other (specify in comments section)		0	0		
Catch Basin				67	99	Product	Other (specify in comments section)		70	25.5	Product	Other (specify in comments section)		0	0		
Creek				0	0	Product	Other (specify in comments section)		39	927.25	Product	Other (specify in comments section)		0	0		
Culvert				1	1	Product	Other (specify in comments section)		6	1.75	Product	Other (specify in comments section)		0	0		
Ditch				16	17	Product	Other (specify in comments section)		171	1786.75	Product	Other (specify in comments section)		0	0		
Drain Line				4	9.5	Product	Other (specify in comments section)		8	2.25	Product	Other (specify in comments section)		0	0		
Drain Pipes				1	1	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Fish Pond				126	139	Product	Other (specify in comments section)		37	10.75	Product	Other (specify in comments section)		0	0		
Fountain				49	48	Product	Other (specify in comments section)		30	7.5	Product	Other (specify in comments section)		0	0		
Fresh H2O Marsh				0	0	Product	Other (specify in comments section)		9	70883	Product	Other (specify in comments section)		0	0		
Ground yellowjacket nest						Product	Other (specify in comments section)				Product	Other (specify in comments section)		0	0		
H20 under Bldg				6	17	Product	Other (specify in comments section)		1	20	Product	Other (specify in comments section)		6	12.5	Product	Ounces (volume)
Horse Trough				10	15.5	Product	Other (specify in comments section)		13	3.25	Product	Other (specify in comments section)		0	0		
Hot tub				7	5.5	Product	Other (specify in comments section)		5	1.25	Product	Other (specify in comments section)		0	0		
Imp H2O				5	6.5	Product	Other (specify in comments section)		61	350.75	Product	Other (specify in comments section)		0	0		
Misc container				15	12	Product	Other (specify in comments section)		40	11	Product	Other (specify in comments section)		0	0		
Multiple				0		Product	Other (specify in comments section)				Product	Other (specify in comments section)		0	0		
Pond (natural)				1	1	Product	Other (specify in comments section)		2	4	Product	Other (specify in comments section)		0	0		
Pothole				2	8	Product	Other (specify in comments section)		3	0.75	Product	Other (specify in comments section)		0	0		
Reservoir				0	0	Product	Other (specify in comments section)		2	20	Product	Other (specify in comments section)		0	0		
Salt Marsh				0	0	Product	Other (specify in comments section)		3	220	Product	Other (specify in comments section)		0	0		
Seepage				0	0	Product	Other (specify in comments section)		7	1.75	Product	Other (specify in comments section)		0	0		
Septic Seepage				1	4	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Septic Tank				2	4.5	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Sewage Treatment Plant				0	0	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Slough				0	0	Product	Other (specify in comments section)		1	40	Product	Other (specify in comments section)		0	0		
Spring				2	2.5	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Storm Drain				0	0	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Street Gutter				2	2	Product	Other (specify in comments section)		27	8	Product	Other (specify in comments section)		0	0		
Sump				20	20	Product	Other (specify in comments section)		15	3.75	Product	Other (specify in comments section)		0	0		
Swim Pool				14	42	Product	Other (specify in comments section)		2	1.25	Product	Other (specify in comments section)		0	0		
Swim pool cover				1	2	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Swim Pool Drain				0	0	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Tank				5	11	Product	Other (specify in comments section)		1	4	Product	Other (specify in comments section)		0	0		
Tire				0	0	Product	Other (specify in comments section)		1	0.25	Product	Other (specify in comments section)		0	0		
Treehole				1	0.5	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Vault				16	2505.5	Product	Other (specify in comments section)		31	9	Product	Other (specify in comments section)		0	0		
Water meter box				0	0	Product	Other (specify in comments section)		0	0	Product	Other (specify in comments section)		0	0		
Waterfall				7	15.5	Product	Other (specify in comments section)		7	1.75	Product	Other (specify in comments section)		0	0		
Well				3	3	Product	Other (specify in comments section)		1	0.25	Product	Other (specify in comments section)		0	0		
Total		0		387	2994	Product	Other (specify in comments section)		594	74346	Product	Other (specify in comments section)		6	12.5	Product	Ounces (volume)

Table A41.

Application Sites:	Pyrenone 25-5 Comments	VectoLex WSP - # Treatments	Total Amount Used16	Total Amount Type17	Total Amount Unit18	VectoLex WSP Comments
Aerial yellowjacket nest						
Bird Bath		0	0	Product	Other (specify in comments section)	per packet
Catch Basin		0	0	Product	Other (specify in comments section)	
Creek		0	0	Product	Other (specify in comments section)	
Culvert		0	0	Product	Other (specify in comments section)	
Ditch		1	1	Product	Other (specify in comments section)	
Drain Line		0	0	Product	Other (specify in comments section)	
Drain Pipes		0	0	Product	Other (specify in comments section)	
Fish Pond		6	8.25	Product	Other (specify in comments section)	
Fountain		1	1	Product	Other (specify in comments section)	
Fresh H2O Marsh		0	0	Product	Other (specify in comments section)	
Ground yellowjacket nest		0	0	Product	Other (specify in comments section)	
H20 under Bldg		0	0	Product	Other (specify in comments section)	
Horse Trough		1	1	Product	Other (specify in comments section)	
Hot tub		0	0	Product	Other (specify in comments section)	
Imp H2O		0	0	Product	Other (specify in comments section)	
Misc container		0	0	Product	Other (specify in comments section)	
Multiple		0	0	Product	Other (specify in comments section)	
Pond (natural)		0	0	Product	Other (specify in comments section)	
Pothole		0	0	Product	Other (specify in comments section)	
Reservoir		0	0	Product	Other (specify in comments section)	
Salt Marsh		0	0	Product	Other (specify in comments section)	
Seepage		0	0	Product	Other (specify in comments section)	
Septic Seepage		0	0	Product	Other (specify in comments section)	
Septic Tank		0	0	Product	Other (specify in comments section)	
Sewage Treatment Plant		0	0	Product	Other (specify in comments section)	
Slough		0	0	Product	Other (specify in comments section)	
Spring		1	1	Product	Other (specify in comments section)	
Storm Drain		0	0	Product	Other (specify in comments section)	
Street Gutter		0	0	Product	Other (specify in comments section)	
Sump		1	1	Product	Other (specify in comments section)	
Swim Pool		0	0	Product	Other (specify in comments section)	
Swim pool cover		0	0	Product	Other (specify in comments section)	
Swim Pool Drain		0	0	Product	Other (specify in comments section)	
Tank		1	1	Product	Other (specify in comments section)	
Tire		0	0	Product	Other (specify in comments section)	
Treehole		0	0	Product	Other (specify in comments section)	
Vault		1	5	Product	Other (specify in comments section)	
Water meter box		0	0	Product	Other (specify in comments section)	
Waterfall		0	0	Product	Other (specify in comments section)	
Well		0	0	Product	Other (specify in comments section)	
Total		13	19.25	Product	Other (specify in comments section)	per packet

Table A42. **Pesticide Application Data for Fall 2011 – SMCMVCD**

Application Sites:	Altosid Pellets WSP - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit12	Altosid Pellets WSP Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	Delta Dust - # Treatments	Total Amount Used31	Total Amount Type32
Aerial yellowjacket nest						0												
Bird Bath	0	0	Product	Other (specify in comments section)	packet	4	1	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Catch Basin	2	2		Other (specify in comments section)	packet	215	47661	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)				
Creek	0	0		Other (specify in comments section)	packet	3	9.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Culvert	0	0		Other (specify in comments section)	packet	3	1.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Ditch	6	6		Other (specify in comments section)	packet	12	60	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Drain Line	0	0		Other (specify in comments section)	packet	5	20.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Drain Pipes	0	0		Other (specify in comments section)	packet	2	0.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Fish Pond	0	0		Other (specify in comments section)	packet	360	170.5	Product	Ounces (volume)		45	14.25	Product	Ounces (weight)				
Fountain	5	5		Other (specify in comments section)	packet	157	43.5	Product	Ounces (volume)		33	8.25	Product	Ounces (weight)				
Fresh H2O Marsh	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Ground yellowjacket nest	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)		26	18.25	Product
H20 under Bldg	0	0		Other (specify in comments section)	packet	31	905	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Horse Trough	1	6		Other (specify in comments section)	packet	2	0.5	Product	Ounces (volume)		6	1.5	Product	Ounces (weight)				
Hot tub	1	1		Other (specify in comments section)	packet	19	6.5	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)				
Imp H2O	2	2		Other (specify in comments section)	packet	22	18.5	Product	Ounces (volume)		3	15.25	Product	Ounces (weight)				
Misc container	1	1		Other (specify in comments section)	packet	53	14.25	Product	Ounces (volume)		12	3	Product	Ounces (weight)				
Multiple	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Pond (natural)	0	0		Other (specify in comments section)	packet	5	2	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Pothole	0	0		Other (specify in comments section)	packet	1	10	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Reservoir	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Salt Marsh	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Seepage	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Septic Seepage	0	0		Other (specify in comments section)	packet	2	20	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Septic Tank	0	0		Other (specify in comments section)	packet	3	2	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Sewage Treatment Plant	0	0		Other (specify in comments section)	packet	13	7552	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Slough	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Spring	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Storm Drain	0	0		Other (specify in comments section)	packet	1	0.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Street Gutter	0	0		Other (specify in comments section)	packet	3	1.75	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)				
Sump	0	0		Other (specify in comments section)	packet	27	9	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)				
Swim Pool	1	1		Other (specify in comments section)	packet	33	103.25	Product	Ounces (volume)		2	2	Product	Ounces (weight)				
Swim pool cover	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Swim Pool Drain	0	0		Other (specify in comments section)	packet	3	0.75	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)				
Tank	0	0		Other (specify in comments section)	packet	2	2.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Tire	0	0		Other (specify in comments section)	packet	2	0.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Treehole	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)				
Vault	2	7		Other (specify in comments section)	packet	10	34.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Water meter box	0	0		Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Waterfall	0	0		Other (specify in comments section)	packet	22	7.75	Product	Ounces (volume)		4	1.5	Product	Ounces (weight)				
Well	0	0		Other (specify in comments section)	packet	4	1.25	Product	Ounces (volume)									
Paper Wasp Nest																		
Total	21	31	Product	Other (specify in comments section)	packet	1019	56660	Product	Ounces (volume)		111	47.25	Product	Ounces (weight)		26	18.25	Product

Table A42.

Application Sites:	Total Amount Unit32	Delta Dust Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Spectracide - # Treatments	Total Amount Used33452	Total Amount Type34463	Total Amount Unit34474	Spectracide Comments	Larvicide GB-1111 - # Treatments	Total Amount Used611	Total Amount Type712	Total Amount Unit713	Larvicide GB-1111 Comments	Natular G30 - # Treatments
Aerial yellowjacket nest																		
Bird Bath																		2
Catch Basin																		35
Creek																		2
Culvert																		4
Ditch																		12
Drain Line			3	160	Product	Ounces (weight)												6
Drain Pipes																		1
Fish Pond																		21
Fountain																		14
Fresh H2O Marsh																		0
Ground yellowjacket nest	Ounces (weight)							36	420	Product	Ounces (volume)							0
H20 under Bldg																		1
Horse Trough																		0
Hot tub																		0
Imp H2O																		25
Misc container																		25
Multiple																		0
Pond (natural)																		2
Pothole																		0
Reservoir																		0
Salt Marsh																		0
Seepage																		0
Septic Seepage																		0
Septic Tank																		0
Sewage Treatment Plant													2	178	Product	Ounces (volume)		0
Slough																		0
Spring																		0
Storm Drain																		0
Street Gutter																		16
Sump																		19
Swim Pool																		0
Swim pool cover																		0
Swim Pool Drain																		0
Tank																		1
Tire																		3
Treehole																		0
Vault																		24
Water meter box																		0
Waterfall																		5
Well																		0
Paper Wasp Nest								2	18.75	Product	Ounces (volume)							0
Total	Ounces (weight)		3	160	Product	Ounces (weight)		38	438.75	Product	Ounces (volume)		2	178	Product	Ounces (volume)		218

Table A42.

Application Sites:	Total Amount Used1317	Total Amount Type1418	Total Amount Unit1419	Natular G30 Comments	Spectracide Pro # Treatments	Total Amount Used1723	Total Amount Type1824	Total Amount Unit1825	Spectracide Pro Comments	Teknar SC - # Treatments	Total Amount Used3144	Total Amount Type3245	Total Amount Unit3246	Teknar SC Comments	Altosid Briquets - # Treatments	Total Amount Used4663	Total Amount Type5764
Aerial yellowjacket nest															0	0	Product
Bird Bath	0.5	Product	Ounces (weight)							0	0	Product	Ounces (volume)		22	22	Product
Catch Basin	12.5	Product	Ounces (weight)							0	0	Product	Ounces (volume)		321	722	Product
Creek	4.5	Product	Ounces (weight)							0	0	Product	Ounces (volume)		5	11	Product
Culvert	1	Product	Ounces (weight)							0	0	Product	Ounces (volume)		3	3	Product
Ditch	17.25	Product	Ounces (weight)							2	392	Product	Ounces (volume)		12	18	Product
Drain Line	1.75	Product	Ounces (weight)							0	0	Product	Ounces (volume)		11	20	Product
Drain Pipes	0.25	Product	Ounces (weight)							0	0	Product	Ounces (volume)		4	6	Product
Fish Pond	10.5	Product	Ounces (weight)							0	0	Product	Ounces (volume)		929	1335	Product
Fountain	3.5	Product	Ounces (weight)							0	0	Product	Ounces (volume)		529	828	Product
Fresh H2O Marsh	0	Product	Ounces (weight)							1	12	Product	Ounces (volume)		0	0	Product
Ground yellowjacket nest	0	Product	Ounces (weight)		11	277.5	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0	Product
H20 under Bldg	2	Product	Ounces (weight)							0	0	Product	Ounces (volume)		3	11	Product
Horse Trough	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		9	61	Product
Hot tub	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		46	47	Product
Imp H2O	10.75	Product	Ounces (weight)							2	33	Product	Ounces (volume)		32	37	Product
Misc container	6.25	Product	Ounces (weight)							0	0	Product	Ounces (volume)		146	246	Product
Multiple	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Pond (natural)	0.5	Product	Ounces (weight)							0	0	Product	Ounces (volume)		12	32	Product
Pothole	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		3	8	Product
Reservoir	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		1	1	Product
Salt Marsh	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Seepage	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Septic Seepage	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Septic Tank	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		1	4	Product
Sewage Treatment Plant	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Slough	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Spring	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Storm Drain	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		2	2	Product
Street Gutter	4.25	Product	Ounces (weight)							0	0	Product	Ounces (volume)		3	3	Product
Sump	4.75	Product	Ounces (weight)							0	0	Product	Ounces (volume)		114	145	Product
Swim Pool	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		63	232	Product
Swim pool cover	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Swim Pool Drain	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		6	7	Product
Tank	4	Product	Ounces (weight)							0	0	Product	Ounces (volume)		12	27	Product
Tire	0.75	Product	Ounces (weight)							0	0	Product	Ounces (volume)		2	2	Product
Treehole	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		4	4	Product
Vault	6.25	Product	Ounces (weight)							0	0	Product	Ounces (volume)		71	126	Product
Water meter box	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		1	1	Product
Waterfall	1.25	Product	Ounces (weight)							0	0	Product	Ounces (volume)		60	150	Product
Well	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		14	16	Product
Paper Wasp Nest	0	Product	Ounces (weight)							0	0	Product	Ounces (volume)		0	0	Product
Total	92.5	Product	Ounces (weight)		11	277.5	Product	Ounces (volume)		5	437	Product	Ounces (volume)		2441	4127	Product

Table A42.

Application Sites:	Total Amount Unit5865	Atlosid Briquets Comments	Altosid Pellets - # Treatments	Total Amount Used111269	Total Amount Type121370	Total Amount Unit121471	Altosid Pellets Comments	Altosid XR Briquets - # Treatments	Total Amount Used151875	Total Amount Type161976	Total Amount Unit162077	Altosid XR Briquets Comments	Altosid XR-G - # Treatments	Total Amount Used172178	Total Amount Type182279	Total Amount Unit182380
Aerial yellowjacket nest	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Bird Bath	Other (specify in comments section)	briquet	3	0.75	Product	Ounces (weight)		2	2.5	Product	Other (specify in comments section)	briquet	5	1.25	Product	Ounces (weight)
Catch Basin	Other (specify in comments section)	briquet	34	489.25	Product	Ounces (weight)		16	29	Product	Other (specify in comments section)	briquet	24	6	Product	Ounces (weight)
Creek	Other (specify in comments section)	briquet	4	1.5	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	4	22.75	Product	Ounces (weight)
Culvert	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)		1	1	Product	Other (specify in comments section)	briquet	5	1.25	Product	Ounces (weight)
Ditch	Other (specify in comments section)	briquet	24	80	Product	Ounces (weight)		1	7	Product	Other (specify in comments section)	briquet	59	668.25	Product	Ounces (weight)
Drain Line	Other (specify in comments section)	briquet	4	1	Product	Ounces (weight)		1	5	Product	Other (specify in comments section)	briquet	8	2.25	Product	Ounces (weight)
Drain Pipes	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Fish Pond	Other (specify in comments section)	briquet	22	5.5	Product	Ounces (weight)		81	111	Product	Other (specify in comments section)	briquet	70	19.25	Product	Ounces (weight)
Fountain	Other (specify in comments section)	briquet	13	3.25	Product	Ounces (weight)		31	54.5	Product	Other (specify in comments section)	briquet	71	17.75	Product	Ounces (weight)
Fresh H2O Marsh	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	5	35208	Product	Ounces (weight)
Ground yellowjacket nest	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
H20 under Bldg	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		5	13	Product	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)
Horse Trough	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)		9	20	Product	Other (specify in comments section)	briquet	7	1.75	Product	Ounces (weight)
Hot tub	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		9	9	Product	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)
Imp H2O	Other (specify in comments section)	briquet	44	27	Product	Ounces (weight)		3	16	Product	Other (specify in comments section)	briquet	65	164.25	Product	Ounces (weight)
Misc container	Other (specify in comments section)	briquet	27	7.75	Product	Ounces (weight)		11	15	Product	Other (specify in comments section)	briquet	93	27.75	Product	Ounces (weight)
Multiple	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Pond (natural)	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)		2	6	Product	Other (specify in comments section)	briquet	3	0.75	Product	Ounces (weight)
Pothole	Other (specify in comments section)	briquet	1	0.5	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Reservoir	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)
Salt Marsh	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		1	1	Product	Other (specify in comments section)	briquet	7	784	Product	Ounces (weight)
Seepage	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	4	1	Product	Ounces (weight)
Septic Seepage	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		1	3	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Septic Tank	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		2	3	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Sewage Treatment Plant	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Slough	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Spring	Other (specify in comments section)	briquet	2	0.75	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Storm Drain	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Street Gutter	Other (specify in comments section)	briquet	13	3.25	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	15	3.75	Product	Ounces (weight)
Sump	Other (specify in comments section)	briquet	4	1	Product	Ounces (weight)		7	7	Product	Other (specify in comments section)	briquet	29	7.5	Product	Ounces (weight)
Swim Pool	Other (specify in comments section)	briquet	3	0.75	Product	Ounces (weight)		12	30	Product	Other (specify in comments section)	briquet	3	1	Product	Ounces (weight)
Swim pool cover	Other (specify in comments section)	briquet	4	2	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)
Swim Pool Drain	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		2	2	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Tank	Other (specify in comments section)	briquet	1	1	Product	Ounces (weight)		2	4	Product	Other (specify in comments section)	briquet	1	4	Product	Ounces (weight)
Tire	Other (specify in comments section)	briquet	4	1	Product	Ounces (weight)		1	1	Product	Other (specify in comments section)	briquet	7	1.75	Product	Ounces (weight)
Treehole	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		2	3	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Vault	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		3	7	Product	Other (specify in comments section)	briquet	55	14.25	Product	Ounces (weight)
Water meter box	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Waterfall	Other (specify in comments section)	briquet	3	0.75	Product	Ounces (weight)		2	5	Product	Other (specify in comments section)	briquet	18	4.5	Product	Ounces (weight)
Well	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		5	6	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Paper Wasp Nest	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)
Total	Other (specify in comments section)	briquet	214	628	Product	Ounces (weight)		212	361	Product	Other (specify in comments section)	briquet	562	36964	Product	Ounces (weight)

Table A42.

Application Sites:	Altosid XR-G Comments	Altosid Liquid (Not-conentrate) # Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit	Altosid Liquid (not-concentrate) Comments	Pyrenone 25-5 # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit8	Pyrenone 25-5 Comments	VectoLex WSP - # Treatments	Total Amount Used2	Total Amount Type17	Total Amount Unit18	VectoLex WSP Comments
Aerial yellowjacket nest		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Bird Bath		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Catch Basin		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Creek		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Culvert		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Ditch		2	40	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Drain Line		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Drain Pipes		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Fish Pond		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		1	1	Product	Other (specify in comments section)	packet
Fountain		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Fresh H2O Marsh		1	3	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Ground yellowjacket nest		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
H20 under Bldg		0	0	Product	Ounces (volume)		7	69.25	Product	Ounces (volume)		0	0			
Horse Trough		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Hot tub		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Imp H2O		2	2.25	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Misc container		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Multiple		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Pond (natural)		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Pothole		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Reservoir		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Salt Marsh		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Seepage		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Septic Seepage		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Septic Tank		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Sewage Treatment Plant		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Slough		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Spring		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Storm Drain		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Street Gutter		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Sump		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Swim Pool		1	5	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Swim pool cover		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Swim Pool Drain		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Tank		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Tire		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Treehole		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Vault		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Water meter box		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Waterfall		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Well		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Paper Wasp Nest		0	0	Product	Ounces (volume)		0	0	Product	Ounces (volume)		0	0			
Total		6	50.25	Product	Ounces (volume)		7	69.25	Product	Ounces (volume)		1	1	Product	Other (specify in comments section)	packet

Table A43. **Pesticide Application Data for Winter 2012 – SMCMVCD**

Application Sites:	Altosid Pellets WSP - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit12	Altosid Pellets WSP Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20	VectoLex CG Comments	Delta Dust - # Treatments	Total Amount Used31	Total Amount Type32
Bird Bath	0	0	Product	Other (specify in comments section)	packet	1	0.25	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)				
Catch Basin	24	32	Product	Other (specify in comments section)	packet	45	104.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Creek	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Culvert	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Ditch	4	8	Product	Other (specify in comments section)	packet	7	3208	Product	Ounces (volume)		6	5	Product	Ounces (weight)				
Drain Line	0	0	Product	Other (specify in comments section)	packet	5	150.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Drain Pipes	0	0	Product	Other (specify in comments section)	packet	1	0.25	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Fish Pond	12	15	Product	Other (specify in comments section)	packet	279	130	Product	Ounces (volume)		63	17.25	Product	Ounces (weight)				
Fountain	20	24	Product	Other (specify in comments section)	packet	103	29.75	Product	Ounces (volume)		39	9.75	Product	Ounces (weight)				
Fresh H2O Marsh	1	2	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Ground yellowjacket nest	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)		1	0.5	Product
H20 under Bldg	0	0	Product	Other (specify in comments section)	packet	20	935.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Horse Trough	0	0	Product	Other (specify in comments section)	packet	2	0.75	Product	Ounces (volume)		6	1.5	Product	Ounces (weight)				
Hot tub	1	1	Product	Other (specify in comments section)	packet	11	3.75	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)				
Imp H2O	10	24	Product	Other (specify in comments section)	packet	23	36	Product	Ounces (volume)		4	17.25	Product	Ounces (weight)				
Misc container	5	7	Product	Other (specify in comments section)	packet	47	12.25	Product	Ounces (volume)		12	3	Product	Ounces (weight)				
Multiple	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Paper Wasp Nest	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Pond (natural)	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Pothole	1	1	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Reservoir	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Salt Marsh	0	0	Product	Other (specify in comments section)	packet	1	3200	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Seepage	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Septic Seepage	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Septic Tank	0	0	Product	Other (specify in comments section)	packet	4	2.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Sewage Treatment Plant	0	0	Product	Other (specify in comments section)	packet	11	4242	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Spring	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Storm Drain	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Street Gutter	0	0	Product	Other (specify in comments section)	packet	4	1.25	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)				
Sump	8	8	Product	Other (specify in comments section)	packet	15	3.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Swim Pool	1	2	Product	Other (specify in comments section)	packet	29	100.25	Product	Ounces (volume)		2	7.5	Product	Ounces (weight)				
Swim pool cover	0	0	Product	Other (specify in comments section)	packet	4	6	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Swim Pool Drain	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Tank	0	0	Product	Other (specify in comments section)	packet	4	21.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Tire	0	0	Product	Other (specify in comments section)	packet	3	15.75	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Treehole	1	1	Product	Other (specify in comments section)	packet	1	0.25	Product	Ounces (volume)		3	0.75	Product	Ounces (weight)				
Vault	7	14	Product	Other (specify in comments section)	packet	1	2.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Water meter box	0	0	Product	Other (specify in comments section)	packet	0	0	Product	Ounces (volume)		0	0	Product	Ounces (weight)				
Waterfall	1	3	Product	Other (specify in comments section)	packet	15	4.5	Product	Ounces (volume)		4	1.25	Product	Ounces (weight)				
Well	1	1	Product	Other (specify in comments section)	packet	4	3	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)				
Total	97	143	Product	Other (specify in comments section)	packet	640	12215.25	Product	Ounces (volume)		145	64.75	Product	Ounces (weight)		1	0.5	Product

Table A43.

Application Sites:	Total Amount Unit32	Delta Dust Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Spectracide - # Treatments	Total Amount Used33452	Total Amount Type34463	Total Amount Unit34474	Spectracide Comments	Natular G30 - # Treatments	Total Amount Used1317	Total Amount Type1418	Total Amount Unit1419	Natular G30 Comments	Teknar SC - # Treatments
Bird Bath													0	0	Product	Ounces (weight)		0
Catch Basin													6	1.5	Product	Ounces (weight)		0
Creek													0	0	Product	Ounces (weight)		0
Culvert													2	0.5	Product	Ounces (weight)		0
Ditch													5	203.75	Product	Ounces (weight)		3
Drain Line			2	156	Product	Ounces (weight)							0	0	Product	Ounces (weight)		0
Drain Pipes													1	0.25	Product	Ounces (weight)		0
Fish Pond													3	1	Product	Ounces (weight)		0
Fountain													2	0.5	Product	Ounces (weight)		0
Fresh H2O Marsh													1	25	Product	Ounces (weight)		0
Ground yellowjacket nest	Ounces (weight)							3	22.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)		0
H20 under Bldg													0	0	Product	Ounces (weight)		0
Horse Trough													0	0	Product	Ounces (weight)		0
Hot tub													0	0	Product	Ounces (weight)		0
Imp H2O													22	31.25	Product	Ounces (weight)		17
Misc container													5	1.25	Product	Ounces (weight)		0
Multiple													0	0	Product	Ounces (weight)		0
Paper Wasp Nest								2	7.5	Product	Ounces (volume)		0	0	Product	Ounces (weight)		0
Pond (natural)													0	0	Product	Ounces (weight)		1
Pothole													0	0	Product	Ounces (weight)		0
Reservoir													0	0	Product	Ounces (weight)		0
Salt Marsh													1	1	Product	Ounces (weight)		1
Seepage													0	0	Product	Ounces (weight)		0
Septic Seepage													0	0	Product	Ounces (weight)		0
Septic Tank													0	0	Product	Ounces (weight)		0
Sewage Treatment Plant													0	0	Product	Ounces (weight)		0
Spring													0	0	Product	Ounces (weight)		0
Storm Drain													0	0	Product	Ounces (weight)		0
Street Gutter													1	0.25	Product	Ounces (weight)		0
Sump													1	0.25	Product	Ounces (weight)		0
Swim Pool													2	0.75	Product	Ounces (weight)		0
Swim pool cover													1	1	Product	Ounces (weight)		0
Swim Pool Drain													0	0	Product	Ounces (weight)		0
Tank													0	0	Product	Ounces (weight)		0
Tire													0	0	Product	Ounces (weight)		0
Treehole													1	0.25	Product	Ounces (weight)		4
Vault													0	0	Product	Ounces (weight)		0
Water meter box													0	0	Product	Ounces (weight)		0
Waterfall													0	0	Product	Ounces (weight)		0
Well													0	0	Product	Ounces (weight)		0
Total	Ounces (weight)		2	156	Product	Ounces (weight)		5	30	Product	Ounces (volume)		54	268.5	Product	Ounces (weight)		26

Table A43.

Application Sites:	Total Amount Used3144	Total Amount Type3245	Total Amount Unit3246	Teknar SC Comments	Altosid Briquets - # Treatments	Total Amount Used4663	Total Amount Type5764	Total Amount Unit5865	Atlosid Briquets Comments	Altosid Liquid Concentrate - # Treatments	Total Amount Used6966	Total Amount Type71067	Total Amount Unit71168	Altosid Liquid Concentrate Comments	Altosid Pellets - # Treatments	Total Amount Used111269
Bird Bath	0	Product	Ounces (volume)		25	28	Product	Other (specify in comments section)	briquet						2	0.5
Catch Basin	0	Product	Ounces (volume)		319	571	Product	Other (specify in comments section)	briquet						49	86
Creek	0	Product	Ounces (volume)		1	2	Product	Other (specify in comments section)	briquet						0	0
Culvert	0	Product	Ounces (volume)		4	9	Product	Other (specify in comments section)	briquet						4	1
Ditch	5.5	Product	Ounces (volume)		11	12	Product	Other (specify in comments section)	briquet						32	18.5
Drain Line	0	Product	Ounces (volume)		4	11	Product	Other (specify in comments section)	briquet						14	5.5
Drain Pipes	0	Product	Ounces (volume)		1	1	Product	Other (specify in comments section)	briquet						0	0
Fish Pond	0	Product	Ounces (volume)		1153	1695	Product	Other (specify in comments section)	briquet						32	8.75
Fountain	0	Product	Ounces (volume)		631	1006	Product	Other (specify in comments section)	briquet						36	11.5
Fresh H2O Marsh	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						0	0
Ground yellowjacket nest	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						0	0
H20 under Bldg	0	Product	Ounces (volume)		4	17	Product	Other (specify in comments section)	briquet						2	1.25
Horse Trough	0	Product	Ounces (volume)		11	25	Product	Other (specify in comments section)	briquet						0	0
Hot tub	0	Product	Ounces (volume)		53	54	Product	Other (specify in comments section)	briquet						2	0.5
Imp H2O	491.25	Product	Ounces (volume)		36	70	Product	Other (specify in comments section)	briquet	1	5	Product	Ounces (volume)		76	32.75
Misc container	0	Product	Ounces (volume)		179	354	Product	Other (specify in comments section)	briquet						39	12.25
Multiple	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						0	0
Paper Wasp Nest	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						0	0
Pond (natural)	8	Product	Ounces (volume)		3	6	Product	Other (specify in comments section)	briquet						1	2
Pothole	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						0	0
Reservoir	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						1	0.25
Salt Marsh	320	Product	Ounces (volume)		1	1	Product	Other (specify in comments section)	briquet						0	0
Seepage	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						1	0.25
Septic Seepage	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						0	0
Septic Tank	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						0	0
Sewage Treatment Plant	0	Product	Ounces (volume)		3	12	Product	Other (specify in comments section)	briquet						0	0
Spring	0	Product	Ounces (volume)		0	0	Product	Other (specify in comments section)	briquet						2	1.5
Storm Drain	0	Product	Ounces (volume)		2	2	Product	Other (specify in comments section)	briquet						0	0
Street Gutter	0	Product	Ounces (volume)		4	6	Product	Other (specify in comments section)	briquet						20	5.25
Sump	0	Product	Ounces (volume)		127	181	Product	Other (specify in comments section)	briquet						13	9.75
Swim Pool	0	Product	Ounces (volume)		70	255	Product	Other (specify in comments section)	briquet						3	1.5
Swim pool cover	0	Product	Ounces (volume)		4	11	Product	Other (specify in comments section)	briquet						4	1.75
Swim Pool Drain	0	Product	Ounces (volume)		4	4	Product	Other (specify in comments section)	briquet						0	0
Tank	0	Product	Ounces (volume)		17	41	Product	Other (specify in comments section)	briquet						1	10
Tire	0	Product	Ounces (volume)		3	4	Product	Other (specify in comments section)	briquet						9	2.5
Treehole	1	Product	Ounces (volume)		22	39	Product	Other (specify in comments section)	briquet						7	1.75
Vault	0	Product	Ounces (volume)		91	187	Product	Other (specify in comments section)	briquet						9	3
Water meter box	0	Product	Ounces (volume)		1	1	Product	Other (specify in comments section)	briquet						0	0
Waterfall	0	Product	Ounces (volume)		66	138	Product	Other (specify in comments section)	briquet						2	0.5
Well	0	Product	Ounces (volume)		18	24	Product	Other (specify in comments section)	briquet						0	0
Total	825.75	Product	Ounces (volume)		2868	4767	Product	Other (specify in comments section)		1	5	Product	Ounces (volume)		361	218.5

Table A43.

Application Sites:	Total Amount Type121370	Total Amount Unit121471	Altosid Pellets Comments	Altosid XR Briquets - # Treatments	Total Amount Used151875	Total Amount Type161976	Total Amount Unit162077	Altosid XR Briquets Comments	Altosid XR-G - # Treatments	Total Amount Used172178	Total Amount Type182279	Total Amount Unit182380	Altosid XR-G Comments	Altosid Liquid (Not-conentrate) # Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit	Altosid Liquid (not-concentrate) Comments
Bird Bath	Product	Ounces (weight)		2	2	Product	Other (specify in comments section)	briquet	3	0.75	Product	Ounces (weight)						
Catch Basin	Product	Ounces (weight)		13	36	Product	Other (specify in comments section)	briquet	33	51.5	Product	Ounces (weight)						
Creek	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Culvert	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	2	0.75	Product	Ounces (weight)						
Ditch	Product	Ounces (weight)		1	2	Product	Other (specify in comments section)	briquet	63	369.5	Product	Ounces (weight)		3	1.5	Product	Ounces (weight)	
Drain Line	Product	Ounces (weight)		2	3	Product	Other (specify in comments section)	briquet	5	1.25	Product	Ounces (weight)						
Drain Pipes	Product	Ounces (weight)		2	2	Product	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)						
Fish Pond	Product	Ounces (weight)		98	151	Product	Other (specify in comments section)	briquet	89	23.75	Product	Ounces (weight)						
Fountain	Product	Ounces (weight)		42	68	Product	Other (specify in comments section)	briquet	97	24.25	Product	Ounces (weight)						
Fresh H2O Marsh	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	4	190	Product	Ounces (weight)						
Ground yellowjacket nest	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
H20 under Bldg	Product	Ounces (weight)		1	1	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Horse Trough	Product	Ounces (weight)		7	37	Product	Other (specify in comments section)	briquet	7	1.75	Product	Ounces (weight)						
Hot tub	Product	Ounces (weight)		7	7	Product	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)						
Imp H2O	Product	Ounces (weight)		4	13	Product	Other (specify in comments section)	briquet	109	665.5	Product	Ounces (weight)		15	46.25	Product	Ounces (weight)	
Misc container	Product	Ounces (weight)		11	22	Product	Other (specify in comments section)	briquet	160	46	Product	Ounces (weight)						
Multiple	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Paper Wasp Nest	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Pond (natural)	Product	Ounces (weight)		1	1	Product	Other (specify in comments section)	briquet	2	40.25	Product	Ounces (weight)		1	2	Product	Ounces (weight)	
Pothole	Product	Ounces (weight)		1	1	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Reservoir	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	3	0.75	Product	Ounces (weight)		1	40	Product	Ounces (weight)	
Salt Marsh	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	5	720.75	Product	Ounces (weight)						
Seepage	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Septic Seepage	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Septic Tank	Product	Ounces (weight)		2	3	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Sewage Treatment Plant	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)						
Spring	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Storm Drain	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Street Gutter	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	35	8.75	Product	Ounces (weight)						
Sump	Product	Ounces (weight)		8	8	Product	Other (specify in comments section)	briquet	50	12.5	Product	Ounces (weight)						
Swim Pool	Product	Ounces (weight)		20	68	Product	Other (specify in comments section)	briquet	1	3	Product	Ounces (weight)						
Swim pool cover	Product	Ounces (weight)		1	1	Product	Other (specify in comments section)	briquet	1	1	Product	Ounces (weight)						
Swim Pool Drain	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Tank	Product	Ounces (weight)		2	4	Product	Other (specify in comments section)	briquet	2	8	Product	Ounces (weight)						
Tire	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	18	4.5	Product	Ounces (weight)						
Treehole	Product	Ounces (weight)		1	1	Product	Other (specify in comments section)	briquet	2	0.5	Product	Ounces (weight)						
Vault	Product	Ounces (weight)		3	12	Product	Other (specify in comments section)	briquet	54	19.5	Product	Ounces (weight)						
Water meter box	Product	Ounces (weight)		0	0	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Waterfall	Product	Ounces (weight)		7	12	Product	Other (specify in comments section)	briquet	30	7.5	Product	Ounces (weight)						
Well	Product	Ounces (weight)		3	3	Product	Other (specify in comments section)	briquet	0	0	Product	Ounces (weight)						
Total	Product	Ounces (weight)		239	458	Product	Other (specify in comments section)	briquet	778	2202.75	Product	Ounces (weight)		20	89.75	Product	Ounces (weight)	

Table A43.

Application Sites:	VectoLex WSP - # Treatments	Total Amount Used16	Total Amount Type17	Total Amount Unit18	VectoLex WSP Comments
Bird Bath					
Catch Basin					
Creek					
Culvert					
Ditch					
Drain Line					
Drain Pipes					
Fish Pond					
Fountain					
Fresh H2O Marsh					
Ground yellowjacket nest					
H20 under Bldg					
Horse Trough					
Hot tub					
Imp H2O					
Misc container					
Multiple					
Paper Wasp Nest					
Pond (natural)					
Pothole					
Reservoir					
Salt Marsh					
Seepage					
Septic Seepage					
Septic Tank					
Sewage Treatment Plant					
Spring					
Storm Drain					
Street Gutter					
Sump					
Swim Pool	1	6	Product	Ounces (weight)	
Swim pool cover					
Swim Pool Drain					
Tank					
Tire					
Treehole					
Vault					
Water meter box					
Waterfall					
Well					
Total	1	6	Product	Ounces (weight)	

Table A44. **Pesticide Application Data for Spring 2012 – SMCMVCD**

Application Sites:	VectoBac 12AS - # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit7	VectoBac 12AS Comments	Altosid Pellets WSP - # Treatments	Total Amount Used11	Total Amount Type12	Total Amount Unit12	Altosid Pellets WSP Comments	BVA-2 - # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit18	BVA-2 Comments	VectoLex CG - # Treatments	Total Amount Used19	Total Amount Type20	Total Amount Unit20
Aerial yellowjacket nest																			
Bird Bath											4	1	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)
Catch Basin						19	25	Product	Other (specify in comments section)	packet	296	64276.9	Product	Ounces (volume)		8	24.25	Product	Ounces (weight)
Creek											6	37.5	Product	Ounces (volume)		2	12.25	Product	Ounces (weight)
Culvert											4	1.75	Product	Ounces (volume)					
Ditch						3	12	Product	Other (specify in comments section)	packet	23	49.5	Product	Ounces (volume)		10	15	Product	Ounces (weight)
Drain Line											6	30.75	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)
Drain Pipes											2	0.5	Product	Ounces (volume)					
Fish Pond	1	1	Product	Ounces (volume)		12	17	Product	Other (specify in comments section)	packet	345	177.5	Product	Ounces (volume)		38	10.25	Product	Ounces (weight)
Fountain						5	7	Product	Other (specify in comments section)	packet	141	45.25	Product	Ounces (volume)		24	6	Product	Ounces (weight)
Fresh H2O Marsh																			
Ground yellowjacket nest																			
H20 under Bldg											17	882.25	Product	Ounces (volume)					
Horse Trough											1	0.25	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)
Hot tub						1	1	Product	Other (specify in comments section)	packet	19	8.25	Product	Ounces (volume)		2	0.5	Product	Ounces (weight)
Imp H2O	3	80	Product	Ounces (volume)		3	7	Product	Other (specify in comments section)	packet	40	131.25	Product	Ounces (volume)		4	6.5	Product	Ounces (weight)
Misc container						2	2	Product	Other (specify in comments section)	packet	42	238.75	Product	Ounces (volume)		6	1.5	Product	Ounces (weight)
Multiple																			
Pond (natural)											2	4.25	Product	Ounces (volume)					
Pothole											2	1.25	Product	Ounces (volume)					
Reservoir																			
Salt Marsh																			
Seepage											1	0.25	Product	Ounces (volume)					
Septic Seepage																			
Septic Tank											1	1	Product	Ounces (volume)					
Sewage Treatment Plant											16	7122	Product	Ounces (volume)					
Slough																			
Spring																			
Storm Drain																			
Street Gutter						1	1	Product	Other (specify in comments section)	packet	6	4.25	Product	Ounces (volume)					
Sump						4	4	Product	Other (specify in comments section)	packet	27	9.5	Product	Ounces (volume)					
Swim Pool											38	130	Product	Ounces (volume)		3	6.5	Product	Ounces (weight)
Swim pool cover											2	3.25	Product	Ounces (volume)					
Swim Pool Drain											1	0.25	Product	Ounces (volume)					
Tank											4	22.75	Product	Ounces (volume)					
Tire											1	0.25	Product	Ounces (volume)					
Treehole											3	0.75	Product	Ounces (volume)					
Vault											16	224.25	Product	Ounces (volume)		1	0.25	Product	Ounces (weight)
Water meter box																			
Waterfall											14	4.5	Product	Ounces (volume)		3	0.75	Product	Ounces (weight)
Well											5	2	Product	Ounces (volume)					
Paper wasp nest																			
Total	4	81	Product	Ounces (volume)		50	76	Product	Other (specify in comments section)	packet	1085	73411.9	Product	Ounces (volume)		106	85	Product	Ounces (weight)

Table A44.

Application Sites:	VectoLex CG Comments	Spheratax SPH (50G) WSP - # Treatments	Total Amount Used29	Total Amount Type30	Total Amount Unit30	Spheratax SPH (50G) WSP Comments	Delta Dust - # Treatments	Total Amount Used31	Total Amount Type32	Total Amount Unit32	Delta Dust Comments	VectoLex WDG - # Treatments	Total Amount Used3345	Total Amount Type3446	Total Amount Unit3447	VectoLex WDG Comments	Spectracide - # Treatments	Total Amount Used33452
Aerial yellowjacket nest																	5	30
Bird Bath																		
Catch Basin																		
Creek																		
Culvert																		
Ditch		1	1	Product	Other (specify in comments section)													
Drain Line												4	172	Product	Ounces (volume)			
Drain Pipes																		
Fish Pond		1	1	Product	Other (specify in comments section)													
Fountain																		
Fresh H2O Marsh																		
Ground yellowjacket nest							18	11.25	Product	Ounces (weight)							18	172.5
H20 under Bldg																		
Horse Trough																		
Hot tub																		
Imp H2O		1	8	Product	Other (specify in comments section)													
Misc container																		
Multiple																		
Pond (natural)																		
Pothole																		
Reservoir																		
Salt Marsh																		
Seepage																		
Septic Seepage																		
Septic Tank																		
Sewage Treatment Plant																		
Slough																		
Spring																		
Storm Drain																		
Street Gutter																		
Sump																		
Swim Pool																		
Swim pool cover																		
Swim Pool Drain																		
Tank																		
Tire																		
Treehole																		
Vault																		
Water meter box																		
Waterfall																		
Well																		
Paper wasp nest																	11	108.75
Total		3	10	Product	Other (specify in comments section)		18	11.25	Product	Ounces (weight)		4	172	Product	Ounces (volume)		34	311.25

Table A44.

Application Sites:	Total Amount Type34463	Total Amount Unit34474	Spectracide Comments	Natular G30 - # Treatments	Total Amount Used1317	Total Amount Type1418	Total Amount Unit1419	Natular G30 Comments	Spectracide Pro # Treatments	Total Amount Used1723	Total Amount Type1824	Total Amount Unit1825	Spectracide Pro Comments	Teknar SC - # Treatments	Total Amount Used3144	Total Amount Type3245	Total Amount Unit3246	Teknar SC Comments	Altosid Briquets - # Treatments
Aerial yellowjacket nest	Product	Ounces (volume)																	
Bird Bath																			18
Catch Basin				4	11.5	Product	Ounces (weight)												302
Creek				4	320	Product	Ounces (weight)												2
Culvert																			9
Ditch				2	4	Product	Ounces (weight)							4	48	Product	Ounces (volume)		18
Drain Line																			3
Drain Pipes																			2
Fish Pond																			633
Fountain				1	0.25	Product	Ounces (weight)												442
Fresh H2O Marsh				1	0.5	Product	Ounces (weight)							2	16	Product	Ounces (volume)		
Ground yellowjacket nest	Product	Ounces (volume)							10	303.75	Product	Ounces (volume)							
H20 under Bldg																			3
Horse Trough																			6
Hot tub																			25
Imp H2O				5	60.5	Product	Ounces (weight)							17	888	Product	Ounces (volume)		30
Misc container																			122
Multiple																			
Pond (natural)																			2
Pothole																			
Reservoir																			
Salt Marsh														1	480	Product	Ounces (volume)		
Seepage																			
Septic Seepage																			
Septic Tank																			1
Sewage Treatment Plant																			
Slough																			
Spring																			1
Storm Drain																			1
Street Gutter																			4
Sump																			75
Swim Pool																			38
Swim pool cover																			1
Swim Pool Drain																			1
Tank																			13
Tire																			2
Treehole														4	1	Product	Ounces (volume)		9
Vault																			52
Water meter box																			
Waterfall																			32
Well																			12
Paper wasp nest	Product	Ounces (volume)							3	105	Product	Ounces (volume)							
Total	Product	Ounces (volume)		17	396.75	Product	Ounces (weight)		13	408.75	Product	Ounces (volume)		28	1433	Product	Ounces (volume)		1859

Table A44.

Application Sites:	Total Amount Used4663	Total Amount Type5764	Total Amount Unit5865	Atlosid Briquets Comments	Altosid Liquid Concentrate - # Treatments	Total Amount Used6966	Total Amount Type71067	Total Amount Unit71168	Altosid Liquid Concentrate Comments	Altosid Pellets - # Treatments	Total Amount Used111269	Total Amount Type121370	Total Amount Unit121471	Altosid Pellets Comments	Altosid XR Briquets - # Treatments	Total Amount Used151875	Total Amount Type161976
Aerial yellowjacket nest																	
Bird Bath	18	Product	Other (specify in comments section)	briquet						1	0.25	Product	Ounces (weight)		2	2	Product
Catch Basin	779	Product	Other (specify in comments section)	briquet						73	268	Product	Ounces (weight)		77	136	Product
Creek	4	Product	Other (specify in comments section)	briquet						30	1351	Product	Ounces (weight)		4	5	Product
Culvert	12	Product	Other (specify in comments section)	briquet						5	2.25	Product	Ounces (weight)		1	1	Product
Ditch	29	Product	Other (specify in comments section)	briquet	1	1	Product	Ounces (volume)		56	282	Product	Ounces (weight)		8	13	Product
Drain Line	5	Product	Other (specify in comments section)	briquet						5	1.25	Product	Ounces (weight)				
Drain Pipes	2	Product	Other (specify in comments section)	briquet													
Fish Pond	951	Product	Other (specify in comments section)	briquet						52	24	Product	Ounces (weight)		176	250.5	Product
Fountain	703	Product	Other (specify in comments section)	briquet						37	9.25	Product	Ounces (weight)		69	93.5	Product
Fresh H2O Marsh																	
Ground yellowjacket nest																	
H20 under Bldg	12	Product	Other (specify in comments section)	briquet						1	8	Product	Ounces (weight)				
Horse Trough	7	Product	Other (specify in comments section)	briquet						1	0.5	Product	Ounces (weight)		3	6	Product
Hot tub	26	Product	Other (specify in comments section)	briquet						4	1	Product	Ounces (weight)		8	8	Product
Imp H2O	54	Product	Other (specify in comments section)	briquet	2	1.5	Product	Ounces (volume)		82	221.75	Product	Ounces (weight)		6	8	Product
Misc container	229	Product	Other (specify in comments section)	briquet						42	11.5	Product	Ounces (weight)		15	21	Product
Multiple																	
Pond (natural)	5	Product	Other (specify in comments section)	briquet											1	8	Product
Pothole															2	2	Product
Reservoir										1	0.25	Product	Ounces (weight)				
Salt Marsh																	
Seepage										1	0.25	Product	Ounces (weight)				
Septic Seepage																	
Septic Tank	4	Product	Other (specify in comments section)	briquet													
Sewage Treatment Plant																	
Slough																	
Spring	1	Product	Other (specify in comments section)	briquet											1	1	Product
Storm Drain	1	Product	Other (specify in comments section)	briquet											1	1	Product
Street Gutter	6	Product	Other (specify in comments section)	briquet						22	5.5	Product	Ounces (weight)		1	1	Product
Sump	107	Product	Other (specify in comments section)	briquet						24	6.25	Product	Ounces (weight)		24	27.5	Product
Swim Pool	163	Product	Other (specify in comments section)	briquet						4	1.75	Product	Ounces (weight)		16	40.5	Product
Swim pool cover	3	Product	Other (specify in comments section)	briquet						2	1.5	Product	Ounces (weight)				
Swim Pool Drain	1	Product	Other (specify in comments section)	briquet													
Tank	34	Product	Other (specify in comments section)	briquet						2	6	Product	Ounces (weight)		1	2	Product
Tire	3	Product	Other (specify in comments section)	briquet						3	0.75	Product	Ounces (weight)				
Treehole	9	Product	Other (specify in comments section)	briquet						3	0.75	Product	Ounces (weight)		1	1	Product
Vault	98	Product	Other (specify in comments section)	briquet						41	11.25	Product	Ounces (weight)		21	1094	Product
Water meter box																	
Waterfall	67	Product	Other (specify in comments section)	briquet						9	2.25	Product	Ounces (weight)		6	12	Product
Well	14	Product	Other (specify in comments section)	briquet						1	0.25	Product	Ounces (weight)		3	4	Product
Paper wasp nest																	
Total	3347	Product	Other (specify in comments section)	briquet	3	2.5	Product	Ounces (volume)		502	2217.5	Product	Ounces (weight)		447	1738	Product

Table A44.

Application Sites:	Total Amount Unit162077	Altosid XR Briquets Comments	Altosid XR-G - # Treatments	Total Amount Used172178	Total Amount Type182279	Total Amount Unit182380	Altosid XR-G Comments	Altosid Liquid (Not-conentrate) # Treatments	Total Amount Used	Total Amount Type2	Total Amount Unit	Altosid Liquid (not-concentrate) Comments	Pyrenone 25-5 # Treatments	Total Amount Used6	Total Amount Type7	Total Amount Unit8	Pyrenone 25-5 Comments
Aerial yellowjacket nest																	
Bird Bath	Other (specify in comments section)	briquet	17	5.5	Product	Ounces (weight)											
Catch Basin	Other (specify in comments section)	briquet	1	6	Product	Ounces (weight)											
Creek	Other (specify in comments section)	briquet															
Culvert	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)											
Ditch	Other (specify in comments section)	briquet	65	266.75	Product	Ounces (weight)		3	5	Product	Ounces (volume)						
Drain Line			2	0.5	Product	Ounces (weight)											
Drain Pipes																	
Fish Pond	Other (specify in comments section)	briquet	13	3.25	Product	Ounces (weight)											
Fountain	Other (specify in comments section)	briquet	20	5	Product	Ounces (weight)											
Fresh H2O Marsh			2	322.5	Product	Ounces (weight)		2	3	Product	Ounces (volume)						
Ground yellowjacket nest																	
H20 under Bldg													1	4.5	Product	Ounces (volume)	
Horse Trough	Other (specify in comments section)	briquet	8	2	Product	Ounces (weight)											
Hot tub	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)											
Imp H2O	Other (specify in comments section)	briquet	81	1808.5	Product	Ounces (weight)		18	130.5	Product	Ounces (volume)						
Misc container	Other (specify in comments section)	briquet	43	12.25	Product	Ounces (weight)											
Multiple																	
Pond (natural)	Other (specify in comments section)	briquet	2	44	Product	Ounces (weight)											
Pothole	Other (specify in comments section)	briquet															
Reservoir			3	40.25	Product	Ounces (weight)											
Salt Marsh			19	2586	Product	Ounces (weight)		1	60	Product	Ounces (volume)						
Seepage			2	0.5	Product	Ounces (weight)											
Septic Seepage																	
Septic Tank																	
Sewage Treatment Plant																	
Slough																	
Spring	Other (specify in comments section)	briquet															
Storm Drain	Other (specify in comments section)	briquet															
Street Gutter	Other (specify in comments section)	briquet	8	2	Product	Ounces (weight)											
Sump	Other (specify in comments section)	briquet	15	3.75	Product	Ounces (weight)											
Swim Pool	Other (specify in comments section)	briquet	1	0.25	Product	Ounces (weight)											
Swim pool cover			1	0.25	Product	Ounces (weight)											
Swim Pool Drain																	
Tank	Other (specify in comments section)	briquet	2	3	Product	Ounces (weight)											
Tire			9	7	Product	Ounces (weight)											
Treehole	Other (specify in comments section)	briquet															
Vault	Other (specify in comments section)	briquet	18	12	Product	Ounces (weight)											
Water meter box																	
Waterfall	Other (specify in comments section)	briquet	3	0.75	Product	Ounces (weight)											
Well	Other (specify in comments section)	briquet															
Paper wasp nest																	
Total	Other (specify in comments section)	briquet	337	5132.5	Product	Ounces (weight)		24	198.5	Product	Ounces (volume)		1	4.5	Product	Ounces (volume)	

Table A45. Pesticide Product Key – SMCMVCD

Product	Active Ingredient	Vector
Altosid Briquets	Methoprene	Mosquito
Altosid Liquid Larvicide	Methoprene	Mosquito
Altosid Liquid Larvicide Concentrate	Methoprene	Mosquito
Altosid Pellets	Methoprene	Mosquito
Altosid Pellets WSP	Methoprene	Mosquito
Altosid XR-Briquets	Methoprene	Mosquito
Altosid XR-G (granules)	Methoprene	Mosquito
Astro®, Ortho® products, Bonide® products, Tengard® products, etc.	Permethrin	Yellow Jacket / Wasp
Bayer Pyrenone 25-5	Pyrethrins and Piperonyl Butoxide	Mosquito
BVA 2	Petroleum Distillate	Mosquito
Delta Dust	Deltamethrin	Yellow Jacket / Wasp
Drione	Pyrethrin and Piperonyl Butroxide and Amorphous Silica Gel	Yellow Jacket / Wasp
Mosquito Larvicide GB-1111	Aliphatic Petroleum Hydrocarbons	Mosquito
Natular G30	Spinosad	Mosquito
Spectracide Pro®	Tetramethrin and Permethrin and Piperonyl Butoxide	Yellow Jacket / Wasp
Spectracide®	Prallethrin and Lambda-cyhalothrin	Yellow Jacket / Wasp
Teknar SC	Bacillus Thuringiensis Israelensis	Mosquito
VectoBac 12AS	Bacillus Thuringiensis Israelensis	Mosquito
VectoLex CG Biologic	Bacillus Sphaericus	Mosquito
VectoLex WDG	Bacillus Sphaericus	Mosquito
VectoLex WSP	Bacillus Sphaericus	Mosquito
Wasp-Freeze	Phenothrin and Trans Allethrin	Yellow Jacket / Wasp

Table A46. **Herbicide Application Data for Summer 2011 – NCMAD**

Application Sites	Aquamaster # Treatmens	Total Amount Used	Total Amount Type	Total Amount Unit	Aquamaster Comments	Blazon Pattern Indicator # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit4	Blazon Pattern Indicator Comments	BullsEye Pattern Idicator # Treatments	Total Amount Used5
Access Roads	15	883.5	Product	Ounces (volume)		6	160	Product	Ounces (volume)		14	103.7
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds	17	1783.5	Product	Ounces (volume)		3	64	Product	Ounces (volume)		17	222.3
Interior Margins/Slopes of Waste Water Ponds	14	975.6	Product	Ounces (volume)		3	80	Product	Ounces (volume)		13	107.2
Napa River Islands/Embankments												
Waste Water Spray Fields	2	64	Product	Ounces (volume)		3	96	Product	Ounces (volume)		5	28.4
Ditches/Channels	2	384	Product	Ounces (volume)							1	16
Empty Lots/Fields	4	93.4	Product	Ounces (volume)							3	127.2
Total	54	4184	Product	Ounces (volume)		15	400	Product	Ounces (volume)		53	604.8

Table A46.

Application Sites	Total Amount Type6	Total Amount Unit7	BullsEye Pattern Idicator Comments	No Foam A # Treatments	Total Amount Used20	Total Amount Type21	Total Amount Unit22	No Foam A Comments	Pro-Spreader Activator # Treatments	Total Amount Used29	Total Amount Type30	Total Amount Unit31
Access Roads	Product	Ounces (volume)		1	1.5	Product	Ounces (volume)		3	18.6	Product	Ounces (volume)
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds	Product	Ounces (volume)		1	15	Product	Ounces (volume)		5	33.8	Product	Ounces (volume)
Interior Margins/Slopes of Waste Water Ponds	Product	Ounces (volume)		1	13.5	Product	Ounces (volume)		5	24.6	Product	Ounces (volume)
Napa River Islands/Embankments												
Waste Water Spray Fields	Product	Ounces (volume)										
Ditches/Channels	Product	Ounces (volume)										
Empty Lots/Fields	Product	Ounces (volume)										
Total	Product	Ounces (volume)		3	30	Product	Ounces (volume)		13	77	Product	Ounces (volume)

Table A46.

Application Sites	Pro-Spreader Activator Comments	R-11 Spreader Activator # Treatments	Total Amount Used32	Total Amount Type33	Total Amount Unit34	R-11 Spreader Activator Comments	Roundup Pro # Treaments	Total Amount Used35	Total Amount Type36	Total Amount Unit37	Roundup Pro Comments	Roundup Pro Max # Treatments
Access Roads		13	529.85	Product	Ounces (volume)		2	51.2	Product	Ounces (volume)		1
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds		10	667.95	Product	Ounces (volume)		2	301.4	Product	Ounces (volume)		
Interior Margins/Slopes of Waste Water Ponds		8	350.1	Product	Ounces (volume)		2	70.4	Product	Ounces (volume)		
Napa River Islands/Embankments												
Waste Water Spray Fields		4	273.7	Product	Ounces (volume)							
Ditches/Channels		2	96	Product	Ounces (volume)							
Empty Lots/Fields		4	49.1	Product	Ounces (volume)		2	189	Product	Ounces (volume)		1
Total		41	1966.7	Product	Ounces (volume)		8	612	Product	Ounces (volume)		2

Table A46.

Application Sites	Total Amount Used38	Total Amount Type39	Total Amount Unit40	Roundup Pro Max Comments	Buccaneer # Treatments	Total Amount Used47	Total Amount Type48	Total Amount Unit49	Buccaneer Comments
Access Roads	102.4	Product	Ounces (volume)		3	588.8	Product	Ounces (volume)	
Pond Levees									
Top and Exterior Slopes of Waste Water Ponds					1	204.8	Product	Ounces (volume)	
Interior Margins/Slopes of Waste Water Ponds					1	256	Product	Ounces (volume)	
Napa River Islands/Embankments									
Waste Water Spray Fields					2	358.4	Product	Ounces (volume)	
Ditches/Channels									
Empty Lots/Fields	921.6	Product	Ounces (volume)						
Total	1024	Product	Ounces (volume)		7	1408	Product	Ounces (volume)	

Table A47. **Herbicide Application Data for Fall 2011 – NCMAD**

Application Sites	Aquamaster # Treatmens	Total Amount Used	Total Amount Type	Total Amount Unit	Aquamaster Comments	Blazon Pattern Indicator # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit4	Blazon Pattern Indicator Comments	BullsEye Pattern Idicator # Treatments	Total Amount Used5
Access Roads	26	3437.4	Product	Ounces (volume)		14	1169	Product	Ounces (volume)		49	933.7
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds	24	7456.3	Product	Ounces (volume)		7	1408.6	Product	Ounces (volume)		65	2612.1
Interior Margins/Slopes of Waste Water Ponds	21	4150.4	Product	Ounces (volume)		7	1544	Product	Ounces (volume)		61	1502.8
Napa River Islands/Embankments	11	11240	Product	Ounces (volume)							9	282
Waste Water Spray Fields	1	51.2	Product	Ounces (volume)		4	467.2	Product	Ounces (volume)		5	81
Ditches/Channels	3	768	Product	Ounces (volume)								
Empty Lots/Fields	1	42.3	Product	Ounces (volume)							4	120
Total	87	27145.6	Product	Ounces (volume)		32	4588.8	Product	Ounces (volume)		193	5531.6

Table A47.

Application Sites	Total Amount Type6	Total Amount Unit7	BullsEye Pattern Idicator Comments	Competitor # Treatments	Total Amount Used8	Total Amount Type9	Total Amount Unit10	Competitor Comments	Karmex XP # Treatments	Total Amount Used14	Total Amount Type15	Total Amount Unit16
Access Roads	Product	Ounces (volume)							45	7907.2	Product	Ounces (weight)
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds	Product	Ounces (volume)							57	26949.6	Product	Ounces (weight)
Interior Margins/Slopes of Waste Water Ponds	Product	Ounces (volume)							53	18132	Product	Ounces (weight)
Napa River Islands/Embankments	Product	Ounces (volume)		12	1264	Product	Ounces (volume)					
Waste Water Spray Fields	Product	Ounces (volume)							1	32	Product	Ounces (weight)
Ditches/Channels									3	1120	Product	Ounces (weight)
Empty Lots/Fields	Product	Ounces (volume)							3	195.2	Product	Ounces (weight)
Total	Product	Ounces (volume)		12	1264	Product	Ounces (volume)		162	54336	Product	Ounces (weight)

Table A47.

Application Sites	Karmex XP Comments	Oust XP # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit19	Oust XP Comments	No Foam A # Treatments	Total Amount Used20	Total Amount Type21	Total Amount Unit22	No Foam A Comments	Polaris # Treatments	Total Amount Used26
Access Roads		63	383.69	Product	Ounces (weight)		10	45.6	Product	Ounces (volume)			
Pond Levees													
Top and Exterior Slopes of Waste Water Ponds		74	865.09	Product	Ounces (weight)		11	605.6	Product	Ounces (volume)			
Interior Margins/Slopes of Waste Water Ponds		67	580	Product	Ounces (weight)		10	276.8	Product	Ounces (volume)			
Napa River Islands/Embankments		7	68	Product	Ounces (weight)							11	9216
Waste Water Spray Fields		1	4.8	Product	Ounces (weight)								
Ditches/Channels		1	8	Product	Ounces (weight)								
Empty Lots/Fields		3	5.88	Product	Ounces (weight)								
Total		216	1915.46	Product	Ounces (weight)		31	928	Product	Ounces (volume)		11	9216

Table A47.

Application Sites	Total Amount Type27	Total Amount Unit28	Polaris Comments	Pro-Spreader Activator # Treatments	Total Amount Used29	Total Amount Type30	Total Amount Unit31	Pro-Spreader Activator Comments	R-11 Spreader Activator # Treatments	Total Amount Used32	Total Amount Type33	Total Amount Unit34
Access Roads				32	2585.2	Product	Ounces (volume)		24	1086.8	Product	Ounces (volume)
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds				31	2840.89	Product	Ounces (volume)		34	3177.7	Product	Ounces (volume)
Interior Margins/Slopes of Waste Water Ponds				28	3042.9	Product	Ounces (volume)		29	1690.6	Product	Ounces (volume)
Napa River Islands/Embankments	Product	Ounces (volume)		11	311	Product	Ounces (volume)					
Waste Water Spray Fields				8	889.6	Product	Ounces (volume)					
Ditches/Channels									3	224	Product	Ounces (volume)
Empty Lots/Fields									4	40.8	Product	Ounces (volume)
Total	Product	Ounces (volume)		110	9669.59	Product	Ounces (volume)		94	6219.9	Product	Ounces (volume)

Table A47.

Application Sites	R-11 Spreader Activator Comments	Diuron 80 # Treatments	Toal Amount Used	Total Amount Type2	Total Amount Unit2	Diuron 80 Comments
Access Roads		18	8343	Product	Ounces (weight)	
Pond Levees						
Top and Exterior Slopes of Waste Water Ponds		17	6372.8	Product	Ounces (weight)	
Interior Margins/Slopes of Waste Water Ponds		15	5318.6	Product	Ounces (weight)	
Napa River Islands/Embankments						
Waste Water Spray Fields		8	3289.6	Product	Ounces (weight)	
Ditches/Channels						
Empty Lots/Fields						
Total		58	23324	Product	Ounces (weight)	

Table A48. **Herbicide Application Data for Winter 2012 – NCMAD**

Application Sites	Aquamaster # Treatmens	Total Amount Used	Total Amount Type	Total Amount Unit	Aquamaster Comments	BullsEye Pattern Idicator # Treatments	Total Amount Used5	Total Amount Type6	Total Amount Unit7	BullsEye Pattern Idicator Comments	Karmex XP # Treatments	Total Amount Used14
Access Roads	4	375.9	Product	Ounces (volume)		5	70	Product	Ounces (volume)		5	700.8
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds	4	824.2	Product	Ounces (volume)		5	157.4	Product	Ounces (volume)		5	1574.4
Interior Margins/Slopes of Waste Water Ponds	3	342	Product	Ounces (volume)		3	72.8	Product	Ounces (volume)		4	742.4
Napa River Islands/Embankments											2	864
Waste Water Spray Fields	2	403.2	Product	Ounces (volume)		2	86.4	Product	Ounces (volume)			
Ditches/Channels												
Empty Lots/Fields	1	30.7	Product	Ounces (volume)		2	5.4	Product	Ounces (volume)		1	38.4
Total	14	1976	Product	Ounces (volume)		17	392	Product	Ounces (volume)		17	3920

Table A48.

Application Sites	Total Amount Type15	Total Amount Unit16	Karmex XP Comments	Oust XP # Treatments	Total Amount Used17	Total Amount Type18	Total Amount Unit19	Oust XP Comments	No Foam A # Treatments	Total Amount Used20	Total Amount Type21	Total Amount Unit22	No Foam A Comments
Access Roads	Product	Ounces (weight)		5	17.52	Product	Ounces (weight)		1	4.8	Product	Ounces (volume)	
Pond Levees													
Top and Exterior Slopes of Waste Water Ponds	Product	Ounces (weight)		5	39.36	Product	Ounces (weight)		1	4.8	Product	Ounces (volume)	
Interior Margins/Slopes of Waste Water Ponds	Product	Ounces (weight)		3	18.2	Product	Ounces (weight)		1	6.4	Product	Ounces (volume)	
Napa River Islands/Embankments	Product	Ounces (weight)											
Waste Water Spray Fields				2	21.6	Product	Ounces (weight)						
Ditches/Channels													
Empty Lots/Fields	Product	Ounces (weight)											
Total	Product	Ounces (weight)		15	96.68	Product	Ounces (weight)		3	16	Product	Ounces (volume)	

Table A48.

Application Sites	R-11 Spreader Activator # Treatments	Total Amount Used32	Total Amount Type33	Total Amount Unit34	R-11 Spreader Activator Comments
Access Roads	4	138.6	Product	Ounces (volume)	
Pond Levees					
Top and Exterior Slopes of Waste Water Ponds	4	134.8	Product	Ounces (volume)	
Interior Margins/Slopes of Waste Water Ponds	2	144	Product	Ounces (volume)	
Napa River Islands/Embankments					
Waste Water Spray Fields	2	172.8	Product	Ounces (volume)	
Ditches/Channels					
Empty Lots/Fields	2	10.6	Product	Ounces (volume)	
Total	14	600.8	Product	Ounces (volume)	

Table A49. **Herbicide Application Data for Spring 2012 – NCMAD**

Application Sites	Aquamaster # Treatmens	Total Amount Used	Total Amount Type	Total Amount Unit	Aquamaster Comments	Blazon Pattern Indicator # Treatments	Total Amount Used2	Total Amount Type3	Total Amount Unit4	Blazon Pattern Indicator Comments	BullsEye Pattern Idicator # Treatments	Total Amount Used5
Access Roads	13	646.9	Product	Ounces (volume)		4	89.6	Product	Ounces (volume)		13	94.4
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds	15	1931.8	Product	Ounces (volume)		3	102.4	Product	Ounces (volume)		15	252
Interior Margins/Slopes of Waste Water Ponds	14	1104.3	Product	Ounces (volume)		3	128	Product	Ounces (volume)		14	149.6
Napa River Islands/Embankments												
Waste Water Spray Fields												
Ditches/Channels												
Empty Lots/Fields	1	256	Product	Ounces (volume)							2	32
Total	43	3939	Product	Ounces (volume)		10	320	Product	Ounces (volume)		44	528

Table A49.

Application Sites	Total Amount Type6	Total Amount Unit7	BullsEye Pattern Idicator Comments	Competitor # Treatments	Total Amount Used8	Total Amount Type9	Total Amount Unit10	Competitor Comments	No Foam A # Treatments	Total Amount Used20	Total Amount Type21	Total Amount Unit22
Access Roads	Product	Ounces (volume)							10	35.1	Product	Ounces (volume)
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds	Product	Ounces (volume)							12	173.2	Product	Ounces (volume)
Interior Margins/Slopes of Waste Water Ponds	Product	Ounces (volume)							11	173.7	Product	Ounces (volume)
Napa River Islands/Embankments				9	288	Product	Ounces (volume)					
Waste Water Spray Fields												
Ditches/Channels												
Empty Lots/Fields	Product	Ounces (volume)										
Total	Product	Ounces (volume)		9	288	Product	Ounces (volume)		33	382	Product	Ounces (volume)

Table A49.

Application Sites	No Foam A Comments	Polaris # Treatments	Total Amount Used26	Total Amount Type27	Total Amount Unit28	Polaris Comments	Pro-Spreader Activator # Treatments	Total Amount Used29	Total Amount Type30	Total Amount Unit31	Pro-Spreader Activator Comments	R-11 Spreader Activator # Treatments
Access Roads							1	6.4	Product	Ounces (volume)		3
Pond Levees												
Top and Exterior Slopes of Waste Water Ponds		1	72	Product	Ounces (volume)		1	25.6	Product	Ounces (volume)		2
Interior Margins/Slopes of Waste Water Ponds							1	32	Product	Ounces (volume)		2
Napa River Islands/Embankments		4	432	Product	Ounces (volume)							
Waste Water Spray Fields												
Ditches/Channels												
Empty Lots/Fields												1
Total		5	504	Product	Ounces (volume)		3	64	Product	Ounces (volume)		8

Table A49.

Application Sites	Total Amount Used32	Total Amount Type33	Total Amount Unit34	R-11 Spreader Activator Comments	Roundup Pro # Treaments	Total Amount Used35	Total Amount Type36	Total Amount Unit37	Roundup Pro Comments
Access Roads	204.8	Product	Ounces (volume)		2	460.8	Product	Ounces (volume)	
Pond Levees									
Top and Exterior Slopes of Waste Water Ponds	332.8	Product	Ounces (volume)		2	537.6	Product	Ounces (volume)	
Interior Margins/Slopes of Waste Water Ponds	102.4	Product	Ounces (volume)		2	537.6	Product	Ounces (volume)	
Napa River Islands/Embankments									
Waste Water Spray Fields									
Ditches/Channels									
Empty Lots/Fields	128	Product	Ounces (volume)						
Total	768	Product	Ounces (volume)		6	1536	Product	Ounces (volume)	

Table A50. Herbicide Product Key – NCMAD

Product	Active Ingredient	Vector
Aquamaster	Glyphosate	Weed
Blazon Pattern Indicator	Polymetric Colorant (proprietary)	Weed
BullsEye Pattern Indicator	Proprietary Colorant	Weed
Competitor	Modified Vegetable Oil	Weed
Karmex XP	Diuron	Weed
Oust XP	Sulfometuron Methyl	Weed
No Foam A	Alkyl Phenol Ethoxylate / Isopropanol	Weed
Polaris	Imazapyr	Weed
Pro-Spreader Activator	Alkyl Phenol Ethoxylate / Isopropanol	Weed
R-11 Spreader Activator		Weed
Roundup Pro	Glyphosate	Weed
Buccaneer	Glyphosate	Weed

Ecological & Human Health
Assessment Report

ATTACHMENT

B

REVIEW OF ADDITIONAL LITERATURE FOR METHOPRENE, BTI AND BACILLUS SPHAERICUS

B.1 Introduction

This attachment serves as an update and supplement to the information about chemical toxicity provided in Appendix B, Ecological & Human Health Assessment Report (June 2013). In that document, approximately 46 active ingredients and numerous products were reviewed, including dozens of papers and documents that provide supporting information about the toxicity for each chemical. While the information provided in the original report was developed using the information available at the time, this attachment is a follow-up review of additional information not included previously in Appendix B for three of the 46 chemicals: 1) methoprene; 2) Bti (*Bacillus thuringiensis israelensis*) and 3) *B. sphaericus* (*Bacillus sphaericus*).

Fifty-one additional publications and reports about these three pesticides were identified and evaluated for consistency with the original assessment conclusions in Appendix B and subsequently in the Districts' Draft PEIRs. This attachment addresses several publications that will be included to supplement Appendix B. Most of these additional articles report using pesticide exposures that are generally longer, or at higher concentrations, than those used by the Districts. Several other factors are presented that may confound their reported results. Based on the information in these reviews, and comparisons of their reported exposure rates, the finding is that in general, the exposures are not relevant to District application scenarios. None of the additional reports contain information that would substantially change the impact assessments in the Draft PEIRs, i.e., would not change a conclusion of no impact or less-than-significant impact to potentially significant impact.

B.2 Approach to the Current Reviews

The objective of Appendix B was to review all active ingredients in use (or proposed for future use) and then to identify those active ingredients that may pose potential human health or ecological health concerns when used by the Districts. Extensive literature reviews were conducted to document the relevant reported toxicity and environmental fate of the pesticides of interest to the Districts. Following the examination in 2012 and 2013 of the reports on the Districts' pesticides, it was determined that three pesticides are of special interest as key methods of mosquito control and additional literature should be reviewed. The reports cited in this attachment are, therefore, focused on the three pesticides: 1) methoprene; 2) Bti; and 3) *B. sphaericus*. These pesticides are detailed and summarized in Chapter 4 of Appendix B (especially Table 4-1). Documented effects of each of these pesticides are presented in Tables 3-1, 3-2, and 3-3 of Chapter 3 of Appendix B. The reports evaluated for this attachment are supplemental to the original reports and generally include and publications not previously evaluated in Appendix B.

B.3 Conclusions

The additional reports listed in this attachment suggest that no modifications to the hazard assessments and conclusions provided in each District's Draft PEIR or Appendix B should be necessary for methoprene, Bti, or *B. sphaericus.*

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
Ali, A., R.J. Lobinske, R.J. Leckel, N. Carandang and A. Mazumdar. 2008. Population Survey and Control of Chironomidae (Diptera) in Wetlands in Northeastern Florida, USA. Florida Entomologist 91(3):446-452.	Two species of Chironomids, *Glyptotendipes paripes* and *Goeldichironomus carus* in Florida wetlands were evaluated for sensitivity to Temephos, Bti, and s-methoprene. This paper reviews the comparison of these larvicides both for efficacy and in cost. The summary of the paper suggests that Bti and S methoprene be used in rotation with Tim FR's for Midge control. The authors suggest that this approach in an IPM technique would have only temporary and reversible impact on nontarget biota. However, the study did not actually evaluate nontargets in the field as part of the study. Note: label rate is 5 to 10 lbs/acre for midges in wastewater ponds and systems. This study used methoprene pellets at a rate of 7.7 to 15 lbs/ acre to achieve 80 and 90% reduction of adult emergence in experimental field plots. Lab bioassys used rates that exceeded 18 or more times what would occur with exposure to maximum label rates.
Anonymous. 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life. Methoprene. Canadian Council of Ministers of the Environment. 11pp	Listing of Methoprene freshwater target levels for acceptable risk…..0.09 µg/L target organism, and 0.53 µg/L management value considered as target thresholds. These are values of water concentrations safe to non-target species.
Brown, M., D. Thomas, P. Mason, J.G. Greenwood and B.H. Kay. 1998. Laboratory and Field Evaluation of the Efficacy of Four Insecticides for *Aedes vigilax* (Diptera: Culicidae) and Toxicity to the Nontarget Shrimp *Leander tenuicornis* (Decapoda: Palaemonidae). J. Econ. Ent. 92(5):1045-1051.	This report describes laboratory and field tests of the toxicity of two organophosphate compounds (temephos and pirimiphosmethyl) and s-methoprene and *Bacillus thuringiensis ssp. israelensis* (Bti) to a saltwater mosquito (*Aedes vigilax*) including an evaluation of the selectivity for the mosquito and possible toxicity to a non-target shrimp *Leander tenuicornis* (a Decapod). In addition to developing LC 50 values the report includes measures of selectivity of each pesticide for the target organisms versus nontarget. The methoprene applications were highly toxic to the saltwater mosquito while not affecting survival of the shrimp that inhabit the same saltwater marsh areas. In addition, s-methoprene did not affect water quality. The authors suggest that methoprene is an "ideal pesticide for continued control of *Ae. vigilax* in Australian saltwater ponds.
Butler, M., H.S. Ginsburg, R.A. LeBrun and A. Gettman. 2010. Evaluation of Nontarget Effects of Methoprene Applied to Catch Basins for Mosquito Control. J. Vector Ecology. 35(2):372-384.	Measurements of methoprene concentrations were made from water in catch basins that were treated with methoprene and from an adjoining salt pond near where the catch basins emptied. Concentrations of methoprene in catch basins and at drainage outlets, after application at mosquito control label rates, were 0.5 ppb and lower, which was below levels determined to be detrimental to organisms other than mosquitoes. Effects of methoprene on communities of organisms that live in catch basins (lab simulated as well as field) were also evaluated. No evidence of declines in abundance of any taxa or consistent change in community level parameters (e.g. species richness, dominance-diversity relationships) was found.
Craggs, R., L. Golding, S. Clearwater, L. Susaria and W. Donovan. 2005. Control of Chironomid Midge Larvae in Wastewater Stabilization Ponds: Comparison of Five Compounds. Water Sci. Tech. 51(12):191-199.	The efficacy of Maldison, an organophosphate insecticide, was compared to *Bacillus thuringiensis* var*. israelensis* (Bti), methoprene, pyriproxyfen, and diflubenzuron. During 21-day small-scale trials, Bti, diflubenzuron and Maldison reduced live larval numbers by 80-89% compared to controls and adult emergence was markedly reduced by all compounds (72-96%). Large-scale trials with methoprene (Prolink XRG granules) at 32 kg total ingredient/ha (to give a final field concentration in the water column of 50 µg/L) reduced midge emergence by approximately 80% over 25 days. It should be noted that the rate of methoprene used in the large-scale field trials was significantly higher than maximum labels rates allowed for mosquito control applications.

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
Csondes, A. 2004. Environmental Fate of Methoprene. 6 pp whitepaper prepared by Cal. DPR.	Review of methoprene characteristics, physiochemical etc., includes tables of reported and verified toxicity and fate and transport properties. Methoprene is an insect growth regulator, used to control a variety of insect species, and is considered a biochemical pesticide. Rather than direct toxicity, methoprene disrupts the insects' metamorphosis and life cycle, thus hindering their ability to reach adulthood and successful reproduction. This paper provides an overview of the uses of Methoprene and descriptions of some special formulations used for mosquito control, especially in floodwater sites, rice cultivations, storm drains, ponds and water treatment works
Davis, R.S. and R. Peterson. 2008. Effects of Single and Multiple Applications of Mosquito Insecticides on Nontarget Arthropods. J. Amer. Mosq. Cont. Assoc. 24(2):270-280.	Experiments were conducted to assess the acute impacts of mosquito adulticides (permethrin and d-phenothrin) and larvicides (*Bacillus thuringiensis israelensis* and methoprene) on nontarget aquatic and terrestrial arthropods after a single application. This experiment was conducted in 2004 and 2005 with methoprene on nontarget terrestrial arthropods using a single application. For aquatic non-target species, no adverse treatment effects were observed. In general, nearly all of the responses evaluated for either study indicated few, if any, clear adverse effects from methoprene applications. Methoprene was used at near maximum label rate (93% of maximum which was 0.20 oz. AI per acre)
Degitz, S., E.J. Durhan, J.E. Tietge, P.A. Koslan, G.W. Holcombe and G.T. Ankley. 2003. Developmental Toxicity of Methoprene and Several Degradation Products in *Xenopus laevis*. Aquatic Toxicol. 64:97-105.	Methoprene is an insect juvenile growth hormone mimic, which inhibits pupation and is used for the control of emergent insect pests such as mosquitoes. Researchers have hypothesized that methoprene use in US may be a contributing factor to the recent increase in malformed amphibians. However, little is known concerning the developmental toxicity of methoprene and its degradation products in amphibians. In these studies, the aqueous stability and developmental toxicity of methoprene and several degradation products (methoprene acid, methoprene epoxide, 7-methoxycitronellal, and 7-methoxycitronellic acid) were examined. *Xenopus laevis* embryos (stage 8) were exposed to the test chemicals (aquatic test chambers with total immersion) for 96 h. Assays were conducted under static renewal (24 h) conditions and chemical concentrations in water were measured at the beginning and end of the renewal periods. Methoprene exposure did not result in developmental toxicity at concentrations up to 2 mg/l (equivalent to 2000 ppb which is 400 times max label application rate for mosquito control), which is slightly higher than its water solubility. Methoprene acid, a relatively minor degradation product, produced developmental toxicity when concentrations exceeded 1.25 mg/l. Methoprene epoxide and 7-methoxycitronellal caused developmental toxicity at concentrations of 2.5 mg/l and higher. 7-Methoxycitronellic acid was not developmentally toxic at a test concentration as high as 30 mg/l. These data indicate that methoprene and its degradation products are not potent development toxicants in *X. laevis*. This, in combination with the fact that field applications of sustained-release formulations of methoprene result in methoprene concentrations that do not typically exceed 0.01 mg/l, suggests that concerns for methoprene-mediated developmental toxicity to amphibians may be unwarranted.

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
Stark, J.D. 2005. A Review and Update of the Report "Environmental and Health Impacts of the Insect Juvenile Hormone Analogue, S-Methoprene" 1999. Report for the New Zealand Ministry of Health. 32pp.	Conclusions of this report were: 1) although methoprene is toxic to 12 orders of insects and may have effects on other nontarget organisms, particularly other nontarget arthropods, methoprene is one of the least environmentally damaging mosquito control agents and poses little risk to human and animal health; 2) concentrations of methoprene necessary to control mosquitoes (1 ppb) are much lower than the concentrations necessary to cause damage to populations of most nontarget organisms. Short half-life in the environment unlikely to accumulate in various environmental compartments. Although new literature has been published showing declines in insect biomass due to long-term use of methoprene and Bti in freshwater wetlands in Minnesota, USA, no evidence for permanent damage to ecosystem function has been found. The causal agent(s) of frog deformities in the USA has still not been clearly elucidated. Some believe these deformities are caused by a parasitic trematode, UV radiation and chemicals synergistically. Authors recommend that methoprene be the first choice for control and eradication of introduced mosquito species
Miyakawa, H., T.K. Hirakawa, O.Y. and Miyagawa, O.S. Tatarazako, T. Miura, J.K. Colbourne and T. Iguchi. 2013. A Mutation in the Receptor Methoprene-Tolerant Alters Juvenile Hormone Response in Insects and Crustaceans. Nature Communications 4, Article number: 1856doi:10.1038/14.	Most of the insects use juvenile hormone III as the innate juvenile hormone ligand. By contrast, crustaceans use methyl farnesoate. Despite this difference, the process of this ligand transition is unknown. A single amino-acid substitution in the receptor. Juvenile hormone-binding pockets of the orthologous genes differ by only two amino acids, yet a single substitution within Daphnia metabolic pathways appears to enhance the receptor's responsiveness to juvenile hormone III. These results suggest that this mutation within an ancestral insect lineage contributed to the evolution of a juvenile hormone III receptor system. This is a theoretical study and has no strong correlative response to the toxicity of methoprene.
Hurst, T.F., B.H. Kay, P.A. Ryan and M.D. Brown. 2007. Sublethal Effects of Mosquito Larvicides on Swimming Performance of Larvivorous Fish *Melanotaenia duboulayi* (Atherinoformes: Melanotaeniidae). J. Econ. Ent. 100(1):61-65.	Laboratory studies were conducted to determine the sublethal effects of exposure to the mosquito larvicides temephos, primiphos-methyl, Bti, *Bacillus sphaericus*, and methoprene. Methoprene exposures of 10 times the effective field concentration had no effect on the Australian Crimson-Spotted Rainbowfish (*Melanotaenia duboulayi*) swimming speed.

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
Kenyon, S. and G. Kennedy. 2001. Methoprene: A Review of the Impacts of the Insect Growth Regulator Methoprene on Nontarget Aquatic Organisms in Fish Bearing Waters (ver. 2.0). Prepared for the Massachusetts Pesticide Board Subcommittee. 40pp.	Although this paper includes no new data generated by these authors, this paper is a comprehensive overview of the reported effects of methoprene on non-target organisms, especially aquatic species, including a review of the reported effects of methoprene on amphibians. The authors report several critical findings and responses based on their reviews of existing publications: 1. Results reported in most published papers do not support the contention that methoprene applications for midge and mosquito control can lead to amphibian malformations. 2. Although some reports suggest that methoprene can adversely affect crustaceans, studies indicate that impacts to crustaceans may be variable in magnitude but are not likely to adversely impact crustaceans at expected environmental concentrations. 3. The use of methoprene at appropriate application levels would be less harmful to aquatic communities than other available mosquito pesticides for mosquito control. 4. Detailed physiochemical information on methoprene, including its short half-life in the environment, challenges reports of potentially irreversible harm to the aquatic ecosystem. 5. Regulatory issues pertaining to potential uses of methoprene for mosquito control are included that are relevant for several locations and states. The reviews in this report include critiques of many of the publications that have reported adverse impacts to non-target species and the ecosystem. 6. Summaries of methoprene publications are focused on plausible and reasonable confounding factors in each study that might account for the reported effects. Several special exposure conditions are discussed that may have played a role in reported effects, such as possible salinity toxicity and additive effects of solvents and media contaminants. This report provides extensive and realistic critiques of methoprene as a pesticide for mosquito control.
Lawler, S.P., D. Dritz and T. Jensen. 2000. Effects of Sustained Release Methoprene and a Combined Formulation of Liquid Methoprene and *Bacillus thuringiensis israelensis* on Insects in Salt Marshes. Arch. Environ. Contam. Toxicol. 39:177-182.	Applications of Bti liquid (Vectobac 12AS) and the methoprene products Altosid Liquid Larvicide and Altosid Pellets near maximum label rates in a salt marsh found no detectable effects of Bti, Bti and methoprene (duplex), or methoprene pellets on nontarget saltmarsh insects. Rates used were 13.68 oz. Bti/acre, 6.09 oz. liquid methoprene/acre, and 9.28 lb methoprene pellets per acre. All pesticides effectively controlled the salt marsh mosquito *Aedes dorsalis*.

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
McKenney, C.L. 2005. The Influence of Insect Juvenile Hormone Agonists on Metamorphosis and Reproduction in Estuarine Crustaceans. Integr. Comp. Biol. 45:97-105.	Comparative developmental and reproductive studies were performed on several species of estuarine crustaceans in response to three juvenile hormone agonists (pyriproxyfen, methoprene and fenoxycarb). Claims that larval development of the grass shrimp, *Palaemonetes pugio*, was greater than two orders of magnitude more sensitive to disruption by methoprene and fenoxycarb than was embryonic development. Developing larvae of the mud crab, *Rhithropanopeus harrisii*, exhibited reduced metamorphic success at lower concentrations of methoprene (100 ppb) and pyriproxyfen (50 ppb) than grass shrimp larvae (1000 ppb and 100 ppb respectively). The final crab larval stage, the megalopa, was more sensitive to methoprene and fenoxycarb exposure than earlier zoeal stages. Juvenile mysids (*Americamysis bahia*) released by exposed adults and reared through maturation without further exposure produced fewer young and had altered sex ratios (lower percentages of males) at lower parental-exposure concentrations than directly affected parental reproduction. These findings support a recommendation to use a functional approach (expanding the test base) as an appropriate screening procedure to evaluate potential environmental endocrine-disrupting chemicals in aquatic environments.
Olmstead, A. and G. LeBlanc. 2003. Insecticidal Juvenile Hormone Analogs Stimulate the Production of Male Offspring in the Crustacean *Daphnia magna*. Environ. Health Perspect. 111(7):919-924.	Juvenile hormone analogs (JHAs) represent a class of insecticides that were designed specifically to disrupt endocrine-regulated processes relatively unique to insects. Earlier report by these authors suggested that the crustacean juvenoid hormone methyl farnesoate (MF) at high levels (50 ppb) can initiate development of oocytes of crustacean Daphnia magna to develop into males. Authors suggest that insecticidal JHAs might mimic the action of MF to produce altered sex ratios of offspring. Daphnids were exposed continuously (3 weeks) to sublethal concentrations of MF, the JHA pyriproxyfen, and several non juvenoid chemicals to discern whether excess male offspring production is a generic response to stress or a specific response to juvenoid hormones. This response was not elicited by methoprene exposure.

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
Olmstead, A. and G. LeBlanc. 2001. Temporal and Quantitative Changes in Sexual Reproductive Cycling of the Cladoceran *Daphnia magna* by a Juvenile Hormone Analog. J. Exp. Zool. 290:148-155.	Cyclic parthenogens, such as the cladoceran, *Daphnia magna*, utilize both asexual (parthenogenetic) and sexual reproduction. Experiments were conducted with the juvenile hormone analog methoprene to test the hypothesis that members of the insect juvenile hormone/vertebrate retinoic acid family of transcription factors are involved in the regulation of sexual reproduction in daphnids. Neither methoprene food reduction, nor crowding independently stimulated entry into the sexual reproductive phase of the daphnids. However, the combination of food deprivation and crowding stimulated entry into the sexual reproductive phase characterized by an initial high production of males and the subsequent intermittent production of haploid egg-containing ephippia. Exposure to 160 nM methoprene (50 ppb) along with food deprivation and crowding caused a significant reduction in the percentage of males produced during the early phase of the sexual cycle and significantly increased the percentage of males produced during the later stages of the cycle. Methoprene concentrations as low as 6.4 nM (2 ppb) reduced the number of resting eggs produced and proportionately increased the production of parthenogenetically-produced neonates. These experiments demonstrate that methoprene may uncouple the coordinated production of males and resting eggs during the sexual reproductive period of *D. magna* at the levels tested Methoprene, at these concentrations, which are higher than typical application rates is said to stimulate male offspring production and defers their production to latter stages of the sexual reproductive period, while inhibiting the production of resting eggs and promoting the continuance of parthenogenetic reproduction
Olmstead, A. and G. LeBlanc. 2001. Low Exposure Concentration Effects of Methoprene on Endocrine Regulated Processes in the Crustacean *Daphnia magna*. Toxicol. Sciences. 62:268-273.	Methoprene may exert toxicity to crustaceans by mimicking or interfering with methyl farnesoate, a crustacean juvenoid. The authors suggest that methoprene interferes with endocrine-regulated processes in crustaceans by several mechanisms involving agonism or antagonism of juvenoid receptor complexes. In this present study, characterizing response curves for methoprene for endpoints related to development and reproduction of the crustacean *Daphnia magna* resulted in response thresholds at approximately 4 ppb, considerably higher than would be used in actual field scenarios. Molt frequency was reduced by methoprene in a concentration-dependent manner, at 4.2 nM (1.3 ppb) and a NOEC of 32 nM (9.9 ppb). Results in the study suggest that methoprene may elicit some toxicity to endocrine-related processes in the 5–50 nM (6 to 16 ppb) concentration range.

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
Rexrode, M., I. Abdel-Saheb and J. Andersen. 2008. Potential Risks of Labeled S-Methoprene Uses to the Federally Listed California Red-Legged Frog. Pesticide Effects Determination. U.S. EPA Biopesticide and Pollution Prevention Division. 77pp.	Based on the results of this reported assessment, the following hypotheses can be **rejected**: > The labeled use of S-methoprene impacts growth and viability of juvenile and adult CRLFs. causing mortality or by adversely affecting growth or fecundity: > indirect effects occur by reducing or changing the composition of food supply; > indirectly affects critical habitat by reducing or changing the composition of the aquatic plant community in the ponds and streams comprising the species' current range and designated critical habitat, thus affecting primary productivity and/or cover; > indirectly affects critical habitat by reducing or changing the composition of the terrestrial plant community (i.e., riparian habitat) and habitat in the ponds and streams comprising the species' current range and designated critical habitat; > modifies critical habitat changing breeding and non-breeding aquatic habitat (via modification of water quality parameters, habitat morphology, and/or sedimentation); > modifies the designated critical habitat of the CRLF by reducing the food supply required for normal growth and viability of juvenile and adult CRLFs; > modifies the designated critical habitat of the CRLF by reducing or changing upland habitat within 200 ft of the edge of the riparian vegetation necessary for shelter, foraging, and predator avoidance. > modifies the designated critical habitat of the CRLF by reducing or changing dispersal habitat within designated units and between occupied locations within 0.7 mi of each other that allow for movement between sites including both natural and altered sites that do not contain barriers to dispersal. > modifies the designated critical habitat of the CRLF by altering chemical characteristics necessary for normal response line, having a threshold of 12.6 nM (4 ppb). The conclusion is that there is a "may affect", but "not likely to adversely affect" determination for the CRLF from exposures to S-methoprene at levels above 4ppb (much higher than actual exposure when s-methoprene is used per the label for mosquito control.

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
Russell, T., B. Kay and G. Skilleter. 2009. Environmental Affects of Mosquito Insecticides on Saltmarsh Invertebrate Fauna. Aquatic Biology 6:77-90.	The effects of Bti and s-methoprene on nontarget aquatic and terrestrial fauna in 2 subtropical saltmarshes approximately 30 km apart are reported. Application rates used were 16.42 oz. Bti per acre and 4.93 oz. methoprene (Altosid Liquid Larvicide) which is slightly in excess of the maximum label rate. The main taxa collected from ephemeral pools were copepods and from terrestrial plots were springtails (*Collembola*), mites (*Acariformes*) and ants (*Hymenoptera*), with smaller numbers of beetles (*Coleoptera*), true bugs (*Heteroptera*) and flies (*Diptera*). Following applications of both products, inconsistent short-term (<20 d) differences in the composition of the arthropod community were noted. After applications of Bti to ephemeral pools, smaller numbers of copepods were recorded at only one locality and the difference was not significant. There were no significant effects of s-methoprene on the arthropods in ephemeral pools at either locality. There were few significant effects on any other taxa and these effects were also localized and short-lived. These results suggest that applications of s-methoprene do not impact the abundance and composition of nontarget arthropod assemblages in typical subtropical saltmarshes.
Sparling, D. 2000. Effects of Altosid and Abate-4E on Deformities and Survival in Southern Leopard Frogs Under Semi-Natural Conditions. J. Iowa Acad Sci. 107(3):90-91.	Experimental wetlands were sprayed with Abate-4E (a.i. temephos) and Altosid (a.i. methoprene) through the summer “following label directions" Tadpoles captured from ponds sprayed with Altosid had a 15% deformity rate mostly involving total or partially missing hind limbs. Tadpoles from control ponds had a 5% rate of deformities. The difference was statistically significant. The relative abundance of tadpoles from ponds sprayed with Abate-4E was significantly lower than those from Altosid-sprayed or control wetlands. This project was conducted with high concentrations of methoprene products to illicit these responses. Comparison of temephos and methoprene indicate that methoprene exposure at label rate did not illicit adverse effects.
Stueckle, T.A., J. Likens and C.M. Foran. 2009. Limb Regeneration and Molting Processes Under Chronic Methoprene Exposure in the Mud Fiddler Crab, *Uca pugnax.* Comp. Biochem. Physiol. Part C. 147:366-377.	This study evaluated the effect chronic methoprene exposure would have on male and female fiddler crab, *Uca pugnax*, limb regeneration and molting. Crabs were chronically exposed to methoprene (dissolved in acetone) concentrations of 0, 0.1, 1.0, 10, 100 and 1000 µg/L (0-1000 ppb). The authors found male crabs lost more weight per body volume than females, took longer to proceed through proecdysis when exposed to 0.1 µg/L methoprene, and exhibited elevated frequency for abnormal limb formation at 1.0 µg/L. Female crabs displayed no such trend. Methoprene also did not significantly alter extractable exoskeleton protein or chitin content, although variable water-soluble protein expression increased with exposure at 1.0 µg/L. The authors suggest that adult male *Uca pugnax* possess greater sensitivity to chronic methoprene exposure during limb regeneration and molting. The authors also point out that the daily pulsed methoprene exposure used in this study may over estimate real world exposure rates since known slow-release methoprene applications result in pulse frequencies ranging every 2-19 days with low to negligible levels between pulses.

Additional Methoprene Publications Reviewed

Publication Authors	Summary of Reported Findings
Stueckle, T.A. 2008. An Evaluation of the Non-Target Effects of Mosquito Control Pesticides on *Uca pugnax* Physiology, Limb Regeneration and Molting Processes. Dissertation submitted to Eberly College of Arts and Sciences at West Virginia University.	This study addresses the potential effects of methoprene and permethrin on physiology, limb regeneration and molting ability of a crustacean species, *Uca pugnax*. The author claims that chronic methoprene exposure at environmental concentrations may cause increased male abnormal regenerative limbs and delays in proecdysis. Both male and female crabs displayed increased variability in water-soluble exoskeleton protein. Results presented link both chemical and salinity regimes to potential harmful effects. The study also focuses on some of the possible additive effects of chemicals and media salinity as additive stressors (permethrin, methoprene and salinity). Concentrations of methoprene used in this study were between label rates for mosquito control to approximately 2.5 to 3X possible exposures based on label rates. The author reports that “most observations were no effect for methoprene alone. The study revealed no significant effects until the other test stressors (permethrin and salinity) were added and tested, suggesting that exposure of *Uca pugnax* to methoprene alone did not result in any significant adverse effects. In addition, males displayed some minor methoprene and permethrin non-additive effects on total exoskeleton protein content, reduced body mass gain, reduced carapace width gain and overall body condition loss. Females displayed only reduced carapace size gain and increased respiration rate, possibly due to increased metabolic and biotransformation of both pesticides. This report suggests that these results, although not significant, indicate that insect growth regulators, pyrethroid insecticides or their mixture into coastal wetland environments may pose a potential risk to crustaceans.
Walker, A., P. Bush, J. Puritz, T. Wilson, E.S. Chang, T. Miller, K. Halloway and M.N. Horst. 2005. Bioaccumulation and Metabolic Effects of the Endocrine Disruptor Methoprene in the Lobster, *Homarus americanus*. Integr. Comp. Biol. 45(1):118-126.	Methoprene has *suspected* toxic effects on larval and adult crustaceans reported recently for lobsters. These studies report the effects of continuous exposures of methoprene on larvae and adults. Low levels of methoprene had adverse effects on stage II lobster larvae at 1 ppb. Stage IV larvae were more resistant, but did exhibit increases in molt frequency beginning at exposures of 5 ppb. Juvenile lobsters exhibited variations in tissue susceptibility to methoprene pathway of lobster cuticle synthesis and the quality of the post-molt shell. It is likely that a combination of factors led to the reported reduced lobster population.

Additional Bti Publications Reviewed

Publication Authors	Summary of Reported Findings
Ali, A., R.J. Lobinske, R.J. Leckel, N Carandang, and A. Mazumdar. 2008. Population Survey and Control of Chironomidae (Diptera) in Wetlands in Northeastern Florida, USA. Florida Entomologist 91(3):446-452.	Two species of Chironomids, *Glyptotendipes paripes* and *Goeldichironomus carus* in Florida wetlands were evaluated for sensitivity to Temephos and Bti and s-methoprene. This paper reviews the comparison of these larvicides both for efficacy and in cost. The summary of the paper suggests that Bti and s-methoprene be used in rotation with Tim FR's for Midge control. The authors suggest that this rotation approach in an IPM technique would have only temporary and reversible impact on nontarget biota. However, the study did not actually evaluate nontargets in the field as part of the study. Rates of Bti used were 2.07 and 4.14 times maximum mosquito control label rates and achieved 52% and 88% reduction of adult emergence in experimental field plots.
Becker, N. 1998. The Use of *Bacillus thuringiensis* subsp. *israelensis* (Bti) Against Mosquitoes, With Special Emphasis on the Ecological Impact. Israel Journal of Entomology. 32:63-69.	Overview report on the use of Bti *Bacillus thuringiensis israelensis* products in Germany and information about the lack of adverse effects resulting from treatments. The author indicates that more than 200 tons of Bti is used annually worldwide without any evidence of harmful impact on the environment. In Germany, 97 cities and municipalities along a 310 kilometer stretch of the Upper Rhine River, with a total population of 2.5 million people, have treated areas to control mosquitoes, mainly the flood-water mosquito *Aedes vexans*, over a breeding area of some 600 km^2 of the Rhine's flood-plain. The control of Aedes mosquitoes in Germany is based solely on the use of Bti products. Precise mapping of the breeding sites accounts not only for the mosquito population but also wide ecological considerations. For instance, from 1981 to 1996 approximately 37 tons of Bti powder or almost 1,000 tons of Bti granules as well as 29 tons of Bti liquid concentrates have been used in Germany, treating over 1,000 km2 of breeding area, resulting in a reduction of the mosquito population by more than 90%. In an extensive monitoring program the environmental safety of Bti treatments is confirmed for each routine treatment. All investigations have shown that the numbers of *Aedes* mosquitoes are drastically reduced but that all other insects continue to develop in the water and provide, as winged adults, a food resource for birds, amphibians and bats.
Boissvert, M. and J. Boisvert. 2000. Effects of *Bacillus thuringiensis* var. *israelensis* on Target and Nontarget Organisms: A Review of Laboratory and Field Experiments. Biocontrol Science and Technology 10:517-561.	An extensive review of the literature was conducted concerning toxicity, mode of action, environmental fate, factors affecting efficacy, and effects on nontarget organisms for the biopesticide Bti (*Bacillus thuringiensis* var. *israelensis*). The majority of this review emphasizes nontarget impacts, analyzing the results of 75 studies covering 125 families, 300 genera and 400 species of target and nontarget organisms. Overall, formulations of Bti used at the label rates for mosquito control do not have a significant impact on most other animals or plants. It was however suggested that under different application conditions, the effects of Bti may be hard to predict. It was further suggested that high frequencies of application and/or over dosages of Bti against mosquitoes may result in some persistence of the toxic crystals, which could have potential adverse effects on the food web. It was recommended that more long-term and controlled studies be performed to better ascertain any potential food web effects that may occur with prolonged use and repeated applications of Bti.

Additional Bti Publications Reviewed

Publication Authors	Summary of Reported Findings
Brown, M., D. Thomas, P. Mason, J.G. Greenwood and B.H. Kay 1998. Laboratory and Field Evaluation of the Efficacy of Four Insecticides for *Aedes vigilax* (Diptera: Culicidae) and Toxicity to the Nontarget Shrimp *Leander tenuicornis* (Decapoda: Palaemonidae). J. Econ. Ent. 92(5):1045-1051.	This report describes laboratory and field tests of the toxicity of two organophosphate compounds (temephos and pirimiphosmethyl) and methoprene and *Bacillus thuringiensis* ssp*. israelensis*.to a saltwater mosquito (*Aedes vigilax*) including an evaluation of the selectivity for the mosquito and possible toxicity to a non-target shrimp *Leander tenuicornis* (a Decapod). In addition to developing LC 50 values the report includes measures of selectivity of each pesticide for the target organisms versus nontarget. The Bti applications were highly toxic to the saltwater mosquito while not affecting survival of the shrimp that inhabit the same saltwater marsh areas in the study. In addition, Bti did not affect water quality. The authors suggest that Bti is "ideal for continued control of *Ae. vigilax* in Australian saltwater ponds".
Cao, C., L. Sun, R. Wen, X. Li, H. Qu and Z. Wang. 2012. Toxicity and Affecting Factors of *Bacillus thuringiensis* var. *israelensis* on *Chironomus kiiensis* Larvae. J. Insect Sci. 12(article 126):1-8.	*Bacillus thuringiensis* var. *israelensis* (Bti). Laboratory bioassays were used to study toxicity and affecting factors of Bti on *Chironomus kiiensis* larvae using three commercial Bti formulations (oil miscible suspension, 1,200 ITU/mL (1gm); wettable powder, 1,200 ITU/mg (1gm); technical material, 5,000 ITU/mg, (4 gm) of Bti). The toxicity of Bti formulations to third and fourth instar *C. kiiensis* larvae was in decreasing order of technical material, oil miscible suspension, and wettable powder, based on the 12 and 24 hour LC50 values. Increasing larval densities (from 10 to 30 per bioassay cup) increased the LC50 values for fourth instar *C. kiiensis* larvae. The LC50 values for fourth instar larvae reared in sand substrate were higher than those from soil substrate, and autoclaved substrates significantly increased the LC50 values. The technical material of Bti at 12 and 24 hours responded similarly to changes in temperature between 30°C and 15°C, but the LC50 values at a range of tested temperatures showed distinct differences in time points. Study provided a comparison of efficacy of Bti formulations but no report on non-target effects in this article.
Caquet, T., M. Roucaute, P. Le Goff and L. Lagadic. 2011. Effects of Repeated Field Applications of Two Formulations of *Bacillus thuringiensis* var. *israelensis* on Nontarget Saltmarsh Invertebrates in Atlantic Coastal Wetlands. Ecotoxicology and Env. Safety. 74(5):1122-1130.	A 2-year controlled study on French Atlantic coastal saltmarsh wetlands was conducted to evaluate the effects of multiple applications of Bti. No adverse effects of the treatments were shown on the abundance of midge larvae, suggesting that the availability of these food sources for birds was not negatively affected by Bti applications. It was concluded that, as currently performed in Western France coastal wetlands, land-based treatments of saltmarsh pools for larval mosquito control with *Bti did not adversely impact nontarget aquatic invertebrate communities*. Near minimum mosquito control label rates for the Bti products Vectobac 12AS and Vectobac WG were utilized in this study.
Craggs, R., L. Golding, S. Clearwater, L. Susaria and W. Donovan. 2005. Control of Chironomid Midge Larvae in Wastewater Stabilization Ponds: Comparison of Five Compounds. Water Sci. Tech. 51(12):191-199.	The efficacy of Maldison, an organophosphate insecticide, was compared to *Bacillus thuringiensis* var. *israelensis* (Bti), methoprene, pyriproxyfen, and diflubenzuron. During 21-day small-scale trials, Bti, diflubenzuron and Maldison reduced live larval numbers by 80-89% compared to controls and adult emergence was markedly reduced by all compounds (72-96%). Large-scale trials with Bti (Vectobac WG) powder at 10 kg total ingredient/ha (to give a final concentration in the water column of 1000 µg/L) resulted in a slight reduction in midge larval numbers compared to controls and had little effect on adult emergence.
Davis, R.S. and R.K.D. Peterson. 2008. Effects of Single and Multiple Applications of Mosquito Insecticides on Nontarget Arthropods. J. Amer. Mosq. Cont. Assoc. 24(2):270-280.	Experiments were conducted to assess the acute impacts of mosquito adulticides (permethrin and d-phenothrin) and larvicides (*Bacillus thuringiensis israelensis* and methoprene) on nontarget aquatic and terrestrial arthropods after a single application. The first experiment was conducted in 2004 and 2005 with Bti on nontarget terrestrial arthropods after a single application. For aquatic samples, no overall treatment effects of Bti were observed. In general, nearly all of the responses evaluated in this study indicated few, if any, deleterious effects from Bti application.

Additional Bti Publications Reviewed

Publication Authors	**Summary of Reported Findings**
Duchet, C., M. Coutellec, E. Franquet, C. Lagneau and L. Lagadic. 2010. Population-Level Effects of Spinosad and *Bacillus thuringiensis israelensis* in *Daphnia pulex* and *Daphnia magna*: Comparison of Laboratory and Field Microcosm Exposure Conditions. Ecotoxicology, 19(7):1224-1237.	Use of a life table response approach to assess population-level effects of two insecticides used against mosquito larvae, spinosad (8 µg/l) and *Bacillus thuringiensis* var. *israelensis* (Bti, 0.5 µg/l), on two nontarget species, *Daphnia pulex* and *Daphnia magna* (Crustacea: Cladocera), under laboratory versus field microcosms conditions. In laboratory conditions, these theoretical calculations and analyses performed for each species suggests a negative effect of spinosad on survival, mean time at death, and fecundity as compared to controls and Bti-treated groups; for both species, population growth rate λ was lower under exposure to spinosad. In field microcosms, 2 days after larvicide application, differences in population growth rates were observed between spinosad exposure conditions, and control and Bti exposure conditions. Simulations performed on spinosad-exposed organisms led to population "extinction. *D. magna* was shown to be more sensitive than *D. pulex* to spinosad in the laboratory, and the effects were also detectable through field population demographic simulations.
Eder, E. and I. Schönbrunner, 2010. Toxicity of *Bacillus thuringiensis israelensis* on the Nontarget Organisms *Triops cancriformis*, *Branchipus schaefferi*, *Leptestheria dahalacensis* (*Crustacea*: *Branchiopoda*: *Notostraca*, *Anostraca*, *Spinicaudata*). The Open Environmental Pollution & Toxicology Journal. 2:16-20.	Authors report that in a blind and randomized study, early post-larval stages of the tadpole shrimp *Triops cancriformis*, the fairy shrimp *Branchipus schaefferi*, and the clam shrimp *Leptestheria dahalacensis* were exposed to different concentrations of a commonly available Bti suspension, equivalent to 0, 4.5 (recommended treatment concentration), 45, 450, and 4500x (related to the recommended level). No statistically significant correlations were found between Bti concentration and mortality or longevity of the examined organisms at any of the exposure levels studied.
Frouz, J., R.J. Lobinske, A. Yaqub and A. Ali. 2007. Larval Gut pH Profile in *Pestiferous Chironomus crassicaudatus* and *Glyptotendipes paripes* (Chironomidae: Diptera) in Reference to the Toxicity of *Bacillus thuringiensis serovar israelensis*. J. Amer. Mosq. Cont. Assoc. 23(3):355-358.	Gut pH was measured in the 4th-stage larvae of two chironomid species, *Chironomus crassicaudatus* and *Glyptotendipes paripes*. The gut pH in both species was close to neutral, varying from 6.7 to 7.4 and 6.9 to 7.6 pH units for *C. crassicaudatus* and *G paripes*, respectively. The gut pH in both chironomid species remained between pH values of 5.5 and 7. The pH profiles in these 2 species of chironomids are lower than for mosquitoes or Lepidoptera larvae. The authors suggest that this could be the reason for the relatively lower susceptibility of chironomid larvae to *Bacillus thuringiensis serovar israelensis* toxin proteins than some other nematoceran Diptera, specifically mosquitoes.
Stark, J.D.. 2005. A Review and Update of the Report "Environmental and Health Impacts of *Bacillus thuringiensis israelensis*" 1998 by Travis R. Glare and Maureen O'Callaghan. Report for the New Zealand Ministry of Health. 32pp.	Much of the new literature on nontarget effects still indicates that Bti is one of the least environmentally damaging pesticides used for mosquito control. Some reports have shown that large declines in insect biomass can occur after long-term use of Bti in freshwater wetlands. However, the authors indicate that no evidence for permanent damage to ecosystem function has been found. Organisms that utilized insects for food, adapted to the declines and either switched to other food sources or travelled (birds) outside of the treated zones to acquire insects. The authors suggest that the conclusions reached by Glare and O'Callaghan in 1998 (no significant impact of Bti on critical food sources) are valid and that Bti be used for control and eradication of introduced mosquito species (with rotation of methoprene). The authors justify their recommendation because they argue that alternative control agents, other than *Bacillus sphaericus*, are OP insecticides that are broad-spectrum neurotoxins that may pose a higher risk to the environment, human, and animal health than Bti.

Additional Bti Publications Reviewed

Publication Authors	**Summary of Reported Findings**
Hurst, T.P., B.H. Kay, P.A. Ryan, and M.D. Brown. 2007. Sublethal Effects of Mosquito Larvicides on Swimming Performance of Larvivorous Fish *Melanotaenia duboulayi* (Atheriniformes: Melanotaeniidae). J. Econ. Ent. 100(1):61-65.	Laboratory studies were conducted to determine the sublethal effects of exposure to the mosquito larvicides temephos, primiphos-methyl, Bti, *Bacillus sphaericus*, and methoprene. Bti exposures of 10 times the effective field concentration had no effect on the Australian Crimson-Spotted Rainbowfish (*Melanotaenia duboulayi*) swimming speed.
Lagadic. L. M. Roucaute and T. Caquet. 2014. Bti Sprays do not Adversely Affect Nontarget Aquatic Invertebrates in French Atlantic Coastal Wetlands. J. Applied Ecology. 51(1):102-113	This was a 6-year study sampling invertebrates in the water and sediment of control and Bti treated saltmarsh pools. Taxa abundance was the metric used along with physicochemical parameters in the same pools so that homogeneity of environmental conditions between the control and treated areas could be tested*. It was concluded that long-term use of Bti in coastal wetlands had no influence on the temporal evolution of the taxonomic structure and taxa abundance of nontarget aquatic invertebrate communities*, *(which is highly driven by abiotic factors).* In addition, over the long term, the amount of invertebrates that could be used as food resources by birds was maintained in Bti-treated areas. Subtle differences in the range of variation of abiotic factors result in discrepancies between control and treated area in terms of invertebrate abundance, which could be wrongly attributed to Bti.
Laurence, D., L. Christophe and F. Roger. 2012. Using the Bio-Insecticide *Bacillus thuringiensis israelensis* in Mosquito Control. www.intechopen.	This article provides an extensive and comprehensive review of the Bti formulations and use scenarios over the last few decades. Excellent source of the Bti background papers. General overview of several issues and information such as environmental factors affecting efficacy, effects on nontarget organisms, effects on ecosystems, managing mosquito resistance, and use with other bio-insecticides.
Lawler, S.P., D. Dritz and T. Jensen. 2000. Effects of Sustained Release Methoprene and a Combined Formulation of Liquid Methoprene and *Bacillus thuringiensis israelensis* on Insects in Salt Marshes. Arch. Environ. Contam. Toxicol. 39:177-182	Applications of Bti liquid (Vectobac 12AS and the methoprene products Altosid Liquid Larvicide and Altosid Pellets near maximum label rates in a salt marsh found no detectable effects of Bti, Bti and methoprene (duplex), or methoprene pellets on nontarget saltmarsh insects. The rate of Bti used was 13.68 oz./acre, which was also an effective for controlling the salt marsh mosquito *Aedes dorsalis*.
Liber, K., K.L. Schmude and D. Rau. 1998. Toxicity of *Bacillus thuringiensis* var. *israelensis* to Chironomids in Pond Mesocosms. Ecotox. 7(6):343-354.	A pond mesocosm wetland study was conducted to evaluate the potential toxicity of *Bacillus thuringiensis* var. *israelensis* to chironomids. Bti was applied to three replicate mesocosms for each of five applications rates (2.4, 8, 20, 40 and 80 lbs/acre), with the base application rate being 8 lbs/acre. The abundance of Chironomid larvae was significantly reduced at the 10x base rate treatment at 4 d. Chironomid abundance was reduced after a second application with 10x base rate, but recovered within 32 d. The abundance of Orthocladiinae larvae was significantly reduced at both the 10x and 5x base rate treatments, whereas the Tanypodinae appeared unaffected by all treatments, but no reductions were statistically significant. Emergence of adult Chironomidae was significantly reduced at the 10x base rate. Emergence of Ceratopogonidae and Chaoboridae was unaffected by all Bti treatments. The maximum mosquito control label rate for the formulation of Bti granules used in this study is 20 lb/acre.

Additional Bti Publications Reviewed

Publication Authors	**Summary of Reported Findings**
Lundstrom, J.O., Y. Brodin, M.L. Schafer, T.Z.P. Vinnersten and O. Ostman. 2010. High Species Richness of Chironomidae (Diptera) in Temporary Flooded Wetlands Associated with High Species Turnover Rates. Bull. Ent. Res. 100(4):433-444.	Species richness and species turnover of Chironomidae was studied in irregularly flooded wetlands of the River Dalälven flood-plains in central Sweden. Recurrent irregular floods may have induced high chironomid species richness. Half of the wetlands were treated with *Bacillus thuringiensis* var. *israelensis* (Bti) against larvae of the flood-water mosquito *Aedes sticticus*. These treatments had no significant effect on chironomid species richness, but there was a higher species turn-over between years of primarily low abundance species in the treated wetlands. The cumulative number of species was also higher in the Bti-treated experimental wetlands than in the untreated reference wetlands. Bti treatment appeared to have only small effects on chironomid species richness possibly due to a compensatory increase of the colonization-extinction dynamics.
Lundstrom, J.O., M.L. Schafer, E. Peterssen, T.Z.P. Vinnersten, J. Landin and Y. Brodin. 2009. Production of Wetland Chironomidae (Diptera) and the Effects of Using *Bacillus thuringiensis israelensis* for Mosquito Control. Bull. Ent. Res. 100(1):117-125.	*Bacillus thuringiensis* var. *israelensis* (Bti) is used to control immature mosquitoes in Sweden. Six years of monitoring Chironomidae, a nontarget organism, was conducted in three wetlands with Bti-treatment against mosquitoes and in three wetlands without treatment. Moderately high label rates (11.6 to 13.4 lbs/acre of the product Vectobac G (a corncob granule) were used. Emergence traps were used for continuous insect sampling. A total of 21,394 chironomids of 135 species were collected. No reduced production of chironomids was found, neither family nor subfamily level, in Bti-treated as compared to untreated wetlands. Four species had higher and one species had lower production in treated areas. Bti-based control of floodwater mosquitoes does not cause any major direct negative effects on chironomid production, and therefore does not induce any risk for indirect negative effects on birds, bats or any other predators feeding on chironomids.
Mezzomo, B.P., A.L. Miranda-Vilela, I.S. Freira, L.C.P. Barbosa, F.A. Portilho, Z.G.M. Lacava and C.K. Grisolia. 2013 Hematotoxicity of *Bacillus thuringiensis* as Spore-crystal Strains Cry1Aa, Cry1Ab, Cry1Ac or Cry2Aa in Swiss Albino Mice. J. Hematol. Thromb. Dis. 1:104 doi: 10.4172/2329-8790.1000104	Albino mice blood parameters were evaluated after gavage with a single dose of prepared Bt proteins as 27 mg/ Kg, 136 mg/Kg or 270 mg/Kg, 24 h, 72 h or 7 days before euthanasia. Binary combinations of these four spore-crystal proteins were also assayed at 270 mg/Kg with a single administration 24 h before euthanasia. Hematotoxicity evaluations of blood samples were conducted using an automated hematology analyzer and with a micronucleus test for genotoxicity analysis in mice bone marrow cells. Spore-crystal administrations provoked selective hematotoxicity for erythroid lineage. Reduction in bone marrow cell proliferation was seen but no genotoxic effects. Similar results were observed for binary combinations at 24 h, suggesting that further studies are required to clarify the mechanism involved in the hematotoxicity found in mice, and to establish the toxicological risks to nontarget organisms, especially mammals.

Additional Bti Publications Reviewed

Publication Authors	Summary of Reported Findings
Negri, A.P., R. M. Soo, F. Flores, N. S. Webster. 2009. *Bacillus* insecticides are not Acutely Harmful to Corals and Sponges. Mar. Ecol. Prog. Ser. 381:157-165.	*Bacillus thuringiensis* is widely considered an environmentally safe insecticide to control mosquitoes and a number of agriculture pests. Bacteria closely related to *B. thuringiensis* have recently been discovered in association with diseased sponges, which has raised concerns that *Bacillus* insecticides may be harmful to tropical marine invertebrates. Coral larvae and juvenile corals were exposed to the insecticides VectoBac® G (containing *B. thuringiensis israelensis*) and VectoLex® G (containing *B. sphaericus*) at concentrations up to 100 fold higher than concentrations that affect target immature mosquitoes. VectoBac G and VectoLex G had no effect on the survival and metamorphosis of *Acropora millepora* and *A. tenuis* larvae *at very high concentrations (5000 µg l^{-1}*). The juvenile corals of the same species were also unaffected after four sequential 48 h exposures to *B. thuringiensis israelensis* and *B. sphaericus* at different stages of development. Adult corals (*A. millepora*) and sponges (*Ianthella basta*) were exposed to a single 6 h pulse of 1000 µg l^{-1} VectoBac G. No evidence of coral or sponge disease was observed during the following 2 wk. These results indicate that insecticides containing *Bacillus* spp. are unlikely to be acutely pathogenic to corals and sponges.
Ostman, O., J.O. Lundstrom, and T.Z.P. Vinnersten. 2008. Effects of Mosquito Larvae Removal with *Bacillus thuringiensis israelensis* (Bti) on Natural Protozoan Communities. Hydrobiologia 607(1):231-235.	Mosquito larvae are considered important predators on protozoans and bacteria, and this study addresses a result of a reduction of mosquito larvae density in natural wetlands caused by application of Bti may indirectly affect these microbial communities. Six natural wetlands were used to illustrate that the densities of heterotrophic protozoans was on an average 4.5 times higher in wetland areas treated with Bti than in control areas. In addition, the taxonomic richness of heterotrophic protozoans increased on an average of 60% in areas with Bti application compared to control areas. The increase in protozoan density and richness was fairly consistent among sites of different wetland habitats, indicating a potential positive, but indirect effect of treatments.
Poopathi, S. and S. Abidha. 2010. Mosquitocidal Bacterial Toxins (*Bacillus sphaericus* and *Bacillus thuringiensis serovar israelensis*): Mode of Action, Cytopathological Effects and Mechanism of Resistance. J. Physiol. Pathophysiol. 1(3):22-38.	This paper provides a general overview and test data discussing the use of Bs and Bti (*Bacillus sphaericus* and *Bacillus thuringiensis* serovar *israelensis*): to provide effective alternatives to broad spectrum larvicides in many situations with little or no environmental impact. New recombinant bacteria are as potent as many synthetic chemical insecticides yet are less prone to resistance, as they typically contain a mixture of endotoxins with different modes of action.
Poulin, B. 2012. Indirect Effects of Bioinsecticides on the Nontarget Fauna: The Camargue Experiment Calls for Future Research. Acta Oecologia 44:28-32.	Birds from natural and human-inhabited areas were used as model species to assess trophic impacts that may have been caused by three years of Bti applications to a monitoring region. The author reports some significant effects of Bti spraying on abundance of reed-dwelling invertebrates serving as food to passerines, as well as on the diet and breeding success of house martins nesting in rural estates and small towns. This report supports several other studies that have reported adverse food web impacts (indirect effects) as a result of the Bt applications. Although these field studies are impacted by several confounding (non-chemical) impacts, the author suggests that these results are important in the context of indirect effects of spray applications.

Additional Bti Publications Reviewed

Publication Authors	**Summary of Reported Findings**
Poulin, B., G. Lefebvre and L. Paz. 2010. Red Flag for Green Spray: Adverse Trophic Effects of Bti on Breeding Birds. J. Applied Ecology 47(4):884-889.	Study of food web interactions in the field with *Bacillus thuringiensis israelensis* (Bti) applications at 34.21 oz. per acre, which is slightly above maximum label rates for mosquito control. Breeding house martins *Delichon urbicum* were used as a model species to test the effect of Bti spraying on foraging rates and chick diet prior to and during 3 years of Bti spraying in the Camargue, France. Intake of Nematocera (Diptera sub-order including midges and mosquitoes) and their predators (spiders and dragonflies) were reported to be decreased significantly at treated sites, concurrently with increased flying ant intake. Clutch size and fledgling survival were lower at treated sites relative to control. Breeding success was positively correlated with intake of Nematocera and their predators at the nest level. No previous study has provided compelling evidence of Bti affecting vertebrate populations following the suppression of prey species. Indirect effects caused by repeated application of Bti through food web interactions warrant more attention.
Russell, T., B. Kay and G. Skilleter. 2009. Environmental Affects of Mosquito Insecticides on Saltmarsh Invertebrate Fauna. Aquatic Biology 6:77-90.	The effects of Bti and s-methoprene on nontarget aquatic and terrestrial fauna in 2 subtropical saltmarshes approximately 30 km apart are reported. Application rates used were 16.42 oz. Bti per acre and 4.93 oz. methoprene (Altosid Liquid Larvicide) which is slightly in excess of the maximum label rate. The main taxa collected from ephemeral pools were copepods and from terrestrial plots were springtails (*Collembola*), mites (*Acariformes*) and ants (*Hymenoptera*), with smaller numbers of beetles (*Coleoptera*), true bugs (*Heteroptera*) and flies (*Diptera*). Following applications of both products, inconsistent short-term (<20 d) differences in the composition of the arthropod community were noted. After applications of Bti to ephemeral pools, smaller numbers of copepods were recorded, but at only one locality, and the difference was not significant. There were few significant effects on any other taxa and these effects were also localized and short-lived. These results suggest that applications of Bti and s-methoprene do not impact the abundance and composition of nontarget arthropod assemblages in subtropical saltmarshes, although more work is needed on potential sub-lethal effects on the communities studied.
Siegel, J.P. 2001. The Mammalian Safety of *Bacillus thuringiensis* Based Insecticides. J. Invert. Pathol. 77:13-21.	This is a short review paper. Numerous laboratory studies have demonstrated that *Bt* and *Bt* products are noninfectious and are toxic to mammals only at high doses. Only two literature reports of Bt infection in man suggest an adverse effect of *Bt* infection and all infected individuals had experienced either extensive burns or a blast injury, which predisposed them to infection. Two epidemiology studies conducted during large-scale aerial *Bt* serovar *kurstaki* spray campaigns reported no increased incidence of illness. Laboratory studies found no evidence of illness in rats and sheep fed *Bt* products, nor have epidemiology studies found increased incidence of diarrhea during *Bt* aerial spray campaigns. Increases in human antibody levels following exposure to Bt products have been reported but there was no increased incidence in asthma or other illness. Based on laboratory studies and field experience, *Bt* insecticides have an excellent safety record.

Additional Bti Publications Reviewed

Publication Authors	**Summary of Reported Findings**
Stevens, M., S. Helliwell and P.A. Hughes. 2005. Toxicity of *Bacillus thuringiensis* var. *israelensis* Formulations, Spinosad and Selected Synthetic Insecticides to *Chironomus tepperi Larvae*. J. Amer. Mosq. Cont. Assoc. 21(4):446-450.	Three *Bacillus thuringiensis* var. *israelensis* (Bti) formulations, the bacterial metabolite spinosad, and 7 synthetic insecticides were bioassayed against 4th instars of *Chironomus tepperi*. LC_{50} values were adjusted to reflect nominal ITU values of the 3 products, but there was still substantial variation in the calculated toxicity (LC50 values ranging from 1,200 ITU/L (1gm) to 2,580 ITU/L (2.2 gm). The differential activity between formulations observed may be a beneficial characteristic when controlling benthic species such as *C. tepperi*. Spinosad and the synthetic insecticides evaluated were all substantially more active than Bti.
Stevens, M., R.J. Akhurst, M.A. Clifton, and P.A. Hughes. 2004. Factors Affecting the Toxicity of *Bacillus thuringiensis* var. *israelensis* and *Bacillus sphaericus* to Fourth Instar Larvae of *Chironomus tepperi* (Diptera: Chironomidae). J. Invert. Pathology 86(3):104-110.	Laboratory bioassays were used to determine the toxicity of commercial products of strains of *Bacillus thuringiensis* var. *israelensis*, VectoBac WDG, 3000ITU/mg (2.5 gm in 1 ml) and *Bacillus sphaericus* to fourth instar larvae of *Chironomus tepperi*. Bioassays were conducted using different temperatures and combinations of larval ages and densities to determine if these factors affected toxicity. Bti exposures of 20-46 mg/L was toxic to fourth instar *C. tepperi* in bioassays using a sand substrate, with age and density increasing LC50 values. The results suggest that the product VectoBac WDG has the potential to provide selective control of this rice pest at economically viable application rates. The proposed effective application rates are 1.78-2.48 lbs/acre. The maximum label rate for mosquito control is 0.89 lb/acre.
Tilquin, M. M. Paris, S. Reynaud, L. Despres, P. Ravanel, R.A. Geremia and J. Gury. 2008. Long Lasting Persistence of *Bacillus thuringiensis* subsp. *israelensis* in Mosquito Natural Habitats. PLoS ONE 3(10):1-10.	These studies address the issue of the persistence, potential proliferation and environmental accumulation of Bti in natural mosquito habitats. The authors contend that Bti environmental persistence may lengthen the exposure time of insects to Bti and could increase the risk of development of resistance and negative impact to nontarget insects. *The exposures used in these studies are unrealistic, irrelevant to actual purposeful applications of Bti*, based on the theory that if one exposes anything to anything long enough results (positive or negative) MAY occur. The authors contend that Bti (a soil microorganism) is already present in most areas so that applications should be considered additive and residual" toxicity" of Bti in the environment is problematic.
Vaughn, I., C. Newberry, D.J. Hall, J.S. Ligget and S.J. Omerod. 2008. Evaluating Large Scale Effects of *Bacillus thuringiensis* var. *israelensis* on Non-Biting Midges (Chironomidae) in a Eutrophic Urban Lake. Freshwater Biol. 53:2117-2128.	Bti effects on larval chironomids from eight experimental treatments, over 3 years, on a eutrophic, urban lake of 200 ha were assessed. Vectobac 12AS (liquid Bti) was applied at a rate of 6.07 liters/ acre which is 1.6 times the maximum label rate for midge control and 6.42 times the maximum label rate for mosquito control. The first two experimental years provided limited evidence of Bti effects, with chironomid densities reduced by up to 14%. Increased scale of application and altered experimental design in the third year revealed reductions in chironomid larval densities of around 35% following Bti treatment, with suppression lasting several months. Results suggest that near-neutral buoyancy formulations of Bti can reduce chironomid numbers in large lakes exceeding 3 m depth where treatment methods avoid over-dispersion. Further studies are recommended to evaluate whether chironomids can be suppressed over longer periods using whole-lake application without long-term ecological implications.
Waalwijk, C., A. Dullemans, G. Wiegers and P. Smits. 1992. Toxicity of *Bacillus thuringiensis* variety *israelensis* Against Tipulid Larvae. J. Appl. Ent. 114:415-420.	Tests with cultures of *Bacillus thuringiensis* were conducted for toxicity to both laboratory and field collected tipulid larvae (leatherjackets). Observed toxicity was shown to be primarily from the parasporal crystals. High pH in the midgut of the tipulid larva was required for the primary step in the pathogenesis of *B. thuringiensis* var. *israelensis*. The authors suggest that the toxicity of one of the Bti crystal proteins is a likely toxin to tipulid larvae. Additional bioassays suggested that *Escherichia coli* recombinants carrying this gene were toxic for L1 larvae of *Tipula oleracea*.

Additional Bti Publications Reviewed

Publication Authors	Summary of Reported Findings
Wirth, M. 2010. Mosquito Resistance to Bacterial Larvicidal Toxins. Open Toxicology Journal. 3:126-140.	Study of possible development of cross-resistance of *Bacillus thuringiensis*. *Bacillus sphaericus* (Bs) is at higher risk for resistance due to its single site action. Cross-resistance is reported among the various Bs isolates. Field and lab evolved resistant populations consistently show recessive and monofactorial inheritance of resistance. Recommended resistance management strategies include application rotations and using mixtures of Bti and Bs. The authors suggest that promising new strategies include genetic engineering to increase the toxin complexity targeted toward mosquito larvae, to enhance the host range of the mosquito control product, and to avoid the evolution of insecticide resistance.

Additional *B. sphaericus* Publications Reviewed

Publication Authors	**Summary of Report Findings**
Brown, M.D., T.M. Watson, J. Carter, D.M. Purdie and B.H. Kay. 2004. Toxicity of VectoLex (*Bacillus sphaericus*) Products to Selected Australian Mosquito and Nontarget Species. J. Econ. Ent. 97(1):51-58.	Laboratory and field bioassay (efficacy) studies were conducted in southeast Queensland, Australia, on the efficacy of VectoLex Control Granule (CG; active ingredient [AI]:50 *Bacillus sphaericus* [*Bs*] International Toxic Units [ITU]/mg, 50gm product/mg) and VectoLex Water Dispersible Granule (WDG) (AI: 650 *Bs* ITU/mg, 650 gm product/mg) formulations against third-instar larvae of *Culex annulirostris* Skuse, *Culex quinquefasciatus* Say, *Culex sitiens* Wiedemann, *Ochlerotatus rigilax* (Skuse), *Ochlerotatus*. *notoscriptus* (Skuse), and *Aedes aegypti* (L.). Laboratory 48-h LC95 values were determined. The *Bs* formulations were most effective against *Culex* spp., with the WDG 10-100 times more effective than the CG on an ITU/mosquito basis. Weekly cohorts of caged third-instar *Cx. annulirostris* were exposed to replicated low (250 g/ha), medium (500 g/ha), and high (1,000 g/ha) dosages of WDG. Concurrent assessment of *Cx. quinquefasciatus* mortality outside the cages was also conducted. In water with high organic content, the low rate produced > 99% *Cx. annulirostris* mortality at 48 h, decreasing to 79% at week 3 and no control at week 4. The medium and high rates resulted in 100% *Cx. annulirostris* mortality for 2 wk post treatment, decreasing to 95% at week 3, and no control at week 4. The WDG was equally effective against *Cx. quinquefasciatus*. *Treatment did not affect water quality or nontarget shrimp and fish species survival*.
Hurst, T.P., B.H. Kay, P.A. Ryan and M.D. Brown. 2007. Sublethal Effects of Mosquito Larvicides on Swimming Performance of Larvivorous Fish *Melanotaenia duboulayi* (Atheriniformes: Melantaeniidae). J. Econ. Ent. 100(1):61-65.	Laboratory studies were conducted to determine the sublethal effects of exposure to the mosquito larvicides temephos, primiphos-methyl, Bti, Bacillus sphaericus, and methoprene. *Bacillus sphaericus* exposures of 10 times the effective field concentration had no effect on the Australian Crimson-Spotted Rainbowfish (*Melanotaenia duboulayi*) swimming speed.
Merritt, R.W., J.L. Lessard, K.J. Wessell, O. Hernandez, M.B. Berg, J.R. Wallace, J.A. Novak, J. Ryan and B.W. Merritt. 2005. Lack of Effects of *Bacillus sphaericus* (VectoLex) on Nontarget Organisms in a Mosquito-Control Program in Southeastern Wisconsin: A 3 Year Study. J. Amer. Mosq. Cont. Assoc. 21(2):201-212.	A 3-year study (2000-2002) in southeastern Wisconsin was conducted to assess the effects of *Bacillus sphaericus* applied for mosquito control on nontarget wetland invertebrates. The experimental design consisted of control and treatment sites (that were applied by helicopter with VectoLex CG), each in 2 vegetation habitat types: reed canary grass marsh (*Phalaris arundinacea*) and cattail marsh (*Typha* spp.). In each of these areas, a predetermined number of timed (30-sec) D-frame aquatic net samples containing vegetation, detritus, and invertebrates were collected 1 day before spraying and 72 h after spraying to detect for effects. We examined and compared 5 bioassessment measures to determine if there was an effect of *B. sphaericus* on nontarget organisms during each of the sampling years. The metrics tested were (1) mean taxa richness (the mean number of all taxa), (2) mean diversity (combines taxa richness and abundances in a summary statistic; i.e., Shannon Index [H'I]), (3) Diptera richness (minus mosquitoes) as a proportion of all other taxa richness (Diptera/others richness), (4) Diptera abundance (minus mosquitoes) as a proportion of all other invertebrate abundance (Diptera/others abundance), and (5) functional group changes in percent collector-gatherers, collector-filterers, scrapers, shredders, and predators. When VectoLex was applied during *6 treatments at the labeled dosage*, no detrimental effects to nontarget organisms could be attributed to this microbial insecticide. Variation in the control vs. treatment and pre vs. post plots was attributed to factors other than the effects of *B. sphaericus* on nontarget organisms, (time of sampling, natural variation that occurs in such diverse habitats as canary grass and cattail marshes, and water depth, which varied among years).

Additional *B. sphaericus* Publications Reviewed

Publication Authors	**Summary of Report Findings**
Negri, A.P., R.M. Soo, F. Flores and N.S. Webster. 2009. Bacillus Insecticides are not Acutely Harmful to Corals and Sponges. Mar. Ecol. Prog. Ser. 381:157-165.	Bacteria closely related to *B. thuringiensis* have recently been discovered in association with diseased sponges, which has raised concerns that *Bacillus* insecticides may be harmful to tropical marine invertebrates. Coral larvae and juvenile corals were exposed to the insecticides VectoBac® G (containing *B. thuringiensis israelensis*) and VectoLex® G (containing *B. sphaericus*) at concentrations up to 100 fold higher than concentrations that affect immature mosquitoes. VectoBac G and VectoLex G had no effect on the survival and metamorphosis of *Acropora millepora* and *A. tenuis* larvae *at very high concentrations (5000 µg l^{-1}*). The juvenile corals of the same species were also unaffected after 4 sequential 48 h exposures to *B. thuringiensis israelensis* and *B. sphaericus* at different stages of development. These results indicate that insecticides containing *Bacillus* spp. are unlikely to be acutely pathogenic to corals and sponges.
Poopathi, S. and S. Abidha. 2010. Mosquitocidal Bacterial Toxins (*Bacillus sphaericus* and *Bacillus thuringiensis* serovar *israelensis*): Mode of Action, Cytopathological Effects and Mechanism of Resistance. J. Physiol. Pathophysiol. 1(3):22-38.	This paper provides a general overview and test data discussing the use of Bs and Bti (*Bacillus sphaericus* and *Bacillus thuringiensis* serovar *israelensis*) to provide effective alternatives to broad spectrum larvicides in many situations with little or no environmental impact. New recombinant bacteria are as potent as many synthetic chemical insecticides yet are less prone to resistance, as they typically contain a mixture of endotoxins with different modes of action.
Stevens, M.M., et al., 2004. Factors Affecting the Toxicity of *Bacillus thuringienss* var. *israelensis* and *Bacillus sphaericus* to Fourth Instar Larvae of *Chironomus tepperi* (Diptera: Chironomidae). J. Invert. Pathology. 86(3):104-110.	Laboratory bioassays were used to determine the toxicity of commercial products of strains of *Bacillus thuringiensis* var. *israelensis* Vectobac WDG, 3000 ITU/mg (2.5 gm in 1 ml) and *Bacillus sphaericus*, VectoLex WDG, 650 ITU/mg, to fourth instar larvae of *Chironomus tepperi*. Bioassays were conducted using different temperatures and combinations of larval ages and densities to determine if these factors affected toxicity. VectoLex WDG showed very low toxicity to *C. tepperi* larvae, and the overall impact of larval age and density was relatively minor (LC50 values 1062-1340 mg/L). VectoLex WDG was determined to be ineffective against the Australian rice pest *C. tepperi*.

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