Larviciding Solutions for Suburban Environments

Samer Elkashef, Tony Hedley, Tom Price, Steven Ramos, Ruben Rosas, Marcia Reed, Ben Weisenberg, Sarah Wheeler

SACRAMENTO-YOLO MOSQUITO & VECTOR CONTROL DISTRICT

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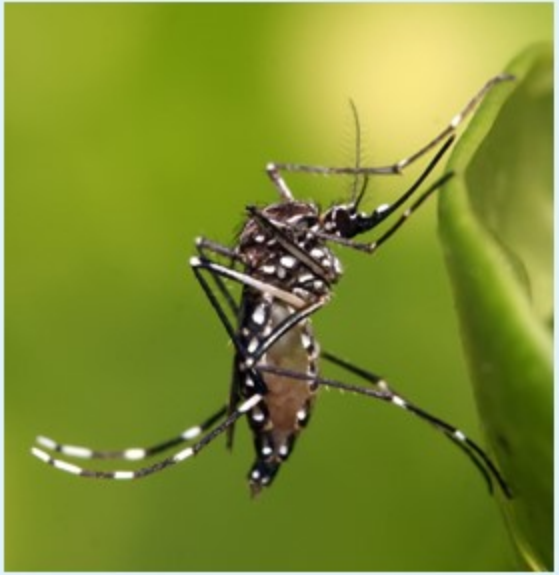
Challenges for Suburban Mosquito Control



How to get everywhere and check everything?

Known Pools

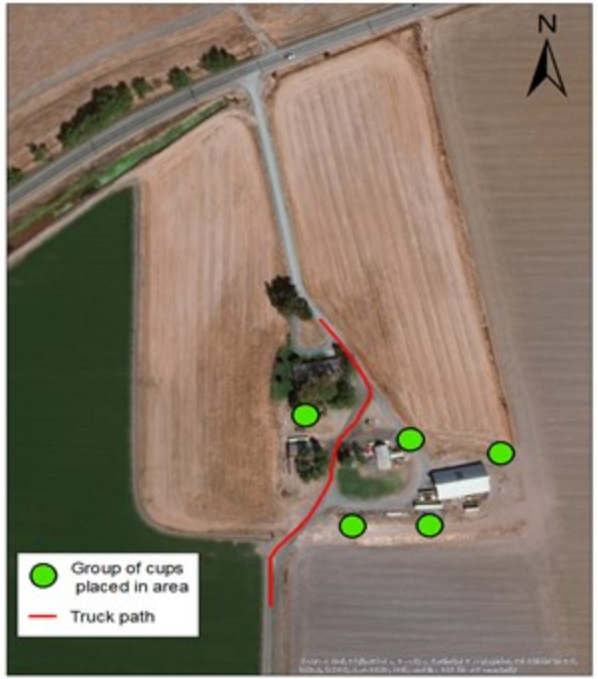
Properties with Pool Permits

Everything Else

WALS: A low volume larviciding (LVL) technique

- VectoBac WDG suspended in water
- Designed to deliver BTI into hard to reach mosquito breeding sources
- Designed with container breeding *Aedes* in mind
- Can this be used for controlling *Culex pipiens* in suburban environments?

Step 1: Can the material reach cryptic sources?



Agriculture Test Sites

Open

Partially Cover

Full Cover

Under Basket

Equipment Evaluated: A1 Super Duty

Equipment Evaluated: Guardian 190 G4

A1
Guardian

Truck Route:
Wind Direction

Each bar graph shows the percentage of dead CQ1 mosquito larvae in each sampling cup after 48h of exposure

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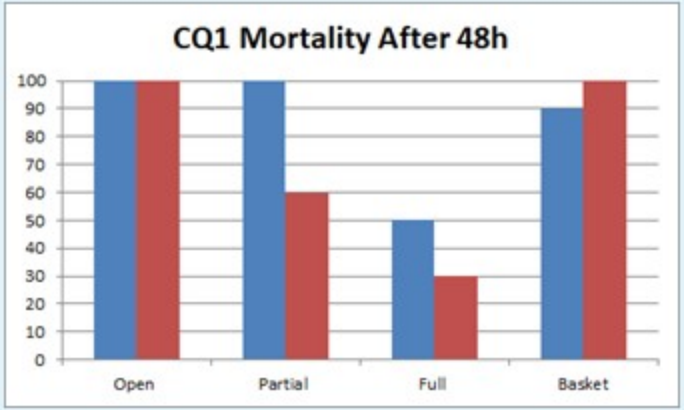
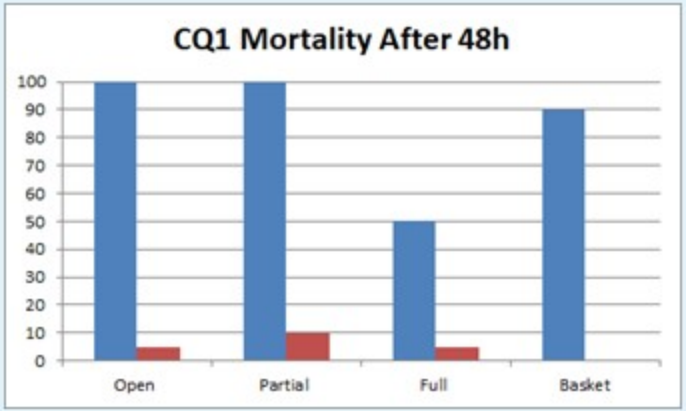
A1

Guardian


CQ1 Mortality After 48h
100
90
80
70
60
50
40
30
20
10
0
Open
Partial
Full
Basket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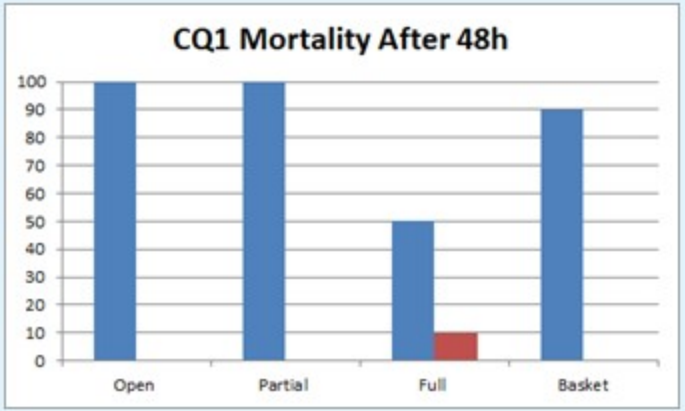
CQ1 Mortality After 48h
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Partial
Full
Basket

Step 2: Greenbelt Application

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Informing the Public

Door Hanger

Email Notification

Park Spray Results

Truck Route:
Wind Direction:

Cup placement
In open:
Partially covered:
Completely covered:

Above ground larval mortality
0%:
25% - <50%:
50% - <75%:
75% - <100%:
100%:

Step 3: Suburban Applications

Evaluated Catch Basins

3 Types of Cup Coverage

Orangevale Results

Truck Route:

Wind Direction:

Cup placement

In open:

Partially covered:

Completely covered:

Above ground larval mortality

0%:

25% - <50%:

50% - <75%:

75% - <100%:

100%:

Below ground larval mortality

0%:

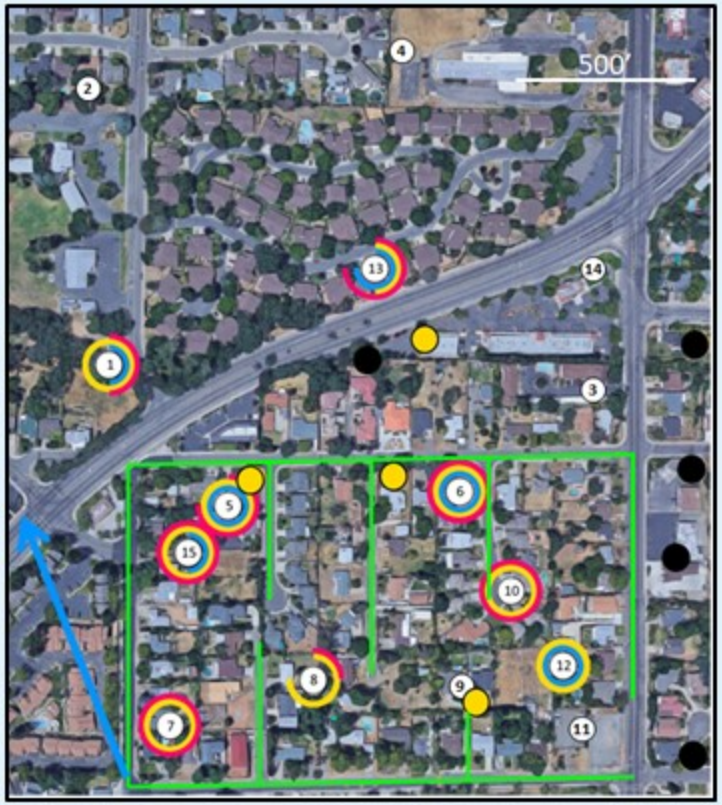
25% - <50%:

50% - <75%:

75% - <100%:

100%:

Wind @1.5-2 mph



Wind @0.2-1.1 mph

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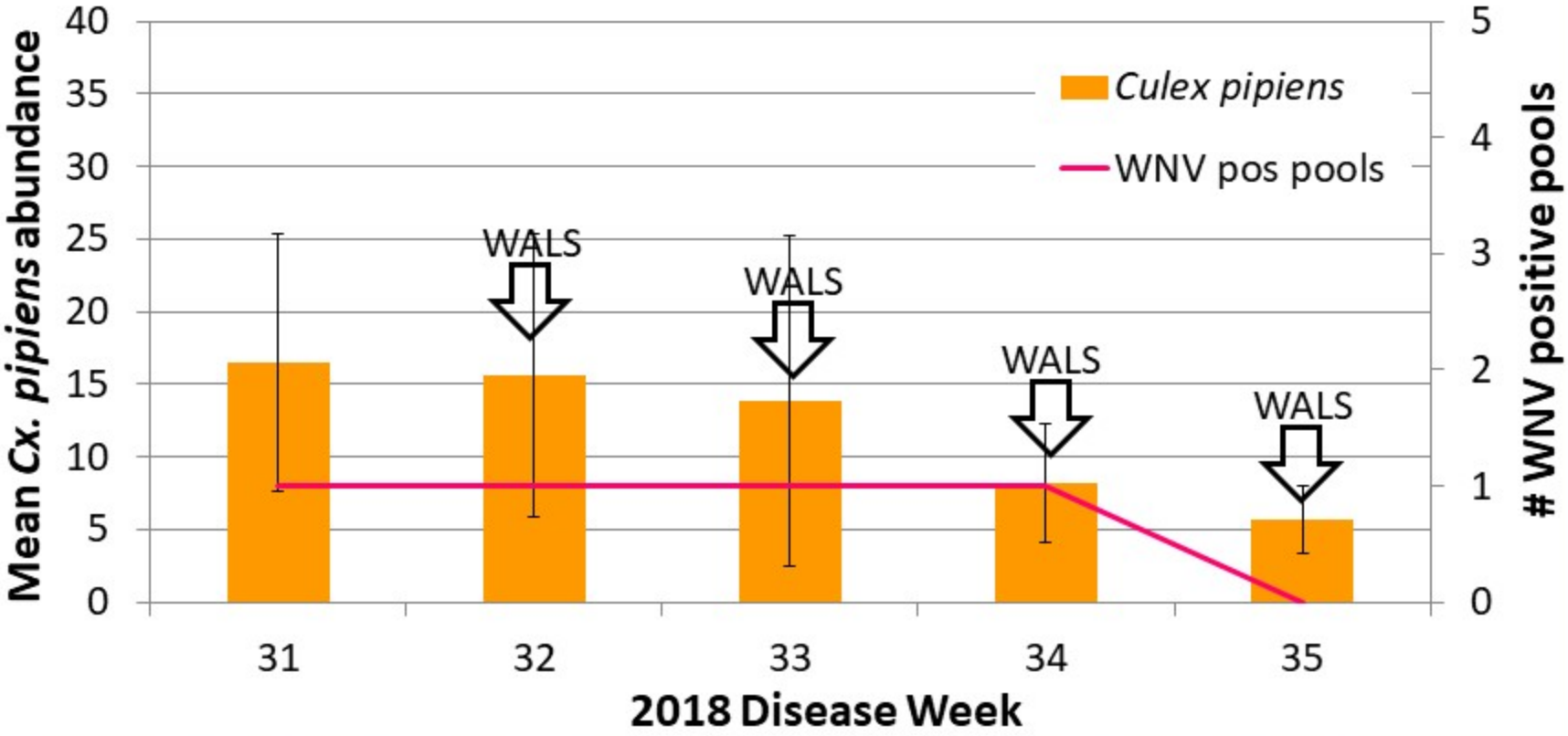
Orangevale mosquito abundance and WNV activity



CO_2 and gravid trap data for *Culex pipiens* were combined for each site and mean abundance was calculated across all trapping locations, standard deviation shown

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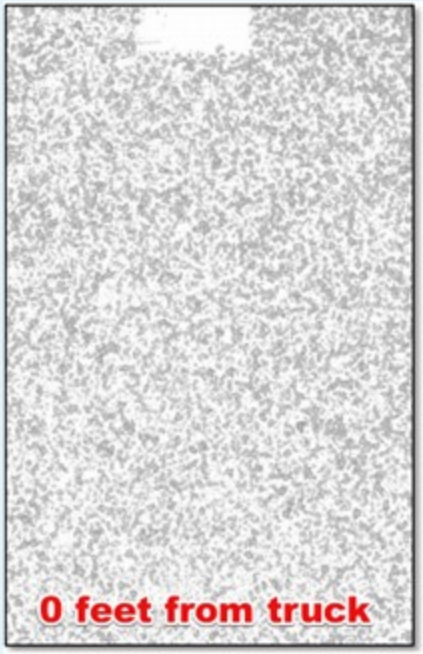
Elk Grove Results

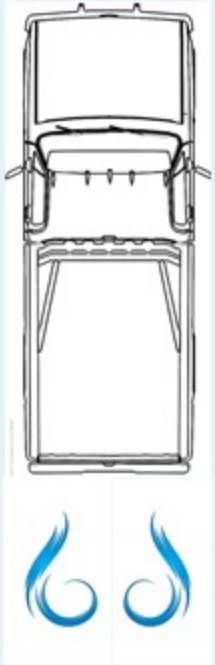
Wind @ less than 1 mph

Wind @ 2.5 mph

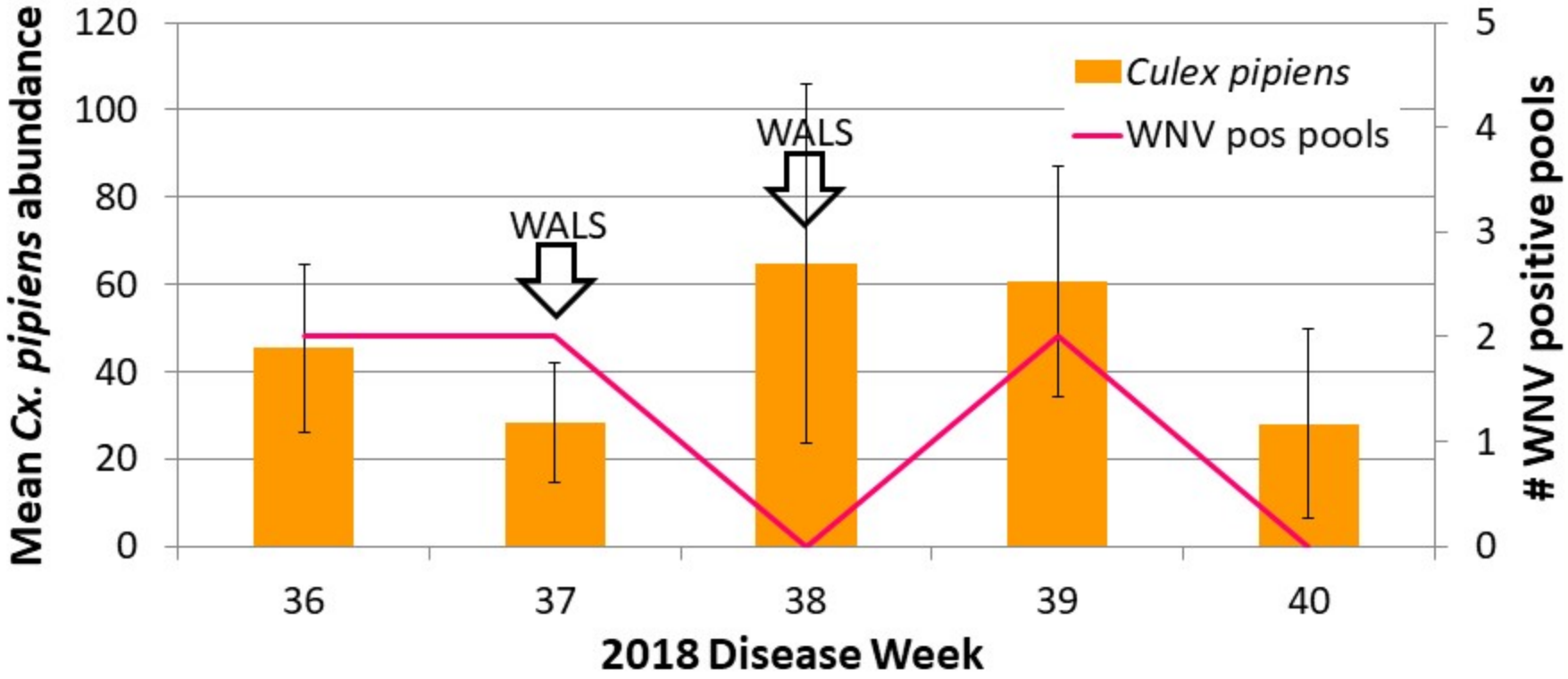
The Need for Wind

No wind leaves material deposits on the road





Elk Grove mosquito abundance and WNV activity



CO_2 and gravid trap data for *Culex pipiens* were combined for each site and mean abundance was calculated across all trapping locations, standard deviation shown

Summary of Initial Investigation

- Applications generally resulted in product drifting approximately 300’ downwind of the spray path
- Good wind was essential to spread the product
- Product readily drifted into cryptic sites and catch basins.

How do you operationaliz

1. Wha
   appl
2. Wha
3. How

FORMATTED DATE_TIME	Wind Speed
9/12/2018 3:00	2.1
9/12/2018 3:10	1.7
9/12/2018 3:20	1.2
9/12/2018 3:30	0.8
9/12/2018 3:40	3.9
9/12/2018 3:50	3
9/12/2018 4:00	3.4
9/12/2018 4:10	0
9/12/2018 4:20	2.7
9/12/2018 4:30	3.3

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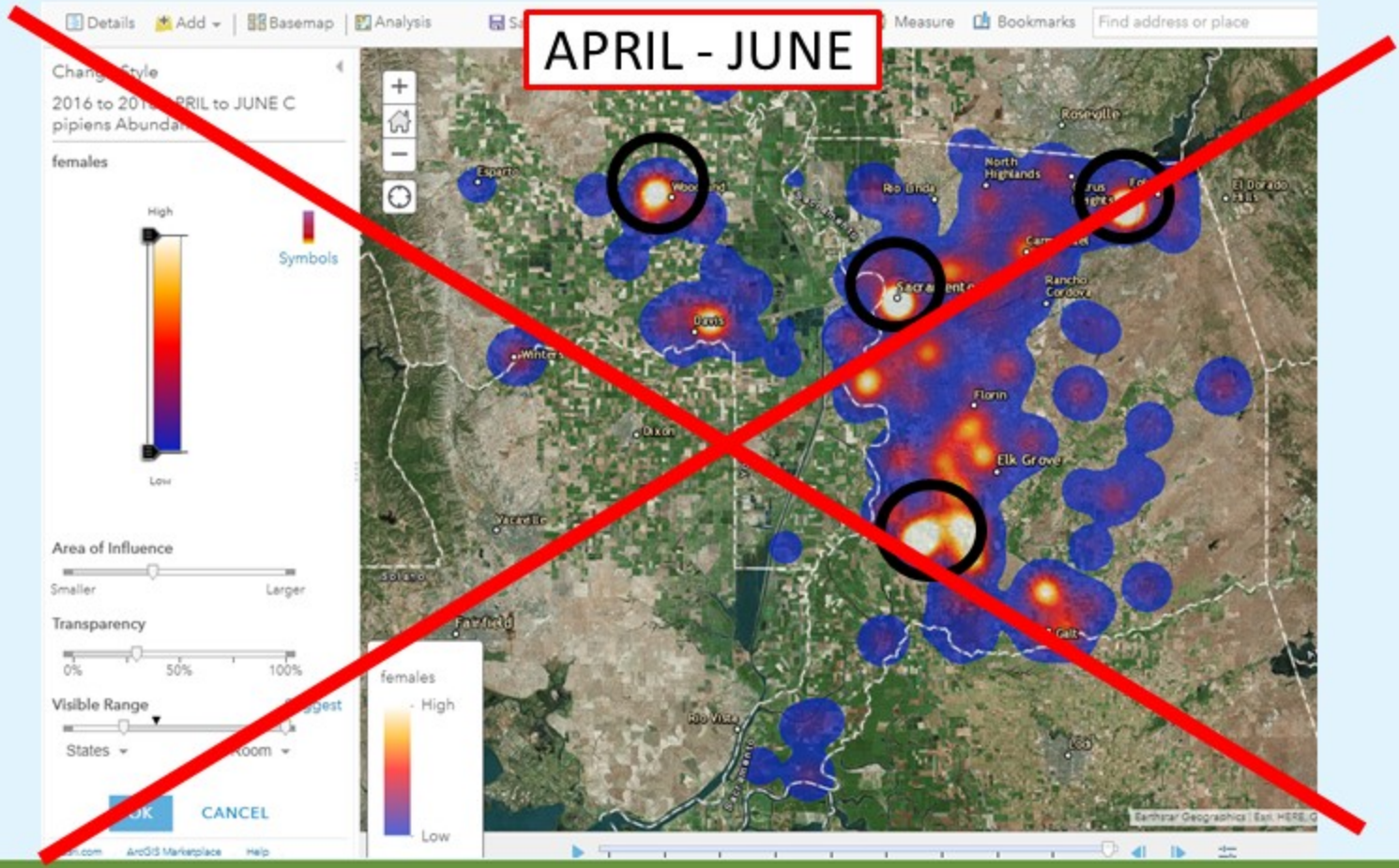
How do you operationalize LVL?

Hard to justify LVL has a response to high WNv prevalence, it just doesn't act fast enough to lower vector index

Can these applications be done proactively to reduce the risk of infection?



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2016-2018 Female *C. pipiens* Abundance

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August 28th, 2019 3:15pm

PLACER MOSQUITO & VECTOR CONTROL DISTRICT

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Enter *Aedes aegypti*

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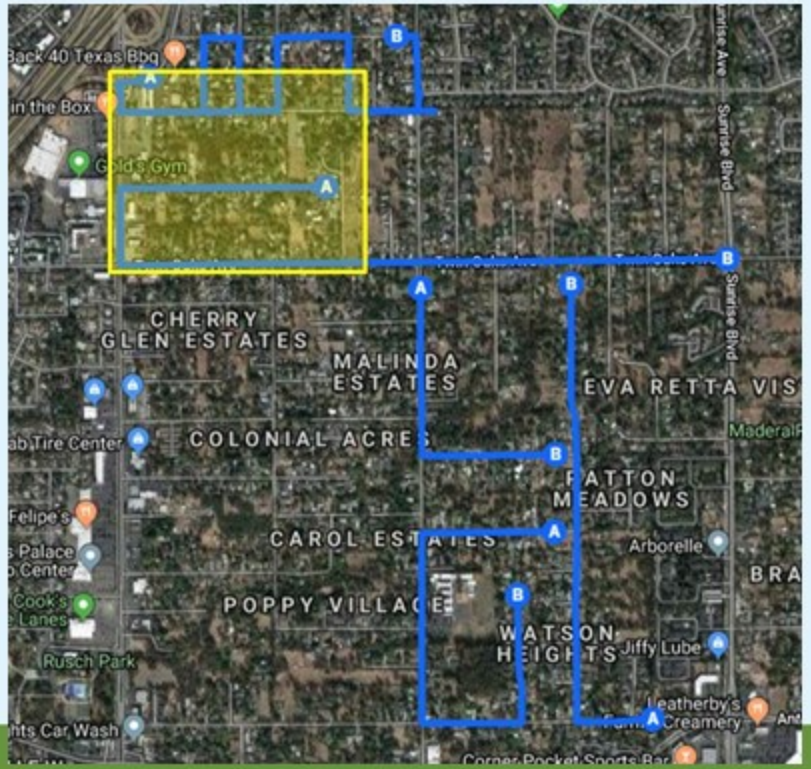
Inspection and Treatment Strategy



- Day 2 LVL with WDG
- 260 acres Treated

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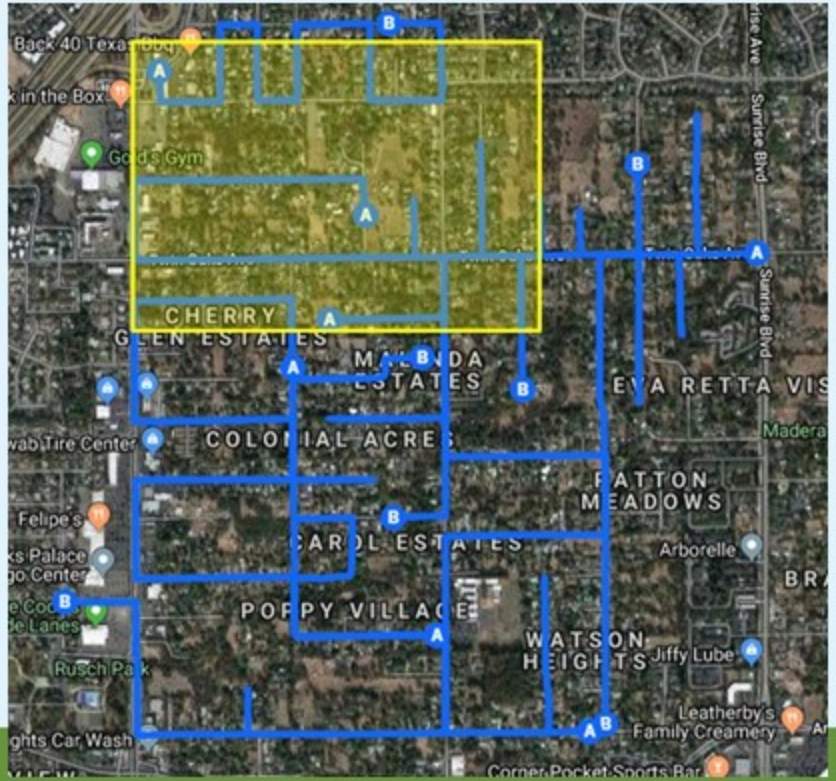
Inspection and Treatment Strategy



- Day 6 LVL and ULV
- Expanded treatment area
- 333 acres Treated

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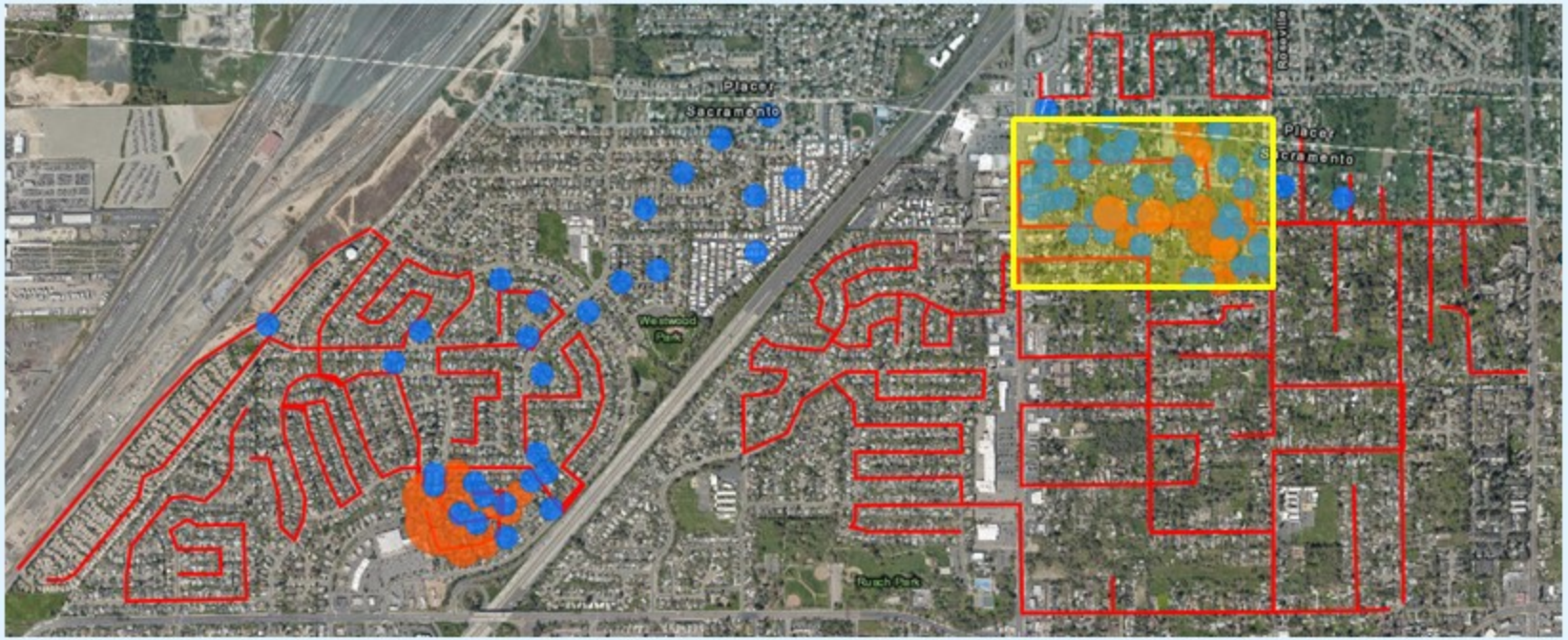
Expanded LVL Routes



How do you make this efficient?

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How do you make this efficient?

- Streamlining the refill process
- Better routing features
- Improvements to the A1
- Material Cost

Refilling in the field

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15 minutes to refill

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Routing and Weather

App Store Preview

This app is available only on the App Store for iPhone and iPad.

inRoute Route Planner 4+

Routing & Road Trip Planning

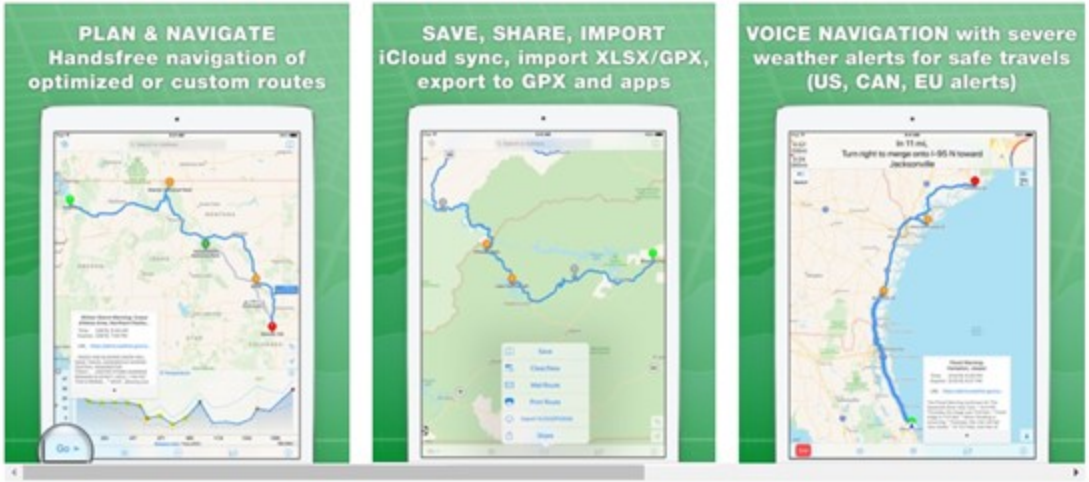
Carob Apps, LLC

#116 in Navigation

★★★★★ 4.6, 3.3K Ratings

Free · Offers In-App Purchases

Screenshots iPhone iPad



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Routing and Weather

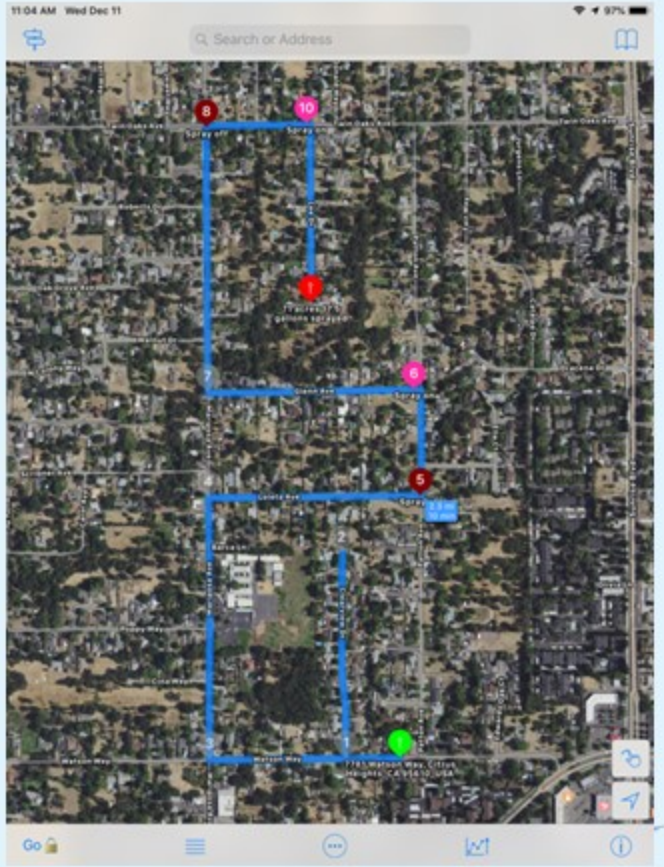
Create Waypoints
Within InRoute App

Start

End

Spray off

Spray on



Routing and Weather

Before Application

During Application

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A1 Improvements

Original calibration point

New calibration point

A1 Improvements

Keep Tabs On Flowrate

A1 Improvements

Pressure Regulator

Motorized Bypass Valve

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Flowrate Adjustments

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A1 Improvements

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Longer Spray Routes

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A1 Improvements

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Citrus Heights WALS Routes and Study Sites

A – Grand Oaks Neighborhood

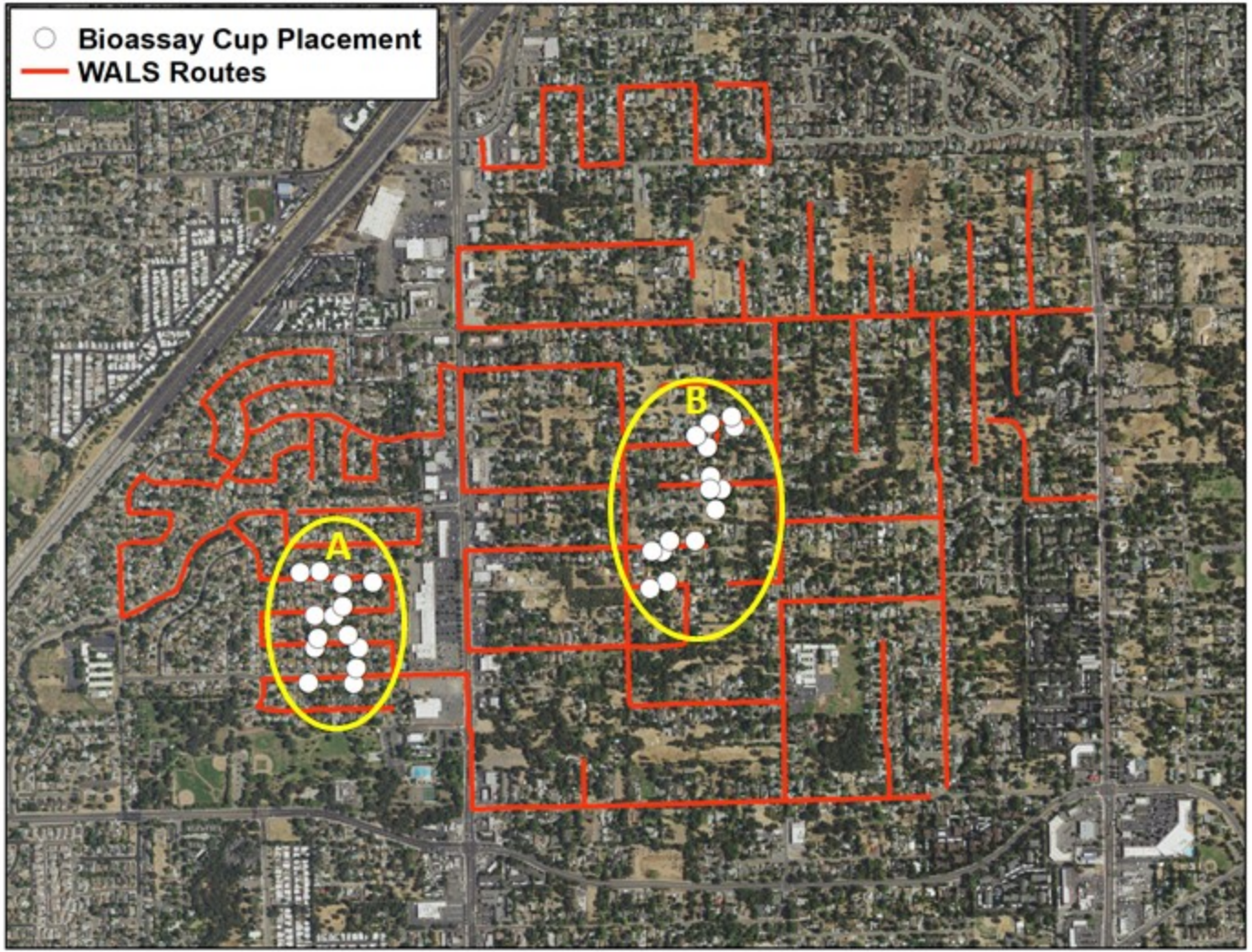
0.25 lb/acre - 9/24/2019

0.50 lb/acre - 9/27/19

B- Colonial Acres Neighborhood

0.50 lb/acre - 9/24/2019

0.25 lb/acre - 9/27/19



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Grand Oaks, Citrus Heights, CA

Aedes aegypti

Culex pipiens

Truck Route:

Wind Direction:

Bioassay larval mortality

0%:

25% - <50%:

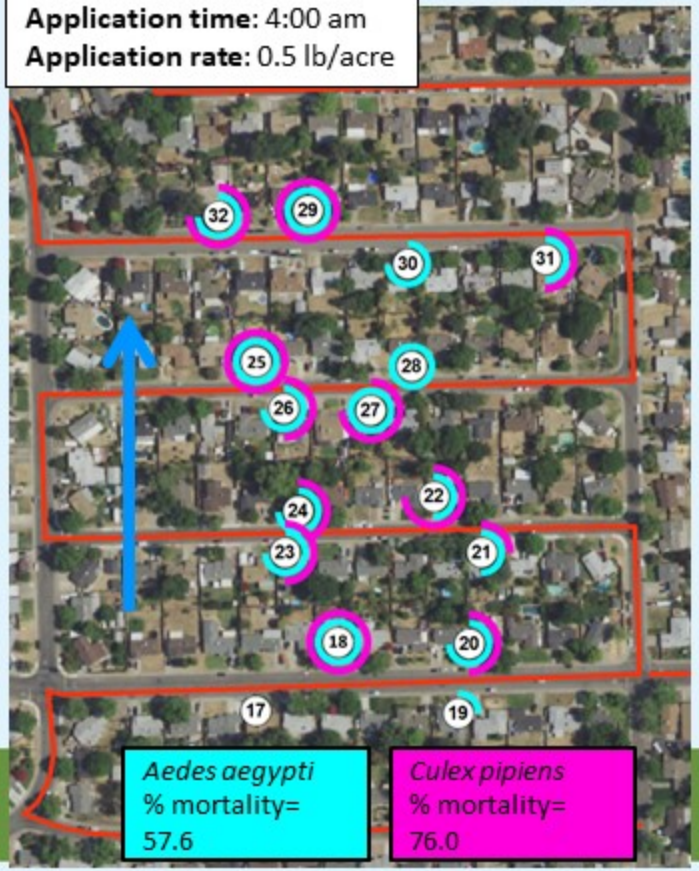
50% - <75%:

75% - <100%:

100%:

September 24, 2019
Wind speed: 10-12 mph
Wind direction: NNW
Application time: 4:00 am
Application rate: 0.25 lb/acre

September 27, 2019
Wind speed: 10-15 mph
Wind direction: S
Application time: 4:00 am
Application rate: 0.5 lb/acre



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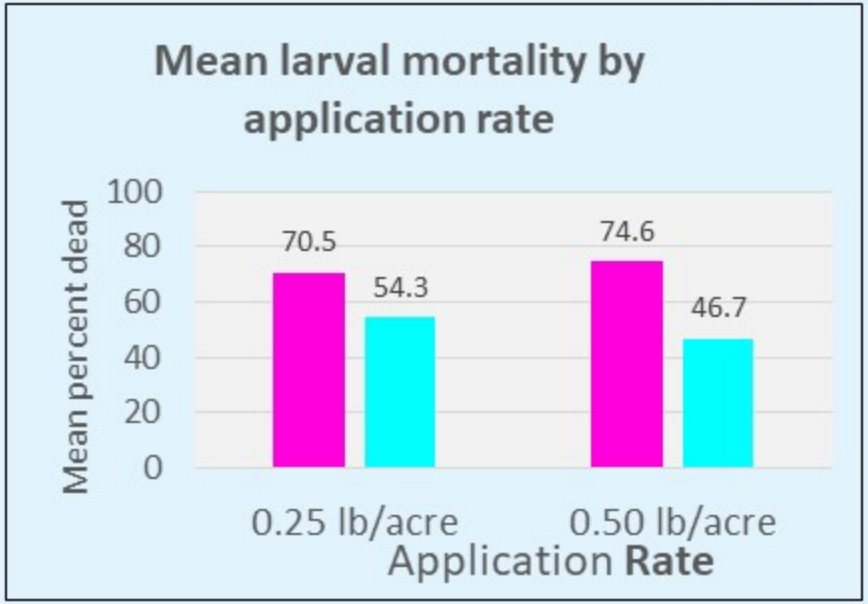
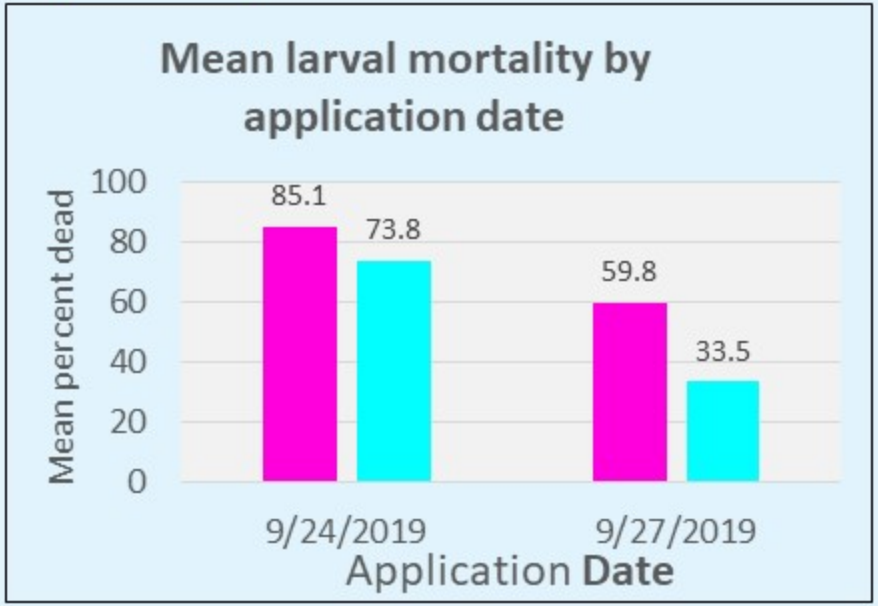
Dose Optimization

Aedes aegypti

Culex pipiens





Larval bioassay data was combined across placement types, application date, and location and was compared by application rate

Larval bioassay data was combined across placement types, application rates, and locations and compared by application date

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Conclusion

- With the proper wind, the use of VectoBac WDG is a good tool to get to backyard sources
- The A1 Super Duty was found to slightly outcompete the Guardian
- The District is optimizing the use of the A1 to meet operational realities
- Dose matters, not as much as wind
- Based on work done at other agencies, we are looking at doing similar applications with different products