Integrated Mosquito and Vector Management Programs

APPENDIX F

RESPONSES TO COMMENTS

Table of Contents

Acronyms

ADD	attention deficit disorder
ASD	autism spectrum disorder
BMP	best management practice
CCD	colony collapse disorder
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CDPR	California Department of Pesticide Regulation
CEQA	California Environmental Quality Act
CRLF	California red-legged frog
CTS	California tiger salamander
DD	developmental delay
EIR	Environmental Impact Report
IARC	International Agency for Research on Cancer
IMVMP/Program	Integrated Mosquito and Vector Management Program
IPM	integrated pest management
IVM	integrated vector management
LOC	Level of Concern
MVCAC	Mosquito and Vector Control Association of California
NPDES	National Pollutant Discharge Elimination System
PAP	Pesticide Application Plan
PEIR	Programmatic Environmental Impact Report
RQ	Risk Quotient
SFGS	San Francisco garter snake
SMCMVCD/District	San Mateo County Mosquito & Vector Control District
SWRCB	State Water Resources Control Board
TMDL	total maximum daily load
ULV	ultralow volume
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
USFWS	US Fish and Wildlife Service
WHO	World Health Organization
WNV	West Nile virus
WSP	western snowy plover

1 Introduction

This Appendix F, Responses to Comments has been prepared by the San Mateo County Mosquito and Vector Control District (SMCMVCD or District) to accompany the revised Draft Programmatic Environmental Impact Report (Draft PEIR) for the proposed Integrated Mosquito and Vector Management Program (IMVMP). The first Draft PEIR (released in March 2016) identified the environmental consequences associated with a range of chemical and nonchemical treatment alternatives (components/methods/tools) for its ongoing program of surveillance and control of mosquitoes and other vectors of human and animal disease and discomfort. It included discussion of best management practices (BMPs) to avoid and/or minimize potential impacts and additional proposed mitigation measures to reduce potentially significant impacts to less than significant. The Responses to Comments document presents responses to public comments received on the first Draft PEIR.

The District is the lead agency under the California Environmental Quality Act (CEQA) with responsibility for preparing responses to public comments and the Final PEIR.

The District has decided to recirculate the Draft PEIR; therefore, the Final PEIR has been delayed. As a result, the District is not required to address the comments on the March 2016 document but has chosen to provide responses herein that are now part of the Draft PEIR. New comments on the revised Draft PEIR will be addressed and incorporated into the Final PEIR.

1.1 Environmental Review Process

The District released the Integrated Vector Management Program Draft PEIR on March 21, 2016, for public review (State Clearinghouse No. 2012052063). The 49-day public review (45 days minimum plus 4 extra days) and comment period began on March 22 and concluded on May 9. During this time, the District held one public hearing at the Veterans Memorial Recreation Center in San Bruno, California on April 20, 2016. There were no oral comments provided at the public hearing; therefore, the hearing transcript is not included herein.

The State of California Governor’s Office of Planning and Research State Clearinghouse and Planning Unit provided a letter dated May 10, 2016, that the District has complied with the State Clearinghouse review requirements for draft environmental documents pursuant to the California Environmental Quality Act. This letter is provided herein at the end of this chapter. The letter from the Department of Transportation, District 4 that was sent to the Clearinghouse is included in this Appendix F document in Chapter 2, Agency Responses.

Each written response describes the disposition of significant environmental issues raised by the commenter. These responses supplement material contained in the text of the revised Draft PEIR. In most cases, the responses refer to material located in the first Draft PEIR. Where the response is intended to result in a text revision to the March 2016 document, that revision is made directly in the revised Draft PEIR, and the response indicates this. None of these text changes result in any changes to the conclusions and determinations of significant impact. In other words, no “less-than-significant” impacts were changed to “potentially significant” or “significant and unavoidable” impacts. Furthermore, no new significant impacts were discovered.

1.2 Report Organization

This Responses to Comments document (Appendix F of the revised Draft PEIR contains the following chapters with a brief explanation of chapter contents.

> **Chapter 2. Public Agency Comments and Responses:** Comments received from one federal, one state, and one local agency are provided with District responses following each letter.

> **Chapter 3. Organization Comments and Responses:** Three letters were provided from an Indian tribe, a private organization/special interest group, and an attorney representing a special interest group. District responses to comments follow each letter or attachments to a letter.

> **Chapter 4. Individual Comments and Responses:** The District received 5 emails from individuals, including individuals who are associated with private organizations. The letters and responses are provided alphabetically.

The following is a list of all public agencies (coded F [Federal}, S [state], L [local]), private organizations (coded O), and private individuals (coded I) who submitted written comments on the Draft PEIR during the comment period. Each letter is assigned a code that includes at least three letters for the agency, organization, or individual name.

Public Agencies

F-USFWS	United States Fish and Wildlife Service
S-DOT	California Department of Transportation
L-SMCP	San Mateo County Department of Parks and Recreation

Private Organizations

O-PSR	Physicians for Social Responsibility, San Francisco Bay Area Chapter
O-TOR	Torres Martinez Desert Cahuilla Indians
O-VOL	Stephan C. Volker Law Offices, representing Healthy Children Alliance

Private Individuals

I-Cal	Jennifer Caldwell, Caldwell-Fisher Charitable Foundation
I-Coo	Ken Cook, Environmental Working Group
I-Gar	Christine Gardner, Environmental Working Group
I-Roo	Serena Roosevelt, Environmental Working Group
I-Sch	Sandra L Schmaier, Families Against the S. F. LBAM Spray Robert D. Schmaier

In the responses to comments, references may be made to responses to a different commenter. For example, if the commenter is directed to see Response O-VOL-22, that reference will be to the response to comment 22 in the letter labeled O-VOL. To protect the privacy of individuals, their address in the comment letter may be redacted (obscured).

STATE OF CALIFORNIA
GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH
STATE CLEARINGHOUSE AND PLANNING UNIT

EDMUND G. BROWN JR.
GOVERNOR

KEN ALEX
DIRECTOR

May 10, 2016

RECEIVED
MAY 13 2016
BY: ......

Chindi Peavey
San Mateo County Mosquito and Vector Control District
1351 Rollins Road
Burlingame, CA 94010

Subject: San Mateo County MVCD Integrated Mosquito and Vector Management Program
SCH#: 2012052063

Dear Chindi Peavey:

The State Clearinghouse submitted the above named Draft EIR to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on May 9, 2016, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Enclosures
cc: Resources Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH# 2012052063
Project Title San Mateo County MVCD Integrated Mosquito and Vector Management Program
Lead Agency San Mateo County Mosquito and Vector Control District

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Type EIR Draft EIR

Description The San Mateo County Mosquito and Vector Control District (District/Project Sponsor) undertakes activities through its Integrated Mosquito and Vector Management Program (IMVMP) to control the following vectors of disease and/or discomfort within its San Mateo County Service Area: mosquitoes, rats, yellow jackets, and ticks. (A vector is defined as "any animal capable of transmitting the causative agent of human disease or capable of producing human discomfort or injury..." (The CA Health and Safety Code, Section 2200(f)). The District is preparing a PEIR to evaluate the effects of the continued implementation of the control strategies and methods prescribed in its IMVMP.

Lead Agency Contact

Name Chindi Peavey
Agency San Mateo County Mosquito and Vector Control District
Phone 650-344-8592 **Fax**
email
Address 1351 Rollins Road
City Burlingame **State** CA **Zip** 94010

Project Location

County San Mateo
City
Region
Lat / Long
Cross Streets NA - possible activities throughout San Mateo County
Parcel No.
Township **Range** **Section** **Base**

Proximity to:

Highways Hwy 101, 280
Airports San Francisco
Railways
Waterways
Schools
Land Use NA - covers all cities and unincorporated, developed and undeveloped area within San Mateo County

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Project Issues Air Quality; Biological Resources; Noise; Public Services; Recreation/Parks; Septic System; Toxic/Hazardous; Vegetation; Water Quality; Landuse; Cumulative Effects; Other Issues; Wetland/Riparian

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Reviewing Agencies Resources Agency; Department of Fish and Wildlife, Region 3; California Coastal Commission; San Francisco Bay Conservation and Development Commission; Department of Water Resources; Office of Historic Preservation; Department of Parks and Recreation; California Highway Patrol; Caltrans, District 4; Air Resources Board; Regional Water Quality Control Board, Region 2; Department of Toxic Substances Control; Native American Heritage Commission; Other Agency(ies)

Date Received 03/25/2016 **Start of Review** 03/25/2016 **End of Review** 05/09/2016

RECEIVED 03/29/2016 16:53 916-323-3018 STATE CLEARINGHOUSE
Mar 29 2016 4:22PM HP LASERJET FAX p.1

STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY EDMUND G. BROWN Jr., Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
P.O. BOX 23660, MS-10D
OAKLAND, CA 94623-0660
PHONE (510) 286-5528
FAX (510) 286-5559
TTY 711
http://www.dot.ca.gov/dist4/

CGOR
5-9-16
E

Serious Drought.
Help save water!

March 30, 2016

SMGen087
SCH# 2012052063

Dr. Chindi Peavey
San Mateo County Mosquito
and Vector Control District
1351 Rollins Road
Burlingame, CA 94010

Governor's Office of Planning & Research
MAR 29 2016
STATE CLEARINGHOUSE

Dear Dr. Peavey:

San Mateo County Mosquito and Vector Control District Mosquito and Vector Management Program – Programmatic Draft Environmental Impact Report

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above project. The mission of Caltrans is to provide a safe, healthy, sustainable, integrated, and efficient transportation system to enhance California's economy and livability. The following comments are based on the Programmatic Draft Environmental Impact Report (PDEIR).

Project Understanding
This project is the continuation of the implementation of vector control methods and actions that are components of the San Mateo County Vector Control District's (District) Integrated Mosquito and Vector Management Program. Components include surveillance, physical control, vegetation management, biological control, chemical control, and non-chemical control methods such as trapping rodents that pose a threat to public health and welfare. We understand many of these methods could encroach onto the State right-of-way (ROW) through atmospheric deposition, waterway transport, etcetera, and/or the need for the District to utilize State roadways for the application of control activities.

Prior to any work being done adjacent to the State ROW, please contact Mr. Robert Young, Senior Biologist, Caltrans, District 4, Office of Environmental Maintenance at (510) 286-4502 or robert.s.young@dot.ca.gov.

Dr. Chindi Pavey/SMCMVCD
March 30, 2016
Page 2

Lead Agency Responsibilities
As the lead agency, the District is responsible for all project mitigation. The project's scheduling, implementation responsibilities, and lead agency monitoring should be fully discussed for all proposed mitigation measures. This information should be presented in the Mitigation Monitoring and Reporting Plan of the Environmental Document. An Encroachment Permit is required for work in the State ROW.

Encroachment Permit
Work that encroaches onto the State ROW requires an encroachment permit that is issued by Caltrans. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating the State ROW must be submitted to: Mr. David Sallady, Office of Permits, California Department of Transportation, District 4, P.O. 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the plans during the encroachment permit process. See the following website link for more information: http://www.dot.ca.gov/hq/traffops/developserv/permits/.

Transportation Management Plan
If it is determined that traffic restrictions and detours are needed on or affecting the State highway system, a Transportation Management Plan (TMP) may be required and approved by Caltrans prior to construction. TMPs must be prepared in accordance with *California Manual on Uniform Traffic Control Devices* (CA-MUTCD). Further information is available for download at the following web address:
http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/camutcd2012/Part6.pdf.

Please ensure that such plans are also prepared in accordance with the transportation management plan requirements of the corresponding jurisdictions. For further TMP assistance, please contact the Office Traffic Management Plans at (510) 286-4579.

Please feel free to call or email Sandra Finegan at (510) 622-1644 or sandra.finegan@dot.ca.gov with any questions regarding this letter.

Sincerely,

PATRICIA MAURICE
District Branch Chief
Local Development – Intergovernmental Review

c: State Clearinghouse

2 Public Agency Comments and Responses

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F-USFWS

United States Department of the Interior

FISH AND WILDLIFE SERVICE
San Francisco Bay National Wildlife Refuge Complex
1 Marshlands Road
Fremont, California 94555

May 9, 2016

Dr. Chindi Peavey
District Manager for San Mateo County Mosquito and Vector Control District
1351 Rollins Road
Burlingame, CA 94010

SUBJECT: Comments regarding the Draft Programmatic Environmental Impact Report for the San Mateo County Mosquito and Vector Control District's Integrated Mosquito and Vector Management Program SCH# 2012052063 (Draft PEIR)

Dear Ms. Peavey:

The U.S. Fish and Wildlife Service, Don Edwards San Francisco Bay National Wildlife Refuge (Refuge) appreciates the opportunity to comment on the Draft Programmatic Environmental Impact Report for the San Mateo County Mosquito and Vector Control District's Integrated Mosquito and Vector Management Program SCH# 2012052063 (Draft PEIR).

We are pleased to see much of our joint effort to develop a Refuge Mosquito Management Plan carried forward in your plan. We encourage you to consider implementing many of the best management practices identified for Refuge lands in similar habitats of non-Refuge lands. Our review of the document yielded several concerns. We offer these comments for your consideration.

General

- There is no discussion or table on treatment thresholds to show when physical, biological, or chemical controls would be conducted. How is treatment triggered for disease and for discomfort? Some type of quantitative range in a table format would be informative. 1
- "Alternatives" under the proposed program seem misleading. It suggests that they are separate and optional from one another, when it reality, they are a suite of actions that would be used together as one comprehensive alternative to respond to different mosquito population conditions. 2
- A map of where activities/alternatives occur, especially by habitat type, would be informative. 3

Best Management Practices (Table 2-8, Table 4-5, Table 5-4)

- We encourage you to use the same BMPs for known and potential listed species habitats as for listed species habitat on Refuge lands. 4
- We suggest adding BMPs for Western snowy plovers.
- We suggest adding California Tiger Salamander to BMPs in Table 2-8, Table 4-5, and Table 5-4, E. 5
- We suggest adding the following BMPs to Table 2-8, Table 4-5, and Table 5-4, E. California Red 6

F-USFWS

Legged Frog and San Francisco Garter Snake:

1. To avoid transferring disease or pathogens between aquatic habitats, mosquito abatement technicians will follow the Declining Amphibian Population Task Force's Fieldwork Code of Practice 6 cont'd

Vegetation Management

- Maps of where maintenance activities (physical control and vegetation management alternative) historically occur would be informative. Also, it would be helpful to differentiate between ditches, natural channels, and stream tributaries on a map. 7
- We request notification of and the opportunity to observe vegetation management activities that occur on the Refuge. 8

Herbicides

- Currently, your agency does not have permission to administer herbicides on the Refuge. If herbicide treatment is necessary on the Refuge, approval must be sought from the Refuge manager and the herbicide must have an approved Pesticide Use Proposal. 9

Pesticides

- With regard to the pesticide Spinosad, U.S. Fish and Wildlife Service does not allow the use of *Saacharopolyspora spinosa* on national wildlife refuges due to its moderate to high toxicity to non-target aquatic and terrestrial invertebrates. We highly caution the use of Spinosad in San Mateo County. We recommend that more research be conducted to reduce effects to non-target insects prior to the broad use of Spinosad products in San Mateo County. 10
- We suggest separating Bacterial larvicides in Table 4-7 to more accurately display toxicity difference between Bti, Bs and Spinosad. Spinosad is moderately toxic to aquatic organisms (reference listed below). 11
- The information is already outdated for Spinosad in Appendix B 4.3.3 and information within the DEIR should include new research and actual treatment locations that are documented in Appendix B Use Tables. In addition to the habitats listed in Appendix B, 4.3.3, Spinosad has also been used in reclaimed marshes, marshes, natural ponds and creeks which are not listed in the description. 12
- A reminder that your agency does not have permission to administer adulticides on the Refuge. If adulticide treatment is necessary on the Refuge, your agency must contact the Refuge and initiate an Emergency Section 7 Consultation and the Refuge would work cooperatively with the District to get an approved PUP in place. 13
- With regard to the Chemical Control Alternative, the impact determinations appear correct for larvicide use, however we do not agree with the "Less Than Significant" determinations in AR-26 and TR-25 for the use of adulticides which may have a significant impact on candidate, sensitive, or special status species, aquatic species including fish and non-target species and terrestrial species. 14
- We request notification of any fogging events near the Refuge. 15

Chapter 4 Biological Resources- Aquatic

- Please add the Marine Mammal Protection Act to the Federal Regulatory Setting (4.1.3.1). There are significant harbor seal haul outs and pupping areas in San Mateo, including District's areas. 16

Special Status Species (Table 5-4)

- Snowy plover habitat should include seasonal wetlands and coastal dunes, as plovers use managed ponds and adjacent levees in the South Bay and as well as coastal beaches in San Mateo County. 17

USFWS

F-USFWS

3

Literature Cited

Lawler and Dritz. 2013 Efficacy of spinosad in control of larval Culex tarsalis and chironomid midges, and its nontarget effects. Journal of the American Mosquito Control Association, 29(4):352–357.

Thank you for considering our comments. We appreciate and look forward to continued coordination with you on mosquito management on Refuge lands. We also encourage you to coordinate with the U.S. Fish and Wildlife Service, Bay Delta Field Office and Sacramento Field Office on mosquito management. If you have questions regarding our comments, please contact Refuge Planner, Winnie Chan at winnie_chan@fws.gov or (510) 792-0222 (Ext. 145).

Sincerely,

Christopher J. Barr
Deputy Project Leader
San Francisco Bay National Wildlife
Refuge Complex

cc:
Kim Turner, U.S. Fish and Wildlife Service, Endangered Species Division, Bay-Delta Office (email)
Jennifer Norris, U.S. Fish and Wildlife Service, Endangered Species Division, Sacramento Office (email)

Comment Letter F-USFWS

US Department of the Interior
Fish and Wildlife Service

Christopher J. Barr, Deputy Project Leader
May 9, 2016

Response 1

The District's thresholds for treatment of larval mosquitoes are based on the species of mosquito, habitat types for larvae, distance to populated area, and quantities detected. The table provided below (from the Draft IMVMP Plan) shows these thresholds which may change based on advisories from the California Department of Public Health (CDPH).

Table 4-3. Larval Source Treatment Guidelines

Species	Distance To Populated Area	Total L/P Density Other Factors
Ae. dorsalis	0 – 10 miles	1 per 10 dips or if adults are found in traps in excess of 5 per trap night per location
Ae. sierrensis	0 – 500 yards	1 per "slurp" with turkey baster
Ae. squamiger	0 – 10 miles	1 per 10 dips or if adults are found in traps in excess of 5 per trap night per location
Ae. washinoi	0 – 500 yards 500 yards – 1 mile	1 per 10 dips or if adults are found in traps in excess of 5 per trap night per location
An. punctipennis	0 - 1.5 miles	2 - 3 per dip
Cx. erythrothorax	0 – 1000 yards 1000 yards - 1 mile	1 per dip or if adults are found in traps in excess of 5 per trap night per location
Cx. pipiens	0 – 500 yards 500 yards – 1 mile 1 mile – 2 miles	1 per 10 dips 1 per dip 5 per dip
Cx. stigmatosoma	0 - 500 yards 500 yards - 1 mile 1 mile - 2 miles	1 per 10 dips 1 per dip 5 per dip
Cx. tarsalis	0 – 500 yards 500 yards – 1 mile 1 mile – 5 miles	1 per 10 dips 1 per dip 5 per dip
Cs. incidens	0 – 500 yards 500 yards – 1 mile	1 per dip 5 or more per dip
Cs. inornata	0 - 1 mile 1 mile - 2 miles	1 - 2 per dip 3 - 5 per dip
Aedes (invasive)	N/A Treatment done if found	N/A Treatment done if found.

The District uses the same larval treatment decision model used by some other districts in the San Francisco Bay Area (i.e., Alameda County and Napa County Mosquito Abatement Districts). See Figure 4-1 below from the Draft IMVMP Plan.

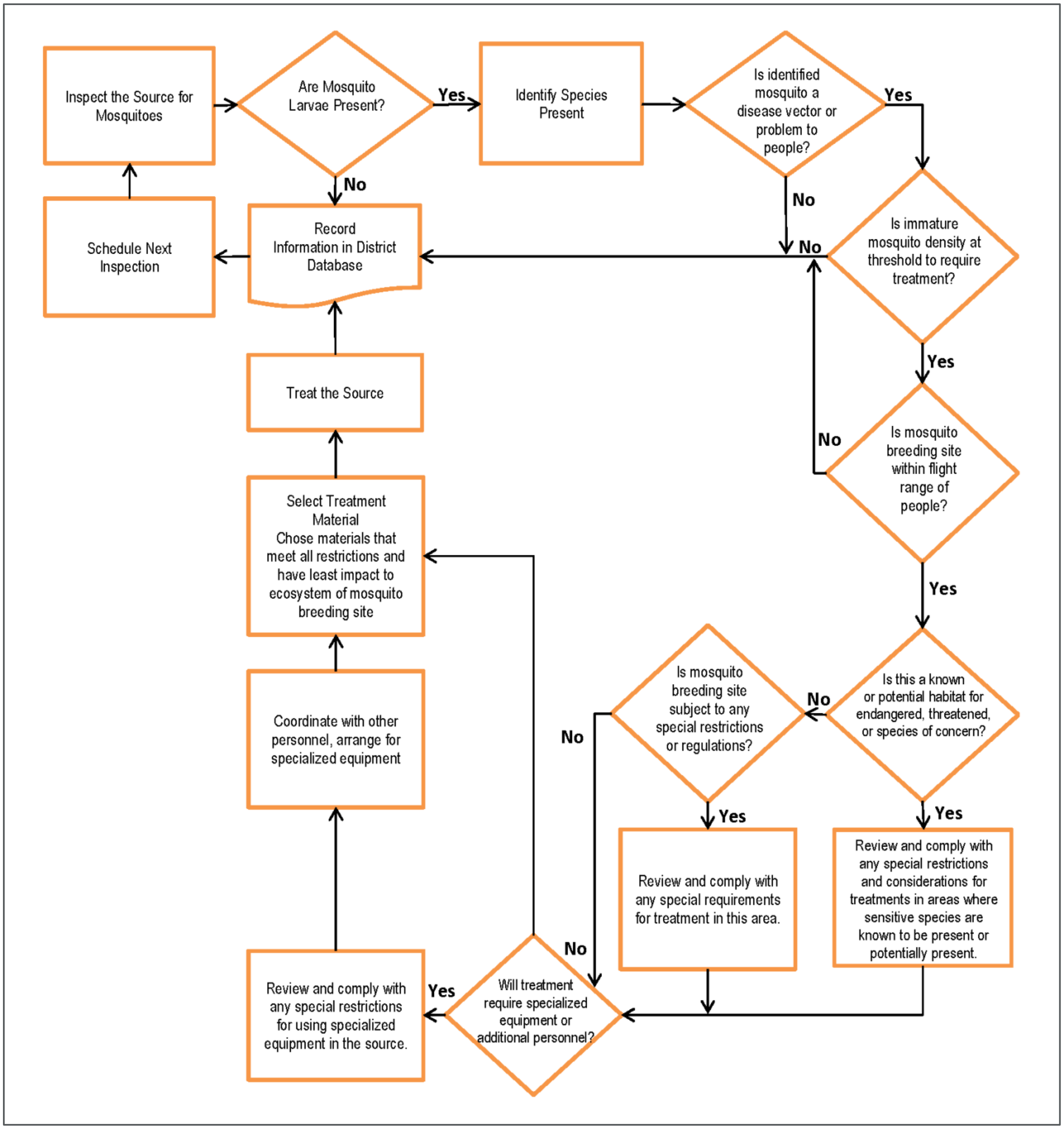

Figure 4-1 Larval Treatment Decision Model

For adult mosquitoes, treatment decisions are based on surveillance trap results. When trap results indicate that adult mosquitoes exist with West Nile virus or any other known harmful pathogen, then an adult mosquito treatment protocol is triggered (see table below). In unique circumstances adult mosquito treatments may be required when disease has not been detected but human discomfort is probable, i.e., aggressive salt marsh mosquitoes exist at such high levels that immediate action is required. Under these circumstances the application would typically take place in the affected neighborhoods and not on USFWS property. Table 4-5, Guidelines for West Nile Virus Adulticide Applications (Large Scale) is provided from the Draft IMVMP Plan.

Table 4-5 Guidelines for West Nile Virus Adulticide Applications (Large-Scale)

WNV Surveillance Factor	Assessment Value	Benchmark	Value	
Environmental conditions High-risk environmental conditions include above-normal temperatures with or without above-normal rainfall, runoff, or snowpack. Weather data link: http://ipm.ucdavis.edu	1	Avg daily temperature during prior 2 weeks ≤ 56°F		
	2	Avg daily temperature during prior 2 weeks 57-65°F		
	3	Avg daily temperature during prior 2 weeks 66-72°F		
	4	Avg daily temperature during prior 2 weeks 73-79°F		
	5	Avg daily temperature during prior 2 weeks > 79°F		
			Cx tars	**Cx pip**
Adult Culex tarsalis and Culex pipiens abundance Determined by trapping adults, enumerating them by species, and comparing numbers to those previously documented for an area for the prior 2-week period.	1	Vector abundance well below average (<50%)		
	2	Vector abundance below average (50–90%)		
	3	Vector abundance average (90–150%)		
	4	Vector abundance above average (150–300%)		
	5	Vector abundance well above average (>300%)		
Virus infection rate in *Culex tarsalis and Culex pipiens* mosquitoes Tested in pools of ≤ 50 females. Test results expressed as minimum infection rate (MIR) per 1,000 mosquitoes tested (MIR) for the prior 2-week period.	1	MIR = 0		
	2	MIR = 1–1.0		
	3	MIR = 1.1–2.0		
	4	MIR = 2.1-5.0		
	5	MIR > 5.0		
Sentinel chicken seroconversion Number of chickens in a flock that develop antibodies to WNV during the prior 2-week period. Number of flocks with a seropositive chicken in a region is an additional consideration. Typically 7-10 chickens per flock. Only include this factor in calculations when sentinel chicken program is actively maintained.	1	No seroconversions in broad region		
	2	One or more seroconversions in broad region		
	3	One or two seroconversions in a single flock in specific region		
	4	More than two seroconversions in a single flock or two flocks with one or two seroconversions in specific region		
	5	More than two seroconversions per flock in multiple flocks in specific region		

Table 4-5 Guidelines for West Nile Virus Adulticide Applications (Large-Scale)

WNV Surveillance Factor	Assessment Value	Benchmark	Value	
Dead bird infection Number of birds that have tested positive (recent infections only) for WNV during the prior 3-month period. This longer time period reduces the impact of zip code closures during periods of increased WNV transmission.	1	No positive dead birds in broad region		
	2	WNV-positive dead bird in broad region		
	3	One WNV-positive dead bird in specific region		
	4	Two or more WNV-positive dead birds in specific region		
	5	Three or more WNV-positive dead birds reported in specific region		
Human cases Do not include this factor in calculations if no cases are detected in region	3	One human infection in broad region		
	4	Two or more human infections in specific region		
	5	One human infection in specific region		
			Cx tars	**Cx pip**
Response Level / Average Rating: Normal Season (1.0 to 2.5) Emergency Planning (2.6 to 4.0) Epidemic (4.1 to 5.0)	**TOTAL**			

Source: *San Mateo County Mosquito-borne Virus Surveillance and Response Plan* (SMCMVCD 2017)

Physical control is not conducted very often on Refuge property, but when areas exist such that physical control could reduce mosquito populations, the proper work plans are created and submitted to the appropriate agencies (i.e., USACE, USFWS). Over the past 15 years, the USFWS in collaboration with SMCMVCD has conducted various habitat restoration or physical control projects that have reduced mosquito breeding habitat by more than 2,000 acres in San Mateo County.

Bair Island is a 3,000-acre property located in Redwood City, along the shores of San Francisco Bay at the mouth of Redwood Creek (within the Don Edwards National Wildlife Refuge) and adjacent to the Redwood Shores development. Areas of Bair Island still produce large numbers of mosquitoes including those capable of transmitting West Nile virus. District staff needs to monitor and treat with larvicides various locations of Outer and Middle Bair Island throughout the year. District technicians visit these locations approximately 20 times per year and cover nearly 400 acres during each visit. The District's Bair Island Integrated Pest Management Plan (2011) is included in the District's proposed Draft IMVMP Plan document.

Response 2

The alternatives terminology referenced in this comment is explained further and clarified herein. Traditionally, CEQA documents have the resource chapters examine the entire program/project for environmental impacts based on applicable environmental topics or concerns. Then, alternatives to the proposed program/project that would reduce or avoid any significant impacts and the no program/no project alternative are discussed in a separate chapter that may be supplemented by an appendix on the alternatives selection process explaining how the proposed program/project was developed. This traditional format was followed in the District's March 2016 document. PEIR Chapters 3 through 12 discuss the environmental impacts associated with the Proposed Program in its entirety, while alternative programs are described in Chapter 15. The explanation below clarifies these two uses of the word "alternative", "Program alternative" and "alternative Programs".

The proposed project is a continuation of the District's ongoing Program for mosquito and vector management (Existing Program) with some additional elements related primarily to physical control, vegetation management, and chemical control in the future if needed (Proposed Program). The District currently employs a Program consisting of six technical alternatives, which the Draft PEIR characterizes as "tools" or "components" of the overall Program, that are implemented with public education as necessary and appropriate based on the Program needs and objectives. These Program components are groups of related or similar activities by type. The District has approximately 20,000 sources that it monitors on a regular basis for mosquito abundance, species, and life cycle. It also responds to complaints and requests for service at other sites as well. At each site where actual treatment is needed, the District has to determine quickly which of the components within its Program is best suited to dealing with the mosquito or other vector problem. As described in the Draft PEIR, the District's management practices emphasize the fundamentals of integrated pest management (IPM), specifically integrated vector management (IVM), which involves the use of multiple tools, including source reduction (physical control), habitat modification (vegetation management), and biological control using mosquitofish, when appropriate before using pesticides. So on a site-specific basis, the District selects from its nonchemical control methods first, then from its chemical control or herbicides under vegetation management, if necessary. Site conditions, including the potential for special-status species to be present and proximity to human activities, affect the alternative(s) selected. More information on this decision-making/selection process is contained in the Draft IMVMP Plan.

However, in the revised Draft PEIR being recirculated in July – August 2018, with this response contained in the Draft PEIR's Appendix F, the word "alternative" has been replaced with the word "component" when it refers to a component or element or method of control associated with the IMVMP.

Response 3

Activity maps that show points of entry and exit from the Don Edwards San Francisco Bay National Wildlife Refuge have been prepared and submitted to USFWS. The District relies on an adaptive management approach for its mosquito control efforts that means maps may not properly reflect where activities may be occurring within the District's Service Area. Maps are static, whereas the locations creating mosquito issues change from season to season based on where standing water collects. For certain physical control activities (e.g., maintaining ditches in coastal marshes), maps are required as a part of the annual permitting process with the US Army Corps of Engineers. However, locations for these source reduction activities can change from year to year. Due to the nature of a Programmatic EIR (i.e., not site-specific) and the many variables that must be considered when implementing a IPM program (e.g., mosquito species that are active, their population size or density, their age structure, location, time of year, local climate and weather, potential for mosquito-borne disease, proximity to human populations, etc.), the accuracy of maps of activity would be highly variable.

However, the District has contacted the San Mateo County Community Development Department, Planning Division for maps of habitat types countywide and in the unincorporated areas, and both sensitive habitat and vegetative type maps were provided by the County. Although static representations, they provide some guidance to staff on where habitats of potential use by special status species may occur. The District also has the California Natural Diversity Database maps reviewed comprehensively in 2015 for the Programmatic PEIR and will periodically review these and more recent maps as needed.

Response 4

The request to use the same BMPs for known and potential listed species habitats as for listed species habitats on Refuge lands cannot be implemented throughout the District, especially in remote locations. However, District staff will be trained to prevent spreading weeds and invasive animal species/pathogens using methods to remove dirt and plant material when moving from one watershed to another (see BMPs described under Response 5 below).

Response 5

BMPs are an important feature of the Existing Program and future actions included in the Proposed Program. BMPs for western snowy plovers and California tiger salamander (CTS) have been added to existing BMPs in Tables 2-8 and 4-5. Both of these tables include aquatic and terrestrial biological resources. Table 5-4 is a list of terrestrial species from the CNDDB search that could occur within the District's Service Area. Both western snowy plover and California tiger salamander are in that table. The following is the modified text for the BMPs:

A. General BMPs

10. Properly train all staff, contractors, and volunteer help to prevent spreading weeds and ~~pests~~ invasive animal species (e.g., New Zealand mud snails) or pathogens (e.g., the fungus that causes chytridiomycosis in amphibians) to other sites. The District headquarters contains wash rack facilities (including high-pressure washers) to regularly (in many cases daily) and thoroughly clean equipment to prevent the spread of weeds. Decontamination methods to clean equipment and personnel clothes, such as boots, of invasive species and pathogens will be included in worker training and be implemented when working in wetlands in different watersheds.

E. California Red-Legged Frog (CRLF), Western Snowy Plover (WSP), California Tiger Salamander (CTS), San Francisco Garter Snake (SFGS) and Steelhead – Central California Coast

1. District staff ~~will~~ receive training on the identification, biology and preferred habitat of California red-legged frog, western snowy plover, California tiger salamander, San Francisco garter snake and steelhead - central California coast prior to accessing potential habitat for these species along with avoidance measures.

2. If suitable habitat is found in or adjacent to the nearby waterways for the California red-legged frog, California tiger salamander, western snowy plover, San Francisco garter snake, and steelhead - central California coast, t~~T~~he District shall conduct ~~a tailboard meeting~~ training prior to entering these areas and periodically throughout the season~~required work to identify avoid potentially adverse effects to these species~~.

3. Prior to the initiation of vegetation maintenance, water manipulation, channel excavation, or vehicle operation, the project work site and adjacent area will be surveyed by a designated District biologist trained in identification and ecology of the ~~three~~ five special-status species to ensure that none are present. This survey is not intended to be a protocol-level survey, but rather one designed to verify that no special-status species are actually on site or in the adjacent waterway. For CRLF, vegetation maintenance and water manipulation shall not occur from November through March to avoid their breeding season (egg laying and hatching). This work will be further delayed if tadpoles are present in the work area. Mosquitofish (*Gambusia affinis*) will not be introduced into any site containing CRLF or CTS. If channel excavation occurs on County Parks property, their staff will be consulted on the appropriate level of survey.

4. All on-site workers will attend an information session (tailboard) conducted by the designated onsite District biologist. This session shall cover identification of the ~~three~~ five species and various life stages (such as CRLF tadpoles) and procedures to be followed if an individual is found on site or in the adjacent waterway.

5. All treatment areas will be inspected each morning by the designated onsite biological monitor to ensure that none of the ~~three~~ five species are present. All construction activities that take place on the ground shall be performed in daylight hours. Construction materials, soil, construction debris, or other material shall be deposited only on areas where vegetation has been mowed and any snakes or frogs present would be readily visible.

F. **Vegetation Management**

6. ~~Vegetation management work will be confined to October 1 to April 30 to minimize potential impacts to special-status species, especially breeding birds.~~ When work is expected to occur between February 1 and ~~April 30~~August 31 in areas known to harbor special status species~~(nesting season for migratory birds)~~, ~~additional~~ consultations will occur with appropriate resource agencies to help identify locations of active nests of raptors or migratory birds as well as any additional protection measures that will need to be implemented prior to commencement of work.

9. If suitable habitat ~~necessary~~ for special-status species is found, including vernal pools, and if nonchemical physical and vegetation management control methods have the potential for affecting special-status species, then the District will coordinate with the CDFW, USFWS, ~~and/or~~ NMFS, and/or County Parks as appropriate, before conducting control activities within this boundary or cancel activities in this area. If the District determines no suitable habitat is present, control activities may occur without further agency consultations.

Response 6

BMPs to avoid transferring diseases or pathogens between aquatic habitats have been clarified in Table 2-8 and Table 4-5 under General BMPs, including BMP A10 as described above in Response 4. Most of The Declining Amphibian Task Force Fieldwork Code of Practice measures are either not applicable to or not feasible for the District's activities. Equipment will be cleaned before uses in different watersheds to the extent feasible. This will include mechanical removal of visible mud, plant material, and other debris at the sample site. Boots and sample equipment can be rinsed in clean water after the mechanical cleaning. More thorough cleaning will occur back at District headquarters. No amphibians are collected during District mosquito control activities.

Response 7

Regarding maps of vegetation maintenance activities, see Response 3 above. In general, the District maintains trails (no more than 5 feet in width) when needed through densely vegetated habitat in urban areas to allow the passage of District staff on foot to conduct surveillance and treatment. The District can provide a list of locations that often require maintenance activities, and the current list of creek brushing sites is provided as Attachment A to this response. These activities consist of minor trimming of poison oak, ivy and branches 3 inches in diameter or less. This only occurs to create paths to standing water for surveillance and treatment activities. None of these activities occurs on Refuge property.

Under the California Fish and Game Code, Lake and Streambed Alteration Agreement (LSAA) requirements apply to any activity that will:

> substantially divert or obstruct the natural flow of any river, stream or lake; or

> substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake; or

> deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river, stream, or lake; and

> substantially adversely affect fish or wildlife.

The District does not engage in large-scale operations affecting lakes and streams (e.g., soil movement, removal of vegetation with branches and stems that exceed 4 inches in diameter, removal of large amounts of vegetation), nor does the District request landowners to engage in such activities. Based on its history of implementing the Program alternatives, the District does not anticipate that its physical control and vegetation management activities will result in diversion or alteration of natural flow or modify the bed, channel, or bank except to improve circulation of water and remove vegetation that creates mosquito breeding habitat, and in no event would any such activities be likely to be "substantial" within the meaning of the Fish and Game Code. For example, under surveillance, taking a water sample to check for mosquito larvae would not modify flows or material from the bed, channel, or bank. BMPs G1 through G17 address maintenance activities in channels/water facilities in waters of the US, including management of sidecast spoils in BMP G16. However, the District may confer with CDFW to provide clarifications on Program activities and review CDFW concerns to determine appropriate LSAA coverage if needed. CDFW did not comment on the District's March 2016PEIR. The need for any subsequent project-level CEQA review at a particular source control/treatment site would be considered at the time the District applied for an LSAA permit.

Control of invasive cordgrass (*spartina)* is covered by the Coastal Conservancy's San Francisco Bay Estuary Invasive Spartina Project Final EIS/EIR (2003).

Response 8

Because these vegetation management activities on the Refuge tend to be planned in advance of mosquito and other vector thresholds being reached to avoid critical breeding periods, this request can be met. The District will inform Refuge staff on times when source reduction work is to be scheduled so that Refuge staff may observe vegetation maintenance activities.

Response 9

The District acknowledges that it does not have permission at present to use herbicides on the Don Edwards National Wildlife Refuge. If this tool is needed in that it appears to be the best method for a particular site, then the District will seek approval from the Refuge manager and follow the PUP process.

Response 10

Concerning the use of spinosad on the Refuge, the District can use other methods on the Refuge. Each year the District submits its PUP to USFWS for approved materials for use at the Refuge. However, the following additional information is provided in support of our conclusion that this pathogen for control of larval mosquitoes does not present a significant impact on nontarget species when applied by the District for mosquito control.

All chemicals can cause adverse effects or even become toxic at levels exceeding individual species "tolerance" levels. However, the sensitivity and tolerance levels are determined by the USEPA and other regulatory agencies using laboratory tests with numerous species of concern that are estimated to be potentially exposed to an application. The results of these tests of each chemical are published in numerous publically available USEPA documents summarizing the testing results with metrics such as the LD_{50}, LC_{50}, and maximum estimated tolerance levels. For the pesticides used by the District for vector control, these metrics are indicated in detail in Appendix B of the PEIR, with information on a current species of interest.

The Draft PEIR disclosed a broad range of issues associated with chemical methods of vector control and made a reasonable good faith effort to address those issues in a manner understandable to the public by PEIR preparers with the appropriate qualifications. The issue of loss of prey and prey habitat, as well as the potential impact on contaminated prey, was addressed in the March 2016 Draft PEIR and further considered by a senior toxicologist and addressed in the extensive response below to support the material in Section 4.2.2.6, Section 4.2.4.1, and Section 4.2.5.1 of the Draft PEIR and the following statement on predator populations in the revised Draft PEIR on page 4-49, page 4-54, and page 4-62:

> "Mosquitoes are part of the food web and their loss may reduce the food base for some predators. Although mosquitoes serve a role as one of many types of prey items for some fish, avian insectivores, bats, and small reptiles and amphibians, the reduction of mosquito abundance over a small area will not affect the predator populations overall, because these species generally have large foraging ranges and can find ~~as~~ other prey sources within the range of their habitat use (Williams et al. 1999) ~~are available~~."

Because the vector control products for mosquitoes are species selective, any claimed potential adverse impact on insect predators associated with District applications (as nontarget exposures) would be temporary and inconsequential for those populations of predator species. Even in the event of ancillary exposures, the recovery of such populations occurs rapidly to maintain the general level of individuals in their populations. The relative higher sensitivity of the target vs. nontarget (less sensitive predator) species provides an adequate measure of safety to maintain the balance of predator populations.

Studies evaluating the toxicity of spinosad in control of *Lepidoptera*, for example, included the relation of pesticide treatment to the insect predators in the food chain. These authors reported that their studies revealed the relative safety of spinosad to natural insect predators that would likely be associated with *Lepidoptera* predation while being highly effective against the target *Lepidoptera*: "spinosad is highly active against *Lepidoptera* but is practically nontoxic to insect natural enemies" (Lawler and Dritz 2013). As a verification of the relative sensitivity to insects and insect predators, these authors further state that "very large direct doses of spinosad in laboratory setting were toxic to nontarget insect predators, while low doses did not exhibit the same level of toxicity to nontargets and was relatively safe against the bulk of the insect predators". (Williams et al. 2003)

Several studies have been conducted that demonstrate the likelihood that some pesticide uses are not harmful to nontarget species while showing toxicity and efficacy for the target species. In a study to compare the relative sensitivity of a pesticide to target vs. nontarget species, Lawler and Dritz (2013) suggest that spinosad is an effective treatment for insect larvae that, at appropriate doses, is safe to the predators and nontarget species. While these authors reported that spinosad is an effective treatment for insect larvae, they noted that it also "kills mayflies and other nontarget insects". They also reported that spinosad was effective against mosquitoes and midges for about a month. However, inspection of the results reported in this study indicate that spinosad was considerably less toxic to mayflies than to desired targets (mosquitoes), and the minimal effects on mayflies were undetectable after 21 days.

While this relative toxicity study focused on spinosad, it illustrates the selective toxicity that is similar for many pyrethroids. The results reported by these authors suggest that while the impact on the target mosquito larvae was appropriately effective, the potential impact on nontarget insect populations would be minimal to inconsequential, because the doses that are effective against mosquito larvae are below levels that would even marginally impact nontarget insect populations. Even with a possible minimal impact on some of the nontarget insects, the impact would not be sufficient to adversely impact them overall. The study conclusion further supports the PEIR's conclusion that properly selected pesticide applications can be effective against target mosquitoes while not resulting in unacceptable adverse impacts on nontarget species. The low levels of pesticides used by the District, combined with the careful application restrictions embodied in the BMPs, results in the effective, yet environmentally compatible treatment for mosquitoes.

Response 11

The comment to separate the bacterial larvicides in Table 4-7 has been done as indicated below for inclusion in the text of the recirculated Draft PEIR. The organophosphate temephos has been removed from the Proposed Program. The cited reference (Lawler and Dritz 2013) has been reviewed and is discussed in Response 10 above.

Table 4-7 Chemical Classes and their Toxicity[1] to Fish and Nontarget Aquatic Invertebrates

Class	Chemical	Mechanism of Action	Toxicity to	
			Fish	Nontarget Invertebrates
Mosquito Larvicides				
Bacterial Larvicides	Bs, Bti~~, spinosad~~	Paralyzes gut ~~or disrupts central nervous system~~	Low	Low
Bacterial Larvicide	Spinosad	Disrupts central nervous system	Low	Low to Moderate
Hydrocarbon esters	Methoprene and s-methoprene	Interferes with maturation process of insects	Moderate	High
Surfactants	Biodegradable alcohol ethoxylated surfactant	Drowns larvae	Very low	Affects Only Surface Breathing Insects

Response 12

Comment noted and considered. Appendix B is not scheduled for revision at this time, but the District has conducted additional review of literature on spinosad in preparing responses to comments. These additional studies on spinosad include the following:

Lawler, S.P. and D. Dritz. 2013. Efficacy of spinosad in control of larval Culex tarsalis and chironomid midges, and its nontarget effects. Journal of the American Mosquito Control Association 29(4):352-357.

These authors reported that spinosad is an effective treatment for insect larvae but that it also “kills mayflies and other non-target insects”. They also reported that spinosad was effective against mosquitoes and midges for about a month and that spinosad caused mortality of mayflies and other nontarget insects. However, inspection of the results reported in this study indicate that spinosad was considerably less toxic to mayflies than to desired targets, and the minimal effects on mayflies were undetectable after 21 days.

Miles M. and R. Dutton. 2000. Spinosad—a naturally derived insect control agent with potential for use in glasshouse integrated pest management systems. *Meded. Fac. Landbouwkd. Toegepaste Biol. Wet. (Univ. Gent)* 65 (2A):393–400.

Demonstrated the efficacy of spinosad and the lack of apparent significant impact on other aquatic organisms in their tests.

Williams T., J. Valle, and E. Vinuela. 2003. Is the naturally derived insecticide Spinosad® compatible with insect natural enemies? *Biocontrol Science and Technology* 13:459–475.

Reports the relative efficacy and nontarget toxicity of spinosad and reports that "spinosad is highly active against Lepidoptera but is reported to be practically nontoxic to insect natural enemies". In their studies, very large direct doses of spinosad in laboratory setting were toxic to nontarget insect predators, while low doses did not exhibit the same level of toxicity to nontargets and were relatively safe against the bulk of the insect predators.

The District uses spinosad in rotation with all other standard mosquito larvicides as part of its IMVMP with the goal of protecting public health while not contributing to pesticide resistance in mosquitoes. Spinosad is not used on the Refuge. It is possible that spinosad may be used in any location the label permits, but the primary application sites in San Mateo County consist of manmade containers and highly polluted waters that do not contain nontarget insects.

Response 13

The District acknowledges that permission to use adulticides in the Refuge needs an Emergency Section 7 Consultation. Staff will identify those mosquito conditions that would prompt this need and prepare preliminary information so that this can be done quickly. The ecology is changing on Bair Island, and adult mosquitoes are being reported in areas of the adjacent Redwood Shores residential development. The breeding sites for *A. dorsalis* need to be identified and mosquito control implemented.

Response 14

Concerning the use of adulticides, the District has reviewed additional information and does not believe that the PEIR impact conclusions of less than significant need to be modified. As stated in the revised Draft PEIR on page 4-73:

> "Although not included in the District's current program, aerial adulticiding could be used in the future to deal with a severe outbreak or risk of mosquito-borne disease transmission as part of the Proposed Program. Aerial applications would be made using ULV techniques. Aerial application of adulticide may be the only reliable means of obtaining effective control over a very large area quickly, in the case of a mosquito-borne disease epidemic."

Then on page 4-74, the following example is provided:

> "Pyrethrins and pyrethroids applied in ULV applications by truck, ATV, or handheld foggers include pyrethrins, phenothrin, and permethrin. Numerous studies have found that these ULV applications result in concentrations in the aquatic environment of 0.23 to 3.77 µg/L and had little to no effect on fish or nontarget aquatic invertebrates (see Appendix B). As part of the Proposed Program, these products would be applied by aircraft as outlined in the IMVMP Plan."

While adulticides have the potential to cause harm to nontarget species, the method of application including ULV, the concentrations used for mosquito control, other product label requirements, and District BMPs provide the rationale for why the physical impact on ecological health is less than significant.

Further support, for the PEIR conclusions of less-than-significant impacts to water quality from adulticides and larvicides applied by the District, is provided in a 2-year monitoring study conducted for the State Water Resources Control Board by the Mosquito and Vector Control Association of California (MVCAC) monitoring coalition to determine whether vector control activities were contributing contaminants to state waters. The MVCAC monitoring coalition conducted chemical monitoring for adulticides at 61 locations during 19 application events in 2011 to 2012 and coordinated physical monitoring for 136 larvicide application events in 2012. Samples were collected from agricultural, urban, and wetland environmental settings in both northern and southern California. Adulticides evaluated included pyrethrin, permethrin, sumithrin, prallethrin, etofenprox, naled, malathion, and the synergist piperonyl butoxide. The monitoring study (MVCAC 2013) was conducted in accordance with the Statewide NPDES Vector Control Permit (SWRCB 2011) and had the following results:

- 1 out of 136 visual observations showed a difference between background and post-event samples;
- 108 physical monitoring samples showed no difference between background and post-event samples; and
- 6 out of 112 samples exceeded the receiving water monitoring limitation or triggers.

The report concluded that there was no significant impact to receiving waters due to application of vector control pesticides in accordance with approved application rates. This is consistent with the primary mandate for vector control districts of protecting public health by reducing vector-borne diseases from mosquitoes and other vectors.

The State Water Resources Control Board evaluated the results of this study (MVCAC 2013) and a concurrent toxicity study conducted by researchers from UC Davis (Phillips et al. 2013) and concluded that, based on the monitoring data, the application of pesticides in accordance with approved application rates does not impact beneficial uses of receiving waters (SWRCB 2014). Therefore, the monitoring and reporting program for the Vector Control Permit was amended in March 2014 to limit the required monitoring to visual observations, monitoring and reporting of pesticide application rates, and reporting of noncompliant applications.

The District's objective is to reduce or minimize the possibility of unwanted nontarget effects in the local environment while addressing the need for vector control. These considerations and how unwanted effects can be eliminated or reduced are embodied in the Program objectives and in each of the applicable BMPs and guide all pesticide applications. By restricting chemical applications to times when most nontarget insects are not active and using care to treat only vector larvae and adults in locations where they are concentrated (i.e., population is high enough to warrant chemical control), impacts to other species are either eliminated or substantially reduced.

In situations where inadvertent exposure to other, beneficial insects might occur, the impact to a few individuals will not adversely impact the population(s), which can recover quickly to original population levels (Emlen et al. 2003; Andrewartha 1972).

Response 15

The District will provide notification to the Service if any fogging events are planned within ¼ mile of the Refuge.

Response 16

The following has been added to Section 4.1.3.1 of the PEIR under Federal Regulatory Setting.

> **<u>4.1.3.1.7 Marine Mammal Protection Act</u>**
>
> <u>This law established a national policy to prevent marine mammal species and population stocks from declining beyond the point where they ceased to be significant functioning elements of the ecosystems of which they are a part. The MMPA established a moratorium on the taking of marine mammals in US waters. It defines "take" to mean "to hunt, harass, capture, or kill" any marine mammal or attempt to do so. The Department of Commerce through the National Marine Fisheries Service is charged with protecting whales, dolphins,</u>

porpoises, seals, and sea lions. Walrus, manatees, otters, and polar bears are protected by the Department of the Interior through the US Fish and Wildlife Service. The Animal and Plant Health Inspection Service, a part of the Department of Agriculture, is responsible for regulations managing marine mammals in captivity. (NMFS no date)

Response 17

BMPs for protection of western snowy plovers in Table 4-5 have been checked as applicable in coastal dunes. Seasonal wetlands are already checked for this species.

Additional References

Andrewartha, H.G. 1972. *Introduction to the Study of Animal Populations*. 2nd edition. University of Chicago Press.

California State Water Resources Control Board (SWRCB). 2014. State Water Resources Control Board Order 2014-0038-EXEC Amending Monitoring and Reporting Program for Water Quality Order 2011-0002-DWQ General Permit No. CAG 990004 (as Amended by Order 2012-0003-DWQ) Statewide National Pollutant Discharge Elimination System Permit for Biological and Residual Pesticide Discharges to Waters of the United States from Vector Control Applications. Available online at http://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/docs/vectorcontrol/2012-0003-dwq/vcp_amended_mrp.pdf.

Emlen, J.M., D.C. Freeman, M.D. Kirchhoff, C.L. Alados, J. Escos, and J.J. Duda. 2003. Fitting population models from field data. Ecological Modelling 162: 119-143.

Lawler and Dritz. 2013. Efficacy of spinosad in control of larval *Culex tarsalis* and chironomid midges, and its nontarget effects. *Journal of the American Mosquito Control Association* 29(4):352-357.

Miles M. and R. Dutton. 2000. Spinosad—a naturally derived insect control agent with potential for use in glasshouse integrated pest management systems. *Meded. Fac. Landbouwkd. Toegepaste Biol. Wet. (Univ. Gent)* 65 (2A):393-400.

National Marine Fisheries Service. No date. Office of Protected Resources and Marine Mammal Protection Act, Factsheet. Website (http://www.nmfs.noaa.gov/pr/pdfs/mmpa_factsheet.pdf) accessed August 31, 2016.

Phillips, B.M, B.S. Anderson, J.P. Voorhees, K. Siegler, L. Jennings, M. Peterson, R.S. Tjeerdema, D. Denton, D., P. TenBrook, K. Larsen, and P Isorena. 2013. General Pesticide Permit Toxicity Study: Monitoring Aquatic Toxicity of Spray Pesticides to Freshwater Organisms. Draft Final Report. Prepared by University of California, Davis, Department of Environmental Toxicology, United States Environmental Protection Agency, and California State Water Resources Control Board for California State Water Resources Control Board, Agreement Number 10-102-270. July. Available online at http://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/docs/vectorcontrol/vcp_tox_study_draft_final_july2013.pdf.

Williams T., J. Valle, and E. Vinuela. 2003. Is the naturally derived insecticide Spinosad® compatible with insect natural enemies? *Biocontrol Sci Technol* 13:459-475. August.

Attachment A: Creek Brushing Sites for San Mateo County MVCDI

Creek Name	City	Longitude	Latitude
Atherton Channel	Atherton	-122.219206079874	37.432358
Millbrae Cr.	Millbrae	-122.401611142912	37.5922081535386
Adeline / Davis Cr.	Burlingame	-122.379266007287	37.5869704602033
Easton Cr.	Burlingame	-122.373883270922	37.5808241321283
Sanchez Cr.	Burlingame	-122.366333237401	37.5790228901727
7th Day Adventist Cr	Burlingame	-122.357417719598	37.5766581135991
Ralston Cr.	Burlingame	-122.354532258933	37.5729781562128
Burlingame/Cherry Cr.	Burlingame	-122.352356007125	37.5639328254332
Borel Cr	San Mateo	-122.32996723516	37.5461100939714
Laurel Cr	San Mateo	-122.32996723516	37.5461100939714
Fernwood Cr	San Mateo	-122.308015334781	37.5259997710416
East Laurel Cr	San Mateo	-122.313288380463	37.5222265745767
Peninsula Cr	San Mateo	-122.315093869445	37.5454589879039
Polhemus Cr	San Mateo	-122.343009110236	37.5249748584436
Portola Cr	San Mateo	-122.313852193325	37.5394990708166
Notre Dame Cr	Belmont	-122.283509466772	37.5189434654942
Belmont Cr.	Belmont	-122.285926365621	37.5136923056272
Los Trancos Cr.	Menlo Park	-122.19152689969	37.3988094970604
Cordilleras Cr	Redwood City	-122.256062396376	37.4833392193776
Club Cr	Redwood City	-122.231421695116	37.4649025206036
Granger Creek	Redwood CIty	-122.242402664506	37.455114473849
Stulstaft Cr	Redwood City	-122.237267576646	37.4734132858109
Ralston Cr	San Carlos	-122.354532258933	37.5729781562128
Brittan	San Carlos	-122.258052183448	37.4944084889842
Pulgas Cr	San Carlos	-122.270011612571	37.5015422196091
Dry Cr	Woodside	-122.258788993611	37.4326457986233
Bear Gulch Cr	Woodside	-122.246972212075	37.4185626401701
Corte Madera Cr	Portola Valley	-122.223885038835	37.3820765826564
Alambique Cr	Woodside	-122.249596695616	37.4037680958084
Sausal Cr	Woodside	-122.231953199507	37.3837703319723
West Union Cr	Woodside	-122.269869180247	37.4275842804813
Westridge Cr	Woodside	-122.217465844348	37.393035483002

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STATE OF CALIFORNIA—CALIFORNIA STATE TRANSPORTATION AGENCY EDMUND G. BROWN Jr., Governor

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
P.O. BOX 23660, MS-10D
OAKLAND, CA 94623-0660
PHONE (510) 286-5528
FAX (510) 286-5559
TTY 711
http://www.dot.ca.gov/dist4/

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March 30, 2016

SMGen087
SCH# 2012052063

Dr. Chindi Peavey
San Mateo County Mosquito
and Vector Control District
1351 Rollins Road
Burlingame, CA 94010

Dear Dr. Peavey:

San Mateo County Mosquito and Vector Control District Mosquito and Vector Management Program – Programmatic Draft Environmental Impact Report

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above project. The mission of Caltrans is to provide a safe, healthy, sustainable, integrated, and efficient transportation system to enhance California's economy and livability. The following comments are based on the Programmatic Draft Environmental Impact Report (PDEIR).

Project Understanding

This project is the continuation of the implementation of vector control methods and actions that are components of the San Mateo County Vector Control District's (District) Integrated Mosquito and Vector Management Program. Components include surveillance, physical control, vegetation management, biological control, chemical control, and non-chemical control methods such as trapping rodents that pose a threat to public health and welfare. We understand many of these methods could encroach onto the State right-of-way (ROW) through atmospheric deposition, waterway transport, etcetera, and/or the need for the District to utilize State roadways for the application of control activities. 1

Prior to any work being done adjacent to the State ROW, please contact Mr. Robert Young, Senior Biologist, Caltrans, District 4, Office of Environmental Maintenance at (510) 286-4502 or robert.s.young@dot.ca.gov.

"Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability"

S-DOT

Dr. Chindi Pavey/SMCMVCD
March 30, 2016
Page 2

Lead Agency Responsibilities
As the lead agency, the District is responsible for all project mitigation. The project's scheduling, implementation responsibilities, and lead agency monitoring should be fully discussed for all proposed mitigation measures. This information should be presented in the Mitigation Monitoring and Reporting Plan of the Environmental Document. An Encroachment Permit is required for work in the State ROW. 2

Encroachment Permit
Work that encroaches onto the State ROW requires an encroachment permit that is issued by Caltrans. To apply, a completed encroachment permit application, environmental documentation, and five (5) sets of plans clearly indicating the State ROW must be submitted to: Mr. David Sallady, Office of Permits, California Department of Transportation, District 4, P.O. 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the plans during the encroachment permit process. See the following website link for more information: http://www.dot.ca.gov/hq/traffops/developserv/permits/. 3

Transportation Management Plan
If it is determined that traffic restrictions and detours are needed on or affecting the State highway system, a Transportation Management Plan (TMP) may be required and approved by Caltrans prior to construction. TMPs must be prepared in accordance with *California Manual on Uniform Traffic Control Devices* (CA-MUTCD). Further information is available for download at the following web address:
http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/pdf/camutcd2012/Part6.pdf. 4

Please ensure that such plans are also prepared in accordance with the transportation management plan requirements of the corresponding jurisdictions. For further TMP assistance, please contact the Office Traffic Management Plans at (510) 286-4579.

Please feel free to call or email Sandra Finegan at (510) 622-1644 or sandra.finegan@dot.ca.gov with any questions regarding this letter.

Sincerely,

PATRICIA MAURICE
District Branch Chief
Local Development – Intergovernmental Review

c: State Clearinghouse

"Provide a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability"

Comment Letter S-DOT

Department of Transportation

Patricia Maurice, District Branch Chief
March 30, 2016

Response 1

The agency requests that the District notify their Office of Environmental Maintenance prior to performing work adjacent for vector control activities adjacent to California Department of Transportation's (Caltrans) right-of-way (ROW).

For work on State of California lands and riparian zones, wetlands, or other sensitive habitats, the District coordinates, reviews activities, communicates, and often collaborates with several agencies including the USFWS, California Department of Fish and Wildlife (CDFW), San Mateo County agencies, municipalities, and property owners of San Mateo County. District staff has long standing cooperative, collaborative relationships with federal, state, and local agencies. Section 2.6 of the revised PEIR covers the District's permits with other agencies (pages 2-66 through 2-69). The District is aware and understands that new sources of mosquito production found within the Caltrans ROW may contain sensitive habitat and resources and consultation with the appropriate regulatory agencies may be necessary.

As indicated in the Draft PEIR, physical control/source reduction is an important component of the District's Integrated Mosquito and Vector Management Program (IMVMP). This component of the Program includes working with property owners and land managers to minimize the potential for mosquito production and vector-borne disease transmission. The California Health and Safety Code (Section 2000 et seq.) clearly delineates property owner responsibility relative to mosquito and vector abatement. It is of the utmost importance that Caltrans properly manages and maintains (e.g., both grade and vegetation) the function of water conveyance features (e.g., roadside water conveyance channels) to minimize and potentially prevent mosquito production and the need for mosquito control operations. The District is aware that Caltrans has worked closely with the California Department of Public Health (CDPH) with regard to identifying the potential for mosquito production and properly maintaining water conveyance features in Caltrans ROWs.

Opportunities for prudent mosquito source reduction exist in Caltrans ROWs located at over 60 sites throughout San Mateo County where debris, cattails, and other vegetation have created mosquito-breeding habitat in urban areas because of improper drainage or maintenance. A list of these sites is attached to this response as Attachment A. We suggest contacting District staff or working with your own staff to help in identifying vector control problem areas for Caltrans to manage and maintain on an annual basis as part of your ongoing maintenance of roadside drainage ditches. As the landowner/land manager, Caltrans should obtain the necessary permits from CDFW for this maintenance activity as part of its overall maintenance program for State ROWs within San Mateo County. For Caltrans mitigation areas, we can review those with staff as well. However, State mitigation areas also need to be maintained to avoid becoming mosquito-breeding habitat. If state-owned lands are not maintained and vector problems arise, the District will need to treat the problem expeditiously and not wait for mosquito larvae or pupae to complete their life cycle.

Section 1.1.3 of the PEIR identifies a number of legislative and regulatory actions that form the basis for the District's authority to engage in vector control. The District is a regulatory agency formed pursuant to California Health and Safety Code Section 2000 et seq. In enacting that law the California Legislature recognized the importance to public health and the economy of proactive management of vectors. Furthermore, due to its public health mission, the California Department of Pesticide Regulation's (CDPR's) Pesticide Regulatory Program provides special procedures for vector control agencies that operate under a Cooperative Agreement with the CDPH. The District operates under a Cooperative Agreement with CDPH (SMCMVCD 2017 that is renewed annually. The application of pesticides by vector control agencies is regulated by a special and unique arrangement among the CDPH, CDPR, and County Agricultural Commissioners.

Response 2

The comment notes that the District is responsible for all project mitigation. An encroachment permit is required for work in the State ROW. The District's only mitigation at present is for an air quality impact involving potential for odors from some pesticide products. Clarification of "work in the State ROW" is needed. At issue is the potential for physical control and/or vegetation management within drainage channels along State roadways. See Response 1 above.

CDPH has prepared recommendations for mosquito control on state properties (CDPH 2008) The District recommends that Caltrans review these BMPs for inclusion in their future new construction and maintenance projects.

Response 3

The comment explains how to apply for an encroachment permit. Comment noted and considered. See Response 2 above.

Response 4

The comment calls for a transportation management plan if traffic restrictions and detours are needed on or affect the State highway system. Comment noted and considered. The District has not had to implement any traffic restrictions and detours involving State highways to date.

Additional References

California Department of Public Health (CDPH). 2008. Best Management Practices for Mosquito Control on California State Properties, Recommendations. June. www.water.ca.gov/saltonsea/docs/CDPH%20Mosquito%20Control%20BMPs.pdf

San Mateo County Mosquito and Vector Control District (SMCMVCD) and California Department of Public Health (CDPH). 2017. Cooperative Agreement between California Department of Public Health and San Mateo County Mosquito and Vector Control District. Effective: January 1, 2018; Expires: December 31, 2018.

Attachment A: CalTrans Sites

Site # for Each Location in Our Database	Site Description	City	# of Sites
8404	Ditch Along 101 on south Side between Oyster Pt. Blvd and Sierra Point Pkway.	SSF	1
8246-8293-10989	Where 380 and 101 intersect imp h20 ditches and imounded areas under the freeways between south airport blvd and 101.	SSF	3
8261	Off of 7th avenue between San Bruno ave and 380. Imp h20 underneath 380 Freeway.	SSF	1
991- 5606	Millbrae Ave exit off ramp and on ramp NW and SW sides are ditches and ponds with cattails.	MLBR	2
7982	HWY 1 at offramp onto skyline blvd ditch on the north east side of off ramp	DC	1
8915	Ditch off highway 1 between highway 1 and 1169 skyline dr.	DC	1
8290	Below hwy 1 at the intersection of palmetto ave and esplanade.	PACF	1
8196	Hwy 35 at Berkshire Blvd ditch NE of intersection.	PACF	1
21672-4600-4748	cabrillo highway ditch on west side across from pacifica pet hospital	PACF	3
39925	Ditch between parking lot and hwy 1 5220-5296 Cabrillo hwy. Linda Mar.	HMB	1
29771	5942-5948 Cabrillo hwy pond like impound.	HMB	1
19206-9850	cabrillo highway ditch along hwy 1 on the west side south of the airport	HMB	2
25826	Ditch Between Cabrillo hwy and Sonora ave 847-899	HMB	1
9807-21457-39898	3 ditches between Capistrano rd and Coronado street along hwy 1 on the east side.	HMB	3
8928	ditch west of highway 1 3610-3634 Cabrillo Hwy	HMB	1
41169	ditch east of Cabrillo hwy HMB between metzgar and grove st.	HMB	1
41168	Ditch e. side hwy1 between grove and Seymour.	HMB	1
19206	Highway 1 northbound (east side) 17450 Cabrillo Highway North to Metzgar Street Single Ditch 2 miles long. East side of airport between highway 1 and airport fence.	HMB	1
10090	Pescadero- Ano Nuevo- Ditch Hwy 1 Northbound (east side)- Costanoa north to Hwy 1 Brewery.	PESC	1
41164	Ditch E.side of hwy 1 between Dolores ave and Redondo beach rd hmb.	HMB	1
11913	Imp H20 - HWY 101 Broadway, very dirty water, west side of freeway, chk from 101-S Millbrae to Broadway exit.	Burl	1
9210	imp h20- Hwy101 Broadway Exit, NE side (by round-about Broadway exit off 101-N & other side of overpass by Airport Blvd intersection).	Burl	1
1273	Peninsula overpass Hwy 101- SM-shallow imps and several ditches.	Burl	1

Site # for Each Location in Our Database	Site Description	City	# of Sites
10982-5753-914	Imp h20 btwn Fash Isl exit from 101S under 92E exit, Ditches/Imp betwn 3rd Ave & Hillsdale, Ditch northside of 101N.onramp twd Adams, behind PetClub & plaza fence Fashion Isl Blvd exit ramp, San Mateo.	SM	3
14093-14089-14114-6033-6032	Hwy 92 impounds and ditches from 101 to SM bridge- 14093, 14089, 14114,6033,6032-- Imp at 92 W OnRamp, N side, from Baker Wy. Check CB at onramp aprx 100 ft from light., Imp N side of onramp at chess dr, S side of Hwy 92, from Edgewater Blvd To FC Blvd. Includes area behind Costco. #0911 for under SM bridge access), N side Hwy 92, Ditch - SM bridge to FC Blvd., 4500 sqft	SM	5
6828-8061-6693-6829-6694	5 ditches and impounds right before Ralston Ave up to Harbor Blvd in Belmont along 101,DITCH Hwy 101 Sth - Hillsdale to Ralston,IMP - Hwy 101 Sth - on-ramp Ralston,IMP - DITCH along WALL - Hwy 101 Ralston,ditch Hwy 101 S, Ralston to Harbor,Ditch with impounded water. SW Corner @ Harbor exit	BMNT	5
6584	Seasonal Impound San carlos101 Off ramp @ RWS Parkway. Check Holly on ramp side also.	SC	1
6745	ditch Hwy 101 N & Skyway Rd between whipple and holly	SC	1
19397	Pickleweed ditch along 101 south at whipple off ramp headed south	RDWC	1
7933	Ditch-culvert at Whipple Avenue on ramp southbound	RDWC	1
41135	imp h20 along 101 across from ToysRUs	RDWC	1
12154	Ditch on East side of 101N past Maple street bridge	RDWC	1
6322	grassy ditch, must check by pulling off 101N btwn Woodside & Maple bridge	RDWC	1
13281	Hwy 101 North of Marsh RD on east side- Imp H20 Hwy 101N, 1000 ft N of Marsh Rd on-ramp, at pullout north	RDWC	1
2541	Ditch along eastbound lane between Dumbarton Bridge and Ravenswood substation	EPA	1
5535	3 Acre impound on Eastbound side between University Ave and Facebook HQ	MP	1
2460	Carduff/Kavanaugh field between University Ave/Hwy 84/railroad tracks/Pump house. South side of HWY	EPA	1
10843	Large freshwater impounds between Pump house/railroad tracks/Hwy 84	MP	1
53884	Ditch along South-eastern edge of pump house	MP	1
10634	Marsh running North- South just west of main entrance. Completely wraps round Facebook headquarters. East side of HWY	MP	1
7251	Ditches on BOTH sides of HWY 84 Between Willow Road and Marsh Road.	MP	1
13332	Impound at entrance to Bayfront Park on HWY 84	MP	1
22779	Ditch on West side of Marsh RD from Bayfront Expy to Northbound hwy 101 on ramp.	MP	1

Site # for Each Location in Our Database	Site Description	City	# of Sites
21771	Ditch on East side of Marsh RD from Bay front Expy to Northbound 101 off ramp	MP	1
2501	West side between Adams Drive and railroad tracks to industrial area. Hwy 109	EPA	1
22694	East side. Ditch between Sandhill Rd and Hwy 84 on Highway 280	Woodside	1
6951	West side . 3985 Woodside Road HWY 84	Woodside	1

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L-SMCP

COUNTY OF SAN MATEO
PARKS DEPARTMENT

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May 9, 2016

Dr. Chindi Peavey, District Manager
San Mateo County Mosquito and Vector Control District
1351 Rollins Road
Burlingame, CA 94010

RE: Draft Programmatic Environmental Impact Report for the San Mateo County Mosquito and Vector Control District's Integrated Mosquito and Vector Management Program

Dear Dr. Chindi Peavey,

The County of San Mateo Parks Department welcomes the opportunity to comment on the Draft Programmatic Environmental Impact Report (Draft PEIR) for the San Mateo County Mosquito and Vector Control District's Integrated Mosquito and Vector Management Program. As you know, an important part of the mission of San Mateo County Parks is to protect and steward natural resources. We would like to recognize the preemptive efforts the San Mateo County Mosquito and Vector Control District (SMC MVCD) has made to coordinate and communicate with our Department's Natural Resource Management and Ranger staff to facilitate access and improve understanding of SMC MVCD activities and potential impacts to County of San Mateo's natural resources. 1

We would like to bring your attention to a few areas of concern regarding the Draft PEIR that may impact natural resources within lands managed by County Parks. The first area relates to meeting thresholds associated with the National Pollutant Discharge Elimination System (NPDES) permit authorized by the Clean Water Act (CWA) and delegated to the State Water Resources Control Board for enforcement. There is a need to coordinate to ensure that endangered species are adequately surveyed within County Parks ahead of potential treatments that could impact the species. Surveys are also needed prior to manual removal of vegetation in aquatic habitats by SMC MVCD staff on County Parks managed land. And lastly, the Draft PEIR discusses the San Bruno Mountain HCP and appears to leave out one of the covered species under the 10(a) permit. 2

The Draft PEIR mentions that there may be potential significant and unavoidable impacts to surface water as a result of your proposed program. The Parks Department has been engaged as a responsible agency in recently developed Total Maximum Daily Load (TMDL) Basin Plan Amendments by the San Francisco Bay Area Regional Water Quality Control Board. It is important for SMC MVCD to be aware that TMDL plans impact staff capacity and financial resources for the Parks Department. We encourage the SMC MVCD to be aware and consider proactive measures to test for and comment on any future TMDL's that arise from exceedances related to pyrethroids in areas that are treated for adult mosquito control using these substances. This burden should be equally shared by all those that may be contributing to exceedances and not solely the burden of the land managers. 3

L-SMCP

The Draft PEIR makes mention of not using protocol-level surveys for California red-legged frogs (CRLF) ahead of channel excavation. County Parks is concerned that with respect to CA RLF that this may lead to potential significant impacts. Many coastside riparian areas that County Parks manages are suspected to host CRLF populations. County Parks suggests that for any channel excavation project proposed by the SMC MVCD within County Parks that use of protocol surveys (includes visual encounter survey, day survey, and night survey with binoculars and lights) be required to avoid inadvertent impacts to CFLF within County Parks. 4

Manual vegetation control is proposed for surveillance and control of potential vectors within the program area. We encourage the SMC MVCD to continue preemptive coordination and communication with our Department well in advance of these measures being implemented on County Parks owned or managed land. 5

Lastly, we would like to make the SMC MVCD aware that the San Bruno Mountain HCP (SBM HCP) Section 10(a) permit was expanded to include the Callippe silverspot (*Speyeria callippe callippe*) butterfly. This species should be considered in this Draft PEIR with respect to any actions that could potentially impact this species or its habitat. It is also important to note, that while the SBM HCP does not have extensive freshwater wetlands or ponds there are areas that do fit this description within the SBM HCP boundary. If these areas would be considered for treatment under this Draft PEIR then additional review or information may be necessary to accurately evaluate potential impacts. 6

Thank you for the opportunity to provide preliminary comments on the Draft PEIR. We would like to continue to have open communication and close coordination with you and your staff.

Sincerely,

Marlene Finley
Parks Director

SAN MATEO COUNTY PARKS

COUNTY OF SAN MATEO CALIFORNIA

Comment Letter L-SMCP

San Mateo County Department of Parks and Recreation

Marlene Finley, Parks Director
May 9, 2016

Response 1

Comment noted. No response is required. The District will continue to work closely with County Parks.

Response 2

Once a pesticide has been released into the environment, it is broken down by exposure to sunlight, (photolysis), exposure to water (hydrolysis), exposure to other chemicals (oxidation and reduction), microbial activity (bacteria, fungi, and other microorganisms), and other plants or animals (metabolism). Pesticide labels set out safety and use guidelines that usually focus on three aspects: rates of application (single and cumulative) for registered crops and pests, timing of application, and restrictions on areas of application (including required buffer zones).

Concerning County Parks' NPDES permit comment, further support for the PEIR conclusions of less-than-significant impacts to water quality from adulticides and larvicides applied by the District is provided in a 2-year monitoring study conducted for the State Water Resources Control Board by the Mosquito and Vector Control Association of California (MVCAC) monitoring coalition to determine whether vector control activities were contributing contaminants to state waters. The MVCAC monitoring coalition conducted chemical monitoring for adulticides at 61 locations during 19 application events in 2011 to 2012 and coordinated physical monitoring for 136 larvicide application events in 2012. Samples were collected from agricultural, urban, and wetland environmental settings in both northern and southern California. Adulticides evaluated included pyrethrin, permethrin, sumithrin, prallethrin, etofenprox, naled, malathion, and the synergist piperonyl butoxide. The monitoring study (MVCAC 2013) was conducted in accordance with the Statewide NPDES Vector Control Permit (SWRCB 2011a) and had the following results:

- 1 out of 136 visual observations showed a difference between background and post-event samples;
- 108 physical monitoring samples showed no difference between background and post-event samples; and
- 6 out of 112 samples exceeded the receiving water monitoring limitation or triggers.

The report concluded that there was no significant impact to receiving waters due to application of vector control pesticides in accordance with approved application rates. This is consistent with the primary mandate for vector control districts of protecting public health by reducing vector-borne diseases from mosquitoes and other vectors.

The State Water Resources Control Board evaluated the results of this study (MVCAC 2013) and a concurrent toxicity study conducted by researchers from UC Davis (Phillips et al. 2013) and concluded that, based on the monitoring data, the application of pesticides in accordance with approved application rates does not impact beneficial uses of receiving waters (SWRCB 2014). Therefore, the monitoring and reporting program for the State Vector Control Permit was amended in March 2014 to limit the required monitoring to visual observations, monitoring and reporting of pesticide application rates, and reporting of noncompliant applications. These studies provide substantial evidence that the District properly concluded that the potential impact of District use of larvicides and adulticides would not hinder achievement of the TMDL targets or otherwise substantially degrade water quality.

Concerning the comment that "endangered species are adequately surveyed within County Parks ahead of potential treatments that could impact the species" including manual removal of vegetation in aquatic habitats on managed lands, the District will work with land managers such as County Parks to identify sensitive habitat areas; however, we cannot be responsible for conducting on-the-ground (site-specific) species surveys for County Parks. Rather, the District has the California Natural Diversity Database (CNDDB) maps that can be checked by our trained technicians prior to going into the field for vegetation or chemical management activities to be prepared for working carefully in and around sensitive areas. We also have countywide maps of sensitive habitat from County Planning for training District staff on general areas to be aware of.

Concerning PEIR Sections 4.1.4.3 and 5.1.4 on the San Bruno Mountain HCP, the following text changes to add the additional covered butterfly Callippe silverspot (*Speyeria callippe callippe*) are provided:

> "The San Bruno HCP has since been amended on four occasions (although the number of species listed on the permit has remained constant). The Permittees intend to request that the amended permit include those species covered in the original incidental take permit, as well as the endangered Callippe silverspot (*Speyeria callippe callippe*) butterfly and San Francisco lessingia, the threatened Bay checkerspot butterfly, and the unlisted San Bruno Mountain manzanita. The 30-year permit was renewed in March 2013 for an additional 30 years. While addressed in the San Bruno Activities Report (MIG TRA 2014), Bay checkers butterfly has not been seen in 30 years, and SFGS and CRLF have never been seen on San Bruno Mountain as almost no aquatic habitat exists to support these two species. The federal ESA Section 10(a)(1)(B) incidental take permit was expanded in 2013 to include the Callippe silverspot (USFWS 2013)." (page 4-19)

> "This HCP addresses impacts to these endangered species: San Bruno elfin butterfly, mission blue butterfly, Callippe silverspot (*Speyeria callippe* callippe), and San Francisco garter snake (SFGS) over 3,500 acres on San Bruno Mountain in San Mateo County for a duration of 30 years. The federal ESA Section 10(a)(1)(B) permit was expanded in 2013 to include the Callippe silverspot (*Speyeria callippe callippe*)." (page 5-29)

Tables 4-4 (page 4-14) and 5-5 (page 5-31) need the addition of the Callippe silverspot to row 3 (San Bruno Mountain HCP), column 3 (Covered Species, Listed and Nonlisted), and this addition has been done for the revised Draft PEIR.

Response 3

The Draft PEIR identified only one potentially significant and unavoidable impact to surface water quality that was associated with the potential use of naled as an adulticide specifically at an impaired waterbody (lower San Mateo Creek) as a worst case. However, the results of the MVCAC (2013) monitoring study suggest that the use of naled by districts in California from 2011 to 2012 did not adversely impact water quality. See Response 2 above. Therefore, this statement is conservative for water quality and reflects the concerns of local water agencies for any effect, no matter how minimal, on an impaired water body as opposed to unimpaired water bodies. Naled is of concern to water agencies because of its breakdown product, but it is rarely used by most vector control districts in the San Francisco Bay Area. SMCMVCD has never used naled and does not intend to utilize it for adult mosquito control unless special circumstances arise. i.e., would be used only if or when resistance to other products occurs. It has been used in Florida to manage the Zika virus outbreak in 2016 and is being used in the Houston area after Hurricane Harvey.

The Basin Plan (SFBRWQCB 2015) establishes a water quality attainment strategy and TMDL for some pesticides and pesticide-related toxicity in the San Francisco Bay Region's urban creeks, including actions and monitoring necessary to implement the strategy. The TMDL notes that pesticides "enter urban creeks through urban runoff. Most urban runoff flows through storm drains owned and operated by the Region's municipalities, industrial dischargers, large institutions (e.g., campuses), construction dischargers, and the California Department of Transportation (Caltrans)." The TMDL further notes that "pesticide use by structural pest control professionals and use of products sold over the-counter can be among the greatest contributors of pesticides in urban runoff." Rather than establish mass loads for pesticide contributions, the TMDL establishes concentration-based numeric targets, expressed in concentration units, and states that "the numeric targets, allocations, and implementation plan described [in the TMDL] are intended to ensure that urban creeks meet applicable water quality standards established to protect and support beneficial uses." The TMDL's pesticide toxicity targets are expressed in terms of acute toxic units (TUa) and chronic toxic units (TUc) and require demonstration of a statistically significant observable effect. An undiluted ambient water or sediment sample that does not exhibit an acute or chronic toxic effect that is significantly different from control samples on a statistical basis shall be assumed to meet the relevant target. The TMDL implementation plan relies heavily on actions by the agencies with the broadest authorities to oversee pesticide use and pesticide discharges, including USEPA, the California Department of Pesticide Regulation, and the Water Board as well as adherence to integrated pest management (IPM) strategies. The TMDL notes that "regulatory and nonregulatory actions are needed to ensure that pesticide use does not result in discharges that cause or contribute to toxicity in urban creeks. Implementing these actions is expected to ensure attainment of the allocations. Many entities are already implementing these actions." The actions identified in the TMDL focus primarily on addressing water quality concerns through the pesticide registration process (through which label requirements are developed), and reducing the use of pesticides, including the potential for urban runoff to enter creeks, through integrated pest management. In particular, to prevent pesticide-related toxicity in urban creeks the TMDL states that mosquito and vector control agencies should "adopt IPM and less toxic pest control techniques so pesticide applications do not contribute to pesticide runoff and toxicity in urban creeks."

The District's Program is based on the principles of IPM and prioritizes nonchemical control over pesticide use. Furthermore, all District applications of chemicals are done in strict compliance with label requirements, BMPs (many of which have been developed in consultation with regulatory agencies) and applicable permit conditions (such as those contained in the Statewide NPDES Vector Control Permit (SWRCB 2011a), by trained professionals. Thus, the District's Existing and Proposed Programs implement the actions specified in the TMDL to ensure attainment of the TMDL's pesticide allocations. (Note that the District does not use pesticide products containing diazinon.) Historically the District has, taken an integrated systems approach to mosquito and vector control, utilizing a suite of tools that consists of public education, surveillance, source reduction (e.g., physical control, vegetation management, water management), biological controls, and chemical controls. As was stated in the Draft PEIR Section 2.3, three core tenets are essential to the success of a sound Integrated Mosquito and Vector Management Program (IMVMP).

> **First**, a proactive approach is necessary to minimize impacts and maximize successful vector management. Elements such as thorough surveillance and a strong public education program make all the difference in reducing potential human vector interactions.

> **Second**, long-term environmentally based solutions (e.g., water management, reduction of harborage and food resources, exclusion, and enhancement of predators and parasites) are optimal as they reduce the potential pesticide load in the environment as well as other potential long- and short-term impacts.

> **Lastly**, utilizing the full array of options and tools (public education, surveillance, physical control, biological control, and when necessary chemical control) in an informed and coordinated approach supports the overall goal of an environmentally sensitive vector management program.

To reduce potential pesticide contributions to urban and/or industrial drains and collector ponds/catch basins from vector control applications, the District follows the IPM approach and strives to minimize the use of pesticides and their impact on the environment while protecting public health. As stated in Response 18 above, unless specific vector control is required, based on surveillance results, to reduce adult mosquito populations, District applications of adulticides are not directed to urban storm drain systems. However, larvicides, per the product labels, may be applied to urban storm drains systems to control larval mosquitoes. Chemicals introduced to urban storm drains from runoff are usually the result of city, homeowner, or landscaper discharges within or near populated areas. In addition, buffers may be used between pesticide and herbicide use areas to address the potential migration of a pesticide and waterbodies. The product label may include specific buffers where they are required. The District adheres to all label requirements for its specific uses.

Based on the information provided above and in PEIR Sections 2.7 and 9.2.7.2.1, the District does not believe it would contribute to exceedences of future TMDLs related to the use of pyrethroids for adult insect control.

Response 4

Concerning the comment requesting the District to do protocol surveys for CRLF to avoid inadvertent impacts within County Parks, the time and expense associated with these surveys makes it prudent for the District to presume presence based on locations identified in the CNDDB and similar habitats and access these habitats carefully for vector control. Most of the District's channel maintenance occurs in salt marsh and brackish habitat and not in the freshwater habitats providing potential habitat for CRLF.

Response 5

The District will continue to coordinate closely with County Parks for surveillance and vegetation management activities.

Response 6

Concerning the Callippe silverspot butterfly, see Response 3 above. The District rarely performs vector control activity within the HCP boundary, and current protocol is to avoid working within the HCP. However, if a public health problem arose and treatment would be needed to protect nearby residential areas, District staff will inform County Parks of the situation prior to accessing the problem areas within the HCP boundary. The District recommends visiting any potential problem areas with County Parks staff prior to the development of a vector control problem in order to determine proactively what additional information is needed, if any.

Additional References

California Regional Water Quality Control Board, San Francisco Bay Region (SFBRWQCB). 2015. San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan). Chapters 1 and 7.

California State Water Resources Control Board (SWRCB). 2014. State Water Resources Control Board Order 2014-0038-EXEC Amending Monitoring and Reporting Program for Water Quality Order 2011-0002-DWQ General Permit No. CAG 990004 (as Amended by Order 2012-0003-DWQ) Statewide National Pollutant Discharge Elimination System Permit for Biological and Residual Pesticide Discharges to Waters of the United States from Vector Control Applications. Available online at http://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/docs/vectorcontrol/2012-0003-dwq/vcp_amended_mrp.pdf

Mosquito and Vector Control Association of California (MVCAC) NPDES Permit Coalition. 2013. 2011/2012 Annual Report, NPDES Vector Control Permit (Order No. 2012-0003-DWQ). February 22.

Phillips, B.M, B.S. Anderson, J.P. Voorhees, K. Siegler, L. Jennings, M. Peterson, R.S. Tjeerdema, D. Denton, D., P. TenBrook, K. Larsen, and P Isorena. 2013. General Pesticide Permit Toxicity Study: Monitoring Aquatic Toxicity of Spray Pesticides to Freshwater Organisms. Draft Final Report. Prepared by University of California, Davis, Department of Environmental Toxicology, United States Environmental Protection Agency, and California State Water Resources Control Board for California State Water Resources Control Board, Agreement Number 10-102-270. July. Available online at http://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/docs/vectorcontrol/vcp_tox_study_draft_final_july2013.pdf.

US Fish and Wildlife Service (USFWS). 2013. Federal Fish and Wildlife Permit, Native Endangered and Threatened Species Habitat Conservation Plan (HCP), San Bruno Mountain. March 29. Available online at: http://parks.smcgov.org/documents/san-bruno-mountain-habitat-conservation-plan-hcp.

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3 Organization Comments and Responses

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Physicians for Social Responsibility
San Francisco Bay Area Chapter

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O-PSR

May 8, 2016

Dr. Chindi Peavey
District Manager
San Mateo County Mosquito and Vector Control District
1351 Rollins Road
Burlingame, CA 94010
peir@smcmvcd.org

Dear Dr. Chindi Peavey,

I am writing you, to provide brief comments regarding your department's Draft Programmatic Environmental Impact Report (PEIR) for the Integrated Mosquito and Vector Management Program. I represent the San Francisco Bay Area Physicians for Social Responsibility (SF Bay Area PSR), which is a non-profit education and advocacy organization with approximately 2,500 members. Our organization combines the power of community activism with the knowledge and credibility of physicians and other health professionals to promote public policies that support human health.

I have reviewed the letter dated May 9, 2016 from Stephan C. Volker on behalf of Healthy Children Alliance and support the arguments put forth in this letter. SF Bay Area PSR believes that the San Mateo County Mosquito and Vector Control District's PEIR fails to thoroughly and accurately disclose and analyze the human and environmental health impacts associated with the pesticide use contemplated in this project. Of particular concern are the proposed usage of pyrethroid and pyrethroid-like compounds, and glyphosate, without a proper and thorough analysis of the impact of such usage on human and environmental health. Young children and pregnant women are especially vulnerable to the negative health impacts associated with pesticide usage. As such, these potential hazards must be given full disclosure and attention in a revised PEIR that would truly aim to be protective of public health 1

Respectfully,

Robert M. Gould, MD

Robert M. Gould, M.D.
President, SF Bay Area PSR
rmgould1@yahoo.com

The Active Conscience of American Medicine

Comment Letter O-PSR

**Physicians for Social Responsibility
San Francisco Bay Area Chapter**

**Robert M. Gould, M.D., President
May 8, 2016**

Response 1

Comments noted and considered. It is agreed that public controversy (including opposition by some individuals and organizations to any use of pesticides) exists within the District's Service Area. This pesticide use controversy is why the District prepared a PEIR and why the document was organized to include two chapters not normally included in EIRs: Chapter 6, Ecological Health and Chapter 7, Human Health. These two chapters are based on a technical Appendix B, Ecological and Human Health Assessment Report.

The District's objective is to reduce or minimize the possibility of unwanted nontarget effects in the local environment while addressing the need for vector control. These considerations and how unwanted effects can be eliminated or reduced are embodied in the Program objectives, in product label instructions, and in each of the applicable BMPs that guide all pesticide applications by the District. By restricting chemical applications to times when nontarget insects are not active and using care to treat only vector larvae and adults in locations where they are concentrated (i.e., population is high enough to warrant chemical control) and in close proximity to human activities, impacts to other species are eliminated or substantially reduced. Once a pesticide has been released into the environment, it can be broken down by exposure to sunlight (photolysis), exposure to water (hydrolysis), exposure to other chemicals (oxidation and reduction), microbial activity (bacteria, fungi, and other microorganisms), and other plants or animals (metabolism). Pesticide labels set out safety and use guidelines that usually focus on three aspects: rates of application (single and cumulative) for registered crops and pests, timing of application, and restrictions on areas of application (including required buffer zones).

See all of the responses to the comments from Stephan C. Volker. The following responses are provided in summary form because the full responses are contained in the responses to the letter labelled O-VOL.

Concerning the use of pyrethroids and pyrethrins for vector control, refer to Responses O-VOL 16, 23, 24, and 25. The overwhelming majority of the District's adulticide applications are site-specific applications using handheld and/or backpack equipment. These applications are performed as necessary to reduce substantial populations of adult mosquitoes in the interest of public health. These pesticide products are also used in targeted applications to ground-nesting yellow jackets, wasps, and potentially for infestations of ticks in areas where humans and domestic animals are frequent visitors or on private property when requested by the property owner. If adult mosquitoes are invading residential areas in close proximity to mosquito breeding sites, the District's IVM principles would require using nonchemical methods first to control the breeding population, followed by the use of larvicides. Adulticiding or control of adult mosquitoes is infrequent and done only when all other methods of control under the IMVMP Plan have been exhausted and the protection of public health against disease requires control. Products used in or adjacent to residential and intensive recreational areas are those that break down quickly due to exposure to air, light, and soil microorganisms. See Response O-VOL 26 on a monitoring study explaining how adulticides are not impacting surface water. Since the ultralow volume (ULV) applications of pyrethroids over surface water cannot be detected in the surface water (with only a few exceptions), then the ground surface would be similarly unaffected. The assumption that children would be exposed under the conditions indicated (i.e., binding to organic matter and sand/soils) is not applicable to the ULV and targeted application techniques for adulticides utilized by the District such that the concern is overstated.

Concerning the use of glyphosate for vegetation management, refer to Responses O-VOL 20, 21, and 22. Use of herbicides by any other water or land management district does not compare to existing use of herbicides by the District. The most frequent use of glyphosate by the District is to remove poison ivy/oak from land areas requiring access by District staff for surveillance and vector control. However, larger areas could be treated in the future if needed for vector control or to assist another agency with invasives such as the Coastal Conservancy's ISP. When applied to typical areas targeted for vegetation management, glyphosate is transformed to less toxic and different chemical constituents in normal soil within a few days, or even quicker when used for most general uses. It can be rapidly bound to soil particles and inactivated, and the unbound glyphosate can be degraded by bacteria. The media reports about the hazards of glyphosate and its several commercial products have not been clearly associated with human health. The numerous reports about "possible" connections to metabolic processes and subtle effects also include confounding factors that make scientifically defensible claims impossible. Where reports of adverse subtle effects exist, they are usually based on laboratory studies of cell lines, etc., at exposures far above any possible actual human exposure.

Concerning the commenter's request to the District to prepare a revised PEIR because the commenter disagrees with the PEIR conclusions of less-than-significant impacts to ecological and human health, opinion on what a significant impact is and is not in this PEIR differs between the commenter and the PEIR preparers. The Draft PEIR thoroughly analyzed the impacts associated with the Proposed Program, and additional information is provided herein and in a revised Draft PEIR (for recirculation) to support the original conclusions as well as consideration of information provided by Mr. Volker and other commenters. The information in the revised Draft PEIR provides clarification of material contained in the original Draft PEIR and addresses specific questions raised in public comments for this PEIR in Appendix F, Responses to Comments. None of the comments identified substantial evidence of a new significant impact that was not considered in the first Draft PEIR, and no Draft PEIR impacts need to be changed from less-than-significant to significant; thus, a recirculated Draft PEIR is not required for these reasons but is provided because clarifications and additions may be considered substantial. A revised Draft PEIR is being recirculated.

See Response O-VOL-7 on considerations in making impact determinations of significance on chemical methods of vector control. The CEQA conclusions of less-than-significant impacts are based not only on the District BMPs (a Program feature that is part of the Program description) but also on application methods and the concentration and type of chemical materials used. All of these factors, and including the physical context in which the applications occur (that subject the treatments to sunlight, air, and soil conditions that minimize persistence and facilitate breakdown) support the Draft PEIR conclusions that the resultant effects are not substantial or adverse enough to be characterized as significant, not that a conclusion of zero or no impact is presented. A loss of some individual nontarget insects could occur on occasion during an application, but the loss would not be substantial for reasons cited in Responses O-VOL 6 and 7.

Appendix B was a technical report designed to cover basic parameters of toxicity, fate, and transport for 46 chemicals and designed to provide sufficient information for the public about the potential adverse effects of the chemicals used by the 9 participating districts, including the District, for vector control. The information and chemical data provided in Appendix B are based on summaries and data generated to satisfy the United States Environmental Protection Agency (USEPA) requirements for registration of chemicals and pesticides. Most of those data are generated by independent research and contract laboratories that conduct strictly controlled laboratory and field tests with the chemical of interest, and numerous possible species are exposed to nearly 100 percent chemical for varied periods of time. Although these tests are designed to identify and characterize the possible toxicity of the chemical, the results are clearly not directly relevant to the very low levels of chemicals used and exposures that result from the District's specific vector control activities in the physical environment described above. Additional literature was reviewed in preparing these and other responses to comments, and part of this literature review is attached to the O-VOL responses to comment as Attachment A (at the end of the responses).

Also see Response O-VOL-15 on the use of best professional judgment by PEIR preparers with the appropriate technical qualifications to evaluate the impacts of human and ecological concern. The author of the responses on pesticide use herein, both insecticides and herbicides, and the ecological and human health impact conclusions and related material in the Draft PEIR is Bill A. Williams, PhD, a toxicologist with the educational and experiential background as an expert on pesticides and their use in aquatic and terrestrial environments. A summary of Dr. Williams' qualifications to evaluate the scientific literature and to consider where and how the District is specifically using the pesticides for vector control in order to draw conclusions of impact significance to humans and to nontarget species is provided in Response O-VOL-15. Dr. Williams has more than 30 years of experience and expertise in environmental risk assessment and toxicology, including CERCLA, NRDA, NEPA, and CEQA projects ranging from upland to sediment to freshwater/marine projects. Dr. Williams has been a member of numerous international, National Academy, and federal committees and workshops to define risk assessment guidelines, test procedures, field study approaches, and avian and mammalian test protocols, and to provide other technical assistance utilized by USEPA regulators. He helped develop USEPA's Framework for Ecological Risk Assessment and USEPA's risk assessment of 2,3,7,8 TCDD (tetrachlorodibenzo-p-dioxin or dioxin). He was a charter member of the Avian Dialogue Group, convened by the Conservation Foundation (RESOLVE) to bring industry, academia, and government regulators together to resolve conflicts between the groups. Dr. Williams has led and supported dozens of successful projects that were acceptable to the Washington Department of Ecology, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, USEPA Regions 2, 9, 10, and numerous other USEPA regions nationwide. Dr. Williams has served on several Oregon DEQ advisory science committees and workshops. He has been a member of several national and regional USEPA Science Advisory Panels, including the National Science Advisory Panel on endocrine disruptors, on uncertainty in risk assessments, and the panel on use of laboratory data in estimates of risk to wildlife.

The highlights of his extensive experience presented are from Dr. Williams' technical resume, which is attached to the end of the O-VOL responses to comments (Attachment B). This resume has been reduced from his master resume to focus on the most relevant aspects of his career dealing with pesticides and risk assessments, excluding his accomplishments at NASA as a Program Scientist and Payload Scientist/Astronaut (1969-1986).

O-TOR

TORRES MARTINEZ DESERT CAHUILLA INDIANS
P.O. Box 1160
Thermal, CA 92274
(760) 397-0300 – FAX (760) 397-8146

RECEIVED
MAY 1 2 2016
BY: ....

May 9, 2016

To whom it may concern:

Re: California Environmental Quality Act Public Resources Code section 21080.3, subd. (b) ; California Assembly Bill 52, Request for Formal Notification of Proposed Projects within your jurisdiction that is traditionally and culturally affiliated with the Torres Martinez Desert Cahuilla Indians.

The purpose of this letter is to request formal notification of proposed projects within your jurisdiction that is traditionally and culturally affiliated with the Torres Martinez Desert Cahuilla Indians, in accordance with Public Resources Code Section 21080.3.1, subd. (b). As of the date of this letter, you have been formally notified that the boundaries of your local government's jurisdiction fall within the area that is traditionally and culturally affiliated with the Torres Martinez Desert Cahuilla Indians. Additionally, Torres Martinez Desert Cahuilla Indians has created specific requests and formal procedures in accordance with California Assembly Bill 52: 1

- Formal notice of and information on proposed projects for which your agency will serve as a lead agency under the California Environmental Quality Act (CEQA), Public Resources Code section 21000 et seq. Pursuant to Public Resources Code section 21080.3.1, subd. (b) shall be sent to Torres Martinez Desert Cahuilla Indians

- Within 14 days of determining that an application for a project is complete or of a decision by your agency to undertake a project, a lead agency must provide formal notification to Cultural Monitoring Coordinator, Michael Mirelez, who is the designated contact and tribal representative for the traditionally and culturally affiliated Torres Martinez Desert Cahuilla Indians regarding notifications pertaining to California Assembly Bill 52

Contact Information:
Michael Mirelez
Cultural Resource Coordinator
Torres Martinez Desert Cahuilla Indians

O-TOR

Address: P.O. Box 1160 Thermal, CA 92274

Office: 760-397-0300 ext:1213
Cell: 760-399-0022
Email: mmirelez@tmdci.org

This notice shall consist of a formal written letter that includes:

- A description of the proposed project
- The project's location
- The lead agency contact information
- A clear and definitive statement that the tribe has 30 day to request consultation
- An Aerial Photo of the project Area
- Copies of the CHRIS Archaeological Record Search

- Once the Torres Martinez Desert Cahuilla Indians has received the notification, we will respond within 30 days as to whether we wish to initiate consultation as prescribed by Public Resources Code section 21080.3.1, subd. (d), the Torres Martinez Desert Cahuilla Indians, may request consultation, as defined by Public Resources Code section 21080.3.1, subd. (b), pursuant to Public Resources Code section 21080.3.2 to mitigate any project impacts a specific project may cause to tribal cultural resources.

- The lead agency shall begin the consultation process within 30 days of receiving the Torres Martinez Desert Cahuilla Indians request for consultation and prior to the release of a negative declaration, mitigated negative declaration, or environmental impact statement.

- Once a review of inadvertent discoveries has been completed by the Cultural Resource Director, all information will then be transferred to the Torres Martinez Desert Cahuilla Indians Tribal Council for a final decision and directive.

Sincerely,

Michael Mirelez
Cultural Resource Coordinator
Torres Martinez Desert Cahuilla Indians

Comment Letter O-TOR

Torres Martinez Desert Cahuilla Indians

Michael Mirelez, Cultural Resource Coordinator
May 9, 2016

Response 1

The District staff has attempted to contact Mr. Mirelez through email, phone, and letter on multiple occasions during 2016 to confirm that the tribe does not have any assets or cultural interests in San Mateo County or in the adjacent counties (San Francisco, Santa Clara, and Santa Cruz) that comprise the Program Area for this PEIR. We have not received a response at this time but will continually attempt to reach out to Mr. Mirelez in order to clarify that the letter does not apply to the District's geographic area. He is to be sent a Notice of Availability of the revised Draft PEIR.

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O-VOL

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10.590.01

May 9, 2016

Via Email and U.S. Mail

Dr. Chindi Peavey, District Manager
San Mateo County Mosquito and Vector Control District
1351 Rollins Road
Burlingame, CA 94010
peir@smcmvcd.org

Re: Comments of Healthy Children Alliance on the Draft Programmatic Environmental Impact Report for the Integrated Mosquito and Vector Management Program

Dear Dr. Peavey:

On behalf of the Healthy Children Alliance we submit the following comments on the Draft Programmatic Environmental Impact Report ("DPEIR") for the San Mateo County Mosquito and Vector Control District ("SMCMVCD's") Integrated Vector Management Program ("Program"), prepared pursuant to the California Environmental Quality Act, Public Resources Code §§ 21000 *et seq*. ("CEQA").

PROJECT DESCRIPTION

CEQA requires than an EIR include "an accurate, stable and finite project description" for the action being reviewed. *County of Inyo v. City of Los Angeles* (1977) 71 Cal.App.3d 185, 192; California Code of Regulations, Title 14 ("Guidelines") § 15124. "A curtailed or distorted project description may stultify the objectives of the reporting process. Only through an accurate view of the project may affected outsiders and public decision-makers balance the proposal's benefit against its environmental cost, consider mitigation measures, assess the advantage of terminating the proposal (i.e., the 'no project' alternative) and weigh other alternatives in the balance. An accurate, stable and finite project description is the *sine qua non* of an informative and legally sufficient EIR." *County of Inyo*, *supra*, 71 Cal.App.3d at 192-193. The project description for the Program fails to satisfy CEQA's requirements in numerous ways.

For example, CEQA mandates that the DPEIR identify the "*precise* location and boundaries of the proposed project . . . on a detailed map," yet the DPEIR entirely fails to do so – in both the text and on the provided map. Guidelines § 15124(a) (emphasis added); DPEIR 2-1, 1

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2-3 (Figure 2-1). As the DPEIR admits, "the Program occurs in an area that is somewhat larger than the District's Service Area," because of the "potential for control activities within the Service Area to affect any adjacent jurisdictions." DPEIR 2-1. But the DPEIR fails to disclose what this larger "Program Area" comprises. *Id.* The adjacent jurisdictions are sizeable. For example, Santa Clara County's southeastern boundary is more than 50 miles from the SMCMVCD service area and Santa Cruz County's southern boundary extends even farther south beyond Santa Clara County. San Francisco County reaches another 7 miles to the north of SMCMVCD's service area. Yet the DPEIR fails to specify what portions of these adjacent counties comprise the "somewhat larger" Program Area. DPEIR 2-1. The "Program Area" map provided as Figure 2-1 does nothing to shed light on this significant failure. DPEIR 2-3. This map identifies the "Service Area" and "adjacent counties" only. Again, there is no identification or depiction of the actual Program Area that would be impacted by Program activities, leaving the sizeable populations of these areas in the dark as to the Program's impacts on them. 1 cont'd

The DPEIR also fails to fairly describe the proposed Program activities – and alternatives to the Program – as required by CEQA. DPEIR S-4 to S-9, 2-5 to 2-52, 2-58 to 2-59; Guidelines § 15124. The DPEIR describes and defines the Program components as "Program alternatives." DPEIR S-4, 2-4 to 2-52. However, "alternatives" are a CEQA term-of-art used to describe potential activities that can be implemented *instead* of the Program to lessen significant impacts. Guidelines § 15126.6; *North Coast Rivers Alliance v. Kawamura* (2015) 243 Cal.App.4th 647, 656. Here, the Program activities are optional components of the Program, not alternatives to the Program as a whole. *Id.* Yet the DPEIR also describes the CEQA alternatives to the entire Program under the heading "Program Alternatives," despite the DPEIR's prior use of this term for components of the proposed Program. DPEIR 2-58 to 2-60, 15-3 to 15-10; Guidelines § 15126.6. Thus, the DPEIR's description of "Program 'tools' or components . . . as 'Program alternatives' for the . . . CEQA process" is inaccurate, confusing and misleading. DPEIR S-4, 1-9, 2-5, 2-58. "The DEIR's . . . failure to appreciate CEQA's requirement to study alternatives *to the program*" violates CEQA. *North Coast Rivers Alliance v. Kawamura*, *supra*, 243 Cal.App.4th at 656. 2a

When discussing the various tools that are part of the Program, the DPEIR does not provide essential information about how SMCMVCD determines when to use them. *See, e.g.*, DPEIR 2-22 (fails to explain how SMCMVCD determines that the "threshold" for chemical control is met for any of the potential vectors). Absent this information, SMCMVCD's chemical control and vegetation management decisions lack accountability. The lack of a clear threshold makes it impossible to evaluate the potential scope and scale of any particular Program tool, or its resulting impacts. 2b

Further, the Project Description indicates that existing Best Management Practices ("BMPs") will be used to reduce what would otherwise be potentially significant impacts caused by the Program. DPEIR S-5 to S-6, 2-62 to 2-89. Again, the DPEIR misuses a CEQA term-of-art, creating an inaccurate and unstable project description. *Id.* Under CEQA, mitigation 3

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"describe[s] feasible measures which could minimize the significant adverse impacts" of a project. Guidelines § 15126.4(a)(1). As defined by the DPEIR, the BMPs are "measures to avoid, minimize, eliminate, rectify, or compensate for potential adverse effects." DPEIR 2-54. This is *exactly* what mitigation measures are supposed to do. Guidelines § 15370 (defining mitigation to include "[a]voiding," "[m]inimizing," "[r]ectifying," "[r]educing," "eliminating," or "[c]ompensating" adverse impacts). The DPEIR attempts to distinguish between the BMPs and mitigation measures solely because the BMPs are "already in use." DPEIR 2-62. But these BMPs are in fact mitigation measures donning a false identity. As mitigation measures, the BMPs violate CEQA because they are unenforceable and vague. Guidelines § 15126.4(a)(2). By analyzing these actions as BMPs rather than mitigation measures, the DPEIR undermines an accurate analysis of the Program's impacts, alternatives, and the applicability and effectiveness of mitigation measures *throughout the DPEIR*. *See* DPEIR §§ 3.2, 4.2, 5.2, 6.2, 7.2, 8.2, 9.2, 10.2, 11.2, 12.2, 13.2 to 13.5, 13.9, 14.4. The DPEIR's failure to adequately describe the Program and its significant impacts sabotages the entire DPEIR analysis. 3 cont'd

The DPEIR also treats the educational aspect of the Program as separate and exempt from CEQA, but it is improper to segment a project into smaller pieces to avoid CEQA review. DPEIR 2-5, 2-52 to 2-53; *Sierra Club v. West Side Irrigation District* (2005) 128 Cal.App.4th 690, 698 ("A public agency may not divide a single project into smaller individual projects in order to avoid its responsibility to consider the environmental impacts of the project as a whole"); Guidelines §§ 15165, 15378. If the educational aspect of the Program is part of the Project under review, it should be considered comprehensively in the DPEIR. 4

RANGE OF ALTERNATIVES

The DPEIR fails to consider a reasonable range of alternatives that could minimize the Program's yet-unknown impacts. Guidelines § 15126.6. The two action alternatives that were considered – Reduced Chemical Control and No Chemical Control – are insufficient to address the numerous impacts that have not been adequately analyzed in the DPEIR, as discussed in more detail below. For example, the DPEIR must also consider alternatives that reduce the significant Program impacts to biological resources and water quality. Pub.Res.Code § 21002; Guidelines § 15126.6. By conflating BMPs and mitigation measures, and thereby understating the Program's impacts, the DPEIR improperly concludes that it need not study other mitigations to address potentially significant impacts. Like the remaining sections of the DPEIR, the alternatives analysis is undermined by the failure to adequately describe and analyze the Program. 5

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IMPACT ANALYSIS

I. Biological Impacts

A. Pollinators

The Program's Chemical Control components include pesticides that harm pollinators. The use of spinosad, pyrethroid-type insecticides (including but not limited to synthetic pyrethroids, permethrin, resmethrin, and etofenprox), and organophosphates such as naled, directly imperils the health of these beneficial insects.[1] Further, the vegetation management component's use of glyphosate has been shown to have sub-lethal effects on the European honeybee.[2] The DPEIR fails to properly account for the Program's pesticide-based pollinator impacts.

First, the DPEIR relies upon an article from *CropScience Canada*, a trade association for pesticide producers, to claim that it is possible that a reduction in milkweed is "largely" to blame for "any adverse impacts to bees and butterflies." DPEIR 5-65, 6-22, 6-26 (citing Menzies, 2015). But pesticide producers have a significant financial interest in sowing seeds of doubt about scientific studies that hurt their bottom lines, just as cigarette companies, and fossil fuel companies, before them. To claim that milkweed loss is "largely" to blame for "any adverse impacts to bees and butterflies" incorrectly extrapolates a harm found with milkweed-dependent monarch butterflies[3] to bees, which are not dependant on milkweed for survival.[4] 6

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[1] Yet Appendix B, which purports to address the human and environmental health concerns of the various pesticides presented in the DPEIR, fails to adequately confront the known harm that pyrethroid-type insecticides cause to bees. *See* U.S. EPA Permethrin, Resmethrin, d-Phenothrin (Sumithrin®): Synthetic Pyrethroids For Mosquito Control, available at: https://www.epa.gov/mosquitocontrol/permethrin-resmethrin-d-phenothrin-sumithrinr-synthetic-pyrethroids-mosquito-control (last visited May 5, 2016) ("pyrethroids are toxic to fish and to bees"). Much of Appendix B fails to discuss bees at all.

[2] Lucila T. Herbert, Diego E. Vázquez, Andrés Arenas and Walter M. Farina, *Effects of field-realistic doses of glyphosate on honeybee appetitive behaviour*, JOURNAL OF EXPERIMENTAL BIOLOGY 217, 3457-3464 (October 2014).

[3] G. F. Robertson, M. P. Zalucki, T. D. Paine, *Larval Host Choice of the Monarch Butterfly (Danaus plexippus L.) on Four Native California Desert Milkweed Species,* JOURNAL OF INSECT BEHAVIOR, Vol. 28, Issue 5, 582-592 (September 2015).

[4] *Resource diversity and landscape-level homogeneity drive native bee foraging* PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES, Vo. 110, no 2, pp 555-558 (January 2013) available online at: http://www.pnas.org/content/110/2/555 (last visited May 5, 2016)

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Second, the DPEIR incorrectly assumes that BMPs it proposes will prevent *any* significant impacts to pollinators. But this assumption is highly flawed. First, these BMPs are mainly targeted at domestic honeybees, yet the many varieties of wild bees (such as bumblebees), moths, butterflies, and flies are important insect pollinators in the San Francisco Bay Area.[5] *E.g.* DPEIR 2-86, 4-40, 5-65, 5-69 to 5-70, 9-22, 9-31, 9-37 (BMP prevents applications over 0.25 acres "during day when honeybees are present and active or when other pollinators are active," with application instead "in areas with little or no honeybees or pollinator activity or after dark"). The DPEIR's focus on domestic honeybees overlooks the diverse pollinator web. Many pollinating moths are active at night and would be subject to spraying under this BMP.[6] The DPEIR must address this potentially significant impact. 7

Along the same vein, the DPEIR erroneously assumes that visual inspection prior to application in smaller areas prevents post application harms. *E.g.*, DPEIR 2-86 (for smaller areas "technician will first inspect the area for the presence of bees and other pollinators. If pollinators are present in substantial numbers, the treatment will be made at an alternative time when these pollinators are inactive or absent"). This fails to acknowledge that pesticide residues will *remain* in toxic amounts for days or even weeks, endangering non-target insects long after application ceases. *E.g.*, DPEIR Appendix B, 4-27 (permethrin causes severe honeybee loss when in treatment area within day after treatment). For both large areas where daytime spraying is limited, and in areas where visual inspections are required, this BMP is *not* sufficient to protect pollinators. 8

Third, the DPEIR only addresses acute impacts of glyphosate use and declares that it will have no impact on pollinators. DPEIR 5-53 to 5-54. As discussed above, glyphosate has been shown to have sub-lethal effects on honeybees. Glyphosate exposure has been associated with a reduction in sucrose sensitivity, and learning performance. Herbert, 2014, *supra*. Yet the DPEIR's BMP preventing "appl[ication of] pesticides that could affect insect pollinators . . . over large areas" does not prevent SMCMVCD from applying herbicides like glyphosate while pollinators are present. *See, e.g.,* DPEIR 9-31. By ignoring these sub-lethal impacts of glyphosate, the DPEIR fails to account for all pathways and methods of harm to pollinating insects, and fails to mitigate those harms. 9

Each of these deficiencies must be corrected in a recirculated DPEIR. 10

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[5] Janis Mara, *Marin volunteers stalk the wild pollinator on UC Extension's 100th birthday*, MARIN INDEPENDENT JOURNAL (May 8, 2014), available at http://www.marinij.com/general-news/20140508/marin-volunteers-stalk-the-wild-pollinator-on-uc-extensions-100th-birthday. Hummingbirds and bats also serve this important function. *Id.*

[6] *See, e.g.,* U.S. Forest Service, Moth Pollination, available at: http://www.fs.fed.us/wildflowers/pollinators/animals/moths.shtml (last visited May 5, 2016)

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B. Special Status Aquatic Species

The Program's Chemical Control components envision the use of a wide variety of pyrethroid type insecticides (including but not limited to pyrethrins, synthetic pyrethroids, permethrin, resmethrin, and etofenprox) that are extremely toxic to aquatic species. Further, because some of these chemicals bind to soil, they accumulate in benthic sediment at levels known to be toxic to benthic invertebrates. Thus, their presence in the watershed poisons the bottom of the aquatic food-chain. Special precautions are necessary to ensure that these chemicals are not introduced into the aquatic environment, including wide buffers around storm-drains, drainage channels, and water bodies. Yet SMCMVCD contemplates that its application of these chemicals to target mosquito adults *will* cause these toxins to enter water bodies. *E.g.* DPEIR 4-69 to 4-70 ("the amount of product encountering the water" is less than the total amount applied). While the pesticide product labels allow mosquito control operations to apply these pesticides in areas that would expose otherwise protected aquatic species, this does not mean that such applications lack environmental impact. CEQA requires SMCMVCD to fully disclose these impacts of applying these chemicals. *Californians for Alternatives to Toxics v. Department of Food and Agriculture* (2005) 136 Cal.App.4th 1, 16-17. 11

The DPEIR also envisions the use of herbicides (including but not limited to diuron, benefin, oryzalin, and triclopyr) that are toxic to aquatic species. DPEIR 4-58. Yet its BMPs are vague and insufficient to prevent these chemicals from migrating into the watershed. For example, diuron, a likely carcinogen, is mobile and will leach into groundwater, yet the BMP merely states that SMCMVCD will provide a buffer (of indeterminate size) between application sites and surface and usable groundwater supplies. This vague BMP provides no assurance that it will prevent contamination.

The SMCMVCD service area is important habitat for fish species listed as threatened or endangered under the Endangered Species Act ("ESA"), 16 U.S.C. section 1531 *et seq*., and the California Endangered Species Act, Fish and Game Code sections 2050-2115, including but not limited to tidewater goby, coho salmon, and steelhead.[7] 12

None of the BMPs specify the types of precautions necessary to prevent these classes of pesticides from entering the watershed. Indeed, none of the BMPs listed in DPEIR Table 4-8 discuss precautions around storm drains and gutters. And none of the BMPs prevent 13

[7] The DPEIR claims that coho are not found in San Mateo County, but the Pescadero and Butano creek watersheds are considered important habitat for these fish. DPEIR 4-7; San Francisco Bay Regional Water Quality Control Board, *Pescadero and Butano Creeks Watershed Sediment TMDL*, available at: http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/pescaderobutanocrkstmdl.shtml (last visited May 5, 2015).

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SMCMVCD from applying any of the pesticides or herbicides when rain is forecast. As such, the BMPs alone cannot prevent significant harm to special status aquatic species – through direct exposure and through the loss of prey and prey habitat – in SMCMVCD's service area. The DPEIR's mistaken decision to ignore food-chain impacts (DPEIR 4-45 to 4-46, 5-40 to 5-41, 6-16) exacerbates its failure to address the Chemical Control component's significant effects on threatened and endangered salmonids and other special status fish species. 13 cont'd

Lastly, the Chemical Control component contemplates the use of methoprene – an insect growth regulator – that it acknowledges is moderately toxic to fish and highly toxic to aquatic invertebrates. DPEIR 2-24; DPEIR Appendix B, 4-5. This chemical is applied to water bodies to alter the growth and development of mosquito larva, rendering them unable to mature. *Id.* The DPEIR mentions in passing that methoprene is potentially bioaccumulative. DPEIR 5-64. The DPEIR does not account for this potential bioaccumulation when it states that the application rate is too low to have any impact. DPEIR 6-29. 14

The DPEIR's incorrect assumptions that the BMPs presented in Table 4-8 will suffice to prevent any harm, and that SMCMVCD's use of these pesticides will not cause significant impacts, must be corrected with an accurate discussion of the harms that these chemicals will cause, and an explanation of how mitigation measures will avoid any significant effects. 15

C. California Red-Legged Frog and Tiger Salamander

EPA evaluated whether permethrin is likely to impact both the aquatic and terrestrial phases of the California red-legged frog, which is listed as a threatened species under the ESA. EPA determined that permethrin *directly* kills California red-legged frogs during aquatic and terrestrial life-phases, and *indirectly* impacts them by killing both aquatic and terrestrial sources of prey.[8] Further, EPA determined that the use of permethrin would likely modify critical habitat for the California red-legged frog. *Id.* EPA likewise evaluated the impacts of glyphosate on the California red-legged frog, and determined that it is likely to adversely affect the terrestrial phase through direct and indirect effects following a reduction in prey and habitat, and is predicted to 16

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[8] U.S. EPA Pesticide Effects Determinations: Risks of Permethrin Use to the Federally Threatened California Red-legged Frog (Rana aurora draytonii) and Bay Checkerspot Butterfly (Euphydryas editha bayensis), and the Federally Endangered California Clapper Rail (Rallus longirostris obsoletus), Salt Marsh Harvest Mouse (Reithrodontomys raviventris), and San Francisco Garter Snake (Thamnophis sirtalis tetrataenia), available at: https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/permethrin/determination.pdf (Last visited May 6, 2016).

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modify the critical habitat.[9] The Recovery Plan for the California red-legged frog,[10] which indicates that Roundup-brand glyphosate contains surfactants that are much more hazardous that glyphosate alone, raises concerns that its use near California red-legged frog habitat should be prohibited. 16 cont'd

The DPEIR acknowledges that use of *many* of the pesticides associated with its Chemical Control and Vegetation Management components would be subject to a court injunction to prevent harm to the California red-legged frog, but for the Program's purpose of vector control. DPEIR 4-9, 5-6, 6-7. But whether the vector control purpose exempts the SMCMVCD from this particular injunction is a *separate* issue from whether the Program is likely to have a significant *impact* on the California red-legged frog. The DPEIR should present a clear examination of these risks. 17

Instead of addressing this issue, however, the DPEIR assumes that the BMPs presented in Table 4-8 will prevent all harm. It also presumes that its use of these pesticides will cause no significant impacts. *See e.g.* DPEIR 4-25 to 4-26, 4-75, 4-104. Both assumptions fail. To the contrary, none of these BMPs adequately address and prevent run-off – through storm drains or otherwise – to protect the California red-legged frog from pesticide exposures. The DPEIR explicitly acknowledges that SMCMVCD's territory includes California red-legged frog habitat. Its failure to specifically address and mitigate potentially significant impacts to this species violates CEQA, and must be corrected. 18

The tiger salamander, a federal and state listed species, is also present in San Mateo County, and is also vulnerable to pesticide exposures. The DPEIR acknowledges that the tiger salamander uses vernal pools in SMCMVCD's service area for breeding (DPEIR 4-8), yet the DPEIR does not include the tiger salamander as a species to protect in its insufficient BMPs. *See* DPEIR Table 4-8. SMCMVCD must evaluate and mitigate the impacts of its Chemical Control measures on tiger salamanders. 19

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[9] U.S. EPA Transmittal Letter requesting formal consultation with U.S. Fish and Wildlife Service, available at: https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/glyphosate/transmittal-ltr.pdf (last visited May 6, 2016); *see also* U.S. EPA, Pesticide Effects Determination: Risks of Glyphosate Use to Federally Threatened California Red-legged Frog (Rana aurora draytonii) (October 2008), available at: https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/glyphosate/determination.pdf (last visited May 6, 2016).

[10] U.S. Fish and Wildlife Service, Recovery Plan for the California Red-legged Frog (May 2002) pp. 122-123. https://www.fws.gov/arcata/es/amphibians/crlf/documents/020528.pdf (last visited May 6, 2016).

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D. Ecological Health, Human Health and Glyphosate

On July 7, 2015, the Marin Municipal Water District ("MMWD") "Board of Directors were given a standing ovation by a packed room of residents after they voted to approve Staff's recommendation to remove herbicides from further consideration in MMWD's DRAFT Wildfire Protection and Habitat Improvement Plan." Sharon Ruston, *The Marin Post, MMWD Board of Directors Votes to Remove Herbicides From Further Consideration!*, July 8, 2015.[11] It did so both due to community opposition and because the World Health Organization recently classified glyphosate as a probable human carcinogen. *See id.* 20

Glyphosate threatens human health and environmental harm in several ways ignored by the DPEIR. Glyphosate is extremely persistent, and can be detected at application levels months after application. Because glyphosate attacks the ability of plants and bacteria to synthesize aromatic amino acids, Monsanto has patented its use as an antimicrobial agent; its use interferes not only with target plants but also with soil bacteria (and bacteria inside anything that accidentally ingests its residue).[12] Healthy soil bacteria should be preserved, not jeopardized by glyphosate.[13] Yet the DPEIR does not mention these significant ecological risks in its discussion of the vegetation management component. 21

The DPEIR also downplays glyphosate's risks to human health. It brushes aside the World Health Organization's International Agency for Research on Cancer determination that glyphosate is "probably carcinogenic to humans."[14] DPEIR 7-16. Instead of accepting the growing body of evidence that glyphosate usage is *not* as innocuous as its manufacturers claim, 22

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[11] Available at https://marinpost.org/blog/2015/7/8/mmwd-board-of-directors-votes-to-remove-herbicides-from-further-consideration (as visited October 1, 2015).

[12] N. de María, et al., New insights on glyphosate mode of action in nodular metabolism: Role of shikimate accumulation, *J. Agric Food Chem.* (April 5, 2006) 54(7):2621-8; Monsanto Technology LLC, Missouri. Glyphosate formulations and their use for the inhibition of 5-enolpyruvylshikimate-3-phosphate synthase. 2010. US Patent number 7771736 B2. https://www.google.com/patents/US7771736.

[13] *See e.g.* McNear Jr., D. H. (2013) The Rhizosphere - Roots, Soil and Everything In Between. *Nature Education Knowledge* 4(3):1 (at the discussion of "Plant Growth Promoting Rhizobacteria (PGPR)"). Available at: http://www.nature.com/scitable/knowledge/library/the-rhizosphere-roots-soil-and-67500617 (last visited May 6, 2016).

[14] *See* Joint FAO/WHO Meeting on Pesticide Residues (JMPR). Available at: http://www.who.int/foodsafety/areas_work/chemical-risks/jmpr/en/ [accessed October 1, 2015].

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the DPEIR calls the World Health Organization's finding "not statistically defensible." *Id.* By dismissing a finding by one of the world's preeminent expert health organizations, SMCMVCD risks experimenting on the residents of San Mateo County. The DPEIR must be revised to appropriately acknowledge these risks. 22 cont'd

E. Pyrethroids, Other Pesticides and Human Health

SMCMVCD plans to use pyrethroids and pyrethroid-like compounds in ground and aerial applications for adult mosquitoes. DPEIR 2-36. In 2014, researchers from U.C. Davis published a study (the "CHARGE study") finding that "children of mothers residing near pyrethroid insecticide applications just before conception or during the third trimester were at greater risk for both [autism spectrum disorder ("ASD")] and [developmental delay ("DD")], with [increased risk ratios] ranging from 1.7 to 2.3."[15] Further, on April 30, 2016, researchers presented new research at the Pediatric Academic Societies 2016 Meeting that finds a correlation between aerial applications of pyrethroid insecticides to target mosquitos and increased diagnosis of ASD and DD.[16] SMCMVCD must address this emerging science, and disclose that its use of these chemicals has a potentially significant human health impact. 23

The DPEIR assumes that pyrethroid and pyrethroid-like compounds will dissipate after application in a way that will prevent human health impacts. DPEIR 7-9. But these dissipation rates often assume exposure to light. *E.g.* DPEIR Appendix B 4-3 (pyrethrins dissipate through photolysis), 4-28 to 4-29 (Etofenprox rapidly degrades with light). Some synthetic pyrethorids bind more readily to organic matter, where they may not dissipate as quickly. Young children, who dig and play in soils, sand, tanbark and water, and who are generally more exposed to pesticide residues on the ground, are likely to be exposed to these chemicals before they dissipate. But the DPEIR addresses risks to children *only* in the context of rodenticide bait stations. It fails to address the heightened risk that children face when exposed to pesticide residues from adulticide fogging – as well as herbicides applied for vegetation management – in areas where they live and play. These risks must be fully discussed and disclosed in a recirculated DPEIR. 24

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[15] Janie F. Shelton, *et al*, Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study, ENVIRONMENTAL HEALTH PERSPECTIVES, Vol. 122, no. 10, pp. 1103-1109 (attached hereto as Exhibit 1).

[16] Steven D. Hicks, et al., *Aerial Pesticide Exposure Increases the Risk of Developmental Delay and Autism Spectrum Disorder*, Abstract for Annual Pediatric Academic Societies Meeting presentation, with related press release, *Aerial Spraying to Combat Mosquitos Linked to Increased Risk of Autism in Children*, April 30, 2016, American Association of Pediatrics (attached as Exhibit 2).

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Appendix B to the DPEIR acknowledges that many of the Program chemicals are likely endocrine disruptors, including pyrethroids and their synergists, glyphosate, methoprene, and others. Endocrine disrupting chemicals ("EDC") are of particular concern: 25

> Pesticides that have hormonal, mutagenic or other toxicities that act at extremely low doses (parts per trillion) are of particular concern when considered in the context of critical and sensitive windows of development. For example, there is recent evidence that when even a very low dose EDC exposure coincides with a critical or sensitive window of susceptibility, it may be more potent than a higher dose exposure, or the low dose exposure may otherwise exert a nontraditional dose-response curve. The consequences of exposure to endocrine disrupting chemicals may also be delayed with additive or synergistic effects from myriad chemical exposures. The paramount concern raised by the emerging scientific evidence is that very small exposures to some endocrine disrupting chemicals, especially at critical stages of fetal development, may result in adverse reproductive and other outcomes. Data primarily from laboratory animal and cell culture studies have shown over 50 pesticides to have known or suspected endocrine disrupting properties in the female reproductive system.[17]

Yet the DPEIR assumes that none of these chemicals will pose any significant harm to humans or wildlife. Without a more robust analysis of the potential risks, the DPEIR fails to inform the public as to the Program's impacts or potential mitigations thereto. Contrary to CEQA, SMCMVCD has failed to "use its best efforts to find out and disclose all that it reasonably can." Guidelines § 15144.

II. Water Quality

The DPEIR acknowledges that the Program's use of naled would have a significant unavoidable impact on water quality because it would further impact lower San Mateo Creek, which is already pesticide-impaired. DPEIR 9-40. This concession does not go far enough. The Basin Plan establishes a total maximum daily load ("TMDL") for pesticide-related toxicity in urban creeks that is *not* specific to any particular pesticide, and the Basin Plan emphasizes its attainment strategy applies to all Bay Area urban creeks. DPEIR 9-12 to 9-13; Basin Plan, Chapter 7. However, the DPEIR does not clearly establish how its use of chemicals other than naled would avoid exceeding the TMDL. Indeed, as discussed above, the BMPs fail to establish a clear buffer for storm drains and gutters or provide specific discussion of ways that run-off will be avoided. For chemicals that bind to the soil, the DPEIR fails to address the mobilization of sediment after pesticide applications. Further, the DPEIR fails to discuss with any clarity the 26

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[17] University of California San Francisco, Program on Reproductive Health and the Environment, Pesticides Matter: A Primer for Reproductive Health Physicians (2011), p. 13.

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potential quantity and concentrations of pesticides that could be used under the Chemical Control or Vegetation Management components. The DPEIR's claims that the BMPs will prevent significant water quality impacts are unsupported and incorrect. 26 cont'd

III. Air Quality

The DPEIR admits that the Chemical Control component of the Program "could be *potentially significant*" because it "could subject people to objectionable odors." DPEIR 10-27, emphasis in original. Yet it erroneously claims that a single voluntary and unenforceable mitigation measure would "reduce the impact to less than significant." DPEIR 10-27, emphasis omitted. CEQA requires more. The DPEIR must analyze and implement *feasible* and *effective* mitigation measures to reduce these air quality impacts. Pub.Res.Code § 21002; Guidelines § 15126.4.

Mitigation measures AQ-25a, AQ-25b, and AQ-25c are neither mandatory nor effective. DPEIR 10-27. This failure must be remedied. For example, the DPEIR could strengthen the individual mitigations, and *require* implementation of "any one of" the three where application of a malodorous chemical occurs within a certain distance of residences or human population centers. The DPEIR could also require notification to residences and offer resources for those who will be impacted. In any event, the DPEIR must do more to mitigate this impact than the vague, voluntary, and unenforceable mitigation measures it currently proposes. DPEIR 10-27. 27

Furthermore, the voluntary and vague nature of mitigation measures AQ-25a, AQ-25b and AQ-25c conflicts with the DPEIR's "less than significant" conclusion, and any future reliance on that conclusion. DPEIR 10-27. As discussed below, SMCMVCD must either commit to preparing EIRs for future Program activities, or include much greater specificity now. Without greater specificity, SMCMVCD cannot presume that air quality impacts will be mitigated now, or during implementation of future site-specific Program activities.

IV. Cumulative Impacts

The DPEIR's cumulative impacts analysis is plagued by many of the same defects as the remainder of the DPEIR. DPEIR 13-1 to 13-19. Again, the DPEIR's conflation of BMPs and mitigation measures makes it impossible for decisionmakers and the public to understand the severity of the Program's cumulative impacts and subsequently, the potential for and effectiveness of any mitigation measures. *Environmental Protection Information Center, Inc. v. Johnson* (1985) 170 Cal.App.3d 604, 625; *County of Inyo*, 71 Cal.App.3d at 192; Guidelines §§ 15130, 15355; DPEIR 13-1. 28

Many of the DPEIR's resource-specific cumulative impact analyses are also deficient. For example, the DPEIR's discussion of the Program's cumulative impacts on pollinators suffers from several serious flaws. First, it contains a largely irrelevant and factually inaccurate 29

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discussion of colony collapse disorder's association with neonicotinoid pesticides when it should instead be focusing on the contribution of the Program's chemical use to the existing decline in pollinator populations. DPEIR 13-7 to 13-8. The DPEIR attempts to shift the focus from the cumulative impacts of pesticides on pollinators to a discussion on whether neonicotinoid pesticides cause colony collapse disorder instead of simply killing bees. *Id.* But whether a study on colony collapse disorder can be replicated is irrelevant to the questions whether neonicotinoid pesticides *harm* bees and whether the Program has cumulative impacts. *Id.* Indeed, there is scientific consensus that neonicotinoid pesticides harm bees, and this is why EPA mandates that all neonicotinoid pesticides state: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen . . . ."[18] Likewise, as discussed above, EPA recognizes that the *Program's* chemicals are likely to harm bees. Because the cumulative impacts analysis focuses on colony collapse disorder, the larger picture of pollinator impacts is ignored. 29 cont'd

Second, the DPEIR improperly attributes urbanization and urban limitations on beekeeping as a significant impact on pollinators in the Program area. While urban growth and regulations limiting beekeeping can also impact bees, the regulations and land use patterns in SMCMVCD's service area do not appear to be a significant limitation on beekeeping. San Mateo County generally allows bee keeping, and only a few municipalities in the County have large-scale bee keeping restrictions. But pesticide applications in the SMCMVCD can occur in much more diverse areas that those urban islands where beekeeping is regulated. By overstating the impact of urban beekeeping regulations, the DPEIR understates the Program's cumulative impacts. 30

Third, the DPEIR completely ignores the significant role of wild pollinators, such as native bumblebees, butterflies and moths. Like its analysis of direct impacts, the DPEIR almost completely conflates domesticated honeybees with *all* pollinators. DPEIR 13-7 to 13-8. But, as discussed above, pollination is performed by a variety of other insects, including wild native bees, butterflies, moths, and flies, as well as hummingbirds and bats. Unexamined impacts on these non-honeybee pollinators include the loss of non-target insects caused by use of spinosad and pyrethroid type insecticides (including but not limited to synthetic pyrethroids, permethrin, and etofenprox). This loss of non-target insects can reduce populations of insect pollinators and also diminish an important food supply for bats. Because the DPEIR declines to address food-chain impacts, it does not analyze whether localized loss of insect populations will harm insectivores, including pollinating bats. 31

Similarly, the DPEIR's cumulative water quality analysis is sorely lacking. DPEIR 13-16. As discussed above, the DPEIR fails to show that the Chemical Control and Vegetation 32

[18] http://www2.epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides (last visited May 6, 2016).

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Management components – other than naled – will not enter impaired waterways. Its statement that SMCMVCD's "use of these 'impairment chemicals' is contributing in less-than-significant amounts" is not reflected by its concession that it may use more toxic pyrethroids which will contribute to receiving water impairment. DPEIR 13-16. CEQA mandates that the EIR contain information sufficient to allow the public to trace the agency's analytical path from evidence to conclusion. *Laurel Heights Improvement Association v. Regents of University of California* (1988) 47 Cal.3d 376, 404. Moreover, under CEQA, even a "de minimis contribution" to an existing cumulative impact may be significant. *Communities for a Better Environment v. California Resources Agency* (2002) 103 Cal.App.4th 98, 117-121; *see also* Pub.Res.Code § 21083(b)(2) ("individually limited" impacts may still be "cumulatively considerable"); Guidelines § 15065(a)(3) (same). 32 cont'd

Last, the DPEIR's failure to consider food webs ignores potentially significant cumulative impacts arising from the Program's planned use of pesticides. Given the toxicity of the Program's proposed pesticides, including but not limited to glyphosate, pyrethroids, naled, and diuron, it is possible that an unintended consequence of the Program's use of chemical controls will be an *increase* in mosquitos in SMCMVCD's service area, as it removes mosquito predators from the food-chain. Indeed, one of the reasons that glyphosate is considered likely to adversely affect the red-legged frog is because of its food-chain impacts.[19] Without a clear view of these secondary and cumulative impacts of the proposed Program, SMCMVCD and the public cannot properly weigh its environmental consequences. 33

Without the required adequate groundwork, the DPEIR cannot accurately determine the Program's potential cumulative impacts, and therefore it cannot mitigate them. As discussed above, the DPEIR's cumulative impacts discussion is fatally flawed in numerous respects. This must be remedied in a recirculated DPEIR. Guidelines § 15088.5. 34

SCOPE OF ANALYSIS FOR FUTURE SITE-SPECIFIC PROGRAM ACTIVITIES

"A program EIR is an EIR which may be prepared on a series of actions that can be characterized as one large project and are related" to each other. Guidelines § 15168(a). However, "[s]ubsequent activities in the program must be examined in the light of the program EIR to determine whether an additional environmental document must be prepared." Guidelines § 15162(c). "Certainly, a program EIR will better fulfill its purpose of reducing the need for subsequent environmental review the more comprehensive and specific the analysis it provides." *Center for Biological Diversity v. Department of Fish and Wildlife* (2015) 234 Cal.App.4th 214, 234. "When an activity is within the scope of the program reviewed in the program EIR but the environmental impacts of the activity are not evaluated, *a further tiered CEQA analysis must be* 35

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[19] U.S. EPA, Pesticide Effects Determination: Risks of Glyphosate Use to Federally Threatened California Red-legged Frog (Rana aurora draytonii), *supra*.

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completed before the activity may be approved." 1 Kostka & Zischke, Practice Under the California Environmental Quality Act (Cont.Ed.Bar 2d ed. 2014) § 10.16, p. 10–23 ("Kostka"), emphasis added, *citing Center for Sierra Nevada Conservation v. County of El Dorado* (2012) 202 Cal.App.4th 1156.

In order to determine whether future site-specific program activities fall within the scope of the program EIR, "the agency should evaluate the site and the activity to determine whether the environmental effects were covered in the program EIR and document its findings by a checklist or other means." Kostka, § 10.16, p. 10–22. Here, however, SMCMVCD glosses over this important program EIR requirement, while conceding that it does not have site-specific or project-specific information. DPEIR 1-22 to 1-27. The DPEIR admits that its analysis is limited to "the activities and materials [that] can be identified at present," and that CEQA requires additional analysis for activities not adequately covered in the program EIR. DPEIR 1-22, 1-23. Yet the DPEIR concludes that "[a]ll pesticides in current use have been evaluated in the PEIR" and that "[f]uture formulations are likely to include ingredients already evaluated," presumptively dismissing the need for future CEQA evaluation despite the lack of site-specific information or knowledge of how future formulations of pesticides and herbicides would react when applied together. DPEIR 1-23. The DPEIR's attempt to preemptively dismiss any need for CEQA review of future Program activities subverts the purpose of CEQA, and the streamlining goals of tiering EIRs. Pub.Res.Code §§ 21002, 21100; Guidelines §§ 15121, 15151, 15165, 15168. 35 cont'd

DPEIR CITATIONS AND REFERENCES

The DPEIR relies on numerous references that do not stand up to scrutiny. DPEIR 17-1 to 17-15. It cites to an article in the Harvard Political Review, an undergraduate student journal addressing politics, policy and culture, to discuss pesticide responses to West Nile Virus and to present the argument against its No-Chemical Control alternative. DPEIR 15-8 to 15-9 (citing Zhang, 2012). It likewise cites as an authoritative scientific source a *blog-post* from the *Mother Jones* website to discuss a correlation between West Nile Virus and drought. DPEIR 1-1 (citing Whelan, 2015). These are not even scientific – let alone authoritative – sources of information. 36

CEQA requires the DPEIR to be an informational document, but the SMCMVCD's reliance upon undocumented, non-scientific media reports and the like instead of reliable, primary source scientific documents does not "provide decision makers with information which enables them to make a decision which intelligently takes account of environmental consequences." Guidelines §§ 15151, 15121. The resources relied upon in making determinations in the DPEIR must be from accurate and reputable sources. Because they are not, SMCMVCD has not satisfied its CEQA duty to "'use its best efforts to find out and disclose all that it reasonably can.'" *Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 428, quoting Guidelines § 15144. 37

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CONCLUSION

For the reasons outlined above, the DPEIR violates CEQA. It is incomplete in numerous significant respects. It must be substantially revised to include a proper scope of analysis, project description, range of alternatives, and impact analysis. Until that occurs, it provides no basis for informed decisionmaking.

Respectfully submitted,

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Attachments: Exhibit 1: Janie F. Shelton, *et al*, Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study, ENVIRONMENTAL HEALTH PERSPECTIVES, Vol. 122, no. 10, pp. 1103-1109

Exhibit 2: Steven D. Hicks, et al., *Aerial Pesticide Exposure Increases the Risk of Developmental Delay and Autism Spectrum Disorder*, Abstract for Annual Pediatric Academic Societies Meeting presentation, with related press release, *Aerial Spraying to Combat Mosquitos Linked to Increased Risk of Autism in Children*, April 30, 2016, American Association of Pediatrics

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Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study

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Background: Gestational exposure to several common agricultural pesticides can induce developmental neurotoxicity in humans, and has been associated with developmental delay and autism.

Objectives: We evaluated whether residential proximity to agricultural pesticides during pregnancy is associated with autism spectrum disorders (ASD) or developmental delay (DD) in the Childhood Autism Risks from Genetics and Environment (CHARGE) study.

Methods: The CHARGE study is a population-based case–control study of ASD, DD, and typical development. For 970 participants, commercial pesticide application data from the California Pesticide Use Report (1997–2008) were linked to the addresses during pregnancy. Pounds of active ingredient applied for organophophates, organochlorines, pyrethroids, and carbamates were aggregated within 1.25-km, 1.5-km, and 1.75-km buffer distances from the home. Multinomial logistic regression was used to estimate the odds ratio (OR) of exposure comparing confirmed cases of ASD (n = 486) or DD (n = 168) with typically developing referents (n = 316).

Results: Approximately one-third of CHARGE study mothers lived, during pregnancy, within 1.5 km (just under 1 mile) of an agricultural pesticide application. Proximity to organophosphates at some point during gestation was associated with a 60% increased risk for ASD, higher for third-trimester exposures (OR = 2.0; 95% CI: 1.1, 3.6), and second-trimester chlorpyrifos applications (OR = 3.3; 95% CI: 1.5, 7.4). Children of mothers residing near pyrethroid insecticide applications just before conception or during third trimester were at greater risk for both ASD and DD, with ORs ranging from 1.7 to 2.3. Risk for DD was increased in those near carbamate applications, but no specific vulnerable period was identified.

Conclusions: This study of ASD strengthens the evidence linking neurodevelopmental disorders with gestational pesticide exposures, particularly organophosphates, and provides novel results of ASD and DD associations with, respectively, pyrethroids and carbamates.

Citation: Shelton JF, Geraghty EM, Tancredi DJ, Delwiche LD, Schmidt RJ, Ritz B, Hansen RL, Hertz-Picciotto I. 2014. Neurodevelopmental disorders and prenatal residential proximity to agricultural pesticides: the CHARGE study. Environ Health Perspect 122:1103–1109; http://dx.doi.org/10.1289/ehp.1307044

Introduction

California is the top agriculture-producing state in the nation, grossing $38 billion in revenue from farm crops in 2010 (California Department of Food and Agriculture 2010). Each year approximately 200 million pounds of active pesticide ingredients are applied throughout the state [California Department of Pesticide Regulation (CDPR) 2014]. Although pesticides are critical for the modern agricultural industry, certain commonly used pesticides have been associated with abnormal and impaired neurodevelopment in children (Bouchard et al. 2010, 2011; Engel et al. 2007; Eskenazi et al. 2006; Grandjean et al. 2006; Guillette et al. 1998; Rauh et al. 2006; Ribas-Fito et al. 2006; Torres-Sánchez et al. 2007; Young et al. 2005). In addition, specific associations have been reported between agricultural pesticides and autism spectrum disorders (ASD) (Roberts et al. 2007) and the broader diagnostic category under which autism falls, the pervasive developmental disorder (PDD) (Eskenazi et al. 2007).

Developmental delay (DD) refers to significant delays young children experience reaching milestones in relation to cognitive or adaptive development. Adaptive skills include communication, self-care, social relationships, and/or motor skills. In the United States, DD affects approximately 3.9% of all children 3–10 years of age, and is approximately 1.7 times more common among boys than girls (Boyle et al. 2011).

Autism is a developmental disorder with symptoms appearing by 3 years of age. Specific deficits occur in domains of social interaction and language, and individuals show restricted and repetitive behaviors, activities, or movements (American Psychiatric Association 2000). The ASDs represent lower severity, usually with regard to language ability. ASDs affect boys 4–5 times more than girls, and the Centers for Disease Control and Prevention (2012) recently estimated a prevalence of 1.1% among children 8 years of age, a 78% increase since their 2007 estimate. Available evidence suggests that causes of both ASD and DD are heterogeneous and that environmental factors can contribute strongly to risk (Hallmayer et al. 2011; Mendola et al. 2002).

The majority of pesticides sold in the United States are neurotoxic and operate through one of three primary mechanisms: *a*) inhibition of acetylcholinesterase (AChE), *b*) voltage-gated sodium channel disruption, and/or *c*) inhibition of gamma-aminobutyric acid (GABA) (Casida 2009). AChE primarily functions as an inhibitory neurotransmitter, but also has critical roles in the development of learning, cognition, and memory. GABA is also an inhibitory neurotransmitter, and is necessary for development and maintenance of neuronal transmission.

Although limited research has assessed *in utero* exposures to pesticides, animal models (rats) of early exposure to organophosphates showed more severe neurodevelopmental effects for males than for females (Levin et al. 2001, 2010). On the basis of previously published epidemiology or mechanistic considerations, we selected the following pesticide families to investigate for this analysis: organophosphates, carbamates,

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organochlorines, and pyrethroids. Potential mechanisms linking these select pesticide groups to autism pathophysiology were recently reviewed (Shelton et al. 2012).

The aim of this paper was to explore the relationship between agricultural pesticide applications and neurodevelopmental outcomes by *a*) assessing the gestational exposure during pregnancy to CHARGE (Childhood Autism Risks from Genes and Environment) study mothers, *b*) testing the hypothesis that children with ASD or DD had higher risk of exposure *in utero* than typically developing children, and *c*) evaluating specific windows of vulnerability during gestation. Because of the well-defined case and control populations in the CHARGE study and the comprehensive availability of potential confounders, this analysis serves as exploratory research to identify environmental risk factors for ASD and DD, and contributes to a broader understanding of the potential risks to neurodevelopment from agricultural pesticides in a diverse population of California residents.

Methods

Study design. The CHARGE study is an ongoing California population-based case–control study that aims to uncover a broad array of factors contributing to autism and developmental delay (Hertz-Picciotto et al. 2006). Since 2003, the CHARGE study has enrolled > 1,600 participants whose parents answer extensive questionnaires regarding environmental exposures including their place of residence during pregnancy. Here we report on ASD and DD in relation to gestational residential proximity to agricultural pesticide applications. The group of children with ASD includes approximately two-thirds with a diagnosis of full-syndrome autism or autistic disorder (68%) and one-third with a diagnosis of an autism spectrum disorder (32%).

Cases were recruited from children diagnosed with full-syndrome ASD or DD in one of the regional centers of the California Department of Developmental Services (DDS). Eligibility in the DDS system does not depend on citizenship or financial status, and is widely used across socioeconomic levels and racial/ethnic groups. It is estimated that 75–80% of the total population of children with an autism diagnosis are enrolled in the system (Croen et al. 2002). In addition to recruitment through the regional centers, some CHARGE participants are also recruited through referrals from other clinics, self-referral, or general outreach. The referents are recruited from the general population (GP) identified through California birth records, and are frequency matched to the autism case population on sex, age, and the catchment area for the regional they would have gone to, had they been a case. Children are eligible if they are 2–5 years of age, born in California, live with a biological parent who speaks either English or Spanish, and reside in the study catchment area. Currently, the catchment area for the CHARGE study participants consists of a 2-hr drive from the Sacramento area, but previously included participants from Southern California. Early in the study, recruitment in Southern California was terminated due to logistical difficulties that led to lower enrollment of general population controls.

Parents of children coming into the study with a previous diagnosis of ASD are administered the Autism Diagnostic Interview–Revised (ADI-R; Le Couteur et al. 2003; Lord et al. 1994, 1997), surveyed regarding a wide range of environmental exposures, and asked to report all addresses where they lived from 3 months before conception to the time of the interview.

Participating children are administered the Autism Diagnostic Observation Schedule (ADOS; Lord et al. 2000, 2003), which, combined with the ADI-R, is used to either confirm their diagnosis or reclassify them for purposes of our study. To rule out ASD, children who enter the study without an ASD diagnosis (from the DD or GP groups) are given the Social Communications Questionnaire (SCQ) (Rutter et al. 2003). Children with a previous diagnosis of DD are evaluated on both the Mullen Scales of Early Learning (MSEL) (Mullen 1995) and Vineland Adaptive Behavioral Scale (VABS) (Sparrow 2005). DD is confirmed if they scored ≥ 15 on the SCQ and ≤ 2 SDs lower than the mean (< 70) on the composite scores of MSEL and VABS. Those meeting criteria for one test, scoring < 77 on the other, and not qualifying for ASD, are classified as atypical and combined with the DD group (25 of the 168) for this analysis. For this sample, of those who entered the study as typically developing, 26 were reclassified with DD and 2 with ASD. Of those who entered as DD, 36 were reclassified with ASD. Only cases with completed diagnostic testing were included in the analysis presented here. Additional details on CHARGE study protocols have been published elsewhere (Hertz-Picciotto et al. 2006).

This study was approved by the institutional review boards for the State of California and the University of California. Written informed consent was obtained by the parent or guardian before collection of any data.

Estimation of pesticide exposures. Since 1990, California has required commercial application of agricultural pesticides to be reported to the CDPR, which makes data publically available in the form of the annual Pesticide Use Report (PUR). As described by CDPR (2014), the pesticide use report data includes

> pesticide applications to parks, golf courses, cemeteries, rangeland, pastures, and along roadside and railroad rights-of-way. In addition, all postharvest pesticide treatments of agricultural commodities must be reported along with all pesticide treatments in poultry and fish production as well as some livestock applications. The primary exceptions to the reporting requirements are home-and-garden use and most industrial and institutional uses.

The PUR database includes all commercial applications at the county level, requiring spatially explicit (latitude and longitude) reporting for commercial agricultural applications. The PUR database then compiles agricultural pesticide applications throughout the state by square-mile areas (1.0 m^2 or 2.6 km^2) set by the U.S. Geological Survey, referred to as a meridian-township-range-section (MTRS). The amount of chemical applied is assigned to an MTRS by date, in pounds (each pound is 0.45 kg) of active ingredient only, excluding synergists and other compounds in the formulation. Mapping software (ArcGIS v10.0; ESRI, Redlands, CA) was used to create a geographic centroid (center-most point in the square mile) for each MTRS for use in this analysis.

From the CHARGE questionnaire administered to the parent, residential addresses were collected and assigned for each day of the pre-conception and pregnancy periods, beginning 3 months before conception and ending with delivery, thereby accounting for participants who changed residences during that time. Addresses were manually cleaned for spelling errors and standardized in ZIP+4 software (http://www.semaphorecorp.com/). Of the 1,043 diagnostically evaluated participants at the time of this study, 983 had given address data for the time period of interest. Overall, 99% of addresses (970 participants with 1,319 unique addresses) were successfully geocoded to obtain a longitude and latitude with a match rate of at least 80% in ArcMap (ArcGIS v10.0; ESRI) using the U.S. Rooftop search algorithm. Unmatched addresses (n = 5) or ties (n = 10) were manually matched to the most likely address.

Next, a spatial model was developed in ArcMap, which created three buffers of varying sizes around each residence with radii of 1.25 km, 1.5 km, and 1.75 km. Where the buffer intersected a centroid (or multiple centroids), the MTRS corresponding with that centroid was assigned to that residence; subsequently, pesticides applied in that MTRS (or multiple MTRSs) were considered exposures for that mother with the timing based on linking the date of application to the dates of her pregnancy. Each pregnancy therefore was assigned an exposure profile corresponding to applications made to the MTRS nearest the mother's home and days of her pregnancy on which those applications occurred (for a visual representation of the exposure model, see Supplemental Material, Figure S1).

We classified chemicals in the PUR according to chemical structure as members of the organophosphate, carbamate, pyrethroid, or organochlorine classes of pesticides. Subclasses of pyrethroids were categorized as type 1 and type 2 because they induce distinct behavioral effects in animal studies (Agency for Toxic Substances and Disease Registry 2003; Breckenridge et al. 2009). In addition, chlorpyrifos, an organophosphate widely used in agriculture, was explored independently because previous research had associated higher levels of prenatal exposure with diminished psychomotor and mental development in children at 3 years of age (Rauh et al. 2006).

Statistical analysis. Most homes (~ 70%) received estimated agricultural pesticide exposure values of 0 because there was no pesticide applied within the buffer zone. For ease of interpretation, we created, for each time period, binary (1 = exposed vs. 0 = not exposed) indicators as independent variables. Multinomial (polytomous) multivariate logistic regression modeling with survey weights was used to estimate the association of prenatal residential proximity to applied pesticides with a binary exposure variable (1 = exposed vs. 0 = not exposed) and a 3-level case status outcome [ASD/DD/TD (typically developing)], using TD children as the reference group. Because it was the only chemical evaluated independently as opposed to an aggregated class of chemicals with varying toxicity levels, chlorpyrifos (an organophosphate) was evaluated both as a dichotomous (any exposure within the buffer area vs. none) and as a continuous variable (untransformed, per 100 lb). Separate models were run for each time period, for each pesticide class of interest, and for alternative residential buffer radii.

Potential confounders were first identified as *a*) variables that may influence one's exposure to pesticides, and *b*) variables that are known to influence the risk of ASD or DD, with no requirement for statistical significance of the univariate association with either the exposure or outcome, but rather an initial evaluation of the relationship between those variables. Formal confounder identification and inclusion was assessed using the combined directed acyclic graph (DAG) and change-in-estimate (in this case, a 10% change in the β of the primary exposure variable in the regression model) criteria (Weng et al. 2009). The DAG was used to establish which variables could potentially confound the associations between ASD or DD and exposure to agricultural pesticides, and the change in estimate criteria was then used to exclude inclusion of those variables that induced minimal (< 10%) change in the β estimate. All other variables which were identified as confounders and met the criteria of a ≥ 10% change in the β were included in the final models.

During model selection, we tested the joint versus independent effects of two classes of pesticides (e.g., pyrethroids and organophosphates) in models that contained each independent variable (dichotomous) for the two pesticides and an interaction variable of those two dichotomous variables. We also explored the possibility that another pesticide was responsible for the observed association due to correlation between pesticides (i.e., if one class is applied, another is more likely to be applied in that same buffer zone) by treating other classes of pesticides as potential confounders.

Final models were adjusted for paternal education (categorical), home ownership (binary), maternal place of birth (United States, Mexico, or outside the United States and Mexico), child race/ethnicity (white, Hispanic, other), maternal prenatal vitamin intake (binary; taken during the 3 months before pregnancy through the first month), and year of birth (continuous). Prenatal vitamin consumption in this time window was found in previous work to have an inverse association with ASD, meaning that early prenatal vitamin intake may confer a lower risk of ASD (Schmidt et al. 2011). Other potential confounders explored but found not to satisfy criteria for confounding (based on inclusion in the DAG or the change in estimate criterion) were distance from a major freeway, maternal major metabolic disorders (diabetes, hypertension, and obesity), gestational age (days), latitude of residence, type of insurance used to pay for the delivery (public vs. private), maternal age, paternal age, and season of conception. Maternal age, though a known risk for ASD, does not differ significantly between cases and controls in the CHARGE study because the participating mothers of TD children are older than those of the GP (Table 1).

All statistical analyses were conducted using SAS software (version 9.3; SAS Institute Inc., Cary, NC). Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated using multinomial (polytomous) logistic regression models (PROC SURVEYLOGISTIC) with "survey" weights. Frequency-matching factors (regional center, age, and sex of child) were included to adjust for sampling strata using a STRATA statement.

The weights we used in exposure frequency and multinomial models adjusted for differential probabilities of enrollment in the study by case or control groups (ASD, DD, and GP controls) and by social and demographic factors (child race/ethnicity, maternal age, maternal education, insurance payment type at birth, regional center, parity, and maternal birth place) that influence voluntary participation in a case–control study. These weights represent the inverse of the probability of participation, within case and demographically defined groups. Thus, the weighted frequency distributions and regression models more accurately represent findings generalizable to the broader recruitment pools from which participants were drawn.

Results

During pregnancy, residences of the CHARGE study participants were distributed broadly throughout California, with the greatest concentrations in Sacramento Valley, followed by the San Francisco Bay area and Los Angeles. One-third lived within 1.5 km of an agricultural pesticide application from one of the four pesticide classes evaluated. ASD and TD groups had similar sociodemographic profiles, with some variation by regional center, prenatal vitamin intake, and maternal place of birth, and more ASD cases were recruited earlier in the study than DD or TD children (Table 1). As described in "Methods," early in the study, challenges were encountered recruiting non-ASD participants in Southern California, resulting in a greater proportion of ASD participants relative to TD participants from that regional center. The DD case group, which was not matched, differed from the reference group on many characteristics, including sex, race/ethnicity, maternal birth place, regional center, maternal education, and paternal education and appears to be of substantially lower socioeconomic status than either the ASD or TD groups (Table 1). Age of the child at enrollment was similar between the ASD and DD groups compared with the TD groups.

In the CHARGE study population, of the pesticides evaluated, organophosphates were the most commonly applied agricultural pesticide near the home during pregnancy. In the group exposed to organophosphates within 1.5 km of the home, 21 unique compounds were identified, the most abundant of which was chlorpyrifos (20.7%), followed by acephate (15.4%), and diazinon (14.5%) (see Supplemental Material, Table S1). The second most commonly applied class of pesticides was the pyrethroids, one-quarter of which was esfenvalerate (24%), followed by lamda-cyhalothrin (17.3%), permethrin (16.5%), cypermethrin (12.8%), and tau-fluvalinate (10.5%). Of the carbamates, approximately 80% were methomyl or carbaryl, and of the organochlorines, 60% of all applications were dienochlor. Among those exposed, only one-third were exposed to a single compound over the course of the pregnancy.

In the unweighted study population, little difference in exposure proportion

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was apparent, yet once the survey weights were applied, both case populations had higher exposure proportions than the TD controls, indicating that factors associated with exposure were also associated with study participation (Table 2). Because the study weights reflect the distributions of the three recruitment strata (ASD, DD, and TD controls) in the pool from which they were drawn, differences between case and control participation by regional center catchment area likely accounts for this effect. For example, DD cases proportionally under-enrolled in the CHARGE study from the Valley Mountain regional center compared with the recruitment pool. Because the Valley region had the highest proportion of exposed participants, weights that accounted for the discrepancy between the proportions of DD cases enrolled from the Valley region would more accurately represent the population distribution of cases and controls.

By pounds applied, the amount of pyrethroids and organophosphates (continuous, unweighted) applied within 1.5 km of the home were strongly correlated with each other (ρ = 0.74, $p < 0.0001$) and to a lesser extent organophosphates with carbamates (ρ = 0.45, $p = 0.01$) and carbamates with pyrethroids (ρ = 0.44, $p < 0.0001$). Because of the low prevalence of organochlorines and type 1 pyrethroids, these were excluded from the analyses, and carbamate exposure, though evaluated for pregnancy (any vs. none), was not evaluated by trimester due to small cell sizes of exposed participants. Overall, exposure to pesticides during gestation was slightly more common for male children than for female children (31% vs. 26%, $p = 0.004$).

For exposure (any vs. none) during pregnancy, children with ASD were 60% more likely to have organophosphates applied nearby the home [1.25 km distance; adjusted OR (aOR) = 1.60; 95% CI: 1.02–2.51] than mothers of TD children. Children with DD were nearly 150% more likely to have carbamate pesticides applied near the home during pregnancy (1.25 km distance; aOR = 2.48; 95% CI: 1.04–5.91). Both of these associations lessened as the buffer size grew larger (Tables 3 and 4), lending support to an exposure–response gradient.

Examining specific gestational time windows, associations with pesticide applications of organophosphates and pyrethroids suggested an association between second- and third-trimester exposure to organophosphates and ASD, and preconception and third-trimester pyrethroid exposure (Table 3). Although those time periods describe the statistically significant associations, many of the effect estimates tended away from the null, which indicates a lack of precision in the specificity of any one time period and compound presented here.

For DD, the sample size permitted only temporal associations to be evaluated for organophosphates and pyrethroids, which were mostly > 1 (the null value), but only one statistically significant association was detected for third-trimester pyrethroid applications. In general, likely because a smaller sample of DD cases was exposed to agricultural pesticides,

Table 1. Characteristics [*n* (%) or mean ± SD] of the CHARGE study population (*n* = 970).

Characteristic	ASD	Delayed	Typical	*p*-Value ASD vs. TD	*p*-Value DD vs. TD
Total	486	168	316		
Male	414 (85.2)	115 (68.5)	262 (82.9)	0.39	0.0003
Child's age at enrollment (months)	36.7 ± 9.7	38.3 ± 8.9	36.9 ± 8.9	0.73	0.11
Childs race/ethnicity				0.12	< 0.0001
White	246 (50.6)	66 (39.3)	165 (52.2)		
Hispanic	130 (26.8)	60 (35.7)	73 (23.1)		
Other	110 (22.6)	41 (24.4)	78 (24.7)		
Mother's age (years)	31.3 ± 5.5	30.8 ± 6.6	31.1 ± 5.7	0.69	0.57
Father's age (years)	33.9 ± 6.4	33.1 ± 7.8	33.5 ± 7.0	0.49	0.52
Mother's education				0.12	< 0.0001
High school or less	67 (13.8)	51 (30.4)	46 (14.6)		
Some college	197 (40.5)	68 (40.5)	100 (31.7)		
College or professional	222 (45.7)	49 (29.2)	170 (53.8)		
Father's education				0.58	< 0.0001
High school or less	106 (21.8)	74 (44.1)	81 (25.6)		
Some college	153 (31.5)	47 (27.9)	91 (28.8)		
College or professional	225 (46.3)	44 (26.2)	144 (45.6)		
Regional center/region				< 0.0001	0.01
Alta	174 (35.8)	82 (48.8)	131 (41.5)		
North Bay	64 (13.2)	19 (11.3)	53 (16.8)		
East Bay	81 (16.7)	17 (10.1)	65 (20.6)		
Valley Mountain	85 (17.5)	38 (22.6)	49 (15.5)		
Southern California	82 (16.9)	12 (7.1)	18 (5.7)		
Maternal birth place				0.07	0.0003
In the USA	367 (75.5)	127 (75.60	259 (82.0)		
In Mexico	38 (7.8)	28 (16.7)	22 (7.0)		
Outside USA or Mexico	81 (16.7)	13 (7.7)	35 (11.1)		
Year of birth				0.0003	0.49
1999–2003	348(71.6)	94 (56.0)	187 (59.2)		
2004–2008	138 (28.4)	74 (44.1)	129 (40.8)		
Homeowner	320 (65.8)	100 (59.5)	242 (76.6)	0.001	< 0.0001
Private health insurance	402 (82.7)	118 (70.2)	270 (85.4)	0.31	< 0.0001
Periconceptional prenatal vitamin	252 (52.0)	79 (53.0)	189 (59.8)	0.003	0.01
Known chromosomal abnormality	11 (2.3)	50 (32.7)	0 (0.0)	—	—

Table 2. Exposure to pesticide applications (any vs. none) within 1.5 km of the home during the 3 months before conception through delivery according to outcome (ASD *n* = 486, DD *n* = 168, TD *n* = 316).

Exposure	ASD *n*	ASD Unweighted %	ASD Weighted %	DD *n*	DD Unweighted %	DD Weighted %	TD *n*	TD Unweighted %	TD Weighted %
No agriculturally applied pesticides	342	70.4	70.1	124	73.8	66.9	219	69.3	72.2
Any agriculturally applied pesticides	144	29.6	29.9	44	26.2	33.0	97	30.7	27.8
Organophosphates	125	25.7	26.6	32	19.1	25.2	84	26.6	24.9
Chlorpyrifos	61	12.6	14.4	20	11.9	18.4	45	14.2	12.4
Pyrethroids	106	21.8	22.5	36	21.4	28.3	67	21.2	20.1
Type 1 pyrethroids	49	10.1	10.4	17	10.1	16.3	29	9.2	7.9
Type 2 pyrethroids	100	20.6	20.9	34	20.2	26.9	63	19.9	19.1
Carbamates	54	11.1	11.0	13	7.7	11.1	30	9.5	7.3
Organochlorines	24	4.9	4.9	4	2.4	3.9	10	3.2	3.3

The development and use of CHARGE survey weights were designed to correct for the nonsociodemographically representative participation, i.e., the differences in participants vs. nonparticipants with regard to key sociodemographic factors such as maternal education, insurance payment type, birth regional center, birth place of mother, and child race. Survey weights are based on the probability of participation in the study.

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the estimates had a lower level of precision than the ASD case group. In addition, although carbamates were associated with DD for applications during pregnancy, the sample of exposed cases was too small to evaluate by trimester (Table 4).

For models evaluating the exposure to chlorpyrifos as a continuous variable with all other covariates remaining the same as above models, each 100-lb (45.4 kg) increase in the amount applied over the course of pregnancy (within 1.5 km of the home) was associated with a 14% higher prevalence of ASD (aOR = 1.14; 95% CI: 1.0, 1.32), but no association was detected with DD. Because aggregate classes of chemical do not have a uniform toxicity, we did not examine the pounds of classes (e.g., organophosphates) of chemicals as a continuous variable because compounds with a higher toxicity may be applied in lower volumes.

The role of simultaneous exposure to multiple classes of pesticides was evaluated in post hoc analyses. First, we evaluated combined categories of organophosphates and pyrethroids, organophosphates and carbamates, and pyrethroids or carbamates as a 3-level variable (0 = unexposed, 1 = exposed to one or the other, and 2 = exposed to both). However, effects from multiple exposures were not found to be higher than the observations of the individual classes of pesticides. Second, we adjusted models of one pesticide for the other. In models for organophosphates, adjusting for pyrethroids attenuated the third-trimester association with ASD slightly, but not substantially (< 10% change in β estimate) (data not shown). In additional analyses, we evaluated the sensitivity of the estimates to the choice of buffer size, using four additional sizes between 1 and 2 km: Results and interpretation remained stable (data not shown).

Discussion

Applications of two of the most common agricultural pesticides (organophosphates and pyrethroids) nearby the home may increase the prevalence of ASD. Specifically, we observed positive associations between ASD and prenatal residential proximity to organophosphate pesticides in the second (for chlorpyrifos) and third trimesters (organophosphates overall), and pyrethroids in the 3 months before conception and in the third trimester. Our findings relating agricultural pesticides to DD were less robust, but suggested an associated with applications of carbamates during pregnancy nearby the home. Because pesticide exposure is correlated in space and time, differences in time windows of vulnerability, if they exist, may be difficult to detect, and variation in associations according to time window of exposure may not represent causal variation.

These findings support the results of two previous studies linking ASD to gestational agricultural pesticide exposure. Using data from the California Department of Developmental Services and California Birth Records, Roberts et al. (2007) conducted a case–control study of 465 cases of autism and 6,975 controls. Although their main finding was an association between ASD and residential proximity to organochlorine compound applications (which we could not evaluate due to low exposure prevalence of this chemical class), they also reported associations with gestational exposures to organophosphates [β = 0.462, *p*-value 0.042 (confidence interval not reported) and bifenthrin (β = 1.57, *p*-value = 0.049 (confidence interval not reported)], a

Table 3. Adjusted ORs[a] (95% CIs) for ASD and residential proximity to agricultural pesticide applications (any vs. none) within prespecified buffers, by time period.[b]

Pesticide, buffer radius (km)	Pregnancy	Preconception	1st trimester	2nd trimester	3rd trimester
Organophosphates					
1.25	1.60 (1.02, 2.51)	1.37 (0.76, 2.50)	1.53 (0.87, 2.68)	1.57 (0.87, 2.83)	1.99 (1.11, 3.56)
1.5	1.54 (1.00, 2.38)	1.38 (0.82, 2.31)	1.45 (0.88, 2.41)	1.85 (1.08, 3.15)	2.07 (1.23, 3.50)
1.75	1.26 (0.83, 1.92)	1.30 (0.80, 2.13)	1.02 (0.63, 1.65)	1.54 (0.93, 2.55)	1.99 (1.20, 3.30)
Chlorpyrifos					
1.25	1.57 (0.82, 3.00)	1.07 (0.40, 2.89)	1.26 (0.52, 3.06)	2.55 (0.95, 6.84)	1.83 (0.72, 4.65)
1.5	1.66 (0.94, 2.93)	1.07 (0.46, 2.48)	1.32 (0.65, 2.70)	3.31 (1.48, 7.42)	1.78 (0.82, 3.87)
1.75	1.78 (1.05, 3.02)	1.25 (0.59, 2.65)	1.12 (0.58, 2.16)	2.63 (1.28, 5.41)	2.15 (1.04, 4.41)
Pyrethroids					
1.25	1.34 (0.82, 2.20)	1.82 (0.92, 3.60)	1.59 (0.86, 2.96)	1.56 (0.83, 2.94)	1.64 (0.84, 3.19)
1.5	1.41 (0.89, 2.25)	1.82 (1.00, 3.31)	1.53 (0.88, 2.67)	1.69 (0.93, 3.06)	1.87 (1.02, 3.43)
1.75	1.27 (0.83, 1.96)	1.69 (0.97, 2.95)	1.14 (0.67, 1.91)	1.49 (0.87, 2.58)	1.83 (1.04, 3.23)
Type 2					
1.25	1.40 (0.83, 2.34)	2.01 (0.97,4.16)	1.64 (0.85, 3.17)	1.29 (0.65,2.56)	1.51 (0.75, 3.05)
1.5	1.53 (0.94, 2.51)	1.98 (1.06, 3.71)	1.85 (1.01, 3.38)	1.45 (0.78, 2.73)	1.67 (0.87, 3.21)
1.75	1.30 (0.82, 2.05)	1.64 (0.92, 2.94)	1.32 (0.76, 2.29)	1.33 (0.75, 2.38)	1.56 (0.86, 2.84)
Carbamates[c]					
1.25	1.37 (0.66, 2.84)	—	—	—	—
1.5	1.80 (0.81, 3.08)	—	—	—	—
1.75	1.43 (0.78, 2.62)	—	—	—	—

[a]Multivariate multinomial conditional logistic regression with survey weights and strata variables for matching variables. All models were adjusted for paternal education, home ownership, maternal place of birth, child race/ethnicity, maternal prenatal vitamin intake (during the 3 months before pregnancy through the first month), and year of birth. [b]Pregnancy: conception (day 0) to the end of pregnancy; preconception: 90 days before conception; 1st trimester: 0–90 days; 2nd trimester: 91–180 days; 3rd trimester: 181 days–birth. [c]Due to low frequency of exposure, the cell counts were too small (< 10) to explore temporal associations, and thus are not presented here.

Table 4. Adjusted ORs[a] (95% CIs) for DD and residential proximity to agricultural pesticide applications (any vs. none) within prespecified buffers, by time period.[b]

Pesticide, buffer radius (km)	Pregnancy	Preconception	1st trimester	2nd trimester	3rd trimester
Organophosphates					
1.25	1.23 (0.65, 2.31)	1.20 (0.54, 2.65)	1.29 (0.60, 2.79)	1.62 (0.75, 3.48)	1.10 (0.46, 2.67)
1.5	1.07 (0.60, 1.92)	0.94 (0.45, 1.97)	1.00 (0.50, 1.99)	1.46 (0.72, 2.96)	0.92 (0.40, 2.13)
1.75	1.01 (0.59, 1.73)	1.30 (0.69, 2.46)	0.98 (0.54, 1.80)	1.52 (0.81, 2.85)	1.21 (0.60, 2.46)
Chlorpyrifos					
1.25	1.62 (0.68, 3.85)	1.73 (0.58, 5.17)	1.61 (0.53, 4.87)	1.73 (0.48, 6.19)	1.04 (0.25, 4.28)
1.5	1.31 (0.61, 2.82)	1.11 (0.41, 3.00)	1.27 (0.48, 3.36)	1.43 (0.46, 4.44)	0.73 (0.21, 2.48)
1.75	1.63 (0.84, 3.16)	1.34 (0.55, 3.25)	1.40 (0.62, 3.17)	1.63 (0.61, 4.39)	1.34 (0.50, 3.60)
Pyrethroids					
1.25	1.53 (0.81, 2.90)	1.96 (0.90, 4.29)	1.70 (0.80, 3.61)	1.63 (0.72, 3.68)	1.69 (0.74, 3.88)
1.5	1.37 (0.76, 2.47)	1.44 (0.69, 3.03)	1.41 (0.72, 2.76)	1.27 (0.58, 2.79)	1.75 (0.81, 3.78)
1.75	1.19 (0.68, 2.08)	1.88 (0.98, 3.60)	1.36 (0.73, 2.51)	1.42 (0.72, 2.80)	2.34 (1.18, 4.67)
Type 2					
1.25	1.56 (0.81, 2.90)	1.43 (0.61, 3.33)	1.60 (0.72, 3.59)	1.78 (0.78, 4.08)	1.80 (0.77, 4.18)
1.5	1.46 (0.79, 2.70)	1.09 (0.48, 2.46)	1.49 (0.71, 3.12)	1.41 (0.64, 3.13)	1.87 (0.85, 4.11)
1.75	1.34 (0.76, 2.37)	1.18 (0.57, 2.43)	1.37 (0.71, 2.64)	1.66 (0.84, 3.28)	2.31 (1.15, 4.66)
Carbamates[c]					
1.25	2.48 (1.04, 5.91)	—	—	—	—
1.5	1.65 (0.70, 3.89)	—	—	—	—
1.75	1.32 (0.60, 2.88)	—	—	—	—

[a]Multivariate multinomial conditional logistic regression with survey weights and strata variables for matching variables. All models were adjusted for paternal education, home ownership, maternal place of birth, child race/ethnicity, maternal prenatal vitamin intake (during the 3 months before pregnancy through the first month), and year of birth. [b]Pregnancy: conception (day 0) to the end of pregnancy; preconception: 90 days before conception; 1st trimester: 0–90 days; 2nd trimester: 91–180 days; 3rd trimester: 181 days–birth. [c]Due to low frequency of exposure, the cell counts were too small (< 10) to explore temporal associations, and thus are not presented here.

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pyrethroid pesticide (Roberts et al. 2007). Eskenazi et al. (2007) found a relationship between symptoms of PDD and prenatal urinary metabolites of organophosphates in a cohort study (CHAMACOS; Center for the Health Assessment of Mothers and Children of Salinas) of mothers living in the Salinas valley. Each 10-fold increase in these metabolites doubled the odds (OR = 2.3, p = 0.05) of PDD at 2 years of age; postnatal concentrations showed some association as well (OR = 1.7, p = 0.04) (Eskenazi et al. 2007). Several studies have also reported evidence of an interaction between organophosphate exposure and polymorphisms for the *PON1* gene, which codes for the enzyme paraoxonase 1, in relation to neurodevelopment (Costa et al. 2005; D'Amelio et al. 2005; Furlong et al. 2005; Lee et al. 2013).

With regard to DD, several studies have reported associations of pesticide exposures with continuous scores on specific cognitive tests. For example, in a cross-sectional study of 72 children < 9 years of age in Ecuador, those prenatally exposed to pesticides as assessed by maternal occupation in the floriculture industry during pregnancy performed worse on the Stanford-Binet copying test than did children whose mothers did not work in floriculture during pregnancy (Grandjean et al. 2006). In another study of maternal occupation in the flower industry, exposed children performed worse on tests of communication, visual acuity, and fine motor skills, with delays of 1.5–2 years in reaching normal developmental milestones (Handal et al. 2008). In the CHAMACOS cohort, organophosphate urinary metabolites from the first and second halves of pregnancy were associated with an average deficit of 7.0 IQ points, comparing the highest quintile to the lowest (Bouchard et al. 2011). A study of inner city children at 3 years of age found that those with the highest (vs. lowest) umbilical cord concentrations of chlorpyrifos were 5 times more likely to have delayed psychomotor development and 2.4 times more likely to have delayed mental development as assessed by cut-off values of continuous scores on the Bayley Scales of Infant Development-II (Rauh et al. 2006).

Strengths of this study include well-defined case and control populations confirmed by standardized diagnostic instruments, extensive information on covariates, and a thorough confounder identification and control strategy. Because children can overcome developmental delay, or may move in or out of the ASD case definition over time, diagnostic confirmation at enrollment minimized outcome misclassification. Further, collection of information on all addresses during pregnancy likely reduced exposure misclassification, because 20% of the population had moved at least once during pregnancy.

Several limitations to this study were unavoidable in the exposure assessment, potentially producing misclassification. Primarily, our exposure estimation approach does not encompass all potential sources of exposure to each of these compounds: Among them were external nonagricultural sources (e.g., institutional use, such as around schools); residential indoor use; professional pesticide application in or around the home for gardening, landscaping or other pest control; and dietary sources (Morgan 2012). Other sources of potential error include errors in reporting to the PUR database, the assumption of homogeneity of exposure within each buffer, and potential geocoding errors. Seasonal variation and address changes mid-pregnancy were accounted for by assigning an address to each day instead of one address for the individual, but information on hours spent in the home or elsewhere was not available.

Use of the PUR data has been refined by some researchers who have enhanced the 1-mi^2 resolution of the PUR data by incorporating land use data (Nuckols et al. 2007; Rull and Ritz 2003). This approach demonstrates higher correlation of PUR-based exposure estimates with in-home carpet dust pesticide concentrations than the PUR data alone (Gunier et al. 2011). In our case, land use reports were not available for about half the CHARGE study counties; given an already low prevalence of exposure, the loss of power by excluding those counties would have outweighed any benefit of increased specificity in exposure estimates from land use data.

Although organophosphate use drastically increased between the 1960s through the late 1990s (U.S. Department of Agriculture 2006), over the past decade, use has been declining (U.S. Environmental Protection Agency 2011). For indoor use, chlorpyrifos has largely been replaced with pyrethroids (Williams et al. 2008), but research indicates pyrethroids may not necessarily be safer. In an *in vitro* study comparing the toxicity of a common pyrethroid, cyfluthrin, with chlorpyrifos, at the same doses cyfluthrin induced either an equivalent or higher toxic effect on the growth, survival, and function of primary fetal human astrocytes, and induced inflammatory action of astrocytes that can mediate neurotoxicity (Mense et al. 2006). In another *in vitro* study comparing the neurotoxicity of fipronil to chlorpyrifos, fipronil induced more oxidative stress and resulted in lower cell counts for nondifferentiated PC12 cells than chlorpyrifos, and disrupted cell development at lower thresholds, leading the authors to conclude that fipronil was in fact more detrimental to neuronal cell development than chlorpyrifos (Lassiter et al. 2009). Although further studies are underway, because of the observed associations in humans and direct effects on neurodevelopmental toxicity in animal studies, caution is warranted for women to avoid direct contact with pesticides during pregnancy.

Conclusions

Children of mothers who live near agricultural areas, or who are otherwise exposed to organophosphate, pyrethroid, or carbamate pesticides during gestation may be at increased risk for neurodevelopmental disorders. Further research on gene–environment interactions may reveal vulnerable subpopulations.

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All *EHP* content is accessible to individuals with disabilities. A fully accessible (Section 508–compliant) HTML version of this article is available at http://dx.doi.org/10.1289/ehp.122-A266.

Erratum: "Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study"

In "Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study" by Shelton et al. [Environ Health Perspect 122:1103–1109 (2014); doi:10.1289/ehp.1307044], the following disclaimer was inadvertently omitted from the Competing Financial Interest Declaration:

> D.J.T., R.J.S., R.L.H., and I.H.-P. have received travel reimbursements and grant support from Autism Speaks, an autism advocacy group. Further, the authors state that their freedom to design, conduct, interpret, and publish research is not compromised by any controlling sponsor as a condition of review and publication.

The authors regret the error.

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EXHIBIT
2

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aap.org
https://www.aap.org/en-us/about-the-aap/aap-press-room/pages/Aerial-Spraying-to-Combat-Mosquitos-Linked-to-Increased-Risk-of-Autism-in-Children.aspx?nfstatus=401&nftoken=00000000-0000-0000-0000-000000000000&nfstatusdescription=ERROR%3a+No+local+token

Aerial Spraying to Combat Mosquitos Linked to Increased Risk of Autism in Children

4/30/2016

New study finds a community's use of airplanes to spread pesticide each summer may pose a greater risk of autism spectrum disorder and developmental disorders among children born in the area.

BALTIMORE, MD – New research to be presented at the Pediatric Academic Societies 2016 Meeting suggests that the use of airplanes to spray anti-mosquito pesticides may increase the risk of autism spectrum disorder and developmental delays among children.

Researchers who will present the abstract, "Aerial Pesticide Exposure Increases the Risk of Developmental Delay and Autism Spectrum Disorder," identified a swampy region in central New York where health officials use airplanes to spray pyrethroid pesticides each summer. The pesticides target mosquitos that carry the eastern equine encephalitis virus, which can cause swelling of the brain and spinal cord. They found that children living in ZIP codes in which aerial pesticide spraying has taken place each summer since 2003 were approximately 25 percent more likely to have an autism diagnosis or documented developmental delay compared to those in ZIP codes with other methods of pesticide distribution, such as manually spreading granules or using hoses or controlled droplet applicators.

"Other studies have already shown that pesticide exposure might increase a child's risk for autism spectrum disorder or developmental delay," said lead investigator Steven Hicks, MD PhD. "Our findings show that the way pesticides are distributed may change that risk. Preventing mosquito-borne encephalitis is an important task for public health departments," he said. "Communities that have pesticide programs to help control the mosquito population might consider ways to reduce child pesticide exposure, including alternative application methods."

Dr. Hicks will present the abstract, "Aerial Pesticide Exposure Increases the Risk of Developmental Delay and Autism Spectrum Disorder," at 1:30 pm on Saturday, April 30, in Exhibit Hall F of the Baltimore Convention Center. Read the abstract.

Please note: only the abstract is being presented at the meeting. In some cases, the researcher may have more data available to share with media, or may be preparing a longer article for submission to a journal. Contact the researcher for more information.

# # #

The Pediatric Academic Societies (PAS) Meeting brings together thousands of individuals united by a common mission: to improve child health and wellbeing worldwide. This international gathering includes pediatric researchers, leaders in academic pediatrics, experts in child health, and practitioners. The PAS Meeting is produced through a partnership of four organizations leading the advancement of pediatric research and child advocacy: Academic Pediatric Association, American Academy of Pediatrics, American Pediatric Society, and Society for Pediatric Research. For more information, visit the PAS Meeting online at www.pas-meeting.org, follow us on Twitter @PASMeeting and #PASMeeting, or like us on Facebook.

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[1508.488] Aerial Pesticide Exposure Increases the Risk of Developmental Delay and Autism Spectrum Disorder

Steven D. Hicks, Vignesh Doraiswamy, Katherine Fry, Eric Wohlford. Pediatrics, Penn State Milton S. Hershey Medical Center, Hershey, PA; Pediatrics, SUNY Upstate Medical University, Syracuse, NY.

BACKGROUND: Pesticides are one environmental factor implicated in developmental delay (DD) and autism spectrum disorder (ASD). The influence of the timing and route of pesticide exposure on the risk of ASD/DD is not well defined.
OBJECTIVE: We identified an area of Central New York (NY) with unique pyrethroid pesticide (PP) exposure to study these factors. Each summer, to combat mosquito-borne encephalitis in the Cicero Swamp region, the Department of Health uses airplanes to apply PPs. In contrast, surrounding areas are exposed to standard methods of pesticide application, such as controlled droplet application, by commercial applicators. The objective of this study was to determine if the amount, route or gestational timing of pesticide exposure influenced the risk of ASD/DD.
DESIGN/METHODS: A retrospective review of records from a tertiary referral center was used to estimate the number of children with ASD/DD from 24 zip codes within Central NY from March, 2010 to March, 2015. Cases were identified using ICD-9 codes for ASD or DD at 6 affiliated pediatric clinics. To control for referral bias, rates of 4 common diagnoses were calculated for each zip code. Publicly available mandated reporting data from the Department of Environmental Conservation were used to quantify pesticide exposure (kg) among zip codes. The 2013 American Community Survey was used to quantify demographic data. Data from the 8 zip codes exposed to yearly aerial PPs were compared with 16 control zip codes.
RESULTS: There was no significant difference between aerial-exposed and control groups in number of children, overall births, premature births, poverty level, or child sex. The referral rate from aerial-exposed zip codes was lower for all 4 control diagnoses. The aerial-exposed zip codes had higher levels of total pesticide exposure ($p = 0.047$), but no difference in pesticide use per square km ($p = 0.10$). The relative risk of ASD/DD for children in zip codes with aerial spraying was 1.25 (95% CI = 1.025-1.506). ASD/DD prevalence correlated with aerial PP exposure ($r = 0.58$) and total pesticide exposure ($r = 0.41$). There was no correlation between gestational age during aerial spraying and ASD/DD prevalence ($r = -0.034$).
CONCLUSIONS: Exposure to pesticides is correlated with increased risk of ASD/DD. The relative risk of ASD/DD increases when PP exposure occurs through aerial application, but the gestational timing of this exposure does not influence ASD/DD risk.

E-PAS2016:1508.488

Session: Poster Session: Epidemiology: Exposures (1:00 PM - 4:00 PM)
Date/Time: Saturday, April 30, 2016 - 1:00 pm
Room: Exhibit Hall F - Baltimore Convention Center
Board: 488
Course Code: 1508

Comment Letter O-VOL

**Stephan C. Volker Law Offices
Representing Healthy Children Alliance**

**Stephan C. Volker
May 9, 2016**

Response 1

The commenter is concerned that the precise location of the project on a detailed map is not provided.

The commenter is reminded that the project is an areawide program, not a site-specific land use development project. Figure 2-1 does precisely show the boundaries of the entire Program Area on a detailed base map. The California Environmental Quality Act (CEQA) requires that the project area include the area where all potential impacts could occur. The Draft Programmatic Environmental Impact Report (PEIR) states that any of the adjacent jurisdictions to the Service Area counties could be affected by the Proposed Program if the District was asked by the adjacent county vector control agency or vector control district to provide assistance in their county, and the Program Area includes the counties that are adjacent to the immediate Service Area county of San Mateo. These are shown on Figure 2-1, and they include San Francisco, Santa Clara, and Santa Cruz counties. For example, the District currently has a contract with the San Francisco Zoo to perform specified mosquito abatement services. Mosquitoes may travel long distances, and their movement is not limited by jurisdictional boundaries. For example, the salt marsh mosquito (species *Aedes dorsalis*) is an aggressive biter that may travel 20 miles for a blood meal. Also, because the District has an airboat, adjacent districts/agencies could ask the District to provide assistance to areas most accessible by airboat (beyond the 20 miles from the county boundary). Thus, the analysis conservatively assumes that an entire adjacent county could be affected, but most impacts would be concentrated in San Mateo County. Of greatest concern would be a vector population originating in an adjacent county where Service Area residents and recreationists could be affected, and District staff would need to access property in that county on short notice.

Response 2a

The commenter objects to the use of the term “alternative” to describe components of the Integrated Mosquito and Vector Management Program (Program/IMVMP) as well as alternative programs.

The District has modified the text of the PEIR to use the word “component” to describe the six elements of the Proposed Program (e.g. PEIR Section 1.2 and throughout document). The proposed project is a continuation of the District’s ongoing Program for mosquito and vector management with some additions/enhancements for possible use in the future. These Program components are groups of related or similar activities by type. The District has over 25,000 sources that it monitors on a regular basis for mosquito abundance, species, and life cycle. It also responds to complaints and requests for service at other sites as well. At each site where actual treatment is needed, the District has to determine quickly which of the technical components within its Program is best suited to dealing with the mosquito or other vector problem. As described in the Draft PEIR, the District’s management practices emphasize the fundamentals of integrated pest management (IPM), specifically integrated vector management (IVM), which involves the use of multiple tools, including source reduction (physical control), habitat modification (vegetation management), and biological control using mosquitofish, when appropriate before using pesticides. So on a site-specific basis, the District selects from its nonchemical control alternatives first, then from its chemical control alternative or herbicides under vegetation management, if necessary. Site conditions, including the potential for special-status species to be present and proximity to human activities, affect the management component(s) selected.

These Program components were distinguished as “alternatives” in separate sections of each impact chapter to ensure that they are fully evaluated on a comparable basis, in similar depth, and so that impacts are explained clearly for each resource or environmental topic. This approach was selected because the various components of the Program (e.g., Vegetation Management, Biological Control, Chemical Control, etc.) differ in their immediate objectives, method, and potential impacts. For example, surveillance informs the process for selecting which tool or method is most appropriate for that location if any. Surveillance impacts are described separately from the site access impacts associated with drainage channel/water management under Physical Control. Each resource chapter considers the environmental impacts of the same set of Program alternatives now “components.” This way the impacts of each Program component can be compared against those of the other components and in total to promote the District’s informed decision regarding which method to use in a particular situation. The District’s separate evaluation of the CEQA mandated alternatives to the project, that would avoid or substantially lessen the significant environmental impacts of the project, is provided in Chapter 15.

CEQA mandated alternatives to the Proposed Program are thoroughly addressed in Chapter 15, Alternatives, which describes CEQA requirements, the process used for screening components (tools) (Section 15.1), components (tools) that were considered but rejected from further consideration (Section 15.2), impacts of the No Program Alternative (Section 15.3), impacts of a Do Nothing Alternative (Section 15.4), and alternatives that would avoid or substantially lessen the significant environmental effects of the Program (Section 15.5). Two such alternative Programs were identified: the Reduced Chemical Control Alternative Program (Section 15.5.1) and the No Chemical Control Program (Section 15.5.2). The impacts of the Proposed Program and these “alternative programs” were compared (Section 15.6), and the environmentally superior alternative was identified (Section 15.7). Thus, all of the CEQA requirements for “alternatives” were addressed. In fact, the IMVMP PEIR went beyond CEQA requirements to address an alternative Program that was infeasible, i.e., the No Chemical Control Program, in order to respond to anticipated public comments that such an alternative Program could be recommended along with a Reduced Vegetation Management Program to exclude the use of the herbicide glyphosate.

The issue in the *North Coast Rivers Alliance v. Kawamura* (2015) decision was that the LBAM PEIR failed to consider control as an alternative to eradication, not that the alternatives evaluated were individually wrong. In the LBAM PEIR, there was a last minute change in the Program’s objective from eradication to control (as the Final PEIR was completed and before preparation of the Findings of Fact) based on a new US Department of Agriculture decision to move to control over eradication. The Court determined that the Program’s original objective of eradication was an improper, too narrowly defined objective. The Court also found that there was prejudicial abuse of discretion in the Environmental Impact Report’s (EIR’s) failure to address control as an alternative to eradication. In contrast, for the District’s IMVMP, no last minute change has occurred in the Proposed Program; and the Program description is stable in its objectives and its planned components although some additional information has been added including clarifications between existing and future activities.

Response 2b

The comment is that the Draft PEIR fails to describe how the District determines which tool to use, so the District’s decisions to use chemical control and herbicides lack accountability.

For adult mosquitoes, treatment decisions are based on surveillance trap results. When trap results indicate that adult mosquitoes exist with West Nile virus (WNV) or any other known harmful pathogen, then an adult mosquito treatment protocol is triggered (see Table 1 below, which has been added to the new Draft IMVMP Plan on which Chapter 2 of the PEIR is based and is incorporated by reference into the revised Draft PEIR. In unique circumstances adult mosquito treatments may be required when disease has not been detected but human discomfort is probable, i.e., aggressive salt marsh mosquitoes exist at such high levels that immediate action is required. Under these circumstances the application would typically take place in the affected neighborhoods and not on US Fish and Wildlife Service (USFWS) property.

Table 1. Larval Source Treatment Guidelines

Species	Distance To Populated Area	Total L/P Density Other Factors
Ae. dorsalis	0 – 10 miles	1 per 10 dips or if adults are found in traps in excess of 5 per trap night per location
Ae. sierrensis	0 – 500 yards	1 per “slurp” with turkey baster
Ae. squamiger	0 – 10 miles	1 per 10 dips or if adults are found in traps in excess of 5 per trap night per location
Ae. washinoi	0 – 500 yards 500 yards – 1 mile	1 per 10 dips or if adults are found in traps in excess of 5 per trap night per location
An. punctipennis	0 - 1.5 miles	2 - 3 per dip
Cx. erythrothorax	0 – 1000 yards 1000 yards - 1 mile	1 per dip or if adults are found in traps in excess of 5 per trap night per location
Cx. pipiens	0 – 500 yards 500 yards – 1 mile 1 mile – 2 miles	1 per 10 dips 1 per dip 5 per dip
Cx. stigmatosoma	0 - 500 yards 500 yards - 1 mile 1 mile - 2 miles	1 per 10 dips 1 per dip 5 per dip
Cx. tarsalis	0 – 500 yards 500 yards – 1 mile 1 mile – 5 miles	1 per 10 dips 1 per dip 5 per dip
Cs. incidens	0 – 500 yards 500 yards – 1 mile	1 per dip 5 or more per dip
Cs. inornata	0 - 1 mile 1 mile - 2 miles	1 - 2 per dip 3 - 5 per dip
Aedes (invasive)	N/A Treatment done if found	N/A Treatment done if found

The District’s thresholds for treatment of larval mosquitoes are based on the species of mosquito, habitat types for larvae, distance to populated area, and quantities detected. The table provided above shows these thresholds, which may change based on advisories from the California Department of Public Health (CDPH).

The District uses the same larval treatment decision model used by some other districts in the San Francisco Bay Area (i.e., Alameda County Mosquito Abatement District and Napa County Mosquito Abatement District). See Figure 1 below.

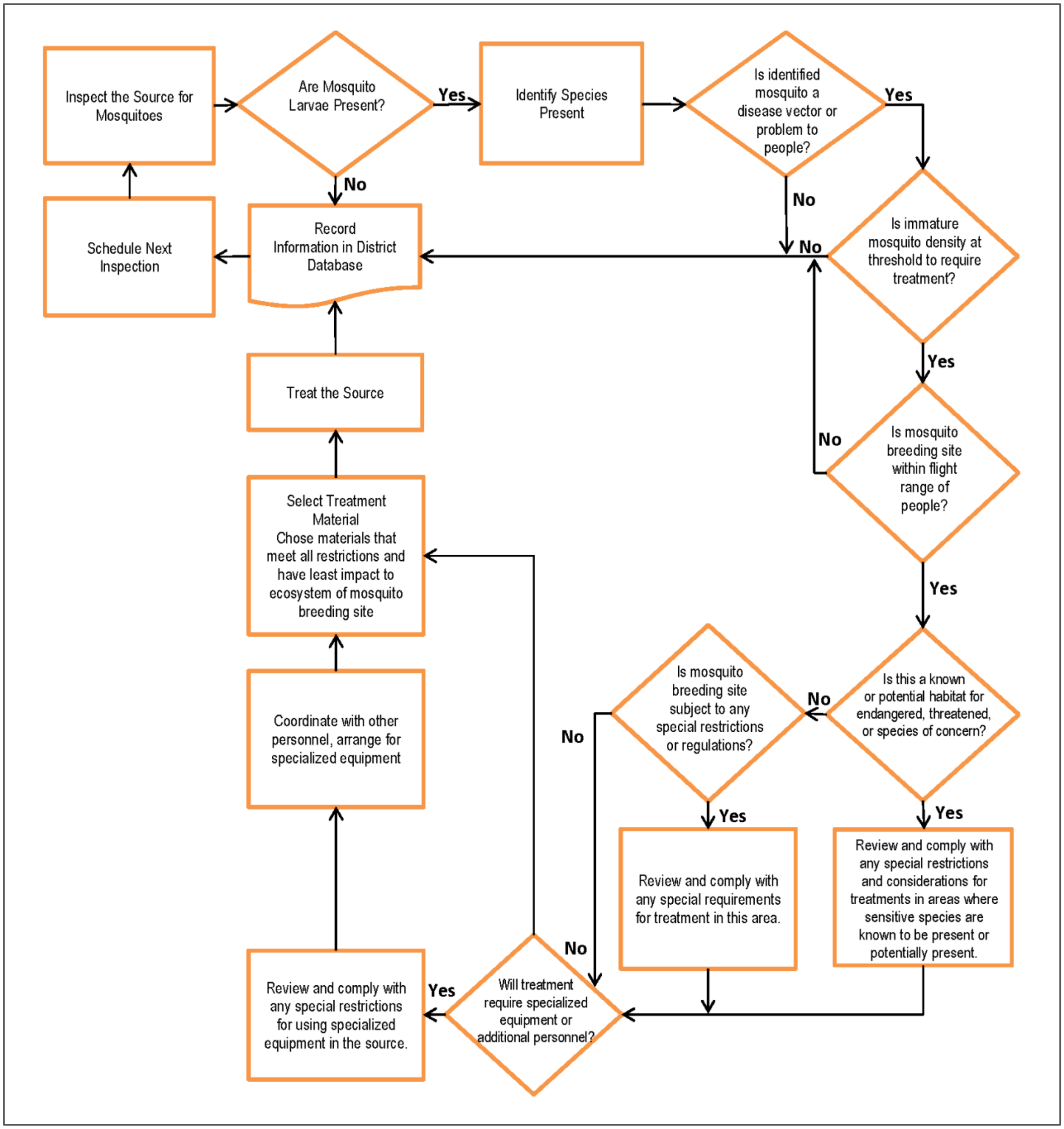


Figure 1. Larval Treatment Decision Model

An excerpt from SMCMVCD's current Pesticide Application Plan (PAP) (2016) is provided here (and incorporated into the IMVMP Plan) to show the thresholds/criteria considered by vector control staff prior to every mosquito control treatment:

8. **Evaluation of available best management practices (BMPs) to determine if feasible alternatives to the selected pesticide application project could reduce potential water quality impacts:**

The District's Operations and Laboratory Management Department reviews post-BMP implementation source pesticide application data to determine efficacy and compliance of BMP treatment. Examples that have resulted in the reduction of pesticide applications are provided below:

a. Establish densities for larval and adult vector populations to serve as action threshold(s) for implementing pest management strategies.

Only those mosquito sources that District staff determine to represent imminent threats to public health or quality of life are treated. The presence of any mosquito may necessitate treatment; however, higher thresholds may be applied depending on the District's resources, disease activity, or local needs. Treatment thresholds are based on a combination of one or more of the following criteria:

- Mosquito species present
- Mosquito stage of development
- Pest, nuisance, or disease potential
- Disease activity
- Mosquito abundance
- Flight range
- Proximity to populated areas
- Size of source
- Presence/absence of natural enemies or predators
- Presence of sensitive/endangered species.

b. Identify target vector species to develop species-specific pest management strategies based on developmental and behavioral considerations for each species.

See Table 2-2 (in Section 2.3.5.1.1) for a list of mosquito species controlled in San Mateo County. The strategies used for these species are described in the *Best Management Practices for Mosquito Control in California* (CDPH and MVCAC 2012) and the *California Mosquito-borne Virus Surveillance and Response Plan* (CDPH et al. 2013).

c. Identify known breeding areas for source reduction, larval control program, and habitat management.

Any site that holds water for more than 96 hours (4 days) can produce mosquitoes. Source reduction is the District's preferred solution and, whenever possible, the District works with property owners to effect long-term solutions to reduce or eliminate the need for continued applications as described in *Best Management Practices for Mosquito Control in California.* The District maintains a database of known sources of larval development, and field technicians carry a copy of this database while recording larval control applications. A list of these Waters of the United States (WOTUS) sites is included in the District's IMVMP.

d. Analyze existing surveillance data to identify new or unidentified sources of vector problems as well as areas that have recurring vector problems.

This practice is included in the *Best Management Practices for Mosquito Control in California*, the *California Mosquito-borne Virus Surveillance and Response Plan,* and the *Statement of Best Management Practices for the San Mateo County Mosquito Abatement District* (SMCMAD 2002) and in the IMVMP that describes the District's control program. The District continually collects adult and larval mosquito surveillance data, dead bird reports, and sentinel chicken test results and uses them to guide mosquito control activities. The District maintains a computerized database of sources of mosquito development and work that has been carried out at each location. Vector control technicians carry laptop computers in the field with copies of this database and have access to records of all the work that has been done at each site. The schedule of inspections and decisions on the kind of control applied are based on information they obtain from this database. In addition, technicians continually search for new sites, sample water for larvae, and answer requests for service from the public.

Response 3

The comments that the use of best management practices (BMPs) makes the project description inaccurate and unstable and that these actions are actually mitigation measures that are unenforceable and vague are incorrect. Further information on the origin of these BMPs and their use by the District is provided below.

The District has been engaged in organized vector control since 1913. The current Program is being evaluated along with additional activities or chemical treatments that the District would like to have available or is considering for use in the future as the entire Proposed Program. The BMPs have evolved over many years of practice and coordination with wildlife refuge managers, water district staff, California Department of Fish and Wildlife (CDFW) biologists, and US Army Corps of Engineers (USACE) engineers on previous agency permits and PAPs including measures to minimize disruption to special-status species and their habitats. The California Department of Public Health and the Mosquito and Vector Control Association of California (CDPH and MVCAC 2012) together regularly publish their *Best Management Practices for Mosquito Control in California* comprised of recommended BMPs for use by vector control districts and by affected landowners. The BMPs help to meet overall Program objectives. As a Program feature, they represent environmental protection activities that modify physical elements of the Program. They are preexisting measures adopted and implemented as part of normal vector control operations including surveillance. In some cases, not all, the BMPs are less specific than similar mitigation measures would be in order to provide for flexibility in dealing with a variety of sites and different chemical treatments as a form of adaptive management to deal with changing physical and biological conditions. In other cases, they are very specific; i.e., do not allow for deviation from product application label requirements. Pesticide label restrictions cover application rates and methods, storage, transportation, mixing, and container disposal that have become part of the District's ongoing practices. The BMPs supplement pesticide label requirements.

The District has developed and adopted their BMPs, is using them in the current Program, and will consider modifications as requested by USACE, CDFW, USFWS, or other resource agencies. Some modifications to the revised Draft PEIR were made based on agency comments. In short, the BMPs are an integral part of the District's current Program (a Program "feature"), are to be continued into the future, and are properly treated as part of the Proposed Program being evaluated in the PEIR. Ignoring the effect of these ongoing practices would mischaracterize the Program being evaluated, resulting in misleading and inaccurate impact analyses. The issue is not just what the District does (apply a specific adulticide) but how it performs a particular task (using ultralow volume [ULV] method with calibrated equipment by trained staff when weather conditions are consistent with label requirements). In most cases, the BMPs reflect common concerns for implementing a particular Program component, not a subsequent action. While the wording of individual BMPs may be similar to mitigation measures used on other projects, the BMPs herein are a legitimate element of the Program description and separate from those mitigation measures that would be added to the Program to reduce an impact to less than significant. Project features including the BMPs are taken into account prior to making a final determination of significance.

It is possible District BMPs could be modified over time to meet resource agency requirements or site conditions. For example, the process for renewing the District's 5-year regional permit with the USACE and its Supplemental Use Permit for vector control on USFWS lands may identify more specific requirements. The USACE permit application is submitted to CDPH, who then sends it to the resource agencies including CDFW. The District will continue to coordinate with USFWS and CDFW on possible future refinements to BMPs to address specific habitat or site conditions, including provisions for vegetation and sediment removal in drainage channels and ongoing responsibilities for maintenance of the affected areas. Sea-level rise may affect site conditions along the shoreline with San Francisco Bay. The USFWS suggested some additional BMPs to address additional special-status species in their comments on the March 2016 PEIR.

To further explain the use of BMPs by vector control agencies in California such as the District, the State Water Resources Control Board (SWRCB) required surface water quality monitoring for the MVCAC National Pollutant Discharge Elimination System (NPDES) Permit Coalition in 2011-2012. The monitoring work reflected the ongoing use of BMPs (MVCAC 2013). See Response 26 on study results that document the effectiveness of the BMP measures. It is important here to note that Section 3.1 of this study explained the BMPs in use by the Districts that contributed to the study results and stated the following: "Member districts of MVCAC implement the BMPs provided in their respective PAPs in meeting the requirements of the Vector Control Permit." Section 9 of the District's PAP includes several of the District BMPs (that are compiled from multiple sources, not just the PAP).

"9. Description of the BMPs to be implemented. The BMP's shall include, at the minimum:

a. **measures to prevent pesticide spill;** District staff monitors application equipment on a daily basis to ensure it remains in proper working order. Spill mitigation devices are placed in all spray vehicles and pesticide storage areas to respond to spills. Employees are trained on spill prevention and response annually.

b. **measures to ensure that only a minimum and consistent amount is used;** Spray equipment is calibrated each year and is a part of the Memorandum of Understanding with CDPH. However, the pesticide label and associated registration by the United States Environmental Protection Agency (USEPA) and California Department of Pesticide Regulation (CDPR) are the authority of how much product can be legally applied to control the target.

c. **a plan to educate Coalition's or Discharger's staff and pesticide applicator on any potential adverse effects to waters if the U.S. from the pesticide application;** Applicators are required to complete pesticide training on an annual basis. Records are kept of these training sessions for review by the local agricultural commissioner and/or CDPH. Employees certified by the CDPH must perform at least 20 hours of Continuing Education units to maintain their certification.

d. **descriptions of specific BMPs for each spray mode, e.g. aerial spray, truck spray, hand spray, etc.;** The District will calibrate truck and hand larviciding equipment each year to meet application specifications. Supervisors review spray records daily to ensure appropriate amounts of material are being used. ULV equipment is calibrated for output and droplet size to meet label requirements. Aerial larviciding equipment is calibrated by the Contractor. Applications are equipped with advanced guidance and drift management equipment to ensure the best available technology is being used to place product in the intended spray area.

e. **descriptions of specific BMPs for each pesticide product used; and** please see the *Best Management Practices for Mosquito Control in California* for general pesticide application BMPs, and the current approved pesticide labels for application BMPs for specific products."

This monitoring work completed by the MVCAC NPDES Permit Coalition (MVCAC 2013) cited above confirms the PEIR's determination that the District's BMPs are an integral part of the IMVMP and have been and will continue to be effective in avoiding and minimizing adverse effects to beneficial uses of receiving waters from the District's mosquito and vector control activities (see Response 26 for supporting analysis). Although the monitoring study confirmed that regulatory requirements were being met, it also confirmed that the BMPs practiced by the vector control districts were in use and effective in avoiding impacts to water quality.

By contrast, mitigation measures are typically new measures or special actions separate from the project itself and then added to a project to reduce significant impacts. For example, in Mitigated Negative Declarations, mitigation measures are new requirements added to the Project to avoid, minimize, eliminate, rectify/compensate for, or otherwise reduce significant impacts from the project under evaluation. They are then incorporated into the project description to indicate the project proponent has committed to implementing these measures but are recognized as separate mitigation measures, not Project features.

The PEIR fully evaluates all potential impacts of the Program, and the commenter has not explained how the inclusion of the BMPs resulted in the PEIR failing to identify or accurately evaluate any particular potential Program impacts. In short, the BMPs do not result in avoiding or "shortcutting" analysis of a potential impact. They are part of the impact analysis along with consideration of the type of chemical or nonchemical method used, application method including equipment, physical characteristics of the surveillance or treatment area, and proximity to people or special status species and sensitive habitats.

Response 4

The commenter is concerned that treating the educational aspects of the Program as exempt from CEQA is an example of segmenting the project.

Rather, as explained in the original PEIR, Chapter 2, Section 2.4, pages 2-52 to 2-53, educational programs such as those conducted by the District are often exempt from CEQA, and the subsequent sections try to explain the educational activities that do not have impacts, as well as where CEQA review is needed. Actions that have been determined not to have a significant effect on the environment are listed in Article 19, Categorical Exemptions, of the CEQA Guidelines. These include educational or training programs that involve no physical alteration in the area affected (CEQA Guidelines § 15322). The types of activities that are used by the District that meet this definition of no physical alteration and, therefore, no impact, are described on page 2-52 in the original Draft PEIR and modified in the revised Draft PEIR (with underlining for additions and ~~strikethrough~~ for deletions) as follows:

> *"The District's education program teaches the public how to recognize, prevent, and suppress mosquito/vector breeding on their property. This part of the Existing Program~~project~~ is accomplished through the distribution of brochures, fact sheets, newsletters, participation in local events and fairs, a District-sponsored open house, presentations to public agencies and community organizations, ~~newspaper and radio~~ advertising and public service announcements (transit, television, and internet), and contact with District staff in response to service requests. Public education also includes a school program that teaches students~~future adults~~ to be responsible by preventing and/or eliminating vector breeding sources and educates their parents or guardians about District services and how they can reduce vector-human interaction.~~Any distribution of educational materials or advice associated with surveillance, physical control, vegetation~~*

> ~~*management, biological control, chemical control, and other nonchemical control/trapping components of the District's overall Program does not add to the impact analyses conducted in this PEIR for these alternatives. For example, if the District determines that it needs to implement control activity on a site in response to a request for service, that activity is evaluated for potential impacts on the environment. The educational activity to the property owner on how to avoid creating a vector control problem is not the environmental impact issue in responding to a request for service by the District.*~~*"* (pages 2-60 and 2-61)

The literature, local events, and training through public presentations to schools and community groups is described above. The potential secondary effects of its education process are adequately described in the PEIR. One example is a homeowner or property owner making a request for service at an existing facility, and the District then advising the property owner to modify their landscaping to avoid ponding/improve drainage, reduce stagnation of water in ornamental ponds, or modify their structure to block access points by rodents. The District's use of equipment is covered primarily under the Surveillance Component or under Physical Control, Vegetation Management, and Chemical Control Components. Another example is giving the public mosquitofish with instructions on their proper use. The use of mosquitofish is evaluated under the Biological Control Component. If the property is abandoned, and there is an abandoned swimming pool or ornamental pond, the District will abate the mosquito-breeding problem most likely under the Biological Control Component. For potential major alterations of the physical environment at a site, the original Draft PEIR stated the following including text revisions for the revised Draft PEIR:

> *"Educational activities also include making recommendations on specific property development and land and water management practices or proposals, in response to ongoing or proposed developments or management practices that may create sources of mosquitoes/vectors. To ensure that the District does not indirectly encourage environmental impacts without CEQA review, the District informs landowners and others who might modify the physical environment at a project level in response to vector control educational programs that they have specific environmental obligations, including compliance with CEQA and agency permit requirements. The District is not a permitting agency, and it is not responsible for implementing or approving the recommendations; therefore, property owners or developers are required to prepare and submit their own documents for projects which may require CEQA review."* (page 2-61)

The revised PEIR text includes the following text (shown below):

> "Public education is a key component that is used to encourage and assist reduction and prevention of vector habitats on private and public property. <u>This component includes educational or training programs that involve no physical alteration in the affected area. The District activities of engagement with landowners and households on measures to control mosquitoes and other vectors that could physically or biologically alter the environment (such as minor landscaping changes, isolated pond management, and site drainage corrections) are covered programmatically in the environmental impact analyses (without speculation) under the following Program components: Physical Control, Vegetation Management, Biological Control, and Chemical Control.</u>~~While this component is a critical element of the District's Program, most public education does not have a significant effect on the environment.~~" (page 2-60)

There was no intent to segment the Program into smaller pieces to avoid CEQA review, and the commenter has not identified any potentially significant impacts that the PEIR failed to consider. A discussion of public education has been added to each of the resource chapters.

Response 5

The comment is that the Draft PEIR fails to consider a reasonable range of alternatives that could minimize impacts; the two considered are insufficient because the commenter disagrees with the analysis of impacts to other resources.

CEQA Guidelines Section 15126.6(a) requires that a draft EIR must describe a reasonable range of alternatives to the project or project location that could feasibly attain most of the basic project objectives and would avoid or substantially lessen any of the significant environmental impacts of the proposed project. Chapter 15 summarizes the analysis of a long list of potential vector control components and then alternative programs for the San Mateo County Mosquito and Vector Control District's IMVMP. It is based on Appendix E, Alternatives Analysis Report, prepared by the Napa County Mosquito Abatement District, which is an analysis of a wide range of potential components or tools for vector control. There is no set number of alternatives, which depends on the impact issues. Section 15.5 explains the alternative programs based on adjustments to the Chemical Control Component (the only component with significant impacts to air quality and surface water resources) along with the no project alternative as required under CEQA. A No Chemical Program Alternative and a Do Nothing Program Alternative are evaluated also; however, they do not meet Program objectives. Only the Reduced Chemical Control Program Alternative has the potential for meeting all of the Program objectives as long as Program effectiveness is maintained.

Refer to Response 3 regarding the use of BMPs and Responses 6 through 34 regarding the adequacy of the impact analysis. The commenter has not provided substantial evidence documenting that additional significant impacts would occur beyond the air quality and surface water quality impact associated with the Chemical Control Alternative. CEQA requires a reasonable range of alternatives, but the number and type depend on project features and impacts. Two Program alternatives addressed in Chapter 15 would both reduce the air quality impact to less than significant. A third Program alternative is discussed in response to public comments where the Vegetation Management Component would eliminate use of the herbicide glyphosate. No significant impacts on biological resources and water quality (except for the future use of naled) would occur; thus, no additional alternatives are required. There is a difference in opinion on what a significant impact is and what is not in this PEIR between the commenter and the PEIR preparers. See Response 7 below that speculation, complaints, fears and suspicions about a project's potential environmental impacts do not constitute substantial evidence. Also see Response 15 below on the use of best professional judgment by PEIR preparers with the appropriate technical qualifications to evaluate the impacts of human and ecological concern.

Response 6

The comment is that the Draft PEIR fails to properly account for the Program's pesticide-based pollinator impacts. It objects to the *Crop Science Canada* article and Appendix B.

There have been numerous reports on the documented toxicity to target insects (intended pests) and the possible toxicity of some pesticides to nontarget insects, including some beneficial insect pollinators. Of particular interest are use of spinosad and pyrethroid-type insecticides (including but not limited to, synthetic pyrethroids, permethrin, resmethrin, and etofenprox). As with all pesticides used to reduce populations of insect pests, toxicity varies by species and chemical. Information about each registered chemical is supported by a large USEPA database addressing direct and potential indirect toxicity of hundreds of chemicals. These data have been developed over decades and are available in the published USEPA databases that include all available physiochemical characteristics and toxicology data for a spectrum of terrestrial and aquatic vertebrate and invertebrate species. A large segment of the database is incorporated into the tables in Appendix B (see Tables 4-1 and 6-1) and Chapters 6 Ecological Health and 13 Cumulative Impacts in the PEIR. In a typical chemical (pesticide) toxicity database, the results of tests on numerous species provide a comparison of relative sensitivity to each chemical listed. The information in the database is updated as needed and includes the results of tests on several potential routes of exposure and both acute and sublethal effects on many nontarget species. This valuable, publically available database served as the primary source of information addressing possible unwanted effects of a potential chemical control product. Based on this, and other relevant information, restrictions for application techniques and other information were included in the development of the District's BMPs and included in the Draft PEIR.

The District's objective is to accomplish the necessary vector control for protection of public and animal health, while minimizing the possibility of unwanted nontarget effects in the local environment. These considerations and how unwanted effects can be eliminated or reduced are embodied in the Program objectives, in decisions on what pesticide is most appropriate for the specific situation, in product label instructions, and in each of the applicable BMPs that guide all pesticide applications. By restricting chemical applications to times when nontarget insects are not active and using care to treat only vector larvae and adults in locations where they are concentrated (i.e., population is high enough to warrant chemical control), impacts to other species are eliminated or substantially reduced.

In situations where inadvertent exposure to other beneficial insects might occur, the impact to a few of those individuals will not likely adversely impact the population(s). Insects, which incorporate relatively short fecundity periods, can recover quickly to original population numbers after loss of substantial numbers of individuals (Emlen 1989; Emlen et al. 2003; Andrewartha 1972).

Numerous reports that the use of glyphosate herbicide and some of its formulations can adversely impact bees and bee colonies, although glyphosate has been shown to be one of the safest herbicide products for over 40 years. Some of the claims that glyphosate impacts bees are based on a report by Herbert et al. (2014) (cited in commenter's footnote 2) that conducted simulated "field tests" to evaluate the effects of glyphosate on honeybee behaviors. These authors designed their study to determine what impact exposures to glyphosate might have on honeybee foraging and hive identification behaviors. Although the hypothesis of these authors predicted that honeybee behaviors would be adversely impacted after exposure to the herbicide glyphosate, the behaviors they studied were not adversely affected by the exposures and their conclusion was "no effect on foraging related behavior was found in these behavioral studies." The implied impact on bee colonies by contact with glyphosate (resulting in sublethal effects that adversely impact behaviors and, therefore, the ability of the colony to maintain the hive and transfer the honey within the colony) is not supported in the Herbert et al. (2014) study because the bees were physically dosed at substantially higher levels and physical contact than would be encountered in the field. This study, in fact, is similar to a laboratory dosing study because the application to the thorax of the bees can result in more exposure to the herbicide than the incidental contact with (treated) vegetation. The commenter's interpretation of the Herbert et al. (2014) study is flawed based on these unrealistic exposures. The original Draft PEIR considered the possible impact of glyphosate on bees in Chapter 6, Ecological Health, under the Vegetation Management Alternative/Component, Section 6.2.5.1.1 (page 6-21).

Although the District has not used glyphosate in the past 5 years, it has been used under the Existing Program and may be necessary to use it in the future in small areas for control of poison oak to allow District staff access to sites for surveillance and control of mosquito development or to assist other agencies as a joint effort to control vegetation to prevent human contact with ticks. Glyphosate is applied directly to the leaves of large stands of poison oak that are preventing a technician from reaching a mosquito breeding site, and physically trimming the noxious plant would be extremely detrimental to the health of the technician. Future considerations for this product use would be in the elimination of aquatic plants that are causing stagnant water and, therefore, mosquito breeding. Elimination or reduction of aquatic plant growth in focused areas would increase flow and give native fish access to mosquitoes and ultimately reduce pesticide usage.

Concern about the possible loss of bee populations is seen in the number of publications and media reports about reductions in bees and bee colonies. There are many credible theories as to the causes of a reduction in bee numbers (where they occur), including the effect of drought on the flora sources, the rise of parasites, fungi, and other classic bee diseases; it is likely that these sources of stress are the most important adverse effects on bee colonies. Reports of bee colony decline have been labeled by some as colony collapse disorder (CCD), and this decline has been reported in many publications, including weekly news magazines (Walsh 2013). However, the reports are not consistent within regions or within some areas of pesticide use where colonies are actually doing better (Genetic Literacy Project 2015). In fact, according to officials in the US Department of Agriculture, US commercial honeybee numbers have remained at levels of 2.4 to 2.6 million hives over the last several years, recently reaching 2.7 million hives (Genetic Literacy Project 2015). Because of the public concern about the possibility of CCD, some information about the phenomenon is included here, including both scientific reports and reports based on the experiences of beekeepers and farmers detailing some of the possible explanations and sources of impact.

> In 2015, US Department of Agriculture Secretary Tom Vilsak stated in the journal Ecology and Zoology: "*In the six years I have been secretary, we have seen a vigorous expansion of our agricultural sector. As much as an enterprise dependent on the forces of nature can be described as robust, American agriculture is robust and growing. Farms are more productive today than ever before."* (Genetic Literacy Project 2015)

Many beekeeper societies have provided evidence for and against the CCD concerns; and some even suggest that where it is suspected, it may actually be due to numerous factors, including (1) movement of the colonies by beehive contractors who rent to farmers during select pollination seasons; (2) loss of adequate habitat and foraging areas; (3) infestations by Varroa predatory mites (Bee Culture 2017); (4) theft of hives for sale in other regions; and (5) numerous other environmental and climate factors. Even some researchers who support the CCD phenomenon attribute it primarily to exogenous factors such as the Varroa parasite mite (DeGrandi-Hoffman et al. 2017). An additional perspective on the CCD issue is provided in some of the publications representing beekeepers. Many active beekeeper publications in the US and Canada (representing those who monitor and provide bees for agriculture) include numerous reports of success and problems of bee colonies. While many of the articles in these publications (such as *CropScience Canada*) are reports of personal experiences with raising bees, many suggest that loss of hives may be due to several external factors as discussed above. *(*Bee Culture 2017; American Bee Journal 2017). Although not peer-reviewed scientific studies, these journals provide the results of member opinions, questionnaires, and experiences in the field that reflect the current status of actual bee colony conditions and likely closely represent the status of active bee colonies in the regions represented by the publications. These publications, although not scientific publications, can be used to weigh the status and health of bee colonies as perceived by the beekeepers and farmers.

The Canadian Council on Bees produced an extensive evaluation and statistically based report describing the status of the honey industry in Canada that indicates a clearly stable and even growing number of bee colonies for each of the provinces. Although not reflecting US bee colony conditions, it supports reports in the US that the CCD phenomenon may be overstated, that it may be due to regional stresses, and that specific reports of CCD in the US could be attributed to numerous confounding factors as well as the possible impacts of pesticides.

Appendix B of the PEIR was developed as a technical report designed to cover basic parameters of toxicity, fate, and transport for 46 chemicals (both active ingredients and adjuvants). It was designed to provide sufficient information to support the PEIR analyses about the potential adverse effects of the chemicals used by the nine participating districts for vector control. The information and chemical data provided in Appendix B are based on summaries and data in the USEPA databases generated to satisfy the USEPA requirements for registration of chemicals, including pesticides. Most of those data are generated by independent research and contract laboratories that conduct strictly controlled laboratory and field tests with the chemical of interest; numerous possible species are exposed to nearly 100 percent chemical for varied periods of time without access to untreated food or habitat. Although these tests are designed to identify and characterize the maximum possible toxicity of the chemical, the results are clearly not directly relevant to the very low levels of chemicals used and exposures that result from the District's specific vector control activities. The objective of Appendix B, however, is not to cover every possible combination of chemical and pest combinations, as the number of possible combinations is in the hundreds and most are not relevant to District operations. Some potential adverse chemical impacts received special attention, including the possible impact on bees and bee populations, largely because several years ago a surge of reports in the media about declining bee populations resulted in intense public interest to identify the cause(s). The demographic and environmental factors that influence bee population success make identification of any specific cause of a perceived decline very difficult to unequivocally determine. However, based on information evaluated for this PEIR and the conclusions by the San Mateo County Agricultural Commissioner (who investigated reports of bee deaths on multiple occasions and reported to District staff that the District did not cause those deaths as reported in Response 7 below), it was determined that District vector control activities were not having a significant impact on local bee populations.

Response 7

The comment is that the assumption that BMPs will prevent *any* significant impacts to pollinators is flawed.

First, the commenter mischaracterizes assumptions affecting conclusions under CEQA regarding pollinators. The comment that the Draft PEIR "incorrectly assumes that BMPs it proposes will prevent *any* significant impacts to pollinators" is misleading. In particular the District uses the following BMP H12 for pesticide applications that was contained in Table 2-8 in Section 2.9 (now in Section 2.7 of the revised Draft PEIR):

> "*Do not apply adulticides in spray/fog forms over large areas (more than 0.25 acre) during the day when honeybees and other pollinators are present and active ~~or when other pollinators are active`~~. Preferred applications of these specific pesticides are to occur in areas with little or no honeybee or pollinator activity or after dark. These treatments may be applied over smaller areas (with handheld equipment), but the technician will first inspect the area for the presence of bees and other pollinators. If pollinators are present in substantial numbers, the treatment will be made at an alternative time when these pollinators are inactive or absent. Liquid larvicides are applied only to water bodies.*" (page 2-92)

The District BMPs are in place now, and have been used effectively, because there is no evidence to show harm to pollinators and the plants they affect from District activities within the District's Service Area, which contains important agricultural resources in coastal areas such as orchards, cut flowers, and vineyards that are dependent on pollinators. Chemical treatments are **not** done on San Bruno Mountain where the endangered checkerspot butterfly is a special-status species. Furthermore, the CEQA conclusions of less-than-significant impacts are based not only on the BMPs but on application methods and the concentration and type of nonpersistent chemical materials used. All of these factors, and including the physical context in which the applications occur (that subject the treatments to sunlight, air, and soil conditions that minimize persistence and facilitate breakdown) support the Draft PEIR conclusions that the effects are not substantial or adverse enough to be characterized as significant, not that there is a conclusion of zero or no impact. There could be a loss of some individual insects on occasion during an application, but the loss would not be substantial for reasons cited below and in Response 6 above.

Periodic concerns are raised by the public with the San Mateo County Department of Agriculture, Weights, and Measures regarding adverse impacts to honeybees, nonbee pollinators (including nocturnal moths), or insect predator populations related to District activities, but these concerns have not been substantiated by the San Mateo County Department of Agriculture (at the request of adjacent landowners or wildlife refuge managers) as a result of focused applications of District pesticides. In addition, it is standard District protocol to work with and notify the San Mateo County Beekeepers Guild of any ULV fogging applications.

Nocturnal moths pollinate nocturnal flowers with pale or white flowers heavy with fragrance and copious dilute nectar. In fact, pollinator populations fluctuate over time and are affected by many different contributing factors. It is not possible to definitively link use of vector control products by the District (at levels established by the USEPA and according to additional District BMPs) to a long-term decline or one that would adversely impact the pollinator or predator population of interest. It is well known in population biology that every population can adequately respond and recover to a loss of large percentages of individuals based on their intrinsic reproductive vigor. Populations with very short reproductive gestation periods (most insects and some small mammals) will recover much faster than populations with long reproductive cycles (large mammals and some birds) (Andrewartha 1972). In fact, there are many current theories about how many individuals in a population can be lost before the likelihood of significant impact or extinction may occur, but some experts suggest the total population of animals (and insects) with very short reproductive cycles (gestation times) can lose as much as 30 percent of the population and still experience complete recovery to pre-stress numbers (Emlen 1989; Emlen et al. 2003). In the case of insect predators, loss of this number of individuals would still be adequate to replenish the population to pre-exposure levels (Fleeger et al. 2003; Mitra et.al. 2011).

Furthermore, the overwhelming majority of the District's adulticide applications are site specific applications using hand held and/or backpack equipment. These applications are performed as necessary to reduce substantial populations of adult mosquitoes in the interest of public health. Annually, a considerable portion of the District's adult mosquito applications are performed in conjunction with contained, anthropogenic sources such as water and/or sewage leaks beneath buildings. When an adult mosquito population(s) is reduced, adulticide applications are no longer required at a given site, unless there is an additional occurrence at another point in time. With the exception of a small number of especially problematic sites, adult mosquito control applications are performed infrequently at a given site. This is primarily due to the fact that once an adult mosquito population is identified and eliminated, District staff work with land/property owners, either in the vicinity or on targeted properties, to repair or remove the issue that produced the adult mosquitoes in the first place. Overall, on an annual basis and considering the District's Service Area, adult mosquito control applications are small scale and relatively infrequent. The District has not engaged in large-scale, aerial applications over urban areas but this is included in the Proposed Program as an option for the future if there is an imminent threat to public health and where aerial applications would be the only reliable means of obtaining effective control in areas bordered by extensive mosquito production sites or with a small, narrow, or inaccessible network of roads. Aerial adulticiding is often the only means available to cover a very large area quickly in case of severe mosquito outbreaks or vector-borne disease epidemics. The District has not needed to do any aerial adulticiding under the current Program, and it would only do so in the case of an extensive outbreak of disease in an area larger than what could be covered by multiple trucks over multiple evenings. If a situation arose where it was necessary to conduct a large-scale application within ¼ mile of USFWS property, then the appropriate staff members at USFWS would receive notification 24 to 48 hours prior to the application (BMP H13).

The District is not required to conduct every imaginable study relating to the potential impacts of its activities, and the lack of reports of harm is itself evidence upon which the District is entitled to rely in assessing the potential for its activities to result in harm. (*Gentry v. City of Murrieta* (1995) 36 Cal.App.4th1359, 1380.) CEQA case law is clear that interpretation of technical or scientific information requires an expert evaluation, and testimony by members of the public, including attorneys, on such issues does not qualify as substantial evidence. Case law also affirms that speculation, complaints, fears, and suspicions about a project's potential environmental impacts also do not constitute substantial evidence. Periodic concerns are raised with the San Mateo County Department of Agriculture regarding adverse impacts to honeybees, nonbee pollinators (including nocturnal moths), or insect predator populations. None of these claims (by adjacent landowners or wildlife refuge managers) have been substantiated by the San Mateo County Department of Agriculture as a result of focused applications of District pesticides. In addition, it is standard District protocol to work with and notify the San Mateo County Beekeepers Guild prior to any ULV fogging applications. This notifying practice allows the Guild to report to its members the location, time, product to be used, and any precautionary measures, if necessary, in order to protect their residential honeybee hives/populations. The District engaged highly qualified technical experts to evaluate all relevant evidence relating to potential impacts to pollinators and other nontarget species, including additional information submitted by the public to the Marin-Sonoma Mosquito and Vector Control District in 2015 for their PEIR, and based on that expert evaluation, concluded that impacts would not be significant.

Response 8

The commenter does not think visual inspections prevent post-application harm.

Visual inspection of the area to be treated prior to treatment is a prudent and practical approach to evaluate the possible presence of potential nontarget species of concern including pollinators. The practice of visual inspection of a site *prior to* application of the pesticide indicates the care given by the District to reduce or minimize potential impacts to readily identifiable nontarget species such as bees and butterflies. Visual inspection is done to avoid applying pesticides when pollinators are observed flying. Also, to confirm the effectiveness of visual inspections, ongoing monitoring of water application areas by vector control districts to meet requirements of their State Vector Control Permit only requires visual inspections at this point. For more information on the SWRCB water quality monitoring, see Response 26.

The concern stated in the comment that visual inspection will not prevent “post-application harms” and “pesticide residues will remain in toxic amounts” is misleading and is really a question about persistence of the active ingredient in specific pesticides used by the District. In every instance involving applications of pesticides, the key issue is potential exposure, which is reduced dramatically after careful application. Potential adverse effects of a pesticide are related directly to the length of time or possible exposure to the active ingredient after application before it breaks down, and exposure is similarly lessened. The persistence of pesticide products is dependent in part on the physical/chemical conditions of the soils and vegetation treated, and the potential for exposure is reduced by soil characteristics and application method. The BMPs used by the District are designed to minimize the potential nontarget (bee) exposure, and the likely exposure is far below the direct contact toxicity data used in USEPA registration data. Although a report by Theiling and Croft (1988), using a new technique to estimate toxicity, indicates that severe losses may be expected if bees are present at the time of treatment (with high concentrations of chemical), or within a day thereafter losses are not likely when a mosquito control product is used properly, since permethrin has a strong repellent effect in the environment and has been considered to pose little risk to bees (USEPA 2006, 2009a).

After an application, the persistence of the chemicals used by the District for vector control to vegetation, soils, or sediment is reduced markedly by the characteristics of the surface soils and/or vegetation, and application residues are well below the toxicity levels identified by USEPA for pesticide registration.

The persistence of all chemicals registered by the USEPA for use in vector control is documented and included in the guidance and label instructions, both of which are summarized in the chemical material safety data sheet (now safety data sheet) documents. For instance, the persistence of glyphosate in soil and sediment has been studied since its development in the early 1970s. The characteristics of glyphosate have been studied and validated over decades. Every organic chemical has a physical/chemical degradation characteristic termed “half-life” (a metric used to describe the elapsed time for a chemical to reach ½ of its initial concentration). Each organic chemical, whether toxic or not, decays in both activity and toxicity over time. For some chemicals, the half-life can be hours, days, or weeks and few chemicals used as pesticides have half-lives normally greater than a week due to degradation by environmental conditions. When pesticides get into soil, or water, or are taken up by plants and animals, the half-life characteristics are altered. The environmental fate of pesticides depends on the physical and chemical properties of the pesticide, particularly the pH of the medium, modifying how likely it is to travel through soil (soil mobility), how well it dissolves in water (water solubility), and how likely it is to become airborne (volatility) (USEPA 1993).

Once a pesticide has been released into the environment, it is broken down by exposure to sunlight, (photolysis), exposure to water (hydrolysis), exposure to other chemicals (oxidation and reduction), microbial activity (bacteria, fungi, and other microorganisms), and other plants or animals (metabolism). Pesticide labels set out safety and use guidelines that usually focus on three aspects: rates of application (single and cumulative) for registered crops and pests, timing of application, and restrictions on areas of application (including required buffer zones).

The environmental fate of pesticides used by the District for vector control is influenced by their chemical properties and by the environmental conditions in which they are applied. The Draft PEIR's Appendix B, Ecological and Human Health Assessment Report, provides a detailed description of the fate and transport in air, water, and soil for each of the active ingredients applied by the District. For example, a summary of the potential uses of glyphosate products by the District is included in Appendix B Table 6-1 and the narrative in Section 4.6.2 of Appendix B. Many second-and third-generation insecticides are formulated to act quickly and then dissipate quickly in the environment, often through photolysis or microbial breakdown. Others bind to soils and sediments where they are degraded abiotically or by soil organisms. These effects, the potential for mobilization after pesticide application and the methods used to minimize exposures to nontarget ecological receptors, are considered in the discussion of the Vegetation Management and Chemical Control Alternatives/Components (see Sections 9.2.5 and 9.2.7 of the PEIR).

There are numerous pesticide products that include inert and/or chemically different additives to enhance the spray characteristics, adhesion properties, and efficacy. Many of those products have been specially tested for toxicity and registered with the USEPA for specific vector control purposes (National Park Service 2016). Although some of these mixture products have been associated with increased toxicity, numerous studies have demonstrated that the increase in toxicity may be due to a surfactant additive. In most instances, these special formulations of pesticide products are intended to reduce the potential for adverse effects or to specifically be used for aquatic environments, e.g., glyphosate products such as Aligare is a glyphosate product, which has been shown to be safer to aquatic wildlife than some of the other formulations of glyphosate (Brodman et al. 2010). If vector control requires application near aquatic boundaries, these formulations would be selected as an extra precaution against adverse effects to aquatic wildlife.

All chemicals can cause adverse effects or even become toxic at levels exceeding individual species "tolerance" levels. The sensitivity and tolerance levels are determined by the USEPA and other regulatory agencies using laboratory tests with numerous species of concern that are estimated to be potentially exposed to an application. The results of these tests on each chemical are published in numerous publically available USEPA documents summarizing the testing results with metrics such as the LD_{50}, LC_{50} and maximum estimated tolerance levels. The USEPA toxicity data tables are intended to provide the range of chemical exposures (doses) to the test species that could result in adverse effects and estimates of the maximum exposure that would result in no effects. Using this metric approach a likely "safe" range of exposures can be estimated. Combining low-volume application techniques and specific BMPs with the chemical properties results in District vector control pesticide applications that are well below adverse exposure levels. For the pesticides used by the District for vector control, these metrics are indicated in detail in Appendix B of the PEIR, with additional information on a current species of interest (honeybee). In several studies, one, for instance, (Frasier and Jenkins 1972) indicates that both technical and formulated glyphosate are practically nontoxic to honeybees with a contact LD_{50} value greater than 100ug/bee (applied directly to the thorax with a saturated Q-tip), which is considerably greater exposure than likely in the environment where District applications could occur.

The half-life and other physiochemical characteristics of the chemicals used by the District for vector control are listed in Table 6-1 of the PEIR Appendix B.

Response 9

Comment is concerned that PEIR only addresses acute impacts of glyphosate use and objects to conclusion of no impact to pollinators.

Glyphosate is an herbicide that is relatively stable to chemical and photo decomposition. The primary pathway of glyphosate degradation is soil microbial action, which yields the minimally toxic breakdown product AMPA and glyoxylic acid. Both products are further degraded to carbon dioxide. Glyphosate adsorbs tightly to soil so that its residues are relatively immobile in soil (USEPA 1993). This characteristic results in the chemical (when it is in the soil) being less available as a route of exposure and would require direct ingestion of the soil or sediment, which is not likely by insect pollinators who focus on flowers.

Although the term sublethal effect is often misused outside the scientific community, it is often used to define the effects of a stressor (pesticide in this case) that is less than mortality. It includes evaluation of the potential effects on physiological and behavioral systems that may occur over time or result in a deficit of a physiological function. Although important in the determination of the potential adverse impacts of the pesticide, it is the "endpoint" most susceptible to confounding, outside, environmental factors. Adverse effects that are categorized as sublethal are also often confused with the concept of chronic effects, which include low level effects that are continued over long periods of time and usually associated with constant exposures to a stressor. Because this condition is not typical of District vector control applications of chemical (generally single localized applications), it is not relevant to the evaluation of District use of pesticides or herbicides.

As stated above in Response 6, the District may use it in small areas for control of poison oak to allow access to sites of mosquito development (surveillance) or for spot treatment of mosquito-breeding habitat. Elimination or reduction of aquatic plant growth would increase flow and give native fish access to mosquitoes and ultimately reduce pesticide usage.

However, one of the sublethal effects on bees considered by the scientific community is evaluation of behavioral responses to chemical exposures. This was the focus of the work by Herbert et al. (2014) discussed in detail in Response 6. The conclusion of this study, which was designed to evaluate the very subtle behavioral responses to a pesticide exposure, was "no effect on foraging related behavior was found in these behavioral studies." Regardless of their negative behavioral results, the authors suggested that the bees may have been able to carry pesticide to the hive (which was not and is not a reliably measurable endpoint) as a reason for the reduction in the number of bees (which was also not observed in their studies). This study provides no defensible support to the authors' hypothesis of behavioral deficit after exposure to the pesticide in the study.

Claims suggesting pesticide applications have clear sublethal adverse effects on bees and bee colonies are not supported by the preponderance of relevant scientific publications. There are many credible theories as to the causes of the reduction in bee numbers (where they occur), including the effect of drought on the flora sources, the rise of parasites, fungi, and other classic bee diseases, and it is likely that these sources of stress are the most important adverse effects on bee colonies. The reports of bee colony decline (labeled by some as colony collapse disorder or CCD) are not consistent within regions or within some areas of pesticide use (Agriculture Secretary Tom Vilsack in Genetic Literacy 2015). Many beekeeper societies have provided evidence for and against the CCD claims, and some even suggest that where it is suspected, it may actually be due to movement of the colonies by beehive contractors.

Many hives are moved to fields where they are requested by farmers during select pollination seasons. Other factors include the loss of adequate habitat and foraging areas due to loss of agricultural land to development (*CropScience Canada*, American Beekeeping Federation, and numerous publications by beekeeper societies reporting actual field information). Probably one of the most informative statements was provided by the US Secretary of Agriculture:

> "*California fields have been parched for the past four years, but even a record-breaking drought hasn't been enough to depress productivity. Since the beginning of the supposed bee crisis that began with Colony Collapse Disorder in 2006, farm productivity in the US has actually increased among America's bee-pollinated crops. In the six years I have been Secretary, we have seen a vigorous expansion of our agricultural sector. As much as an enterprise dependent on the forces of nature can be described as robust, American agriculture is robust and growing. Farms are more productive today than ever before". (*Agriculture Secretary Tom Vilsack in Genetic Literacy 2015*)*

Most of the reports of reduced bee numbers and colony collapses do not include consideration of the numerous confounding factors that impact the bee colonies, diminishing their evidentiary value. The effects of drought, disease, parasites, viruses, and predation all play a role when impacts to bees are reported.

In conclusion, the District's applications of pesticides for vector control are done in strict compliance with USEPA, manufacturer, and its BMP guidance, which are designed to minimize exposure to pollinators. District application methods and chemical characteristics of the products used and proposed for use for insect control make the potential for long-term (chronic) exposure to insect pollinators unlikely. Finally, the comment presents no substantial evidence that application under the Program will result in substantial adverse sublethal effects to pollinating insects, and the available scientific literature also does not support such claims. The District engaged highly qualified technical experts to evaluate substantial relevant evidence relating to potential impacts to pollinators, including additional information submitted by the public in 2015 for MSMVCD's IVMP PEIR, and based on that expert evaluation, concluded that impacts would not be significant.

Response 10

The commenter states the deficiencies listed above must be corrected in a recirculated Draft PEIR.

As discussed in Responses 6 through 9, the Draft EIR correctly analyzed the impacts associated with the Proposed Program, and additional information is provided herein to support the original conclusions as well as consideration of information provided by the commenter. The information above provides clarification of material contained in the PEIR and addresses specific questions raised in public comments for this PEIR. None of the comments identified substantial evidence of a new significant impact that was not considered in the Draft PEIR other than the revised determination that the use of an adulticide (naled) could have a cumulatively considerable water quality impact to a pesticide impaired water body, i.e. lower San Mateo Creek discussed in Section 13.7 of the revised Draft PEIR and no Draft PEIR incremental impacts need to be changed from less-than-significant to significant; thus a recirculated Draft PEIR is appropriate. Furthermore, the District has decided to recirculate the PEIR because substantial new information has been provided, and previous material has been revised in most of the PEIR chapters. Also see Response 15 below on the technical qualifications of the principal toxicologist who worked on the Draft PEIR and prepared responses to many of the questions raised herein on the chemical treatments. The technical qualifications of all of the preparers of the District's PEIR are summarized in Chapter 16, Preparers.

Response 11

The comment is that applications according to the product label do not mean that the applications lack environmental impact, and these impacts require full disclosure.

Some of the chemicals used for vector control include the pyrethroid insecticides such as permethrin, resmethrin, and etofenprox that are used (or proposed for use) as adulticides by the District. While these chemicals are not very toxic to terrestrial species of mammals and birds (they are below the USEPA LOC for most uses), they can be toxic to aquatic species at high concentrations. The toxicity of these pesticides is species specific, and the thresholds provided by the USEPA guidance indicate that it should not be introduced to aquatic systems. As with all chemicals, the exposure (dose) is the primary factor resulting in potential toxicity, and care is taken by the District to reduce or minimize the possible introduction into water bodies. As stated on page 9-35 in the revised Draft PEIR with clarifications added:

> "The use of adulticides to control mosquitoes is a ~~the~~ method of control ~~of last resort~~ and only one element in the District's IPM program. Adulticides are only applied when other tools are not available and when specific criteria by the District are met, including species composition, population density, proximity to human populations, and/or human disease risk. The active ingredients currently in use have been deliberately selected for lack of persistence and minimal effects on nontarget organisms when applied in strict conformance to label instructions for ULV mosquito control. Adulticides are applied using existing ground application equipment or ~~rotary~~future fixed-wing aircraft following strict conformance with label requirements and BMPs described in the District's PAP."

Further discussion is provided on page 9-36:

> "Several studies have shown that pyrethrins applied using ULV techniques do not accumulate in water or sediment following repeated applications. These studies also determined that no toxicity is associated when exposure is limited to the amounts used when following ULV protocols for mosquito control (Lawler et al. 2008; Amweg et al. 2006). Pyrethrins would have a less-than-significant impact on surface water or groundwater, including their limited use near septic systems, when applied following District BMPs and using ULV techniques, and when used in accordance with label requirements and the District's PAP."

In summary, the adulticides are not applied directly to water and, most importantly, the ULV method results in no toxicity to water or related sediments, except for the potential use of the organophosphate naled. Furthermore, the characteristics of the other adulticides reduce the likelihood of exposure to nontarget species because they bind to soil, making them less likely to be available. Because they are known to be toxic to some of the aquatic species, applications are conducted using ULV techniques and with strict adherence to the product labels as determined by the USEPA guidance (USEPA 2005). The product label requirements are critical, but we have not relied just on following those requirements in making impact determinations. The study mentioned above provided results of field applications to show that the ULV application technique substantially avoids impacts to water and related sediments. Furthermore, special precautions including the District BMPs are used to ensure that they are not introduced into the aquatic environment in amounts that would impact nontarget species, including benthic invertebrates. The statement that product could encounter water means it is possible that a small amount could reach the water surface, not that it is actually applied to the water. Furthermore, adulticides are meant to encounter the adult mosquito in the air or resting on vegetation. The verbal context in which the few words were extracted and misrepresented by the commenter is provided below with clarification:

> "For example, the maximum application rate of an adulticide that could be used is 0.87 ounce/acre, although maximum application rates are generally not required. The concentration of the active ingredient is 5 percent or less of this volume, which translates

> into a water concentration of 1.04 µg/L if the water is 1 foot deep or 4.14 µg/L if the water is 3 inches deep. This "construct" assumes all of the product contacts the water when in reality, it does not. Aerial applications would be made over vegetated areas preferred by adult mosquitoes and would not be directly targeting waterbodies, so the amount of product theoretically encountering the water is generally a fraction of this." (page 4-72)

The use of herbicides to control vector habitat on land and in water is governed largely by USEPA guidance, label requirements, and the District's category H BMPs but others as well (explained below). This USEPA guidance is one of the factors used to develop the label recommendations and is also the basis for the development of appropriate BMPs for herbicide applications. The recommendations include the requirement to maintain adequate buffers between the application area and the edge of the water body for some materials. By following these USEPA recommendations, the likelihood that the pesticide will result in adverse aquatic impacts is very low. Concerning the use of diuron for weed control (e.g., Karmex XP), this material is no longer under consideration for future use. Herbicides are commonly applied by a sprayer only to the tops and exterior slopes of wastewater and winery waste ponds (see Table 2-1) that are often lined to prevent leaching of any material to soil and groundwater, and would not be used in or adjacent to natural aquatic habitat or along riparian corridors (i.e., site-specific conditions taken into consideration for use of particular product). District BMPs include minimization of drift and runoff and following label requirements to determine an adequate buffer to natural water bodies for terrestrial herbicides. Applicators will remain aware of wind conditions prior to and during application events to minimize any possible unwanted drift to waterbodies and other areas adjacent to the application areas (BMP H7). Furthermore, the timing of vegetation management work including chemical use will be confined to before February 1 or after August 31 to minimize potential impacts to special-status species, including birds. If any work is needed between February 1 and August 31 in areas known to harbor special status species, consultations with appropriate resource agencies will occur in advance to help identify locations of active nests and/or additional protection measures (BMP F6). Every effort will be made to complete vegetation management in riparian corridors prior to the onset of heavy rains (BMP F7) to minimize potential for runoff. See Response 9 for how the District proposes to use glyphosate in the future.

Response 12

The comment is concerned with the toxicity of pyrethroids and herbicides and their potential to impact aquatic species.

Comment noted and considered. The Draft PEIR Table 4-3 was based on a single source checked in 2015 for reported occurrences of fish and amphibian species: California Natural Diversity Database. It identified only Coho salmon and steelhead habitat in the Program Area, not Chinook salmon. Tidewater goby are listed in Table 4-3. Coho salmon and tidewater goby have been added to the following paragraph under the Physical Control Alternative (Section 4.2.4.1.1 on pages 4-54 and 4-55), and Coho salmon was already included under Vegetation Management Alternative (Section 4.2.5.1.1 on page 4-62) but tidewater goby is added even though the text used the term other species in both paragraphs:

> "Because their rapid currents do not provide suitable habitat for mosquitoes, creeks and rivers generally do not support substantial numbers of mosquitoes, although, some mosquitoes can be found in slow eddies and back channels, or in pools isolated on the banks as flows recede. Creeks and rivers may support special-status species including tidewater goby, Coho salmon, steelhead and hardhead as well as California red-legged frog, CTS, foothill yellow-legged frog, SFGS, western pond turtle, and other species, as indicated in Table 4-3 and Table 5-3. Isolated ponds and back channels may provide habitat for mosquito larva, but these areas may also provide excellent rearing habitat for young fish and amphibians, as they provide warmer water temperatures, higher primary productivity and protection from predaceous fish." (page 4-55)

> "Because their rapid currents do not provide suitable habitat for mosquitoes, creeks and rivers generally do not support substantial numbers of mosquitoes, although, some mosquitoes can be found in slow eddies and back channels, or in pools isolated on the banks as flows recede. Creeks and rivers may support special-status species including tidewater goby, steelhead, Coho salmon, California red legged frog, foothill-yellow-legged frog, CTS, aquatic reptiles, and other species, as indicated in Table 4-3, Table 5-3, and Table 5-4. Isolated ponds and back channels may provide habitat for mosquito larva, but these areas may also provide excellent rearing habitat for young fish and amphibians, as they provide warmer water temperatures, higher primary productivity and protection from predaceous fish." (page 4-62)

While the other source of information provided in footnote 7 is reputable (SFBRWQCB 2016), the website text provides additional information on Coho for the Pescadero and Butano Creeks watersheds as follows: "These watersheds provide habitat for a diverse array of aquatic life, including steelhead trout and, in the recent past, Coho salmon" (SFBRWQCB 2016). The focus of the environmental setting for the PEIR is conditions in 2012 when the NOP was distributed up to early 2018 when the revised Draft PEIR was completed, not the "recent past." Comment noted, and no other text changes in the PEIR on this issue are required.

Response 13

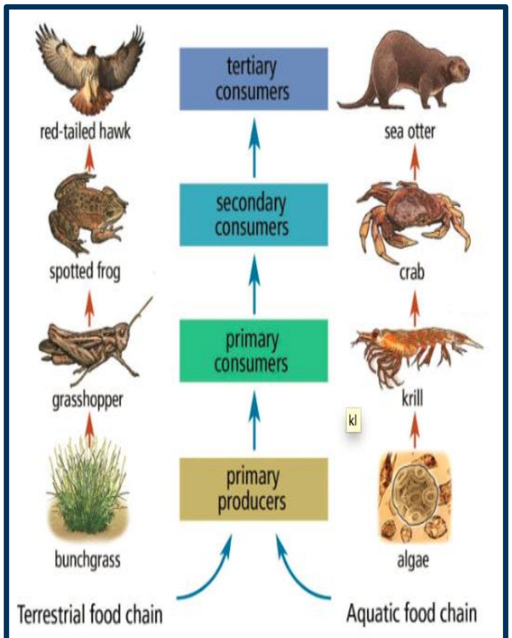
The comment is concerned that the BMPs do not include precautions around storm drains and gutters and do not prevent application when rain is forecast.

Concerning pesticide applications being sensitive to weather conditions, including rain, see Response 11 above and BMPs H6 and H7. Where it becomes necessary to treat storm drains with pyrethroids to eradicate localized infestations, care is taken to document the treatment and as noted, all treatment is performed using ULV techniques and with strict adherence to the product labels as determined by the USEPA guidance, which has been developed using the toxicity and species sensitivity data provided as a part of the registration process for each chemical. Direct treatment of storm drains with pyrethroids to combat infestations is considered to be appropriate where potential exists for adverse impacts on public health. However, storm drains are most often a problem when garbage and sediment from local streets prevent stormwater from draining quickly, leaving stagnant underground pools or ponds resulting in mosquito breeding. USEPA routinely modifies the label guidance when it is appropriate to account for runoff and movement via storm drains and other potential conduits that might increase exposure to no target species. Many pyrethroid labels were revised as recently as 2013 to reduce potential for runoff and drift. (USEPA 2013). The label statements spell out good stewardship and BMPs and clarify how these types of products are intended to be used. Such label statements serve to reduce the potential for runoff and drift to waterbodies that can result from applications of pyrethroid end-use products in residential, commercial, institutional, and industrial areas, applied by both professional pesticide control operators and residential consumers.

Most often, storm drains in residential areas are treated with larvicides. Street sweeping and trash removal are physical methods of control employed by the affected jurisdictions and homeowners to minimize stagnant water under local streets; unfortunately, these practices do not occur sufficiently in every neighborhood.

The comment repeats the assertion that the BMPs are not adequate to prevent harm to special-status aquatic species such as salmonids and other fish. This assertion is contradicted by the substantial evidence and analysis in the Draft PEIR and additional clarifications provided herein and in Response 3. Furthermore, the comment that food chain impacts would exacerbate a "failure to address significant impacts" is misleading. Rather, the commenter disagrees with the Draft PEIR's conclusion that impacts would be less than significant but does not provide any substantial evidence to refute the material analyzed in the Draft PEIR, which includes the references cited in PEIR Chapter 17, the references cited in each appendix, and the additional references cited here in this responses to comments including Attachment A, Additional Literature Review.

BMP H6 says to postpone or cease application when a high chance of rain is predicted and rain is a determining factor on the product label. It is not necessary to include another specific BMP to not apply pesticides or herbicides when rain is forecast because the District follows the label requirements for each product and would not apply adulticides or other adult insect chemicals when rain is likely because mosquitoes typically do not fly during rain events, therefore making the treatment futile. Using this general guidance, no additional BMP would be needed. Avoiding rain events is an overall District practice because rain would dilute the concentration of the chemical being applied, be inconsistent with the product label concentration rate, and potentially mean the application would be ineffective. Larvicides are applied directly to water, so rain is not an issue for effectiveness. Herbicides used for vegetation control on land and in water are focused on the area and actual vegetation of concern, and particular care is taken via careful, focused application strategies to minimize the possibility of reaching adjacent waterbodies of any size. The Draft PEIR disclosed a broad range of issues associated with chemical methods of vector control and made a reasonable good faith effort to address those issues in a manner understandable to the public by PEIR preparers with the appropriate qualifications.



A terrestrial and aquatic food chain to show the flow of the food web

The issue of loss of prey and prey habitat, as well as the potential impact to contaminated prey, was addressed in the Draft PEIR and further considered by a senior toxicologist and addressed in the extensive response below to support the material in Sections 4.2.2.6, 4.2.4.1, and 4.2.5.1 of the Draft PEIR and the following statement on predator populations in the original Draft PEIR on pages 4-46, 4-51, and 4-58 with clarifications added (and on pages 4-49, 4-54, and 4-62 in the revised Draft PEIR):

> "Mosquitoes are part of the food web and their loss may reduce the food base for some predators. Although mosquitoes serve a role as one of many types of prey items for some fish, avian insectivores, bats, and small reptiles and amphibians, the reduction of mosquito abundance over a small area will not affect the predator populations overall, because these species generally have large foraging ranges and can find~~, as~~ other prey sources within the range of their habitat use (Williams et al. 1994)~~are available~~."

Because of the selective nature of the vector control products for mosquitoes, any claimed potential adverse impact to insect predators associated with District applications (as nontarget exposures) would be temporary and an inconsequential impact to those populations of predator species. Even in the event of ancillary exposures, the recovery of such populations occurs rapidly to maintain the general level of individuals in their populations. The relative higher sensitivity of the target versus nontarget (less sensitive predator) species provides an adequate measure of safety to maintain the balance of predator populations.

Studies evaluating the toxicity of spinosad in control of *Lepidoptera*, for example, included the relation of pesticide treatment to the insect predators in the food chain. The authors reported that their studies revealed the relative safety of spinosad to natural insect predators that would likely be associated with

Lepidoptera predation while being highly effective against the target *Lepidoptera*: “spinosad is highly active against *Lepidoptera* but is practically nontoxic to insect natural enemies” (Lawler and Dritz 2013). As a verification of the relative sensitivity to insects and insect predators, in their publication, Lawler and Dritz state that “very large direct doses of spinosad in laboratory setting were toxic to nontarget insect predators, while low doses did not exhibit the same level of toxicity to nontargets and was relatively safe against the bulk of the insect predators.” (Williams et al. 2003)

It is clear that species differences in sensitivity to chemicals where chemicals could be applied are dramatic, but one of the concerns raised by the public about the safety of glyphosate (and other pesticides) is based on possible adverse effects or toxicity occurring as a result of bioaccumulation (uptake and sequestering of chemical in tissues) of chemical in the target species and subsequent food web transfer to nontarget predators. The processes of bioaccumulation and biomagnification (where the chemical actually becomes more concentrated in the exposed animal than the media) are processes seen primarily in the higher food web trophic levels. These processes are more typical of transfer of chemical to tissues of larger predator species and not particularly relevant to District vector control operations with pesticides and herbicides focused largely on insect vectors and their habitats.

An adverse effect to nontarget predators (food web transfer of applied chemical) would require the consumption of adequate numbers of contaminated pests to reach a concentration in the predator that would be toxic. In the food web constructs, predators consume prey items that are smaller in size and mass. This is the basis for the hierarchy inherent in the classical ecological food web. This process requires consumption of adequate numbers (mass) of contaminated prey items to exceed the dose known to result in adverse effects or mortality. An example of a purposeful impact using the process in the food chain is the baiting of small mammals to reduce the numbers of large pest species (coyotes, ground squirrels, etc.). In these instances, very large quantities of the poison are introduced into the bait animal carcass where the quantity of chemical is known to cause mortality in the predator. To result in the bioaccumulation of chemical in an insect predator, the consumption of large numbers of contaminated insects would be needed to reach a level of sensitivity in the predator. Given the specificity of pesticide toxicity to the mosquito prey of potential predators (see Table 6-1 in Appendix B of the PEIR), it would not be a likely route of chemical transfer.

The approach used to address potential food web transfer (uptake) of chemicals and contaminated prey is the ecological risk assessment, which is a series of calculations that take into account the concentration of the exposure media, potential ingestion rates of the prey items and the predators, and the concentrations of the sources of exposure. The series of parameters used in the ecological risk assessment food web analysis require information about each of the species of interest, the contaminants (pesticides) of interest, and demographic information for each affected species (target and nontarget). Using these data an estimate of the likelihood and amount of transfer of contaminant can be estimated. As it is obvious that little if any bioaccumulation of chemical occurs in target insects, for example, the transfer to the predator would be minimal. If the target insects in this scenario are killed as planned, the miniscule amount of chemical on the insect could be ingested by the predator. However, to reach a toxicity threshold that would result in adverse impacts to a predator bird, very large numbers would be needed: for glyphosate, for example, 2,000 to 4,000 mg of chemical would be required. This range equates to approximately 800 to 1,600 fully saturated (with chemical) mosquitoes and since each mosquito is not “100 percent chemical”, this scenario suggests that secondary toxicity is not likely.

To address the possible food web implications of pesticide applications requires knowledge about the specific species of concern, the habitats being treated, and the concentrations of the pesticides as they are applied and on the vegetation and/or insects after application. This complex combination of parameters and the values associated with them are not usually available, so food web risk assessments are based on available demographic data, assumptions, and the numerous uncertainties associated with each. Hundreds of possible combinations of food web interactions exist but the concern about the impact of insect prey on predator populations can be illustrated by the figure in the insert above depicting a simple hypothetical web at the low trophic levels.

One other food web issue is the potential to remove substantial numbers of mosquitoes (as prey items) that are required for upper trophic level species. The figure insert roughly illustrates this issue in which the grasshopper holds the approximate terrestrial trophic position representing the terrestrial insect species and the krill represents an aquatic saltwater insect species. Although it does not directly represent the food web for insects, this figure provides a graphic representation of the hierarchy of the trophic levels in a food web. Some food web depictions include dozens of interactions in a complex series of connections. In the figure depiction of a food web relationship, it is clear that removal or substantial reduction in one trophic level of the web can impact the demographics of a higher, lower, or equal trophic species. Recovery of the species impacted is dependent primarily on the reproductive replacement potential, which is rapid for the insects. Discussion of the impact of removal of the target insect species by pesticides should acknowledge the recovery potential. In most scenarios, most impacts are temporary. However, since the purposeful removal of mosquito adults and larvae at a location is the objective of vector control, the possible impact to predators must be contrasted with the objective of maintaining the public health.

Several studies have been conducted that demonstrate the likelihood that some pesticide uses are not harmful to nontarget species while showing toxicity and efficacy for the target species. In a study to compare the relative sensitivity of a pesticide to target vs nontarget species, Lawler and Dritz (2013) suggest that spinosad is an effective treatment for insect larvae that, at appropriate doses, is safe to the predators and nontarget species. While this relative toxicity study focused on spinosad, it illustrates the selective toxicity that is similar for many pyrethroids. The results reported by these authors suggest that while the impact on the target mosquito larvae was appropriately effective, the potential impact on nontarget insect populations would be minimal to inconsequential, because the doses that are effective against mosquito larvae are below levels that would even marginally impact nontarget insect populations. Even with a possible minimal impact on some of the nontarget insects, the impact would not be sufficient to adversely impact them overall. The study conclusion further supports the PEIR’s conclusion that properly selected pesticide applications can be effective against target mosquitoes while not resulting in unacceptable adverse impacts to nontarget species. The low levels of pesticides used by the District, combined with the careful application restrictions embodied in the BMPs, results in the effective, yet environmentally compatible treatment for mosquitoes.

Moreover, inadvertent reduction of mosquito predators in a population as a result of pesticide applications conducted for vector control is a nontarget species issue only if a significant portion of the predator population is removed for an extended time. Any impact on some individuals in an insect predator population would be short lived, and population recovery would be rapid (Emlen et al. 2003). The number of insect predators impacted, when compared to the total population(s) of the predators, would be inconsequential in the long term. The relative impact on target insects versus the nontarget predators of a pesticide has been demonstrated in other studies as well. Davis et al. (2007) and Davis and Peterson (2008) evaluated the relation of target versus nontarget predators in tests using methoprene. Although these authors were evaluating methoprene, the demographics are similar as the lower toxicity to the predators would likely not have adverse species level or food web effects. Similar to the results of the studies by Davis et al. (2007) and Davis and Peterson (2008), adverse effects to a few of the individuals in a nontarget predator population as a result of typical glyphosate applications would be inconsequential.

Response 14

The comment is focused on methoprene and its toxicity but states that the Draft PEIR does not account for its potential bioaccumulation.

The concept implied in the comment that bioaccumulation always leads to toxicity is flawed. Not all pesticides bioaccumulate. Bioaccumulation is a phenomenon associated with numerous chemicals and pesticides based on extensive, long-term exposures of a product to several laboratory test species using measures of tissue concentration before and after exposures to the chemical. Additional work is often conducted in a field situation to increase the understanding of the role bioaccumulation plays in modifying the laboratory toxicity. These studies are usually conducted in the laboratory as a requirement for chemical registration, but the metabolism of methoprene in the environment reduces the amount of parent chemical available in soils (Schooley et al. 1975). Accumulation and the degree of bioaccumulation of methoprene can vary widely according to the characteristics of the exposure and the environmental conditions at the time of application.

It is correct to suggest that methoprene has been shown to be toxic to some aquatic species. It has been shown to be moderately toxic to some fish (rainbow trout); but in three studies on bluegill sunfish, the range of concentrations used in laboratory tests resulted in effects ranging from moderate to very high toxicity. It is moderately toxic to crustaceans such as shrimp, lobsters and crayfish, and freshwater invertebrates. However, these results occurred at much higher exposures of methoprene than would occur in field applications of methoprene for mosquito control. The potential adverse impact of methoprene to these aquatic species can be minimized or ameliorated by the prudent use of strict application guidelines combined with its characteristic degradation characteristics (degraded by sunlight and/or microorganisms) in the environment. Exposure of aquatic organisms will be limited by the low solubility (0.51 ppm) of methoprene in water and by its rapid degradation in aquatic environments; therefore, the impact is less than significant.

In a multiyear study conducted in wetlands, researchers found no long-term negative impact on nontarget insects apparent after 8 years of treatment, but effects were found in some years. In some years some chironomid groups were affected, but there was no detectible difference in total chironomid biomass due to treatment over 8 years in the treated versus nontreated wetlands (Hershey et al. 1997).

Water analyses in field and laboratory conditions and a comparison of reported Altosid (a methoprene product) use with reported frog deformities in Minnesota demonstrate that a connection between frog deformities and Altosid use is unlikely" (Henrick et al. 2002). These results indicate that factors other than s-methoprene and its degradation products are contributing to the recent outbreak of frog deformities (Henrick et al. 2002).

Although some of the characteristic metrics of toxicity might be of concern, the impact of methoprene in water at the diluted concentrations resulting from application for mosquito control make the potential adverse effects less likely to be of concern because the toxicity to aquatic animals occurs at levels in the parts per million range, rather than the parts per billion level that are found in likely realistic applications, including those that occur under the Program. The District's use of methoprene is not expected to result in exposures harmful to aquatic invertebrates because methoprene is short-lived in the aquatic environment, and it does not have a particularly high potential for bioaccumulation (EXTOXNET 1995).

Response 15

The conclusory comment that BMPs are inadequate and pesticide use impact discussions are inaccurate, and that significant impacts will result, is a summary statement by the commenter.

Preceding responses on the use of BMPs (Response 3) and on chemical use by the District provide clear and substantial evidence that the conclusions of less-than-significant impacts from the District's chemical control options are technically defensible and appropriate. Additional literature was reviewed in preparing these and other responses to comments, and some of this literature review is attached to this response to comments document as Attachment A (at the end of the responses). Furthermore, the author of the responses on pesticide use herein, both insecticides and herbicides, and the ecological and human health impact conclusions and related material in the Draft PEIR, is Bill A. Williams, PhD, a toxicologist with the educational and experiential background as an expert on pesticides and their use in aquatic and terrestrial environments.

A summary of Dr. Williams' qualifications to evaluate the scientific literature and to consider where and how the pesticides are being used specifically by the District for vector control in order to draw conclusions of impact significance to humans and to nontarget species are provided below. The highlights of his extensive experience presented are from Dr. Williams' technical resume, which is attached to the end of these responses to your comments (Attachment B). This resume has been reduced from his master resume in order to focus on the most relevant aspects of his career dealing with pesticides and risk assessments, excluding his accomplishments at NASA as a Program Scientist and Payload Scientist/Astronaut (1969-1986).

Dr. Williams has more than 30 years of experience and expertise in environmental risk assessment and toxicology, including Comprehensive Environmental Response, Compensation, and Liability Act, Natural Resource Damage Assessment, National Environmental Policy Act, and CEQA projects ranging from upland to sediment to freshwater/marine projects. Dr. Williams has been a member of numerous international, National Academy, and federal committees and workshops to define risk assessment guidelines, test procedures, field study approaches, and avian and mammalian test protocols, and to provide other technical assistance utilized by USEPA regulators. He helped develop USEPA's Framework for Ecological Risk Assessment and USEPA's risk assessment of 2,3,7,8 TCDD (tetrachlorodibenzo-p-dioxin or dioxin). He was a charter member of the Avian Dialogue Group, convened by the Conservation Foundation (RESOLVE) to bring industry, academia, and government regulators together to resolve conflicts between the groups. Dr. Williams has led and supported dozens of successful projects that were acceptable to the Washington Department of Ecology, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, United States Environmental Protection Agency, Regions 2, 9, 10, and numerous other USEPA regions nationwide. Dr. Williams has served on several Oregon Department of Environmental Quality advisory science committees and workshops. He has been a member of several national and regional USEPA Science Advisory Panels, including the National Science Advisory Panel on endocrine disruptors, uncertainty in risk assessments, and the panel on use of laboratory data in estimates of risk to wildlife.

Of particular relevance to his role on the CEQA documents for mosquito and vector control agencies is that Dr. Williams recently provided strategic and scientific support in the development of an Integrated Pest Management (IPM) system for use by the Mid-Peninsula Open Space District in the San Francisco Bay Area. The IPM is tailored to the vectors of concern, the pesticides and herbicides used by the District, and potential risk to the nontarget aquatic and terrestrial species. Pesticides incorporated into the IPM were based on evaluations of the use of more than 20 herbicides (with emphasis on use of glyphosate in regional wildland areas for control of over 60 invasive plant species), dozens of insecticides, structural and nuisance agricultural and urban pests, and selected regional wildlife pests. The IPM developed for the open space district included control of ants, cockroaches, wasps and flies, ticks, and mosquitoes. The IPM plan included recommendations for establishing and conducting pest identification, conducting damage assessments, and establishing tolerance levels and several tiers of proposed vector control that addressed top to bottom elements of implementation strategies.

Dr. Williams also provided scientific reviews and risk assessments addressing the potential adverse effects of CAL FIRE herbicide use to reduce the potential for and mitigation of wildfires in California. The Vegetation Treatment Program project included evaluation of potential adverse impacts of herbicides used in forestry and rangeland to control brush and grasses and for maintenance of areas that have been previously cleared of heavy vegetative fuels. The primary herbicides of concern in the evaluation were the numerous products containing glyphosate as the active ingredient.

Dr. Williams has participated in numerous workshops as a speaker or panel member on ecological risk assessment addressing such topics as uncertainty analysis in ecological risk assessments, ecotoxicological principles for avian field studies, population ecology and wildlife toxicology of agricultural pesticide use, and environmental effects assessment. He has published numerous peer-reviewed studies in scientific journals and presented abstracts in scientific meetings, including the following (of more than 9 book chapters, 55 peer reviewed studies, and more than 105 meeting presentation abstracts):

Williams, B.A., J.Q. Word, and W. Gardiner. 2007. Detecting the Presence and Effects of Pharmaceuticals and Personal Care Products in Water Samples. WEFTEC Annual Conference October 11-17 September, 2007. San Diego, CA.

Williams, B.A., J.Q. Word, and W. Gardiner. 2007. Reducing Effects of Endocrine Disrupting Compounds: Effluent Blending. Water Reuse Assoc. Conference July 29-30, 2007. Providence, RI.

Williams, B.A., L.J. Kennedy, J.A. Nedoff, and T. Fuji. 2005. Risk Assessment as a Tool for Emerging Contaminants and Water Quality Decisions. PNW AWWA Meeting, Portland, OR, 4-6 May 2005.

Bahe, A., B.A. Williams, L.J. Kennedy, and J.A. Nedoff. 2004. Do Residual Levels of Pharmaceuticals Contribute to Endocrine Disruption? 25th Annual Mtg. SETAC, Portland, OR, 14-18 November 2004.

Williams, B.A., L.J. Kennedy, and J.A. Nedoff. 2003. Uncertain About Uncertainty in Environmental Risk Assessment. NorCal SETAC, Berkeley, CA, 6-7 May 2003.

Kapustka, L.A., B.A. Williams, and A. Fairbrother. 1996. Evaluating Risk Predictions at Population and Community Levels in Pesticide Registration - Hypotheses To Be Tested. Environ. Toxicol. & Chem. 15(4): 427-431.

Williams, B.A., et al. 1994. Assessing Pesticide Impact in Birds. Final Report of the Avian Effects Dialogue Group (1988-1993). Resolve, Washington, DC.

Williams, B.A. et al. 1991. Assessing Pesticide Impact in Birds. Discussions of the Avian Effects Dialogue Group (1989-1991). Resolve, Washington, DC.

The substantial evidence contained in the Draft PEIR and in the Final PEIR compiled by Dr. Williams and the best professional judgment exercised by Dr. Williams in the context of this CEQA evaluation of vector control is defensible and sufficient.

Response 16

The comment is focused on potential impacts for California red-legged frog (CRLF) from permethrin and glyphosate, and the commenter cites USEPA determinations to make his case.

There are two parts to this comment on CRLF: use of permethrin and use of glyphosate. California has designated more than 1.7 million acres as critical habitat for CRLF. The District has a commitment to consider mosquito surveillance and control cautiously when operating within known CRLF critical habitat (as an effort to avoid impacts to special-status species) and to monitor and avoid/minimize chemical applications in areas that might impact them. The District participated in a 2-year water quality monitoring study (MVCAC 2013) and will continue to do visual monitoring for the SWRCB. (See Responses 3 and 26 on the MVCAC monitoring study.

The District's policy is to apply all pesticides according to label requirements. The reference to the publication by the USEPA on possible adverse impacts of permethrin to CRLF (although the citation as listed by the commenter is incorrect) addresses the possible direct and indirect effects of the permethrin categories of pesticides on CRLF. The report describes the possible ways that exposure to the chemical might impact the population of this species, but clearly describes the effects of direct spraying and contact within habitat areas. Similarly, the reference to the publication by the USEPA on possible adverse impacts of glyphosate to CRLF (although the citation as listed by the commenter is incorrect as well) was a similar evaluation of the possible direct and indirect effects of the glyphosate products on CRLF. The report describes the possible ways that exposure to the chemical might impact the population of this species, but clearly describes the effects of direct spraying and contact within habitat areas.

As stated above, it is with utmost emphasis that one of the objectives of the District's vector control applications is to use strict but feasible BMPs in CRLF habitat. In addition, the District will check the California Natural Diversity Database periodically in order to have a clear and documented evaluation of the range of the CRLF in all proposed application sites within San Mateo County. Using this conservative and careful approach to the District's permethrin and glyphosate applications, it is highly unlikely that such direct applications of permethrin or glyphosate exposure, as hypothesized in these two internal USEPA technical memos, would occur. Furthermore, the fact is that such direct applications are not relevant to District applications. See Response 3 on the District's potential use of glyphosate.

Permethrin

Although a potential exists for the applications of permethrin (or any other adulticide used by the District), in the vicinity of unlined storm drains or as a ULV fog over wetlands, to infringe on an area of CRLF habitat, the basic issue in all cases is not what the potential toxicity may be, given that most of those data are developed in studies that purposely provide extreme levels of exposure to the chemical of interest, but whether exposure and the resulting potential for toxicity is realistic under the conditions and timing of the proposed vector control application. Typical methods of testing for toxicity in the laboratory are most often not representative of the potential for exposure in the field, or thus of the potential for "real world" impacts. The USEPA designations of toxicity are based, for the most part, on the results of these highly unrealistic laboratory exposures and serve only as guidance for use patterns and labeling in order to address the safety measures needed to minimize chemical exposure to nontarget species such as the CRLF. Also, permethrin use would be limited to targeted treatment of adult insects (adulticiding), either mosquitoes or wasps/ticks. In these scenarios, the potential for the product to actually contact CRLF at levels high enough to result in adverse impacts would require inappropriately broad applications extending beyond the adulticide target locations. Most of the District's chemical treatments are to mosquito larvae and pupae using other highly targeted (rather than broad spectrum) products.

Any chemical can become toxic if the exposure (dose) is high enough to exceed the receptor's threshold sensitivity to that chemical. For many chemicals, the threshold to exhibit toxic effects is very high; for others, the threshold may be low. Since these characteristics are species and chemical specific, USEPA provides the relative toxicity data for thousands of chemical products. Tests with permethrin at high levels in the laboratory suggest that it can, at high doses, adversely affect the aquatic and terrestrial phases of the CRLF. However, the concern about this pesticide should be compared to the potential for exposure in actual field conditions. Habitat specifics and numerous confounding factors will alter any potential for adverse effects of chemical exposure to the CRLF. Although CRLF may move considerable distances from their breeding habitat, use of other areas would occur only if external factors prevent them from utilizing their preferred habitat.

Peer reviewed and published reports that suggest a link between permethrin applications and CRLF survival or impacts include confounding factors that cannot be ruled out as part of any observed effects (Kiesecker et al. 2001). Rather, the concerns for this endangered amphibian are linked to indirect relationships that are subject to numerous confounding factors (Kiesecker et al. 2001) that also may contribute to adverse effects to the species at early life stages (Johanssen et al. 2006). Clearly, water quality issues, prey availability, habitat alteration, and other environmental conditions provide a substantial number of other factors that may impact the CRLF populations (Adams et al. 2013). Amphibian populations are known to be adversely impacted by viral infections and parasites as illustrated by studies of amphibians in pristine, elevated regions far from the potential impact of these, or any other, chemicals.

The USFWS has identified and documented the following nonpesticide confounding factors that can adversely affect the CRLF. The following confounding factors in the interpretation of adverse impacts to CRLF are provided by the California Department of Fish and Game (2002):

> In Coastal lagoons, the most significant mortality factor in the pre hatching stage is water salinity.
  - 100 percent mortality occurs in eggs exposed to salinity levels greater than 4.5 parts per thousand.
  - Larvae die when exposed to salinities greater than 7.0 parts per thousand.

> Predation is an important factor. Bitterns (*Botaurus lentiginosus*) and Black Crowned Night Herons (*Nycticorax nycticorax*) are likely predators of adult frogs. Juvenile frogs, which are more active diurnally, and less wary than adults, may be more susceptible to predation by diurnal predators, such as the Great Blue Heron (*Ardea herodias*) and several species of garter snakes (*Thamnophis* sp.), including the endangered San Francisco Garter Snake (*Thamnophis sirtalis tetrataenia*).

These confounding factors that impact frog populations make establishing pesticide causality nearly impossible, especially at the potential exposure that could result from the District's use under the Program.

For a discussion of potential chemical effects on prey, see Response 13. When considered in light of the evidence and analysis in the PEIR, there is no substantial evidence that the occasional application of permethrin in accordance with label requirements and BMPs would have a substantial adverse effect on individual CRLFs or CRLF populations in general, either directly or as a result of changes to CRLF critical habitat.

Glyphosate

Some reports cited by the public suggest that the potential impact of glyphosate and glyphosate products includes adverse impacts to several life stages of amphibians and their habitats. These reports are not directly relevant to the potential impact of glyphosate on the CRLF in the environment as the data presented are based primarily on toxicity in laboratory studies using both high doses and several sequential lower doses in a laboratory setting. The toxicity of glyphosate to dozens of species is listed in Table 6-1 of Appendix B.

While the addition of some surfactants to glyphosate products may make the products more toxic to some biota, the primary concern for CRLF is toxicity based on studies using high, continuous exposures to the products in laboratory tests. The exposures in the laboratory studies are clearly not representative simulations of the potential exposures in field applications because the laboratory studies involve captive test species, unable to choose uncontaminated food or habitat. Many laboratory tests are designed and conducted to determine the 'worst-case" exposure to a chemical and then to lower the test concentrations slowly until a test concentration shows no adverse effect to the test animals (USEPA 2012a; Williams et al. 1994). In this way, the concentrations that produce exposures with little or no adverse response can be documented and used to define the applications that should be safe to the animals and environment. As in all of the relevant laboratory toxicity studies, the exposures in laboratory conditions are essentially 100 percent with no ability to choose areas or food items of lessor concentrations, and use of nonrepresentative, unrealistic exposures.

The primary causes identified by the USFWS as leading to an adverse impact on the status of the threatened CRLF are loss of habitat and overwhelming predation, invasive species, and competition for foraging items (National Wildlife Federation listings). The potential impact of glyphosate on the CRLF is marginal and only applicable in situations of excess exposure to incorrectly treated areas. The toxicity and adverse effects reported in laboratory studies would not be expected to occur as a result of the District's potential herbicide applications for mosquito or invasive species control in the field, because of the much lower potential exposures and the District's adherence to its BMPs. Special care is taken to avoid applications where CRLF have been identified and reported by resource agency personnel or District biologists and technicians based on observations and database investigations.

Reports on the effects of glyphosate to amphibians and other nontarget wildlife using mesocosms (outdoor studies in confined ponds) are intended to extend the results of the laboratory studies to more realistic environmental conditions by providing exposures in outdoor pond systems. However, even in these reports, the exposure parameters far exceed the possible exposure (dose) that would be received by amphibians in real environmental applications by the District that are far below these concentrations. An example of mesocosm studies, the report "The Lethal Impact of Roundup on Aquatic and Terrestrial Amphibians" by Rick A. Relyea published in *Ecological Applications* 15(4), 2005, pp. 1118–1124, provides "more realistic" exposures, but the potential effects to CRLF suggested by this author are neither appropriate to the CRLF habitats nor to the spatial and temporal exposures that would occur in the environment. The exposures used were based on direct overspray of the mesocosm units with concentrations greater than those used by the District. This approach is unrealistic if the author intended to extrapolate the results to reasonably foreseeable field exposures as conducted by the District with ULV techniques. The applications used in the Relyea report resulted in considerably more potential exposure (all spray applied directly to the surface of the ponds) to the test species than would be expected with typical District applications. In these mesocosm studies a series of artificial ponds is used to simulate field conditions. However, the direct spraying of the pond surface of the mesocosms is in sharp contrast to the targeted, hand applications that are typical of the more focused and directed herbicide applications the District uses than the broad area applications used in agricultural operations.

Concerning the potential future use of glyphosate products to do vegetation thinning and removal in aquatic habitats for mosquito breeding control, the products containing glyphosate that are designated for use in aquatic environments (reduction of unwanted aquatic vegetation) are specifically designed to reduce the potential adverse impacts to aquatic organisms. One of the most prevalently used glyphosate products for aquatic vegetation is Aquamaster®. USEPA has determined that the toxicity and exposure is sufficiently low that no significant risk of unreasonable adverse effects would occur to aquatic organisms under normal labeled use conditions (Monsanto 2005). Using the standard aquatic test organisms (USEPA 2016a), USEPA has designated the Aquamaster® products as "practically nontoxic" with most of the toxicity estimates in the ppm (mg/L) designation. Use of the glyphosate formulations designated for aquatic environments includes all of the standard precautionary guidance such as maximum wind velocity, temperature, humidity, and sensitive areas.

In response to the concerns about the potential impact of glyphosate and its product formulations on the CRLF, the USEPA developed a comprehensive risk assessment for all of the potential application scenarios that might encounter the CRLF or its habitat. Using the most conservative (high) applications and several typical (more realistic) application scenarios, the USEPA has reported that glyphosate "may affect" the CRLF if they are exposed at very high concentrations of glyphosate (and also its formulation ingredients, including surfactants). This determination is based on computer models that use assumptions of application rates from the highest known (generally industrial and some urban uses) to the rates likely more appropriate for District uses. The risk assessment produced by the USEPA was published in "Risks of glyphosate use to federally threatened California red-legged frog (*Rana aurora draytonii*)" in 2008. In this 180-page exercise, the potential effects of glyphosate were modeled and risk estimates generated for almost every conceivable exposure to the CRLF and its prey items and habitats. The results of this comprehensive computer study suggest that at high rates of application (well above the rates used by the District) some adverse impacts may be possible, but the overall conclusions about the potential risks suggest that the nominal rates used by the District are likely to result in minimal to no effects. For example, some of the conclusions provided in the report by the USEPA include the following:

> **Direct Effects:** When used for habitat modification (vegetation control) the acute and chronic Level of Concern (LOC) for freshwater invertebrates are not exceeded for glyphosate, its salts or formulations.

In addition, the analysis indicates that the probability of an individual effect and the percentage effect to the freshwater invertebrate population prey base would be very low.

> **Indirect Effects:** The acute and chronic LOCs for freshwater invertebrates are not exceeded for glyphosate, its salts or formulations. In addition, the analysis indicates that the probability of an individual effect and the percentage effect to the freshwater invertebrate population prey base would be very low, and the field monitoring data available are considerably lower than the modeled concentrations utilized in the risk assessment.

> **Terrestrial prey items, riparian habitat:** For terrestrial invertebrates, the upper bound Risk Quotients (RQs) for small insects exceed the LOC for listed terrestrial invertebrates for all uses and for nonlisted terrestrial invertebrates at very high (much higher than used by the District) application rates above about 8 lbs active ingredient (a.i.)/acre. In other words, the guidance and risk estimates are based on estimates of worst-case exposures that are well beyond the applications used by the District. However, at the lower upper bound USEPA derived RQ (<0.01 with 0.4 lb a.i./acre), the chance of an individual effect is less than 1 in 9×10^{18} (eighteen zeros) and about a chance of less than 1×10^{-17} (seventeen zeros) percentage effect to the terrestrial invertebrate prey base. These calculations by the USEPA support the contention that chances for an adverse impact are nearly zero.

> **All other uses** at application rates below about 4 lb a.i./acre have no effect designation: According to the USEPA risk assessment, this category applies to all crops, forestry and impervious surfaces at lower rates, rangeland, residential, rights of way at lower rates and turf.

All chemicals can cause adverse effects or even become toxic at levels exceeding the tolerance and sensitivity levels for that species. However, the sensitivity and tolerance levels are determined by the USEPA and other regulatory agencies using laboratory tests with numerous species of concern that are estimated to be potentially exposed to an application. The results of these tests on each chemical are published in numerous publically available USEPA documents summarizing the testing results with metrics such as the LD_{50}, LC_{50} and maximum estimated tolerance levels. For glyphosate, these metrics are indicated in detail in Appendix B (Section 4.6.2) of the PEIR and support the fact that District use levels are far below those that could result in an adverse impact.

While the referenced USEPA risk assessment for glyphosate provides some valuable information about the potential for adverse effects to CRLF, the conclusions include identification of the numerous areas where there are uncertainties (and the risk assessment uses large uncertainty or safety factors). However, it clearly indicates that the use of glyphosate and its formulations should be considered relatively safe to the CRLF if care is taken in the selection of areas for application, use of the recommended application rates, and prudent prior assessment of areas that may contain CRLF or its habitat.

The Safe Drinking Water and Toxic Enforcement Act (Proposition 65) was passed as a ballot initiative in 1986, requires the state to annually publish a list of chemicals known to the state to cause cancer or reproductive toxicity so that the public and workers are informed about exposures to potentially harmful compounds. Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHA) administers the act and evaluates additions of new substances to the list annually. However, Proposition 65 does not take into account the concept of exposure; therefore, it does not evaluate risk using the risk assessment process (see Section 6.1.3.2.3 in the revised Draft PEIR). Lack of defensible scientific methods used in the chemical listings in Proposition 65 can result in unworkable and overly conservative regulations. In fact, a recent federal court judgment overturned the labeling requirement for Roundup (glyphosate) in California based on the determination of inappropriate use of science assumptions (US District Judge William Shubb, Feb.26, 2018). Because of the inappropriate use of the scientific process, this proposition should not be used as justification to characterize the risk of glyphosate.

Response 17

The comment maintains that while vector control programs are exempt from the injunction, this is a separate issue from whether the Program is likely to have a significant impact on CRLF. Specifically, for applications of a pesticide for purposes of public health vector control under a program administered by a public entity, the injunction does not apply.

The injunction is part of the regulatory setting for the aquatic and terrestrial biology chapters of the PEIR. It should be included in the environmental setting because it shows that use of the chemicals of concern to CRLF may be reduced, which is important in addressing cumulative impacts. Some previous users of these materials may switch to other nonlisted pesticides rather than comply with the no-use buffer zones established under the injunction. For those other users that do comply, the buffer zone is an effective measure for minimizing the effect of the active ingredients on CRLF. The presence of the injunction does not require a determination of significant impact because the vector control applications must be considered in the context of their use. The listed pesticides do include permethrin; esfenvalerate, methoprene, and naled that are the only listed materials included in the District's IMVMP. The text on page 4-9 has been corrected as indicated below.

> Of the 66 pesticides listed in the original injunction, the District currently uses ~~may employ, esfenvalerate,~~ methoprene and permethrin, while~~and~~ naled and esfenvalerate are part of the Proposed Program for vector control. Esfenvalerate may be applied directly to yellow-jacket and wasp nests~~control~~ in response to public complaints in the future ~~and for tick control~~ if District surveillance indicated a public health risk. Methoprene is used for larval mosquito control, and permethrin is currently~~may be~~ used for ~~adult mosquito~~ yellow jacket control and may be used in the future for adult mosquito and tick control. N~~n~~aled is not currently used but may be used for adult mosquito control in the future. Best management practices related to CRLF are laid out in Tables 2-8 and 4-5 (BMPs E1-E8). However, as described above, ~~vector control programs are exempt from the stipulated injunction. Specifically,~~ for applications of a pesticide for purposes of public health vector control under a program administered by a public entity, the injunction does not apply. ~~The District may use the following herbicides listed in the injunction: oryzalin, DCPA (chlorthal dimethyl), glyphosate, imazapyr, diuron, and triclopyr. Where used for vegetation management for control of mosquito-breeding habitat, the injunction would not apply.~~

Esfenvalerate is a Type 2 pyrethroid that would be used by the District only for yellow jacket, wasp and ticks primarily in recreation areas frequented by people. Because these applications do not occur in habitat areas where CRLF may be significantly exposed, esfenvalerate use under the Program would not pose a risk to CRLF or other amphibians. More information about esfenvalerate is included in Appendix B, Section 4.1.6. Methoprene is a mosquito larvicide/insect growth regulator discussed in detail in Appendix B, Section 4.3.4 and in the PEIR Section 6.2.7.1.2 that is widely used by the District for mosquito control but used at rates that do not present a significant toxicity risk to aquatic species, including amphibians. See Response 16 above for permethrin and also Response 14 on methoprene.

Response 18

The commenter is concerned about pesticide runoff from vector control applications, through storm drains or otherwise, resulting in significant toxicity to CRLF.

To reduce potential pesticide contributions to urban and/or industrial drains and collector ponds/catch basins from vector control applications, the District follows an integrated pest management (IPM) approach that strives to minimize the use of pesticides and their impact on the environment while protecting public health. Storm drains become a mosquito-breeding problem when water is trapped and stagnates, not during the rainy season when the drains are flushed frequently. Also see the portions of Response 11 and Response 16 addressing storm drain management.

As discussed in Section 2.3 of the PEIR, the District employs IPM principles by first determining the species and abundance of mosquitoes/vectors through evaluation of public service requests and field surveys of immature and adult mosquito/vector populations and, then, if the populations exceed predetermined criteria, using the most efficient, effective, and environmentally sensitive means of control. For all mosquito species, public education is an important control strategy for minimizing or avoiding mosquito-breeding conditions on private property. In some situations, water management or other physical control activities can be instituted to reduce mosquito-breeding sites. In some cases, the District can also use biological control such as the planting of mosquitofish in ornamental fish ponds, water troughs, water gardens, fountains, and unused swimming pools. When these nonchemical approaches are not effective, or are otherwise deemed inappropriate, then pesticides are used to treat specific vector-producing or vector-harboring areas.

When pesticides are applied, the District implements label requirements and BMPs to reduce adverse effects to surface-water and groundwater resources during and following pesticide applications. For example, some pesticide labels restrict applications within 24 hours following rain events or in areas where intense or sustained rainfall is forecasted to occur within 24 hours following application. In such cases, the District would not apply pesticides until weather conditions are appropriate. Adulticides are never applied when it is raining because the mosquitoes are not as active and the droplets do not stay suspended, limiting the effectiveness of the product, in addition applications occur during warmer months when the region has little or no rain events. The adulticide is not applied directly to the water but in micron sized droplets above the water's surface, which minimizes the amount of active ingredient that actually reaches the water surface. See Draft PEIR Section 9.2.7.2 on this issue of adulticides and water quality. For the larvicide methoprene, which may be applied in liquid or granular forms directly to wetlands or aerially (from the ground) to reach larvae in the water, see Section 9.2.7.1.2 of the Draft PEIR.

The mobility and environmental fate of a particular pesticide is influenced by its chemical properties and by the environmental conditions in which it is applied, and these factors influence potential exposure in the field to nontarget organisms. The PEIR's Appendix B, Ecological and Human Health Assessment Report, provides a detailed description of the fate and transport in air, water, and soil for each of the active ingredients in products applied by the District (as well as some others not used by the District). Many second- and third-generation insecticides are formulated to act quickly and then dissipate quickly in the environment, often within hours or days. Others bind to soils and sediments where they are degraded abiotically or by soil organisms. These effects, the application methods used for vector control, and the potential for mobilization after pesticide application, are considered in the discussion of the Vegetation Management and Chemical Control Alternatives, which conclude that all of the active ingredients included in the Proposed Program would not significantly impact surface water or groundwater (see Sections 9.2.5 and 9.2.7 of the PEIR), or aquatic species (Sections 4.2.5 and 4.2.7 of the PEIR). For each of the pesticides used by the District there is minimal movement of pesticides in sediments or soils into water bodies due to the binding and half-life characteristics of the chemical used.

Response 19

The comment is that the California tiger salamander is not mentioned in the District's BMPs.

Based on a request from the USFWS in their Comment 6, BMPs for the California tiger salamander and western snowy plover have been added to existing BMPs in Table 2-8 and Table 4-5. The following is the revised text for the BMPs:

E. California Red-Legged Frog (CRLF), Western Snowy Plover (WSP), California Tiger Salamander (CTS), San Francisco Garter Snake (SFGS) and Steelhead – Central California Coast

1. District staff receive training on the identification, biology and preferred habitat of California red-legged frog, western snowy plover, California tiger salamander, San Francisco garter snake and steelhead - central California coast prior to accessing potential habitat for these species along with avoidance measures.
2. If suitable habitat is found in or adjacent to the nearby waterways for the California red-legged frog, California tiger salamander, western snowy plover, San Francisco garter snake, and steelhead - central California coast, the District shall conduct training prior to entering these areas and periodically throughout the season.
3. Prior to the initiation of vegetation maintenance, water manipulation, channel excavation, or vehicle operation, the project work site and adjacent area will be surveyed by a designated District biologist trained in identification and ecology of the threefive special-status species to ensure that none are present. This survey is not intended to be a protocol-level survey, but rather one designed to verify that no special-status species are actually on site or in the adjacent waterway. For CRLF, vegetation maintenance and water manipulation shall not occur from November through March to avoid their breeding season (egg laying and hatching). This work will be further delayed if tadpoles are present in the work area. Mosquitofish (*Gambusia affinis*) will not be introduced into any site containing CRLF or CTS. If channel excavation occurs on County Parks property, their staff will be consulted on the appropriate level of survey.
4. All on-site workers will attend an information session (tailboard) conducted by the designated onsite District biologist. This session shall cover identification of the five species and various life stages (such as CRLF tadpoles) and procedures to be followed if an individual is found on site or in the adjacent waterway.
5. All treatment areas will be inspected each morning by the designated onsite biological monitor to ensure that none of the five species are present. All construction activities that take place on the ground shall be performed in daylight hours. Construction materials, soil, construction debris, or other material shall be deposited only on areas where vegetation has been mowed and any snakes or frogs present would be readily visible.

The CTS has only been identified in one remote location of San Mateo County in an area for which mosquito control is extremely unlikely to occur; but in the event control was necessary in this particular location, all necessary BMPs would be employed.

Response 20

The comment notes that Marin Municipal Water District removed herbicides from its *Draft Wildfire Protection and Habitat Improvement Plan*.

Use of herbicides by any other water or land management district does not compare wholeheartedly to use of herbicides for vector control because the agency objectives are different (land management versus public health protection). So this comment is not entirely relevant to the District's PEIR except for noting that there is agreement that public controversy (that includes opposition by some individuals and organizations to any use of pesticides) exists within the District's Service Area and that vegetation management methods can include herbicides (or not). This controversy is why the District prepared a PEIR and why the document was organized to include two chapters not normally included in EIRs: Chapter 6, Ecological Health and Chapter 7, Human Health. Please refer to Response 22 below on the topic of the WHO classification of glyphosate and materials.

Response 21

The comment is concerned with the persistence of glyphosate in the environment.

The persistence of glyphosate is dependent on the physical/chemical conditions of the soils and vegetation treated, and the impact of the chemical on the rhizomes and the plant root system is not continual or at levels of contact that would result in the suggested toxicity to the root system. The paper by McNear (2013) is a good introductory compendium of the mechanism of action of possible toxicity when the roots of plants are treated directly. This report is an illustrative examination of the structure and sensitivity of typical root systems, but has no clear relation to the potential toxicity of chemicals such as glyphosate after a typical District application to target vegetation (McNear 2013). The results of studies on the root systems exposed after direct glyphosate application suggest that the complexity of a root system may be impacted by direct exposure (Barberis et al. 2013), but this is neither a typical nor likely exposure based on the District's potential uses of glyphosate products. The District would be directly applying the material to the above ground foliage of poison oak with little contact to the root system which would be needed to achieve the impacts reported by McNear (2013). A future consideration of the use of glyphosate might be to eliminate aquatic plants such as cattails or other common underwater vegetation that supports mosquito breeding. Elimination of that vegetation could increase flow, give native fish access to mosquito larvae and reduce the need for pesticide applications. The applications target the unwanted vegetation, not indiscriminate application over a large area. It would be the exception that the District would be involved in a large-scale application (e.g., dozens of acres). If the District were to be involved in an herbicide application, it would most likely be small scale and using hand equipment, truck, boat, or all-terrain vehicle (ATV)-based equipment. Regardless of this potential toxicity, there is no clear, direct association to toxicity to the root systems of unintended vegetation when glyphosate is applied for vector management according to District uses. Direct exposures in laboratory studies do not provide realistic exposures when a chemical is applied in the field (Williams et al. 1994).

For decades, scientists have demonstrated and validated that every organic chemical has a physical/chemical degradation characteristic termed "half-life" (a metric used to describe the elapsed time for a chemical to reach ½ of its initial activity). Each organic chemical, whether toxic or not, decays in both activity and toxicity over time. For some chemicals, the half-life can be hours, days, or weeks. By design, few chemicals used as pesticides[1] have half-lives greater than a week and are further degraded by the environmental conditions of the application area. When pesticides get into soil, or water, or are taken up by plants and animals, the half-life characteristics are altered. The environmental fate of pesticides depends on the physical and chemical properties of the pesticide, particularly the pH of the medium, modifying how likely it is to travel through soil (soil mobility), how well it dissolves in water (water solubility), and how likely it is to become airborne (volatility).

Once a pesticide has been released into the environment, it can be broken down by exposure to sunlight, (photolysis), exposure to water (hydrolysis), exposure to other chemicals (oxidation and reduction), microbial activity (bacteria, fungi, and other microorganisms), and other plants or animals (metabolism). Pesticide labels set out safety and use guidelines that usually focus on three aspects: rates of application (single and cumulative) for registered crops and pests, timing of application, and restrictions on areas of application (including required buffer zones).

The environmental fate of pesticides[1] used by the District are influenced by their chemical properties and by the environmental conditions at the time of application. The PEIR's Appendix B, Ecological and Human Health Assessment Report, provides a detailed description of the fate and transport in air, water, and soil for each of the active ingredients applied by the District and eight other vector control districts (and includes discussions about many of the other inert or active ingredients that may be encountered with use of some specific formulations of glyphosate based products). Although most of the additives are inert or nearly nontoxic, it is important to evaluate the additives when selection of a glyphosate product. The

[1] The term "pesticides" includes herbicides used for destroying weeds and other unwanted vegetation.

tables in Appendix B include many of these additives for informational purposes. A summary of the potential uses of glyphosate products by the District is included in Appendix B, Table 6-1 and the narrative in Section 4.6.2 of Appendix B. Many second-and third-generation pesticides are formulated to act quickly and then dissipate quickly in the environment, often through photolysis or microbial breakdown. Others bind to soils and sediments where they are degraded abiotically or by soil organisms. These effects, the potential for mobilization after pesticide application and the methods used to minimize exposures to unintended receptors, are considered in the discussion of the Vegetation Management and Chemical Control Alternatives (see Sections 9.2.5 and 9.2.7 of the PEIR).

There are numerous herbicide products (such as Roundup) using the active ingredient glyphosate as its primary constituent, but many of these products use inert and/or chemically different additives to enhance the spray characteristics, adhesion properties, and efficacy. Many of those products have been specially tested for toxicity and registered with the USEPA for specific vector control purposes, including vegetation control (National Park Service 2016). Although some of these mixture products have been associated with increased toxicity, numerous studies have demonstrated that the increase in toxicity may be due to a surfactant additive. In most instances, these special formulations of pesticide products are intended to reduce the potential for adverse effects or to specifically be used for aquatic environments (e.g., Accord, which has been shown to be safer to aquatic wildlife) (Brodman et al. 2010)).

Some reports suggest that exposure to glyphosate may be toxic at sublethal levels, negatively impacting the basic physiological systems of animals in several trophic levels. However, most studies directed specifically at these systems have resulted in equivocal results without clear causal effects. In one study on the effects of six concentrations of glyphosate on growth rate and aflatoxin B1 (AFB1), and production by Aspergillus section Flavi strains under different water activity (aW), the authors report that at high concentrations glyphosate significantly increased the growth of all Aspergillus section Flavi strains. Aflatoxin B1 production did not show noticeable differences among different pesticide concentrations assayed at all aW in both strains. This study has shown that these Aspergillus flavus and A. parasiticus strains are able to grow effectively and produce aflatoxins in high nutrient status media even at a large range of glyphosate concentrations under different water activity conditions thereby indicating no negative effect. (Barberis et al. 2013)

Glyphosate has been shown to have a half-life of a few days in some conditions to longer in some soils. The generally accepted, conservative, half-life for soils is reported to be approximately a month to 42 days, depending on the soil type, pH, and other characteristics of the soils. Vegetation residues of glyphosate have been measured in numerous studies, and it is typical that the measurable residue of glyphosate in target vegetation diminishes rapidly after incorporation into the plant tissue (Zhang et al. 2015). Glyphosate changes from the primary chemical to the lessor resulting product chemicals. The half-life denotes the time for the parent compound to decrease in detectable concentration by half the application concentration essentially halving the exposure concentration available. When applied to typical areas targeted for vegetation management, glyphosate is transformed to less toxic and different chemical constituents in normal soil within a few days, or even quicker when used for most general uses such as those by the District. It can be rapidly bound to soil particles and inactivated, and the unbound glyphosate can be degraded by bacteria.

Response 22

Comment 22 asserts the Draft PEIR of “downplays glyphosate’s risks to human health.”

The PEIR preparers (including Dr. Williams) evaluated dozens of studies on glyphosate, the World Health Organization (WHO) report, and scientific reviews of the WHO report in determining that potential use by the District poses a less-than-significant impact on human health. The WHO report is the result of a “panel discussion” (by the International Agency for Research on Cancer [IARC]) that routinely reviews information about the potential for selected chemicals and products to impact human health and the environment. The chemicals and products selected for these reviews usually hat have achieved some level of public interest and concern but which concern may or may not be supported by the data and information available. The panel is comprised of several European scientists, political representatives, and environmental nongovernmental organizations (NGOs) engaging in environmental advocacy. These, and other organizations reporting to the WHO (a scientifically conservative advocacy agency) are generally self-appointed and eventually sponsored by the UN. This group is known to generally follow the “precautionary principle” in any determinations of potential impact of chemicals. The precautionary principle is a concept generally rejected by the scientific community that demands that unless one can prove there is or can be no adverse impacts of a substance, the substance should be considered hazardous (objective of the Precautionary Principle). Stipulating adherence to the use of the Precautionary Principle is a common approach used by the public and some media to suggest that even without negative information about real hazard, the chemical in question should be banned. To those with scientific training, this suggests that one must “prove a negative” which is essentially impossible in any statistical sense of a defensible scientific process. In fact, the Precautionary Principle is a tenant of the WHO organizations and the IARC when making declarations about the hazards of chemicals in review.

The IARC has been criticized by dozens of technical experts who evaluated the process used by the panel to list glyphosate as a probable carcinogen. It has been demonstrated that IARC rejected the 800 studies / 3,000 documents that gave glyphosate a positive safety result, basing their decision of “probably carcinogenic” on only eight studies, of which three actually included results that were themselves arguably insignificant. After the WHO publication listing of glyphosate as a probable carcinogen, dozens of practicing scientists in the mainstream scientific community (including European Food Safety Administration, the German Federal Institute for Risk Assessment and the lead author of one of the studies used by IARC to draw its conclusions) have criticized and disputed the report by the IARC for using a poor methodology and inadequate research. The conclusions drawn by the IARC about the potential adverse effects of glyphosate were based on studies that are not relevant to actual, potential exposures and on studies that were based on unrealistically high exposures to petri dish cells and in vitro laboratory conditions. Once again, the precautionary principle requires “proof of a negative” which requires that the studies disprove any possible negative effect in a universe of possible outcomes in order to accept the results of a study.

In most of its reported reviews, the UN IARC has advocated the precautionary principle (WHO 2015). This process clearly played a significant role in the declaration regarding glyphosate. As an illustration of some of the other recent unsubstantiated proclamations by the UN IARC, this panel declared that bacon and other animal products are “possibly carcinogenic”, and recently declared that hot coffee was possibly a carcinogen (WHO 2016), only to rescind their first proclamation to say it is the hot water that is the potential carcinogen. Once again, these unsubstantiated proclamations have been challenged by credible scientists and likewise, the declaration about glyphosate has been challenged by numerous reputable, practicing scientists who reiterated that there was no credible research evaluated in the proclamation that was clear enough or statistically valid to make such a claim (WHO 2015; Mink et al. 2012).

Glyphosate exposure was not associated with cancer incidence overall or with most of the cancer subtypes studied by de Roos et al. (2005). Given the widespread use of glyphosate, and the paucity of information providing significant and relevant causality amid the nonscientific claims that glyphosate exhibits numerous low-level or sublethal adverse effects (Seneff nd), Dr. Williams concluded that there have been no demonstrated significant adverse health effects (even in pesticide applicators) where proper use and appropriate application concentrations were followed. The studies reporting potential human health effects are associated with extreme exposures to applicators during misuse scenarios and spills and/or working in the preparation of the commercial products (Mink et al. 2012). These conditions and potential exposure conditions are neither typical nor likely in the use and applications by trained District staff. All application directions include detailed procedures to deal with a spill, and the District has pesticide spill handling procedures described in PEIR Sections 8.1.1, 8.2.5.1.2, and 8.2.7.1.2. Glyphosate remains a reliable and safe product for use in the numerous situations where control of vegetation is needed for habitat management (for vector control, small-scale poison oak control or for targeted invasive species control). Importantly, it has been demonstrated that herbicides are a different class of chemicals than those classified as insecticides that have specific, demonstrated autonomic effects. The media reports about the hazards of glyphosate and its several commercial products have not been clearly associated with human health. The numerous reports about “possible” connections to metabolic processes and subtle effects also include confounding factors that make scientifically defensible claims impossible. Where there are reports of adverse subtle effects, they are usually based on laboratory studies of cell lines etc., at exposures far above any possible actual human exposure.

USEPA continually reviews the available scientific data and other relevant information in support of the registration of glyphosate (i.e., commercial product Roundup for weed control) and has indicated that there are sufficient data to assess the hazards of and to make a determination on aggregate exposure for glyphosate including exposure resulting from the tolerances established by continued USEPA evaluations. USEPA’s assessment of exposures and risks associated with glyphosate are clearly indicated in the numerous studies used to develop the guidance for use. Using these data, the USEPA has set maximum safe exposure levels for both humans and animals (tolerances) of pesticide residues for crops based on the huge number of scientific studies and complex risk assessment approaches provided in support of the active ingredient in the products. These tolerances are hundreds of times higher than estimated toxic values using total exposure values to pesticides (including safety levels to protect children and others who may be vulnerable). The US Department of Agriculture tests crops each year to make sure tolerance levels are not exceeded. Very few pesticides are found above the tolerance levels (despite some unsubstantiated media reports). The exposures that were used in the WHO evaluation and some studies were not reasonable examples of the exposures that might be encountered by humans, especially those who might be potentially exposed as a result of the District’s use of very low levels of glyphosate under the Program (USEPA 1993; National Pesticide Information Center, Oregon State University 2011). There are occasionally media reports of studies linking glyphosate to cancers of various types, but these are generally results from cultured cells in the laboratory. Extrapolation of these very high dose laboratory studies to animals and humans are not reliable indicators of potential adverse effects outside a controlled laboratory study (Williams et al. 1994).

The Safe Drinking Water and Toxic Enforcement Act (Proposition 65) was passed as a ballot initiative in 1986, requires the state to annually publish a list of chemicals known to the state to cause cancer or reproductive toxicity so that the public and workers are informed about exposures to potentially harmful compounds. Cal/EPA’s Office of Environmental Health Hazard Assessment (OEHHA) administers the act and evaluates additions of new substances to the list annually. However, Proposition 65 does not take into account the concept of exposure; therefore, it does not evaluate risk using the risk assessment process (see Section 7.1.4.2.3 in the revised Draft PEIR). Lack of defensible scientific methods used in the chemical listings in Proposition 65 can result in unworkable and overly conservative regulations. In fact, a recent federal court judgment overturned the labeling requirement for Roundup (glyphosate) in California based on the determination of inappropriate use of science assumptions (US District Judge William Shubb, Feb.26, 2018). Because of the inappropriate use of the scientific process, this proposition should not be used as justification to characterize the risk of glyphosate.

Response 23

The comment calls for the District to address the use of pyrethroids and pyrethroid-like compounds on human health, in particular a correlation between aerial applications of pyrethroid insecticides and increased diagnosis of autism spectrum disorder (ASD) and developmental delay (DD).

Aerial applications may be the only reliable means of obtaining effective control in areas bordered by extensive mosquito production sites or with a small, narrow, or inaccessible network of roads. Aerial adulticiding is often the only means available to cover a very large area quickly in case of severe mosquito outbreaks or vector-borne disease epidemics. The District has not needed to do any aerial adulticiding and would only do so in the future in the case of an extensive outbreak of disease in an area larger than what could be covered by trucks in a few of days.

The comments address two studies suggesting that pyrethroids can cause the onset of attention deficit disorder (ADD) when pregnant women are in regions near agricultural (CHARGE report included as Exhibit 1) or vector control (Hicks et al. 2016 included as Exhibit 2) applications of the pyrethroid pesticides. There have been literally hundreds of publications and reports suggesting that autism is associated with exposure to a wide variety of sources including pesticides, household products, chemicals in plastic bottles, viruses, etc. While there is no definitive source, but most peer-reviewed reports also indicate a likely link to genetic sources that either directly or indirectly (possible genetic sensitivity) increase the likelihood that the onset of ASD or DD (Frietag 2007). While some reports of these disorders have been associated with nearby agricultural pyrethroid applications, these relationships cannot be directly linked to an exposure solely to pyrethroids, and there are no actual data to indicate that there was actual exposure in these reported examples. Other reports contend that the onset of these disorders likely has numerous causes (Lyall et al. 2014).

The CHARGE study (Exhibit 1) provides comparisons of reports of onset of DD and ASD and the California pesticide use reports data and agricultural pesticide applications in proximity to residential areas. The comparisons are based on the potential relationship of two distinct, but not similar data sets. The California pesticide reports are culminations of the total pounds of active ingredient for each pesticide, fungicide, and other chemicals applied to agricultural lands (and other areas) by all pesticide applicators. This linkage is based on expected or estimated proximity to the actual applications in selected distances from the fields sprayed. Comparisons to DD and ASD onset during each gestational trimester is provided using demographic comparisons. The objective of the study reported was to determine the potential link of the onset of these disorders to the agricultural application of organophosphates, organochlorines, pyrethroids, and carbamates reported as collective pounds applied (pounds applied cannot be directly associated with human exposures). These applications are not relevant to the operations of the District in its vector control programs. In fact, agricultural applications are largely dissimilar to the application techniques and amounts used by the District. Agricultural applications are primarily land-based and sometimes applied aerially where the residues persist on the ground, while mosquito applications are primarily water-based for larvae and then air-based using ULV methods (that facilitate rapid break down) for adults.

The authors of both studies contend specifically that the use of aerial and/or ground-based applications of the pesticides may be correlated to the onset of these disorders, while they report no other potential influences that are clear confounding factors in the studies. There is no discussion or correlation to the relationship to nonaerial or nonagricultural, standard application techniques such as spreading granules or using hoses with controlled droplet application, especially by commercial applicators.

The study methodology in both of these reports is based on use of retrograde demographic reports of DD and ASD from test and control areas and using statistical comparisons to parse out the possible relation of pesticide applications to the reported onset data of DD and ASD. The authors provide comparisons to the possible linkages, but there is no discussion of the numerous other environmental and exposure factors that could contribute to the results. For instance, there is no indication that several potential (according to the decades of research) factors such as lead in the drinking water, local sources of contamination, activities in the community, etc., could be sources of the effects. Hence, the timing and actual exposures cannot be determined in either study.

A detailed response on the CHARGE report is included herein as Response 38 which includes a better, more applicable study using risk techniques. A detailed response on the Hicks et al abstract is included herein as Response 39.

Response 24

This comment suggests that the District application of pyrethroid and pyrethroid-like compounds and herbicides will expose young children to these products after fogging and targeted vegetation management.

As has been discussed and substantiated throughout the PEIR and the Appendix B, application of a product cannot be directly associated with exposure in most instances. The assumption that young children will be adversely affected by such applications is flawed in that the District does not and will not likely apply pyrethroid (or generally any other) pesticides broadly to areas specifically designated for play by children. It is neither appropriate nor likely that such applications to playgrounds or sports fields will be considered or, excluding rodenticides, in nearby sites where children may play, or in residential areas, unless specific public health concerns warrant such actions. An exception would be the use of a pyrethroid for control of ground-nesting yellow jacket wasps in areas (such as parks and back yards) where children would be at risk of attack from these aggressive stinging insects. The pyrethroid material would be targeted to the nest, not broadly applied to the ground surface.

If adult mosquitoes are invading residential areas in close proximity to mosquito breeding sites, the District's IVM principles would require using nonchemical methods first to control the breeding population, followed by the use of larvicides. ULV fogging or aerial applications to control adult mosquitoes are infrequent and done to protect public health and only occur after all other methods of mosquito control have occurred. Aerial adulticiding is often the only means available to cover a very large area quickly in case of severe mosquito outbreaks or vector-borne disease epidemics. The District has not needed to do any aerial adulticiding to date, and would only do so in the case of an extensive outbreak of disease in an area larger than what could be covered by trucks in a few days. Products used in or adjacent to residential and intensive recreational areas are those that break down quickly due to exposure to air, light, and soil microorganisms. See Response 26 below on a monitoring study explaining how adulticides are not impacting surface water. Since the spray/fog applications of pyrethroids over surface water cannot be detected in the surface water (with only a few exceptions), then the ground surface would be similarly unaffected. The active ingredients currently used for control of adult mosquitoes have been deliberately selected for lack of persistence and minimal effects on nontarget organisms when applied in accordance with label guidelines for ULV mosquito control. The assumption that children would be exposed under the conditions indicated (i.e., product binding to organic matter and sand/soils) is not applicable to the ULV and targeted application techniques utilized by the District such that the concern is overstated. Herbicide applications would only be made to the leaves of large stands of poison oak or the leaves of cattails and other aquatic plants. This combination of ULV applications of pyrethroids over water and wetlands and direct application of the herbicide to foliage of the target vegetation would prevent contact with soil, sand, tanbark, or water therefore eliminating any direct exposure to children.

Response 25

The commenter is concerned with the use of any chemicals that could be endocrine disruptors and pose significant harm to humans or wildlife.

The USEPA has expressed concern in the last decade about the possibility that exposure to some chemicals, including pesticides, may contribute to a disruption of the endocrine system of some animals'. In response to the concern about possible endocrine disruption, the USEPA has indicated (USEPA 2006, 2009b, 2014, 2015) that because the mechanism for this phenomenon is not well understood and has been seen in many different species, it is clear that literally hundreds of chemicals may play a role in this phenomenon to some degree. Although this phenomenon has been the focus of numerous media reports, realistic exposures needed to elicit these responses (generally substantially higher than any realistic exposures) are generally not included in media reports. In an attempt to identify and categorize those chemicals that may play a role in endocrine disruption, the USEPA has convened numerous government panels (and PEIR preparer Dr. Williams was a member of some of those panels) to provide guidance and recommendations about how to screen and isolate chemicals that should be critically evaluated for properties that contribute to or cause disruption of the endocrine system. At the current time, the resulting evaluations suggest that many (literally most) chemicals may be associated with some level of endocrine interaction when and if the actual dose is sufficiently high (usually hundreds of times greater that possible exposures) and the animal is exposed long enough. These conclusions have been based primarily on laboratory exposures to surrogate animals that are purposely very high so that any possible impact might be observed (Diamanti-Kandarakis et al. 2009). These clear “worst-case” laboratory studies have generally provided equivocal results and have not resulted in any scientifically useful determination of how and in what circumstances endocrine disruption occurs in the real world (Nohynek et al. 2013). This phenomenon continues to be a subject of concern by the USEPA and other agencies, but current understanding of the linkages to specific chemicals is limited to a handful of examples and even USEPA (2017) declares that, “*Such effects (reports suggesting a link between possible endocrine disruption to some sublethal effects) may have an endocrine-related basis, which has led to* ***speculation*** *about the possibility that these endocrine effects* ***may have*** *environmental causes. However, considerable scientific uncertainty remains regarding the actual causes of such effects”.* Given the extremely limited potential for any major exposure to humans and wildlife from the chemicals proposed for vector control and habitat management, the potential for actual harm in the real world is practically nonexistent. The revised Draft PEIR has been updated to include published Weight of Evidence evaluations on potential endocrine disruptors, where appropriate (Sections 6.2.5.1.1 and 7.2.5.1 and elsewhere)

Response 26

This comment suggests that chemicals, including those that bind to soils and exhibit subsequent mobilization and those that run off from urban storm drains and gutters after vector control applications, and would cause total maximum daily load (TMDL) exceedances for some Pesticide-Related Toxicity in Urban Creeks.

The Basin Plan (SFBRWQCB 2015) establishes a water quality attainment strategy and TMDL for some pesticides and pesticide-related toxicity in the San Francisco Bay Region’s urban creeks, including actions and monitoring necessary to implement the strategy. The TMDL notes that pesticides “enter urban creeks through urban runoff. Most urban runoff flows through storm drains owned and operated by the Region’s municipalities, industrial dischargers, large institutions (e.g., campuses), construction dischargers, and the California Department of Transportation (Caltrans).” The TMDL further notes that “pesticide use by structural pest control professionals and use of products sold over the-counter can be among the greatest contributors of pesticides in urban runoff.” Rather than establish mass loads for pesticide contributions, the TMDL establishes concentration-based numeric targets, expressed in concentration units, and states that “the numeric targets, allocations, and implementation plan described [in the TMDL] are intended to ensure that urban creeks meet applicable water quality standards established to protect and support beneficial uses.” The TMDL’s pesticide toxicity targets are expressed in terms of acute toxic units (TUa) and chronic toxic units (TUc) and require demonstration of a statistically significant observable effect. An undiluted ambient water or sediment sample that does not exhibit an acute or chronic toxic effect that is significantly different from control samples on a statistical basis shall be assumed to meet the relevant target. The TMDL implementation plan relies heavily on actions by the agencies with the broadest authorities to oversee pesticide use and pesticide discharges, including the USEPA, CDPR, and SWRCB as well as adherence to integrated pest management (IPM) strategies. The TMDL notes that “regulatory and nonregulatory actions are needed to ensure that pesticide use does not result in discharges that cause or contribute to toxicity in urban creeks. Implementing these actions is expected to ensure attainment of the allocations. Many entities are already implementing these actions.” The actions identified in the TMDL focus primarily on addressing water quality concerns through the pesticide registration process (through which label requirements are developed), and reducing the use of pesticides, including the potential for urban runoff to enter creeks, through integrated pest management. In particular, to prevent pesticide-related toxicity in urban creeks the TMDL states that mosquito and vector control agencies should “adopt IPM and less toxic pest control techniques so pesticide applications do not contribute to pesticide runoff and toxicity in urban creeks.”

The District’s Program is based on the principles of IPM and prioritizes nonchemical control over pesticide use. Furthermore, all District applications of chemicals are done in strict compliance with label requirements, BMPs (many of which have been developed in consultation with regulatory agencies) and applicable permit conditions (such as those contained in the Statewide NPDES Vector Control Permit (SWRCB 2011), by trained professionals. Thus, the District’s existing and Proposed Programs implement the actions specified in the TMDL to ensure attainment of the TMDL’s pesticide allocations. (Note that the District does not use pesticide products containing diazinon.) The District has, for over the past two decades, taken an integrated systems approach to mosquito and vector control, utilizing a suite of tools that consists of public education, surveillance, source reduction (e.g., physical control, vegetation management, water management), biological controls, and chemical controls. As stated in PEIR Section 2.3, three core tenets are essential to the success of a sound Integrated Mosquito and Vector Management Program (IMVMP).

> **First**, a proactive approach is necessary to minimize impacts and maximize successful vector management. Elements such as thorough surveillance and a strong public education program make all the difference in reducing potential human vector interactions.

> **Second**, long-term environmentally based solutions (e.g., water management, reduction of harborage and food resources, exclusion, and enhancement of predators and parasites) are optimal as they reduce the potential pesticide load in the environment as well as other potential long- and short-term impacts.

> **Lastly**, utilizing the full array of options and tools (public education, surveillance, physical control, biological control, and when necessary chemical control) in an informed and coordinated approach supports the overall goal of an environmentally sensitive vector management program.

To reduce potential pesticide contributions to urban and/or industrial drains and collector ponds/catch basins from vector control applications, the District follows the IPM approach and strives to minimize the use of pesticides and their impact on the environment while protecting public health. As stated in Response 18 above, unless specific vector control is required, based on surveillance results, to reduce adult mosquito populations, District applications of adulticides are not directed to urban storm drain systems. However, larvicides, per the product labels, may be applied to urban storm drains systems to control larval mosquitoes. Chemicals introduced to urban storm drains from runoff are usually the result of city, homeowner, or landscaper discharges within or near populated areas. In addition, buffers may be used between pesticide and herbicide use areas to address the potential migration of a pesticide and waterbodies. The product label may include specific, region or state specific buffers where they are required. The District adheres to all label requirements for its specific uses.

Further support for the PEIR conclusions of less-than-significant impacts to water quality from adulticides and larvicides applied by the District, is provided in a 2-year monitoring study conducted for the SWRCB by the MVCAC monitoring coalition to determine whether vector control activities were contributing contaminants to state waters. The MVCAC monitoring coalition conducted chemical monitoring for adulticides at 61 locations during 19 application events in 2011 to 2012 and coordinated physical monitoring for 136 larvicide application events in 2012. Samples were collected from agricultural, urban, and wetland environmental settings in both northern and southern California. Adulticides evaluated included pyrethrin, permethrin, sumithrin, prallethrin, etofenprox, naled, malathion, and the synergist piperonyl butoxide. The monitoring study (MVCAC 2013) was conducted in accordance with the Statewide NPDES Vector Control Permit (SWRCB 2011) and had the following results:

> 1 out of 136 visual observations showed a difference between background and post-event samples;

> 108 physical monitoring samples showed no difference between background and post-event samples; and

> 6 out of 112 samples exceeded the receiving water monitoring limitation or triggers.

The report concluded that there was no significant impact to receiving waters due to application of vector control pesticides in accordance with approved application rates. This is consistent with the primary mandate for vector control districts of protecting public health by reducing vector-borne diseases from mosquitoes and other vectors.

The SWRCB evaluated the results of this study (MVCAC 2013) and a concurrent toxicity study conducted by researchers from University of California Davis (Phillips et al. 2013) and concluded that, based on the monitoring data, the application of pesticides in accordance with approved application rates does not impact beneficial uses of receiving waters (SWRCB 2014). Therefore, the monitoring and reporting program for the Vector Control Permit was amended in March 2014 to limit the required monitoring to visual observations, monitoring and reporting of pesticide application rates, and reporting of noncompliant applications. These studies provide substantial evidence that the District properly concluded that the potential impact of District use of larvicides and adulticides would not hinder achievement of the TMDL targets or otherwise substantially degrade water quality.

Concerning pesticide quantities, the District monitors its pesticide application rates, records this information on pesticide application logs, and reports its product use to the San Mateo County Agricultural Commissioner. The District also reports its pesticide use and application rates to the SWRCB. The PEIR reports on pesticide use quantities in Chapter 13 (Table 13-2) based on these submittals and in Appendix B, Attachment A.

Concerning concentration, BMP H3 states: "Materials will be applied at the lowest effective concentration for a specific set of vectors and environmental conditions. Application rates will never exceed the maximum label application rate. <u>Truck, hand larviciding and fogging equipment will be calibrated and inspected semiannually.</u>" (p. 2-89)

Response 27

This air quality comment questions the mitigation measures as being voluntary and not mandatory. The language excerpt is not quite accurate. This response will clarify the PEIR language and make appropriate text changes to page 10-27 (original Draft PEIR) and elsewhere.

First of all, the objectionable odors impact statement characterizes the impact as **potentially significant but mitigable**, while the comment incorrectly quotes the statement as just being *potentially significant*. This significance determination terminology is explained in Section 1.6 (pages 1-22 and 1-23).

Second, the comment mischaracterizes the mitigation requirements established in the PEIR. On page 10-28, the PEIR states: "To mitigate Impact AQ-25, the District and its contractors may implement any of the following measures as applicable to the specific application situation to reduce drift towards human populations/residences from the ground and aerial application of odorous treatment compounds." This statement is followed by a description of Mitigation Measures AQ-25a, AQ-25b, and AQ-25c and the conclusion that "Use of any one of these measures would reduce the impact to **less than significant.**" Therefore, implementing all of these mitigation measures is not mandatory, nor are they all required in a specific application situation in order to reduce the significant impact associated with objectionable odors to less than significant. Implementing any one of the measures would, however, be mandatory. There are 3 options to allow for what is most prudent to use for the specific application. The use of the phrase "may implement" refers to the ability of the District to choose the appropriate measure; it was not meant to imply that the District may choose to implement none of the measures, just any one of the measures is sufficient as a minimum. To be clear on the point, the words "may implement" and "any of" will be changed to "shall implement one or more of the following measures as applicable" to avoid the implication that the measures are all voluntary. At least one of the measures is required. The following text change on page 10-28 will be carried into Section 10.2.11 (page 10-37) and Summary Table S-2 (page S-19) of the revised Draft PEIR.

> "To mitigate Impact AQ-25, the District and its contractors ~~may~~ shall implement ~~any~~ one or more of the following measures as applicable to the specific application situation to reduce drift towards human populations/residences from the ground and aerial applications of any of the odorous treatment compounds:"

The mitigation measures are not vague or voluntary, nor are they unenforceable. Each measure includes a description of the procedures to be followed in order to minimize the potential for drift into populated areas, location where the mitigation measure would be implemented, monitoring/reporting action to ensure the measure is implemented appropriately, criteria to assess the effectiveness of the mitigation measure, agency responsible for implementing the measure, and timing of its implementation. Thus, sufficient detail is provided to ensure that the mitigation is applied in the appropriate location at the appropriate time and by the appropriate entity; and measures also are included to document the effectiveness of the mitigation. By providing defined measures to limit the time, location, method and drift of chemical applications, the mitigation is sufficient to support the PEIR's determination that the Program's use of chemicals, as mitigated, would not create objectionable odors affecting a substantial number of people.

To put the air quality objectionable odors situation in context, the following clarification from the District is provided in 2015, the District conducted 3 large-scale ULV fogging applications in response to presence of mosquitoes carrying WNV. These applications totaled approximately 2,153 acres of the 476,160 acres that exist in San Mateo County. Land uses in the application area included residential, light industrial, and recreational (city parks). The active ingredient covering those applications was approximately 216 ounces for all 3 treatments which would equate to 1 ounce of active ingredient per every 2,204 acres of San Mateo County. This small volume of material over such a large area minimizes the potential for people to come into contact with the product during these large-scale events.

The commenter suggests that the "Draft PEIR could also require notification to residences"; however, this would not specifically mitigate the impact. District staff are available to address complaints by the public, and the effectiveness criteria for each of the measures include "Document odor complaints from the public." The public calls the District to complain about mosquitoes and other vectors, so if there were an odor problem at the time a District truck was in the area, then based on the District's experience, concerned residents would be likely to call the District if there was an odor problem not easily identified as a sewer, gas leak, or farm-related odor. Therefore, the mitigation measures are written appropriately; and no modifications are required. The District's BMP H13 already provides for 24-48 hours advance notice for large-scale treatments that could occur in close proximity to human activities.

Response 28

The comment asserts that the "conflation of BMPs and mitigation measures makes it impossible … to understand the severity of the Program's cumulative impacts and subsequently, the potential for and effectiveness of any mitigation measures."

Please refer to Response 3 above. In short, the BMPs are an integral part of the District's current Program, are to be continued into the future, and are properly treated as part of the Proposed Program being evaluated in the PEIR. To not consider them means the PEIR would overstate the impacts and be inappropriately speculative because there is no evidence that the District wants to abandon these procedures or that the responsible agencies who grant the District permits would want the District to abandon these practices in future permits, although some may be modified to respond to changing conditions. The cumulative impact analysis provided in the Draft PEIR is a thoughtful analysis of existing and future activities under the Draft IMVMP Plan in Chapter 13 of regional environmental concerns and whether any of the Proposed Program's less-than-significant impacts are cumulatively considerable/significant in the larger area context appropriate for a programmatic EIR. The discussion in Chapter 13 has been updated and expanded in the revised Draft PEIR.

Response 29

The comment that the discussion of cumulative impacts on pollinators is flawed because it contains "factually incorrect information on Colony Collapse Disorder (CCD)" is addressed first in the response below, followed by a discussion of the larger comment on coverage of pollinator impacts.

As an initial matter, the comment does not identify any specific factual assertions that it claims are incorrect, thus a specific response to the argument that the PEIR contains factually incorrect information on CCD cannot be provided. Although the District does not use neonicotinoid products, a discussion of the potential contribution of these products to cumulative impacts on pollinators, including possible CCD, was included in the PEIR because it is relevant to the understanding of possible sources of impacts to bees. It is important to emphasize that many of the "reports" about the causes of CCD are associated with uses of neonicotinoids but have no bearing on District vector control using chemical control. As indicated above, the District does not use neonicotinoid products; thus, to the extent CCD is an actual impact caused by neonicotinoids, the District's Program does not contribute to this impact.

In fact, many of the concerns about CCD are due to exaggerated and inaccurate representations in the media based on scientifically unconfirmed observations and reports of CCD in Europe and the US (Hopwood et al. 2012; Arnason 2015). Much of the extrapolation to CCD for bees has been based on reports about the toxicity to bees of the neonicotinoid pesticides derived in laboratory "swab" tests in which the chemical is applied directly to the body of the bee at concentrations well above expected concentrations after vector control (Bradbury 2013). To address some of the current concerns about the potential adverse impact of neonicotinoids on bees, the USEPA (2016b) has issued new, recommended label requirements and offers suggestions on the use of these products when near possible bee colonies. The label requirements for the neonicotinoid pesticides do, in fact, state: "Do not apply this product while bees are foraging. Do not apply this product until flowering is complete and all petals have fallen" as a requirement for the use of these pesticides in regions that contain active bee activity, both agricultural and associated urban hives. These label mandates have been developed to minimize the potential for bee exposures and have been on the labels since 2013 (Bradbury 2013). Again, the District does not use neonicotinoid products; thus, to the extent CCD is an actual impact caused by neonicotinoids, the District's Program does not contribute to this impact and extrapolation of these concerns to District vector control are not warranted. For informational purposes, however, the neonicotinoid products are part of the cumulative impact discussion on declines in bee population.

While the District does not use neonicotinoid products, to be inclusive, the PEIR addresses the potential toxicity of neonicotinoid to bees to expand the possible non-District related contributors to CCD. USEPA recognizes the value of the neonicotinoid pesticides for agriculture and indicates that care must be taken when using these products. However, it is also clear that the reports in the media of CCD have not been tied solely to the use of these products (USEPA 2016b). Rather, most of the reports of CCD have been connected loosely (i.e., inappropriately) to pesticide use without considering the effects of the dozens of confounding factors, including loss of habitat, loss of flowering plants and trees due to development, mite infections, viruses, stress due to agricultural movement of the colony, and predators to the colony. Identification of the confounding factors associated with the CCD phenomenon has resulted in recent care given to reduce the stresses and/or habitat losses that directly adversely impact bee survival and bee colony status. In contrast to some of the nonscientific and personal reports of possible bee deaths and CCD in the press and other media in Canada (Thomson and Ahluwalia 2015) and the US (Brown 2014; UC Master Gardener Program of Sonoma County 2016), according to information from apiary publications, reported cases of CCD have declined substantially in Canada over the last several years (MAAREC 2016). The number of hives that do not survive over the winter months – the overall indicator for bee health – has maintained an average of about 28.7 percent since 2006-2007, but dropped to 23.1

percent for the 2014–2015 winter. While winter losses remain somewhat high, the number of those losses attributed to CCD has dropped from roughly 60 percent of total hives lost in 2008 to 31.1 percent in 2013; and initial reports for 2014-2015 losses also appear to be on the decline. Emphasis on careful identification of and reduction of confounding factors in the beekeeping industry has been on the forefront of professional beekeeper groups for years (American Beekeeping Federation 2016). See also Response 6 which addresses the use of nonlocal sources of information (both US and Canada) in describing the causes of CCD.

On a broader scale, the existence or extent of a cumulative impact to pollinators by pesticides in general is unclear. A comprehensive USEPA report, developed in conjunction with Environment Canada and CDPR (White Paper In Support of the Proposed Risk Assessment Process for Bees, USEPA et al. 2012), found that a definitive linkage of reported bee deaths primarily to pesticides cannot be established. Among the numerous reviews, conclusions and recommendations in the 275-page report there are numerous sections that discuss the issue of causality and problems in addressing this complexity:

> "*There are several challenges that exist when integrating the various exposure and effects data that can be used to assess potential effects of pesticides on honeybees and their colonies. For instance, different bees are expected to be exposed to pesticides at different magnitudes, depending upon their function in the colony. In addition, interpreting the impacts of mortality and sublethal effects on the ultimate survival of the colony is complicated by a lack of definitive understanding of the linkages between many of these endpoints*." (USEPA et al. 2012, page 3)

A follow on review and critique of the White Paper by a select panel of scientists, both internal to the regulatory agencies and outside (representing universities, other federal agencies and commercial agricultural product companies), emphasized and validated the many questions associated with the linkage of specific pesticide exposure and the other confounding factors in the White Paper.

While some pesticide toxicity to bees has been demonstrated and summarized by the USEPA, the toxicity data used in USEPA guidance is generated using bees in the laboratory. This test is conducted by using a pesticide-saturated cotton swab, applied firmly against the thorax, resulting in a contact exposure far greater than would be achieved in actual field conditions (USEPA 2012b; Fishel 2005). In contrast to this purposeful and artificially exaggerated laboratory contact exposure, the toxicity values reported in USEPA guidance are not typical of the more likely casual contact with any pesticide used in District vector control applications, which both due to the levels applied and compliance with BMPs designed to avoid or minimize exposure to pollinators, do not approach these potential exposure levels.

Seasonal impacts on bees and their colonies are common and typical for most areas in North America, where bees are raised commercially or as a hobby (MAAREC 2016). Further complicating the understanding of potential pesticide impacts to bees and other pollinators is the widespread urban use of many of these pesticides by homeowners, gardeners, and others who commonly use these chemicals. Urban use of insecticides can be a large percentage of total use nationally (Aspelin 2003). However, by following the practices that reduce potential exposure as indicated in the label guidelines and USEPA regulatory guidance, safe applications of pesticides can be practiced without substantial adverse effects to bee colonies.

As noted, the District does not use neonicotinoid products; thus, to the extent CCD is an actual impact caused by neonicotinoids, the District's Program does not contribute to this impact. For the products used or potentially used by the District, the District BMPs reflect an understanding of and adherence to CDPH/MVCAC guidance designed to minimize effects on bees and include additional recommendations limiting pesticide use only within the wind speed parameters on the product labels conditions. The guidance and the BMP approach is tailored to minimize the potential for direct bee exposure to any of the pesticides used for vector control by the District. Furthermore, the District uses the following BMP H12 for pesticide applications that is contained in Table 2-8 in Section 2.7 on page 2-92 of the revised Draft PEIR with clarifications added (in underline):

> "Do not apply adulticides in spray/fog forms over large areas (more than 0.25 acre) during the day when honeybees and other pollinators are present and active ~~or when other pollinators are active~~. Preferred applications of these specific pesticides are to occur in areas with little or no honeybee or pollinator activity or after dark. These treatments may be applied over smaller areas (with hand held equipment), but the technician will first inspect the area for the presence of bees and other pollinators. ~~Based on the care in application timing for bees, it is also true the District applies that care to other known pollinators if present. As a further cautionary approach,~~ If bees and other ~~any~~ pollinators are ~~known to be~~ present in substantial numbers, the treatment will be made at an alternative time when these pollinators are inactive or absent. Liquid larvicides are applied only to water bodies."

As with all pesticides, the USEPA provides label guidance and mandates that have been developed to minimize the potential for exposure, and the labels are based on extensive laboratory and field tests of toxicity to bees that have been directly exposed to these chemicals to determine the worst case scenarios if the bees become directly coated with the pesticide (spraying) and if they are in direct, extended contact with contaminated vegetation. The mandated label restrictions are based on the following supporting information used to minimize the potential for direct exposure (USEPA 2012c):

> Minimize exposure of this product to bees and other insect pollinators when they are foraging on pollinator attractive plants around the application site.

> Minimize drift of this product on to beehives or to off-site pollinator attractive habitat. Drift of this product onto beehives or off-site to pollinator attractive habitat can result in bee kills. Utilize Best Management Practices that reduce the likelihood of exposure, including application restrictions during potential drift conditions, proximity to known colonies and other information about the status and activity of the bees in the area of proposed applications.

Publications such as the NW Honey Bee Habitat Restoration (2017) which is a nonprofit advocate for honeybee health) indicate that reports of declines in honeybee numbers and CCD are the result of numerous factors. In its publication it states "Some of the factors contributing to this are stress from moving and transporting hives, malnutrition, loss of habitat, disease, the parasite nosema, and foulbrood (caused by spore-forming *Paenibacillus* larvae), wax moth (*Achroia grisella*, of the family *Pyralidae*), and varroa mites which hitch a ride on a bee into the hive, then lay eggs which will feed on the young bees and ultimately will wipe out the entire hive". The multitude of possible adverse impacts on honeybees and the potential for CCD make it scientifically impossible to develop causality for any single or even any combination of sources that cause regional or localized decline of bee populations. Research reported for bees is also relevant to other pollinators. One way to consider the larger issue of impacts to pollinators (i.e., butterflies and moths in addition to bees) aside from CCD and pesticide use is to consider recent information from beekeeper journals from Canada that honey production has improved. While agricultural and urban use of pesticides in Canada is similar to that of the US (Agriculture and Agri-Food Canada 2013, Crop Protection Survey), the impact on bees and bee colonies appears to be minor. In Canada, Statistics Canada reported that beekeepers produced 95.3 million pounds of honey, up from 85.5 million last year and 76.5 million in 2013. Alberta produced most of the production gain as beekeepers increased production by 7.3 million lb from 35.5 million in 2014 to 42.8 million in 2015. Beekeepers produced more honey because bee colony numbers jumped 3.6 percent compared to 2014. Prairie bee colonies in 2015 had winter losses averaged 11 percent in Manitoba, Saskatchewan, and Alberta, much lower than losses of 20 to 40 percent in previous years. National honey yields were also up. Beekeepers averaged 132 lb per hive, a gain of 9 lb over 2014. Because other insect pollinators do not produce honey, there is no similar method for showing increases in these pollinators. However, this information from Canada suggests that pesticide use is not a substantial contributing factor to adverse effects on bees and bee colonies.

Many reports of adverse effects of pesticides to Monarch butterflies and some moths have been provided in the press, with a link to the indirect effect of glyphosate on reduction of the milkweed plant that serves as a food source and provides habitat during foraging and migration. Some of the issues associated with loss of bees and butterflies is outlined in a recent Science article (Keim 2014) in which the author addresses the loss of flowering plants and environmental changes as likely causes of the perception that these species are in decline. Although the author suggests that some reported declines in bees and butterflies may be due to pesticides, numerous other factors contribute to this impact and he indicates that it is difficult to actually quantify adverse effects. In fact, in addition to the impact of viruses, parasites, and natural stressors, he suggests that pesticide impacts may be eclipsed by habitat loss since pollinator habitat is disappearing nationwide. Most of the reports of pollinator declines ignore the numerous complex, confounding factors that influence bee numbers and colony failure included above, that are in play and make extrapolations and unfounded correlations to chemical effects regardless of the likely actual exposures. As in all evaluations of potential adverse chemical impacts in the environment, assigning a correlation of an impact and a process, correlation is not causation. Without the determination of the numerous factors potentially impacting an observed effect, any observed effect cannot be defensibly attributed to a single or even multiple factors.

There is an annual native bee count in Sonoma County that will provide valuable data to researchers at University of California Berkeley, who are able to discern information about the health of an ecosystem from the diversity of the bee population. They plan to publish their results in the journal Conservation Biology. Preliminary information suggests that native bee species have declined in the last year, which researchers attributed to the drought that has parched the region for two straight summers. (Brown 2014)

Pollinator populations fluctuate over time and are affected by many different contributing factors. Therefore, it is not possible to definitively link pesticide use by the District (at levels established by the USEPA and according to additional BMPs) to a long-term decline locally. Although the USEPA provides summaries of the data on potential adverse chemical impacts to bees, these laboratory tests use direct thoracic exposures in the laboratory (USEPA 2012b). One current theory about bee deaths and CCD has been casually associated with the use of pesticides, particularly the neonicotinoid pesticides which the District does not use. Numerous other factors such as drought, disease such as Israeli Acute Paralysis virus, invasive varroa mites (a pest of honey bees) and the gut parasite Nosema, may be affecting declines in pollinator populations. Measures on the pesticide labels along with additional BMPs ensure the District’s activities, including use of chemicals, are not having a significant impact on insect pollinators, nor are they contributing considerably to a cumulative impact on insect pollinators. However, it is also clear that the reports in the public media of CCD have not been tied solely to the use of any specific pesticide, including any of the District products in use or proposed for use (USEPA 2016c). BMPs and application label requirements address both bees and other insect pollinators, and are implemented to avoid substantial harm to these insects within the District’s Service Area by District activities. All these reasons support the analysis and conclusion in the revised Draft PEIR Section 13.3.1, page 13-8, that the Program’s less-than-significant impacts on insect pollinators related to mosquito and yellow jacket abatement activities would not be cumulatively considerable or significant.

Periodic concerns are raised by the public with the San Mateo County Department of Agriculture, Weights, and Measures regarding adverse impacts to honeybees, nonbee pollinators (including nocturnal moths) or insect predator populations related to District activities but have not been substantiated by the San Mateo County Department of Agriculture (at the request of adjacent landowners or wildlife refuge managers) as a result of focused applications of District pesticides. In addition, it is standard District protocol to work with and notify the San Mateo County Beekeepers Guild of any ULV fogging applications. This allows the Guild to report to its members the location, time, product to be used and any precautionary measures if necessary to protect their residential honeybee populations.

Response 30

The comment argues that urbanization and urban limitations on beekeeping are not having a significant impact on pollinators in the Program Area, that this impact is overstated, therefore the District's contribution to cumulative impacts are understated.

It is important to note that a discussion of cumulative impacts is intended to address all of the components or confounding factors that could be involved. Cumulative impacts may occur when several less-than-significant impacts contribute to an un-associated impact that becomes significant as a result of the aggregation of the incremental impacts. In this case, a series of effects that each alone would not be significant would need to be acting at the same time, same location, against the same species of concern. This scenario, although possible, is not typical in District vector control and would certainly be outside normal operations. Urbanization most often results in a reduction in agricultural land, and agricultural land provides foraging opportunities for pollinators, especially for crops where flowering precedes the production of fruit such as vineyards and orchards. Limitations on beekeeping in urban areas would further contribute to a decline in pollinator populations. The issue is not whether urbanization itself has a significant impact on pollinator populations but whether it has any impact, even a less-than-significant one that may be contributing to a cumulative impact. That beekeeping is allowed in some residential areas in addition to the more extensive beekeeping activities associated with agricultural uses is a part of the issue but it does not cause an understatement of the District's potential contribution to cumulative impacts to pollinators. The PEIR provides an overview of the beekeeping industry and defines the wider range of bee activity and the possible sources of bee exposures beyond the areas where the District applies chemicals for vector control. Although there have been numerous media reports that bees and bee colonies are being adversely impacted by pesticides, there are numerous other reports by bee associations and researchers that suggest that any reported reduction in bee numbers or bee colonies are highly exaggerated and likely focused on the wrong sources of stress and exposure. See Response 6 for these citations. Where reductions in bee numbers have been reported, one of the claims is pesticide poisoning. However, there are numerous reports (NW Honey Bee Habitat Restoration 2017; Brown 2014; Keim 2014) suggesting and supporting the likely relationship of adverse environmental factors, disease, parasites, and unusual predation, as probable causes of the reduction of numbers of bees.

The foraging range of bees in pursuit of nectar is fairly closely tied to the location of the hives, including the artificial hives used for collection and sale of honey. Although there is some indication that bees may forage as far as several miles from the hive, a practical maximum distance from the hive has been summarized for several reports (Traynor 2002) and is said to be a maximum of approximately 3 to 4 miles when nectar is not readily available closer to the hive. The PEIR addresses the larger issue of urban development and loss of agricultural lands that had beekeeping associated with them to promote the fertilization of the numerous crops that depend on bees for fertilization. Loss of some agricultural land is also loss of habitat for bees and other insect pollinators.

As discussed above, most of the reports of colony collapse disorder (CCD) have been exaggerated and/or inappropriately connected to pesticide use without considering the effects of loss of habitat, loss of flowering plants and trees due to urban development, mite infections, viruses, stress due to movement of the colony for agricultural pollination at different locations, and predators to the colony. Identification of the confounding factors associated with the CCD phenomenon has resulted in more care given to reduce the stresses and/or habitat losses that directly adversely impact bee survival and bee colony status. In many cases, loss of honey productivity is not actually associated with decreased bee activity or the loss of bee numbers or the CCD reported by the media. In fact, one of the current impacts of lower honey productivity, as reported by numerous local beekeepers, can be attributed to theft of thousands of beehives and displacement of the appropriate hive locations (Pollock 2015, Rocha 2017; Lawrence 2016).

Periodic concerns are raised by the public with the San Mateo County Department of Agriculture, Weights, and Measures regarding possible impacts to honeybees, nonbee pollinators (including nocturnal moths) or insect predator populations related to District activities, but these have not been substantiated by the San Mateo County Department of Agriculture (at the request of adjacent landowners or wildlife refuge managers) as a result of focused applications of District pesticides. In addition, it is standard District protocol to work with and notify the San Mateo County Beekeepers Guild of any ULV fogging applications.

For additional information on bee population decline and other pollinators, see Responses 6, 29 and 31.

Response 31

The comment is that the Draft PEIR completely ignores the significant role of wild pollinators, such as native bumblebees, butterflies, and moths.

Adverse impacts to other nonbee pollinators and food web predator populations have not been reported as a result of focused applications of vector control pesticides. In fact, pollinator populations fluctuate over time and are affected by many different contributing factors. It is not possible to definitively link use of vector control products by the District (at levels established by the USEPA and according to additional BMPs) to a long-term decline or one that would adversely impact the predator population of interest. It is well known in population biology that every population can adequately respond and recover to a loss of large percentages of individuals based on their intrinsic reproductive vigor. Populations with very short reproductive gestation periods (most insects and some small mammals) will recover much faster than populations with long reproductive cycles (large mammals and some birds). In fact, there are many theories about how many individuals in a population can be lost before the likelihood of significant impact or extinction may occur (Emlen1989), and most researchers support the concept that up to 50 percent of some vigorous populations can be removed without extinction of the species. However, the loss of these other pollinators would not occur to this extent in large part because the limitation on applications during the day or when other pollinators are active (see BMP H12).References to some of the predators of mosquitoes can be found dating back more than 100 years and help form the basis for much of the research that has occurred since (Beutenmuller 1890; Felt 1904; Howard 1901, 1910: Mitchell 1907; Smith 1904; Underwood 1903; Weeks 1890). These selected publications (provided as an example among dozens of others) have not established a defensible concept of adverse impacts from localized mosquito control to predators and other related populations. Other factors such as drought may be affecting declines in pollinator populations. District BMPs and application label requirements address both bees and other insect pollinators, and are implemented to avoid substantial harm to these insects within the District’s Service Area by District activities. Because of the selective nature of the vector control products for mosquitoes, any claimed potential adverse impact to insect predators (as nontarget exposures) associated with District applications would be temporary and inconsequential in the impact to those populations of predator species. Even in the event of ancillary exposures, the recovery of such populations occurs rapidly to maintain the general level of individuals in their populations. The relative higher sensitivity of the target vs nontarget (less sensitive predator) species provides an adequate measure of safety to maintain the balance of predator populations.

As discussed in the PEIR (Section 6.2.7.2.1 and elsewhere) and other responses to this commenter’s comments, based on the available evidence it is reasonable to conclude that District pesticide applications under the Program, using required limitations in application methods and rates as found on the product labels and in District BMPs, will not result in a significant impact to these populations or higher trophic level species that consume mosquitoes as part of their diet. For example, in 2015 the District conducted 3 large-scale ULV fogging applications in response to presence of mosquitoes carrying WNV in close proximity to residential areas. These applications totaled approximately 2,153 acres of the 476,160 acres that exist in San Mateo County. The active ingredient covering those applications was approximately 216 ounces during those treatments which would equate to 1 ounce of active ingredient per every 2,204 acres of San Mateo County.

Also see Response 13.

Response 32

The comment is that the cumulative impact to water quality is lacking.

Potential water quality impacts to groundwater and surface water from application of vector control chemicals are analyzed in Sections 9.2.5 and 9.2.7 of the PEIR, the Vegetation Management and Chemical Control Components, respectively. Each of the active ingredients and adjuvants applied by the District were evaluated individually with consideration of pesticide's mode of action, persistence in the environment, toxicity, and environmental fate. Furthermore, the District's methods for application of the material, such as ULV techniques, were also considered. Based on this evidence and expert analysis, the Draft PEIR concludes that the vector control chemicals would have less-than-significant impacts to surface water and groundwater when applied consistent with the vector control application techniques, label requirements, and BMPs implemented by the District except for the potential future use of naled.

With respect to the cumulative impact assessment, the PEIR focuses on the actual effects the District's contribution will have on the environment at the cumulative level. Contrary to what is implied by the commenter, *Communities for a Better Environment v. California Resource Agency* (103 Cal. App 4th 98) does not require that the District find that <u>any</u> level of contribution to an existing cumulative impact be deemed cumulatively considerable, particularly when program and/or project effects are indirect or uncertain. As discussed in Section 13.7 of the PEIR, several studies have shown that specific vector control chemicals applied using ULV techniques do not accumulate in water or sediment following repeated applications. These studies have also determined that no toxicity is associated when exposure is limited to the amounts used when following ULV protocols for mosquito control (Lawler et al. 2008; Amweg et al. 2006). Furthermore, the monitoring of pesticides used for vector control on waters throughout California in 2011-2012 did not detect substantial impacts to receiving waters, as described in Response 23 above. A two-year monitoring study conducted for the SWRCB by the MVCAC Monitoring Coalition (MVCAC 2013) to determine whether vector control activities were contributing contaminants to state waters supports the PEIR's conclusions that impacts to water quality from the District's IMVMP are less than significant (except for the use of naled which is significant and unavoidable). For the revised cumulative impact analysis in Section 13.7, the thesis that the District's use of some vector control chemicals may contribute considerably to an existing cumulative impact (from all other pesticide users' activities) to water quality in designated impaired surface waterbodies within the Program Area. The Phillips et al. 2013 study sampling data report was reviewed and summarized in Section 13.7, and the results of chemical detections in post vector control application water samples for dichlorvos, the breakdown product of naled, indicate that the future use of naled could result in a cumulatively considerable incremental impact to the pesticide-impaired waterbody or lower San Mateo Creek

Response 33

The comment is that the Draft PEIR failed to consider food webs and, therefore, ignored potentially significant cumulative impacts.

Because of the selective nature of the vector control chemical products for mosquitoes, any claimed potential adverse impact to insect predators associated with District applications (as nontarget exposures) would be temporary and inconsequential in the impact to those populations of predator species. Even in the event of ancillary exposures, the recovery of such populations occurs rapidly to maintain the general level of individuals in their populations. The relative higher sensitivity of the target vs nontarget (less sensitive predator) species provides an adequate measure of safety to maintain the balance of predator populations. Although some nontarget predator species may be inadvertently exposed to a pesticide, the potential impact to the predator population would likely not be significant or even detectable. Similarly, for the target insects that could be exposed and subsequently carry a "body burden" of the chemical, the concentrations of consumed chemical by the predator species in these scenarios would be below the level of concentration in the food items to result in toxicity to the predator species. In the evaluation of the potential loss of prey species (target species reductions) the number and location of available alternative food items available to the predator species would preclude any significant adverse impacts due to the loss of a single predator food item (Van Bael et al. 2008). See Response 13 for a more comprehensive discussion of food web impacts.

Response 16 addresses glyphosate impacts to amphibians and explains that the primary causes identified by the USFWS as leading to adverse effects to the CRLF are loss of habitat, invasive species and competition for foraging items. The potential impact of glyphosate on CRLF is marginal and only applicable in situations of excess exposure to incorrectly treated areas. Response 16 also explained the reasons why the toxicity and adverse effects reported in laboratory studies would not be expected occur as a result of the District's potential herbicide applications for mosquito or invasive species control. Based on this evidence and analysis, the District properly concluded that the potential impact of District use of glyphosate under the Program would not contribute considerably to a cumulative impact to CRLF. USEPA has evaluated the potential adverse impacts of glyphosate on the CRLF in a recent administration memorandum that reports that glyphosate may be likely to affect CRLF for direct contact exposure and indirect effects on prey items using dose estimates based on laboratory data and risk estimates (commenter's footnote 19, Memorandum to Environmental Fate and Effects Division 2008). The laboratory data, however, provides toxicity values based on direct exposures and doses, not representative of the District application options, specific BMPs, focus on target vectors with care to not expose nontarget species.

The District's ongoing methods of control of vector populations using nonchemical methods and insecticides, and its limited use of herbicides for control of mosquito breeding habitat, are not triggering or creating a cumulatively considerable impact to nontarget species.

Response 34

The comment is that the Draft PEIR cannot accurately determine the Program's potentially cumulative impacts, so it cannot mitigate them. The Draft PEIR must be recirculated.

As discussed in Responses 28 through 33, the cumulative impact analysis has been revised to include additional information. Most importantly, we have revisited the analysis for surface water quality and added a conclusion that there may be a cumulatively considerable effect on designated impaired surface water bodies in the Program Area from one of the chemicals (naled) included in the IMVMP (see Section 13.7),. Key issues for the PEIR have been addressed in language understandable to the public. However, substantial material has been added to the revised Draft PEIR, which references a new Draft IMVMP Plan, and it is being recirculated for public review. Material provided in these responses to comments provides sufficient clarification to be clear on points raised, and this material will be made public as part of a recirculated Draft PEIR.

Response 35

The comment is that the PEIR preemptively dismisses any need for CEQA review of future Program activities that subverts the purpose of CEQA.

The PEIR does not gloss over program EIR requirements, nor does it presumptively dismiss the need for future CEQA evaluation. Rather, Section 1.8, Use of This PEIR for Future CEQA Compliance (pages 1-23 through 1-29) clearly acknowledges that the analysis is limited to the activities and materials that can be identified at present including both the Existing Program and the identified future activities or materials and equipment that could be used. It notes that "Future activities not within the scope of the Program evaluated in the PEIR are considered "new actions" and may be subject to future environmental review under CEQA" (Section 1.8.1, page 1-25). It also clearly outlines the steps that would be followed in determining whether additional CEQA analysis would be required in the future. The specific process the District will follow to ensure CEQA compliance as it moves forward implementing its Program is explained in detail in Sections 1.8.1 and 1.8.2. The comment seems to suggest that the District make a determination now whether all future activities would be subject to additional CEQA, but this is not feasible because they are not known. Known future activities deemed likely are called out in the PEIR and are evaluated. The CEQA Guidelines § 15144 notes that foreseeing the unforeseeable is not possible, but that an agency must use its best efforts to find out and disclose all that it reasonably can. This PEIR has done that, describing for example all pesticides in current use and a number of pesticides not currently in use but with the potential for use in the foreseeable future (Section 1.8.1.1, page 1-25). The CEQA Guidelines § 15145 do not require speculation, however, and the PEIR has outlined the steps that would be taken to ensure compliance with CEQA in the future for both chemical and nonchemical treatments. One of the purposes of this PEIR has been to anticipate reasonably foreseeable vector control activities by the District in order to avoid use of the emergency action exemption provisions if there were a serious outbreak of vector-borne disease requiring immediate action, thus ensuring that, to the extent feasible, potential impacts have been evaluated and disclosed to the public and decision makers in advance of any action.

Response 36

The comment is that the Draft PEIR relies on numerous references that do not stand up to scrutiny in the opinion of the commenter.

Almost 300 references are cited in the main text of the PEIR with additional references cited only in the technical reports included as Appendices A through E. The new Appendix F, Responses to Comments, includes many attachments that are referenced in the Draft PEIR. The vast majority of these references are documents from governmental sources (such as the local planning agencies, Centers for Disease Control and Prevention, USEPA, and USFWS) and scientific studies published in the dozens of scientific journals addressing toxicology and environmental impacts. The importance of vector control is illustrated in a publication addressing WNV (Zhang 2012) and illustrates a means of contrasting the possible unwanted effects of vector control to the importance of vector eradication for public health. The use of a very few articles published in the media and found in online searches is minor, and they deal with current events/issues. The 2015 article by Whelan (printed in *Mother Jones*, a publication of interest to the environmental community) citing the relationship between the California drought and the incidence of WNV was reviewed with eight vector control district managers who determined it was not inconsistent with the results of their surveillance activities; and furthermore, it was acceptable to cite in part because members of the public may relate to this publication better than to some of the scientific journals used.

Response 37

The comment is misleading to say that the PEIR relies on undocumented, nonscientific media reports. Rather, numerous references represent appropriate and relevant scientific studies by qualified authors that were used in the determinations of significant impact related to ecological and human health along with the Appendix B, including more than 212 published studies and reports, and in the PEIR 57 publications and sources from the USEPA and 6 sources from USFWS as appropriate. The District has used its best efforts to find relevant materials in light of what is reasonably feasible and is not required to be exhaustive or encyclopedic in its documentation. Consistent with the CEQA Guidelines Section 15151, the District's PEIR has made a good faith effort at full disclosure of the impacts of its vector control activities based on substantial evidence reviewed by persons with the appropriate qualifications as documented in Chapter 16 and herein. See also Response 15 above on the qualifications of the toxicologist who reviewed the scientific studies and other technical documents. Attachment B, Literature Review, discusses 134 studies and source materials cited in the PEIR and/or in these responses to comments.

Response 38

<u>Review of Exhibit 1</u>

Shelton, J.F. et al. 2014. Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study. Environmental Health Perspectives 122 [10]: 1103-1109.

This study evaluates the application of organophosphates, organochlorines, pyrethroids, and carbamates for agricultural purposes on an aspect of human health. Only one of these pesticide classes is used by the District for vector control: pyrethroids. At issue is the applicability of this study to the District's Proposed Program and its relevance to the PEIR's determinations of less-than-significant impacts on human health.

The first way in which the pyrethroids studied is distinguishable is that the amount of pesticide product applied for the control of agricultural pests is much higher than the amount needed to control mosquitoes or ground-nesting yellow jacket wasps and localized infestations of ticks. The District's original Draft PEIR clarifies this point as indicated below in the Program Description Section 2.3.5.1.2 on ground adulticiding of mosquitoes:

> *"The most common form of adulticide application is via insecticide aerosols at very low dosages. This ultra low volume method is commonly referred to as the ULV method. This method employs handheld or backpack sprayers for ground applications. Barrier or residual treatments for adult mosquitoes consist of an application using a material generally applied with a compressed air sprayer to the preferred foliage, buildings, or resting areas of the mosquito species. Cold aerosol generators, cold foggers, and ULV aerosol machines were developed to eliminate the need for great quantities of petroleum oil diluents necessary for earlier fogging techniques. These units are constructed by mounting a vortex nozzle on the forced air blower of a thermal fogger. Insecticide is applied as technical material or at moderately high concentrations (as is common with the pyrethroids), which translates to very small quantities per acre and is, therefore, referred to as ULV. In agriculture, this rate is assumed less than 36 ounces per acre, but mosquito control ground adulticiding operations rarely exceed 1-2.5 ounces per acre. During a typical WNV adulticide application, a truck-mounted ULV application can cover 600 acres (approximately a 0.5-mile radius) while only using 32 ounces of active ingredient. As with all applications, staff follow label requirements and District protocols and BMPs to guide the decision-making process. The optimum sized droplet for mosquito control with cold aerosols applied at ground level has been determined to be in the range of 5 to 20 microns."* (page 2-50)

The authors suggest that pesticides are one of the environmental factors implicated in DD and ASD. They emphasize, however, that the influence of pesticide exposure on the risk of ASD/DD is not well defined (Shelton et al., 2014).

The studies provide comparisons of reports of onset of DD and ASD and the California pesticide use reports of agricultural pesticide applications data. These comparisons are based on the potential relationship of two distinct, but not similar data sets. The California pesticide reports are culminations of the reported uses (by total pounds of active ingredient) of each pesticide, fungicide, and other chemicals applied to agricultural lands. This linkage is based on expected or estimated proximity to the actual applications in selected distances from the agricultural fields sprayed. The authors provide comparisons to DD and ASD onset during each gestational trimester. The objective of the study was to determine the potential link of the onset of these disorders to the information about the application of organophosphates, organochlorines, pyrethroids, and carbamates reported as collective pounds of active ingredient applied to the agricultural fields in the region.

The authors contend specifically that the use of agricultural applications of the pesticides may be correlated to the onset of these disorders, while they report no other potential influences that are clear confounding factors in the studies. There is no discussion or correlation to the relationship to nonagricultural, standard vector control application techniques such as spreading granules or using hoses with controlled droplet application, especially by commercial applicators.

The study methodology is based on use of retrograde demographic reports of DD and ASD from test and control areas and using statistical comparisons to parse out the possible relation of aerial applications to the reported onset data of DD and ASD. The authors provide statistical comparisons to the possible linkages, but there is no discussion of the numerous other environmental and exposure factors that could contribute to the results. For instance, there is no indication in the report that numerous nonchemical factors (according to the decades of research) such as lead in the drinking water, local sources of contamination, activities in the community, etc. contribute to the reported results. Hence, the timing and actual exposures cannot be determined in the study.

The common flaw in many demographic studies such as this is that correlation is not always causality. The linkages suggested by Shelton et al. (2014) do not show a clear, unambiguous causality. Although there are hundreds of studies that attempt to link diseases to specific external factors, they do not typically provide a defensible correlation to causality. This study suggests the onset of DD and ASD may be correlated to information about the application of pesticides in agricultural fields with residential proximity. There is no discussion about method of application, whether aerial or ground-based applications, but the locations of the agricultural applications were based on square-mile areas for use in a spatial model with buffer zones around the residences. The CHARGE Study is not relevant to the normal activities or application methods of pyrethroids by the District for vector control. The applications resulting from typical District operations use pyrethroid products at amounts that are far below the levels resulting from agricultural applications.

Although the onset is considered to have a large genetic component, the study of potential links of environmental and chemical factors to the onset of DD and ASD includes dozens of potential causes that confound the results of the studies. Many of the possible links to the onset of DD and ASD include numerous factors that have been suggested as contributing to autism (Lyall et al. 2014, Frietag 2007). Some of the suggestions for factors to consider include some foods, heavy metals, infectious diseases, smoking, drugs, pesticide, lack of certain vitamins, vaccines, solvents, and even emotional neglect. Without acknowledging, understanding, and control of these many confounding factors, there is, at this time, no scientific evidence that clearly links any factor, solely, to the onset of these conditions. This lack of clear causality is an issue in many demographic studies because the contributions to adverse effects and onset of DD and ASD cannot easily be determined and separated from the other factors.

A better example is the following study cited in Attachment A that examined exposure for mosquito control, not agriculture:

Macedo, P.A., Ryan S Davis, Robert K.D. Peterson. 2010. Evaluation of Efficacy and Human Health Risk of Aerial Ultra-Low-Volume Applications of Pyrethrins and Piperonyl Butoxide for Adult Mosquito Management in Response to West Nile Virus Activity in Sacramento County, California. *Journal of the American Mosquito Control Association*, 26(1):57–66.

This publication is an excellent example of using risk techniques to consider the risk of the public health concerns of insect vectors of disease vs the risk of the use of the insecticide used to remove them from a target area. By providing cross-modality comparison of the two risk analyses, the authors provide a risk-benefit analysis similar to those used by USEPA and those used to determine the practicality and relative adverse effects associated with the process. The results of the study reveal the importance of a rigorous comparison and contrast of the likely realistic exposure and effects of chemical exposure against the highly likely adverse public health impacts of mosquito infestations. This paper clearly provides an example of the methodology to evaluate the potential risk of a product and application technique against the likely actual adverse effects. This approach provides a method to compare, contrast, and evaluate the relative adverse impacts of the District's vector control activities and the possible adverse impacts to public health if the vector control is not provided.

Response 39

<u>Review of Exhibit 2</u>

Hicks, S,D., V. Doraiswamy, K. Fry, and E. Wohlford. 2016. Aerial Pesticide Exposure Increases the Risk of Developmental Delay and Autism Spectrum Disorder. Abstract No. 1508.488. The Pediatric Academic Societies Meeting, Baltimore, MD.

The authors suggest that pesticides are one of the environmental factors implicated in DD and ASD. They emphasize, however, that the influence of the timing and route of pesticide exposure on the risk of ASD/DD is not well defined.

The abstract submitted for consideration provides a hypothesis for one of the many possible causes of DD and ASD, attempting to link exposure from aerial pesticide applications to the onset of these two disorders. The objective of the study was to determine the potential link of the onset of these disorders to the annual aerial applications of pyrethroid pesticide used to combat mosquito-borne encephalitis in in a Central New York area each summer from March 2010 to March 2015. The authors contend specifically that the use of aerial applications of the pesticide may be correlated to the onset of these disorders; while they report that there is no correlation to use of non-aerial, standard application techniques such as spreading granules or using hoses with controlled droplet application, especially by commercial applicators.

The study methodology is based on use of retrograde demographic reports of DD and ASD from test and control areas and using statistical comparisons to parse out the possible relation of aerial applications to the reported onset data of DD and ASD. Using areas not associated with aerial spraying as control groups, the authors found no significant difference between aerial-exposed and control groups in parameters such as the number of children, overall births, premature births, poverty level, or child gender. The referral rate from aerial-exposed zip codes was lower for all 4 control diagnoses. The aerial-exposed zip codes had higher levels of total pesticide exposure but no difference in pesticide use per square km. The authors calculated that the relative risk of ASD/DD for children in zip codes with aerial spraying was approximately 25% higher than in areas with no aerial spraying. There were no other relevant effects evaluated or reported, including the gestational age during aerial spraying and DD/ASD prevalence. Numerous statistical comparisons are presented using the demographic data, but there is no discussion of the numerous other environmental and exposure factors that could contribute to the results. For instance, there is no indication that several potential factors (according to the decades of research) such as lead in the drinking water, local sources of contamination, activities in the community, etc., result in substantial adverse impacts to public health. Hence, the timing and actual exposures to suspect chemicals and other contributing factors cannot be determined in the study. The common error in many demographic studies such as this is that correlation is not always causality. The linkages suggested by the authors do not show a clear, unambiguous causality.

Without acknowledging, understanding, and examining control of these many confounding factors, there is, at this time, no scientific evidence that clearly links any factor, solely, to the onset of these conditions. This lack of clear causality is an issue in many demographic studies because the contributions to adverse effects and onset of DD and ASD cannot easily be determined and separated from the other factors.

The authors suggest that exposure to aerial application of (pyrethroid) pesticides appears to be correlated with increased risk of ASD/DD compared to the reports of onset of DD/ASD from areas without aerial spraying. Although the authors suggest that aerial application of the pyrethroid pesticide is linked to the reported cases of DD/ASD, it does not appear to be related to gestational timing of the projected exposure.

Although there are numerous studies that attempt to link diseases to specific external factors, typically they do not provide a defensible correlation. This study suggests the onset of DD and ASD may be correlated to information about the timing of the aerial application of insecticide to combat mosquito-borne disease on a regional basis. These and many other pesticide researchers include the factors impacting their conclusions about pesticide effects and include summary statements similar to those of Hicks et al. 2016 that "Communities that have pesticide programs to help control the mosquito population might consider ways to reduce child pesticide exposure, including alternative application methods."

Although some similar application methods may be utilized in some specific conditions to minimize or reduce the risk of mosquito-borne diseases, the report is not relevant to the normal mosquito control activities and chemical treatment application methods used by the District in San Mateo County, California. In a situation of severe mosquito outbreak or vector-borne disease epidemic where public health (risk of encephalitis, WNV, or other mosquito-borne disease) is a high priority and mosquito control is critical to public health, this aerial application technique using pyrethroids would be considered by the District. Additionally, the District would not repeat an application to the same area over and over for years at a time nor do they spray/fog from the ground with adulticides on a routine basis. Rather, adulticides are used only when surveillance indicates a potential outbreak or possible health issue and other techniques have failed or will not be effective.

The findings reported by these authors are not relevant to the specific pesticide application scenarios or the application techniques (low-volume spraying and ULV aerosols) used by the San Mateo County Mosquito and Vector Control District. Aerial spraying in nearby areas, as depicted in the report, over several consecutive summers, results in far greater potential exposures than the application of pyrethroids to control adult mosquitos in typical District operations. In this study, the use of two independent sets of data (demographic data and spray event data) cannot reliably provide a clear cause and effect because other nonpesticide related effects can contribute to the onset of DD and ASD.

Although the onset of ASD/DD is considered to have a large genetic component, the study of potential links of environmental and chemical factors to the onset of DD and ASD continue to address numerous other potential causes that confound the results of the studies. Many of the possible links to the onset of DD and ASD include numerous factors that have been suggested as contributing to autism (Lyall et al. 2014; Frietag 2007). Some of the suggestions for factors to consider include some foods, heavy metals, infectious diseases, smoking, drugs, pesticides, certain vitamin deficiencies, vaccines, solvents, and even emotional neglect. The list of possible factors that could influence the onset of DD and ASD indicated by the authors illustrates the contributions to adverse effects and onset of DD and ASD cannot easily be determined and separated from the other factors.

“However, the findings do not prove that aerial pesticides raise the risk of autism,” stressed lead researcher Dr. Steven Hicks, a pediatrician at Penn State Milton S. Hershey Medical Center, in Hershey, PA. "This study really brings up more questions than answers," he said. "We need more research before taking any public action on pesticide use."

Discussion of this issue is included in Section 7.2.7.2.2 of the revised draft PEIR.

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Zhang, C., X. Hu, J. Luo, Z. Wu, L. Wang, B. Li, Y. Wang, and G. Sun. 2015. Degradation dynamics of glyphosate in different types of citrus orchard soils in China. *Molecules* 20: 1161-1175.

Attachment A – Literature Review

Evaluations of many of the studies cited in (or consulted for) the responses to public comments for the District's Revised Draft PEIR are provided below.

Adams MJ, Miller DAW, Muths E, Corn PS, Grant EHC, Bailey LL, et al. 2013. Trends in Amphibian Occupancy in the United States. PLoS ONE 8(5).

These authors conducted an analysis of the rate of change in the probability that amphibians occupy ponds and other comparable habitat features across the United States. They report that overall occupancy by amphibians declined 3.7% annually from 2002 to 2011. Species that are of concern are said to have declined an average of 11.6% annually. Their computer modeling approach is used to suggest that amphibian declines may be more widespread and severe than previously realized. However, this report is based on extrapolation of probability to reach their conclusions.

Agriculture and Agri-Food Canada. 2013. Results of the Canadian Crop Protection Survey. Available online at http://www.agr.gc.ca/eng/about-us/offices-and-locations/pest-management-centre/publications-and-newsletter/results-of-the-canadian-crop-protection-survey/?id=1187969993038.

A national publication directed toward Canadian farmers and businesses produce the best possible food and agriculture products. Through numerous programs and services the publication summarizes the efforts to support innovation, sustainable farming, business development, managing risk, trade and market development.

American Beekeeping Association's American Bee Journal. 2107. July issue available online at http://www.americanbeejounal.com.American Beekeeping Federation. 2016. Newsletters outlining steps by USDA and others to increase habitat areas and provide conditions for robust bee colonies. Available online at http://www.abfnet.org/.

Bee keeper publication that provides current information on the bee keeping industry, changes in regulations, articles by practicing bee keepers and regulators that is intended for the use of commercial and other bee keepers about the status of honey production, possible bee impacts of pesticides and other factors. It is a current events publication in the bee keeper's world.

Amweg, E.L., D P. Weston, C.S. Johnson, J. You, and M.J. Lydy. 2006. Effect of piperonyl butoxide on permethrin toxicity in the amphipod Hyalella azteca. Environmental Toxicology and Chemistry 25:1817-1825.

This report compares PBO and pyrethroid residues and impacts that potentially co-occur in urban creeks, this study determined if environmental levels of PBO were capable of synergizing pyrethroids in the environment. Three types of toxicity tests were conducted with the amphipod Hyalella azteca to determine the minimum PBO concentration required to increase toxicity of the pyrethroid permethrin: Sediment was spiked with permethrin only; permethrin and overlying water spiked with PBO; and permethrin, PBO, and overlying water spiked with PBO. These results suggest that environmental PBO concentrations rarely, if ever, reach concentrations needed to increase pyrethroid toxicity to sensitive organisms, though available data on environmental levels are very limited, and additional data are needed to assess definitively the risk.

Andrewartha, H.G. 1972. Introduction to the Study of Animal Populations. 2nd edition. University of Chicago Press.

The book is a feneral text used in many population ecology and population dynamics courses at the university level. It is a compendium of chapters dedicated to addressing the potential interactions of the numerous environment, habitat, disease, and reproduction aspects that drive population success and/or failure. Although it is a general text, it provides many of the basics of populations of animals across most species. A key discussion included is the general basis for population disruption and extinction.

Antunes-Kenyon, S. and G. Kennedy. 2001. Methoprene: A review of the impacts of the insect growth regulator methoprene on non-target aquatic organisms in fish bearing waters (Ver. 2.0). Prepared for Massachusetts Pesticide Board Subcommittee. August.

Address limb regeneration and molting ability of a crustacean indicator species, Uca pugnax. A runoff event simulation with permethrin contaminated sediment found that U. pugnax experienced induction of hepatopancreas glutathione S-transferase activity while respiration and hemolymph osmolarity did not vary. This detoxification enzyme a generalist biomarker. Claims that chronic methoprene exposure at environmental concentrations caused increased male abnormal regenerative limbs and delays in proecdysis. Both male and female crabs displayed increased variability in water-soluble exoskeleton protein possibly affecting exoskeleton quality. In addition, males displayed 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 resilience by only experiencing reduced carapace size gain and increased respiration rate, possibly due to increased metabolic and biotransformation of both pesticides. Claims that inputs of insect growth regulators, pyrethroid insecticides or their mixture into coastal wetland environments pose a risk to crustacean physiology, fitness, and sensitive growth processes.

Arnason, Robert. 2015. Beekeepers produce bumper honey crops. Statistics Canada. December. As also reported in *The Western Producer Bee Keeper Journal*.

Bee keeper journal article intended for the use of commercial and other bee keepers about the status of honey production, possible bee impacts of pesticides, and other factors. It is a current events journal of interest in the bee keeper's world.

Aspelin, A.L. Pesticide usage in the United States: Trends During the 20th Century. *CIPM Technical Bulletin* 105. February.

Reports on the urban vector control applications, indicating that there are numerous sources of pesticides found in urban creeks including structural uses, ant control applications, and homeowner applications to lawns.

Barberis, C.L., C.S. Carranza, S.M. Chiacchiera, and C.E. Magnoli. 2013. Influence of herbicide glyphosate on growth and aflatoxin B1 production by Aspergillus section Flavi strains isolated from soil on in vitro assay. *Journal of Environmental Science and Health*, Part B, 48(12), 1070-1079. (On toxic fungi appearing in soil sprayed with glyphosate).

These authors report on the effect of six glyphosate concentrations on growth rate and aflatoxin B1 (AFB1) production by Aspergillus section Flavi strains under different water activity (aW) on maize-based medium. In general, the lag phase decreased as glyphosate concentration increased and all the strains showed the same behavior at the different conditions tested. They suggest that at high concentrations glyphosate significantly increased the growth of all Aspergillus section Flavi strains. Aflatoxin B1 production did not show noticeable differences among different pesticide concentrations assayed at all aW in both strains. This study has shown that these Aspergillus flavus and A. parasiticus strains are able to grow effectively and produce aflatoxins in high nutrient status media over a range of glyphosate concentrations under different water activity conditions.

Barberis, C.L., C.S. Carranza, S.M. Chiacchiera, and C.E. Magnoli. 2013. Influence of herbicide glyphosate on growth and aflatoxin B1 production by Aspergillus section Flavi strains isolated from soil on in vitro assay. Journal of Environmental Science and Health Part B, 48(12): 1070-1079.

The effect of six glyphosate concentrations on growth rate and aflatoxin B1 (AFB1) production by Aspergillus section Flavi strains under different water activity (aW) on maize-based medium was investigated. In general, the lag phase decreased as glyphosate concentration increased and all the strains showed the same behavior at the different conditions tested. The glyphosate increased significantly the growth of all Aspergillus section Flavi strains in different percentages with respect to control depending on pesticide concentration. At 5.0 and 10 m this fact was more evident; however significant differences between both concentrations were not observed in most strains. Aflatoxin B1 production did not show noticeable differences among different pesticide concentrations assayed at all aW in both strains. This study has shown that these Aspergillus flavus and A. parasiticus strains are able to grow effectively and produce aflatoxins in high nutrient status media over a range of glyphosate concentrations under different water activity conditions.

Bee Culture, The Magazine of American Beekeeping. 2017. April issue available online at http://www.beeculture.com/category/2017/apr-2017/.

Bee keeper journal article intended for the use of commercial and other bee keepers about the status of honey production, possible bee impacts of pesticides, and other factors. It is a current events in the bee keeper's world.

Beutenmuller, W. 1890. The destruction of the mosquito. In Dragonflies vs Mosquitoes: Can the Mosquito Pest be Mitigated. Studies in the Life History of Irritating Insects, Their Natural Enemies and Artificial Checks, R.H. Lamborn, pp 99-127. New York: D. Appleton and Co.

An early monograph on biological control of medical pests and vectors published prior to the turn of the last century. At that time the possible use of dragonflies as natural enemies for the control of mosquitoes was clearly recognized. However, as indicated in the monograph, the difficulties associated with the colonization and management of these insects quickly extinguished any idea for the practical use of these predators for mosquito control. The monograph memorializes some of the early methods of biological vector control, based generally on natural predator/prey principles. The genesis of the technique then focused on the mosquitofish Gambusia affinis which was used for biological control. This fish was much easier to deal with than dragonflies, was quickly utilized and transported throughout the world during the early decades of this century in attempts to control mosquitoes.

Bradbury, Steven, Director OPP. 2013. Transmission letter from Fred Jenkins (FIFRA) on Pollinator Protection Labeling for Nitroguanidine Neonicotinoid Products. USEPA letter to registrants, August 15, 2013.

Letter available from the USEPA head of Pesticides Programs to be aware of the potential for new restrictions about the use and availability of existing pesticides with neonicotinoid properties and the requirement to include new tests in the registration process.

Brodman, R., W.D. Newman, K. Laurie, S. Osterfeld, and N. Lenzo 2010. Interaction of an aquatic herbicide and predatory salamander density on wetland communities. *Journal of Herpetology* 44(1):69-82.

Report suggesting that pesticides could have unintended impacts on amphibians These authors conducted a replicated field experiment in constructed ponds to test for both the effects of Accord and predator (Tiger Salamanders, *Ambystoma tigrinum*) density on amphibians and aquatic invertebrates. Herbicide treatment had significant density-dependent effects on Tiger Salamander growth, development, and survival. The survival of anurans and aquatic invertebrates was also affected by herbicide treatment and predator density. These results suggest that competition and predation may mediate indirect effects of this herbicide on the aquatic fauna. They conclude that exposure to Accord poses less of a risk to the ecology of amphibians than do other formulations of glyphosate-based herbicides.

Brown, Matt. 2014. Drought may be taking toll on bees in Sonoma. *The Press Democrat*, June 28. Available online at http://www.pressdemocrat.com/csp/mediapool/sites/PressDemocrat/News/story.csp?cid=237153 2&sid=555&fid=181.

Publication in the newspaper (online) Press Democrat of Sonoma suggesting that the perceived loss of bees in the county and elsewhere may be related to the extreme drought conditions in California and particularly in the Sonoma area. The article was based on information in the UC Davis publication series on bees and agriculture. This is a hypothetical comment that is focused on the loss of bees reported associated with drought conditions in the agricultural communities of California.

California Department of Pesticide Regulation (CDPR) 1995. California State Plan for Protection of Endangered Species from Pesticide Exposure. September 13.

The purpose of this plan is to protect federally listed endangered species in California from potentially harmful pesticide exposures, incorporating federal protection strategies or developing alternative local plans where needed. This Plan includes all federally listed species designated threatened, endangered, proposed threatened, proposed endangered and Category 1 candidate species in California and will address new listings on an ongoing basis. This plan includes all federally listed species designated threatened, endangered, proposed threatened, proposed endangered and other candidate species in California. This plan includes all pesticides registered for use in California and all types of registrations including new active ingredients, experimental use permits, and emergency exemptions.

California Department of Fish and Game. 2002. California Red-Legged Frog (Rana aurora draytonii). Department of Pesticide Regulation, Endangered Species Project.

A California state publication of the CFG that provides all the demographics of the red legged frog in California, including its behaviors, range, habitat, food preferences, potential predators, reproduction, mortality influences, and pesticide concerns. This is good, publicly available pamphlet that provides guidance for those who might be interested in studying or preserving this species.

California Department of Public Health (CDPH) and Mosquito and Vector Control Association of California (MVCAC). 2012. Best Management Practices for Mosquito Control in California-Recommendations. Available online from CDPH, Vector-Borne Disease Section at http://www.cdph.ca.gov/HealthInfo/discond/Pages/MosquitoBorneDiseases.aspx or http://www.westnile.ca.gov/resources.php under the heading Mosquito Control and Repellent Information. July.

Outlines and summarizes California guidelines and regulations for municipalities in their vector control programs. Provides regulatory information needed to assign appropriate vector control techniques that do not violate reasonable state pollution and pesticide regulation practices.

California State Water Resources Control Board (SWRCB). 2011. Water Quality Order No. 2011-0002-DWQ, Permit for Biological and Residual Pesticide Discharges to Waters of United States from Vector Control Applications. NPDES General Permit No. CAG 990004. Available online at http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2011/wqo2011_0002.pdf.

The State guidelines for water discharge by all potential sources of discharge of pollutants of all categories into waters of the State. These guidelines must be adhered to, discharges monitored for reporting, and documentation must be available.

California State Water Resources Control Board (SWRCB). 2014. State Water Resources Control Board Order 2014-0038-EXEC Amending Monitoring and Reporting Program for Water Quality Order 2011-0002-DWQ General Permit No. CAG 990004 (as Amended by Order 2012-0003-DWQ) Statewide National Pollutant Discharge Elimination System Permit for Biological and Residual Pesticide Discharges to Waters of the United States from Vector Control Applications. Available online at http://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/docs/vectorcontrol/2012-0003-dwq/vcp_amended_mrp.pdf.

The State guidelines for water discharge by all potential sources of discharge of pollutants of all categories into waters of the State. These guidelines must be adhered to, discharges monitored for reporting, and documentation must be available.

Canadian Council of Ministers of the Environment. 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life. Methoprene. Available online at http://ceqg-rcqe.ccme.ca/download/en/192.

Listing of Methoprene target levels for risk… 0.09 target organism, and 0.53 management value. This document provides an official Canadian viewpoint on the potential toxicity and safe exposure levels for methoprene in Canada.

Csondes, A. 2004. Environmental Fate of Methoprene. 6 pp whitepaper prepared by CDPR. Available online at http://www.cdpr.ca.gov/docs/emon/pubs/methofate.pdf.

Review of methoprene characteristics, physiochemical etc., includes tables of toxicity and properties. Methoprene disrupts the insects' metamorphosis and life cycle, thus hindering their ability to reach adulthood and successful reproduction. Special slow-release formulations are commonly used for mosquito control, especially breeding in floodwater sites, rice cultivations, storm drains, ponds, and water treatment works.

Davis, R.S., R.K.D. Peterson, and P.A. Macedo. 2007. An Ecological Risk Assessment for Insecticides used in adult mosquito management. *Integrated Environmental Assessment and Management* 3 (3): 373–382.

This author developed a deterministic ecological risk assessment focused on 6 common mosquito adulticides used in vector control, including 3 pyrethroids (phenothrin, resmethrin, and permethrin), pyrethrins, and 2 organophosphates (malathion and naled). Piperonyl butoxide, a synergist for the pyrethroids, was also assessed. Both aquatic and terrestrial nontarget organisms were considered for acute and chronic exposures to the adulticides. Tier I exposure estimates were derived from ISCST3 and AERMOD for deposition and air concentrations affecting terrestrial organisms and PRZM-EXAMS for standard pond concentrations affecting aquatic organisms. Nontargets exposed to adulticides included small mammals, birds, as well as aquatic vertebrates and invertebrates in a pond subject to receiving the chemical via drift and runoff. Risk quotients were obtained by comparing exposures to toxic endpoints. All risk quotients were low indicating that risks to ecological receptors most likely were small.

Davis, R.S., and R.K.D. Peterson. 2008. Effects of single and multiple applications of mosquito insecticides on nontarget arthropods. *Journal of the American Mosquito Control Association* 24(2):270-280.

These authors conducted two studies during the late summers of 2004 through 2006 at Benton Lake National Wildlife Refuge near Great Falls, MT. in 2004 and 2005 to assess 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 second experiment was conducted in 2005 and 2006 to assess longer-term impacts of permethrin on nontarget terrestrial arthropods after multiple repeated applications. For aquatic samples, in the first study, no overall treatment effects were observed. Three response variables were associated with fewer individuals present in the insecticide-treated plots in a multivariate analysis. For the multiple-spray study conducted in 2005 and 2006, six of the response variables collected via sticky cards exhibited significant overall treatment effects, but none was associated with fewer individuals in the insecticide-treated plots. None of the responses collected using sweep-net sampling suggested overall treatment effects. No discernable pattern was evident. In general, nearly all of the responses evaluated indicated few, if any, deleterious effects from insecticide application.

Degitz, S.J., E.J. Durhan, J.E. Tietze, P.A. Kosian, G.W. Holcombe, and G.T. Ankley. 2003. Developmental toxicity of methoprene and several degradation products in *Xenopus laevis. Aquatic Toxicol.* June; 64 (1):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. Some claims 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 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, 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. The five test chemicals had differential stability in aqueous solution that was in some instances affected by the presence of test organisms. 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.**

DeGrandi-Hoffman, G., H. Graham, and F. Ahumada. 2017. Are dispersal mechanisms changing the host-parasite relationship and increasing the virulence of Varroa destructor (Mesostigmata: Varroidae) in managed honey bee (Hymenoptera: Apidae) colonies. Entomological Society of America Aug 1;46(4):737-746.

Varroa is a parasite of concern to bee keepers and farmers that utilize bee colonies to pollinate their crops. This study reports an 11-month longitudinal study, in which they applied multiple miticide treatments, resulting in mite numbers that remained high and bee colony losses exceeded 55%. High mortality from varroa in managed apiaries is a departure from the effects of the mite in feral colonies where bees and varroa can coexist. These authors suggest that differences in mite survival strategies and dispersal mechanisms may be contributing factors. In feral bee colonies, mites can disperse through swarming. In managed apiaries, where swarming is reduced, mites disperse on foragers robbing or drifting from infested hives. They demonstrated that yearly swarming curtails varroa population growth, enabling colony survival for >5 yr. Without swarming, colonies collapsed by the third year. To disperse, varroa must attach to foragers that then enter other hives. These authors hypothesize that stress from parasitism and virus infection combined with effects that viruses have on cognitive function may contribute to forager drift and mite and virus dispersal. We also hypothesize that drifting foragers with mites can measurably increase mite populations. Simulations initialized with field data indicate that low levels of drifting foragers with mites can create sharp increases in mite populations in the fall and heavily infested colonies in the spring. We suggest new research directions to investigate factors leading to mite dispersal on foragers, and mite management strategies with consideration of varroa as a migratory pest.

de María, N., J.M. Becerril, J.I. García-Plazaola, A. Hernandez, M.R. De Felipe, and M. Fernandez-Pascual. 2006. New insights on glyphosate mode of action in nodular metabolism: Role of shikimate accumulation. J. Agric Food Chem. April 5;54(7):2621-8.

These authors tested the short-term effects of glyphosate on the growth, nitrogen fixation, carbohydrate metabolism, and shikimate pathway in leaves and nodules of nodulated lupine plants. All glyphosate treatments decreased nitrogenase activity rapidly (24 h) after application, even at the lowest and sublethal dose used (1.25 mM). This early effect on nitrogenase could not be related to either damage to nitrogenase components (I and II) or limitation of carbohydrates supplied by the host plant. These effects were accompanied by inhibition of the activity of phosphoenolpyruvate carboxylase (PEPC). There were rapid effects on the increase of shikimic and protocatechuic (PCA) acids in nodules and leaves after herbicide application. On the basis of the role of shikimic acid and PCA in the regulation of PEPC, as potent competitive inhibitors, this additional effect provoked by glyphosate on 5-enolpyruvylshikimic-3-phosphate synthase enzyme (EPSPS; EC 2.5.1.19) inhibition would divert most PEP into the shikimate pathway, depriving energy substrates to bacteroides to maintain nitrogen fixation. They suggest that these findings provide a new explanation for the effectiveness of glyphosate as an herbicide in other plant tissues, for the observed differences in tolerance among species or cultivars, and for the transitory effects on glyphosate-resistant transgenic crops under several environmental conditions.

De Roos, A.J., A. Blair, J.A. Rusiecki, J.A. Hoppin, M. Svec, M. Dosemeci, D.P. Sanler, and M.C. Alavania. Cancer incidence among glyphosate-exposed pesticide applicators in the Agricultural Health Study, *Environmental Health Perspectives* Jan;113 (1).

These authors evaluated associations between glyphosate exposure and cancer incidence in the Agricultural Health Study (AHS), a prospective cohort study of 57,311 licensed pesticide applicators in Iowa and North Carolina. Detailed information on pesticide use and other factors was obtained from a self-administered questionnaire completed at time of enrollment (1993–1997). Among private and commercial applicators, 75.5% reported having ever used glyphosate, of which > 97% were men. In this analysis, glyphosate exposure was defined as a) ever personally mixed or applied products containing glyphosate; b) cumulative lifetime days of use, or “cumulative exposure days” (years of use × days/year); and c) intensity-weighted cumulative exposure days (years of use × days/year × estimated intensity level). Poisson regression was used to estimate exposure–response relations between glyphosate and incidence of all cancers combined and 12 relatively common cancer subtypes. Glyphosate exposure was not associated with cancer incidence overall or with most of the cancer subtypes we studied. There was a suggested association with multiple myeloma incidence that should be followed up as more cases occur in the AHS.

Devon, L.J., Staff Writer (nonscientist). Pesticides and herbicides like glyphosate now strongly linked to Parkinson's disease and other neurological disorders. Natural News**, Tuesday, March 08, 2016.**

This article is representative of the many non-peer reviewed reports that provide an overview of some of the current interest in and concern about pesticides in human and ecological health. The focus of this report is glyphosate and its possible role in the adverse impacts on genetics and gene modification. The report claims that glyphosate and other herbicides may be altering the normal sequences of gene expression and impacting the natural responses of the gut to foods. While this is the theme of the report, it appropriately includes the suggestion that other factors such as antibiotics, vaccines, formaldehyde, MSG, mercury, as some other chemicals may adversely impact normal gene expression. The report relies on extrapolations of the results of extreme exposures to pesticides (over extended periods of time) to conclude that there is a linkage to Parkinson’s. As is the case with most of the similar studies evaluated, the reliance on secondary and indirect relationships in studies on environmental impacts, and especially those addressing human health, can provide some potential correlations; but without a clearly determined exposure, there can be no clear causality.

Diamanti-Kandarakis, E., J.P. Bourguignon, L.C. Giudice, R. Hauser, G.S. Prins, A.M Soto, R.T. Zoeller, and A.C. Gore. 2009. Endocrine Disrupting Chemicals: an Endocrine Society Scientific Statement. Endocr Rev. Jun; 30 (4): 293-342.

> Scientific Statement of The Endocrine Society suggesting that there is evidence that endocrine disruptors (EDCs) have effects on male and female reproduction, breast development and cancer, prostate cancer, neuroendocrinology, thyroid, metabolism and obesity, and cardiovascular endocrinology. Results from animal models, human clinical observations, and epidemiological studies converge to implicate EDCs as a significant concern to public health.

The statement includes support for the concept that EDCs represent a broad class of molecules such as organochlorine pesticides and industrial chemicals, plastics and plasticizers, fuels, and many other chemicals that are present in the environment or are in widespread use. The Society makes a number of recommendations to increase understanding of effects of EDCs, including enhancing increased basic and clinical research, invoking the precautionary principle, and advocating involvement of individual and scientific society stakeholders in communicating and implementing changes in public policy and awareness.

Emlen, J.M. 1989. Terrestrial population models for ecological risk assessment: a state of the art review. *Environmental Toxicology and Chemistry* 8 [9]: 831-842.

Presents a series of computer based population models for terrestrial species populations and the hypothetical interactions between behavior, fecundity, foraging techniques, predator/prey impacts and includes numerous constructs that can be used to project potential reproduction rates, mortality, and population extinction likelihood.

Emlen, J.M., D.C. Freeman, M.D. Kirchhoff, C.L. Alados, J. Escos, and J.J. Duda. 2003. Fitting population models from field data. Ecological Modelling 162: 119-143.

A study of the potential for field data from other authors to fit and modify or validate the population theories presented in Emlen et al., 1985 and their other earlier publications that present computer based population models for terrestrial species populations and the hypothetical interactions between behavior, fecundity, foraging techniques, predator/prey impacts and includes numerous constructs that can be used to project potential reproduction rates, mortality, and population extinction likelihood.

Extension Toxicology Network (EXTOXNET). 1995. Pesticide Information Profile. Methoprene. Available online at http://pmep.cce.cornell.edu/profiles/extoxnet/haloxyfop-methylparathion/methoprene-ext.html.

Information and suggested toxicity data used to determine the potential toxicology issues to outline the possible impacts of these pesticides on several species.

Felt, E.P. 1904. Mosquitoes or Culicidae of New York State. New York State Museum Bulletin 79, pp 241-400.

Early monograph describing the species of mosquito found in New York at the turn of the century. This and other monographs of the time provided the basic information about mosquito species that has been used as a basic tool since its publication.

Fishel, F.M. 2005. Pesticide toxicity profile: neonicotinoid pesticides. UF/IFAS EDIS Document PI-80. Available online at http://edis.ifas.ufl.edu/pi087.

This document provides an excellent, comprehensive, and general overview of human toxicity, a listing of laboratory animal and wildlife toxicities, and a cross-reference of chemical, common, and trade names of many neonicotinoid pesticides registered for use in Florida. Along with the toxicity information of LD50, LC50 and dermal toxicity for five common neonicotinoids, he addresses humans and wildlife, the author has a section directed specifically to the issue of toxicity to bees and the perceptions of colony collapse disorder (CCD). This document is PI-80, one of a series of the Pesticide Information Office, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida.

Fleeger, J.W. K.R. Carman, and R.M. Nisbetl. 2003. Indirect effects of contaminants in aquatic ecosystems. The Science of the Total Environment 317: 207-233.

The focus of this study is the determination of the impact that contaminants may exert via direct effects on keystone facilitator and foundation species, and how contaminant-induced changes in nutrient and oxygen dynamics may alter ecosystem function. Thus, populations and communities in nature may be directly and/or indirectly affected by exposure to pollutants. While the direct effects of toxicants usually reduce organism abundance, indirect effects may lead to increased or decreased abundance. They provide the results of the review of 150 papers that reference indirect toxicant effects in aquatic environments. The authors state that contaminant-induced changes in behavior, competition and predation or grazing rate can alter species abundances or community composition, and enhance, mask or spuriously indicate direct contaminant effects. Trophic cascades were found in 60% of the manipulative studies and, most commonly, primary producers increased in abundance when grazers were selectively eliminated by contaminants. Indirect contaminant effects may have profound implications in environments with strong trophic cascades such as the freshwater pelagic. In spite of their undesirable environmental influence, these authors suggest that contaminants can be useful manipulative tools for the study of trophic and competitive interactions in natural communities.

Frasier, W.D., and G. Jenkins. 1972. The acute contact and oral toxicities of CP67573 and MON2139 to worker honey bees. Unpublished report 4G1444 submitted to United States Environmental Protection Agency by Monsanto Company, prepared by Huntingdon Research.

Report submitted by Monsanto as part of the data requirements for registration of glyphosate while it was still in consideration for registration. The numeric identities are the pre-submission designations used by chemical companies to disguise the potential product prior to actual registration. This is a data set submitted on the tests of direct contact of glyphosate to honeybee thorax. The results indicate that direct thoracic contact of glyphosate to honeybee thorax with a cotton tip indicated “practically non-toxic to honeybees”.

Frietag, C.M. 2007. The genetics of autistic disorders and its clinical relevance: a review of the literature. Molecular Psychiatry 12: 2-22.

Although the onset of ASD/DD is considered to have a large genetic component, the study of potential links of environmental and chemical factors to the onset of DD and ASD continue to address numerous other potential causes that confound the results of the studies. Many of the possible links to the onset of DD and ASD include numerous factors that have been suggested as contributing to autism. Some of the suggestions for factors these authors suggest to consider include some foods, heavy metals, infectious diseases, smoking, drugs, pesticide, certain vitamin deficiencies, vaccines, solvents and even emotional neglect. The list of possible factors that could influence the onset of DD and ASD indicated by the authors illustrates the contributions to adverse effects and onset of DD and ASD cannot easily be determined and separated from the other factors. Overall, the findings reported by these authors are not relevant to the specific pesticide application scenarios or the application techniques (low-volume spraying and ULV aerosols) used by the District. Aerial spraying in nearby areas, as depicted in the report, over several consecutive summers, results in far greater potential exposures than the application of pyrethroids to control adult mosquitos in typical District operations. In this study, the use of two independent sets of data (demographic data and spray event data) cannot reliably provide a clear cause and effect because other non-pesticide related effects can contribute to the onset of DD and ASD.

Genetic Literacy Project. 2015. There's No Wild Bee Colony Collapse Either. Ecology and Zoology, August 25, 2015.

A critical review of the reported colony collapse disorder (CCD) as presented in the press and by some magazines and news outlets. This review provides a series of rebuttals and information that counters the claims that the CCD is a significant, major issue and that bees are about to disappear from the planet. In a series of directed responses the authors synthesize the facts as they relate to the problems posed by environmental impacts. They content that emerging facts about the health of the global bee population were changing our understanding about pollinators and food. The data showed recent growth, and not a decline, in the number of commercial hives throughout the United States and the world.

Henrick, C.A., J. Ko, J. Nguyen, J. Burleson, G. Lindahl, D. Van Gundy, and J.M. Edge. 2002. Investigation of the relationship between s-methoprene and deformities in anurans. 2002. *Journal of the American Mosquito Control Association* 18(3):214-221

Reports on their acute toxicity tests that incorporated direct applications of methoprene to jugs of pondwater that resulted in unrealistic exposures when the test species was introduced to the jugs as the test medium. Reported that methoprene is toxic to amphibians, such as frogs, toads, and salamanders but at relatively high exposure concentrations. A comparison of reported Altosid use with reported frog deformities in Minnesota demonstrate that a connection between frog deformities and Altosid use is unlikely". These results indicated that factors other than s-methoprene and its degradation products are contributing to the recent outbreak of frog deformities. Their acute toxicity tests that incorporated direct applications of methoprene to jugs of pondwater resulted in unrealistic exposures when the test species was introduced to the jugs as the test medium. These authors report that methoprene is toxic to amphibians, such as frogs, toads, and salamanders but at relatively high exposure concentrations

Herbert, L.T., D.E. Vázquez, A. Arenas, and W.M. Farina. 2014. Effects of field-realistic doses of glyphosate on honeybee appetitive behavior. Journal of Experimental Biology 217: 3457-3464 (October).

These authors report on studies of the effects of field-realistic doses of glyphosate (GLY) on honeybees exposed chronically or acutely to the herbicide. They report several behavioral endpoints such as sucrose sensitivity, elemental and non-elemental associative olfactory conditioning of the proboscis extension response (PER), and foraging-related behavior. They report a reduced sensitivity to sucrose and learning performance for the groups chronically exposed to GLY concentrations within the range of recommended doses. They suggest that when olfactory PER conditioning was performed with sucrose reward with the same GLY concentrations (acute exposure), elemental learning, and short-term memory retention decreased significantly compared with controls. Other behavioral response changes are reported after an acute exposure to GLY directly on contact surfaces. They speculate that GLY at the concentrations they used (said to be in agro-ecosystems after standard spraying such as reduced sensitivity to nectar reward and impaired associative learning in honeybees. However, no effect on foraging related behavior was found. They therefore speculate that successful forager bees could become a source of constant inflow of nectar with GLY traces that could then be distributed among the nest that might have consequences on colony performance. Although the hypothesis of these authors predicted that honeybee behaviors would be adversely impacted after exposure to the herbicide glyphosate, the behaviors they studied were not adversely affected by the exposures and their conclusion was "no effect on foraging related behavior was found in these behavioral studies. The implied impact on bee colonies by contact with glyphosate (resulting in sublethal effects that adversely impact behaviors and, therefore, the ability of the colony to maintain the hive and transfer the honey within the colony) is not supported because the bees were physically dosed at substantially higher levels and physical contact than would be encountered in the field.

Hershey, A.E, A.R. Lima, G.J. Niemi, and R.R. Regal. 1997. Bti and methoprene nontarget risks. An 8-year study in Minnesota wetlands. *Ecological Applications* 8 (1) 41-60.

These authors presented the results of their studies that began in1997 (*Ecological Applications: Vol. 8, No. 1, pp. 41–60*) at the 2002 conference of the MAMCA where they reported the results of the effects of the mosquito larvicides methoprene and Bacillus thuringiensis israelensis (Bti) on the benthic macroinvertebrate communities of 27 wetland ecosystems in Wright County, Minnesota. These larvicides are generally considered safe for nontarget species. After 3 yr of preliminary investigations, including 2 yr of intensive sampling, larvicide treatments were applied during 1991–1993. Nine of the wetlands were experimentally treated with methoprene and an additional set of nine wetlands were treated with Bti. While nine wetlands were left untreated to serve as a control treatment. In general, insecticide treatment had minimal effects on nontarget groups during the first treatment year. They report that in 1992 highly significant reductions due to both methoprene and Bti were observed in several insect groups. Predatory insects were reduced on methoprene-treated sites but not Bti-treated sites in 1992. Effects were observed broadly across insect taxa, Diptera, were affected most strongly, especially the dipteran suborder Nematocera, which included Chironomidae. Minimal effects on noninsect macroinvertebrates were observed. Bti- and methoprene-treated sites also showed a reduction in richness of insect genera and an increased tendency to be dominated by one or a few genera.

These authors suggest that both indirect effects and direct toxicity likely contributed to the observed differences in the target and nontarget species. Bti is likely to be directly toxic only to nematoceran Diptera; thus effects of Bti on other insect groups may have resulted from disruption of the invertebrate food web. Methoprene is more broadly toxic; thus observed methoprene effects on non nematoceran groups may have been due to either direct toxicity or food web effects, or both. They suggest that the observed 2–3 yr lag time in response of nontarget insects to larvicide treatment may require longer term studies to evaluate the safety of these larvicides.

Hicks, S.D., Vignesh Doraiswamy, Katherine Fry, and Eric Wohlford. 2016. Aerial Pesticide Exposure Increases the Risk of Developmental Delay and Autism Spectrum Disorder. Abstract No. 1508.488. The Pediatric Academic Societies Meeting, Baltimore, MD,

The authors suggest that pesticides are one of the environmental factors implicated in DD and ASD. They emphasize, however, that the influence of the timing and route of pesticide exposure on the risk of ASD/DD is not well defined.

The abstract submitted for consideration provides a hypothesis for one of the many possible causes of DD and ASD, attempting to link exposure from aerial pesticide applications to the onset of these two disorders. The objective of the study was to determine the potential link of the onset of these disorders to the annual aerial applications of pyrethroid pesticide used to combat mosquito-borne encephalitis in in a Central New York area each summer from March 2010 to March 2015. The authors contend specifically that the use of aerial applications of the pesticide may be correlated to the onset of these disorders; while they report that there is no correlation to use of non-aerial, standard application techniques such as spreading granules or using hoses with controlled droplet application, especially by commercial applicators.

The study methodology is based on use of retrograde demographic reports of DD and ASD from test and control areas and using statistical comparisons to parse out the possible relation of aerial applications to the reported onset data of DD and ASD. Using areas not associated with aerial spraying as control groups, the authors found no significant difference between aerial-exposed and control groups in parameters such as the number of children, overall births, premature births, poverty level, or child sex. The referral rate from aerial-exposed zip codes was lower for all 4 control diagnoses. The aerial-exposed zip codes had higher levels of total pesticide exposure but no difference in pesticide use per square km. The authors calculated that the relative risk of ASD/DD for children in zip codes with aerial spraying was approximately 25% higher than in areas with no aerial spraying. There were no other relevant effects evaluated or reported, including the gestational age during aerial spraying and DD/ASD prevalence. Numerous statistical comparisons are presented using the demographic data, but there is no discussion of the numerous other environmental and exposure factors that could contribute to the results. For instance, there is no indication that several potential factors (according to the decades of research) such as lead in the drinking water, local sources of contamination, activities in the community, etc., result in substantial adverse impacts to public health. Hence, the timing and actual exposures to suspect chemicals and other contributing factors cannot be determined in the study. The common error in many demographic studies such as this is that correlation is not always causality. The linkages suggested by the authors do not show a clear, unambiguous causality. The findings reported by these authors are not relevant to the specific pesticide application scenarios or the application techniques (low-volume spraying and ULV aerosols) used by the District. Aerial spraying in nearby areas, as depicted in the report, over several consecutive summers, results in far greater potential exposures than the application of pyrethroids to control adult mosquitos in typical District operations. In this study, the use of two independent sets of data (demographic data and spray event data) cannot reliably provide a clear cause and effect because other nonpesticide related effects can contribute to the onset of DD and ASD.

Hopwood, J., M. Vaughn, M. Shepherd, D. Biiddinger, E. Mader, S.H. Black, and C. Mazzacano. 2012. Are neonicotinoids killing bees. A review of research into the effects of neonicotinoid insecticides on bees, with recommendations for action. Xerces Society for Invertebrate Conservation. Hopwood,

A Xerces Society report on the condition and status of bees and bee colonies suggesting a connection of pesticides (especially neonicotinoids) to reductions in bee populations. They report that this class of pesticides can persist in soil for months after single application. They also suggest that residues can be found in pollen and nectar which are then consumer flower visiting insects such as bees in some situations concentrations of residues can reach me the levels if consumption is very high. They suggest that imidacloprid, clothianidin, dinotefuran, and thiamethoxam are highly toxic to honey bees while thiacloprid and acetamiprid are only mildly toxic to bees. The report focuses on the numerous factors that can impact the potential toxicity of neonicotinoids to bees and other pollinators with suggestions on how to minimize the potential for adverse effects. The authors suggest that Colony Collapse Disorder (CCD) may involve pesticides, but do not provide direct causal evidence in this report.

Howard, L.O. 1901. Mosquitoes; How They Live; How They Carry Disease; How They are Classified; How They May Be Destroyed. McLure, Phillips and Co., New York.

Early monograph describing the species of mosquito at the turn of the century. This and other monographs of the time provided the basic information about mosquito species that has been used as a basic tool since its publication.

Howard, L.O. 1910. Preventive and Remedial Work Against Mosquitoes. US Dept. of Agric., Bureau of Entomology, Bulletin 89.

Early monograph describing the species of mosquito at the time and provided some basic information about possible methods to control or eradicate mosquitos. This and other monographs of the time provided the basic information about mosquito species that has been used as a basic tool since its publication.

Huffington Post. Roundup, An Herbicide, Could Be Linked To Parkinson's, Cancer and Other Health Issues, Study Shows. June 25, 2013.

This study is taken from an article in the Huffington Post (not a scientific source) as reported by Reuters and is a secondary summary lifted from a study in the journal Entropy that lists the myriad of potential onset of Parkinson's due to exposure to glyphosate (Roundup) and is illustrative of the type of report common in the publication and television media that tend to extrapolate and extend the results of scientific publications without a critical evaluation of the study approach, actual exposures in the original report, or discussion of the implications in the real world. Unfortunately, reports such as this in the Huffington Post (which allows unfettered access to its publications) can result in inappropriate conclusions about the possible impacts of chemicals.

Janossy, Thomas. Ph.D. Parkinson's Disease: Caused by Glyphosate (Monsanto) and/or Trichloroethylene? Friday, 31 October 2014. In: Radix.com.

Radix.com supports a blog representing an anti-pesticide and anti-GMO environmental group with a clear agenda to eradicate pesticides and condemn any products that may be associated with GMOs or their offshoots. While the blog is clearly slanted to an anti-pesticide agenda, it includes discussion of some of the other factors that could be involved in the onset of Parkinson's. The author cites earlier work implicating bacterial infections and several extraneous factors such as dietary habits, other environmental exposures, and occupation in the possible links to the disease. Although the author of the blog includes the possibility of other, exogenous factors, he nevertheless implies that glyphosate is the culprit. Conveniently, the blog has several suggestions for commercial products that are available to alleviate the adverse effects of pesticides. The claims of such blogs must be considered critically in light of the products they recommend to the reader.

Johansson. M., H. Piha, and K.H. Merila. 2006. Toxicity of six pesticides to common frog (*Rana temporaria*) tadpoles. *Environ Toxicol Chem*. Dec;25(12):3164-70.

These authors tested the toxicity of six commonly used pesticides on Rana temporaria spawn and tadpoles. In acute tests, tadpoles were exposed to relatively high concentrations of azoxystrobin, cyanazine, esfenvalerate, MCPA ([4-chloro-2-methylphenoxy] acetic acid), permethrin, and pirimicarb for 72 h. Chronic exposure tests were performed from fertilization to metamorphosis with azoxystrobin, cyanazine, and permethrin at concentrations similar to those found in surface waters in agricultural areas in Sweden. The most lethal pesticides in these tests of acute exposure were azoxystrobin, permethrin, and pirimicarb. They report negative effects at high doses on the growth of the tadpoles were observed with azoxystrobin, cyanazine, and permethrin.

The chronic exposure at lower pesticide concentrations did not result in increased mortality or impaired growth. However, they report a positive effect of permethrin on growth and size at metamorphosis. The results suggest that the pesticides in these tests can inflict strong negative effects at high concentrations but have no or relatively weak effects on R. temporaria spawn or tadpoles at the low concentrations found in Swedish surface waters.

Keim, B. 2014. Beyond honeybees: now wild bees and butterflies may be in trouble. Science May 16. Available online at http://www.wired.com/2014/05/wild-bee-and-butterfly-declines.

Trade publication editorial suggesting that there is a critical negative impact on pollinators due to numerous United States Environmental and anthropogenic factors and that not only the trend of honeybee decline may also include the butterfly populations. The author suggests that the trends and perception of pollinator declines may be linked to some pesticide use, especially the neonicotinoids that are used in areas proximal to hives and butterfly foraging/habitat.

Kiesecker, J.K., A.R. Blaustein, and L.K. Belden 2001. Complex causes of amphibian population declines. *Nature* April 5; 410: 681-684.

Amphibian populations have suffered widespread declines and extinctions in recent decades. These authors suggest that pathogen outbreaks in amphibian populations in the western USA are linked to climate-induced changes in UV-B exposure. Using long-term observational data and a field experiment, we examine patterns among interannual variability in precipitation, UV-B exposure and infection by a pathogenic oomycete, Saprolegnia ferax. They indicate that climate-induced reductions in water depth at oviposition sites may have caused high mortality of embryos by increasing their exposure to UV-B radiation and, consequently, their vulnerability to infection They further suggest that factors such as precipitation, and thus water depth/UV-B exposure, elevated sea-surface temperatures could be the precursor for pathogen-mediated amphibian declines in many regions.

Lawler, S.P., and D. Dritz. 2013. Efficacy of spinosad in control of larval Culex tarsalis and chironomid midges, and its nontarget effects. Journal of the American Mosquito Control Association 29(4):352-357.

These authors reported that spinosad is an effective treatment for insect larvae but that it also “kills mayflies and other non-target insects”. They also reported that spinosad was effective against mosquitoes and midges for about a month and that spinosad caused mortality of mayflies and other nontarget insects. However, inspection of the results reported in this study indicate that spinosad was considerably less toxic to mayflies than to desired targets, and the minimal effects on mayflies were undetectable after 21 days

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.

Such deliberate consequences have been possible by the discovery and use of Juvenile Hormone Analogs (JHAs), the synthetic chemicals that mimic JH action, which have also been utilized as insecticides for several decades. Although there is limited use of JHAs for insect pest control, the list of new insect species susceptible to these compounds has been expanding revealing the potential for future use of this class of insecticides. The relatively fewer effects of JHAs on non-target insects and animals and favorable environmental fate of these compounds make them attractive insecticides.

Lawrence, K. 2016. Beehive thefts annoy beekeepers. NZ Farmer, October 1. Available online at http://www.stuff.co.nz/business/farming/agribusiness/84728125/bizarre-statistics-around-beehive-thefts--where-are-all-the-hives.

An article in the publication used by bee keepers and farmers that addresses one of the root problems with the real or perceived loss of bee numbers and bee populations. There is a real concern among the bee keepers that individuals are stealing bee hives and transporting them to other areas (farms) which results in the loss of bees, honey revenue, and future pollination of crops that incorporated the hives. This article discusses how some of the perception of colony collapse disorder may be, in part due to this problem.

Lyall, K.R., J Schmidt, and I. Hertz-Picciotto. 2014. Maternal lifestyle and environmental risk factors for autism spectrum disorders. Int. J. Epidemiol. Apr; 43 (2): 443-464.

These authors contend that there are numerous factors that influence the onset of autism disorders and review and summarize as a rebuttal to the reports that directly and causally link onset of these disorders to any single factor or environmental exposure. This paper reviews the evidence on modifiable preconception and/or prenatal factors that have been associated, in some studies, with autism spectrum disorder (ASD), including nutrition, substance use, and exposure to environmental agents. This review is restricted to human studies with at least 50 cases of ASD, having a valid comparison group, conducted within the past decade and focusing on maternal lifestyle or environmental chemicals. They report that higher maternal intake of certain nutrients and supplements has been associated with reduction in ASD risk via folic acid supplements. They challenge those who have suggested no impact of maternal smoking and alcohol use on ASD, they indicate more rigorous exposure assessment is needed. A number of studies have demonstrated significant increases in ASD risk with estimated exposure to air pollution during the prenatal period, particularly for heavy metals and particulate matter. Little research has assessed other persistent and non-persistent organic pollutants in association with ASD specifically. Conclusions: More work is needed to examine fats, vitamins and other maternal nutrients, as well as endocrine-disrupting chemicals and pesticides, in association with ASD, given sound biological plausibility and evidence regarding other neurodevelopmental deficits. They recommend that the field can be advanced by large-scale epidemiological studies and use of biomarkers and other means to understand underlying mechanisms.

Macedo, P.A., J.J. Schleier III, M. Reed, K. Kelley, G.W. Goodman, D.A. Brown, and R.K.D. Peterson. 2010. Evaluation of efficacy and human health risk of aerial ultra-low volume applications of pyrethrins and piperonyl butoxide for adult mosquito management in response to West Nile Virus activity in Sacramento County, California. Journal of the American Mosquito Control Association 26(1):57–66.

This publication is an excellent example of using risk techniques to consider the risk of the public health concerns of insect vectors of disease vs the risk of the use of the insecticide used to remove them from a target area. By providing cross-modality comparison of the two risk analyses, the authors provide a risk-benefit analysis similar to those used by USEPA and those used to determine the practicality and relative adverse effects associated with the process. The results of the study reveal the importance of a rigorous comparison and contrast of the likely realistic exposure and effects of chemical exposure against the highly likely adverse public health impacts of mosquito infestations. This paper clearly provides an example of the methodology to evaluate the potential risk of a product and application technique against the likely actual adverse effects. This approach provides a method to compare, contrast, and evaluate the relative adverse impacts of the District's vector control activities and the possible adverse impacts to public health if the vector control is not provided

McNear Jr., D.H. 2013. The rhizosphere - roots, soil and everything in between. Nature Education Knowledge 4(3):1 (at the discussion of "Plant Growth Promoting Rhizobacteria (PGPR)"). Available at http://www.nature.com/scitable/knowledge/library/the-rhizosphere-roots-soil-and-67500617.

The chapter addresses the interactions and impacts of chemicals and nutrients at the level of the root rhizomes, which are the hair-like structures on the roots that absorb and move the nutrients into the plant stem and leaves. There is a good general description of the potential for chemicals and nutrients to interact with the plants at levels below ground surface. Although it is a rudimentary presentation of the plant physiology that could be implicated in the uptake of chemicals (and pesticides) it provides no direct discussion of the potential impact of the pesticides of interest that may be either beneficial or harmful. It is a reasonable explanation for the concern for understanding the fate and transfer of any chemical or nutrient considered for vector control or farming practices.

Mercola, Dr. 11 Commonly Used Pesticides Linked to Parkinson's Disease. Low-Level Pesticide Exposure Linked to Parkinson's Disease. A blog at Mercola.com. February 20, 2014.

This article cites a study implicating 11 pesticides that increase the risk of Parkinson's disease. The article implies that even very low-level exposures can result in Parkinson's in people with a specific common gene variant that renders them more susceptible to Parkinson's. The author indicates that ambient exposure to organophosphate pesticides also increased the risk of developing Parkinson's disease, and he provides a number of suggestions to minimize the risk of Parkinson's, including specific commercially available products that are described in the article. By providing a pseudo-scientific review of the possible linkages to the onset of Parkinson's, the author provides many suggested methods (including the use of his products) to reduce the risk of Parkinson's disease. While some of the information provided in articles such as this may be credible, the resulting emphasis on the purchase of products makes the content of the article less credible. However, this is typical of the numerous articles available on the web and commercial publications that focus on emotional responses to the implications of risk and the conveniently available products offered for sale by the author.

Mid-Atlantic Apiculture Research Report (MAAREC). 2005. Seasonal Cycles of Activities in Colonies. Available online at https://agdev.anr.udel.edu/maarec/honey-bee-biology/seasonal-cycles-of-activities-in-colonies**.**

This is the publication of the MAAREC established with representation from the departments of agriculture, state beekeeping organizations, and land-grant universities from each of the following states: New Jersey, Maryland, Delaware, Pennsylvania West Virginia, and Virginia. Also participating in the task force is a representative of the USDA/ARS (Beltsville Bee Lab, MD) to identify research and extension priorities for apiculture in the Mid-Atlantic Region, review proposals, monitor progress, and assist specialists in obtaining funding for apiculture extension and research efforts. The focus of MAAREC research has been on the identification of alternatives to chemical controls and promotion of less reliance on chemical pesticides for mite control. Some of the research objectives consider apiary inspector and beekeeper input and the use of tools such as beekeeper surveys to identify the most effective ways to assist beekeepers in understanding and making sound management decisions for mite and disease control.

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 on several species of estuarine crustaceans in response to three juvenile hormone agonists (pyriproxyfen, **methoprene,** and fenoxycarb). Claims that l**arval 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 and pyriproxyfen than grass shrimp larvae. The final crab larval stage, the megalopa, was more sensitive to methoprene and fenoxycarb exposure than earlier zoeal stages. Juvenile mysids 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 using a functional approach as an appropriate screening procedure to evaluate **potential environmental endocrine-disrupting chemicals in aquatic environments.**

McNear Jr., D.H. 2013. The Rhizosphere - Roots, Soil and Everything In Between. Nature Education Knowledge 4(3):1 (at the discussion of "Plant Growth Promoting Rhizobacteria (PGPR)"). Available online at http://www.nature.com/scitable/knowledge/library/the-rhizosphere-roots-soil-and-67500617 [accessed October 1, 2015].

This monograph report is a compendium of the workings and processes involved in the root system of plants. It provides a good overview of the root system components that may be impacted by chemicals but it does not provide any of the potential sites that would be sensitive to toxicity based on chemical mode of action.

Miles M. and R. Dutton. 2000. Spinosad—a naturally derived insect control agent with potential for use in glasshouse integrated pest management systems. *Meded. Fac. Landbouwkd. Toegepaste Biol. Wet. (Univ. Gent)* 65 (2A):393–400.

Demonstrated the efficacy of spinosad and the lack of apparent significant impact on other aquatic organisms in their tests is provide in this research report. The study incorporates novel ways to evaluate the potential exposure/toxicity of spinosad and other pesticides.

Mink, P.J., J.S. Mandel, B.D. Sceurman, and J.I. Lundin. 2012. Epidemiologic studies of glyphosate and cancer: a review. *Regul Toxicol Pharmacol* Aug;63 (3): 440-452.

These authors examined the potential risk of glyphosate in humans including a review of the epidemiologic literature to evaluate whether exposure to glyphosate is associated causally with cancer risk in humans. They also reviewed relevant methodological and biomonitoring studies of glyphosate. Seven cohort studies and 14 case-control studies examined the association between life estate and one or more cancer outcomes. Their review found no consistent pattern of positive associations including a causal relationship between total cancer in adults or children or any site-specific cancer and exposure to glyphosate. They further suggest that biomonitoring studies support the importance of exposure assessment and epidemiological studies and indicate that study should incorporate not only duration and frequency of pesticide use but also type of pesticide formulation. They suggest that generic exposure assessments usually lead to exposure misclassification and recommend that exposure algorithms be validated with biomonitoring data.

Mitchell, E.G. 1907. Mosquito Life. New York: G.P. Putnam and Sons.

Early monograph describing the species of mosquito found in New York at the turn of the century. This and other monographs of the time provided the basic information about mosquito species that has been used as a basic tool since its publication.

Mitra, A., C. Chatterjee, and F.B. Mandal. 2011. Synthetic chemical pesticides and their effects on birds. Research Journal of Environmental Toxicology 1-16.

This report is a review of the potential impacts of three groups of chemicals on birds. The authors summarize the potential toxicity of organochlorines, organophosphates, and carbamates, focusing on the potential impact on the primary endpoints required in registration. Although this report is a summary of previous work and available literature in USEPA files and in environmental journals it adds primarily to the discussions about the specific mechanism of action and target organs of each group. They discuss egg shell thinning by organochlorines, enzyme inhibition, and reduction of neurotransmitters by organophosphates and carbamates. The authors conclude that habitat regions known to exist for bird populations should be monitored for these chemicals to reduce the potential impact to bird populations.

Miyakawa, H., K. Toyota, I. Hirakawa, Y. Ogino, S. Miyagawa1, S. Oda1, N. 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 May.

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 Methoprene-tolerant has an important role during evolution of the arthropod juvenile hormone pathway. Microcrustacea Daphnia pulex and D. magna share a juvenile hormone signal transduction pathway with insects, involving Methoprene-tolerant and steroid receptor coactivator proteins that form a heterodimer in response to various juvenoids. Juvenile hormone-binding pockets of the orthologous genes differ by only two amino acids, yet a single substitution within Daphnia Met enhances the receptor’s responsiveness to juvenile hormone III. These results indicate 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 not strong response to the toxicity of methoprene.

Monsanto Technology LLC, Missouri. Glyphosate formulations and their use for the inhibition of 5-enolpyruvylshikimate-3-phosphate synthase. 2010. US Patent number 7771736 B2. Available online at https://www.google.com/patents/US7771736.

This is a documentation of a Monsanto research on glyphosate and its effect on the inhibition of some plant root enzymes and is provided to inform one of the potential side effects of glyphosate formulations that are not pure glyphosate active ingredient. The implications are a reduction in root function if high exposures travel to the root system and are sequestered there.

Moreno, Polo. 2007. Notes on the Stipulation Injunction and Order for Protection of California Red-Legged Frog. Endangered Species Program, California Department of Pesticide Regulation.

California DPR memorandum that specifies care in application of pesticides in areas that are known or suspected CRLF habitat.

Mosquito and Vector Control Association of California NPDES Permit Coalition. 2013. MVCAC NPDES Permit Coalition 2011/2012 Annual Report, NPDES Vector Control Permit (Order No. 2012-0003-DWQ).

This is the documentation of the vector control guidelines and restrictions in the NPDES Permit issued to MVCAC.

National Park Service. 2008. Yosemite. Invasive Plant Management Plan for Yosemite National Park. ESA. Available online at http://www.nps.gov/yose/learn/management/invasive.htm.

The Invasive Plant Management Plan Update is used by Park resource managers to control non-native invasive species. Adaptive management would allow the park to assess the safety and effectiveness of herbicides considered for protecting Yosemite's biodiversity. It provides a framework for decision making and prioritization strategies that based upon the time tested paradigms of Adaptive and Integrated Pest Management. Two herbicides, glyphosate and aminopyralid are currently used in the park. Following the 2009 Big Meadow Fire in Yosemite, the Interagency Fire Management Team recommended applying a pre-emergent herbicide that to prevent cheatgrass from overtaking the meadow after the late-season fire. Since this specific chemical was not considered and evaluated in the 2008 IPMP, the park was unable to use this new tool. Successful aspects of the IPMP, such as annual work plans, prioritization, minimum tool analysis, and education, and outreach, would continue to be implemented.

National Pesticide Information Center, Oregon State University. 2011. Glyphosate Technical Fact Sheet. npic@ace.orst.edu.

Compilation and synthesis of the most current information on pesticides and specifically addresses each pesticide of interest with data beyond the level of MSDS. This addresses the pesticide glyphosate and includes all information about structure, metabolism, hazard levels, fate and transport, environmental exposure issues, wildlife at potential risk, and current regulatory guidelines. This information is provided by a no-partisan research group at the Oregon State University. This, and the other information technical fact sheets are updated as needed, but not on a rigid schedule.

Nohynek G.J, C.J. Borgert, D. Dietrich, and K.K. Rozman. 2013. Endocrine disruption: fact or legend? Toxicology Letters 223 (3): 295–305.

Review and summary of the potential EDCs in personal care products that showed estrogenic activity in screening tests, although regulatory toxicity studies showed no adverse effects on reproductive endpoints. Hormonal potency is the key issue of the safety of EDCs. Estrogen-based drugs, e.g. the contraceptive pill or the synthetic estrogen DES, possess potencies up to 7 orders of magnitude higher than those of PCP ingredients; yet, in utero exposure to these drugs did not adversely affect fertility or sexual organ development of offspring unless exposed to extreme doses. Additive effects of EDs are unlikely due to the multitude of mechanisms how substances may produce a hormone-like activity; even after uptake of different substances with a similar mode of action, the possibility of additive effects is reduced by different absorption, metabolism and kinetics. This is supported by a number of studies on mixtures of chemical EDCs. Overall, despite of 20 years of research a human health risk from exposure to low concentrations of exogenous chemical substances with weak hormone-like activities remains an unproven and unlikely hypothesis.

North Coast Rivers Alliance v. Kawamura (2015) 243 Cal.App.4th 647, 656.

The litigation summary of the Case against the California Department of Food and Agriculture to prosecute the case against LBAM vector control. The entire court proceedings is contained in the designated location listed above. The case allegation is that the CEQA provided for the LBAM control did not adequately address hazards and environmental impacts. The case was settled with a ruling that pest control was necessary but actually not attainable.

NW Honey Bee Habitat Restoration. 2017. Education. Available online at http://www.nwhoneybee.org/education.html.

A publically available information and editorial publication in Washington state that follows, monitors, and reports on information concerning bee status in general, but focuses on the state of Washington. The editorials are not peer reviewed, but are widely distributed to some of the members of the organization prior to publication. Although most of the information is not verified beyond the editorial level, it provides some of the current issues and concerns about bee populations, perceptions of Colony Collapse Disorder and other factors, including pesticide uses that might be considered in the reported declines in bee populations in some regions.

North Carolina Partners in Amphibian and Reptile Conservation (NCPARC). 2009. Observations on Herbicide Choices & Amphibian Conservation. Available online at http://www.ncparc.org/pubs/Herbicide%20Choices%20&%20Amphibian%20Conservation.pdf.

This group advocates for less chemical use in both agriculture and urban settings. They suggest that because glyphosate is a non-selective systemic herbicide widely used for vegetation control. It is considered relatively non-toxic to humans and most terrestrial wildlife and as such has been marketed for years as environmentally-friendly. The chemical kills plants by inhibiting the activity of certain enzymes that are present only in plants. Glyphosate is the active ingredient in Roundup, which was manufactured exclusively by Monsanto until 2000, when the patent expired. Since then many other companies have developed their own glyphosate formulations. Monsanto reported that aquatic species were much more sensitive to the formulated product than to the technical grade glyphosate that was used to make Roundup. The higher toxicity of the formulations was determined to be due to the presence of POEA (polyethoxylated tallow amine) surfactants. As a precaution to prevent harm to aquatic life, when these formulations are applied to upland sites according to label instructions, the risk to surfactant-sensitive species is considered important when exposing fish and amphibians.

Olmstead, A.W., 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. July 1;290 (2):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 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 significantly reduced the number of resting eggs produced and proportionately increased the production of parthenogenetically-produced neonates. These experiments demonstrate that methoprene uncouples the coordinate production of males and resting eggs during the sexual reproductive period of D. magna. **Methoprene stimulates 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**. J. Exp. Zool. 290:148-155, 2001.

Olmstead, A.W., 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 similarly may exert toxicity to crustaceans by mimicking or interfering with methyl farnesoate, a crustacean juvenoid. We hypothesized that methoprene interferes with endocrine-regulated processes in crustaceans by several mechanisms involving agonism or antagonism of juvenoid receptor complexes. In the present study, characterizing and comparing the concentration-response curves for methoprene and several endpoints related to development and reproduction of the crustacean Daphnia magna. Methoprene has multiple mechanisms of toxicity and low-exposure concentration effects. Methoprene reduced the growth rate of daphnids with evidence of only a single concentration.

Olmstead, A.W., and G. LeBlanc. 2003. Insecticidal juvenile hormone analogs stimulate the production of male offspring in the crustacean *Daphnia magna. Environ. Health Perspect*. June;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. Recently we demonstrated that the crustacean juvenoid hormone methyl farnesoate programs oocytes of the crustacean Daphnia magna to develop into males. We hypothesized that insecticidal JHAs might mimic the action of methyl farnesoate, producing altered sex ratios of offspring. Daphnids were exposed chronically (3 weeks) to sublethal concentrations of methyl farnesoate, the JHA pyriproxyfen, and several nonjuvenoid chemicals to discern whether excess male offspring production is a generic response to stress or a specific response to juvenoid hormones. Only methyl farnesoate and pyriproxyfen increased the percentage of males produced by exposed maternal organisms. As previously reported with methyl farnesoate, acute exposure (24 hr) to either pyriproxyfen or the JHA methoprene caused oocytes maturing in the ovary to develop into males. We performed experiments to determine whether combined effects of a JHA and methyl farnesoate conformed better to a model of concentration addition (indicative of same mechanism of action) or independent joint action (indicative of different mechanisms of action). Combined effects conformed better to the concentration-addition model, although some synergy, of unknown etiology, was evident between the insecticides and the hormone. These experiments demonstrate that insecticidal JHAs mimic the action of the crustacean juvenoid hormone methyl farnesoate, resulting in the inappropriate production of male offspring. The occurrence of such an effect in the environment could have dire consequences on susceptible crustacean populations.

Phillips, B.M, B.S. Anderson, J.P. Voorhees, K. Siegler, L. Jennings, M. Peterson, R.S. Tjeerdema, D. Denton, D., P. TenBrook, K. Larsen, and P Isorena. 2013. General Pesticide Permit Toxicity Study: Monitoring Aquatic Toxicity of Spray Pesticides to Freshwater Organisms. Draft Final Report. Prepared by University of California, Davis, Department of Environmental Toxicology, United States Environmental Protection Agency, and California State Water Resources Control Board for California State Water Resources Control Board,

Agreement Number 10-102-270. July. Available online at [http://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/docs/vectorcontrol/vcp_tox_study_draft_final_july2013.pdf.](http://www.waterboards.ca.gov/water_issues/programs/npdes/pesticides/docs/vectorcontrol/vcp_tox_study_draft_final_july2013.pdf)

Pollock, B. 2015. Stolen hives impact beekeepers' livelihoods. *Mail Tribune*, May 17, 2015. Available online at http://www.mailtribune.com/article/20150517/NEWS/150519643.

An article in the publication used by bee keepers and farmers that addresses one of the root problems with the real or perceived loss of bee numbers and bee populations. There is a real concern among the bee keepers that individuals are stealing bee hives and transporting them to other areas (farms) which results in the loss of bees, honey revenue, and future pollination of crops that incorporated the hives. This article discusses how some of the perception of colony collapse disorder may be, in part due to this problem.

Relyea, R.A. 2005. The lethal impact of roundup on aquatic and terrestrial amphibians. *Ecological Applications* 15(4): 1118–1124.

This author assembled communities of three species of North American tadpoles in outdoor pond mesocosms that contained different types of soil (which can absorb the pesticide) and applied Roundup as a direct overspray. After three weeks, he reports that Roundup killed 96–100% of larval amphibians (regardless of soil presence). I then exposed three species of juvenile (post-metamorphic) anurans to a direct overspray of Roundup in laboratory containers. After one day, Roundup killed 68–86% of juvenile amphibians. These results suggest that Roundup, a compound designed to kill plants, can cause extremely high rates of mortality to amphibians that could lead to population declines. This statement is far from reality. The exposures used were DIRECT OVERSPRAY of the mesocosm units which is completely arbitrary and unrealistic if the author intends to extrapolate the results to field exposures.

Rexrode, M., I. Abdel-Saheb, and J.L. Andersen. 2008. Potential Risks of Labeled S-Methoprene Uses to the Federally Listed California Red-Legged Frog. Pesticide Effects Determination. USEPA Biopesticide and Pollution Prevention Division. February 20.

One of the important frog papers following disproved:

- Based on the results of this assessment, the following hypotheses can be rejected: The labeled use of S-methoprene: growth and viability of juvenile and adult CRLFs causing mortality or by adversely affecting growth or fecundity;
- indirectly affect by reducing or changing the composition of food supply;
- indirectly affect 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 affect 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;
- modify critical habitat changing breeding and non-breeding aquatic habitat (via modification of water quality parameters, habitat morphology, and/or sedimentation);
- modify the designated critical habitat of the CRLF by reducing the food supply required for normal growth and viability of juvenile and adult CRLFs;
- modify 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.

- modify 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 which do not contain barriers to dispersal.
- modify the designated critical habitat of the CRLF by altering chemical characteristics necessary for normal response line, having a threshold of 12.6 nM.
- Molt frequency was reduced by methoprene in a concentration-dependent manner, at 4.2 and 0.21 nM a NOEC of 32 nM. Methoprene reduced fecundity 24 and <0.18 nM. Claim that methoprene elicits significant toxicity to endocrine-related processes in the 5–50 nM concentration range. Molting and reproduction were impacted at significantly lower methoprene concentrations, with a distinct concentration response and a threshold of <0.2 nM.
- The conclusion is that there is a "may affect", but "not likely to adversely affect" determination for the CRLF from the use of S-methoprene.

Rocha, V. 2017. Thieves steal hundreds of beehives primed to pollinate Central Valley almonds. Los Angeles Times, January 20, 2017. Available online at http://www.latimes.com/local/lanow/la-me-ln-stolen-bees-northern-california-20170120-story.html.

An article in the publication used by bee keepers and farmers that addresses one of the root problems with the real or perceived loss of bee numbers and bee populations. There is a real concern among the bee keepers that individuals are stealing bee hives and transporting them to other areas (farms) which results in the loss of bees, honey revenue, and future pollination of crops that incorporated the hives. This article discusses how some of the perception of colony collapse disorder may be, in part due to this problem

Sacramento-Yolo Mosquito and Vector Control District. 2008. Mosquito Reduction Best Management Practices Manual. Available online at (https://www.fightthebite.net/download/ecomanagement/SYMVCD_BMP_Manual.pdf.

Compendium of the BMPs recommended for vector control by the SY district. Includes handling and application procedures and applicator safety measures. BMPs intended to minimize the potential for unwanted adverse effects to nontarget humans and wildlife.

San Mateo County Mosquito & Vector Control District (SMCMVCD). 2016. Pesticide Application Plan (PAP).

Compendium of the methods recommended for vector control by the SMCMVCD and the IMPs and techniques to be considered. Includes handling and application procedures and applicator safety measures. BMPs intended to minimize the potential for unwanted adverse effects to nontarget humans and wildlife.

San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). 2015. San Francisco Bay Basin (Region 2) Water Quality Control Plan (Basin Plan). Chapters 1 and 7.

Publication by the SFBRWQCB detailing the regulatory guidelines associated with the plan for the SF basin water quality objectives and includes information about the desired and current state of the watershed. The publication outlines the Plan with specifics about each potential chemical of concern.

San Francisco Bay Regional Water Quality Control Board (SFBRWQCB). 2016. Pescadero and Butano Creeks Watershed Sediment TMDL. Available at http://www.waterboards.ca.gov/sanfranciscobay/water_issues/programs/TMDLs/pescaderobutanocrkstmdl.shtml.

Publication by the SFBRWQCB detailing the regulatory guidelines for the total chemical loads in their watershed. The publication outlines the TMDL (total chemical loading of the watershed at selected intervals in the path of the flow).

Schooley, D.A., K.M. Creswell, L.E. Staiger, and G.B. Quistad. 1975. Environmental degradation of the insect growth regulator Isopropyl (2E,4E)-11-Methoxy-3,7,11-trimethyl-2-4-dodecandienoate (Methoprene), IV Soil Metabolism. *J. Agric. Food Chem.* 23(3) 369-373.

Evaluation of the insect growth regulator methoprene in soil. Monitoring the breakdown of the chemical under soil conditions using radiochemical tracing techniques. Results indicate the rapid and extensive breakdown of methoprene in soils under typical conditions.

Seneff Stephanie. MIT Computer Laboratory. ND. Various Media submissions as nonpublished documents.

Stephanie Seneff is an Independent Scientist and Consultant, Computer Science and Artificial Intelligence Laboratory, MIT, Cambridge, MA 02139, USA. Critique on Dr. Seneff's views on the role of glyphosate in the production of diseases and the links to childhood problems. From other researchers "However she, has not actually performed any research into glyphosate. She is a Senior Research Scientist at the MIT Computer Science and Artificial Intelligence Laboratory." Therefore, it is misleading to cite her as a researcher and authority. She has published only speculations and gives many presentations, but has not created any new data.

Shelton, J.F. E.M. Geraghty, D.J. Tancredi, L.D. Delwiche, R.J. Schmidt, B. Ritz, R.L. Hansen, and I. Hertz-Picciotto. 2014. Neurodevelopmental Disorders and Prenatal Residential Proximity to Agricultural Pesticides: The CHARGE Study. Environmental Health Perspectives 122 [10]: 1103-1109.

This study evaluates the application of organophosphates, organochlorines, pyrethroids, and carbamates for agricultural purposes on an aspect of human health. The authors suggest that pesticides are one of the environmental factors implicated in DD and ASD. They emphasize, however, that the influence of pesticide exposure on the risk of ASD/DD is not well defined.

The studies provide comparisons of reports of onset of DD and ASD and the California pesticide use reports of agricultural pesticide applications data. These comparisons are based on the potential relationship of two distinct, but not similar data sets. The California pesticide reports are culminations of the reported uses (by total pounds of active ingredient) of each pesticide, fungicide, and other chemicals applied to agricultural lands. This linkage is based on expected or estimated proximity to the actual applications in selected distances from the agricultural fields sprayed. The authors provide comparisons to DD and ASD onset during each gestational trimester. The objective of the study was to determine the potential link of the onset of these disorders to the information about the application of organophosphates, organochlorines, pyrethroids, and carbamates reported as collective pounds of active ingredient applied to the agricultural fields in the region. The authors contend specifically that the use of agricultural applications of the pesticides may be correlated to the onset of these disorders, while they report no other potential influences that are clear confounding factors in the studies. There is no discussion or correlation to the relationship to nonagricultural, standard vector control application techniques such as spreading granules or using hoses with controlled droplet application, especially by commercial applicators.

Smith, J.B. 1904. Report of the New Jersey State Agricultural Experiment Station upon the Mosquitoes Occurring within the State, Their Habits, Life History & C. Trenton, New Jersey.

A compendium of the species and habitats of mosquitos that can be found in the state of New Jersey. The summaries itemize the types of habitats were mosquitos can breed and survive and the areas and regions where they are found.

Stark, J.D. 2005. A Review and Update of the Report "Environmental and health impacts of the insect juvenile hormone analogue, S-methoprene" 1999 by Travis R. Glare and Maureen O'Callaghan. Report for the New Zealand Ministry of Health.

After ingestion by the target organisms the crystals dissolve and release the toxic proteins that then kill the organism.

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) In fact, the concentrations of methoprene necessary to control mosquitoes (1 part per billion) are often much lower than the concentrations necessary to cause damage to populations of many nontarget organisms.

Methoprene has a short half-life in the environment making it unlikely to accumulate in various United States 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.**

Additionally, a concern discussed in the original assessment was the possibility that methoprene may be the cause of limb malformations being detected in frogs in the USA. Even though it has been six years since the last assessment, the causal agent(s) of frog deformities in the USA has still not been clearly elucidated. Some scientists believe that these deformities are caused primarily by a parasitic trematode, not methoprene. Others believe that a combination of several factors, such as trematodes, UV radiation, and chemicals may be working synergistically to cause the observed malformations. It is my opinion that the conclusions reached by Glare and O'Callaghan in 1999 are still valid today and I would **recommend that methoprene be the first choice for control and eradication of introduced mosquito species.**

Stetka, Bret. 2014. Parkinson's Disease and Pesticides: What's the Connection? "Scientists find a way chemicals may contribute to Parkinson's". April 8, 2014.

The report claims that farmers are more prone to Parkinson's than the general population is, possibly linked to pesticide exposures. The report claims that there is a clear link between pesticide exposure and a higher risk for Parkinson's disease which is a neurodegenerative disease second in occurrence to Alzheimer's. The claim is based on a reported possible cellular mechanism of action for the onset of Parkinson's which the author claims may be related to some pesticides.

While the author makes the claim that exposure to glyphosate can be linked to the onset of Parkinson's, contrary to that claim, in his initial overview, he makes the following correct statement that "Regardless of inciting factors — and there appear to be many…(factors, sic)" that may be related to the onset of Parkinson's. He states that neurons associated with muscular control in the substantia nigra pars compacta may be impacted, which results in impaired movement and coordination, tremors, and rigidity. However, this report is based on extrapolation of the possible effects to this important brain nucleus, suggesting that any factor that impacts it could be involved in the onset of muscular disorders (including Parkinson's). This assumption is reasonable, but the specific factor cannot be specified.

Inspection of the structure of the study and conclusions indicates that there were numerous other factors (as agreed by the author) that likely contribute to the onset. Although this report provides an important discussion on the possible metabolic or cellular links of pesticides to this and other diseases, it provides no clear connections to the actual exposures. Use of secondary and indirect relationships in studies involving human health can provide correlations, but without a clearly determined exposure, there can be no clear causality.

Theiling, K.M., and B.A. Croft. 1988. Pesticide side-effects on arthropod natural enemies: a database summary. Agriculture, Ecosystems and Environment 21:191-218.

A compendium and summaries of the interactions of insects and arthropods prey and food item preferences and how interactions affect the populations and ultimate survival of several species.

Thomson, J., and M. Ahluwalia. 2015. Bee-killing pesticides: The fight ramps up. CBC News. May 21.

A media report on the condition and status of bees and bee colonies suggesting a connection of pesticides (especially neonicotinoids) to reductions in bee populations. Reports that CCD cases have declined substantially in Canada over the last several years.

Traynor, J. 2002. How Far Do Bees Fly? One Mile, Two, Seven? And Why: Bee Culture, June.

An extension of the J. E. Eckert "wreath experiment" in a three year study (1927-1929) that was published in 1933. This study evaluated the question about bee transit capability. Two areas in Wyoming that were separated by a 17 mile stretch of barren badlands, were used and colonies were placed at increasing distances from the irrigated food sources. Results indicated that colonies can survive and collect pollen from a food source four miles away. The recommendation from this experiment is that a two mile buffer zone is not sufficient to protect bees from pesticides (or to prevent pollen transfer from two different varieties of plants grown several miles apart). The results suggest that the area covered by bees increases exponentially with distance from the apiary since the area of a circle is a function of the square of the radius:

Underwood, W.L. 1903. Mosquitoes and suggestions for their extermination. *Popular Science Monthly* 63:453-466.

Early publication describing the species of mosquito currently observed in the US and included some basic methods available for eradication of the species of concern. Published at the turn of the century in the popular magazine that focused on scientific research at the level for public consumption. This and other publications of the time provided the basic information about mosquito eradication.

USDA Forest Service. 2003. Human and ecological risk assessment of nonylphenol polyethoxylate-based (NPE) surfactants in Forest Service herbicide applications. Unpublished report written by David Bakke, Pacific Southwest Region Pesticide-Use Specialist. May.

Report summarizes some USFS risk assessment work on herbicides (report not provided by commenters, but it was retrieved from the internet posting of the USFS. The Forest Service uses herbicides with a common component nonylphenol polyethoxylate (NPE) found in these commercial surfactants at rates varying from 20 to 80%. Nonylphenol (NP) and NPE exhibit some estrogen-like properties although are much weaker than the natural estrogen estradiol. The author suggests that the low hazard quotients for accidental exposure scenarios exceed a level of concern. While the accidental exposure scenarios are not the most severe one might imagine they are representative of reasonable accidental exposures. The report further suggests that the expected chronic exposure levels, there is little risk to terrestrial wildlife at any application rate considered in this risk assessment. With the typical application rates, two scenarios represent a slight risk of effects to mammals: direct spray to a small mammal (assuming the skin affords no protection) and consumption of contaminated vegetation by a large grazing mammal, such as a deer. None of the other acute exposures at the typical rates of application represent a risk of effects to terrestrial wildlife.

United States Environmental Protection Agency (USEPA).1991. RED Facts: Methoprene. Pesticides and Toxic Substances, Washington, DC. March.

Source of pesticide information about toxicity, safety, handling, and application guidance for Methoprene including all registration and testing information and status of the RED for glyphosate. These documents are official USEPA informational tools about the listed pesticide. These documents contain the most recent information about the registration status of the chemical, including new requirements for testing that are demanded by the USEPA Office of Pesticide Programs.

United States Environmental Protection Agency (USEPA). 1993. Reregistration eligibility decision (RED) glyphosate, Office of Prevention, Pesticides, and Toxic Substances (7508W). EPA 738-R-93-014.

Source of pesticide information about toxicity, safety, handling, and application guidance for Methoprene including all registration and testing information and status of the RED for glyphosate. These documents are official USEPA informational tools about the listed pesticide. These documents contain the most recent information about the registration status of the chemical, including new requirements for testing that are demanded by the USEPA Office of Pesticide Programs.

United States Environmental Protection Agency (USEPA). 2005. Pesticide Registration (PR) Notice 2005 -1 Notice to Manufacturers, Producers, Formulators, and Registrants of Pesticide Products. Available online at https://www.epa.gov/sites/production/files/2014-04/documents/pr2005-1.pdf.

Source of pesticide information about labeling and/or new toxicity information to be included in the labels and MSDS documents. This document provides the updated requirements for pesticide information to be included in new or existing registered chemicals. These documents contain the most recent information about the requirements for continued registration of a chemical, including new requirements for testing that are demanded by the USEPA Office of Pesticide Programs.

United States Environmental Protection Agency (USEPA). 2006. Reregistration Eligibility Decision (RED) for Permethrin. EPA 738-F-06-012. June.

Source of pesticide information about toxicity, safety, handling, and application guidance for Permethrin including all registration and testing information and status of the RED for permethrin. These documents are official USEPA informational tools about the listed pesticide. These documents contain the most recent information about the registration status of the chemical, including new requirements for testing that are demanded by the USEPA Office of Pesticide Programs.

United States Environmental Protection Agency (USEPA). 2008. Risks of glyphosate use to federally threatened California red-legged frog (*Rana aurora draytonii*). Pesticide Effects Determination. Environmental Fate and Effects Division, Office of Pesticide Programs, Washington DC. October 17.

This document is a comprehensive risk assessment directed to evaluate the potential adverse effects of glyphosate exposure on the listed CRLF. The assessment is structured using the tiered USEPA guidance for risk assessment and includes specific exposure potentials and specific habitats in the calculations of the risk estimates. The report states that using the best information available the Agency makes a Likely to Adversely Affect determination for the CRLF from the use of glyphosate under some environmental conditions and exposure rates. Additionally, the Agency has determined that there is the potential for modification of CRLF designated critical habitat from the use of the chemical. This assessment indicates that direct effects to the terrestrial-phase CRLF eating broadleaf plants, small insects and small herbivorous mammals on a dietary-basis may be at risk following chronic exposure to glyphosate at high application rates. In addition, for one particular formulation medium and large-sized CRLF's eating small herbivorous mammals on a dose-basis may be at risk following acute exposure at an application rate of 5.5 lb formulation/A (industrial outdoor uses). At the lowest application rate of 1.1 lb formulation/A, there is potential risk to medium-sized CRLF's eating small herbivorous mammals on a dose-basis (ornamental lawns and turf). These specific conditions are used to recommend acceptable application rates and target vegetation types but excludes many application scenarios that are label driven and outside the potential habitat of the CRLF.

United States Environmental Protection Agency (USEPA). 2009a.Reregistration Eligibility Decision (RED) for Permethrin. EPA 738-R-306, May.

Source of pesticide information about toxicity, safety, handling, and application guidance for Permethrin including all registration and testing information and status of the RED for permethrin. These documents are official USEPA informational tools about the listed pesticide. These documents contain the most recent information about the registration status of the chemical, including new requirements for testing that are demanded by the USEPA Office of Pesticide Programs.

United States Environmental Protection Agency (USEPA), 2009b. Endocrine Disrupting Compounds. Federal Register 74 [71], April 15,

Documents from the FIFRA in OPP that indicate the list of chemicals that may be considered as potential candidates for endocrine disruption characteristics. Although the list is considered preliminary, the Agency intends to screen and evaluate these chemicals to develop a short list of candidates for tests.

United States Environmental Protection Agency (USEPA). 2012a. FIFRA: Risk Assessment Methods Process for pollinator risk assessment framework. USEPA Science Advisory Panel, September. Available online at http://www.epa.gov/pollinator-protection/fifra-peer-review-proposed-risk-assessment-methods-process.

New test methods being developed to evaluate the effect of pesticides on pollinators with indications of new laboratory tests that may be incorporated into the FIFRA guidance.

United States Environmental Protection Agency (USEPA). 2012b. Test Guidelines for Pesticides and Toxic Substances. Series 850 under FIFRA, TSCA, and FFDCA. June. Available online at http://www.epa.gov/test-guidelines-pesticides-and-toxic-substances/series-850-ecological-effects-test-guidelines.

New test methods being developed to evaluate the effect of pesticides on pollinators are provided and the potential methods to be used with indications of new laboratory tests that may be incorporated into the FIFRA guidance.

United States Environmental Protection Agency (USEPA). 2012c. FIFRA: Risk Assessment Methods Process for pollinator risk assessment framework. USEPA Science Advisory Panel, September. Available online at http://www.epa.gov/pollinator-protection/fifra-peer-review-proposed-risk-assessment-methods-process.

In September 2012, EPA participated in a Federal Insecticide, Fungicide and Rodenticide Act Scientific Advisory Panel (SAP) meeting on a proposed pollinator risk assessment framework. This framework is designed for determining the potential risks of pesticides to honey bees. EPA, in collaboration with Health Canada's Pest Management Regulatory Agency and the California Department of Pesticide Regulation, developed a White Paper in Support of the Proposed Risk Assessment Process for Bees describing the new risk assessment process and the exposure and toxicity data needed to inform that process. EPA adopted and is using this pollinator risk assessment framework when pesticides are evaluated as part of the pesticide registration process and registration review activities for already registered pesticides.

United States Environmental Protection Agency (USEPA). 2013. Environmental Hazard and General Labeling for Pyrethroid and Synergized Pyrethrins Non-agricultural Outdoor Products. February. Available online at https://www.epa.gov/ingredients-used-pesticide-products/pyrethrins-and-pyrethroids-reregistration-and-labeling#label.

Source of pesticide information about toxicity, safety, handling, and application guidance for Pyrethroids and pyrethrins including all registration and testing information and status of the RED for permethrin. These documents are official USEPA informational tools about the listed pesticide. These documents contain the most recent information about the registration status of the chemical, including new requirements for testing that are demanded by the USEPA Office of Pesticide Programs.

United States Environmental Protection Agency (USEPA). 2014. Endocrine Disruptor Screening Program Comprehensive Management Plan. February.

USEPA press release noting the development of new screening tools to detect and evaluate the potential for ED by chemicals in review for registration and for re-registration. The press release indicated the use of technical experts who proposed using biomarker based test techniques. The Endocrine Disruptor Screening Program (EDSP) uses a two tiered approach to screen pesticides, chemicals, and environmental contaminants for their potential effect on estrogen, androgen, and thyroid hormone systems. The EDSP is mandated to use validated methods for the screening and testing chemicals to identify potential endocrine disruptors, determine adverse effects, dose-response, assess risk and ultimately manage risk under current laws. These methods or assays allow EPA to identify and characterize the endocrine activity (specifically, estrogen, androgen, and thyroid) of pesticides, commercial chemicals, and environmental contaminants.

United States Environmental Protection Agency (USEPA). 2015. Press release - New cutting edge technology proposed to screen endocrine disrupting chemicals. Available online at USEPA.gov/endocrine disruptors.

USEPA press release noting the development of new screening tools to detect and evaluate the potential for ED by chemicals in review for registration and for re-registration. The press release indicated the use of technical experts who proposed using biomarker based test techniques. The Endocrine Disruptor Screening Program (EDSP) uses a two tiered approach to screen pesticides, chemicals, and environmental contaminants for their potential effect on estrogen, androgen, and thyroid hormone systems. The EDSP is mandated to use validated methods for the screening and testing chemicals to identify potential endocrine disruptors, determine adverse effects, dose-response, assess risk and ultimately manage risk under current laws. These methods or assays allow EPA to identify and characterize the endocrine activity (specifically, estrogen, androgen, and thyroid) of pesticides, commercial chemicals, and environmental contaminants.

United States Environmental Protection Agency (USEPA) 2015. "Interim Use Limitations for Eleven Threatened or Endangered Species in the San Francisco Bay Area," "San Francisco Bay Area Endangered Species Litigation - Center for Biological Diversity v. EPA," "Court Issues Stipulated Injunction Regarding Pesticides and the California Red-legged Frog," "Endangered Species Case – Northwest Center for Alternatives to Pesticides v. EPA," and "Endangered Species Case - Washington Toxics Coalition v. EPA." Available online at http://www.epa.gov/endangered-species.

A record of the proceedings in a court case suing EPA by two environmental activist groups indicating the EPA is not doing enough to protect the CLRF, especially the restrictions and de-listing of the pesticides that these activists suggest adversely impact the CLRF. The suit claims to provide additional guidance and potential regulatory limits on use numerous pesticides suggesting a potential causal adverse impact on the CRLF. USEPA sponsored reply and approach to address concerns about the CRLF but has little causal connection to actual pesticide uses.

United States Environmental Protection Agency (USEPA). 2015. New Labeling for Neonicotinoid Pesticides / Protecting Endangered Species from Pesticides. Available online at http://www2.epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides and http://www.epa.gov/espp/litstatus/effects/redleg-frog/permethrin/determination.pdf.

New information and suggested restrictions and label changes that are intended to reduce the possible impacts of these pesticides on bees and bee colonies.

United States Environmental Protection Agency (USEPA). 2015. Press release - New cutting edge technology proposed to screen endocrine disrupting chemicals. Available online at USEPA.gov/endocrine disruptors.

USEPA press release noting the development of new screening tools to detect and evaluate the potential for ED by chemicals in review for registration and for re-registration. The press release indicated the use of technical experts who proposed using biomarker based test techniques. The Endocrine Disruptor Screening Program (EDSP) uses a two tiered approach to screen pesticides, chemicals, and environmental contaminants for their potential effect on estrogen, androgen, and thyroid hormone systems. The EDSP is mandated to use validated methods for the screening and testing chemicals to identify potential endocrine disruptors, determine adverse effects, dose-response, assess risk and ultimately manage risk under current laws. These methods or assays allow EPA to identify and characterize the endocrine activity (specifically,

estrogen, rogen, and thyroid) of pesticides, commercial chemicals, and environmental contaminants.

United States Environmental Protection Agency (USEPA). 2016a. Series 850 - Ecological Effects Test Guidelines. Available online at https://www.epa.gov/test-guidelines-pesticides-and-toxic-substances/series-850-ecological-effects-test-guidelines.

These documents contain the extensive list of laboratory and field tests that are recommended and usually required to achieve registration of a new or existing chemical that is being evaluated for potential adverse impacts.

United States Environmental Protection Agency (USEPA). 2016b. New Labeling for Neonicotinoid Pesticides. May 9. Available online at https://www.epa.gov/pollinator-protection/new-labeling-neonicotinoid-pesticides.

New information and suggested restrictions and label changes that are intended to reduce the possible impacts of these pesticides on bees and bee colonies.

United States Environmental Protection Agency (USEPA). 2016. Colony Collapse Disorder. Available online at http://www.epa.gov/pollinator-protection/colony-collapse-disorder.

Describes the Colony Collapse Disorder as the phenomenon that occurs when the majority of worker bees in a colony disappear and leave behind a queen, plenty of food and a few nurse bees to care for the remaining immature bees and the queen. Once thought to pose a major long term threat to bees, reported cases of CCD have declined substantially over the last five years. The number of hives that do not survive over the winter months – the overall indicator for bee health – has maintained an average of about 28.7 percent since 2006-2007 but dropped to 23.1 percent for the 2014-2015 winter. While winter losses remain somewhat high, the number of those losses attributed to CCD has dropped from roughly 60 percent of total hives lost in 2008 to 31.1 percent in 2013; in initial reports for 2014-2015 losses, CCD is not even mentioned.

United States Environmental Protection Agency (USEPA). 2017. What is Endocrine Disruption? February22. Available online at https://www.epa.gov/endocrine-disruption/what-endocrine-disruption**.**

USEPA description of the potential impact of chemicals that have been shown to produce changes in endocrines in wildlife, especially changes in sex designations. The document includes the information used by the Agency to evaluate the status of the endocrine disruption phenomenon and includes thoughts about the implications for wildlife and ecological interactions. Although the document is targeting the general public as a FAQ level, it defines the issue as a potential regulatory issue. The ability to detect and/or regulate those chemicals that exhibit ED tendencies is an important current interest of the Agency. Recommendations for tests that would identify ED chemicals were developed in part, as a result of this document.

United States Environmental Protection Agency (USEPA), Health Canada, and California Department of Pesticide Regulation (CDPR). 2012. White Paper in Support of the Proposed Risk Assessment Process for Bees. Submitted to FIFRA Science Advisory Panel, September 11-14, 2012.

This document is a synthesis of several meetings of scientists and regulators from the US and Canada to develop a recommended approaches to evaluating the risk to bees and bee colonies. It was produced by the FIFRA Science Advisory Panel (invited experts supported by the USEPA as outside consultants) convened 2012 to recommend appropriate guidance to both countries on approaches for the evaluation of the status of honeybees in both countries and the prospects for continued honeybee success. The risk paradigm follows the general risk assessment guidance of the USEPA with direction on the important parameters to include in such a specialized risk assessment.

University of California (UC) Master Gardener Program of Sonoma County. 2016. Bees at Sonoma Garden Park. Available online at http://ucanr.edu/sites/scmg/Feature_Articles/Bees_at_Sonoma_Garden_Park/.

A publication targeting public and private concerns that are interested in developing and maintaining bee-friendly gardens and landscaping in Sonoma. The publication is a summary of the approaches and techniques used in the Sonoma Garden Park to enhance and attract bees and beneficiary pollinators.

Van Bael, S.A., S.M. Philpott, R. Greenberg, P. Bichier, N.A. Barber, K.A. Mooney, and D.S. Gruner. 2008. Birds as predators in tropical agroforestry systems. Ecology Apr;89(4):928-34.

These authors report on studies of insectivorous birds and their potential to reduce arthropod abundances and the subsequent impact on the plants the insects forage on. The premise developed in the research is that populations of insects can be heavily predated yet rebound and recover to pre predated population numbers. There remains significant variation in bird effects as predators to reduce insect populations but these authors suggest that it may be due to characteristics such as plant productivity or quality, habitat complexity, and/or species diversity of predator and prey assemblages. They analyzed data from bird enclosure studies in forests and agroforestry systems to ask whether birds consistently reduce their arthropod prey base and whether bird predation differs between forests and agroforestry systems. They then addressed differences in agroforestry systems to determine magnitude of bird predation effects such as (1) differs between canopy trees and understory plants, (2) differs when migratory birds are present or absent, and (3) correlates with bird abundance and diversity. We found that, across all studies, birds reduce all arthropods, herbivores, carnivores, and plant damage. They report no difference in the magnitude of bird effects between agroforestry systems and forests despite simplified habitat structure and plant diversity in agroforests. Within agroforestry systems, bird reduction of arthropods was greater in the canopy than the crop layer. The diversity of the predator assemblage correlated with the magnitude of predator effects; where the diversity of birds, especially migratory birds, was greater, birds reduced arthropod densities to a greater extent. They propose mechanisms for relationships between bird predator, insect prey, and habitat characteristics and provide a model of ecological effects interactions.

Walker, A.N, P. Bush, J. Puritz, T. Wilson, E.S. Chang, T. Miller, K. Holloway, and M.N. Horst. 2005. Bioaccumulation and metabolic effects of the endocrine disruptor methoprene in the lobster, *Homarus americanus. Integr. Comp. Biol.* 45:118-126.

Methoprene has toxic effects on larval and adult crustaceans. Subsequently, the seasonal lobster catches from the WLIS have decreased dramatically. The lethality of the pesticides to lobsters had been unknown. We studied the effects of methoprene while other investigators studied effects of the other pesticides. Effects on larvae, adults or both, could have contributed to this decline. We found that low levels of methoprene had adverse effects on lobster larvae. It was toxic to stage II larvae at 1 ppb. Stage IV larvae were more resistant, but did exhibit significant increases in molt frequency beginning at exposures of 5 ppb. Juvenile lobsters exhibited variations in tissue susceptibility to methoprene: hepatopancreas appeared to be the most vulnerable, reflected by environmental concentrations of methoprene inhibiting almost all protein synthesis in this orga suggesting that methoprene affects the normal pathway of lobster cuticle synthesis and the quality of the post-molt shell. Although it is likely that a combination of factors led to the reduced lobster population in WLIS, methoprene may have contributed both by direct toxic effects and by disrupting homeostatic events under endocrine control.

Walsh, B. 2013. Beepocalypse Redux: Honeybees Are Still Dying – and We Still Don't Know Why. Time magazine May 7, 2013.

Editorial on the possibility of Colony Collapse Disorder (CCD) which was first reported in 2006, when commercial beekeepers began noticing that their adult worker honeybees would suddenly flee the hive, ending up dead somewhere else and leading to the rapid loss of the colony. The data suggest that rather than the typical loss of 10% to 15% of their colony, the reported losses in the U.S. have ranged from 28% to 33%. He reports that since 2006 an estimated 10 million beehives worth about $200 each have been lost, costing beekeepers some $2 billion. There are now 2.5 million honeybee colonies in the U.S., down from 6 million 60 years ago. And if CCD continues, he predicts that the consequences for the agricultural economy are dire. He attributes the increased mortality to pesticide exposure, loss of habitat, decreases in fruit and vegetation sources of pollen related to crop changes and other environmental factors. He suggests that the survivorship of honeybee colonies is too low for us to be confident in our ability to meet the pollination demands of U.S. agricultural crops.

Weeks, A. 1890. Utility of dragonflies as destroyers of mosquitoes. In Dragonflies vs. Mosquitoes: Can the Mosquito Pest Be Mitigated. Studies in the Life History of Irritating Insects, Their Natural Enemies and Artificial Checks, R.H. Lamborn, pp 69-95. New York: D. Appleton and Co.

Early monograph describing the foraging and habitats of mosquito and the dragonfly as a primary predator to the mosquito. Concepts of using the dragonfly in experiments addressing the eradication of mosquitos. Results indicated that the use of dragonflies was not practical because of the difficulty in handling and controlling them.

Williams. B. et al., eds. 1994. Assessing Pesticide Impacts on Birds. Final Report of the Avian Effects Dialogue Group, 1988-1993. RESOLVE, Center for Environmental Dispute Resolution. Williams, B. et al., Editors.

This is the final report of the Avian Effects Dialogue Group's five year meetings to evaluate and rank the potential for laboratory tests to project likely effects of pesticides in actual field applications. The panels included government, industry, university, and private scientists who brought real life experience and information to the discussions. The resulting information helped to direct and revisit many of the testing protocols used in the USEPA pesticide registration process. The results indicate that few laboratory tests actually predict possible field effects without large uncertainty. The USEPA uses many of the recommendations to review and design new, more appropriate test guidelines.

Williams T., J. Valle, and E. Vinuela. 2003. Is the naturally derived insecticide Spinosad® compatible with insect natural enemies? *Biocontrol Science and Technology* 13:459–475.

Reports the relative efficacy and nontarget toxicity of spinosad and reports that "spinosad is highly active against Lepidoptera but is reported to be practically nontoxic to insect natural enemies" .In their studies, very large direct doses of spinosad in laboratory setting were toxic to nontarget insect predators, while low doses did not exhibit the same level of toxicity to non-targets and was relatively safe against the bulk of the insect predators.

World Health Organization. 2015a. Carcinogenicity of tetrachlorvinphos, parathion, malathion, diazinon, and glyphosate. *The Lancet* May;16:490-91.

Very conservative report of the UN IARC, and using the precautionary principle it reported that glyphosate, and some of the other pesticides reviewed are “possibly” carcinogenic. The report was developed and published as an IARC document with some interesting research papers that were counter to the declaration not included in the review report. The results continue to be challenged by numerous outside (and some internal) experts on glyphosate.

World Health Organization. 2015b.Evaluation of five organophosphate insecticides and herbicides. Includes rebuttal discussions. *IARC Monographs* 112.

Actual WHO report provided by the JMPR panel for toxicology. Includes an explanation of their role and mission of the panel membership of the JMPR of the World Health Organization in the United Nations. This panel provides a very conservative report of the UN IARC, and using the precautionary principle it reported that glyphosate, and some of the other pesticides reviewed are “possibly carcinogenic.”

World Health Organization (WHO). 2015c. Joint FAO/WHO Meeting on Pesticide Residues (JMPR). Available online at http://www.who.int/foodsafety/areas_work/chemical-risks/jmpr/en/ [accessed October 1, 2015].

Explanation and panel membership of the JMPR of the World Health Organization in the United Nations. This panel provides a very conservative report of the UN IARC, and using the precautionary principle it reported that glyphosate, and some of the other pesticides reviewed are “possibly carcinogenic.

Wu, X., D.H. Bennett, B. Ritz, J. Frost, D. Cassady, K. Lee, and I. Hertz-Picciotto. 2011. Residential insecticide use in Northern California homes with young children. *Journal of Exposure Science and Environmental Epidemiology* 21: 427-436.

Residential insecticide usage and actual application details were collected in a population-based sample of 477 households residing within 22 counties in northern California with at least one child of age ≤ 5 years between January 2006 and August 2008. Altogether, 80% of the households applied some type of insecticide in the previous year, with half of this population using two or more application methods. Of the households using insecticides, half reported applying insecticides relatively infrequently (<4 times per year), whereas 11-13% reported high frequency of use (>24 times per year). Application frequency was temperature dependent, with significantly more applications during the warmer months from May through October. Spot treatments appeared to be the most prevalent application pattern for sprays. For one out of three of the indoor applications, children played in the treated rooms on the day of the application, and for 40% of the outdoor applications, pets played in the treated area on the day of the application. These authors report that describing the intensity of insecticide use and accompanying behaviors in families with young children may inform future insecticide exposure modeling efforts, and ultimately, risk assessments

Zhang, Audrey, 2012, Combatting West Nile Virus, Effectively. Harvard Political Review, Double Helix, October 7, Available online at http://harvardpolitics.com/specialty-blogs/double-helix/combating-west-nile-virus-effectively.

The author discusses the fact that the guidance for spraying during West Nile Virus outbreaks give no guidelines other than that spraying is recommended when human cases are reported, leaving further decisions to the states. He suggests that public health agencies consider mosquito-borne diseases to be relatively endemic and regional, which

he suggests is similar to cases of Eastern Equine Encephalitis outbreaks. He recommends, however, that the recent West Nile Virus outbreak has demonstrated the capacity for an epidemic to spread from essentially one state to the entire country. The speed with which this epidemic has moved has demonstrated that even though we consider WNV to be an “emerging” infectious disease, it has a capacity to be a serious national public health threat. He states that in order to have an effective public health response, states must act quickly against threats like disease-carrying mosquitoes. He argues that there is inadequate official state wide policies on mosquito control, policies are highly variable, and that mobilizing a response is not adequate.

Zhang, X. Hu, J. Luo, Z. Wu, L. Wang, B. Li, Y. Wang, and G. Sun. 2015. Degradation dynamics of glyphosate in different types of citrus orchard soils in China. *Molecules* 20: 1161-1175.

In this study, the degradation dynamics of glyphosate in different types of citrus orchard soils in China were evaluated under field conditions. Glyphosate soluble powder and aqueous solution were applied at 3000 and 5040 g active ingredient/hm2, respectively, in citrus orchard soils, and periodically drawn soil samples were analyzed by high performance liquid chromatography. The results showed that the amount of glyphosate and its degradation product aminomethylphosphonic acid (AMPA) in soils was reduced with the increase of time after application of glyphosate formulations. Indeed, the amount of glyphosate in red soil from Hunan and Zhejiang Province, and clay soil from Guangxi Province varied from 0.13 to 0.91 µg/g at 42 days after application of aqueous solution. The amount of glyphosate in medium loam from Zhejiang and Guangdong Province, and brown loam from Guizhou Province varied from less than 0.10 to 0.14 µg/g, Overall, these findings demonstrated that the degradation dynamics of glyphosate aqueous solution and soluble powder as well as AMPA depend on the physicochemical properties of the applied soils, in particular soil pH, which should be considered in the application of glyphosate herbicide.

Zoecon Corporation. 1974. Technical bulletin on Altosid. Toxicological properties.

This is one of many technical bulletins describing the physiochemical characteristics of Altosid (methoprene) with information on applications restrictions, and target species. This bulletin was updated at least once by USEPA in 2001.

Attachment B – Resume for Bill Williams, PhD

Cardno
Shaping the Future

Bill A. Williams PhD

Current Position
Senior Consultant & Risk Assessor

Discipline Area
> Ecological & Human Health Risk Assessments
> Natural Resource Damage Assessments
> Environmental Site Assessments
> Probabilistic Risk Assessments
> Toxicology
> Biomarker Research
> Mitigation Strategies

Years' Experience
47 Years

Joined Cardno
2009

Education
> National Academy of Sciences Post-Doctoral 1968-1970
> PhD, Physiology & Biophysics, University of Illinois, Urbana, 1968
> MS, Physiology & Biophysics, University of Illinois, Urbana, 1965
> BA, Physiology & Biophysics, University of California, Berkeley, 1963

Affiliations

www.cardno.com

Summary of Experience

Dr. Williams has more than 40 years of experience and expertise in environmental risk assessment and toxicology including CERCLA, NRDA, NEPA, and CEQA projects ranging from upland to sediment to freshwater/marine projects. Dr. Williams has been a member of numerous international, National Academy, and federal committees and workshops to define risk assessment guidelines, test procedures, field study approaches, and avian and mammalian test protocols, and provide other technical assistance utilized by USEPA regulators. He helped develop USEPA's Framework for Ecological Risk Assessment and USEPA's risk assessment of 2,3,7,8 TCDD. He was a charter member of the Avian Dialogue Group, convened by the Conservation Foundation (RESOLVE) to bring industry, academia, and government regulators together to resolve conflicts between the groups. Dr. Williams has led and supported dozens of successful projects that were acceptable to the Washington Department of Ecology, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, US Environmental Protection Agency, Region X, and numerous other USEPA regions nationwide.
Dr. Williams has served on several Oregon DEQ advisory science committees and workshops. He has been a member of several national and regional EPA Science Advisory Panels, including the SAP panels on endocrine disruptors, uncertainty in risk assessments, and the panel on use of laboratory data in estimates of risk to wildlife.

Significant Projects

Expert Witness-Senior Consultant- Ecological Risk Estimates and Development of Integrated Pest Management Guidance for Pesticides for Mid-Peninsula Open Space District, Los Altos, California.

Dr. Williams provided strategic and scientific support in the development of an Integrated Pest Management (IPM) system for use by the Mid-Peninsula Open Space District. The IPM is tailored to the vectors of concern, the pesticides and herbicides used by the District, and potential risk to the non-target aquatic and terrestrial species. Pesticides incorporated into the IPM were based on evaluations of the use of more than 20 herbicides (with emphasis on use of glyphosate in regional wildland areas for control of over 60 invasive plant species), dozens of insecticides, structural and nuisance agricultural and urban pests, and selected regional wildlife pests. The IPM developed for the District included control of ants, cockroaches, wasps and flies, ticks, and mosquitoes. The IPM plan included recommendations for establishing and conducting pest identification, conducting damage assessments, establishing tolerance levels and several tiers of proposed vector control that addressed top to bottom elements of implementation strategies. The IPM delivered to the District included more than 120 pages of evaluations and recommendations, including extensive quantitative Ecological and Human Health Risk assessments. Dr. Williams prepared and supported draft and final documents and graphics for use in public meetings relating to the results of the studies.

Expert Witness-Senior Consultant- Ecological Risk Estimates and Development of Herbicide Risks to Non-target vegetation and Wildlife in California Wildfire Areas for the California Department of Forestry & Fire Protection (CAL FIRE).

Dr. Williams provided scientific reviews and risk assessments addressing the potential adverse effects of CAL FIRE herbicide use to reduce the potential for and mitigation of wildfires in California. The Vegetation Treatment Program (VTP) project included evaluation of potential adverse impacts of herbicides used in forestry and rangeland to control brush

- Society of Environmental Toxicology & Chemistry
- Pacific Northwest Society of Environmental Toxicology & Chemistry

and grasses and for maintenance of areas that have been previously cleared of heavy vegetative fuels. The primary herbicides of concern in the evaluation were the numerous products containing glyphosate as the active ingredient. Glyphosate was one of the most effective herbicides for control of the vegetation that provides potential fuel for wildfires. Control of this vegetation is the target of the CAL FIRE VTP management process statewide. Because vegetation control treatments are not appropriate in all locations and can cause environmental impacts, the recommendations were designed for site specific conditions in the wide range of wildfire environments in the State. In response to the need for their VTP, comprehensive guidelines were developed for the practical management and operation of the VTP including prioritization, selection, assessment, and mitigation of appropriate vegetation treatments. The reviews and documents provided to CAL FIRE for its Vegetation Treatment Program provides the framework that is being used for the implementation of appropriate fuels treatments across non-federal lands in California.

Senior Consultant- Ecological Risk Estimates of Pesticides for Nine Mosquito/Vector Control Districts, Northern California

Dr. Williams is providing strategic and scientific support in the development of the ecological and human health assessments of commercial pesticide product applications (46 active ingredients and adjuvants) for the control of mosquitoes and other vectors of human diseases and discomfort in nine counties of California. Providing impact analyses for both chemical and nonchemical treatment methods of control in Programmatic Environmental Impact Reports (under CEQA) for the nine districts/agencies in the San Francisco Bay Area and Monterey County. . The impact analyses considered the toxicity and fate and transport of the active ingredients based on a literature review including ultra-low volume (ULV) spray applications. Also included were herbicides for the control of mosquito-breeding habitat.

Senior Consultant/Technical Advisor/Ecological Risk – Passaic River Project, Newark, New Jersey, Passaic Coordinating Partners Group (CPG)

Providing strategic and conceptual support to a member of the CPG for their Passaic River facility. Developing strategy and proactive approaches to CERCLA and NRDA mitigation and restoration options. Working with CPG member to define their potential risk, and strategy for acceptable allocation within the Consortium of PRPs on the Passaic River. Providing comprehensive evaluation of Ecological and Human Health risks. Providing on-going technical review of all on-going work, including existing work plans, schedules, and work elements to develop new plans and approach to streamline the schedule and to reduce costs.

Senior Consultant- NRDA-Gulf of Mexico

Dr. Williams is on the Cardno NRDA team responding to the Deepwater Horizon accident and oil spill in the Gulf of Mexico on behalf of BP Exploration & Production Inc. (BP). Bill has provided support to the Terrestrial Mammal and Bird Technical Working Groups (TWG) and participated in the design or implementation of the cooperative NRDA studies included in those TWGs.

Senior Consultant- Ecological Risk Estimates of Contamination at a Golf Course in Southern California

Dr. Williams provided strategic and scientific support in the development of the risk estimates of commercial use and application of herbicides for the control of unwanted vegetation of California. Prepared documents and graphics for use in discussions and public meetings relating the results of the studies. Confidential Client.

Senior Scientist – Evaluation of Mercury and Other Contaminants in Outfall Plumes, Port Gamble, Washington and Mare Island Site, City of Vallejo

Evaluated and critiqued contaminants detected in facility outflow, and estimate risk to aquatic and terrestrial resident and endangered species. Prepared presentation approaches and materials for discussions with U.S. Environmental Protection Agency (EPA) Region 10.

Senior Project Manager – Ecological Risk Assessment, Whitefish River, Montana, Burlington Northern Santa Fe

Developed an ecological risk assessment for a river adjacent to a railroad fueling facility. Reviewed results of initial sampling of sediment in the river to identify preliminary chemicals of potential ecological concern, and then prepared a sampling and analysis plan for additional studies needed to conduct the risk assessment, including co-located sediment and benthic samples. Compared the results of the benthic community analysis with chemical data for co-located sediment samples to evaluate whether chemicals in sediment were resulting in toxicity to the benthos or whether physical conditions were responsible for changes in the benthic communities. The risk assessment estimated potential risks to resident and endangered ecological receptors, and identified protective sediment concentrations of PAHs and PCBs for the most sensitive ecological receptors.

Senior Project Manager – Probabilistic Risk Assessments, Southeastern U.S.; FMC Corp. and American Cyanamid, Princeton, New Jersey; and Novartis, Inc. and Rhone Poulenc, Durham, North Carolina

While employed by Kennedy Jenks, conducted probabilistic risk assessments to assess potential risks from application of pesticide to agricultural crops in southeastern United States. This risk assessment was conducted to evaluate numerous application and exposure scenarios that might result in risk to aquatic and terrestrial resident, endangered, and other non-target wildlife. Results from these studies are being used to evaluate the potential use of probabilistic risk assessment to evaluate the appropriateness of EPA restrictions on the labeling of the pesticide.

Senior Risk Assessor – Human Health and Ecological Risk Assessments, Spokane, WA, Teck Cominco America

Provided strategic support and risk assessments for a potential Superfund listing for Lake Roosevelt, Washington Presented approaches to EPA Region 10 for the development of the characterization, RI/FS, and potential NRDA for Lake Roosevelt. As Senior NRDA advisor and risk assessor, provided strategic support and risk assessments in support of a potential Superfund listing for Lake Roosevelt. Aquatic, sediment, and upland sources in the lake were being characterized for the potential cleanup of metals and other contaminants.

Expert Witness – Ecological Risk Assessment, Columbia River Basin, Bellevue, Washington, Northwest Pulp and Paper Association,

Provided expert evaluation and testimony concerning the impact of pulp and paper effluents, including dioxin and other organochlorines, on populations of Bald Eagles in the Columbia River Basin. The focus of the project was to determine the extent of potential exposure and possible effects of pulp mill operations on the Bald Eagle population in the Columbia River Basin. An ecological risk assessment was conducted that focused on the reproductive success and population dynamics of resident and endangered species, especially the Bald Eagles in the region. As a result of the assessment, it was concluded that the number of nesting pairs of Bald Eagles in the region had far surpassed the U.S. Fish and Wildlife Service Recovery goals, and that the population of eagles in the region was actually vigorous and strong. The results of the study were presented at open congressional hearings and to the Department of Interior. Shortly thereafter, DOI changed the listing from Endangered to Threatened with caveats for several regions.

Consultant – Human Health Risk Assessments, Klamath Falls, Oregon

Provided strategic support and risk assessments for a site contaminated with asbestos and heavy metals. Developed sampling and analysis protocols, data objectives, and soil risk triggers for adults, children, and pets. Provided several risk scenarios for exposure to both the buried and surface asbestos, including evaluation of ACM and inert moieties. Provided expert testimony and presentations for the plaintiffs.

Senior Risk Assessor – Ecological Risk Assessment, Eugene, OR, L.D. McFarland, Colorado

Provided an ecological risk assessment of pentachlorophenol and copper on freshwater fish and other aquatic species. Provided study plan, sampling plan, and fish residue testing oversight. Provided complete review of aquatic residue data, including hazard and exposure data for use in the preliminary ecological risk assessment. The focus was the impact of a spill of lumber treatment products on fish and benthic invertebrates in two small sport-fishing ponds. The spill included products containing creosote and substantial amounts of PCPs. Although there was substantial mortality of some fishes, it was determined that the impact would be short-lived, and that the ponds could be used for sport fishing after a period of a few months without additional mitigation. The results and recommendations of the project were accepted by the Oregon Department of Fish and Wildlife.

Senior Risk Assessor – Environmental Risk Assessment, Refinery Terminal Site, Willamette River, Portland, Oregon, Texaco/Equilon

Conducted human health and ecological risk assessments focusing on the potential risk of upland operations and river sediments at a refinery terminal site on the Willamette River. Constituents of concern included benzene, toluene, ethylbenzene, and xylene (BTEX); metals; and PAHs. The project was conducted according to the Oregon Department of Environmental Quality Risk Assessment guidelines.

Senior Risk Assessor – Environmental Risk Assessment, Nine Navy Bases in the San Francisco Bay Area, San Bruno, California, U.S. Navy

Conducted human health and ecological risk assessments for nine Navy bases in the San Francisco Bay area. Developed and instituted guidance for Feasibility Study Design, and provided mitigation strategies based on protective concentrations of contaminants acceptable to the Regional Boards, the U.S. Navy, and other regulators. Project involved use of innovative approaches to refining ecological estimates of exposure to higher trophic level receptors. Approach included site-specific and realistic estimates of doses to receptors using probabilistic techniques, and resulted in the innovative approach to development of "protective chemical levels" (PCLs) still in use by regulators and other environmental assessors.

Senior Risk Assessor – Environmental Sampling and Risk Assessment, Walnut Creek, California, Carollo Engineers

Provided project and sampling plan oversight and scientific support to a risk-based analysis of the contribution of publicly owned treatment works (POTW) effluent to waterways, including risk to aquatic organisms and birds at sites in northern California. Risk assessment has focused on effluents and contamination according to the National Toxics Rule, the California Toxics Rule, and EPA Ambient Water Quality Criteria guidelines. Constituents evaluated included organics, metals, and PAHs.

Senior Risk Assessor – Ecological Risk Assessment, Washington, DC, U.S. Environmental Protection Agency (EPA)

Produced a series of wildlife toxicity profiles for PCBs for use by EPA as guidelines for acceptable exposure levels of PCBs to birds and mammals. In addition to acute toxicity profiles, the report also presented thresholds and acceptable exposure levels for reproduction, growth, and immunological endpoints. The report was used as a preliminary guideline, and was incorporated into EPA wildlife exposure handbooks

Senior Risk Assessor – Ecological Risk Assessment, Washington, DC, EPA

Developed position documents for the EPA Office of Toxic Substances for the risk of dioxin to terrestrial wildlife methods to provide predictive impacts on birds and mammals. In addition to acute toxicity profiles, the report also presented thresholds and acceptable exposure levels for reproduction, growth, and immunological endpoints. The report was used as a preliminary guideline, and was incorporated into EPA wildlife exposure handbooks for dioxin.

Senior Risk Assessor and Expert Witness – Ecological Risk Assessments, Various Locations, Multiple Clients

While at EP&T, developed a series of comprehensive ecological risk assessments for new agricultural chemicals proposed for registration and chemicals due for re-registration according to the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Risk assessments included predictive risk to non-target aquatic and terrestrial wildlife. The results of the studies were prepared in formats acceptable to the state and EPA regulators. Clients included American Cyanamid, Princeton, NJ; Rhone-Poulenc, Durham, NC; Ciba Geigy Company; and Dow Chemical.

Workshops and Invited Panel Member

> Invited Speaker, “Implementing Probabilistic Ecological Assessments: A Consultation”. National Academy of Sciences Advisory Panel to USEPA, Washington, DC. 5-7 April 2001
> Invited Instructor. “Ecotoxicology for Hazard Communication”. Society of Chemical Hazard Communication Annual Meeting. Washington, DC. 3 October 1999
> Invited Panel Member, “Review of Probabilistic Risk Assessment for Chlorfenpyr”. National Academy of Sciences Advisory Panel to USEPA, Washington, DC. 23-24 September 1999
> Invited Panel Member, “Uncertainty Analysis in Ecological Risk Assessments” SETAC Workshop, Pellston, MI. August, 1995
> Invited Panel Member, Session Chair, SETAC/OECD Joint Workshop on Avian Toxicity Laboratory Testing. Pensacola, FL. 4-7 December 1994
> Program Chair. Ecotoxicological Principles for Avian Field Studies. SETAC Pellston Workshop on Radiotelemetry for Avian Field Studies. Asilomar, CA. January 1993
> Invited Panel Member, “Wildlife Criteria External Advisory Panel”. Washington State Department of Ecology, Olympia, WA. 1994-1998
> Invited Panel Member, “Environmental Effects Assessment Workshop”, USEPA, Office of Hazardous Waste, Seattle, Washington. 24-28 July 1988
> Invited Charter Member, “Avian Field Testing Dialogue Group”, The Conservation Foundation, Wash., DC. 1988-1992
> Invited Panel Member, “Risk Assessments for Land Application of Pulp and Paper Mill Sludge”, USEPA Workshop on Dioxin, Baltimore, MD. September 1991

> Invited Panel Member, Session Chair, SETAC Pellston Workshop on the Population Ecology and Wildlife Toxicology of Agricultural Pesticide Use: A Modeling Initiative for Avian Species. Kiawah Island, S. Carolina. July 1990
> Panel Panel Member, "Standing Committee on Ecotoxicology of the Risk Assessment Council, USEPA, Washington, DC. 1987-1988
> Invited Panel Member, "Terrestrial Environmental Risk Assessments" in the Organization of European Council of Development" Conference, Wash, DC. 13-17 June 1988
> Chair and Panel Member "Critical Ecosystems of Concern," Oregon State University. September 1987
> Invited Panel Member, SETAC Conference, "Research Priorities in Ecological Risk Assessment," Breckenridge, Colorado. August 1987

Chair/Session Organizer Technical Meetings

> Session Chair: Emerging Pollutants. Society of Environmental Toxicology and Chemistry. November 14-18, 2004, Portland, Oregon
> Organizational/Program. Pacific Northwest Society Environmental Toxicology and Chemistry. April, 2004. Port Townsend, WA.
> Session Chair: Applications of Ecotoxicology to Real World Problems. Society Environmental Toxicology and Chemistry. November 7-12, 2003, Austin Texas
> Session Chair. Exposure and Effects Endpoints. Society Environmental Toxicology and Chemistry. November 7-12, 2003, Austin Texas
> Organizational/Program Co-Chair. Pacific Northwest Society Environmental Toxicology and Chemistry. May, 2002, Portland, Oregon
> National Academy of Sciences Risk Assessment Task Force (1988-1990)
> Wildlife Toxicology Special Session on Acetylcholinesterase Assays in the Field. 10th Society Environmental Toxicology and Chemistry. Toronto, Canada. 29 October – 3 November 1989
> ASTM Committee on Field Protocols for Wildlife Population Studies (1987-1990)
> ASTM Committee on Acetylcholinesterase Determination in Field Studies (1988)
> Wildlife Toxicology Session Chair, 8th Society Environmental Toxicology and Chemistry, Pensacola, Florida. 9-12 November 1987
> Wildlife Toxicology Session Chair, 7th Society Environmental Toxicology and Chemistry, Washington, DC. 3-6 November 1986
> Acetylcholinesterase Assay Symposium Chairman, VII Society Environmental Toxicology and Chemistry, Washington, DC. 3-6 November 1986
> Wildlife Toxicology Session, 6th Society Environmental Toxicology and Chemistry, St. Louis, MO. 8-22 November 1985
> General Conference Chairman, Wildlife Toxicology Symposium, Portland, OR. January 1984

Publications

Selected Book Chapters

> Kapustka, L.A., B.A. Williams, A. Fairbrother, J. Glicken, and R. Bennett. 1996. "Environmental Risk Assessment for Sustainable Cities -- A Position Paper." United Nations Environmental Programme-International Environmental Technology Centre Special Publication # 3. Osaka, Japan.

> Williams, B.A. and J.M. Emlen. 1994. "Population Models as a Research Tool: An Empirical Perspective." In: Wildlife Toxicology and Population Modeling: Integrated Studies of Agroecosystems, pp. 501-508. Kendall, R.J and T.E. Lacher, eds. Lewis Publishers.

> Williams, B.A. 1993. "Biomarkers in Avian Field Studies: Environmental Toxicology and Risk Assessment." In: ASTM Volume 2 STP 1216, Gorsuch, J.W., F.J. Dwyer, C.G. Ingersoll, and T.W. La Point, eds. American Society for Testing and Materials, Philadelphia.

Selected Journal Publications (Of 55)

> Fairbrother, A., L.A. Kapustka, B.A. Williams, and R.S. Bennett. 1997. "Effects - Initiated Assessments Are Not Risk Assessments." Human and Ecological Risk Assessment: (3), No. 2, pp. 119-124.

> Fairbrother, A., L.A. Kapustka, B.A. Williams, and J. Glicken. 1996. Ecological Risk Assessment Benefits Environmental Management. Sandia Report SAND94 3062 UC - 630. Sandia National Laboratories, Albuquerque, NM.

> Kapustka, L.A., B.A. Williams, and A. Fairbrother. 1996. "Evaluating Risk Predictions at Population and Community Levels in Pesticide Registration - Hypotheses To Be Tested." Environ. Toxicol. & Chem. 15(4), 427-431.

> Williams, B.A., et al. 1994. "Assessing Pesticide Impact in Birds. Final Report of the Avian Effects Dialogue Group (1988-1993)." Resolve, 156 pp., Washington, DC.

> Williams, B.A. and J.M. Emlen. 1994. "Population Models as a Research Tool: An Empirical Perspective." In: Wildlife Toxicology and Population Modeling: Integrated Studies of Agroecosystems, pp. 501-508. Kendall, R.J. and T.E. Lacher, eds. Lewis Publishers.

> Williams, B.A. 1993. "Biomarkers in Avian Field Studies: Environmental Toxicology and Risk Assessment." In: ASTM Volume 2 STP 1216, Gorsuch, J.W., F.J. Dwyer, C.G. Ingersoll, and T.W. La Point, Eds. American Society for Testing and Materials, Philadelphia, PA.

> Williams, B.A., et al. 1991. "Assessing Pesticide Impact in Birds. Discussions of the Avian Effects Dialogue Group (1989-1991)." Resolve, Washington, DC.

> Kilbride, K.M., J.A. Crawford, K.L., Blakely, and B.A. Williams. 1992. "Habitat Use by Breeding Female California Quail in Western Oregon." J. Wildl. Manage, 56(1):85-90.

> Bennett, R.S., B.A. Williams, D.W., Schmedding, and J.K. Bennett. 1991. "Effects of Dietary Exposure to Methyl Parathion on Egg Laying and Incubation in Mallards." Environmental Toxicology and Chemistry, 10(4): 501-507.

> Buerger, T.T., R.J. Kendall, B.S. Mueller, T. DeVos, and B.A. Williams. 1991. "Effects of Methyl Parathion on Northern Bobwhite Survivability." Environmental Toxicology & Chemist, 10(4) 527-532.

Selected Recent Abstracts (Of 105)

> Williams, B.A., J.Q. Word, and W. Gardiner. 2007. Detecting the Presence and Effects of Pharmaceuticals and Personal Care Products in Water Samples. WEFTEC Annual Conference October 11-17 September, 2007. San Diego, CA.

> Williams, B.A., J.Q. Word, and W. Gardiner. 2007. Reducing Effects of Endocrine Disrupting Compounds: Effluent Blending. Water Reuse Assoc. Conference July 29-30, 2007. Providence, RI.

> Williams, B. A., J.Q. Word, and W. Gardiner. 2007. Tiered Risk Estimates for Water Reuse: Retrospective estimates of Risk for Industrial Applications. Use of Environmental Benefit Approaches to Estimate Risks. Water Reuse Assoc. Annual Conference June 4-5, 2007. El Paso, TX.

> Williams, B. A., J.Q. Word, and W. Gardiner. 2007. "It Ain't the Sediment, Dummy": Relative Contribution Of Sediment And Water To PCBs In Fish Tissue. PNWSETAC, April 14-15, 2007, Port Townsend, WA.

> Williams, B.A., Fuji, T., T.P. Pinit, and L.J. Kennedy. 2005. "Using Relative Risk Assessments to Address Perceived Adverse Environmental Risks." 26th SETAC Baltimore, MD, 13-17 November 2005.

> Williams, B.A., L.J. Kennedy, and Taku Fuji. 2005. "Using Risk Assessment To Address Perceived Environmental Risks Associated with Railroad Operations." Railroad Conference, Urbana, IL, 25-27 October 2005.

> Williams, B.A., L.J. Kennedy, J.A. Nedoff, and T. Fuji. 2005. "Risk Assessment as a Tool for Emerging Contaminants and Water Quality Decisions." PNW AWWA Meeting, Portland, OR, 4-6 May 2005.

> Williams, B.A., J.A. Nedoff, and L.J. Kennedy. 2005. "Risk Assessment as a Tool for Water Reuse Projects: Assessing Emerging Contaminants and Other Water Quality Concerns." WaterReuse Meeting, San Diego, CA, 28 February - 1 March 2005.

> Williams, B.A., L.J. Kennedy, and J.A. Nedoff. 2004. "Should Ecological and Human Health Endpoints Be Based on Similar Endpoints?" Society for Risk Analysis Annual Meeting, Palm Springs, CA, 5-8 December 2004.

> Kennedy, L.J., J.A. Nedoff, and B.A. Williams. 2004. "How Risky Is Fish Consumption?" Society for Risk Analysis Annual Meeting, Palm Springs, CA, 5-8 December 2004.

> Nedoff, J.A., L.J. Kennedy, and B.A. Williams. 2004. "How Few PCB Congeners Can Estimate Total PCBs in Aquatic Biota?" Society for Risk Analysis Annual Meeting, Palm Springs, CA, 5-8 December 2004.

> Williams, B.A., L.J. Kennedy, and J.A. Nedoff. 2004. "Hormesis: How Low a Dose Is Too High?" 25th Annual Mtg. SETAC, Portland, OR, 14-18 November 2004.

> Bahe, A., B.A. Williams, L.J. Kennedy, and J.A. Nedoff. 2004. "Do Residual Levels of Pharmaceuticals Contribute to Endocrine Disruption?" 25th Annual Mtg. SETAC, Portland, OR, 14-18 November 2004.

> Kennedy, L.J., J.A. Nedoff, and B.A. Williams. 2004. "A Probabilistic Evaluation of Uncertainty and Variability in Fish Consumption Risks." 25th Annual Mtg. SETAC, Portland, OR, 14-18 November 2004.

> Nedoff, J.A., L.J. Kennedy, and B.A. Williams. 2004. "Which PCB Congeners Are Needed To Estimate Total PCBs in Aquatic Biota?" 25th Annual Mtg. SETAC, Portland, OR, 14-18 November 2004.

> Williams, B.A., L.J. Kennedy, and J.A. Nedoff. 2003. "A Little Pesticide Is Good for You: Hormesis Revisited." 24th Annual Mtg. SETAC, Austin, TX, 7-12 November 2003.

> Williams, B.A., L.J. Kennedy, and J.A. Nedoff. 2003. “Uncertain About Uncertainty in Environmental Risk Assessment.” NorCal SETAC, Berkeley, CA, 6-7 May 2003.
> Kennedy, L.J., B.A. Williams, and J.A. Nedoff. 2003. “Developing Site-Specific Fish Consumption Rates without Site-Specific Data.” Society for Risk Analysis Annual Meeting, Baltimore, Md, 7-10 December 2003.
> Williams, B.A. and L.J. Kennedy. 2001. “One Child - One Bird: Should HHRA Values Be Used for Ecological Receptors?” Society for Risk Analysis Annual Meeting, Seattle, WA, 2-5 December 2001.
> Williams, B.A., B.B. Milner, L.J. Kennedy, and P. Kaiser. 2001. “Is Household Hazardous Waste Really Hazardous?” Society for Risk Analysis Annual Meeting, Seattle, WA, 2-5 December 2001.
> Williams, B.A. and N. Bonnevie. 1999. “Refined Exposure Parameters for Use in Probabilistic Risk Assessments.” 20th Annual SETAC Proceedings, Philadelphia, PA, November 1998.
> Williams, B.A., J. Holder, D. Haury, and G. Robilliard. 1998. “Ecological Risk Assessment and NRDA Endpoints: Some Are, Some Aren’t.” 19th Annual SETAC Proceedings, Charlotte, NC, November 1998.
> Williams, B.A., and R. Banta. Refinement of Wildlife Exposure Calculations for Ecological Risk Assessments. 19th Annual SETAC Proceedings, Charlotte, NC, November 1998.
> Williams, B.A., A. Fairbrother, J.A. Gagne, and J.P. Sullivan. 1995. “Effect of Bird Age on Food Avoidance and Dietary Toxicity with Northern Bobwhite (*Colinus virginianus*).” 16th Annual SETAC Proceedings, Vancouver, BC, November 1995.
> Williams, B.A., L.A. Kapustka, and A. Fairbrother. 1994. “Use of Terrestrial Toxicity Tests for Superfund Sites.” 15th Annual SETAC Proceedings, Denver, CO, November 1994.
> Kapustka, L.A., B.A. Williams, and A. Fairbrother. 1994. “Evaluating Risk Predictions at Population and Community Levels-Hypotheses To Be Tested.” 15th Annual SETAC Proceedings, Denver, CO, November 1994.
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4 Private Individuals

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From: Jennifer Caldwell [redacted]
Sent: Monday, May 9, 2016 11:15 AM
To: Peir <peir@smcmvcd.org>
Subject: San Mateo County Mosquito and Vector Control

I-Cal

Dear Dr. Chindi Peavey,

I have reviewed the letter dated May 9, 2016 from Stephan C. Volker on behalf of Healthy Children Alliance and support the arguments put forth in this letter. The San Mateo County Mosquito and Vector Control District's PEIR fails to thoroughly and accurately disclose and analyze the human health impacts associated with the pesticide use contemplated in this project. Of particular concern are the pyrethroid and pyrethroid-like compounds and glyphosate usage contemplated in the document without a proper analysis of the impact of their usage on human health. Young children are pregnant women are especially vulnerable to the negative health risks associated with pesticide usage. These risks must be given full disclosure and attention in a revised PEIR. 1

Respectfully,

Jennifer Caldwell
President, Caldwell-Fisher Charitable Foundation

1

Comment Letter I-CAL

Caldwell, Jennifer

May 9,2016

Response 1

Comments noted and considered. It is agreed that public controversy (including opposition by some individuals and organizations to any use of pesticides) exists within the District's Service Area. This pesticide use controversy is why the District prepared a PEIR and why the document was organized to include two chapters not normally included in EIRs: Chapter 6, Ecological Health and Chapter 7, Human Health. These two chapters are based on a technical Appendix B. Ecological and Human Health Assessment Report.

The District's objective is to reduce or minimize the possibility of unwanted nontarget effects in the local environment while addressing the need for vector control. These considerations and how unwanted effects can be eliminated or reduced are embodied in the District's Draft IMVMP Plan including Program objectives, in product label instructions, and in each of the applicable BMPs that guide all pesticide applications by the District. By restricting chemical applications to times when nontarget insects are not active and using care to treat only vector larvae and adults in locations where they are concentrated (i.e., population is high enough to warrant chemical control) and in close proximity to human activities, impacts to other species are avoided or substantially reduced. Once a pesticide has been released into the environment, it can be broken down by exposure to sunlight, (photolysis), exposure to water (hydrolysis), exposure to other chemicals (oxidation and reduction), microbial activity (bacteria, fungi, and other microorganisms), and other plants or animals (metabolism). Pesticide labels set out safety and use guidelines that usually focus on three aspects: rates of application (single and cumulative) for registered crops and pests, timing of application, and restrictions on areas of application (including required buffer zones).

See all of the responses to the comments from Stephan C. Volker. The following responses are provided in summary form because the full responses are contained in the responses to the letter labelled O-VOL.

Concerning the use of pyrethroids and pyrethrins for vector control, refer to Responses O-VOL 16, 23, 24, and 25. The overwhelming majority of the District's adulticide applications are site specific applications using hand held and/or backpack equipment. These applications are performed as necessary to reduce substantial populations of adult mosquitoes in the interest of public health. These pesticide products are also used in targeted applications to ground-nesting yellow jackets, wasps and potentially for infestations of ticks in areas where humans and domestic animals are frequent visitors or on private property when requested by the property owner. If adult mosquitoes are invading residential areas in close proximity to mosquito breeding sites, the District's IVM principles would require using nonchemical methods first to control the breeding population, followed by the use of larvicides. Adulticiding or control of adult mosquitoes is infrequent and done when all other methods included in the IMVMP Plan have been exhausted and the protection of public health against disease requires control. . Products used in or adjacent to residential and intensive recreational areas are those that break down quickly due to exposure to air, light, and soil microorganisms. See Response O-VOL 26 on a monitoring study explaining how adulticides are not impacting surface water. Since the ultralow volume (ULV) applications of pyrethroids over surface water cannot be detected in the surface water (with only a few exceptions), then the ground surface would be similarly unaffected. The assumption that children would be exposed under the conditions indicated (i.e., binding to organic matter and sand/soils) is not applicable to the ULV and targeted application techniques for adulticides utilized by the District such that the concern is overstated.

Concerning the use of glyphosate for vegetation management, refer to Responses O-VOL 20, 21, and 22. Use of herbicides by any other water or land management district does not compare to existing use of herbicides by the District. The most frequent use of glyphosate by the District is to remove poison ivy/oak from land areas requiring access by District staff for surveillance and vector control. However, larger areas could be treated in the future if needed for vector control or to assist another agency with invasives such as the Coastal Conservancy's ISP. When applied to typical areas targeted for vegetation management, glyphosate is transformed to less toxic and different chemical constituents in normal soil within a few days, or even quicker when used for most general uses. It can be rapidly bound to soil particles and inactivated, and the unbound glyphosate can be degraded by bacteria. The media reports about the hazards of glyphosate and its several commercial products have not been clearly associated with human health. The numerous reports about "possible" connections to metabolic processes and subtle effects also include confounding factors that make scientifically defensible claims impossible. Where reports of adverse subtle effects exist, they are usually based on laboratory studies of cell lines etc., at exposures far above any possible actual human exposure.

Concerning the commenters' request to the District to prepare a revised PEIR because the commenter disagrees with the PEIR conclusions of less-than-significant impacts to ecological and human health, opinion on what a significant impact is and is not in this PEIR differs between the commenter and the PEIR preparers. The Draft PEIR thoroughly analyzed the impacts associated with the Proposed Program, and additional information is provided herein and in a revised Draft PEIR to support the original conclusions as well as consideration of information provided by Mr. Volker and other commenters. The information in the revised Draft PEIR provides clarification of material contained in the original Draft PEIR and addresses specific questions raised in public comments for this PEIR in Appendix F, Responses to Comments. None of the comments identified substantial evidence of a new significant impact that was not considered in the Draft PEIR, and no Draft PEIR impacts need to be changed from less-than-significant to significant; thus a recirculated Draft PEIR is not required for these reasons but is provided because clarifications and additions may be considered re substantial. A revised Draft PEIR is being recirculated.

See Response O-VOL-7 on considerations in making impact determinations of significance on chemical methods of vector control. The CEQA conclusions of less-than-significant impacts are based not only on the District BMPs (a Program feature that is part of the Program description) but also on application methods and the concentration and type of chemical materials used. All of these factors, and including the physical context in which the applications occur (that subject the treatments to sunlight, air, and soil conditions that minimize persistence and facilitate breakdown) support the Draft PEIR conclusions that the effects are not substantial or adverse enough to be characterized as significant, not that a conclusion of zero or no impact is presented. A loss of some individual nontarget insects could occur on occasion during an application, but the loss would not be substantial for reasons cited in Responses O-VOL 6 and 7.

Appendix B was a technical report designed to cover basic parameters of toxicity, fate, and transport for 46 chemicals and designed to provide sufficient information for the public about the potential adverse effects of the chemicals used by the 9 participating districts, including the District, for vector control. The information and chemical data provided in Appendix B are based on summaries and data generated to satisfy the US Environmental Protection Agency (USEPA) requirements for registration of chemicals and pesticides. Most of those data are generated by independent research and contract laboratories that conduct strictly controlled laboratory and field tests with the chemical of interest; and numerous possible species are exposed to nearly 100 percent chemical for varied periods of time. Although these tests are designed to identify and characterize the possible toxicity of the chemical, the results are clearly not directly relevant to the very low levels of chemicals used and exposures that result from the District's specific vector control activities in the physical environment described above. Additional literature was reviewed in preparing these and other responses to comments, and part of this literature review is attached to the O-VOL responses to comments as Attachment A (at the end of the responses).

Also see Response O-VOL-15 on the use of best professional judgment by PEIR preparers with the appropriate technical qualifications to evaluate the impacts of human and ecological concern. The author of the responses on pesticide use herein, both insecticides and herbicides, and the ecological and human health impact conclusions and related material in the Draft PEIR, is Bill A. Williams, PhD, a toxicologist with the educational and experiential background as an expert on pesticides and their use in aquatic and terrestrial environments. A summary of Dr. Williams' qualifications to evaluate the scientific literature and to consider where and how the District is specifically using the pesticides for vector control in order to draw conclusions of impact significance to humans and to nontarget species is provided in Response O-VOL-15. Dr. Williams has more than 30 years of experience and expertise in environmental risk assessment and toxicology, including CERCLA, NRDA, NEPA, and CEQA projects ranging from upland to sediment to freshwater/marine projects. Dr. Williams has been a member of numerous international, National Academy, and federal committees and workshops to define risk assessment guidelines, test procedures, field study approaches, and avian and mammalian test protocols, and to provide other technical assistance utilized by USEPA regulators. He helped develop USEPA's Framework for Ecological Risk Assessment and USEPA's risk assessment of 2,3,7,8 TCDD (tetrachlorodibenzo-p-dioxin or dioxin). He was a charter member of the Avian Dialogue Group, convened by the Conservation Foundation (RESOLVE) to bring industry, academia, and government regulators together to resolve conflicts between the groups. Dr. Williams has led and supported dozens of successful projects that were acceptable to the Washington Department of Ecology, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, USEPA Regions 2, 9, 10, and numerous other USEPA regions nationwide. Dr. Williams has served on several Oregon DEQ advisory science committees and workshops. He has been a member of several national and regional EPA Science Advisory Panels, including the National Science Advisory Panel on endocrine disruptors, on uncertainty in risk assessments, and the panel on use of laboratory data in estimates of risk to wildlife.

The highlights of his extensive experience presented are from Dr. Williams' technical resume, which is attached to the end of the O-VOL response to comments (Attachment B). This resume has been reduced from his master resume to focus on the most relevant aspects of his career dealing with pesticides and risk assessments, excluding his accomplishments at NASA as a Program Scientist and Payload Scientist/Astronaut (1969-1986).

From: Ken Cook [redacted]
Sent: Monday, May 9, 2016 7:19 AM
To: Peir <peir@smcmvcd.org>
Subject: San Mateo County Mosquito and Vector Control District's PEIR

I-Coo

Dear Dr. Chindi Peavey,

I have reviewed the letter dated May 9, 2016 from Stephan C. Volker on behalf of Healthy Children Alliance and support the arguments put forth in this letter. The San Mateo County Mosquito and Vector Control District's PEIR fails to thoroughly and accurately disclose and analyze the human health impacts associated with the pesticide use contemplated in this project. Of particular concern are the pyrethroid and pyrethroid-like compounds and glyphosate usage contemplated in the document without a proper analysis of the impact of their usage on human health. Young children are pregnant women are especially vulnerable to the negative health risks associated with pesticide usage. These risks must be given full disclosure and attention in a revised PEIR. 1

Respectfully,

Ken Cook
*President, Environmental Working Group**
*(*Affiliation for identification purposes only)*

—

Kenneth A Cook
President, EWG

1

Comment Letter I-COO

Cook, Ken

May 9,2016

Response 1

Comments noted and considered. The commenter is affiliated with an organization Environmental Working Group and states his “affiliation for identification purposes.” According to the EWG website (http://www.ewg.org/about-us/board-members), he is one of the environmental community’s most prominent and effective critics of establishment agriculture and U.S. farm policy, and he resides in Marin County which is outside of the District’s Program Area.

It is agreed that public controversy (including opposition by some individuals and organizations to any use of pesticides) exists within the District’s Service Area. This pesticide use controversy is one reason why the District prepared a PEIR and also why the document was organized to include two chapters not normally included in EIRs: Chapter 6, Ecological Health and Chapter 7, Human Health. These two chapters are based on a technical Appendix B. Ecological and Human Health Assessment Report. They were prepared to help the concerned public find easily the pesticide use impact analysis within a large document.

The District’s objective is to reduce or minimize the possibility of unwanted nontarget effects in the local environment while addressing the need for vector control. These considerations and how unwanted effects can be eliminated or reduced are embodied in the Program objectives, in product label instructions, and in each of the applicable BMPs that guide all pesticide applications by the District. By restricting chemical applications to times when nontarget insects are not active and using care to treat only vector larvae and adults in locations where they are concentrated (i.e., population is high enough to warrant chemical control) and in close proximity to human activities, impacts to other species are eliminated or substantially reduced. Once a pesticide has been released into the environment, it can be broken down by exposure to sunlight (photolysis), exposure to water (hydrolysis), exposure to other chemicals (oxidation and reduction), microbial activity (bacteria, fungi, and other microorganisms), and other plants or animals (metabolism). Pesticide labels set out safety and use guidelines that usually focus on three aspects: rates of application (single and cumulative) for registered crops and pests, timing of application, and restrictions on areas of application (including required buffer zones).

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Concerning the commenters' request to the District to prepare a revised PEIR because the commenter disagrees with the PEIR conclusions of less-than-significant impacts to ecological and human health, opinion on what a significant impact is and is not in this PEIR differs between the commenter and the PEIR preparers. The Draft PEIR thoroughly analyzed the impacts associated with the Proposed Program, and additional information is provided herein and in a revised Draft PEIR (for recirculation) to support the original conclusions as well as consideration of information provided by Mr. Volker and other commenters. The information in the revised Draft PEIR provides clarification of material contained in the original Draft PEIR and addresses specific questions raised in public comments for this PEIR in Appendix F, Responses to Comments. None of the comments identified substantial evidence of a new significant impact that was not considered in the first Draft PEIR, and no Draft PEIR impacts need to be changed from less-than-significant to significant; thus a recirculated Draft PEIR is not required for these reasons but is provided because clarifications and additions may be considered substantial. A revised Draft PEIR is being recirculated.

See Response O-VOL-7 on considerations in making impact determinations of significance on chemical methods of vector control. The CEQA conclusions of less-than-significant impacts are based not only on the District BMPs (a Program feature that is part of the Program description) but on application methods and the concentration and type of chemical materials used. All of these factors, and including the physical context in which the applications occur (that subject the treatments to sunlight, air, and soil conditions that minimize persistence and facilitate breakdown) support the Draft PEIR conclusions that the resultant effects are not substantial or adverse enough to be characterized as significant, not that a conclusion of zero or no impact is presented. A loss of some individual nontarget insects could occur on occasion during an application, but the loss would not be substantial for reasons cited in Responses O-VOL 6 and 7.

Appendix B was a technical report designed to cover basic parameters of toxicity, fate, and transport for 46 chemicals and designed to provide sufficient information for the public about the potential adverse effects of the chemicals used by the 9 participating districts, including the District, for vector control. The information and chemical data provided in Appendix B are based on summaries and data generated to satisfy the US Environmental Protection Agency (USEPA) requirements for registration of chemicals and pesticides. Most of those data are generated by independent research and contract laboratories that conduct strictly controlled laboratory and field tests with the chemical of interest, and numerous possible species are exposed to nearly 100 percent chemical for varied periods of time. Although these tests are designed to identify and characterize the possible toxicity of the chemical, the results are clearly not directly relevant to the very low levels of chemicals used and exposures that result from the District's specific vector control activities in the physical environment described above. Additional literature was reviewed in preparing these and other responses to comments, and part of this literature review is attached to the O-VOL responses to comments as Attachment A (at the end of the responses).

Also see Response O-VOL-15 on the use of best professional judgment by PEIR preparers with the appropriate technical qualifications to evaluate the impacts of human and ecological concern. The author of the responses on pesticide use herein, both insecticides and herbicides, and the ecological and human health impact conclusions and related material in the Draft PEIR, is Bill A. Williams, PhD, a toxicologist with the educational and experiential background as an expert on pesticides and their use in aquatic and terrestrial environments. A summary of Dr. Williams' qualifications to evaluate the scientific literature and to consider where and how the District is specifically using the pesticides for vector control in order to draw conclusions of impact significance to humans and to nontarget species is provided in Response O-VOL-15. Dr. Williams has more than 30 years of experience and expertise in environmental risk assessment and toxicology, including CERCLA, NRDA, NEPA, and CEQA projects ranging from upland to sediment to freshwater/marine projects. Dr. Williams has been a member of numerous international, National Academy, and federal committees and workshops to define risk assessment guidelines, test procedures, field study approaches, and avian and mammalian test protocols, and to provide other technical assistance utilized by USEPA regulators. He helped develop USEPA's Framework for Ecological Risk Assessment and USEPA's risk assessment of 2,3,7,8 TCDD (tetrachlorodibenzo-p-dioxin or dioxin). He was a charter member of the Avian Dialogue Group, convened by the Conservation Foundation (RESOLVE) to bring industry, academia, and government regulators together to resolve conflicts between the groups. Dr. Williams has led and supported dozens of successful projects that were acceptable to the Washington Department of Ecology, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, USEPA Regions 2, 9, 10, and numerous other USEPA regions nationwide. Dr. Williams has served on several Oregon DEQ advisory science committees and workshops. He has been a member of several national and regional USEPA Science Advisory Panels, including the National Science Advisory Panel on endocrine disruptors, on uncertainty in risk assessments, and the panel on use of laboratory data in estimates of risk to wildlife.

The highlights of his extensive experience presented are from Dr. Williams' technical resume, which is attached to the end of the O-VOL responses to comments (Attachment B). This resume has been reduced from his master resume to focus on the most relevant aspects of his career dealing with pesticides and risk assessments, excluding his accomplishments at NASA as a Program Scientist and Payload Scientist/Astronaut (1969-1986).

I-Gar

From: Christine Gardner [redacted]
Sent: Monday, May 9, 2016 11:30 AM
To: Peir <peir@smcmvcd.org>
Subject: San Mateo Mosquito and Vector Control District's PEIR

Dear Dr. Chindi Peavey,

I have reviewed the letter dated May 9, 2016 from Stephan C. Volker on behalf of Healthy Children Alliance and support the arguments put forth in this letter. The San Mateo County Mosquito and Vector Control District's PEIR fails to thoroughly and accurately disclose and analyze the human health impacts associated with the pesticide use contemplated in this project. Of particular concern are the pyrethroid and pyrethroid-like compounds and glyphosate usage contemplated in the document without a proper analysis of the impact of their usage on human health. Young children are pregnant women are especially vulnerable to the negative health risks associated with pesticide usage. These risks must be given full disclosure and attention in a revised PEIR. 1

Respectfully,

Christine Gardner
Board Member, Environmental Working Group
Founder,, moregreenmoms

1

Comment Letter I-GAR — Gardner, Christine

May 9, 2016

Response 1

Comments noted and considered. It is agreed that public controversy (including opposition by some individuals and organizations to any use of pesticides) exists within the District's Service Area. This pesticide use controversy is why the District prepared a PEIR and why the document was organized to include two chapters not normally included in EIRs: Chapter 6, Ecological Health and Chapter 7, Human Health. These two chapters are based on a technical Appendix B. Ecological and Human Health Assessment Report.

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Concerning the commenters’ request to the District to prepare a revised PEIR because the commenter disagrees with the PEIR conclusions of less-than-significant impacts to ecological and human health, opinion on what a significant impact is and is not in this PEIR differs between the commenter and the PEIR preparers. The Draft PEIR thoroughly analyzed the impacts associated with the Proposed Program, and additional information is provided herein and in a revised Draft PEIR (for recirculation) to support the original conclusions as well as consideration of information provided by Mr. Volker and other commenters. The information in the revised Draft PEIR provides clarification of material contained in the original Draft PEIR and addresses specific questions raised in public comments for this PEIR in Appendix F, Responses to Comments. None of the comments identified substantial evidence of a new significant impact that was not considered in the Draft PEIR, and no Draft PEIR impacts need to be changed from less-than-significant to significant; thus, a recirculated Draft PEIR is not required for these reasons but is provided because clarifications and additions may be considered substantial. A revised Draft PEIR is being recirculated.

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The highlights of his extensive experience presented are from Dr. Williams' technical resume, which is attached to the end of the O-VOL response to comments (Attachment B). This resume has been reduced from his master resume to focus on the most relevant aspects of his career dealing with pesticides and risk assessments, excluding his accomplishments at NASA as a Program Scientist and Payload Scientist/Astronaut (1969-1986).

From: Serena Torrey Roosevelt [redacted]
Sent: Monday, May 9, 2016 4:03 PM
To: Peir <peir@smcmvcd.org>
Subject: Concern about Mosquito and Vector Control District's PEIR

I-Roo

Dear Dr. Chindi Peavey,

I have reviewed the letter dated May 9, 2016 from Stephan C. Volker on behalf of Healthy Children Alliance and support the arguments put forth in this letter. The San Mateo County Mosquito and Vector Control District's PEIR fails to thoroughly and accurately disclose and analyze the human health impacts associated with the pesticide use contemplated in this project. Of particular concern are the pyrethroid and pyrethroid-like compounds and glyphosate usage contemplated in the document without a proper analysis of the impact of their usage on human health. Young children are pregnant women are especially vulnerable to the negative health risks associated with pesticide usage. These risks must be given full disclosure and attention in a revised PEIR. 1

Respectfully,

Serena Roosevelt
Student, Stanford University, Hasso Plattner School of Design Thinking
Member, Board of Directors, EWG
Resident, Menlo Park

1

Comment Letter I-ROO Roosevelt, Torrey

May 9, 2016

Response 1

Comments noted and considered. It is agreed that public controversy (including opposition by some individuals and organizations to any use of pesticides) exists within the District's Service Area. This pesticide use controversy is why the District prepared a PEIR and why the document was organized to include two chapters not normally included in EIRs: Chapter 6, Ecological Health and Chapter 7, Human Health. These two chapters are based on a technical Appendix B, Ecological and Human Health Assessment Report.

The District's objective is to reduce or minimize the possibility of unwanted nontarget effects in the local environment while addressing the need for vector control. These considerations and how unwanted effects can be eliminated or reduced are embodied in the Program objectives, in product label instructions, and in each of the applicable BMPs that guide all pesticide applications by the District. By restricting chemical applications to times when nontarget insects are not active and using care to treat only vector larvae and adults in locations where they are concentrated (i.e., population is high enough to warrant chemical control) and in close proximity to human activities, impacts to other species are eliminated or substantially reduced. Once a pesticide has been released into the environment, it can be broken down by exposure to sunlight, (photolysis), exposure to water (hydrolysis), exposure to other chemicals (oxidation and reduction), microbial activity (bacteria, fungi, and other microorganisms), and other plants or animals (metabolism). Pesticide labels set out safety and use guidelines that usually focus on three aspects: rates of application (single and cumulative) for registered crops and pests, timing of application, and restrictions on areas of application (including required buffer zones).

See all of the responses to the comments from Stephan C. Volker. The following responses are provided in summary form because the full responses are contained in the responses to the letter labelled O-VOL.

Concerning the use of pyrethroids and pyrethrins for vector control, refer to Responses O-VOL 16, 23, 24, and 25. The overwhelming majority of the District's adulticide applications are site specific applications using handheld and/or backpack equipment. These applications are performed as necessary to reduce substantial populations of adult mosquitoes in the interest of public health. These pesticide products are also used in targeted applications to ground-nesting yellow jackets, wasps and potentially for infestations of ticks in areas where humans and domestic animals are frequent visitors or on private property when requested by the property owner. If adult mosquitoes are invading residential areas in close proximity to mosquito breeding sites, the District's IVM principles would require using nonchemical methods first to control the breeding population, followed by the use of larvicides. Adulticiding or control of adult mosquitoes is infrequent and done only when all other methods of control under the IMVMP Plan have been exhausted and the protection of public health against disease requires control. Products used in or adjacent to residential and intensive recreational areas are those that break down quickly due to exposure to air, light, and soil microorganisms. See Response O-VOL 26 on a monitoring study explaining how adulticides are not impacting surface water. Since the ultralow volume (ULV) applications of pyrethroids over surface water cannot be detected in the surface water (with only a few exceptions), then the ground surface would be similarly unaffected. The assumption that children would be exposed under the conditions indicated (i.e., binding to organic matter and sand/soils) is not applicable to the ULV and targeted application techniques for adulticides utilized by the District such that the concern is overstated.

Concerning the use of glyphosate for vegetation management, refer to Responses O-VOL 20, 21, and 22. Use of herbicides by any other water or land management district does not compare to existing use of herbicides by the District. The most frequent use of glyphosate by the District is to remove poison ivy/oak from land areas requiring access by District staff for surveillance and vector control. However, larger areas could be treated in the future if needed for vector control. When applied to typical areas targeted for vegetation management, glyphosate is transformed to less toxic and different chemical constituents in normal soil within a few days, or even quicker when used for most general uses. It can be rapidly bound to soil particles and inactivated, and the unbound glyphosate can be degraded by bacteria. The media reports about the hazards of glyphosate and its several commercial products have not been clearly associated with human health. The numerous reports about "possible" connections to metabolic processes and subtle effects also include confounding factors that make scientifically defensible claims impossible. Where reports of adverse subtle effects exist, they are usually based on laboratory studies of cell lines, etc., at exposures far above any possible actual human exposure.

Concerning the commenters' request to the District to prepare a revised PEIR because the commenter disagrees with the PEIR conclusions of less-than-significant impacts to ecological and human health, opinion on what a significant impact is and is not in this PEIR differs between the commenter and the PEIR preparers. The Draft PEIR thoroughly analyzed the impacts associated with the Proposed Program, and additional information is provided herein and in a revised Draft PEIR (for recirculation) to support the original conclusions as well as consideration of information provided by Mr. Volker and other commenters. The information in the revised Draft PEIR provides clarification of material contained in the original Draft PEIR and addresses specific questions raised in public comments for this PEIR in Appendix F, Responses to Comments. None of the comments identified substantial evidence of a new significant impact that was not considered in the first Draft PEIR, and no Draft PEIR impacts need to be changed from less-than-significant to significant; thus, a recirculated Draft PEIR is not required for these reasons but is provided because clarifications and additions are substantial. A revised Draft PEIR is being recirculated.

See Response O-VOL-7 on considerations in making impact determinations of significance on chemical methods of vector control. The CEQA conclusions of less-than-significant impacts are based not only on the District BMPs (a Program feature that is part of the Program description) but on application methods and the concentration and type of chemical materials used. All of these factors, and including the physical context in which the applications occur (that subject the treatments to sunlight, air, and soil conditions that minimize persistence and facilitate breakdown) support the Draft PEIR conclusions that the resultant effects are not substantial or adverse enough to be characterized as significant, not that a conclusion of zero or no impact is presented. A loss of some individual nontarget insects on occasion during an application could occur on occasion during an application, but the loss would not be substantial for reasons cited in Responses O-VOL 6 and 7.

Appendix B was a technical report designed to cover basic parameters of toxicity, fate, and transport for 46 chemicals and designed to provide sufficient information for the public about the potential adverse effects of the chemicals used by the 9 participating districts, including the District, for vector control. The information and chemical data provided in Appendix B are based on summaries and data generated to satisfy the US Environmental Protection Agency (USEPA) requirements for registration of chemicals and pesticides. Most of those data are generated by independent research and contract laboratories that conduct strictly controlled laboratory and field tests with the chemical of interest; and numerous possible species are exposed to nearly 100 percent chemical for varied periods of time. Although these tests are designed to identify and characterize the possible toxicity of the chemical, the results are clearly not directly relevant to the very low levels of chemicals used and exposures that result from the District's specific vector control activities in the physical environment described above. Additional literature was reviewed in preparing these and other responses to comments, and part of this literature review is attached to the O-VOL responses to comments as Attachment A (at the end of the responses).

Also see Response O-VOL-15 on the use of best professional judgment by PEIR preparers with the appropriate technical qualifications to evaluate the impacts of human and ecological concern. The author of the responses on pesticide use herein, both insecticides and herbicides, and the ecological and human health impact conclusions and related material in the Draft PEIR, is Bill A. Williams, PhD, a toxicologist with the educational and experiential background as an expert on pesticides and their use in aquatic and terrestrial environments. A summary of Dr. Williams' qualifications to evaluate the scientific literature and to consider where and how the District is specifically using the pesticides for vector control in order to draw conclusions of impact significance to humans and to nontarget species is provided in Response O-VOL-15. Dr. Williams has more than 30 years of experience and expertise in environmental risk assessment and toxicology, including CERCLA, NRDA, NEPA, and CEQA projects ranging from upland to sediment to freshwater/marine projects. Dr. Williams has been a member of numerous international, National Academy, and federal committees and workshops to define risk assessment guidelines, test procedures, field study approaches, and avian and mammalian test protocols, and to provide other technical assistance utilized by USEPA regulators. He helped develop USEPA's Framework for Ecological Risk Assessment and USEPA's risk assessment of 2,3,7,8 TCDD (tetrachlorodibenzo-p-dioxin or dioxin). He was a charter member of the Avian Dialogue Group, convened by the Conservation Foundation (RESOLVE) to bring industry, academia, and government regulators together to resolve conflicts between the groups. Dr. Williams has led and supported dozens of successful projects that were acceptable to the Washington Department of Ecology, Oregon Department of Environmental Quality, Oregon Department of Fish and Wildlife, USEPA Regions 2, 9, 10, and numerous other USEPA regions nationwide. Dr. Williams has served on several Oregon DEQ advisory science committees and workshops. He has been a member of several national and regional USEPA Science Advisory Panels, including the National Science Advisory Panel on endocrine disruptors, on uncertainty in risk assessments, and the panel on use of laboratory data in estimates of risk to wildlife.

The highlights of his extensive experience presented are from Dr. Williams' technical resume, which is attached to the end of the O-VOL response to comments (Attachment B). This resume has been reduced from his master resume to focus on the most relevant aspects of his career dealing with pesticides and risk assessments, excluding his accomplishments at NASA as a Program Scientist and Payload Scientist/Astronaut (1969-1986).

From: Sandie Schmaier [redacted]
Sent: Monday, May 9, 2016 12:03 AM
To: Peir <peir@smcmvcd.org>
Subject: Residential Spraying of Glyphosate and the like - Hillsborough/San Mateo

I-Sch

Dear Dr. Chindi Peavey,

I have reviewed the letter dated May 9, 2016 from Stephan C. Volker on behalf of Healthy Children Alliance and support the arguments put forth in this letter. The San Mateo County Mosquito and Vector Control District's PEIR fails to thoroughly and accurately disclose and analyze the human health impacts associated with the pesticide use contemplated in this project. Of particular concern are the pyrethroid and pyrethroid-like compounds and glyphosate usage contemplated in the document without a proper analysis of the impact of their usage on human health. Young children are pregnant women are especially vulnerable to the negative health risks associated with pesticide usage. These risks must be given full disclosure and attention in a revised PEIR. 1

Scripts Research Institute in San Diego has found a direct correlation between Parkinson's cases and glyphosate drift into residential areas.
I will send you the link to this story so you can learn about this research. 2

Respectfully,

Sandra L. Schmaier,
Pacific Heights Team Leader- Families against the S.F. LBAM Spray
[redacted]

Robert David Schmaier
Business Owner in San Mateo
[redacted]

[redacted]

1

Comment Letter I-SCH — Schmaier, Sandra L. & Schmaier, Robert David

May 9, 2016

Response 1

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Response 2

We did not receive a link to the identified report by the Scripps Research Institute on drift of glyphosate application into residential areas and Parkinson's Disease. However, Dr. Williams has reviewed many studies on glyphosate and others where the common flaw in many demographic studies is that correlation is not causality. A summary of the reviews of selected reports is included at the end of this response.

In general, it is not possible to clearly link the onset of Parkinson's to a specific factor. Many research studies provide potential linkages of the onset to external factors, based on trends or correlations to otherwise unrelated data. Some of the typical reports that suggest a linkage of glyphosate exposure to Parkinson's disorder have been reviewed and evaluated in the last section of this document. While Parkinson's disease is one of the most common ailments associated with elderly adults (second only to Alzheimer's disease) it is important that substantial research effort should be focused on determining the cause(s). However, at this time there has been no clear linkage to any single factor or exposure. Because of the adverse impact of Parkinson's disease on individuals and families, continued research effort is warranted and may, in the future, provide some clear indication of the role of the multitude of possible factors that may be involved. Again, however, at this time, there remains no clear linkage of any single factor, including exposure to glyphosate (Roundup) to the onset of Parkinson's.

The linkages between pesticide exposure and human disease suggested in many studies do not show a clear, unambiguous causality. Although there are hundreds of studies that attempt to link diseases to specific external factors, they do not typically provide a defensible correlation to causality. For example, some authors suggest that pesticides are one of the environmental factors implicated in developmental delay (DD) and autism spectrum disorder (ASD). Although the onset is considered to have a large genetic component, the study of potential links of environmental and chemical factors to the onset of DD and ASD includes dozens of potential causes that confound the results of the studies. Many of the possible links to the onset of DD and ASD include numerous factors that have been suggested as contributing to autism

(Lyall et al. 2014, Frietag 2007). Some of the suggestions for factors to consider include some foods, heavy metals, infectious diseases, smoking, drugs, pesticide, lack of certain vitamins, vaccines, solvents and even emotional neglect. Without acknowledging, understanding, and control of these many confounding factors, there is, at this time, no scientific evidence that clearly links any factor, solely, to the onset of these conditions. This lack of clear causality is an issue in many demographic studies because the contributions to adverse effects and onset of DD and ASD cannot easily be determined and separated from the other factors.

Also, many of the studies on glyphosate are on agricultural use of the product where fields and/or unplanted rows (i.e., large areas) are sprayed with glyphosate to control weeds. The District's use of glyphosate for vector control is highly targeted and localized (sprayed onto vegetation using hand cans) which would minimize the potential for human exposure. These applications are so infrequent that none have occurred in the past 5 years Under consideration for future use is the use of glyphosate for treating larger areas such as vegetation along recreational trails that harbor ticks.

Review of Reports of Implied Glyphosate Links to Parkinson's Disease: A Review of Selected typical reports

In response to Comment 2 that glyphosate exposure may be associated with the onset of Parkinson's disease, the following review addresses and evaluates some of the typical reports or readily available online material that suggest a linkage of glyphosate exposure to Parkinson's disorder. While Parkinson's disease is one of the most common disorders associated with elderly adults (second only to Alzheimer's disease), it is important that substantial research effort should be focused on determining the cause(s). However, at this time there has been no clear linkage to any single factor or pesticide exposure. Because of the adverse impact on individuals and families of Parkinson's disease, continued research effort is warranted and may, in the future, provide some clear indication of the role of the multitude of possible factors that may be involved. Again, however, at this time, there remains no clear linkage of any single factor, including exposure to glyphosate (Roundup) to the onset.

The five reports or materials addressed below are representative examples of some of the many research studies that attempt to link the onset of Parkinson's to herbicide uses. The following selected examples of current research studies are evaluated with a critique of the conclusions presented in each and the relation of the exposure to herbicides, especially glyphosate (Roundup).

a) **Parkinson's Disease and Pesticides: What's the Connection? "Scientists find a way chemicals may contribute to Parkinson's". Bret Stetka. April 8, 2014.**

The report claims that farmers are more prone to Parkinson's than the general population is, possibly linked to pesticide exposures. The report claims that there is a clear link between pesticide exposure and a higher risk for Parkinson's disease which is a neurodegenerative disease second in occurrence to Alzheimer's. The claim is based on a reported possible cellular mechanism of action for the onset of Parkinson's which the author claims may be related to some pesticides.

While the author makes the claim that exposure to glyphosate can be linked to the onset of Parkinson's, contrary to that claim, in his initial overview, he makes the following correct statement that "Regardless of inciting factors — and there appear to be many…(factors,sic)" that may be related to the onset of Parkinson's. He states that neurons associated with muscular control in the *substantia nigra pars compacta* may be impacted, which results in impaired movement and coordination, tremors, and rigidity. However, this report is based on extrapolation of the possible effects to this important brain nucleus, suggesting that any factor that impacts it could be involved in the onset of muscular disorders (including Parkinson's). This assumption is reasonable, but the specific factor cannot be specified.

Inspection of the structure of the study and conclusions indicates that there were numerous other factors (as agreed by the author) that likely contribute to the onset. Although this report provides an important discussion on the possible metabolic or cellular links of pesticides to this and other diseases, it provides no clear connections to the actual exposures. Use of secondary and indirect relationships in studies involving human health can provide correlations, but without a clearly determined exposure, there can be no clear causality.

b) Pesticides and **herbicides like glyphosate now strongly linked to Parkinson's disease and other neurological disorders**. ***Natural News*****, Tuesday March 08, 2016. by: L.J. Devon, Staff Writer (non scientist)**

This article is representative of the many non-peer reviewed reports that provide an overview of some of the current interest in and concern about pesticides in human and ecological health. The focus of this report is glyphosate and its possible role in the adverse impacts on genetics and gene modification. The report claims that glyphosate and other herbicides may be altering the normal sequences of gene expression and impacting the natural responses of the gut to foods. While this is the theme of the report, it appropriately includes the suggestion that other factors such as antibiotics, vaccines, formaldehyde, MSG, mercury, as some other chemicals may adversely impact normal gene expression. The report relies on extrapolations of the results of extreme exposures to pesticides (over extended periods of time) to conclude that there is a linkage to Parkinson's. As is the case with most of the similar studies evaluated, the reliance on secondary and indirect relationships in studies on environmental impacts, and especially those addressing human health, can provide some potential correlations; but without a clearly determined exposure, there can be no clear causality.

c) Roundup, An Herbicide, Could Be Linked To Parkinson's, Cancer And Other Health Issues, Study Shows. *Huffington Post*. June 25, 2013.

This study is taken from an article in the *Huffington Post* (not a scientific source) as reported by Reuters and is a secondary summary lifted from a study in the journal *Entropy* that lists the myriad of potential onset of Parkinson's due to exposure to glyphosate (Roundup) and is illustrative of the type of report common in the publication and television media that tend to extrapolate and extend the results of scientific publications without a critical evaluation of the study approach, actual exposures in the original report, or discussion of the implications in the real world. Unfortunately, reports such as this in the *Huffington Post* (which allows unfettered access to its publications) can result in inappropriate conclusions about the possible impacts of chemicals.

d) Parkinson's Disease: Caused by Glyphosate (Monsanto) and/or Trichloroethylene? Thomas Janossy, Ph.D. Friday, 31 October 2014. In: Radix.com.

Radix.com supports a blog representing an anti-pesticide and anti-GMO environmental group with a clear agenda to eradicate pesticides and condemn any products that may be associated with GMOs or their offshoots. While the blog is clearly slanted to an anti-pesticide agenda, it includes discussion of some of the other factors that could be involved in the onset of Parkinson's. The author cites earlier work implicating bacterial infections and several extraneous factors such as dietary habits, other environmental exposures, and occupation in the possible links to the disease. Although the author of the blog includes the possibility of other, exogenous factors, he nevertheless implies that glyphosate is the culprit. Conveniently, the blog has several suggestions for commercial products that are available to alleviate the adverse effects of pesticides. The claims of such blogs must be considered critically in light of the products they recommend to the reader.

e) 11 Commonly Used Pesticides Linked to Parkinson's Disease.Low-Level Pesticide Exposure Linked to Parkinson’s Disease. Dr. Mercola. A blog at Mercola.com. February 20, 2014.

This article cites a study implicating 11 pesticides that increase the risk of Parkinson’s disease. The article implies that even very low-level exposures can result in Parkinson’s in people with a specific common gene variant that renders them more susceptible to Parkinson’s. The author indicates that ambient exposure to organophosphate pesticides also increased the risk of developing Parkinson’s disease, and he provides a number of suggestions to minimize the risk of Parkinson’s, including specific commercially available products that are described in the article. By providing a pseudo-scientific review of the possible linkages to the onset of Parkinson’s, the author provides many suggested methods (including the use of his products) to reduce the risk of Parkinson’s disease. While some of the information provided in articles such as this may be credible, the resulting emphasis on the purchase of products makes the content of the article less credible. However, this is typical of the numerous articles available on the web and commercial publications that focus on emotional responses to the implications of risk and the conveniently available products offered for sale by the author.

Additional References

Devon, L. J. 2016. Pesticides and herbicides like glyphosate now strongly linked to Parkinson's disease and other neurological disorders. *Natural News.* Tuesday March 08, 2016. Staff Writer (non scientist). Available at http://www.naturalnews.com/053226_herbicides_gene_expression_Parkinsons.html

Frietag, C.M. 2007. The genetics of autistic disorders and its clinical relevance: a review of the literature. Molecular Psychiatry 12: 2-22.

Huffington Post. Roundup, An Herbicide, Could Be Linked To Parkinson’s, Cancer And Other Health Issues, Study Shows. June 25, 2013. Available at: http://www.huffingtonpost.com/2013/04/25/roundup-herbicide-health-issues-disease_n_3156575.html

Janossy, Thomas, Ph.D. Parkinson's Disease: Caused by Glyphosate (Monsanto) and/or Trichloroethylene? *Radix.com.* Friday, 31 October 2014. Available at https://oradix.com/health/parkinson-s-disease-caused-by-glyphosate-monsanto-and-or-trichloroethylene.

Lyall, K.R., J Schmidt, and I. Hertz-Picciotto. 2014. Maternal lifestyle and environmental risk factors for autism spectrum disorders. *Int. J. Epidemiol*. Apr; 43 (2): 443-464.

Mercola, Dr. 11 Commonly Used Pesticides Linked to Parkinson's Disease. Low-Level Pesticide Exposure Linked to Parkinson’s Disease. A blog at Mercola.com. February 20, 2014. Available at: http://articles.mercola.com/sites/articles/archive/2014/02/20/pesticide-exposure-parkinsons-disease.aspx

Stetka, Bret. 2014. Parkinson's Disease and Pesticides: What's the Connection? “Scientists find a way chemicals may contribute to Parkinson’s”. April 8. Available at: http://www.scientificamerican.com/article/parkinsons-disease-and-pesticides-whats-the-connection/.

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