Department of Pesticide Regulation

Paul Helliker
*Director*

Gray Davis
*Governor*

Winston H. Hickox
*Secretary, California Environmental Protection Agency*

M E M O R A N D U M

TO: Kean S. Goh, Ph.D.
Agriculture Program Supervisor IV
Environmental Monitoring Branch

FROM: Juanita Bacey, Environmental Research Scientist
Keith Starner, Environmental Research Scientist
Frank Spurlock, Ph.D. Senior Environmental Research Scientist
Environmental Monitoring Branch

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SUBJECT: PRELIMINARY RESULTS OF STUDY #214: MONITORING THE OCCURRENCE AND CONCENTRATION OF ESFENVALERATE AND PERMETHRIN PYRETHROIDS

## SCOPE OF THIS MEMORANDUM

This memorandum provides results of water sampling conducted in tributaries to the Sacramento and San Joaquin Rivers by the Department of Pesticide Regulation (DPR) for the Surface Water Protection Program. Information presented is from November 2002 through March 2003. Results from chemical analysis conducted by the California Department of Food and Agriculture (CDFA) and bioassays conducted by the California Department of Fish and Game (DFG) are also presented here.

The primary objectives of this monitoring project were to determine (a) if the insecticides esfenvalerate and permethrin are moving offsite into surface waters, during winter storm events, and if so, (b) the typical range of concentrations that may be observed. A secondary objective was to obtain more data on organophosphate (OP) insecticides and selected herbicide residues in surface water. This memorandum does not include an in-depth interpretation of the data, which will be provided in the final report.

## BACKGROUND

In the Sacramento and San Joaquin valleys there are more than 750,000 acres of almonds, nectarines, peaches, plums and prunes grown (Epstein et al., 2000). As part of integrated pest management, OP insecticides are applied on these tree crops, generally with dormant oil, to control the San Jose scale, the peach twig borer, aphids and other pests. This is done primarily between December and February when trees are dormant, allowing for better pesticide coverage to achieve effective control of pests.

The dormant-spray season coincides with seasonal rainfall, thus increasing the likelihood of insecticides to move offsite to surface water, either dissolved in water or attached to sediment. Various monitoring studies conducted by DPR and U.S. Geological Survey (USGS) have shown that detections of OPs such as diazinon and chlorpyrifos are frequently detected during dormant-spray seasons (Dileanis et al., 2002; Ross et al., 1996; Domagalski et al., 1997; Kratzer, 1998).

DPR is required to protect the environment, including surface water, from environmentally harmful pesticides (Food and Agricultural Code, section 11501), and has asked growers to voluntarily take measures to reduce water contamination from OPs during the rainy season (Bennett et al., 1998). Since 1992 the use of OPs during the dormant-spray season has been steadily decreasing, but they are being replaced by pyrethroids, specifically esfenvalerate and permethrin (Epstein et al., 2000).

The potential for environmental impacts to surface water from esfenvalerate and permethrin use is uncertain. Physico-chemical characteristics indicate a potential for esfenvalerate and permethrin to move offsite with sediment and the potential for an acute toxicity threat to aquatic organisms (Table 1 and 2).

## MATERIALS AND METHODS

**Site Description**

Four monitoring sites were chosen that reflect areas with the heaviest historical applications of esfenvalerate and permethrin through the dormant-spray season (Figures 1-4). When evaluating the desirability of these sites for monitoring, previous detections of diazinon during dormant-spray seasons and the proximity of monitoring sites to application sites were also considered. All of the sites are dominated by agricultural inputs. In addition, site selection followed the general guideline in Standard Operating Procedure (SOP) FSWA002.00 (Bennett, 1997). The sites were:

1.) Wadsworth canal at South Butte road, a tributary that runs southeast into the Sutter Bypass canal which in turn flows into the Sacramento river
2.) Jack Slough at highway 70, a tributary that flows southeast into the Feather river which in turn flows into the Sacramento river
3.) Del Puerto creek at Vineyard road, a tributary that flows west into the San Joaquin river
4.) Highline canal at Griffith road, a tributary that flows east into the Merced River, which in turn flows into the San Joaquin River.

**Sampling Plan**

Monitoring occurred during two storm events in the dormant-spray season of 2002-2003. The number and frequency of samples collected was dependent on the intensity and duration of the runoff event. Sufficient numbers of samples were collected to maximize the likelihood that peak concentrations of pesticides were captured.

Whole water collected from each site was analyzed for esfenvalerate and permethrin, currently used OPs, and selected herbicides (Table 3). Carbamates were not monitored due to the lack of detections in past dormant-spray monitoring.

Sediment samples were also collected and analyzed for esfenvalerate, permethrin, bifenthrin lambda cyhalothrin, cyfluthrin, and cypermethrin (Table 3). Background sediment samples were collected November 18$^{th}$ and 20$^{th}$, 2002, prior to the start of dormant-spray applications. Sediment samples were then collected at the start and at the end of each water-sampling event, and again seven and fourteen days after each storm event.

Water samples were also analyzed for total suspended sediment and bioassays for acute toxicity to the sensitive aquatic species *Ceriodaphnia dubia* were conducted.

**Sampling Method**

Each chemical screen, toxicity sample and suspended sediment sample was individually collected in 1-liter amber bottles. A total of 40 pesticide water samples were collected at three of the sites. All samples were collected by grab sample, as close to center channel as possible. The grab pole consisted of a 1-liter amber glass bottle at the end of an extended pole. Amber bottles were sealed with Teflon-lined lids.

Sediment samples were collected using either a hand scoop or a 24-inch long, by 2-inch diameter, Teflon cylindrical tube. When collecting with the hand scoop, the top 1-inch of submerged sediment was collected near the waters edge and placed into a 1-pint, clear glass jar. This was repeated within the same general area until the jar was approximately ¾ full. When collecting with the tube, one end of the tube was thrust into the sediment near the waters edge and then removed. The top 1-2 inches of the sediment was collected in the tube and placed into a 1-pint, clear glass jar. This was repeated within the same general area until the jar was approximately ¾ full.

All water samples were transported and stored on wet ice or refrigerated at 4°C until extraction for chemical analysis or toxicity testing. Sediment samples were transported on wet ice and then placed in a freezer until extraction. Dissolved oxygen (DO), pH, specific conductivity (EC), and water temperature were measured *in situ* at each site at the time of each grab sample.

**Environmental Measurements**

Dissolved oxygen, EC and temperature were measured with an YSI® (Yellow Springs Instruments®) DO/EC meter (model 85). Water pH was measured with a Sentron® pH meter (model 1001) or a YSI® pH meter (model 60). Additionally, alkalinity, hardness, and ammonia were measured by the DFG aquatic toxicity lab. Totals of alkalinity and hardness were measured with a Hach® titration kit. Total ammonia was measured with an Orion® multi-parameter meter (model 290A) fitted with an Orion® ammonia ion selective electrode (model 95-12).

Rainfall and discharge data (where available) were also gathered for the study area. Rainfall measurements were obtained from the California Department of Water Resources database (CDEC), University of California, Davis, Statewide Integrated Pest Management Program, California Weather Databases (UCD IPM), and AccuWeather.com.

Discharge data were obtained from USGS gauging stations and the Central Valley Regional Water Quality Control Board (CVRWQCB). Rainfall, discharge and TSS information will be used to estimate pesticide loads and potential aqueous toxicity during similar storm events. This will be provided in the final report.

**Pesticide Analysis**

Chemical analyses were performed by the California Department of Food and Agriculture's Center for Analytical Chemistry. The following was used to determine concentrations of pesticides:

- OPs - GC/FPD - gas chromatography/flame phometric detector
- Pyrethroids - GC/ECD - gas chromatography/electron capture detector, confirmed with GC/MS
- Triazines - LC/MS/MS – liquid chromatography/atmospheric pressure chemical ionization mass spectrometry

The pyrethroid water samples were extracted *in toto*, without filtration, and extracting solvent was used to rinse the sample bottles to insure complete removal of any pyrethroid adsorbed to the glass container.

Comprehensive chemical analytical methods will be provided in the final report. The reporting limit was determined as the lowest concentration of analyte that the method can detect reliably in a matrix blank. Method titles and reporting limits for this study are reported in Table 3.

**Toxicity Tests**

The Department of Fish and Game's Aquatic Toxicology Laboratory performed aquatic toxicity tests. Acute tests were performed in undiluted, unfiltered sample water using 96-hour, static-renewal bioassays with the cladoceran *Ceriodaphnia dubia* in accordance with current U. S. Environmental Protection Agency procedures (U.S. EPA, 1993).

**Quality Control**

Quality control (QC) for the chemistry portion of this study was conducted in accordance with Standard Operating Procedure QAQC001.00 (Segawa, 1995) and consisted of a continuing QC program. Ten percent of the total number of water samples was submitted for chemistry analyses as field blanks and another ten percent as blind spikes. Blind spike and continuing QC results for each of the analytical screens are presented in Tables 4 though 8. There were no detections of any pesticides in any of the field blank samples (not in tables).

More detailed quality control data, including method development, the establishment of control limits, spike recoveries, and analysis of QC will be included in the final report.

## RESULTS

**Environmental Measurements (Tables 9-10)**

Wadsworth Canal

During the first storm event on January 22, 2003, water temperature ranged from 11.0 to 11.8$^{o}$ C. Dissolved oxygen ranged from 8.64 to 8.78 mg/L, with percent saturation ranging from 81 to 84%, while both the pH measurements ranged from 6.44 to 7.56, and EC measurements ranged from 244.6 to 307.7 µS/cm. During the first hour of sampling both temperature and DO were at their lowest point and then increased during the sampling period. Both EC and pH were at their highest at the first hour and decreased during the sampling period. Hourly suspended sediment during the storm event ranged from 28.0 to 173.2 mg/L.

Storm events prior to the initial sampling date of January 22, 2003 had not been sampled due to the relatively few pesticide applications prior to those times. Total rainfall for January 21 through the 22$^{nd}$ for this area was 0.40 inches. There was no rainfall for 7 days prior to the 21$^{st}$.

The local County Agricultural Commissioner's office confirmed the application of dormant spray insecticides during this time period.

During the second storm event on February 15 through the 16th, 2003, water temperature ranged from 11.6 to 14.6$^{o}$ C. The pH measurements ranged from 7.15 to 7.55. Dissolved oxygen and EC measurements were not measured during this storm event. During the first hour of sampling both temperature and pH were at their highest points and then decreased during the sampling period. Hourly suspended sediment during the storm event ranged from 7.6 to 3114.4 mg/L.

Total rainfall for February 15 through the 16$^{th}$ for this area was approximately 0.95 inches. Approximately 0.54 inches had fallen 2 days earlier on the 13$^{th}$, but because there was no rainfall for 18 days prior to the 13$^{th}$, this was not sufficient rainfall to cause significant runoff. The local County Agricultural Commissioner's office confirmed the application of dormant spray insecticides during this time period.

Discharge data for this site will be presented in the final report.

Jack Slough

During the first storm event on January 22, 2003, water temperature ranged from 10.5 to 11.0$^{o}$ C. Dissolved oxygen ranged from 9.42 to 11.51 mg/L, with percent saturation ranging from 88 to 107%. The pH measurements ranged from 7.0 to 7.39, and EC measurements ranged from 107.5 to 109.9 µS/cm. During this sampling event, temperature increased slightly by the end of the sampling period. Other water quality measurements (pH, EC, DO) fluctuated during this sampling period. Hourly suspended sediment during the storm event ranged from 66.0 to 80.4 mg/L.

Storm events prior to January 22, 2003 had not been sampled due to a lack of pesticide applications. Total rainfall for January 21 through the 22$^{nd}$ for this area was 0.40 inches (UCD IPM, 2003). There was no rainfall for 7 days prior to the 21$^{st}$. The local County Agricultural Commissioner's office confirmed the application of dormant spray insecticides during this time period.

During the second storm event on February 15 through the 16th, 2003, water temperature ranged from 11.8 to 13.1$^{o}$ C. Dissolved oxygen ranged from 7.78 to 8.55 mg/L, with percent saturation ranging from 76 to 82%.

The pH measurements ranged from 7.09 to 7.56, and EC measurements ranged from 144.2 to 163.6 µS/cm. Both temperature and EC were highest at the first hour of sampling and then decreased during the sampling period, while pH and DO fluctuated during this sampling period. Hourly suspended sediment during the storm event ranged from 80.0 to 300.0 mg/L.

Total rainfall for February 15 through the 16th for this area was approximately 0.95 inches. Approximately 0.54 inches had fallen 2 days earlier on the 13th, but because there was no rainfall for 18 days prior to the 13th, this was not sufficient rainfall to cause significant runoff. The local County Agricultural Commissioner's office confirmed the application of dormant spray insecticides during this time period.

Discharge data is not available for this site.

Del Puerto Creek

Due to the lack of rainfall in this area this site was only sampled on March 15th, 2003. Water temperature ranged from 13.7 to 19.8° C. Dissolved oxygen ranged from 8.2 to 8.96 mg/L, with percent saturation ranging from 85 to 93%. The pH measurements ranged from 8.29 to 9.03, and EC measurements ranged from 223.5 to 389 µS/cm. During this sampling event, temperature had increased by the end of the sampling period. Other water quality measurements (pH, EC, DO) fluctuated during this sampling period. Hourly suspended sediment during the storm event ranged from 452.0 to 2708.8 mg/L.

Total rainfall for March 15th for this area was 0.96 inches. Prior to the 15th, the last precipitation was less than 0.25 inches February 24th and 27th, but because there was no rainfall for 11 days prior to the 24th, this was not sufficient rainfall to cause significant runoff . The local County Agricultural Commissioner's office confirmed the application of dormant spray insecticides during this time period.

Discharge data for this site will be presented in the final report.

Highline Canal

This site was not sampled due to the lack of rainfall and the use of the canal for mid-spring irrigation supply purposes.

**Pesticide Concentrations and Toxicity (Tables 11-12)**

Wadsworth Canal

During the storm event on January 22, 2002, there were no pyrethroid detections in any of the water or sediment samples collected. Trace* amounts of chlorpyrifos were detected, and diazinon detections ranged from 0.106 to 0.130 ppb. Other detections during this storm event included the herbicides simazine, diruon, and norflurazon. There was no significant acute toxicity to *C. dubia* in any of the samples collected during this storm event.

During the storm event on February 15, 2003, there was one detection of Esfenvalerate (trace) and one permethrin detection (0.094 ppb), both occurring at the same time. Again, trace amounts of chlorpyrifos were detected and diazinon detects ranged from 0.102 to 0.246 ppb. At the time of detection of the two pyrethroids, and the highest detection of diazinon (0.246ppb), the acute toxicity test indicated 0% survival to *C. dubia*. Bioassay results for the sample collected during the following hour reported 60% survival to *C. dubia.* The only insecticide detected in that sample was diazinon at 0.176 ppb. Other detections during this storm event included the herbicides bromacil, diruon, and norflurazon. No sediment samples were collected during this storm event.

Jack Slough

During the storm event on January 22, 2002, there were no pyrethroid detections in any of the water or sediment samples collected. Trace amounts of chlorpyrifos were detected, and diazinon detections ranged from 0.0978 to 0.138 ppb. There was significant acute toxicity to *C. dubia* (65% survival) in one sample. The diazinon detection at that time was 0.183 ppb. The herbicide diuron was also detected during this storm event.

During the storm event on February 15, 2003, there were no pyrethroid detections in any of the water or sediment samples collected. Diazinon detections ranged from 0.107 to 0.195 ppb. There was significant acute toxicity to *C. dubia* in three samples collected (60, 10, and 15% survival). Diazinon concentrations at these times were 0.195, 0.107, and 0.161 ppb, respectively. Other detections during this storm event included the herbicides diuron, bromacil and simazine.

Del Puerto Creek

During the storm event on March 15th, 2003, esfenvalerate was detected in every sample. Detections ranged from trace amounts to 0.093 ppb. Both chlorpyrifos and diazinon were also detected with concentrations ranging from 0.0594 to 0.233 ppb and 0.0826 to 0.119 ppb, respectively. Other OP detections included dimethoate, ethoprop, and methyl parathion.

Herbicide detections included simazine, diuron, hexazinone, norflurazon, metribuzin, bromacil and ACET.

There was significant acute toxicity to *C. dubia* in all samples collected (0% survival). There was one detection of bifenthrin in one sediment sample at this site (0.0242 ppb). There were no additional pyrethroid detections in any sediment samples collected at this site.

*** Trace = An analyte concentration that falls between the reporting limit and method detection limit (DPR memo dated 7/17/02).**

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**TABLE 1. PHYSICAL CHARACTERISTICS AND ENVIRONMENTAL FATE OF DETECTED PESTICIDES**

| **Pesticide** | **Koc** | **Solubility** (mg/l) | **Field Dissipation** (half-life in days) | **Soil Degradation - Aerobic** (half-life in days) | **Soil Degradation – Anaerobic** (half-life in days) | **Hydrolysis** (half-life in days) |
|---|---|---|---|---|---|---|
| Esfenvalerate | 251,700 [a] | 0.006 [b] | ND | 38.6 [b] | 90.4 [b] | >30 [b] |
| Permethrin | 277,000 [b] | 0.0055 [b] | ND | 39.5 [b] | 197 [b] | >30 - 242 [b] |
| Bifenthrin | 237,000 [b] | 0.000014 [b] | ND | 96.3 [b] | 425 [b] | >30 [b] |
| Lambda cyhalothrin | 326,000 [b] | 0.005 [b] | ND | 42.6 [b] | ND | 8.66 - >30 [b] |
| Cyfluthrin | 124,000 [b] | 0.0023 [b] | ND | 11.5 [b] | 33.6 [b] | 1.84 - 183 [b] |
| Cypermethrin | 310,000 [b] | 0.004 [b] | ND | 27.6 [b] | 55.0 [c] | 1.9 - 619 [b] |
| Diazinon | 1,520 [c] | 40 – 68.8 [c] | 7-48 [c] | 39 | 17 | 11.55 - 77.0 [c] |
| Chlorpyrifos | 6,070-14,800 [c] | 0.45 – 1.2 [c] | 4-139 [c] | 30.5 | ND | 15.75 - 77.0 [c] |
| Dimethoate | 9-20 [c] | 23,800 – 39,800 [c] | 7 [c] | 3 | ND | 4.5 - 157.5 [c] |
| Ethoprop | 26-186 [c] | 700-843 [c] | 4-87 [c] | 24 | 100 | 198.0 [c] |
| Methyl Parathion | 6,300 [c] | 55-60 [c] | 1-30 [c] | ND | ND | 33.0-69.3 [c] |

ND - No data available

Sources:

a. Dupont. Asana Technical Report. 2003
b. Laskowski, D.A. 2002
c. ARSUSDA. Pesticide Properties Database. 2003

**TABLE 2. TOXICITY OF DETECTED INSECTICIDES**

| Pesticide | *Ceriodaphnia dubia* (ppb) | *Daphnia magna* (ppb) | *Oncorhynchus mykiss* (96hr LC50, ppb) |
|---|---|---|---|
| Esfenvalerate | ND | **0.24** [a] | 0.26[a] |
| Permethrin | **.55**[b] | **0.75** [a] | 9.8 [a] |
| Bifenthrin | **0.07**[b] | **1.6** [a] | 0.15 [a] |
| Lambda cyhalothrin | **.30**[b] | **0.23** [a] | 0.44 [a] |
| Cyfluthrin | **.14**[b] | **.16** [a] | 0.302 [a] |
| Cypermethrin | ND | **1.25** [a] | 0.92 [a] |
| Diazinon | 0.4[c] | 0.96 [d] | 90-1650[d] |
| Chlorpyrifos | 0.08[c] | 0.1-1.7[d] | 7.1-27[d] |
| Dimethoate | ND | **1700**[e] | 6200-7500[d] |
| Ethoprop | ND | 44.0[d] | 1100-13800[d] |
| Methyl Parathion | 02.6[f] | 0.14-28.2[d] | 0.0022 – 0.161[d] |

ND - No data available

SOURCES:

a. DPR Ecotox Database, 2003
b. Mokry and Hoagland, 1990
c. Sheipline, R. 1993
d. U.S. EPA Ecotox Database, 2003
e. Siepmann S. and T. Yargeau, 1996
f. Menconi, M. and J.M. Harrington, 1992

NOTES:

- Numbers in Normal print are for 48-hour EC50 toxicity tests.
- Numbers in **Bold** are for 48-hour LC50 toxicity tests.

Number ranges are for all studies listed in the indicated source and may represent 2-6 individual studies.

**TABLE 3. CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE, CENTER FOR ANALYTICAL CHEMISTRY ORGANOPHOSPHATE AND TRIZINE/HERBICIDE PESTICIDES**

| **Organophosphate Pesticides in Water Method: GC/FPD** | | **Organophosphate Pesticides Water Method: GC/FPD** | | **Triazines/Herbicides in Method: LC/MS/MS** | |
|---|---|---|---|---|---|
| **Compound** | **Reporting Limit (µg/L)** | **Compound** | **Reporting Limit (µg/L)** | **Compound** | **Reporting Limit (µg/L)** |
| Azinphos methyl | 0.05 | Phosmet | 0.05 | Atrazine | 0.05 |
| Chlorpyrifos | 0.04 | Thimet (Phorate) | 0.05 | Bromacil | 0.05 |
| Diazinon | 0.04 | Profenofos | 0.05 | Diuron | 0.05 |
| DDVP (dichlorvos) | 0.05 | Tribufos | 0.05 | Hexazinone | 0.05 |
| Dimethoate | 0.05 | | | Metribuzin | 0.05 |
| disulfoton | 0.05 | | | Norflurazon | 0.05 |
| ethoprop | 0.05 | | | Prometon | 0.05 |
| Fenamiphos | 0.05 | | | Prometryn | 0.05 |
| Fonofos | 0.05 | | | Simazine | 0.05 |
| Malathion | 0.05 | | | DEA | 0.05 |
| methidathion | 0.05 | | | ACET | 0.05 |
| Methyl Parathion | 0.05 | | | DACT | 0.05 |

**TABLE 3. CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE, CENTER FOR ANALYTICAL CHEMISTRY ORGANOPHOSPHATE AND TRIZINE/HERBICIDE PESTICIDES CONTINUED**

| **Pyrethroid Pesticides in Surface Water Method: GC/ECD, confirmed with GC/MSD** | |
|---|---|
| **Compound** | **Reporting Limit (µg/L)** |
| Esfenvalerate | 0.05 |
| Permethrin | 0.05 |
| | |
| **Pyrethroid Pesticides in Sediment Method: GC/ECD, confirmed with GC/MSD (MG/G)** | |
| **Compound** | **Reporting Limit (µg/g)** |
| Fenvalerate/Esfenvalerate | 0.011 |
| Permethrin | 0.01 |
| Bifenthrin | 0.01 |
| Lambda Cyhalothrin | 0.013 |
| Cyfluthrin | 0.011 |
| Cypermethrin | 0.011 |

## TABLE 4. BLIND SPIKE QUALITY CONTROL DATA

| Extraction Date | Sample Number | Screen | Pesticide | Spike Level | Recovery | Percent Recovery | Exceed CL[a] |
|---|---|---|---|---|---|---|---|
| 1/23/03 | 97 | PY | Permethrin | 0.20 | 0.095 | 47.5 | LCL[b] |
| Back-up blind spike results for 97 | | | Permethrin | 0.20 | 0.205 | 103 | No |
| 1/23/03 | 99 | PY | Esfenvalerate | 0.25 | 0.222 | 88.8 | No |
| 1/24/03 | 96 | OP | Methidathion | 0.25 | 0.244 | 97.6 | No |
| 1/24/03 | 98 | OP | Diazinon | 0.35 | 0.296 | 84.6 | No |
| 2/18/03 | 551 | PY | Permethrin | 0.30 | 0.297 | 99.0 | No |
| 2/18/03 | 624 | PY | Permethrin | 0.35 | 0.289 | 82.6 | No |
| 2/19/03 | 525 | OP | Chlorpyrifos | 0.25 | 0.217 | 86.8 | No |
| 2/19/03 | 626 | OP | Malathion | 0.20 | 0.165 | 82.5 | No |
| 2/19/03 | 552 | OP | Diazinon | 0.25 | 0.22 | 88.0 | No |
| 2/19/03 | 524 | OP | Dimethoate | 0.45 | 0.378 | 84.0 | No |
| 2/28/03 | 526 | TR | Hexazinone | 0.35 | 0.376 | 107 | No |
| 3/3/03 | 553 | TR | Norflurazon | 0.15 | 0.165 | 110 | UWL |
| 3/3/03 | 554 | TR | Bromacil | 0.20 | 0.255 | 127.5 | UCL |
| 3/3/03 | 625 | TR | DEA | 0.30 | nd | nd[c] | LCL |
| 3/17/03 | 343 | PY | Esfenvalerate | 0.35 | 0.419 | 120 | No |
| 3/18/03 | 345 | TR | DACT | 0.20 | 0.183 | 91.5 | No |
| 3/19/03 | 555 | OP | Ethoprop | 0.25 | 0.188 | 75.2 | No |

[a] CL=Control Limit; Upper CL (UCL), Lower CL (LCL).

[b] Chemist unsure whether problem occurred during extraction or when making blind spike. Back-up blind spike recovery was good, but bottles are spiked individually.

[c] The blind spike was spiked 10X lower than planned.

## TABLE 5. CONTINUING QUALITY CONTROL – ORGANOPHOSPHATE PESTICIDES

| Date | Numbers | Ethoprop | Diazinon | Disulfoton | Chlorpyrifos | Malathion | Methidathion | Fenamiphos | Methyl Azinphos | Dichlorvos | Phorate | Fonophos | Dimethoate | Methyl Parathion | Tribufos (DEF) | Profenofos |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/24/2003 | (96),(98),101,108, 115,122,129,136, 143 | 74.4 | 79.2 | 77.8 | 83.9 | 89.1 | 87.4 | 83.3 | 81.5 | 80.7 | 87.2 | 92.1 | 98.3 | 103 | 101 | 108 |
| 1/24/2003 | 150,237,245,249, 256,263,270,277, 284 | 87.7 | 93.8 | 91.3 | 96.7 | 103 | 101 | 99.4 | 91.4 | 72.8 | 81.5 | 83.9 | 112 | 91.5 | 93.6 | 98.9 |
| 2/19/2003 | 165, 172, 179, 186, 193, 201, 208, 215 | 97.3 | 97.1 | 90.8 | 98.3 | 102 | 96.4 | 97.1 | 93.5 | not analyzed | 88.0 | 92.6 | 90.2 | 94.5 | 96.7 | 97.9 |
| 2/19/2003 | 626, 552, 525, 532, 600, 607, 614, 621 | 91.4 | 90.1 | 87.7 | 98.1 | 99 | 97.2 | 107 | 105 | not analyzed | 88.1 | 92.9 | 90.8 | 95 | 96.8 | 95.9 |
| 2/19/2003 | 225, 232, 235, 501, 508, 515, 522, 524 | 81.2 | 83.0 | 78.7 | 86.9 | 88.5 | 88.2 | 90.4 | 79.8 | not analyzed | 83.5 | 88.3 | 88.8 | 89.3 | 91.5 | 92.6 |
| 3/19/2003 | 304,312,319,326, 333,340,(555) | 87.0 | 90.9 | 83.4 | 92.2 | 96.3 | 97.0 | 106 | 110 | not analyzed | 101 | 102 | 95.1 | 106 | 106 | 105 |
| Average Recovery | | 86.5 | 89.0 | 85.0 | 92.7 | 96.3 | 94.5 | 97.2 | 93.5 | 76.8 | 88.2 | 92.0 | 95.9 | 96.6 | 97.6 | 99.7 |
| Standard Deviation | | 8.0 | 6.7 | 5.9 | 6.1 | 6.3 | 5.5 | 9.1 | 12.2 | 5.6 | 6.8 | 6.0 | 8.7 | 6.6 | 5.2 | 5.8 |
| CV | | 9.20 | 7.54 | 6.96 | 6.61 | 6.52 | 5.78 | 9.40 | 13.01 | 7.28 | 7.72 | 6.53 | 9.03 | 6.80 | 5.36 | 5.77 |
| Upper Control Limit | | 123 | 147 | 119 | 121 | 126 | 128 | 125 | 137 | 106 | 110 | 113 | 117 | 119 | 126 | 125 |
| Upper Warning Limit | | 113 | 130 | 109 | 112 | 116 | 117 | 115 | 122 | 98 | 102 | 105 | 108 | 111 | 116 | 115 |
| Lower Warning Limit | | 71 | 63 | 68 | 77 | 76 | 75 | 77 | 64 | 67 | 74 | 76 | 73 | 77 | 75 | 74 |
| Lower Control Limit | | 60 | 46 | 58 | 68 | 66 | 64 | 68 | 49 | 59 | 66 | 68 | 65 | 68 | 65 | 64 |

*Highlighted cells are percent recoveries exceeding control limits

Sample numbers in () are blind spikes.

Spike level = 0.1ppb (OP screen/Diazinon analysis in river water)

## TABLE 6. CONTINUING QUALITY CONTROL – TRIAZINE PESTICIDES

| Extraction Date | Sample Numbers | Spike | Percent Recovery | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Atrazine | Simazine | Diuron | Prometon | Bromacil | Hexazinone | Metribuzin | Prometryn | DEA (Deethyl) | ACET (Deiso) | DACT | Norflurazon | Propazine (Surrogate) |
| 1/29/2003 | 102,109,116,123, 130,137,144,151 | 1 | 80.0 | 81.5 | 109 | 83.5 | 122 | 116 | 79.5 | 90.5 | 108 | 112 | 86.5 | 93.0 | 79.5 |
| | | 2 | 75.5 | 82.5 | 109 | 81.0 | 108 | 110 | 95.5 | 87.0 | 104 | 107 | 92.5 | 87.5 | 77.0 |
| 2/24/2003 | 238, 245, 250, 257, 264, 271, 278, 285 | 1 | 105 | 106 | 108 | 94.0 | 112 | 108 | 98.0 | 102 | 99.0 | 106 | 122 | 120 | 102 |
| | | 2 | 99.5 | 107 | 102 | 97.0 | 114 | 109 | 103 | 112 | 97.0 | 110 | 124 | 122 | 105 |
| 2/27/2003 | 166,173,180, 187,194,202, 209,216 | 1 | 86.5 | 86.0 | 101 | 74.5 | 97.5 | 83.5 | 89.5 | 91.0 | 81.5 | 82.0 | 91.0 | 98.5 | 91.5 |
| | | 2 | 79.5 | 79.5 | 108 | 74.0 | 101 | 88.0 | 77.8 | 86.5 | 81.0 | 101 | 94.0 | 98.0 | 90.5 |
| 2/28/2003 | 226,233,290, 502,509,516, 523,(526) | 1 | 86.0 | 93.0 | 125 | 84.5 | 112 | 94.5 | 99.5 | 85.5 | 86.5 | 80.0 | 103 | 99.0 | 89.5 |
| | | 2 | 94.5 | 103.5 | 123 | 86.0 | 120 | 95.0 | 102 | 97.5 | 90.5 | 85.0 | 106 | 102 | 95.0 |
| 3/3/2003 | (553,554,625) 533,601,608, 615,622 | 1 | 90.5 | 99.5 | 114 | 82.5 | 102 | 89.0 | 89.5 | 88.0 | 98.5 | 80.0 | 99.0 | 91.5 | 92.0 |
| | | 2 | 95.5 | 100.0 | 117 | 94.0 | 106 | 93.5 | 108 | 102 | 100 | 88.5 | 111 | 99.0 | 104 |
| 3/18/2003 | (345),338,331, 324,317,310, 302 | 1 | 86.0 | 85.5 | 91.0 | 74.5 | 98.5 | 84.0 | 99.0 | 80.0 | 84.0 | 69.0 | 72.0 | 99.5 | 81.0 |
| | | 2 | 86.0 | 92.0 | 139 | 80.5 | 104 | 86.5 | 82.5 | 87.5 | 78.5 | 83.0 | 77.5 | 105 | 86.5 |
| Average Recovery | | | 88.7 | 92.9 | 112 | 83.8 | 108 | 96 | 93.6 | 92.3 | 92.3 | 91.8 | 98.2 | 101 | 91.0 |
| Standard Deviation | | | 8.67 | 9.9 | 12.7 | 7.85 | 7.93 | 11.36 | 9.74 | 8.90 | 9.82 | 14.17 | 16.03 | 10.28 | 9.19 |
| CV | | | 9.77 | 10.6 | 11.3 | 9.36 | 7.35 | 11.78 | 10.41 | 9.64 | 10.65 | 15.45 | 16.33 | 10.15 | 10.10 |
| Upper Control Limit | | | 105 | 108 | 118 | 106 | 117 | 121 | 110 | 111 | 116 | 140 | 101 | 113 | 115 |
| Upper Warning Limit | | | 98.2 | 101 | 109 | 99.2 | 111 | 113 | 103 | 105 | 109 | 128 | 95.7 | 107 | 107 |
| Lower Warning Limit | | | 72.2 | 73.2 | 73.4 | 73.8 | 84.9 | 76.9 | 75.0 | 78.9 | 79.1 | 78.3 | 73.7 | 84.8 | 72.4 |
| Lower Control Limit | | | 65.8 | 66.3 | 64.4 | 67.4 | 78.4 | 68.1 | 68.0 | 72.4 | 71.7 | 66.0 | 68.2 | 79.2 | 63.8 |

*Highlighted cells are percent recoveries exceeding control limits

Sample numbers in () are blind spikes.
Spike Level = 0.2ppb (Triazine screen in river water)

## TABLE 7. CONTINUING QUALITY CONTROL – PYRETHROID PESTICIDES IN WATER

| Extraction Date | Sample Numbers | Percent Recovery | |
|---|---|---|---|
| | | Permethrin | Esfenvalerate |
| 1/23/2003 | 149,236,244,248,255,262,269, 276,283 | 92.7 | 107 |
| 1/23/2003 | (97),(99),100,107,114,121,128, 135,142 | 95.0 | 102 |
| 2/14/2003 | 156,163,627, 637 | 79.0 | 95.0 |
| 2/18/2003 | 171,185,(624),(551),613, 531,620,606,514,507 | 99.0 | 106 |
| 2/18/2003 | 224,164,200,178,192,295, 214,207,231,234, | 118 | 122 |
| 2/19/2003 | 500, 521 | 100 | 111 |
| 3/17/2003 | 300,308,315,322,329, 336,343 | 107 | 89.8 |
| Average Recovery | | 98.7 | 105 |
| Standard Deviation | | 12.12 | 10.56 |
| CV | | 12.28 | 10.09 |
| Upper Control Limit | | 127 | 131 |
| Upper Warning Limit | | 117 | 121 |
| Lower Warning Limit | | 76.0 | 80.2 |
| Lower Control Limit | | 65.9 | 70.0 |

*Highlighted cells are percent recoveries exceeding control limits

Sample numbers in () are blind spikes.
Spike Level = 0.2ppb (Esfenvalerate and Permethrin total in river water with sediment)

**TABLE 8. CONTINUING QUALITY CONTROL – PYRETHROID PESTICIDES IN SEDIMENT**

| Extraction Date | Sample Numbers | Percent Recovery | | | | | |
|---|---|---|---|---|---|---|---|
| | | bifenthrin | lambda cyhalothrin | permethrin (cis&trans) | cyfluthrin 1-4 | cypermethrin 1-4 | fenvalerate/ esfenvalerate |
| 11/22/2002 | 1,2,3, (w. 210 sample) | 103 | 114 | 96.0 | 113 | 107 | 117 |
| 2/10/2003 | 4,5,10,11,14,15,20, 21 | 99.0 | 105 | 100.0 | 92.0 | 96.0 | 98.0 |
| 2/18/2003 | 12,99, 110 | 98.8 | 103 | 99.6 | 102 | 99.0 | 103 |
| 3/6/2003 | 7, 13, (215: 508-515) | 85.2 | 85.0 | 83.2 | 78.3 | 79.0 | 84.0 |
| 4/3/2003 | 6,8,9, 25,26 | 96.8 | 101 | 98.8 | 88.6 | 95.3 | 96.8 |
| Average Recovery | | 97 | 102 | 96 | 95 | 95 | 100 |
| Standard Deviation | | 6.7 | 10.5 | 7.1 | 13.2 | 10.2 | 11.9 |
| CV | | 6.98 | 10.36 | 7.39 | 13.97 | 10.72 | 11.94 |
| Upper Control Limit | | 142 | 158 | 133 | 152 | 173 | 149 |
| Upper Warning Limit | | 131 | 145 | 123 | 139 | 154 | 137 |
| Lower Warning Limit | | 88.9 | 90.9 | 81.2 | 88.4 | 76.2 | 87.4 |
| Lower Control Limit | | 78.4 | 77.4 | 70.8 | 75.6 | 56.8 | 74.7 |

Sample numbers in () are blind spikes.
Spike Level = 0.03ppm

**TABLE 9. RESULTS: WATER QUALITY MEASUREMENTS**

| **Wadsworth Canal 1/22/2003** | | | | | | **Jack Slough 1/22/03** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Time** | **Temp** | **pH** | **EC** | **DO** | | **Time** | **Temp** | **pH** | **EC** | **DO** |
| 15:35 | 11 | 7.56 | 307.7 | 8.64 | | 15:45 | 10.5 | 7 | 109.2 | 11.51 |
| 16:32 | 11.8 | 7.11 | 302.7 | 8.66 | | 16:45 | 10.6 | 7 | 109.8 | 11.5 |
| 17:25 | 11.7 | 7.08 | 287.8 | 8.78 | | 17:45 | 10.6 | 7.05 | 109.7 | 11.3 |
| 18:30 | 11.8 | 7.04 | 274.3 | 8.72 | | 18:45 | 10.7 | 7.1 | 109.2 | 10.95 |
| 19:35 | 11.8 | 6.75 | 260.2 | 8.75 | | 19:45 | 10.8 | 7.1 | 108.4 | 10.79 |
| 20:35 | 11.8 | 6.72 | 255.1 | 8.78 | | 20:45 | 10.9 | 7.02 | 109.9 | 10.46 |
| 21:40 | 11.8 | 6.44 | 246.5 | 8.77 | | 21:45 | 11 | 7.39 | 109.1 | 9.42 |
| 22:35 | 11.8 | 6.45 | 244.6 | 8.73 | | 22:45 | 11 | 7.2 | 107.5 | 11.15 |
| **Wadsworth Canal 2/15-16/2003** | | | | | | **Jack Slough 2/15-16/03** | | | | |
| **Time** | **Temp** | **pH** | **EC** | **DO** | | **Time** | **Temp** | **pH** | **EC** | **DO** |
| 21:30 | 14.6 | 7.62 | NA | NA | | 21:56 | 13.1 | 7.09 | 163.6 | 7.78 |
| 22:25 | 14.5 | 7.57 | NA | NA | | 2300 | 13 | 7.36 | 163.4 | 7.84 |
| 23:30 | 14.3 | 7.57 | NA | NA | | 24:00:00 | 12.9 | 7.34 | 162 | 8.16 |
| 24:30:00 | 14.1 | 7.53 | NA | NA | | 1:00 | 12.8 | 7.38 | 157.8 | 8.31 |
| 1:30 | 13.8 | 7.55 | NA | NA | | 2:00 | 12.7 | 7.56 | 152.3 | 8.36 |
| 2:30 | 12 | 7.15 | NA | NA | | 3:00 | 12.6 | 7.52 | 150 | 8.38 |
| 3:30 | 11.9 | 7.15 | NA | NA | | 4:00 | 12.4 | 7.52 | 145.2 | 8.44 |
| 4:30 | 11.6 | 7.16 | NA | NA | | 5:00 | 12.1 | 7.46 | 142.6 | 8.06 |
| 5:30 | 11.8 | 7.36 | NA | NA | | 6:00 | 11.8 | 7.43 | 142.2 | 8.55 |
| **Del Puerto Creek 3/15/03** | | | | | | | | | | |
| **Time** | **Temp** | **pH** | **EC** | **DO** | | | | | | |
| 9:30 | 13.7 | 8.59 | 223.5 | 8.65 | | | | | | |
| 10:30 | 14.8 | 8.29 | 381 | 8.6 | | | | | | |
| 11:25 | 16.1 | 8.67 | 385 | 8.96 | | | | | | |
| 12:30 | 17.8 | 8.51 | 347.5 | 8.36 | | | | | | |
| 13:30 | 18.9 | 9.03 | 363 | 8.35 | | | | | | |
| 14:30 | 19.8 | 8.74 | 389 | 8.2 | | | | | | |

## TABLE 10. RESULTS: TOTAL SUSPENDED SEDIMENT

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Wadsworth - 1/22/2003** | | | | | | | | | |
| Sample # | | 105 | 112 | 119 | 126 | 133 | 140 | 147 | 154 |
| Time | | 15:35 | 16:32 | 17:25 | 18:30 | 19:35 | 20:35 | 21:40 | 22:35 |
| Sediment (mg/L) | | 28 | 28 | 61.6 | 173.2 | 106 | 80.8 | 69.2 | 64.4 |
| | | | | | | | | | |
| **Wadsworth Canal 2/15-16/03** | | | | | | | | | |
| Sample # | 169 | 176 | 183 | 190 | 197 | 505 | 512 | 519 | 529 |
| Time | 21:30 | 22:25 | 23:30 | :30 | 1:30 | 2:30 | 3:30 | 4:30 | 5:30 |
| Sediment (mg/L) | 7.6 | 10 | 10.4 | 27.2 | 200 | 3114.4 | 1439.6 | 684.4 | 336.8 |
| | | | | | | | | | |
| **Jack Slough - 1/22/2003** | Time | | | | | | | | |
| Sample # | 241 | 297 | 253 | 260 | 267 | 274 | 281 | 288 | |
| Time | 15:45 | 16:45 | 17:45 | 18:45 | 19:45 | 20:45 | 21:45 | 22:45 | |
| Sediment (mg/L) | 73.6 | 71.6 | 73.6 | 78.8 | 80.4 | 63.6 | 70.8 | 66 | |
| | | | | | | | | | |
| **Jack Slough 2/15-16/03** | | | | | | | | | |
| Sample # | 205 | 212 | 219 | 229 | 293 | 604 | 611 | 618 | 637 |
| Time | 21:56 | 23:00 | 24:00:00 | 1:00 | 2:00 | 3:00 | 4:00 | 5:00 | 6:00 |
| Sediment (mg/L) | 80 | 82.4 | 84.8 | 93.2 | 126 | 159.6 | 230.8 | 247.6 | 300 |
| | | | | | | | | | |
| **Del Puerto Creek 3/15/03** | | | | | | | | | |
| Sample # | 306 | 313 | 320 | 327 | 334 | 341 | | | |
| Time | 9:20 | 10:20 | 11:20 | 12:20 | 13:20 | 14:20 | | | |
| Sediment (mg/L) | 2708.8 | 1476 | 1216.8 | 727.6 | 557.6 | 452 | | | |

**TABLE 11. RESULTS: PESTICIDE DETECTIONS IN WATER AND ACUTE TOXICITY (ppb)**

| | Sampling time | Chlorpyrifos | Diazinon | Simazine | Diuron | Bromacil | Hexazinone | Metribuzin | Norflurazon | ACET | Dimethoate | Ethoprop | Methyl Parathion | Esfenvalerate | Permethrin | Acute toxicity (% survival) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Wadsworth Canal** | 15:35 | trace | 0.130 | 0.066 | 0.175 | nd | nd | nd | 0.052 | nd | nd | nd | nd | nd | nd | 95/100 |
| Jan. 22, 2003 | 16:32 | trace | 0.130 | nd | 0.218 | nd | nd | nd | 0.053 | nd | nd | nd | nd | nd | nd | 100/100 |
| | 17:25 | nd | 0.116 | nd | 0.236 | nd | nd | nd | 0.077 | nd | nd | nd | nd | nd | nd | 95/100 |
| | 18:30 | trace | 0.117 | nd | 0.317 | nd | nd | nd | 0.091 | nd | nd | nd | nd | nd | nd | 100/100 |
| | 19:35 | nd | 0.106 | 0.078 | 0.194 | nd | nd | nd | 0.09 | nd | nd | nd | nd | nd | nd | 100/100 |
| | 20:35 | trace | 0.115 | nd | 0.186 | nd | nd | nd | 0.113 | nd | nd | nd | nd | nd | nd | 90/100 |
| | 21:40 | trace | 0.114 | nd | 0.149 | nd | nd | nd | 0.093 | nd | nd | nd | nd | nd | nd | 100/100 |
| | 22:35 | trace | 0.111 | nd | 0.151 | nd | nd | nd | 0.093 | nd | nd | nd | nd | nd | nd | 100/100 |
| | | | | | | | | | | | | | | | | |
| Feb. 15-16, 2003 | 21:30 | trace | 0.103 | nd | 0.077 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 100/100 |
| | 22:25 | trace | 0.103 | nd | 0.133 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 100/100 |
| | 23:30 | trace | 0.103 | nd | 0.091 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 95/100 |
| | 0:30 | trace | 0.102 | nd | 0.115 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 95/100 |
| | 1:30 | trace | 0.106 | nd | 6.12 | 0.923 | nd | nd | 0.374 | nd | nd | nd | nd | nd | nd | 95/100 |
| | 2:30 | nd | 0.246 | nd | 1.05 | 0.381 | nd | nd | 0.243 | nd | nd | nd | nd | trace | 0.094 | 0/100 |
| | 3:30 | nd | 0.176 | nd | 1.5 | 0.324 | nd | nd | 0.121 | nd | nd | nd | nd | nd | nd | 60/100 |
| | 4:30 | nd | 0.19 | nd | 1.678 | 0.121 | nd | nd | 0.052 | nd | nd | nd | nd | nd | nd | 95/100 |
| | 5:30 | trace | 0.13 | nd | 0.521 | nd | nd | nd | 0.063 | nd | nd | nd | nd | nd | nd | 95/100 |

**Trace = An analyte concentration that falls between the reporting limit and method detection limit (DPR memo dated 7/17/02).**
**% survival = % survival in sample / % survival in control**

**TABLE 11. RESULTS: PESTICIDE DETECTIONS IN WATER AND ACUTE TOXICITY (ppb) CONTINUED**

| | Sampling time | Chlorpyrifos | Diazinon | Simazine | Diuron | Bromacil | Hexazinone | Metribuzin | Norflurazon | ACET | Dimethoate | Ethoprop | Methyl Parathion | Esfenvalerate | Permethrin | Acute toxicity (% survival) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Jack Slough** | 15:45 | trace | 0.126 | nd | 0.196 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 100/100 |
| Jan. 22, 2003 | 16:45 | trace | 0.113 | nd | 0.183 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 65/100 |
| | 17:45 | trace | 0.098 | nd | 0.186 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 90/100 |
| | 18:45 | trace | 0.129 | nd | 0.19 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 85/100 |
| | 19:45 | trace | 0.111 | nd | 0.176 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 90/100 |
| | 20:45 | trace | 0.127 | nd | 0.263 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 85/100 |
| | 21:45 | trace | 0.129 | nd | 0.274 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 80/100 |
| | 22:45 | trace | 0.138 | nd | 0.198 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 100/100 |
| Feb. 15-16, 2003 | 23:00 | nd | 0.167 | nd | 0.21 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 95/100 |
| | 0:00 | nd | 0.178 | nd | 0.265 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 100/100 |
| | 1:00 | nd | 0.161 | nd | 0.275 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 80/100 |
| | 2:00 | nd | 0.142 | nd | 0.213 | 0.135 | nd | nd | nd | nd | nd | nd | nd | nd | nd | 100/100 |
| | 3:00 | nd | 0.197 | nd | 0.192 | 0.192 | nd | nd | nd | nd | nd | nd | nd | nd | nd | 90/100 |
| | 4:00 | nd | 0.195 | nd | 0.26 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 60/100 |
| | 5:00 | nd | 0.107 | 0.246 | 0.348 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 10/100 |
| | 6:00 | nd | 0.161 | 0.415 | 0.326 | nd | nd | nd | nd | nd | nd | nd | nd | nd | nd | 15/100 |
| **Del Puerto Creek** | 9:20 | nd | 0.083 | 2.281 | 2.819 | nd | 0.09 | 0.142 | 1.387 | 0.112 | nd | trace | trace | 0.062 | nd | 0/95 |
| March 15, 2003 | 10:20 | 0.059 | 0.096 | 1.943 | 4.184 | 0.246 | 0.316 | nd | 2.021 | 0.08 | trace | trace | trace | 0.093 | nd | 0/95 |
| | 11:20 | 0.233 | 0.119 | 3.787 | 4.288 | 0.463 | 3.564 | nd | 3.034 | 0.147 | trace | trace | trace | 0.087 | nd | 0/95 |
| | 12:20 | 0.169 | 0.109 | 1.155 | 5.516 | nd | 1.032 | nd | 3.536 | nd | 0.201 | nd | trace | 0.057 | nd | 0/95 |
| | 13:20 | 0.104 | 0.111 | 0.404 | 5.524 | nd | 0.382 | nd | 1.51 | nd | 0.302 | nd | nd | trace | nd | 0/95 |
| | 14:20 | 0.115 | 0.092 | 0.243 | 5.94 | nd | 0.288 | nd | 1.143 | nd | 0.25 | nd | nd | trace | nd | 0/95 |

**Trace = An analyte concentration that falls between the reporting limit and method detection limit (DPR memo dated 7/17/02).**
**% SURVIVAL = % SURVIVAL IN SAMPLE / % SURVIVAL IN CONTROL**

**TABLE 12. RESULTS: PESTICIDE DETECTIONS IN SEDIMENT (µg/g, wet weight basis)**

| **Site 1. Wadsworth Canal** | | Bifenthrin | Lambda | Cyfluthrin | Cypermethrin | Esfenvalerate | Permethrin | Wet weight | Dry weight |
|---|---|---|---|---|---|---|---|---|---|
| Time | Date | | | | | | | grams | grams |
| 10:30 | 11/18/2002 | nd | nd | nd | nd | nd | nd | 23.04 | 12.12 |
| 16:45 | 1/22/2003 | nd | nd | nd | nd | nd | nd | 21.94 | 14.65 |
| 22:55 | 1/22/2003 | nd | nd | nd | nd | nd | nd | 20.74 | 14.14 |
| 13:50 | 1/29/2003 | nd | nd | nd | nd | nd | nd | 18.02 | 12.26 |
| 13:10 | 2/5/2003 | nd | nd | nd | nd | nd | nd | 18.23 | 12.87 |
| NO SEDIMENT SAMPLES WERE COLLECTED DURING THE SECOND STORM EVENT ON 2/15/03 | | | | | | | | | |
| **Site 2. Jack Slough** | | | | | | | | | |
| Time | Date | | | | | | | grams | grams |
| 10:00 | 11/18/2002 | nd | nd | nd | nd | nd | nd | 21.99 | 12.17 |
| 15:45 | 1/22/2003 | nd | nd | nd | nd | nd | nd | 18.89 | 10.1 |
| 22:45 | 1/22/2003 | nd | nd | nd | nd | nd | nd | 20.49 | 8.22 |
| 14:30 | 1/29/2003 | nd | nd | nd | nd | nd | nd | 24.42 | 11.96 |
| 13:50 | 2/5/2003 | nd | nd | nd | nd | nd | nd | 24.01 | 12.54 |
| 12:50 | 2/13/2003 | nd | nd | nd | nd | nd | nd | 25.02 | 11.62 |
| 21:56 | 2/15/2003 | nd | nd | nd | nd | nd | nd | 25 | 5.98 |
| 6:00 | 2/16/2003 | nd | nd | nd | nd | nd | nd | 25 | 14.24 |
| 12:00 | 2/24/2003 | nd | nd | nd | nd | nd | nd | 20.54 | 9.69 |
| 11:55 | 3/3/2003 | nd | nd | nd | nd | nd | nd | 20.31 | 7.44 |

**TABLE 12. RESULTS: PESTICIDE DETECTIONS IN SEDIMENT (µg/g, wet weight basis) CONTINUED**

| **Site 3. Del Puerto Creek** | | Bifenthrin | Lambda | Cyfluthrin | Cypermethrin | Esfenvalerate | Permethrin | Wet weight | Dry weight |
|---|---|---|---|---|---|---|---|---|---|
| Time | Date | µg/g (ppm) | | | | | | grams | grams |
| 10:30 | 11/20/2002 | nd | nd | nd | nd | nd | nd | 22.55 | 15.87 |
| 9:10 | 3/15/2003 | 0.0242 | nd | nd | nd | nd | nd | 20.61 | 13.92 |
| 9:30 | 3/15/2003 | nd | nd | nd | nd | nd | nd | 21.25 | 12.38 |
| 13:15 | 3/15/2003 | nd | nd | nd | nd | nd | nd | 20.53 | 13.01 |
| 10:20 | 3/21/2003 | nd | nd | nd | nd | nd | nd | 20.13 | 14.87 |
| 9:15 | 3/28/2003 | nd | nd | nd | nd | nd | nd | 20.19 | 13.64 |

**Figure 1**

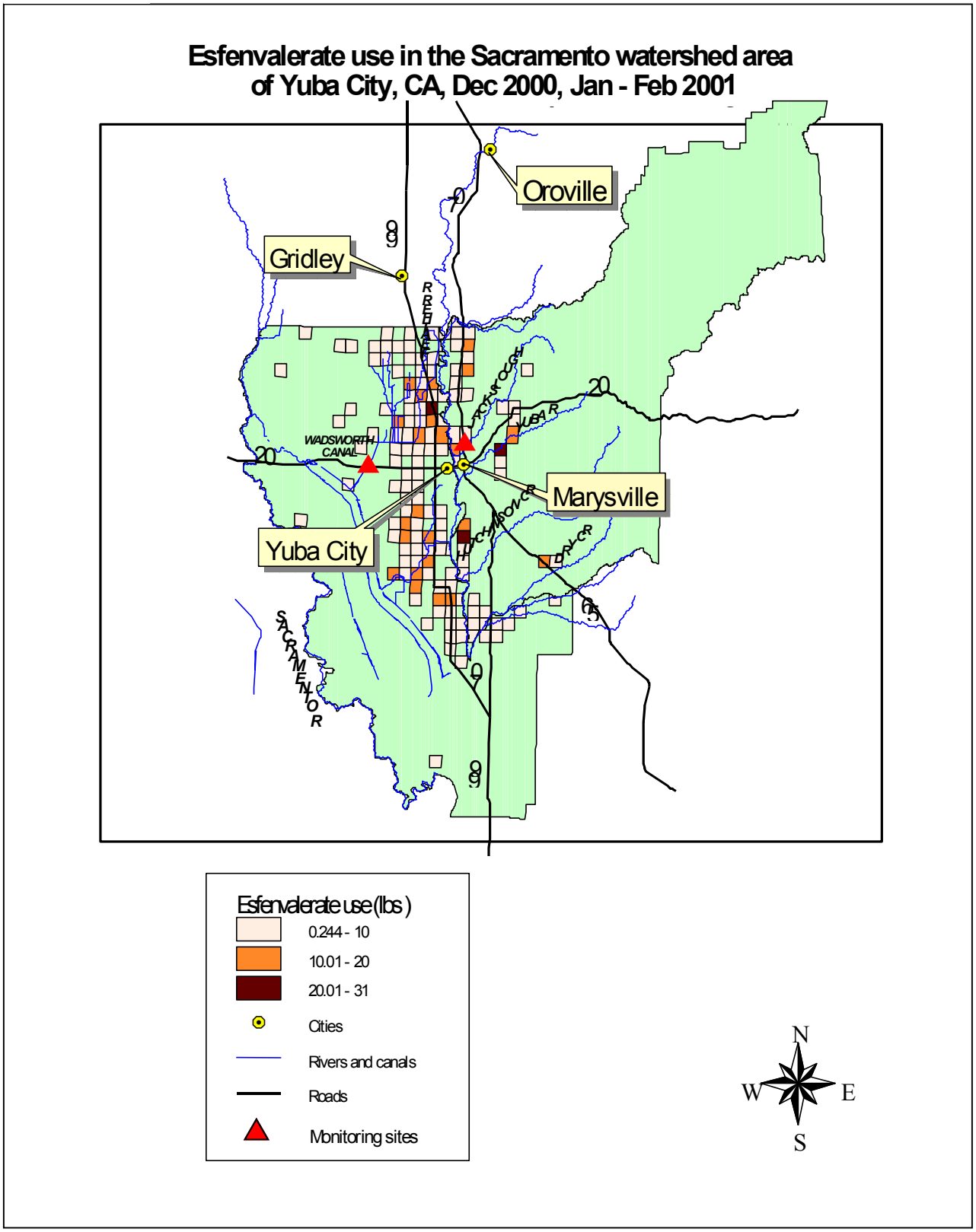

Esfenvalerate use in the Sacramento watershed area
of Yuba City, CA, Dec 2000, Jan - Feb 2001
Oroville
Gridley
Marysville
Yuba City
WADSWORTH CANAL
FEATHER R
BEAR R
HONCUT
DRY CR
SACRAMENTO R
Esfenvalerate use (lbs)
0.244 - 10
10.01 - 20
20.01 - 31
Cities
Rivers and canals
Roads
Monitoring sites
N
W
E
S

**Figure 2**

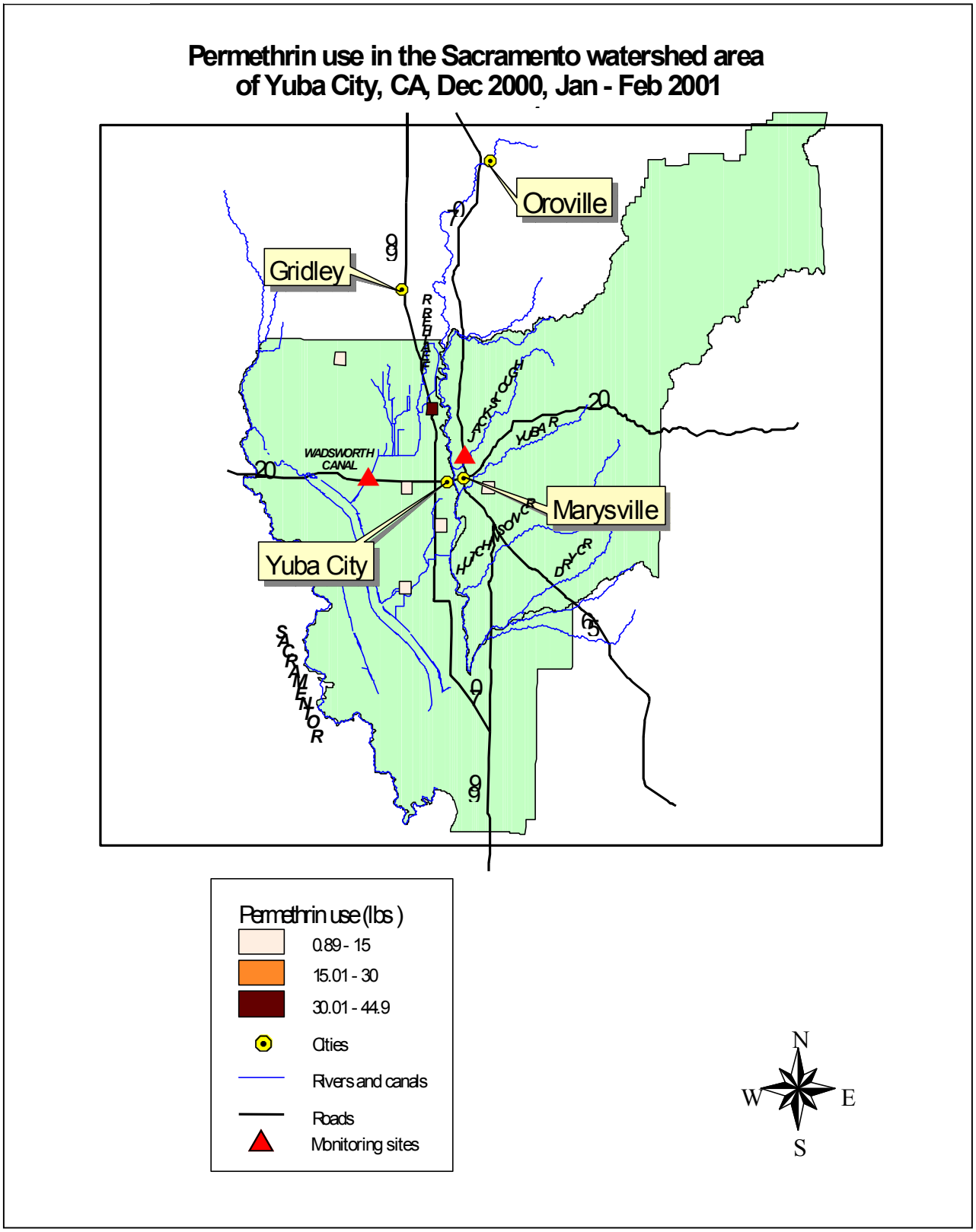

Permethrin use in the Sacramento watershed area
of Yuba City, CA, Dec 2000, Jan - Feb 2001
Oroville
Gridley
Marysville
Yuba City
WADSWORTH CANAL
JACKSON
YUBA R
HUTCHISON CR
DRY CR
SACRAMENTO R
Permethrin use (lbs)
0.89 - 15
15.01 - 30
30.01 - 44.9
Cities
Rivers and canals
Roads
Monitoring sites
N
W
E
S

**Figure 3**

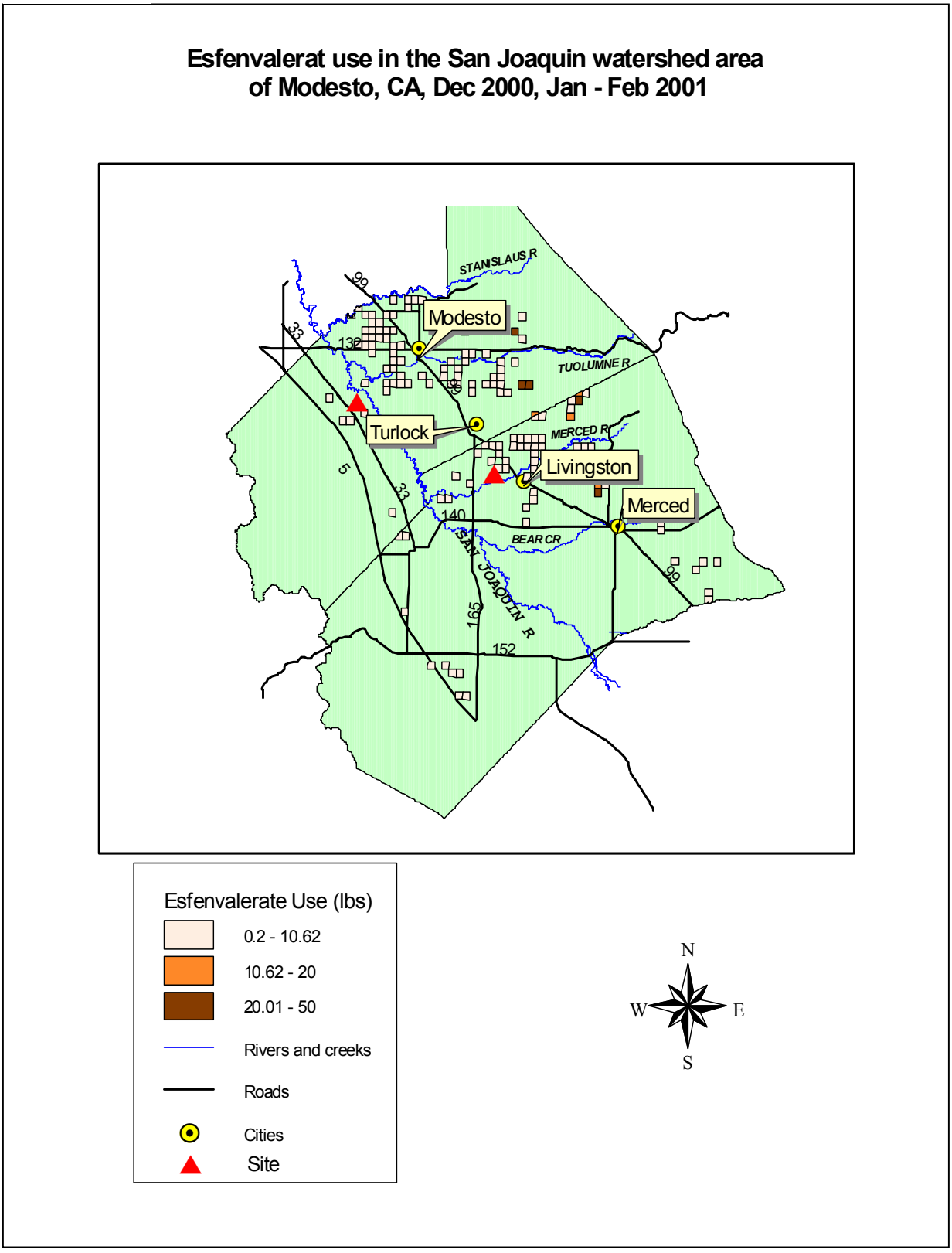
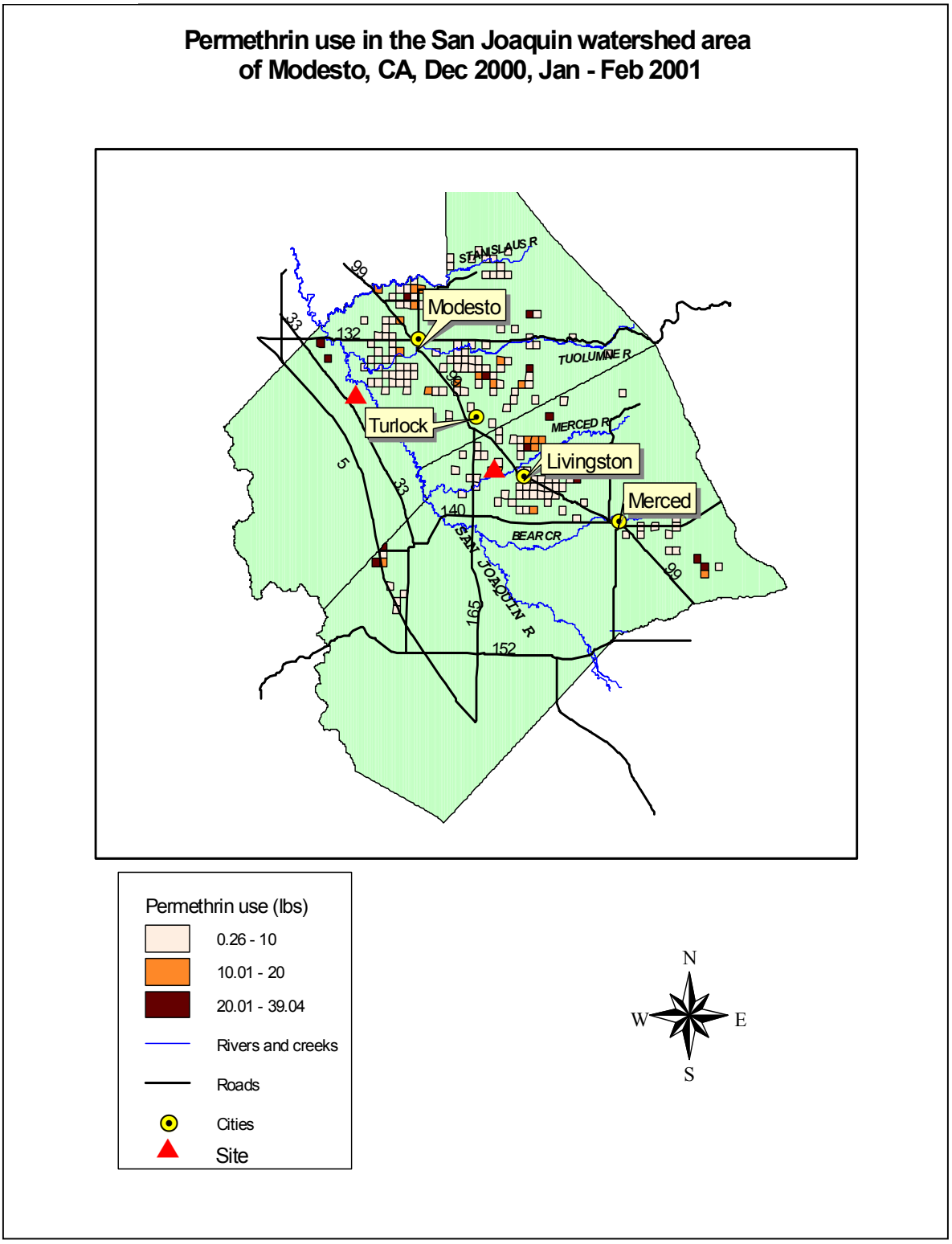

Esfenvalerat use in the San Joaquin watershed area
of Modesto, CA, Dec 2000, Jan - Feb 2001
STANISLAUS R
Modesto
TUOLUMNE R
Turlock
MERCED R
Livingston
Merced
BEAR CR
SAN JOAQUIN R
99
33
132
5
140
165
152
Esfenvalerate Use (lbs)
0.2 - 10.62
10.62 - 20
20.01 - 50
Rivers and creeks
Roads
Cities
Site
N
W
E
S

**Figure 4**


Permethrin use in the San Joaquin watershed area
of Modesto, CA, Dec 2000, Jan - Feb 2001
Modesto
Turlock
Livingston
Merced
STANISLAUS R
TUOLUMNE R
MERCED R
BEAR CR
SAN JOAQUIN R
99
33
132
5
140
165
152
Permethrin use (lbs)
0.26 - 10
10.01 - 20
20.01 - 39.04
Rivers and creeks
Roads
Cities
Site
N
W
E
S