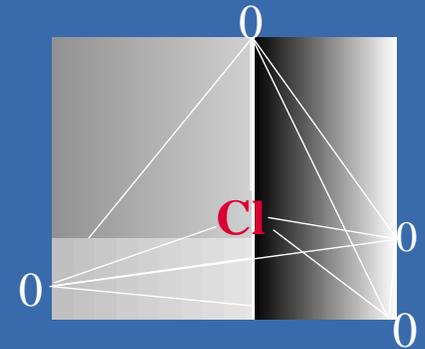


Santa Clara Valley  
Water District



# Perchlorate Impacts to Private and Municipal Wells in Santa Clara County, CA

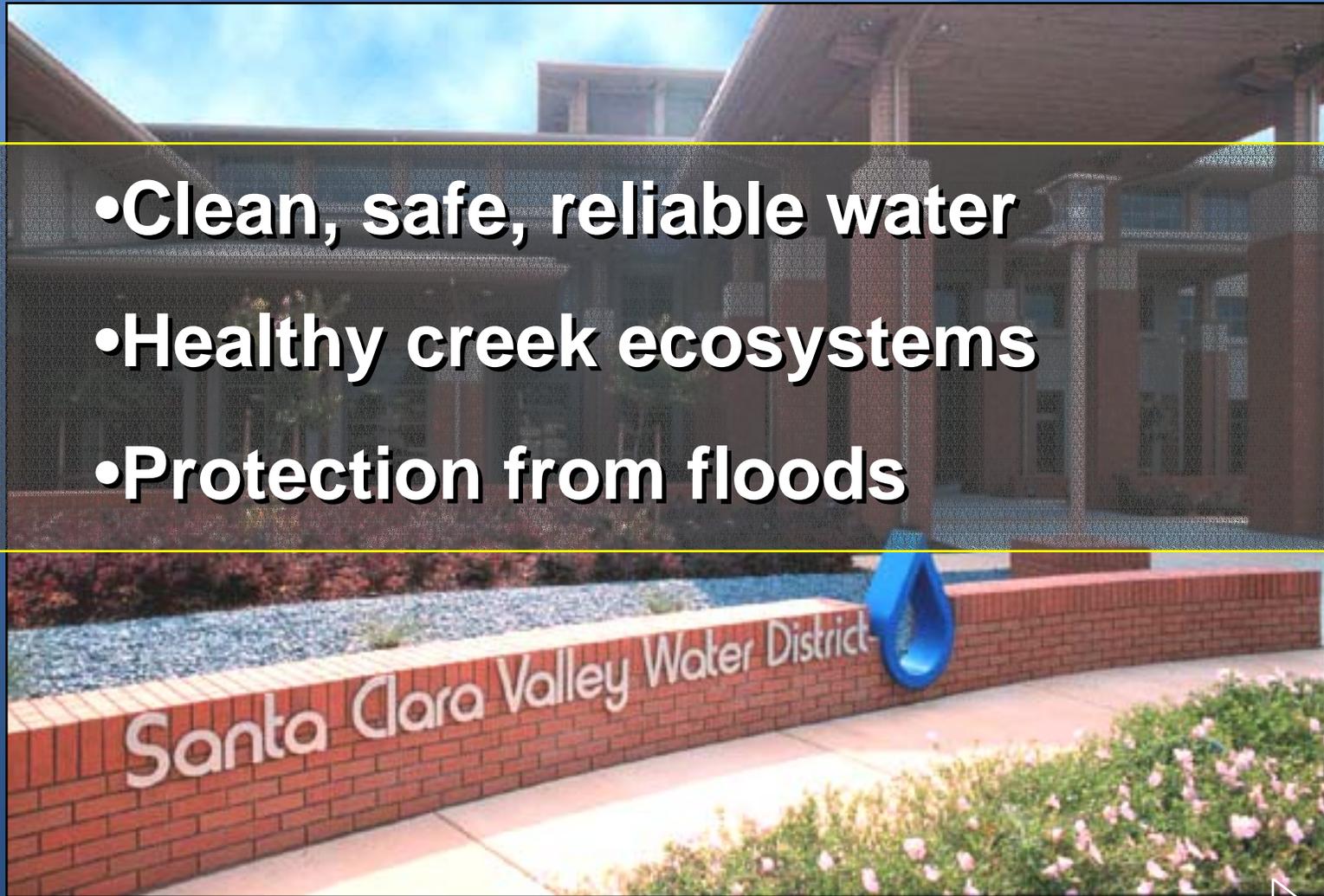
*Thomas K.G. Mohr*  
Perchlorate Project Manager  
Santa Clara Valley Water District



# Overview

- **The Santa Clara Valley Water District**
- **Olin Corporation Tennant Road site history**
- **Discovery – connecting the dots**
- **The roles of the various public agencies**
- **Public agency response**
- **Perchlorate occurrence in San Martin**
- **Perchlorate treatment technologies**
- **The challenge of risk communication**
- **Comparative responses to similar problems**
- **Challenge of Multiple Potential Sources**

- **Clean, safe, reliable water**
- **Healthy creek ecosystems**
- **Protection from floods**



# Three primary sources of water for Santa Clara County:

*Imported*



*Local surface and groundwater*



*Recycled*



## District Mission:

*The mission of the Santa Clara Valley Water District is a healthy, safe and enhanced quality of living in Santa Clara County through watershed stewardship and comprehensive management of water resources in a practical, cost-effective and environmentally sensitive manner.*

## Ends Policy

*The groundwater basins are aggressively protected from contamination and the threat of contamination*

- SCVWD Board Ends Policy E-2.1.5

# Industrial Uses and Sources of Perchlorate:

Fireworks	matches	flares
air bag manufacturing	explosives manufacturing	
Rocket manufacturing		Rocket disassembly
Rocket retrofitting		explosives disposal
unexploded or partially exploded ordinance		
chlorate manufacturing		chlorate application
chlorite manufacturing		OCl- manufacturing
Explosives used in geo-seismic work (Magnagel)		
Chilean nitrate as fertilizer “bulldog soda”		
Chilean nitrate as feed stock for Nitric acid production		
Chilean nitrate as feed stock for explosives production		
Gas drying applications		Perchloric acid disposal
Perchloric acid used to increase downhole permeability		
Natural sources (evaporites)		Production from lightning
Production from active cathodic protection systems		
Clandestine Methamphetamine Labs		Cloud Seeding

Sources: Dr. Andrew Jacskon, Texas Tech U., Mohr & Crowley, Hydrovisions, 2002

## The property

425 Tennant Ave., Morgan Hill, Calif.  
13-acre parcel purchased by  
Olin Corp in 1956

## Activity at the property

1956 and prior	Agricultural use
1956 – 1988	Production of highway flares and skeet; packaging of pool supplies
1988 – 1996	Production and warehousing of highway flares
1997 -- 1998	Demolition and removal of buildings and structures, underground storage tanks; evaluation of soil and groundwater; disposal of 1,000 tons of waste skeet; perchlorate not yet identified by scientific community as a potential contaminant



# Olin Facility, ~1971



MACTEC

DRAWN  
TJH

## Perchlorate detection and investigation

- August 2000 Due diligence investigation by potential buyer detects perchlorate – which is now recognized as an environmental hazard – in groundwater samples.
- Aug. 29, 2000 Olin notifies California Office of Emergency Services and Santa Clara County Environmental Health Dept.
- Oct. 2000 Three on-site monitoring wells installed in shallow zone. Perchlorate detected in all three wells.
- Feb. 2001 Initial contact between Olin and Central Coast Regional Water Quality Control Board.
- March 2001 Regional Board requests further site testing and testing of Morgan Hill municipal well located 250 feet to the southwest of site.
- Sept. 2001 Perchlorate detected in one of three on-site monitoring wells.

Jul/Oct/Dec 2001

Samples at Morgan Hill municipal well detects no perchlorate; Santa Clara Valley Water District receives communication from RWQCB

March 2002

Perchlorate detected in municipal well; well closed by city.

April 2002

Resampling indicates perchlorate still present at a lower level; City of Morgan Hill initiates drilling of replacement well.

May 2002

RWQCB, Olin, Mactec, District meet – District recommends sampling private wells downgradient of site

June – Sept. 2002

Mactec conducts detailed site investigation; commences sampling of 27 private wells

Sep/Oct 2002

Results show five detections in private wells to ½ mile south; 33 more wells selected for sampling

Oct/Nov 2002: Mactec finds five more detections up to 1 mile south

Nov/Dec 2002: District samples 15 regional monitoring wells

Jan 13, 2003: Results show two detections at 3.9 and 4.3 miles south

Jan. 16, 2003: RWQCB, District, County Health, Morgan Hill Hold Press Conference

MLK Weekend: >2,000 calls fielded by District staff

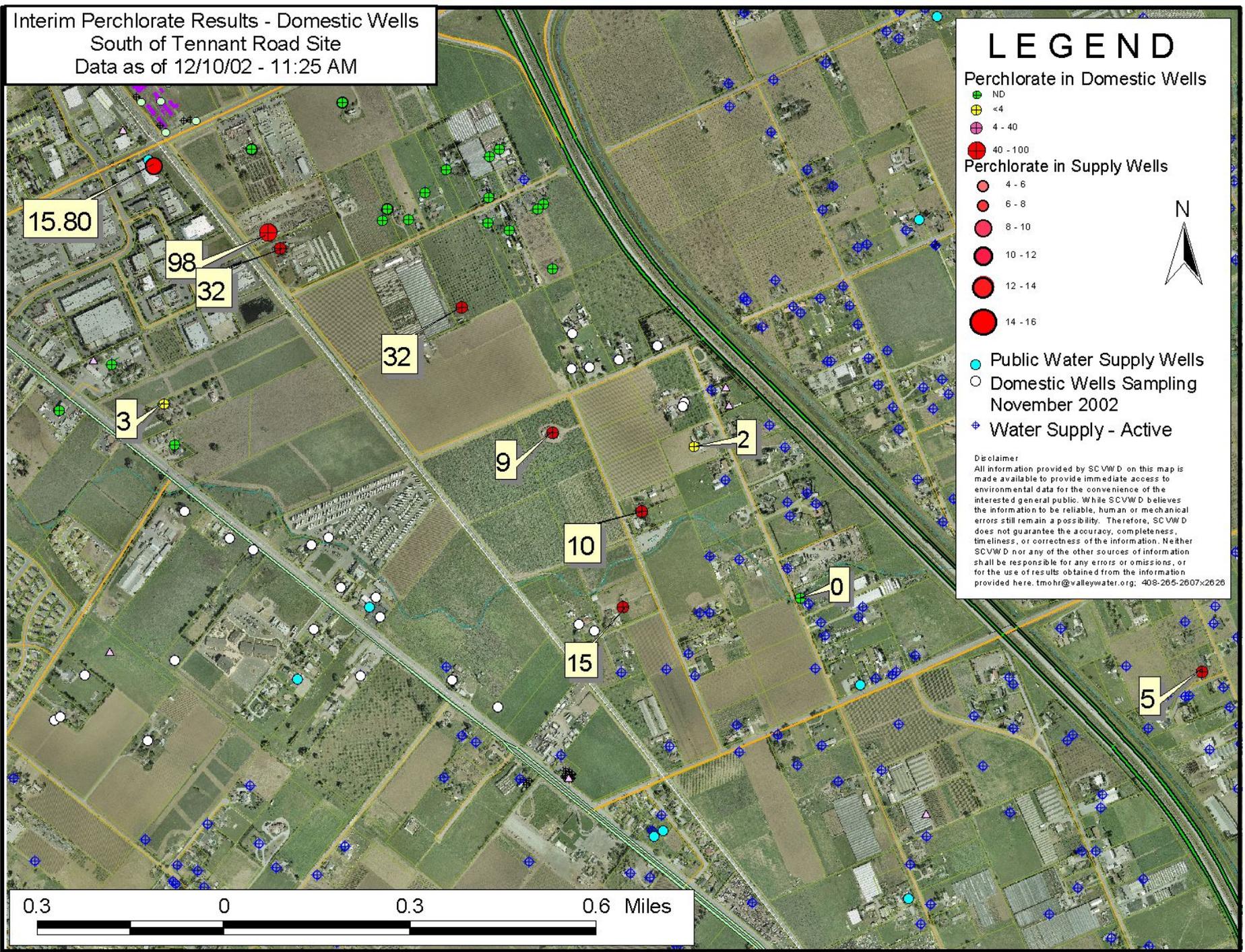
Jan/Feb/Mar District staff and contractors collect 1,045 samples

Feb 10, 2003 District confirms presence of perchlorate to 7.5 miles

Feb 12, 2003 RWQCB/District/County host public meeting; 850 residents turn out

Currently -- Plume is 10+ miles long; no treatment on offsite wells yet

Interim Perchlorate Results - Domestic Wells  
 South of Tennant Road Site  
 Data as of 12/10/02 - 11:25 AM



## LEGEND

**Perchlorate in Domestic Wells**

- ND
- <4
- 4 - 40
- 40 - 100

**Perchlorate in Supply Wells**

- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 14
- 14 - 16

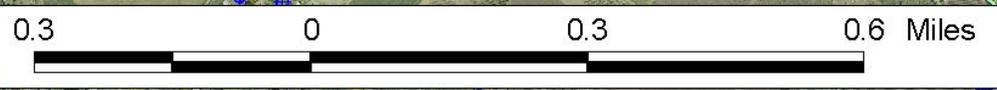
● Public Water Supply Wells

○ Domestic Wells Sampling November 2002

◆ Water Supply - Active

N

Disclaimer  
 All information provided by SCVWD on this map is made available to provide immediate access to environmental data for the convenience of the interested general public. While SCVWD believes the information to be reliable, human or mechanical errors still remain a possibility. Therefore, SCVWD does not guarantee the accuracy, completeness, timeliness, or correctness of the information. Neither SCVWD nor any of the other sources of information shall be responsible for any errors or omissions, or for the use of results obtained from the information provided here. tmoht@valleywater.org; 408-265-2607x2626



# LEGEND

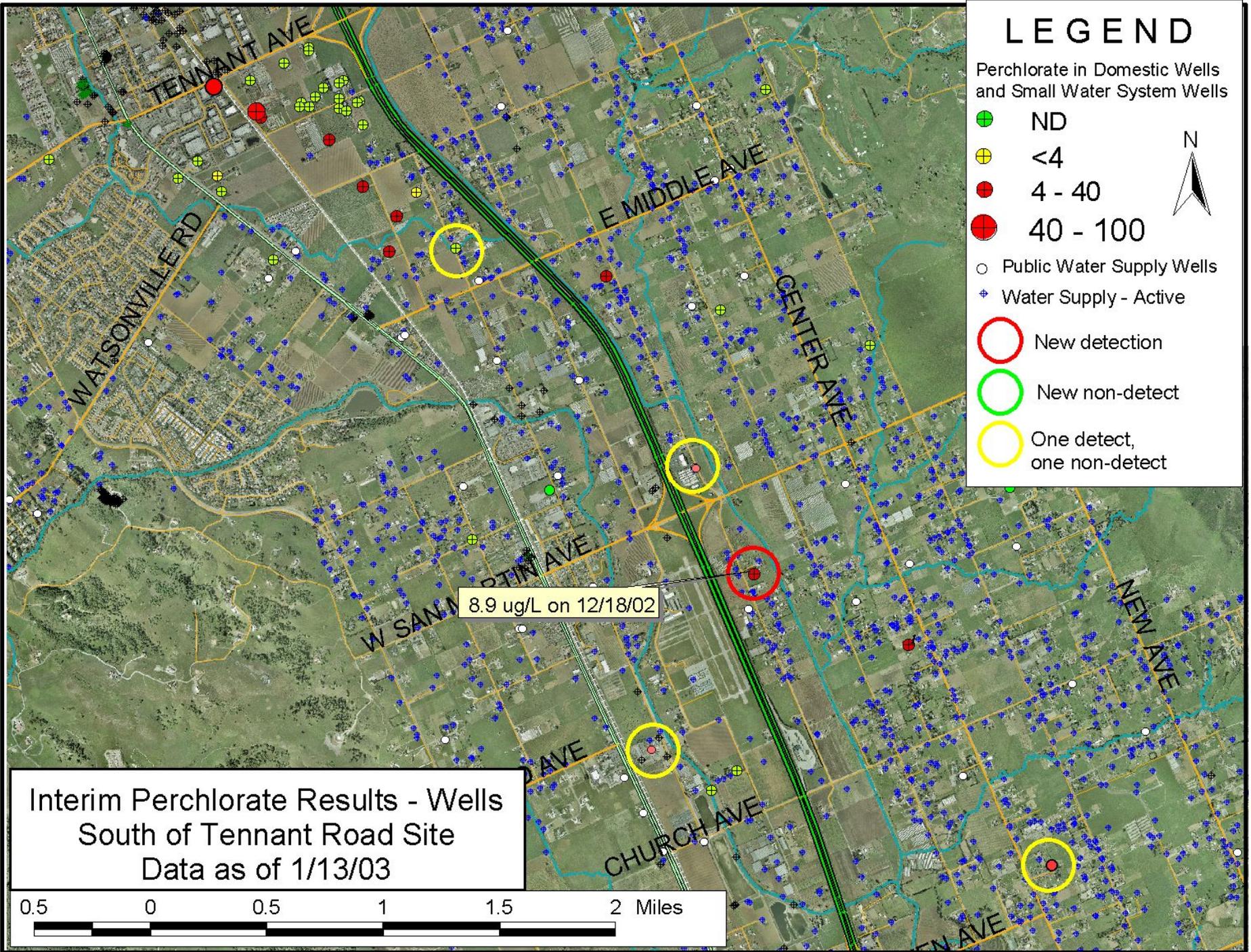
Perchlorate in Domestic Wells and Small Water System Wells

- ND
- <4
- 4 - 40
- 40 - 100



- Public Water Supply Wells
- Water Supply - Active

- New detection
- New non-detect
- One detect, one non-detect



Interim Perchlorate Results - Wells  
South of Tennant Road Site  
Data as of 1/13/03

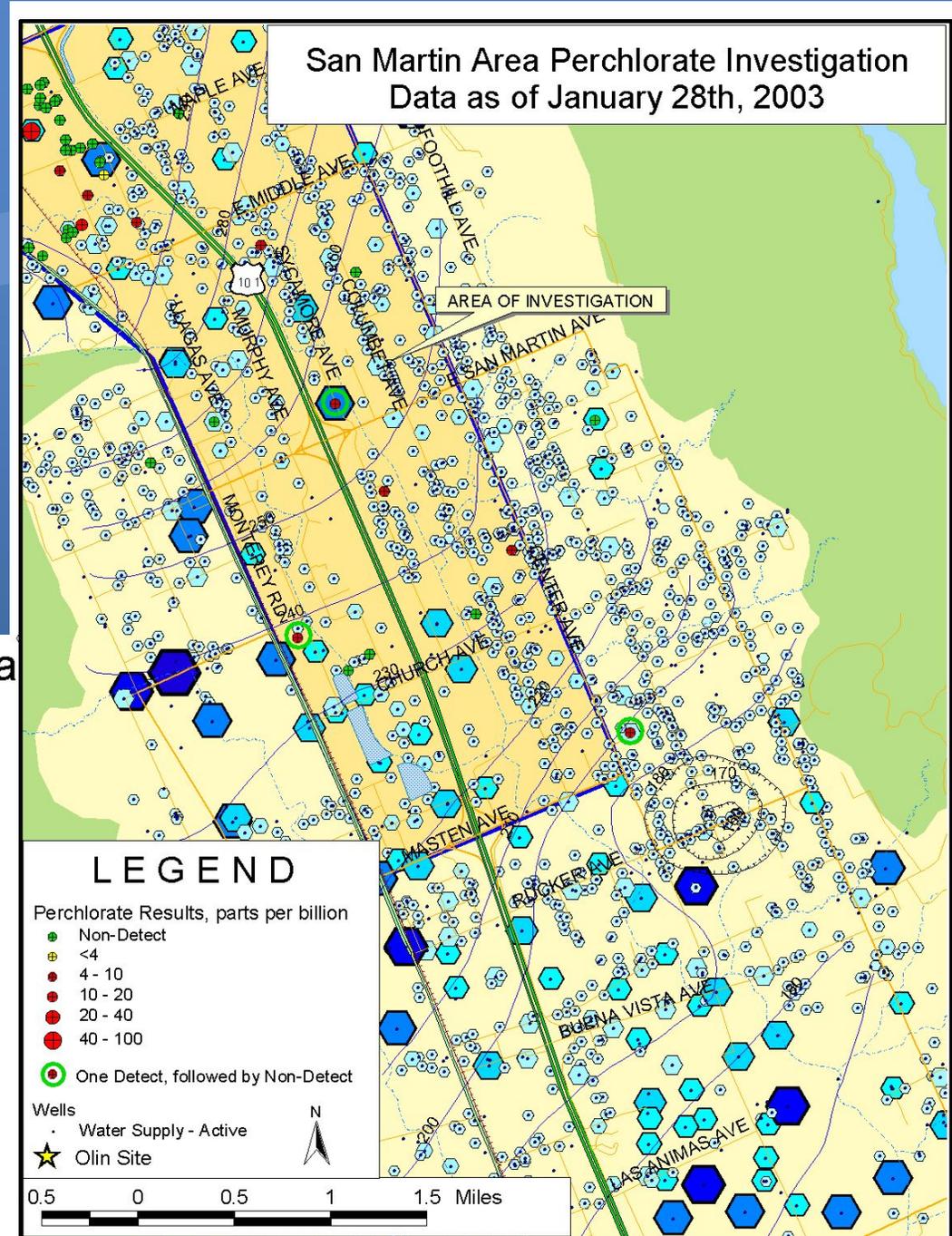


# How are wells in the Affected area used?

>100 AF/yr – Municipal  
 10 to 100 AF/yr – Ag & Ind  
 <10 AF/yr – Ag and Domestic

## Annual Pumping, Acre-Feet per Year

- 0 - 5 AF/yr
- 5 - 10 AF/yr
- 10 - 20 AF/yr
- 20 - 50 AF/yr
- 50 - 100 AF/yr
- 100 - 200 AF/yr
- 200 - 500 AF/yr
- 500 - 1,000 AF/yr
- 1,000 - 8,000 AF/yr



# News Conference

- **Thursday 1/16/03 with representatives from the Central Coast Regional Water Quality Control Board, Santa Clara County, and Morgan Hill**
- **Announced that 450 private wells potentially affected**
- **Encouraged residents within area of investigation to schedule free well sampling; offered bottled water to those who need it**



# San Jose Mercury News

CENTS | FINAL EDITION | FC ...  
 VING NORTHERN CALIFORNIA SINCE 1851

WWW.MERCURYNEWS.COM

FEBRUARY 13, 2003 | THURSDAY  
 THE NEWSPAPER OF SILICON VALLEY

## WELLS | San Martin awaits answers

Continued from Page 1A

ed to know more about perchlorate, which is used in explosives and highway flares and has been linked to thyroid disorders. The water district on Tuesday reported that more than a third of the water wells tested so far have shown signs of the chemical.

"Make a plan," said Rudy Boynton of Gilroy, who lives near a well that tested positive. He called on officials to develop a cleanup plan now, rather than waiting until the full extent of contamination is known. "Do something for us,"

The district began testing wells last month after it discovered the chemical had spread via an underground flare several miles south of its source, a highway safety firm operated by Olin Corp. in south Morgan Hill from 1955 to 1996.

Olin cleaned its site after it closed the plant, but at the time, perchlorate was that among the chemicals that would have been considered a danger.

"This isn't a good situation any way you look at it," said Harvey Packard, the senior engineer for the Central Coast

Regional Water Quality Control Board, which is leading the investigation of the contamination. "We know who is responsible and Olin Corp. is viable. They are accepting responsibility."

Olin officials have said it would pay for cleanup. The company is also providing bottled water for residents whose wells are contaminated or who haven't received results yet.

Perchlorate has been detected in 90 of the 2' far. Five hundred businesses a test results fit Packard's start until a have contained identified.

"It's not and it's not Packard's process, from the plumage of traveled; taminated very difficult. Official answers ingestive interfor mone ft by danu

dren, pregnant women and fetuses. Thyroid hormones, said Dr. Martin Fenstersheib, are "critical to the development of every organ in newborns."

Still, he and other officials don't have hard data on how much exposure is enough to cause health problems. San Martin mother Maria De La Torre isn't taking any chances. She said earlier Wednesday that she is worried for her six children, but she

by shade trees and backed by a barn, Claudia Morgan worried more about home values than her health. Now that her two children are grown, she wants to take the proceeds and her horses and move to a much bigger place in Oklahoma. For the past month, she's worried that no one would buy her house if its well tested positive for perchlorate.

"I was sweating it," she said. No anymore. On Monday, the water district called to say her well is safe.

an's next-door neighbor Dayton wasn't sure her well has tested for perchlorate. Like r perchlorate. Like ns, Dayton and n raised two children. San Martin he very concerned health.

Perchlorate is also worse than those of her neighbors or those of her neighbors. "I think they're safe, but how do you know the level isn't getting higher?" she asked. "When can you trust the tests?"

Contact Frank Sweeney at fsweeney@sjmercury.com or (408) 920-5675.

## 1,200 will get well water tested

Contamination of the underground aquifers by the chemical perchlorate in the South County may take many years and cost millions of dollars to clean up.

By Frank Sweeney  
 Mercury News

More than 1,200 South County residents, worried that a chemical used in rocket fuel and highway flares has contaminated their drinking water, have contacted the Santa Clara Valley Water District to arrange for free tests of their wells.

By Monday evening, four days after officials disclosed

everyone potentially affected by the contamination with free bottled water for drinking and cooking.

District officials have gotten initial requests for more than 4,000 bottles of water. About 200 homes were getting the free water from Crystal Springs on Monday, with an additional 200 scheduled to receive bottled water Wednesday. The sudden demand



## The Valley

### Concern grows on tainted wells

SOUTH COUNTY PROBLEM SPREADING

By Frank Sweeney  
 Mercury News

An underground plume of perchlorate, a chemical used in rocket fuel and highway flares that has contaminated some drinking water wells in southern Santa Clara County, has spread farther than officials originally thought.

Results from new tests in the San Martin area show contamination in wells west and south of a four-mile-long target area where Santa Clara Valley Water District officials suspected that perchlorate tainted drinking water supplies.

Initial results of the water district's large-scale tests of wells in the area won't be available until next week, but tests ordered by other government agencies showed the

spread of the plume Thursday. "We're starting to get indications that the plume may be larger than we anticipated," said water district spokesman Mike D. Marcano. "We're getting closer to finding how pervasive it is."

The latest reports showed perchlorate in two of three wells of the West San Martin Water Works, which has about 100 customers in an area west of Highway 101.

"The scary part is that this well is so deep," said Sylvia Hamilton, president of the San Martin Neighborhood Alliance and a customer of the little water company. "When it goes down to the lower strata, then you're really in trouble."

See WELLS

# THE PINNACLE

Serving Gilroy, San Martin, Morgan Hill & Coyote

## South Valley

Volume 2, Number 27

WWW.PINNACLENEWS.COM

Week of January 17, 2003

## MH, SM wells contaminated

Perchlorate discovered in some water supplies; county urges testing

By DALE RODEBAUGH

Pinnacle Staff Writer

Up to 450 wells in Morgan Hill and San Martin are in danger of contamination from a thyroid-disrupting chemical that would make them unusable, perhaps forever.

Tests so far in an area near Morgan Hill's defunct Olin Standard plant at 425 Tennant Ave. have confirmed seven cases of contamination. The Santa Clara Valley Water District wants owners of all 450 wells in an area bounded by Tennant Avenue to the north, Masten Avenue to the south, Monterey Road to the west and Center Avenue to the east to call the county to arrange for testing.

To have your well tested free of charge, call 408-265-2607 ext. 2649.

The company was in business for 40 years. "My wife has a thyroid problem," said Bob Cerutti, a member of the San Martin Neighborhood Alliance whose well was tested at more than twice the EPA limit. "Why didn't the Water District See Contaminated wells, Page A9

# Morgan Hill Times

Serving Morgan Hill, San Martin and Coyote Valley since 1894

Est. 1894 • Vol. 109, No. 05

editormh@morganhilltimes.com

January 17, 2003

779-4106 50 cents



JAMES M. MOHS/Chief Photographer

A drum of core sample dirt sits near a test site on the Olin Corporation property at Tennant and Railroad Aves.

## Wells contaminated

Up to 450 private wells in danger from chemical in underground water table

By CAROL HOLZGRAFE

Staff Writer

A 'plume' of the chemical potassium perchlorate from a now closed industrial site has traveled much farther through the underground aquifer than originally thought and might cause health problems for residents

who rely on some of the hundreds of private wells in its path.

Residents who get their water from the city are in no danger. Gilroy and San Martin wells are also uncontaminated. Potassium perchlorate is a by-product of fusee production and is used, not only in flares and matches, but in solid rocket propellants and fireworks. It is a naturally occurring salt.

The chemical is known to cause tumors and thyroid problems but, so

far, the amounts found in local wells are far below the danger levels, according to Santa Clara County Water District spokesman Mike DiMarco.

"At this point it's not a huge public health threat," he said Thursday.

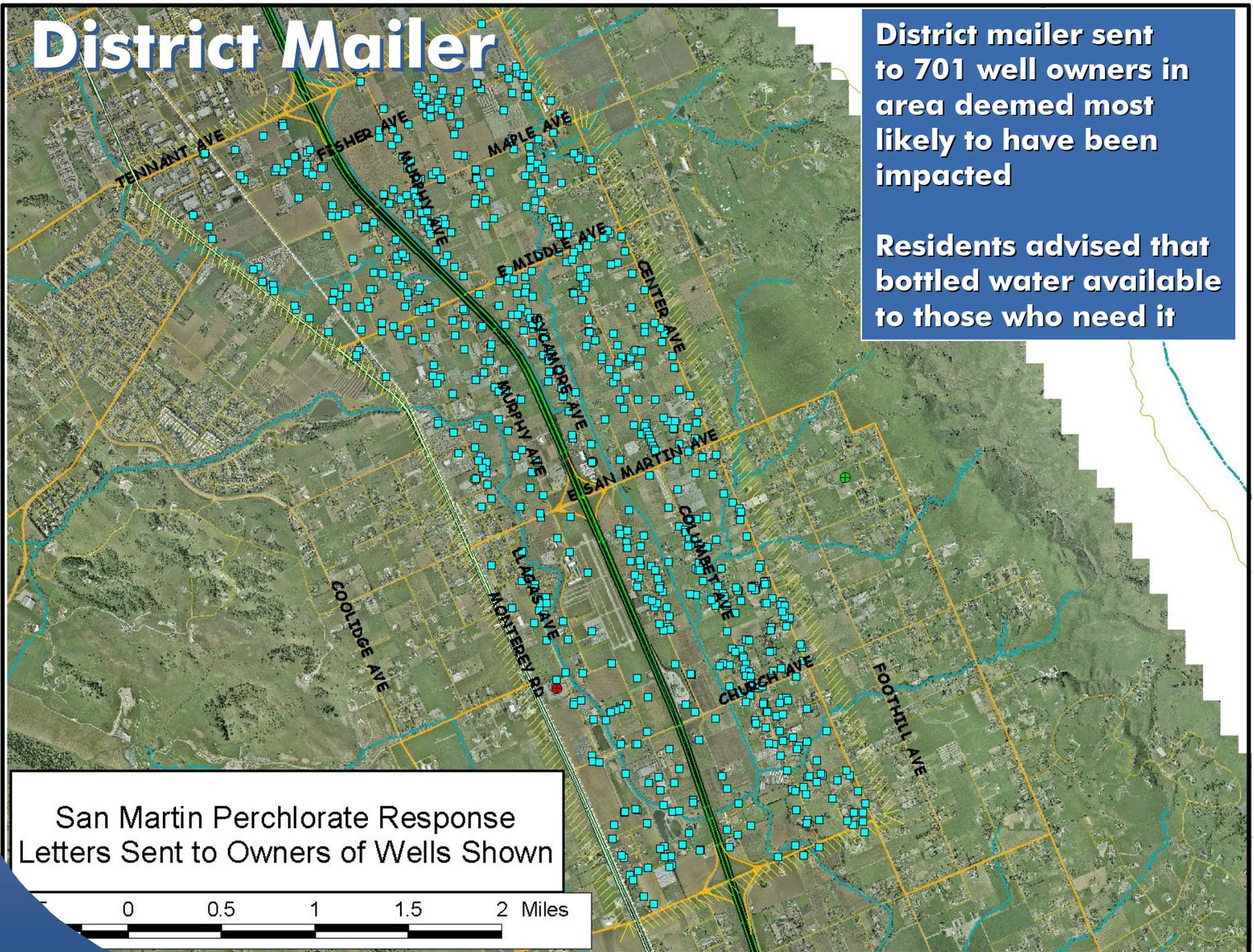
On Wednesday the SCCWD announced that a state investigation had found that hundreds of private wells southeast of the site from

Turn to WATER, A8

# District Mailer

District mailer sent to 701 well owners in area deemed most likely to have been impacted

Residents advised that bottled water available to those who need it



San Martin Perchlorate Response Letters Sent to Owners of Wells Shown

0 0.5 1 1.5 2 Miles









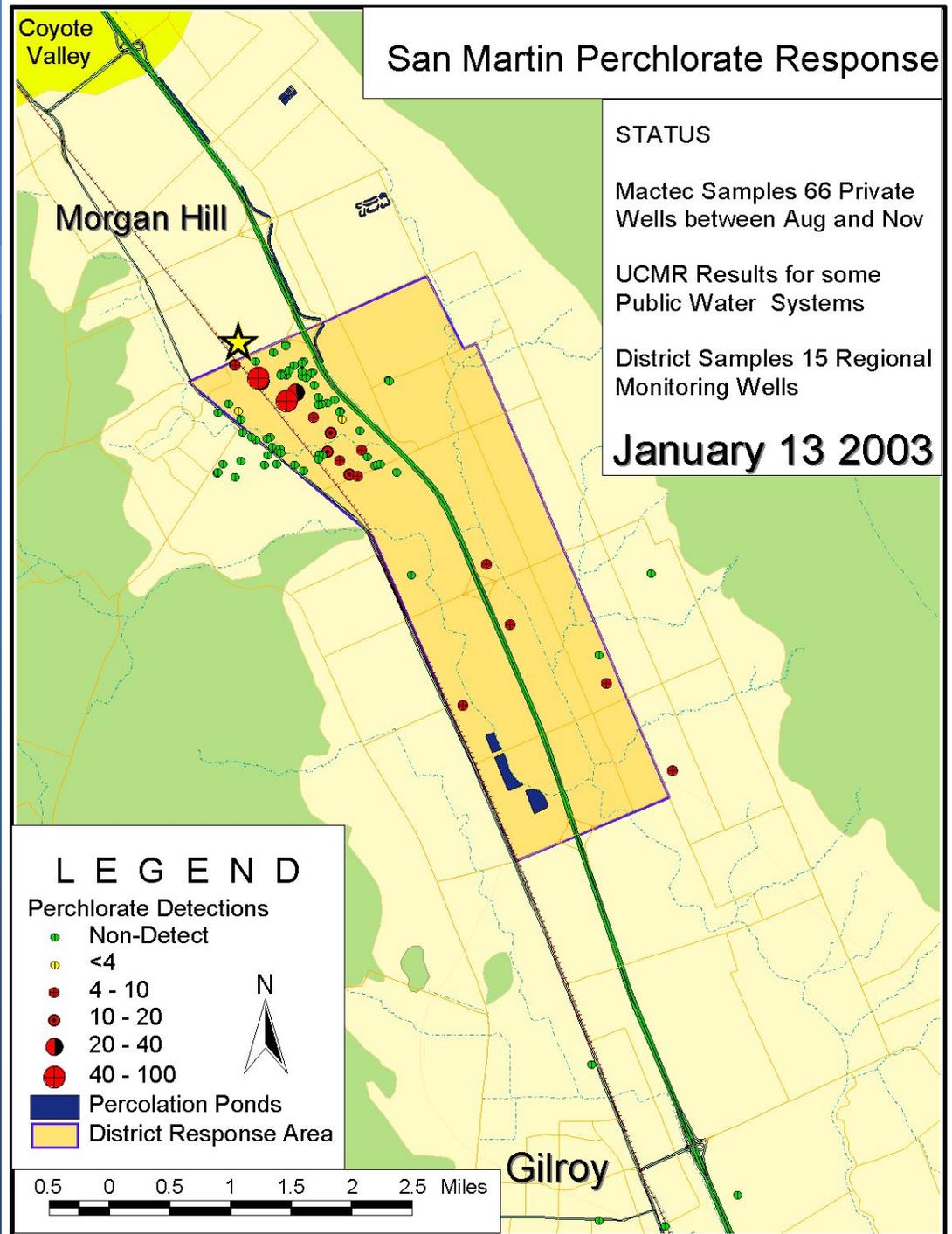
**San Martin Area – looking North  
District Church Ponds Recharge Facility**

**Bottled Water Delivery  
District: ~1,240 Homes  
Olin: ~ 800 + homes  
2% of household water  
used for drinking and  
cooking**



**\$17,000/week**

“People in the area may have immediate concerns about their drinking water, so the District is prepared to offer free testing of private wells”



# San Martin Perchlorate Response

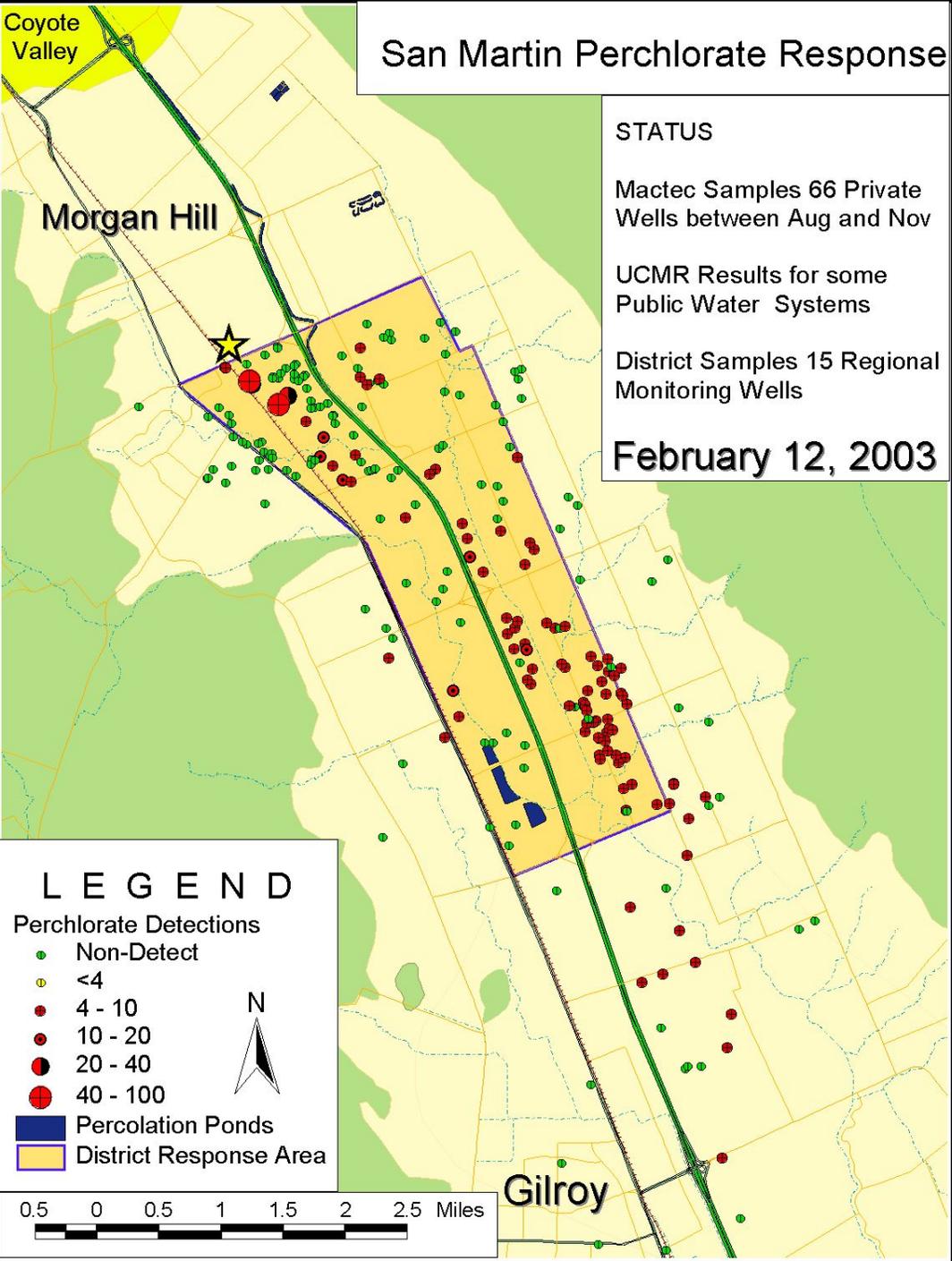
## STATUS

Mactec Samples 66 Private Wells between Aug and Nov

UCMR Results for some Public Water Systems

District Samples 15 Regional Monitoring Wells

February 12, 2003



# San Martin Perchlorate Response

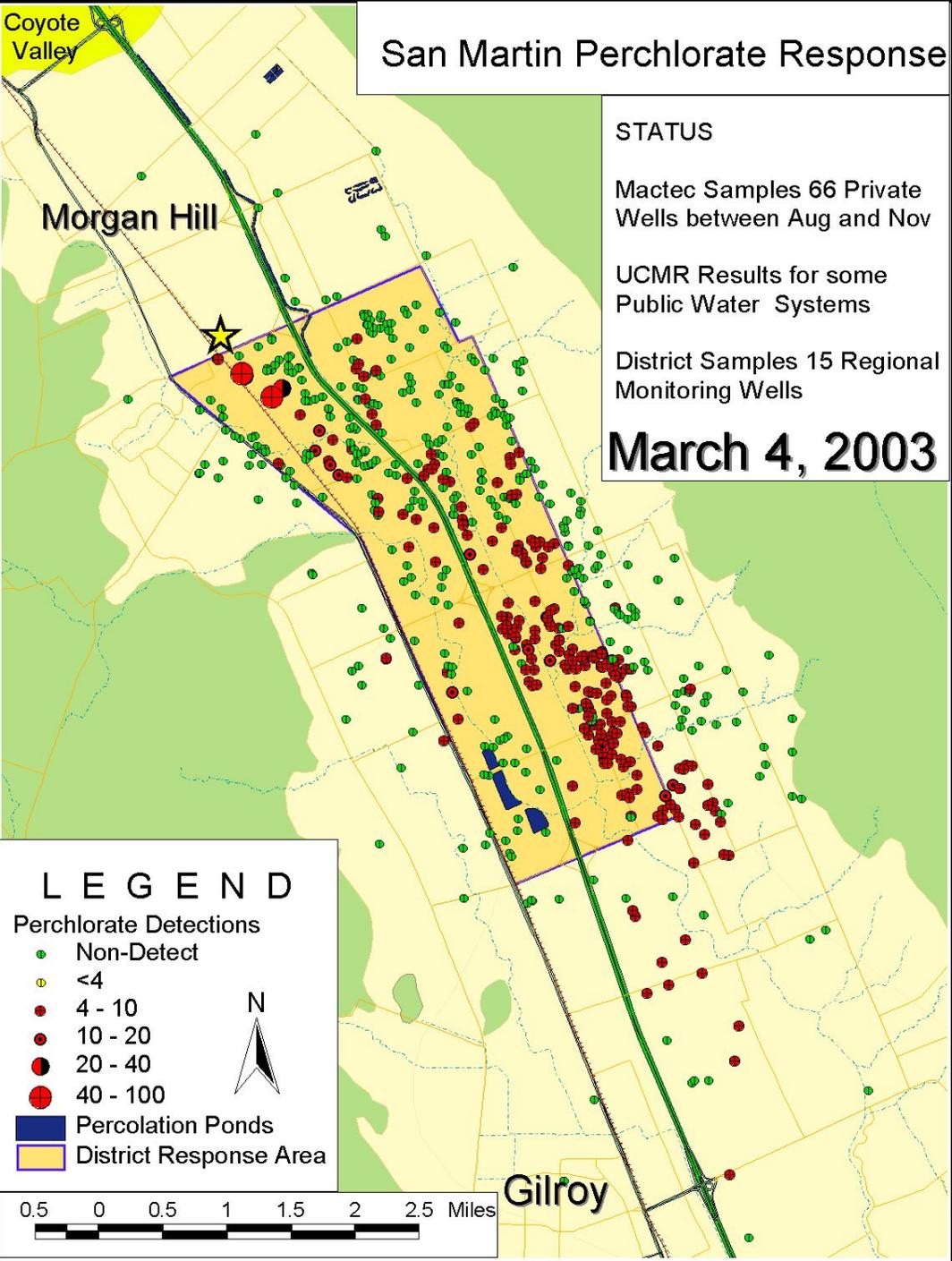
## STATUS

Mactec Samples 66 Private Wells between Aug and Nov

UCMR Results for some Public Water Systems

District Samples 15 Regional Monitoring Wells

### March 4, 2003



## Summary of Results as of July 3, 2003

Concentration # of Samples

ND (< 4 ppb) 784

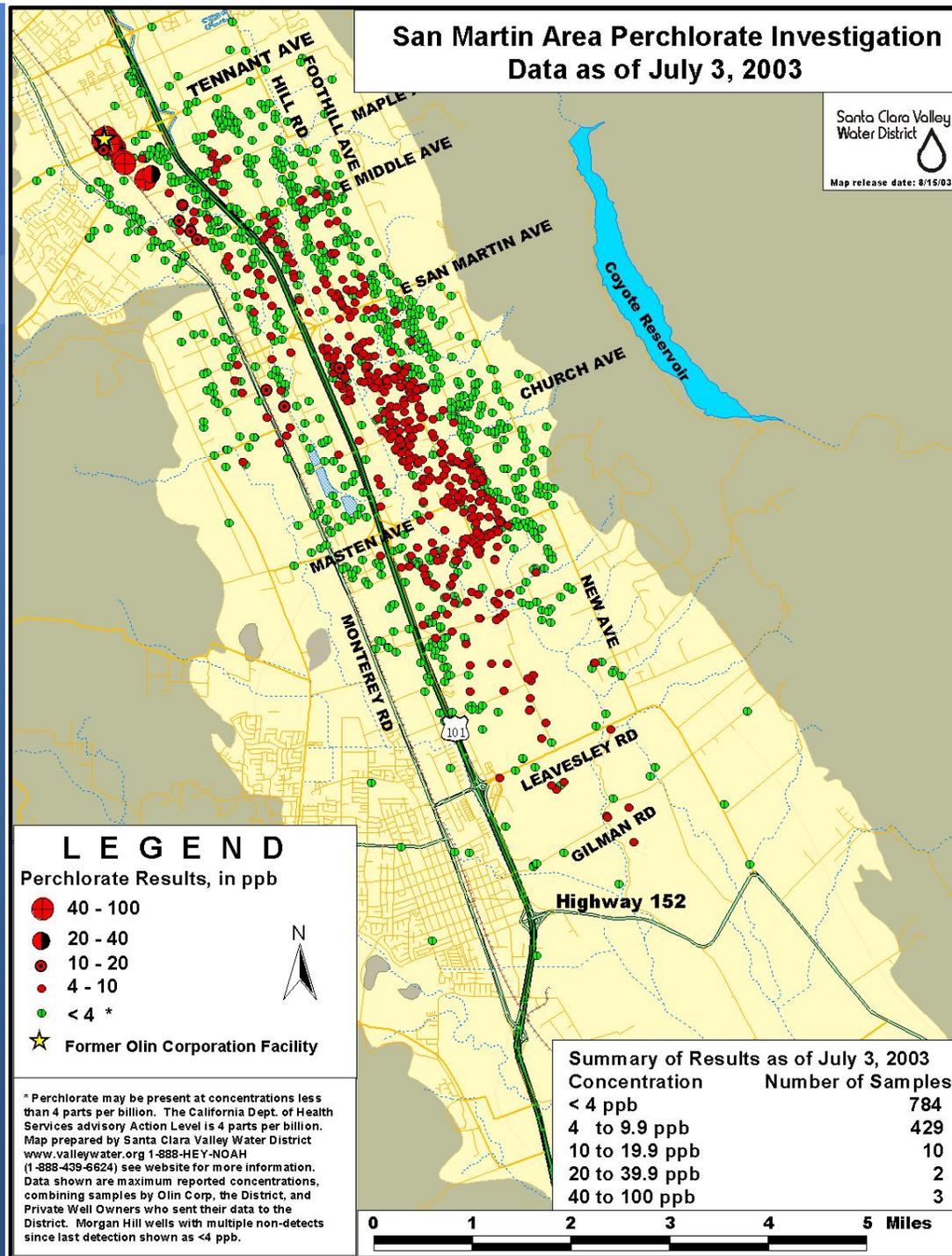
4-10 ppb 429

10-20 ppb 10

20-40 ppb 2

40-100 ppb 3

Total 1228

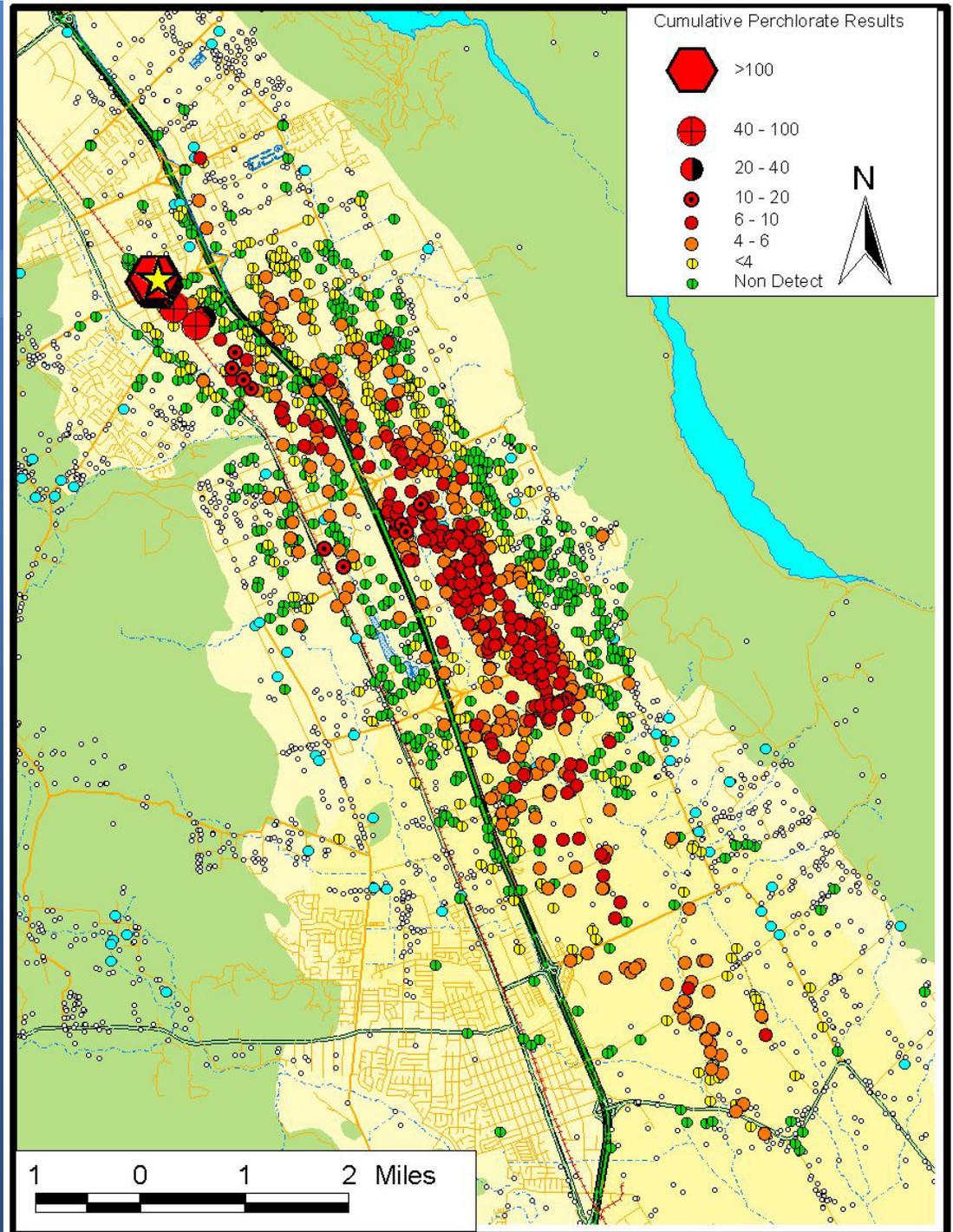


**Data as of 9-15-04**

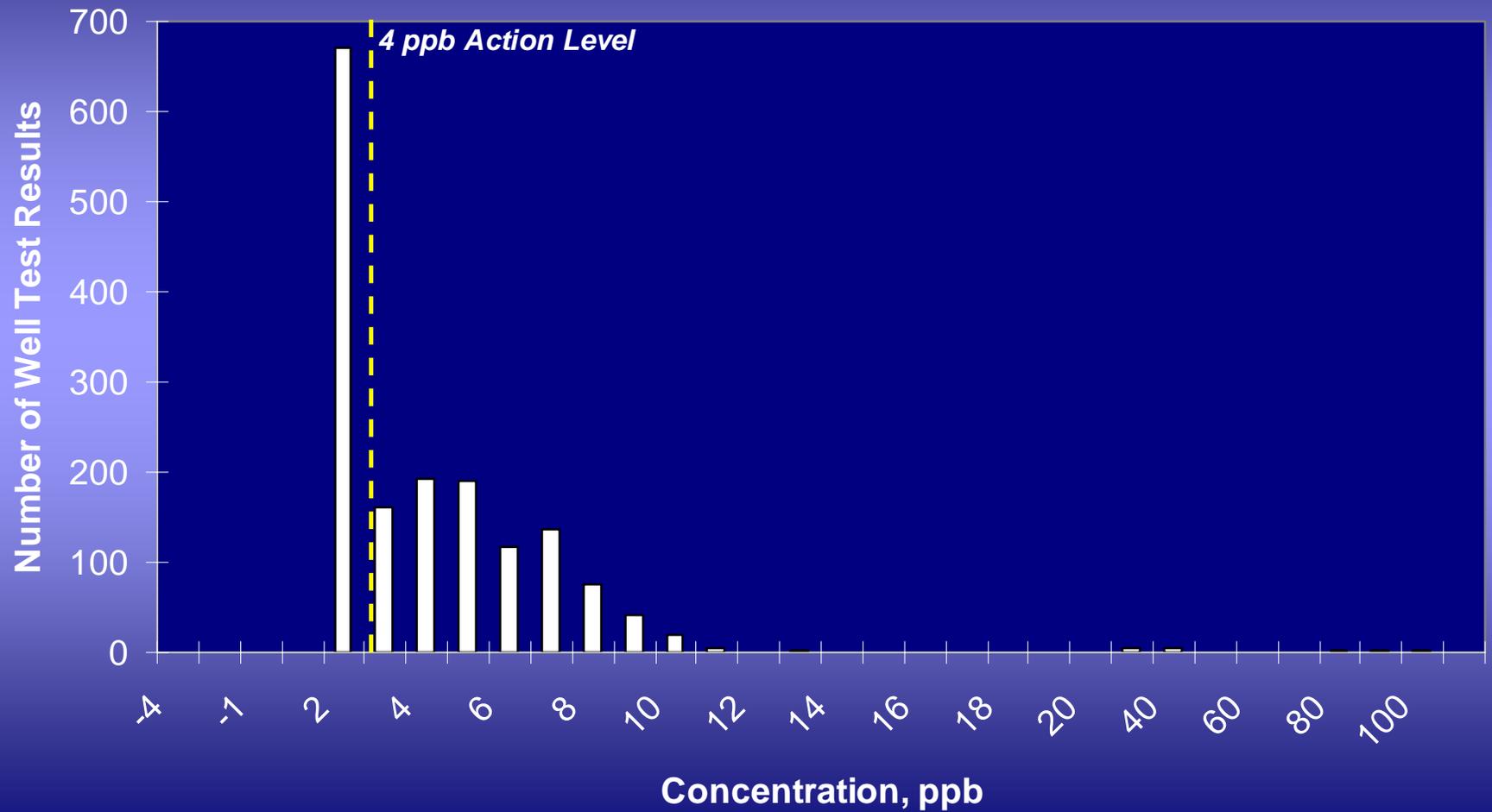
**California PHG  
finalized at 6 ppb  
in March 2004;  
Action level raised to  
6 ppb**

**628 wells ND  
377 wells < 4 ppb  
352 wells 4 to 6 ppb  
237 wells 6 to 10 ppb  
20 wells > 10 ppb**

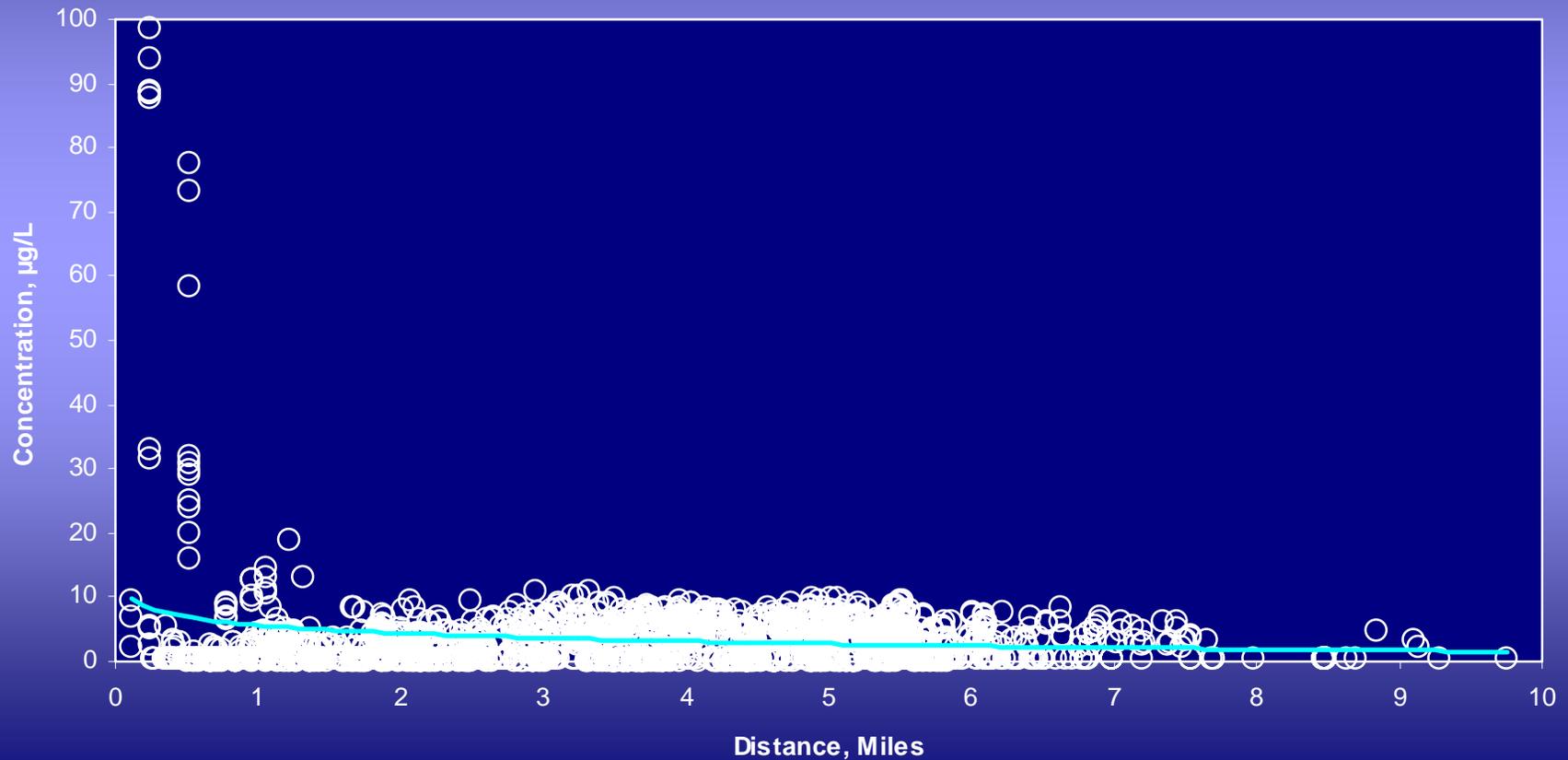
**1,621 wells sampled**



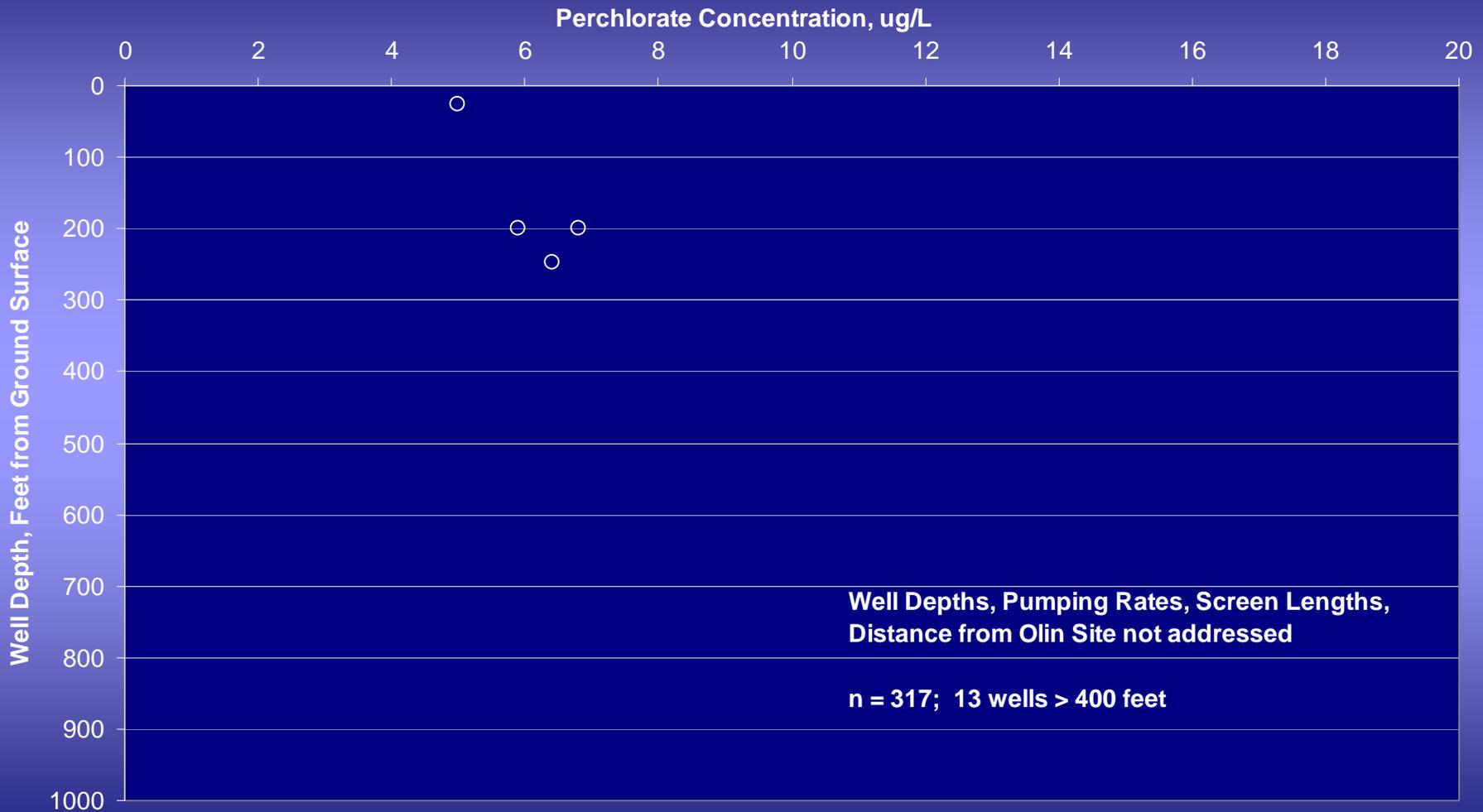
## Perchlorate Concentration Histogram, Off-Site Private Wells (includes repeat analyses in same wells)



## Variation of Concentration with Distance from Olin Site Using Data from All Dates for Off-Site Private Wells Depth, Pumping, and Screen Length not Addressed

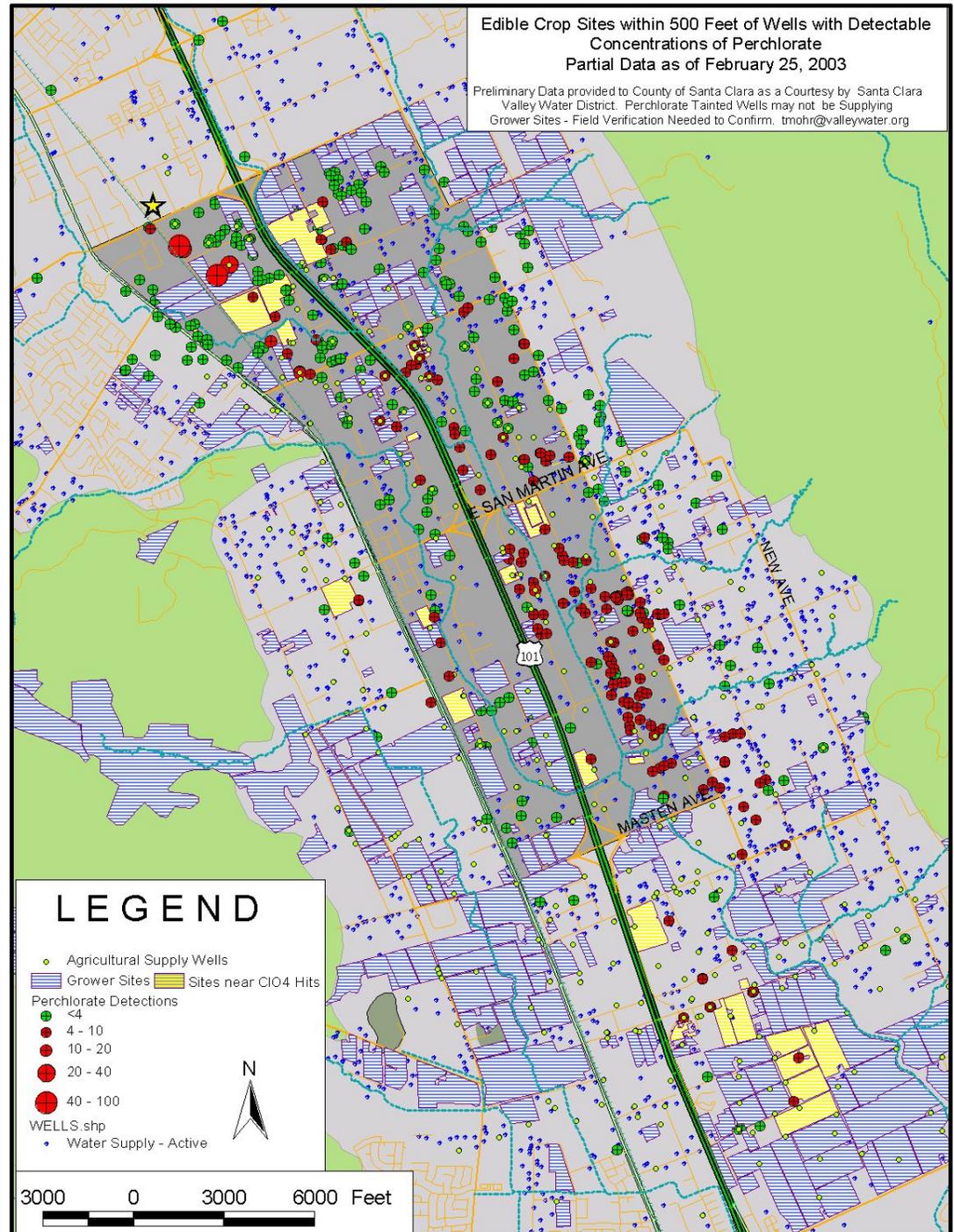


## Apparent Distribution of Perchlorate with Well Depth in Off-Site Private Wells



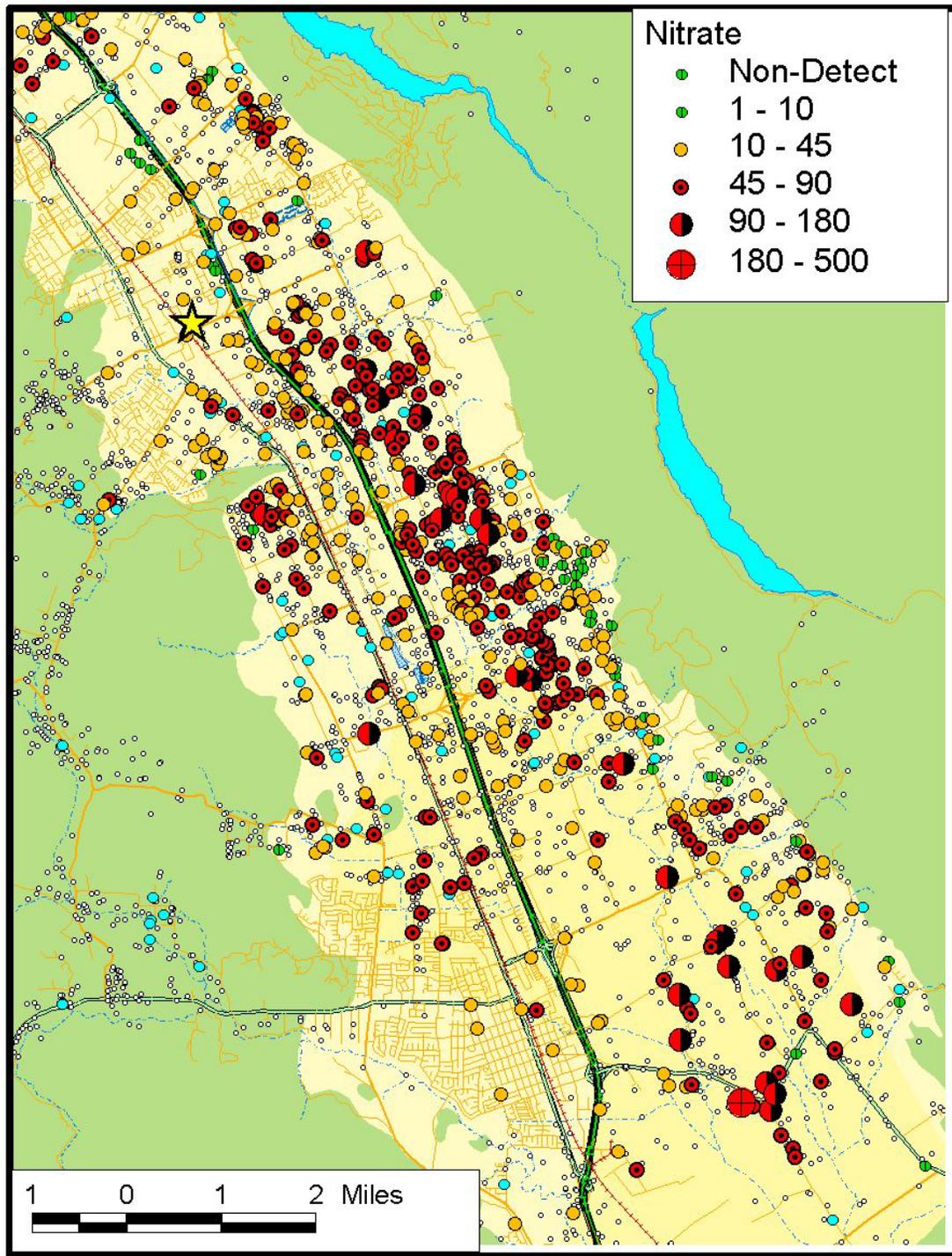
**Edible food crops  
grown in proximity  
to domestic wells  
with perchlorate  
detections**

**Significance of  
 $\text{ClO}_4^-$  presence  
indeterminate  
without context of  
quantitative risk  
assessment**



## **Treatment Technologies:**

- **biological Treatment in Fluidized Bed Reactors**
- **biological Treatment in Packed Bed Reactors**
- **ion exchange with regenerable resins**
- **ion exchange with disposable resins**
- **reverse osmosis with nano-filtration**
- **hydrogen based membrane biofilm reactors**
- **electro-oxidation**
- **electro-chemical reduction**
- **electrolytic separation**
- **granular activated carbon**
- **vacuum distillation**
- **in-situ bioremediation**
- **permeable reactive barriers**



## Nitrate (mg/L)

50% of wells exceed MCL for nitrate

Perchlorate IX Resin Removes only ClO<sub>4</sub>-

If water is still “undrinkable”, what’s the benefit of spending millions on treatment?

As > 10 µg/L in some areas

**If Nitrate were regulated for Iodide Uptake inhibition in the same manner proposed for perchlorate . . . .**

**Equivalence to Perchlorate PHG of 0.006 mg/L:**

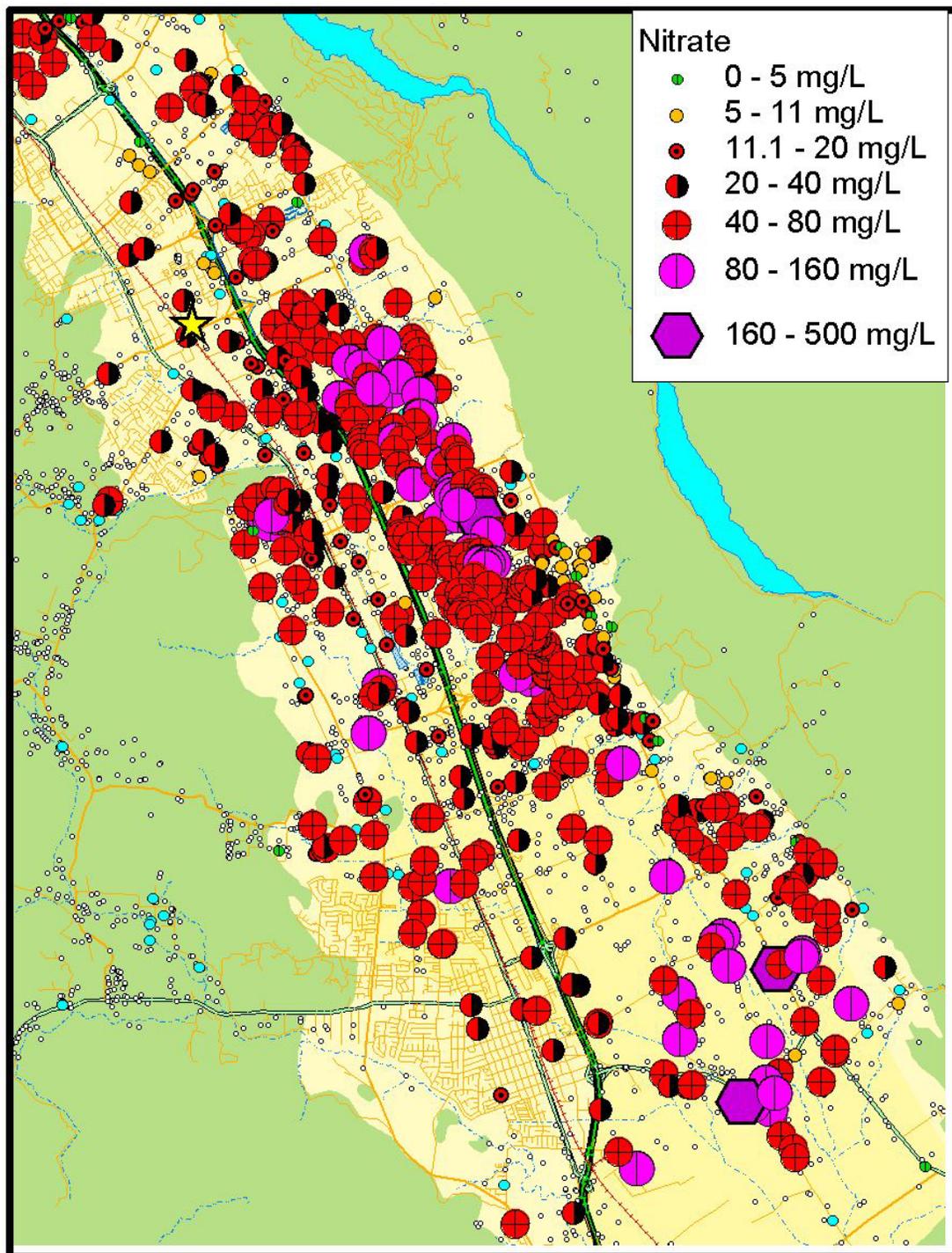
**Nitrate MCL should be **11 mg/L****

**rather than 45 mg/L . . . .**

**(Analysis by Dr. Richard Bull, former NAS**

**Panelist on Draft EPA Perchlorate MCLG Review)**

**Presented to Groundwater Resources Assn of California 8/4/04**



If Nitrate were regulated for IUI at 11 mg/L . . .

Nitrate is commonly present at a higher effective dose than the levels proposed to regulate  $\text{ClO}_4^-$

Has nitrate presented a thyroid problem?

Alternative	Treat and Distribute Surface Water	Treat and Distribute Groundwater	Point of Use Treatment for Domestic Supply	Point of Use Treatment for Domestic Supply Plus Recycled Water for Agricultural Supply	Point of Use Treatment for Domestic Supply Plus Wellhead Treatment for Agricultural Supply	Wellhead Treatment
Timeframe for Implementation (Years)	4-5	4-5	0.5 - 1	3-5	1-2	1-2
Capital Cost (Millions)	\$150	\$135	\$2	\$135	\$13 - \$15	\$30
Annual Operation and Maintenance Costs (Millions)	\$2	\$2	\$0.5	\$1	\$1	\$11
Annual Lease Cost (Millions)	Not Applicable	Not Applicable	\$0.8	Not Applicable	\$1.7	\$17.4
Source of Water	Surface Water	Groundwater	Groundwater	Groundwater, Recycled Water	Groundwater	Groundwater
Centralized Treatment	Yes	Yes	No	Domestic: No Agriculture: Yes	No	No
Distribution System	Yes	Yes	No	Yes	No	No
All Beneficial Uses Supplied	Yes	Yes	No	Yes	Yes	Yes
Contributes to Groundwater Cleanup	No	Yes	Yes	Yes	Yes	Yes

## **Treatment Challenges and Logistics:**

- **Distribution network absent in most impacted areas**
- **Flows are low**
- **Concentrations are low**
- **Homeowner solution elusive**
- **Brine management**
- **Cost of lab testing prohibitive – test kit needed**
- **Certification of systems = bottleneck**
- **Perception of biological treatment – association with wastewater and fear of pathogens**

## FUNDING INITIATIVES

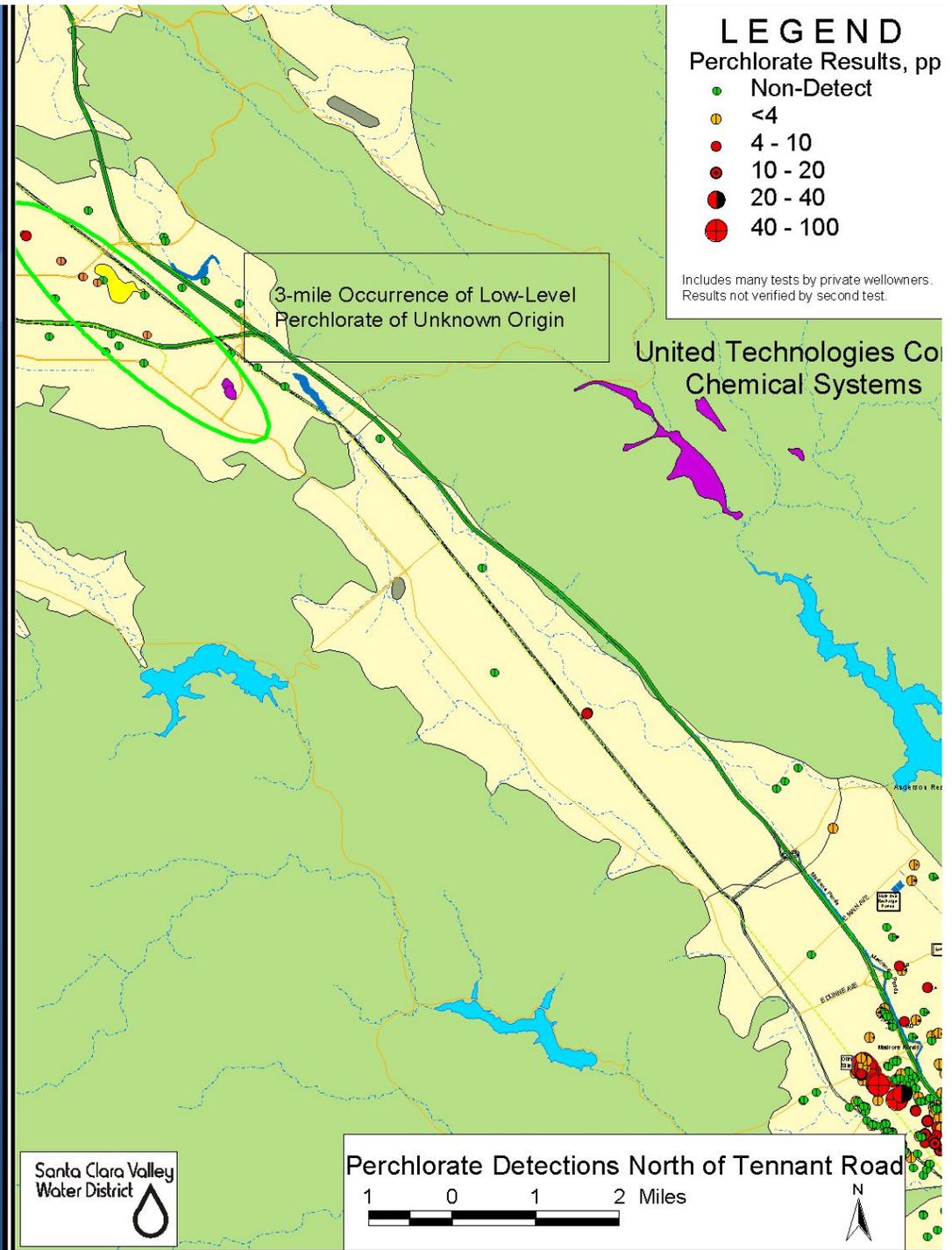
- 2003/4 EPM and STAG Grants - \$1.7M
- 2004/5 EPM and STAG Grants - \$800K
- Pombo Bill – passed House in Sept. @ \$25 M
- Santa Clara Valley Water District Reserves
- City of Morgan Hill Water Rate Increases
- City of Gilroy Reserves Spent on Contingencies
- Olin Corporation has spent > \$ 9M so far . . .

*Total Spent to Study Health Effects = ~ \$5 M ??*

# The Complications of Other Possible Sources:

- Bulldog Soda Fertilizer
- Roadside Flares
- UTC Rocket Motor Plant Runoff or aerial deposition from partial burning
- Rain, mineral deposits
- Methamphetamine Labs
- Forensics Tools ?

Legal Costs escalate



# Public Outreach Initiatives

- **web site**
- **all report files scanned and served online**
- **public meetings**
- **formation of community action group by RWQCB**
- **elected official forum**
- **media releases and interviews**

The image displays a screenshot of the Santa Clara Valley Water District website. The main content area features a "Perchlorate" section with a "fact sheet" header. The fact sheet includes the following text:

**What is perchlorate?**  
 Perchlorate (ClO<sub>4</sub><sup>-</sup>) is both a natural and a man-made salt. It is primarily used as an oxidizer in solid fuels for rockets and missiles. Other uses include production of highway safety flares, fireworks, matches, dyes, lubricating oils, air bag inflators, paints, electroplating and medical specialty tests. Perchlorate should not be confused with perchloroethylene (PCE), commonly referred to as "perc," a hazardous dry cleaning solvent.

**How does perchlorate affect drinking water in Santa Clara County?**  
 Prior to modern environmental laws, perchlorate wastes associated with weapons and rocket fuel manufacturing facilities, research facilities, military bases, pyrotechnics and highway flare manufacturing facilities were often improperly disposed, which resulted in contamination of soil, groundwater and surface water. Perchlorate can persist for many years in ground and surface water and is difficult to remove with standard water treatment processes. Over the past year, the Santa Clara Valley Water District has become increasingly concerned regarding the detection of perchlorate in our groundwater basins. Perchlorate has been detected above the newly revised state Department of Health Services

Below the fact sheet, there is a section for "Other Useful Links" with the following items:

- [Federal EPA Perchlorate - Information Fact Sheet](#)
- [Cal/EPA's Office of Environmental Health Assessment - Factsheet](#)
- [California Department of Health Services - California Drinking Water](#)
- [Public Health Goal For Perchlorate - Draft Document](#)

At the bottom of the page, there is a footer with the text: "Providing stream stewardship, wholesale water supply and flood protection for Santa Clara Valley" and "© 2002 Santa Clara Valley Water District. All rights reserved."

Overlaid on the right side of the screenshot are two smaller browser windows. The top window shows a "fact sheet" page with the same title and content as the main page. The bottom window shows a document titled "FIRST QUARTER (JANUARY—MARCH) 2002 GROUNDWATER MONITORING REPORT" for the "OLIN/STANDARD FUSEE SITE" located at "425 TENNANT AVENUE, MORGAN HILL, CALIFORNIA". The report number is "RWQCB Monitoring and Reporting No. 01-161". The logo for "LAW RESOURCE GROUP SOLUTIONS" is visible at the top of the report page.

**District Web Pages provide Perchlorate Info and current reports**

Contact:

Tom Mohr  
Perchlorate Project Manager  
408-265-2607 x 3760  
tmohr@valleywater.org  
<http://www.valleywater.org>