Olin Corporation Groundwater Cleanup Project Status Update

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Site Cleanup Program

January 27, 2017 Board Meeting

1

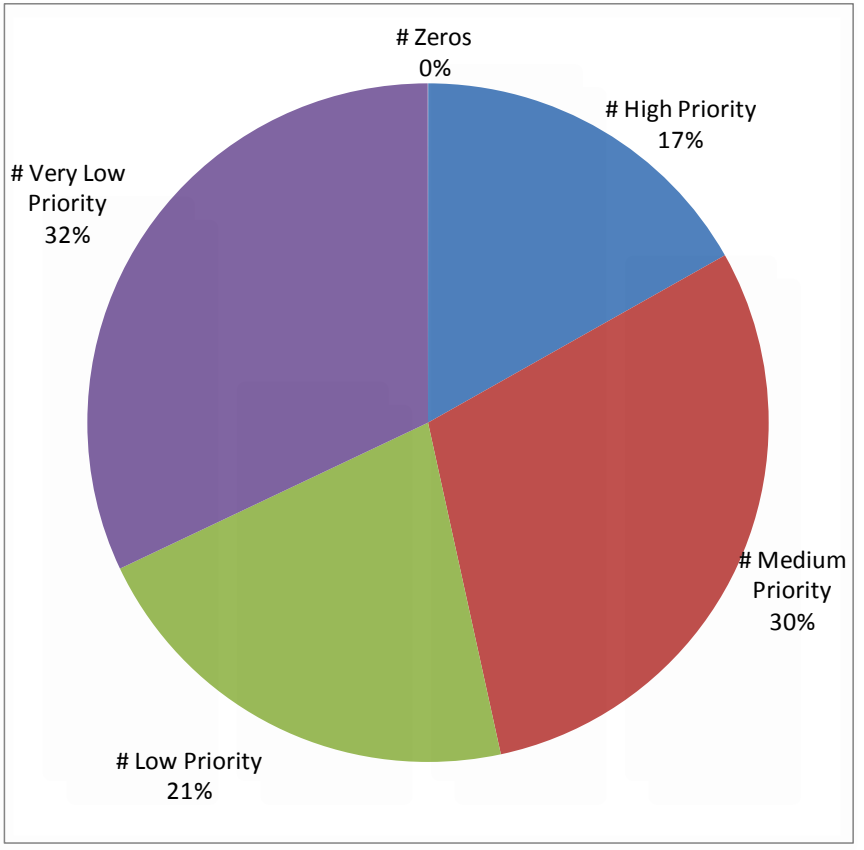
Item No. 18
January 26-27, 2017
Presentation

Site Cleanup Program

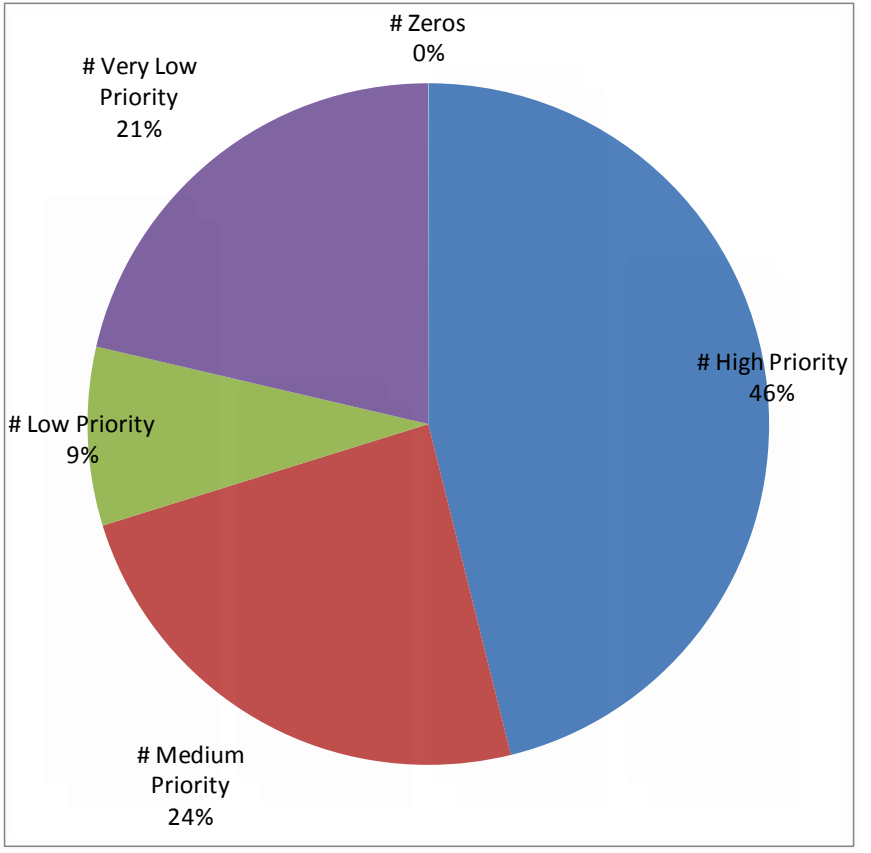
- **Site Cleanup Program currently has 8.3 staff positions**
- **131 active cleanup cases**
- **Prioritization of our work:**
  - **Risk to Human Health and the Environment (4 categories)**
  - **Site and Waste Complexity (3 categories)**
  - **Public Participation (3 categories)**

Comparison of Priority and Hours Worked

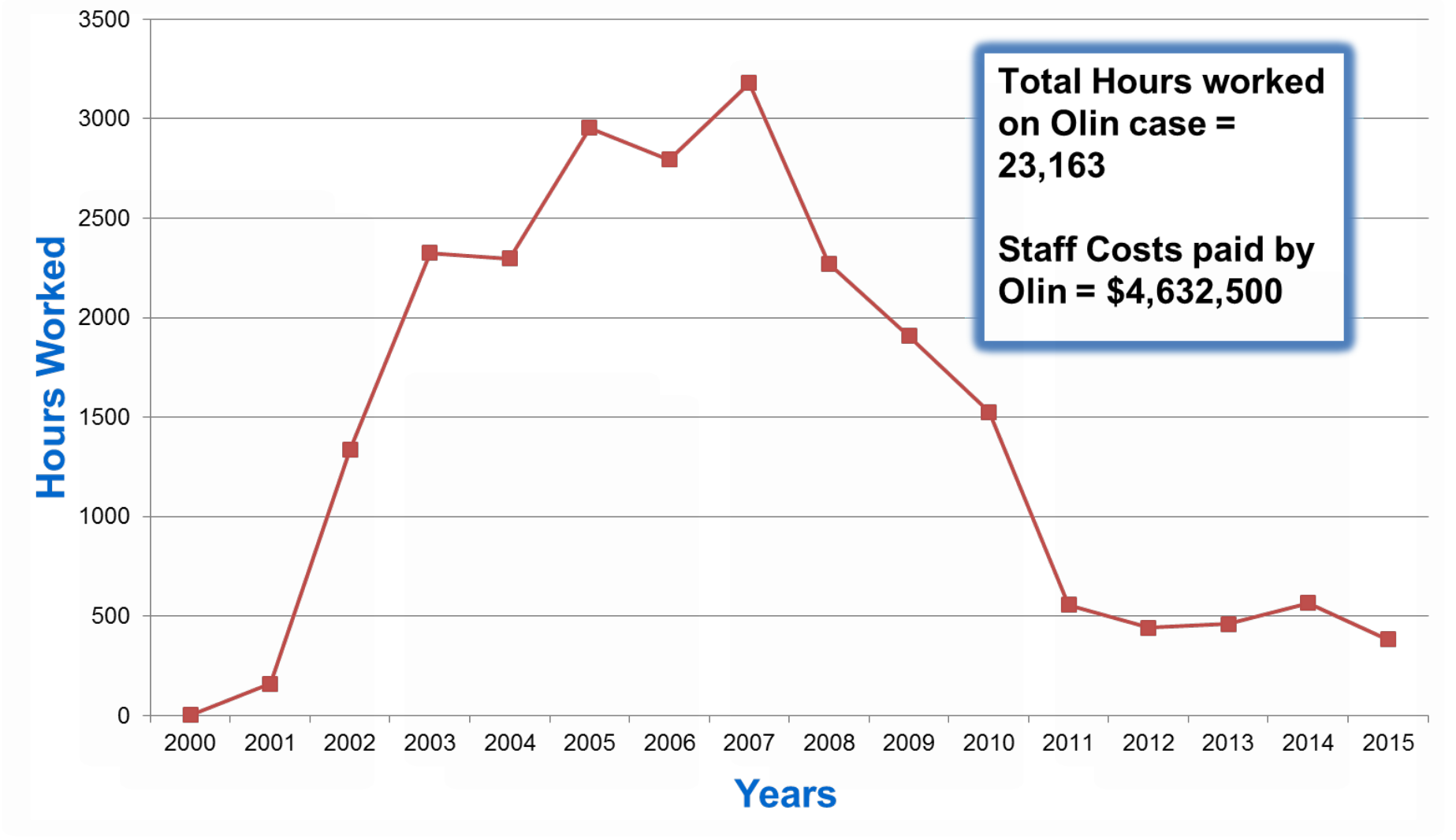
Case Priority



Hours Worked



Staff Hours Worked on Olin Cleanup Case (2000-2015)

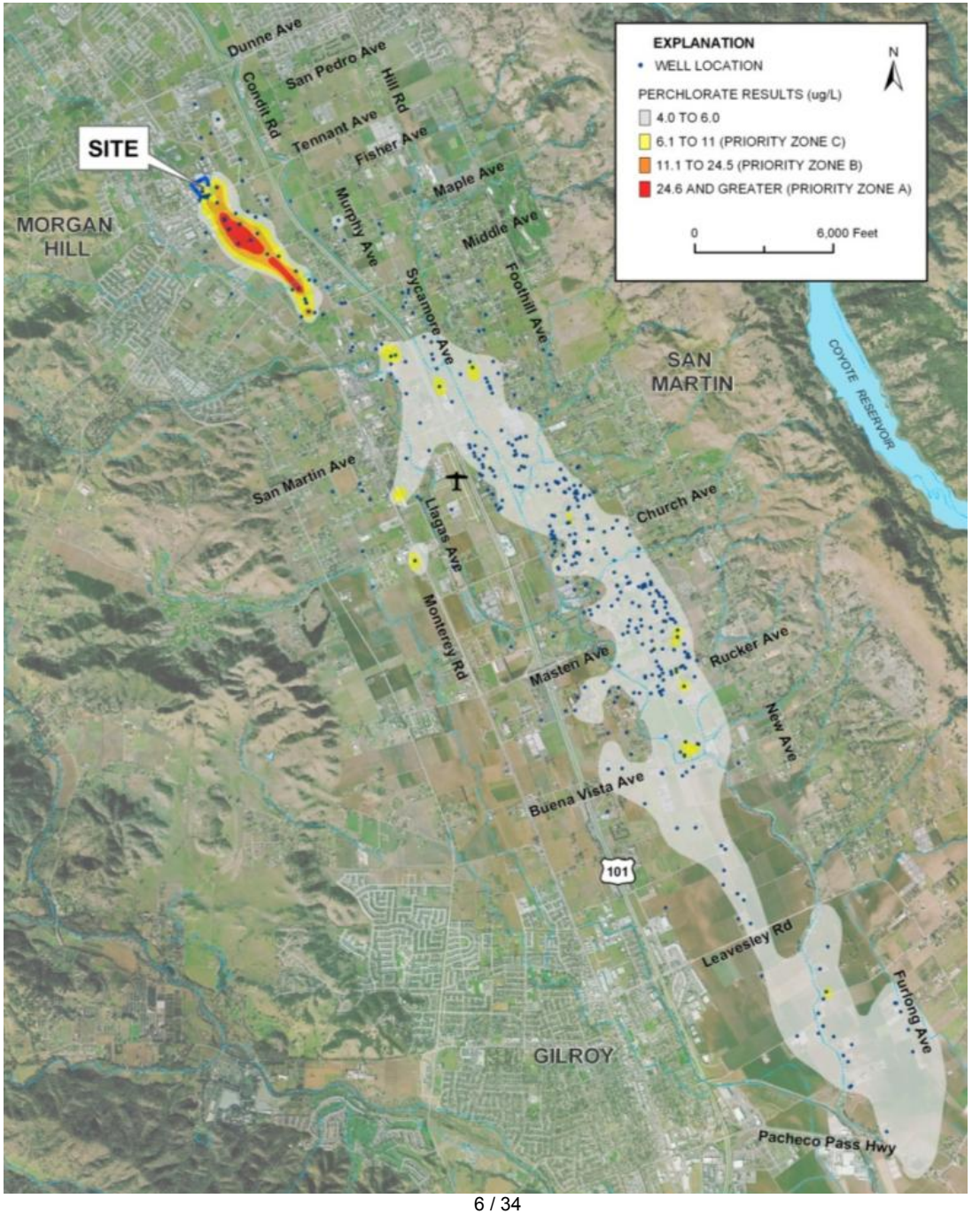


What is Perchlorate?

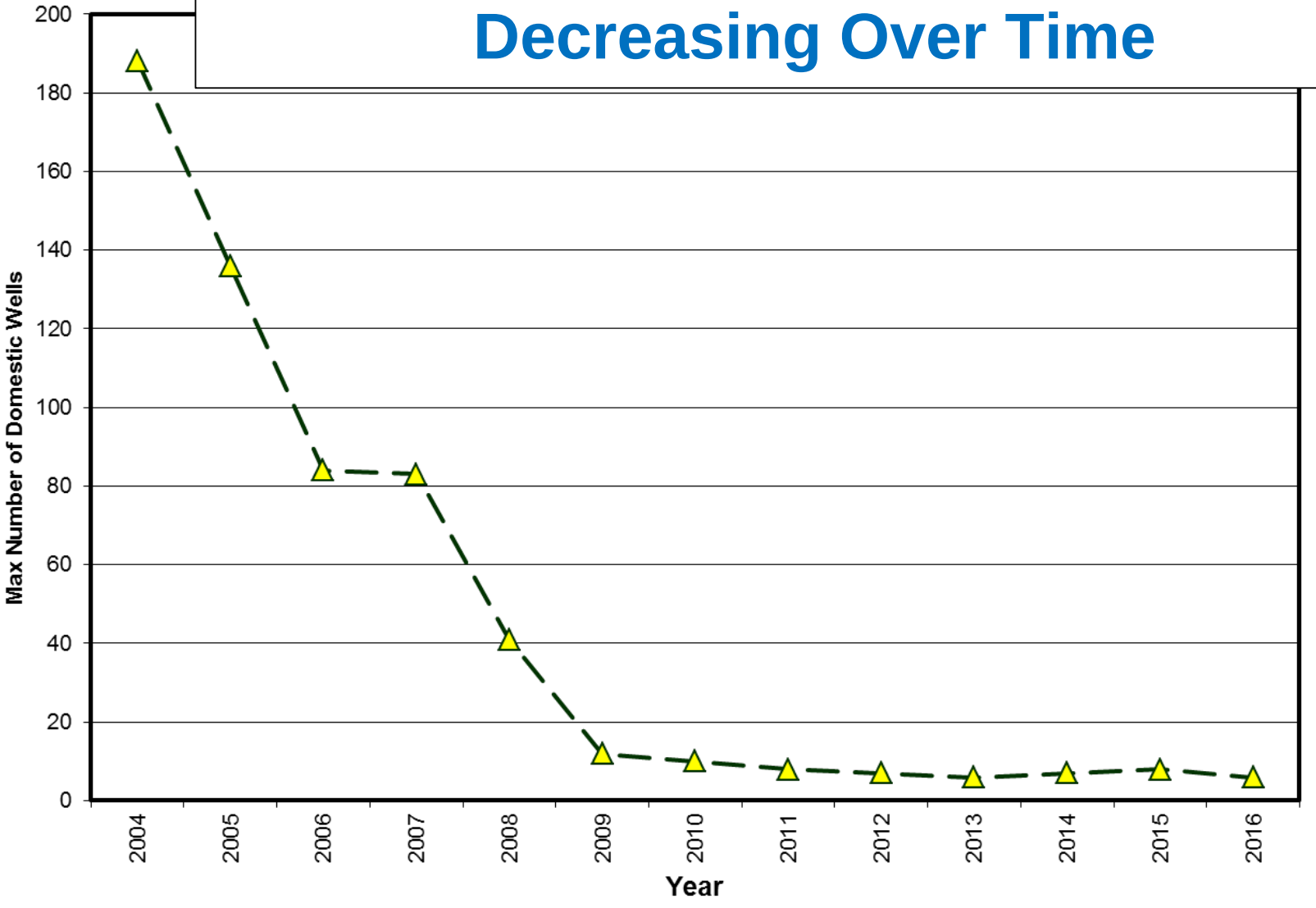
- **Occurs both naturally and as a man-made compound**
- **Highly soluble**
- **Very mobile in water**
- **Primary route of exposure is ingestion**
- **Maximum contaminant level is 6 micrograms per liter**

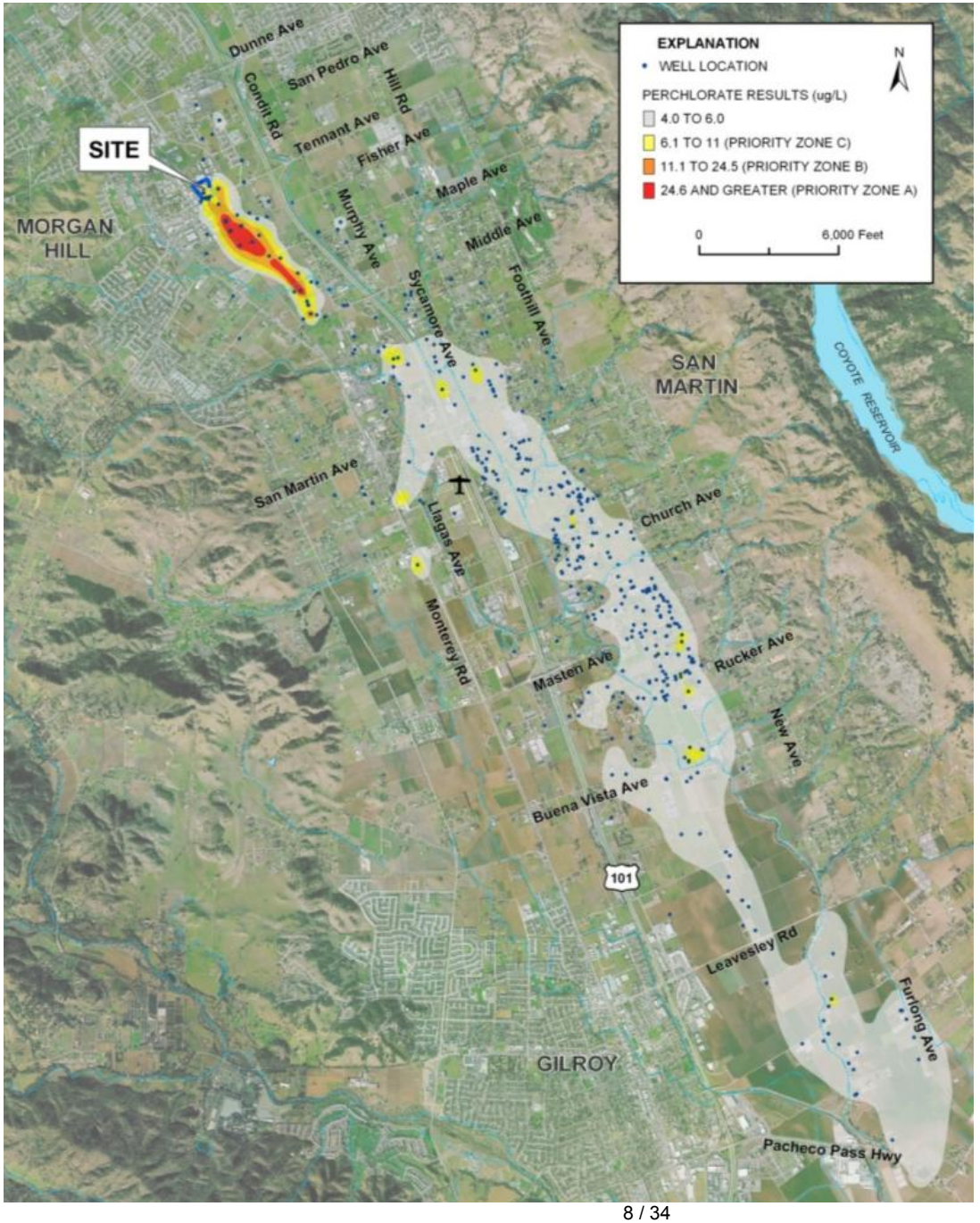
INTERMEDIATE AQUIFER

2007



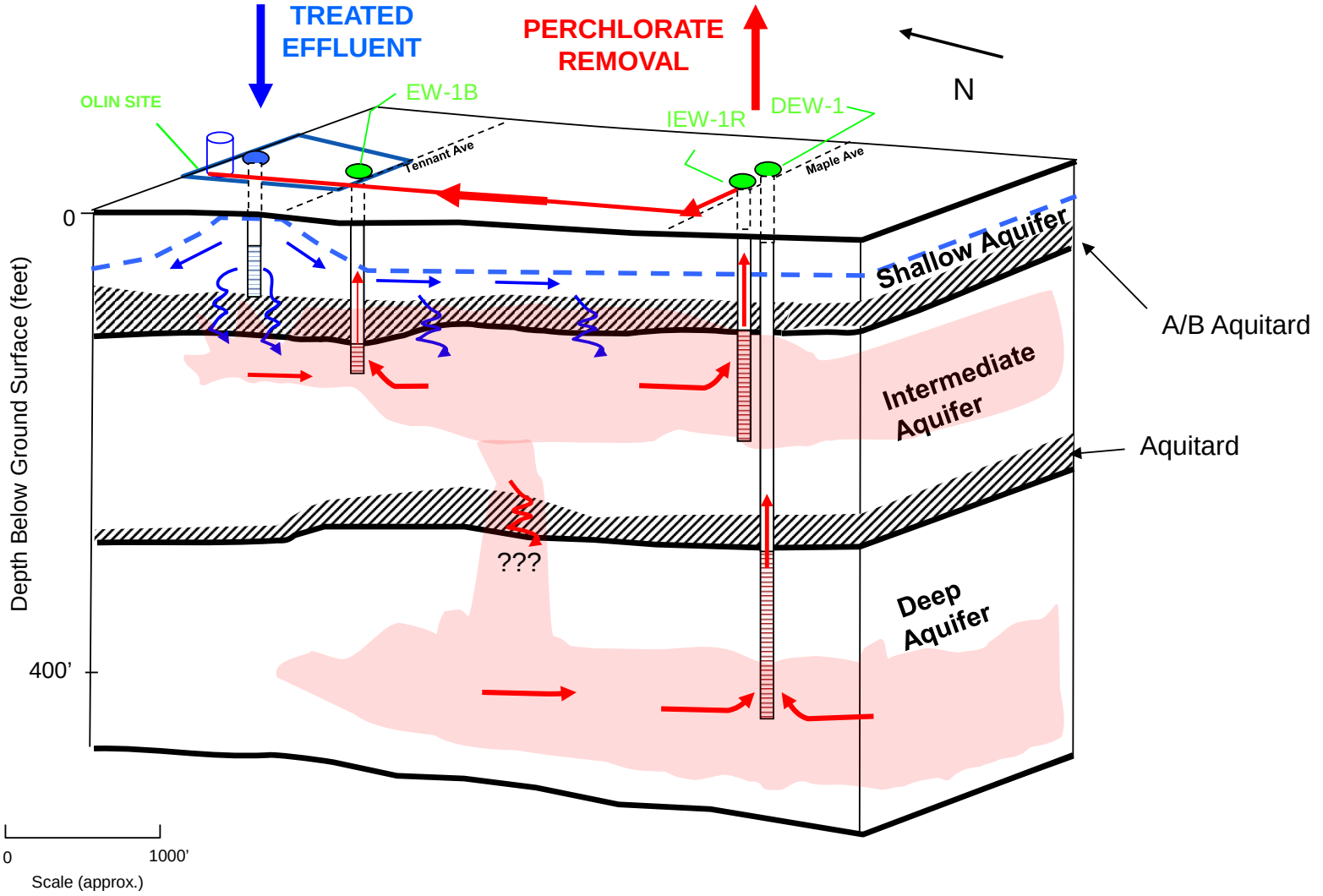
Number of Domestic Wells Exceeding Maximum Contaminant Level Decreasing Over Time




EXPLANATION
WELL LOCATION
PERCHLORATE RESULTS (ug/L)
4.0 TO 6.0
6.1 TO 11 (PRIORITY ZONE C)
11.1 TO 24.5 (PRIORITY ZONE B)
24.6 AND GREATER (PRIORITY ZONE A)
0
6,000 Feet
N
SITE
MORGAN HILL
SAN MARTIN
GILROY
COYOTE RESERVOIR
Dunne Ave
Condit Rd
San Pedro Ave
Hill Rd
Tennant Ave
Fisher Ave
Maple Ave
Murphy Ave
Middle Ave
Sycamore Ave
Foothill Ave
San Martin Ave
Llagas Ave
Monterey Rd
Church Ave
Masten Ave
Rucker Ave
New Ave
Buena Vista Ave
101
Leavesley Rd
Furlong Ave
Pacheco Pass Hwy


Site
Tennant Avenue
N
US 101
Fisher Avenue
Maple Avenue
Map Scale
1,000 Feet
Google

CONCEPTUAL MODEL




Injection Wells
Tennant Avenue
Treatment System
Site
EW-01B1
N
US 101
Fisher Avenue
DEW-1
Maple Avenue
IEW-1R
Map Scale
1000 Feet
Google

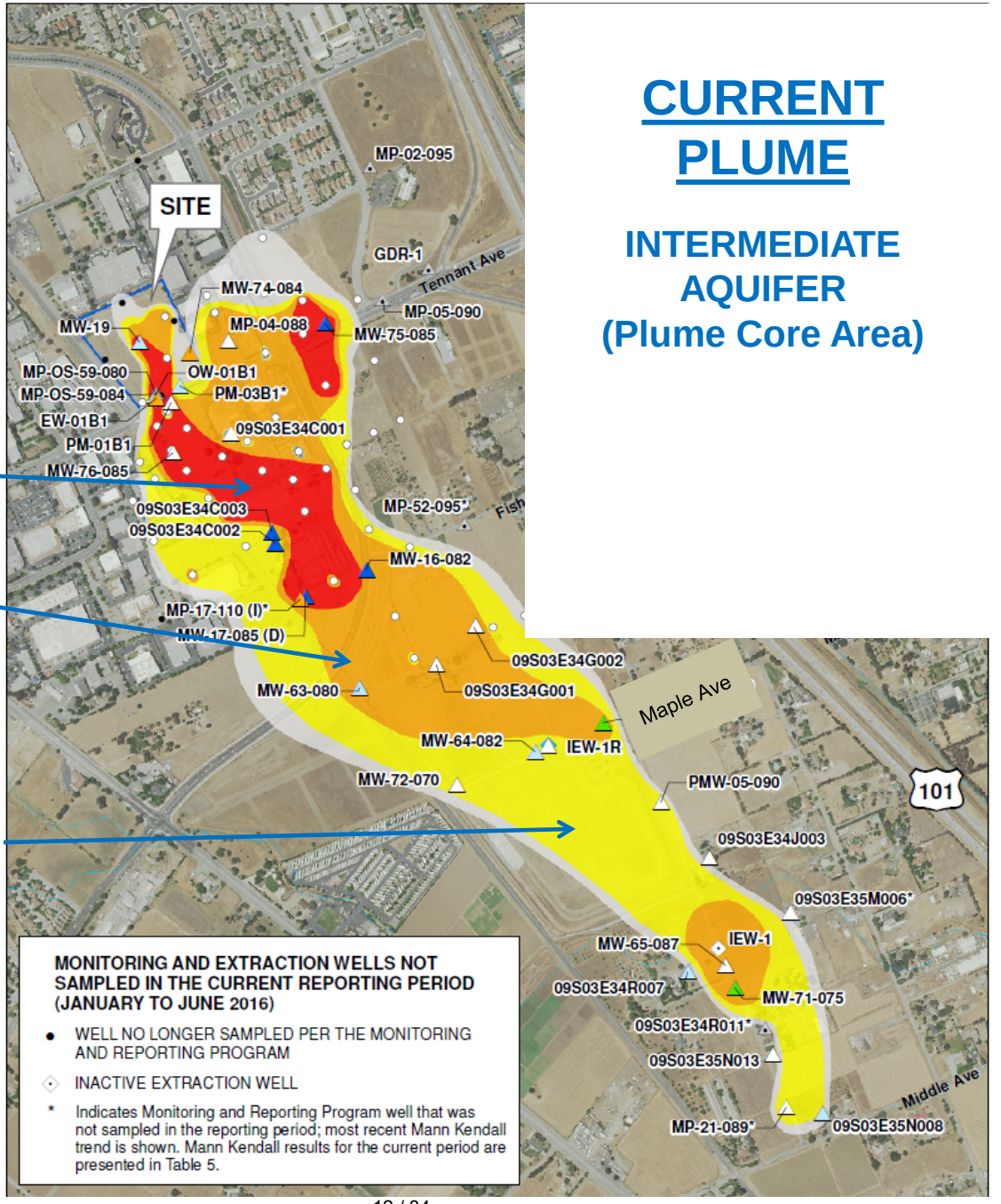
CURRENT PLUME

INTERMEDIATE AQUIFER (Plume Core Area)

Red Areas
>4x MCL

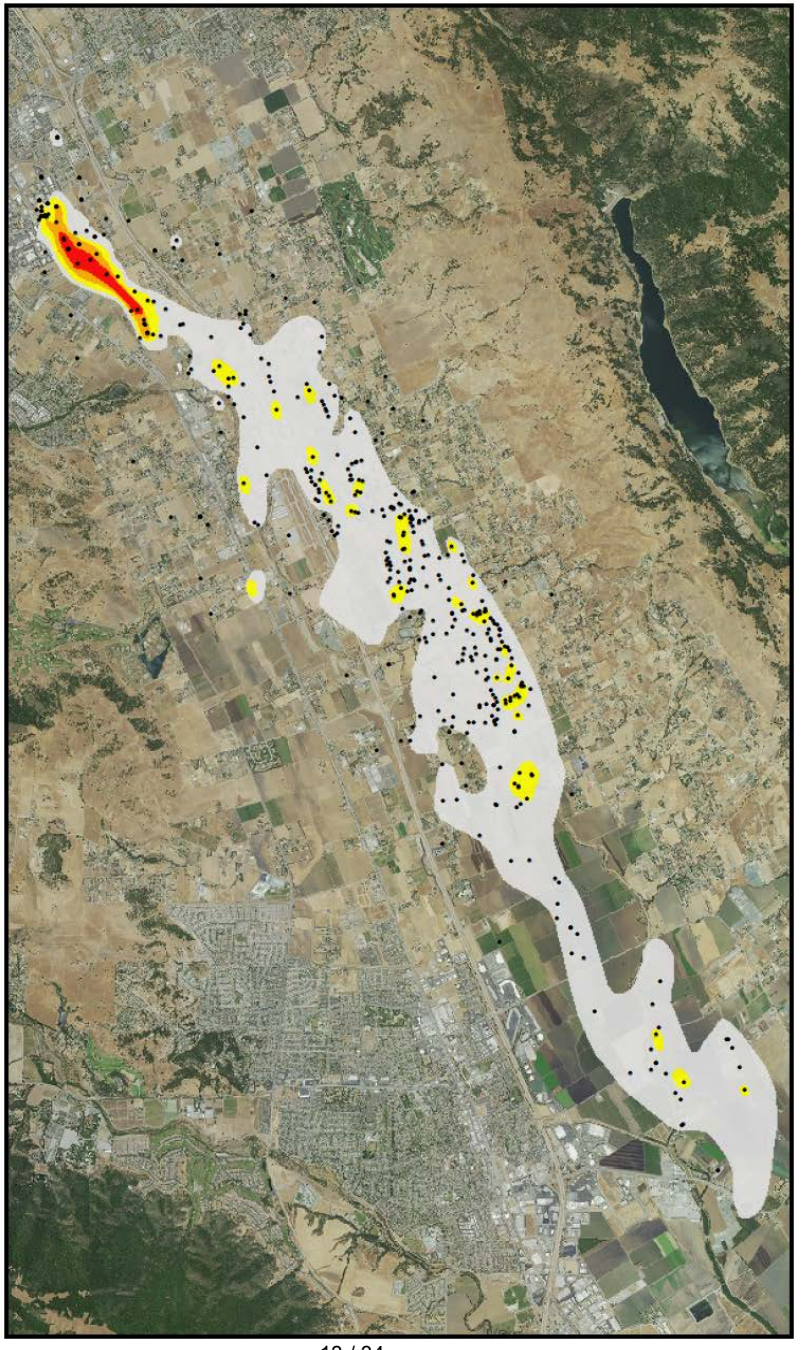
Orange Areas
2 - 4x MCL

Yellow Areas
>MCL to 2x MCL



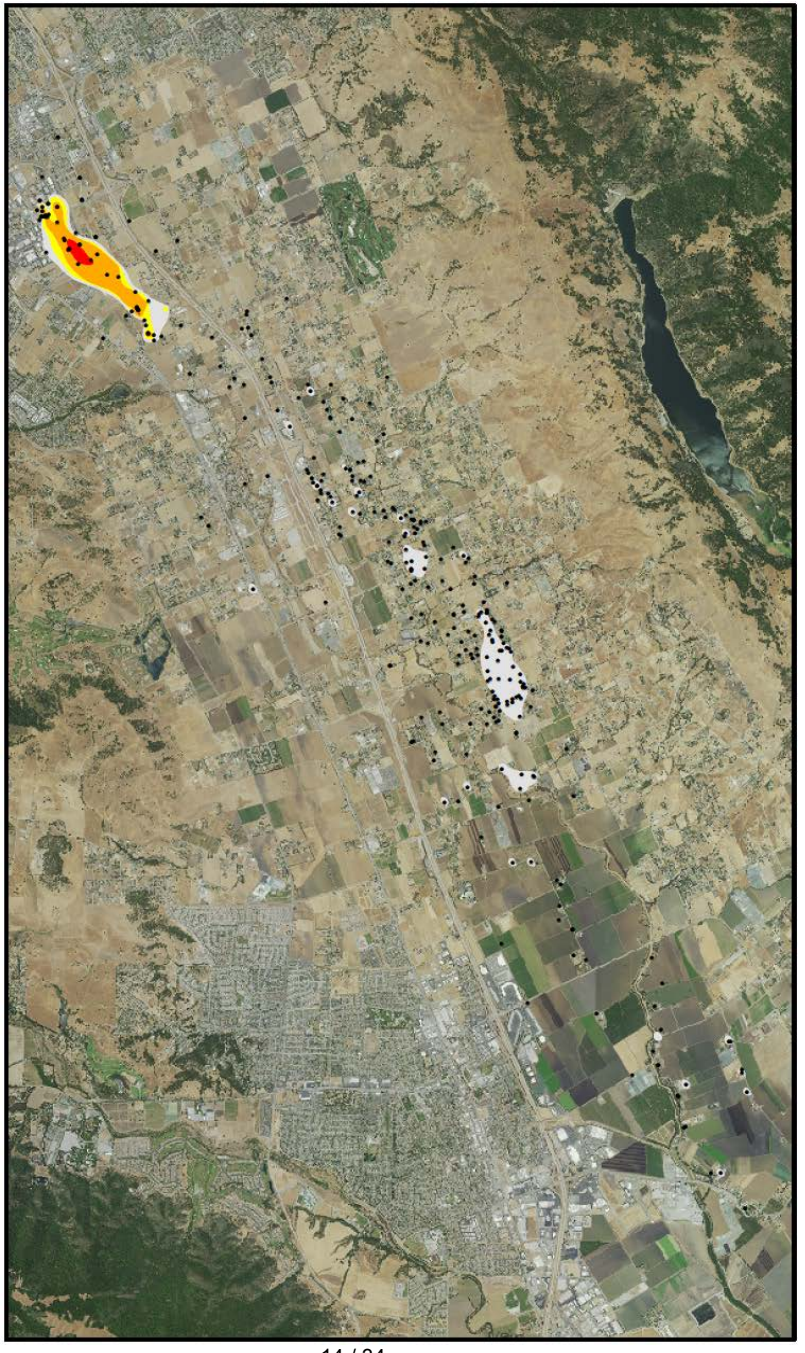
INTERMEDIATE AQUIFER

2007



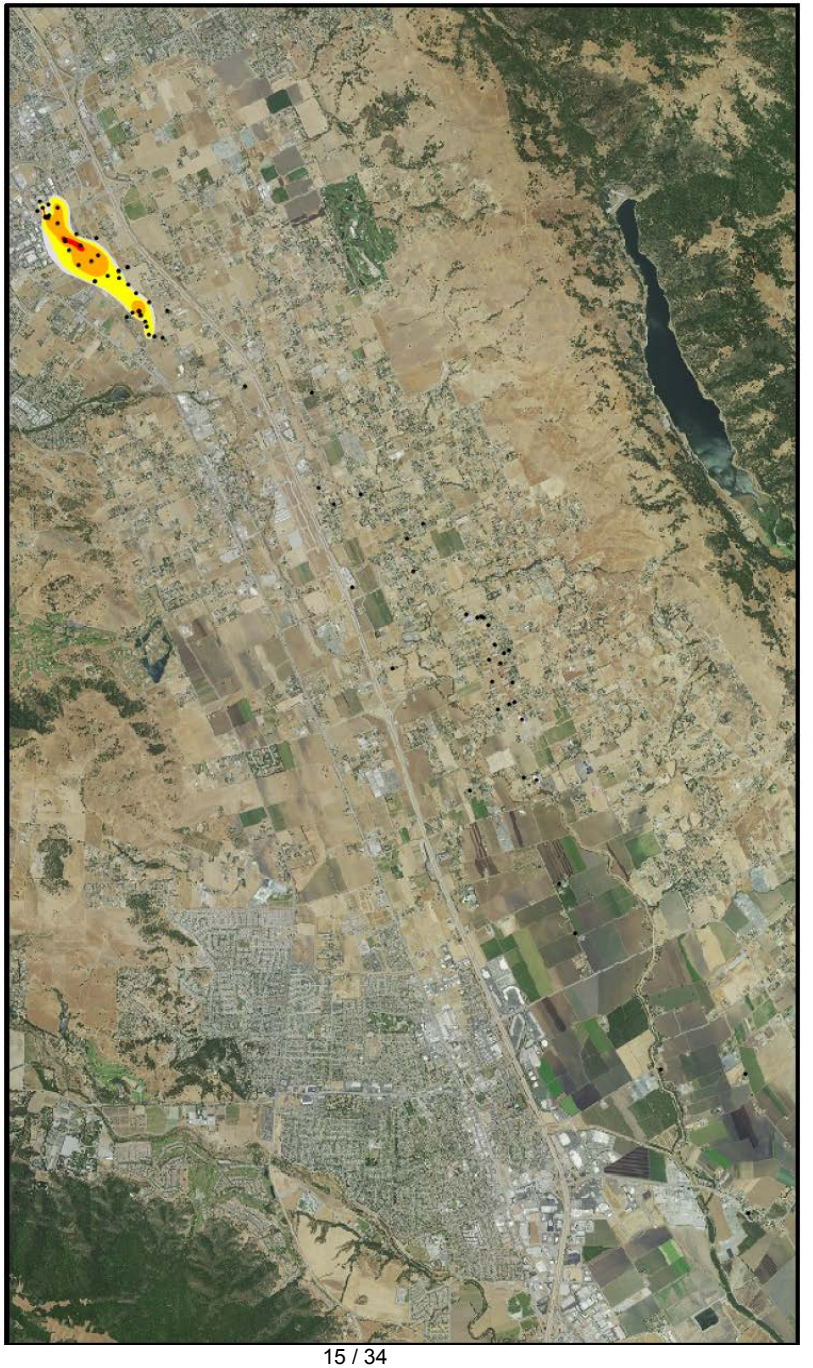
INTERMEDIATE AQUIFER

2010



INTERMEDIATE AQUIFER

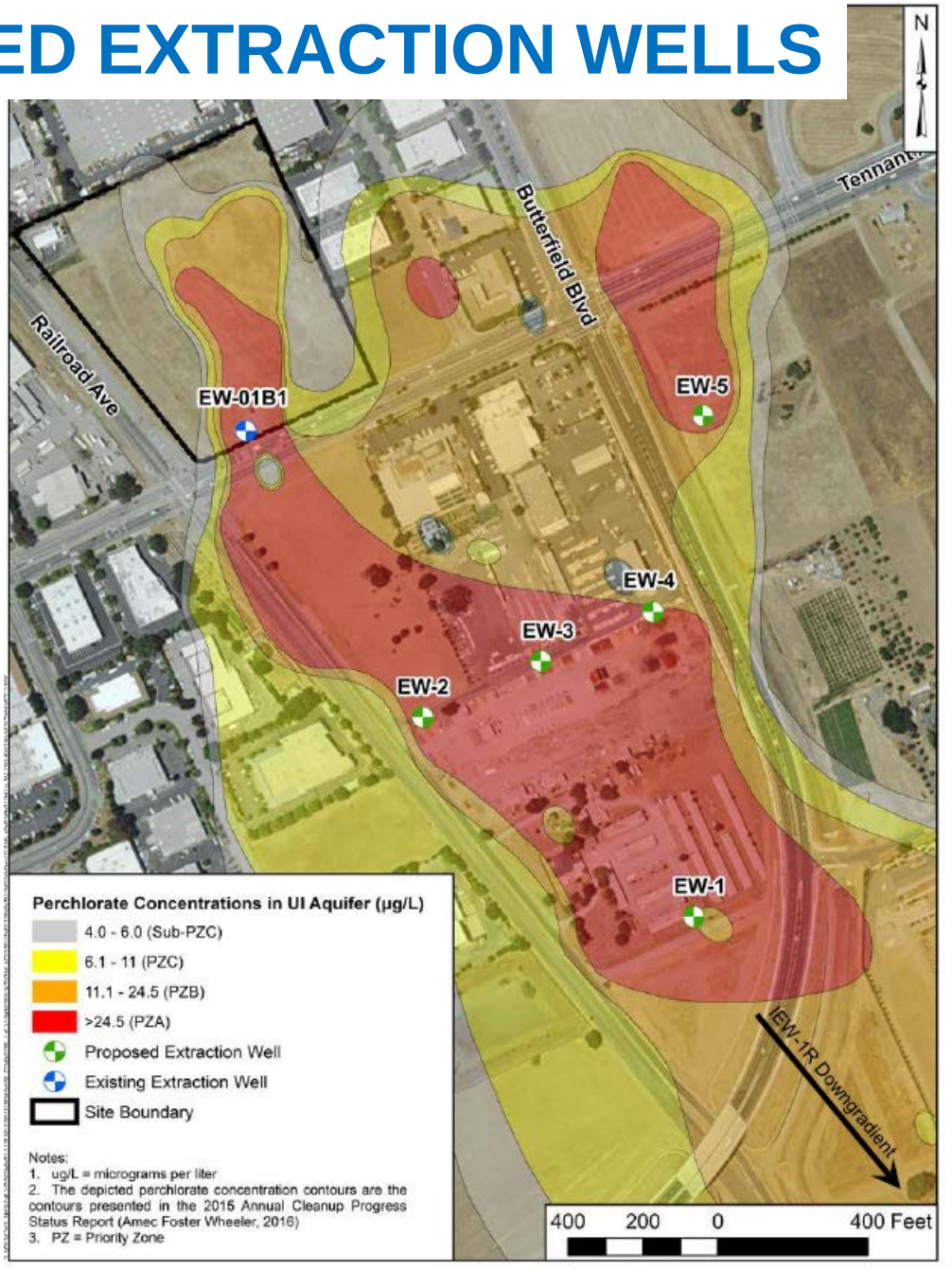
2013



INTERMEDIATE AQUIFER

2016

PROPOSED EXTRACTION WELLS

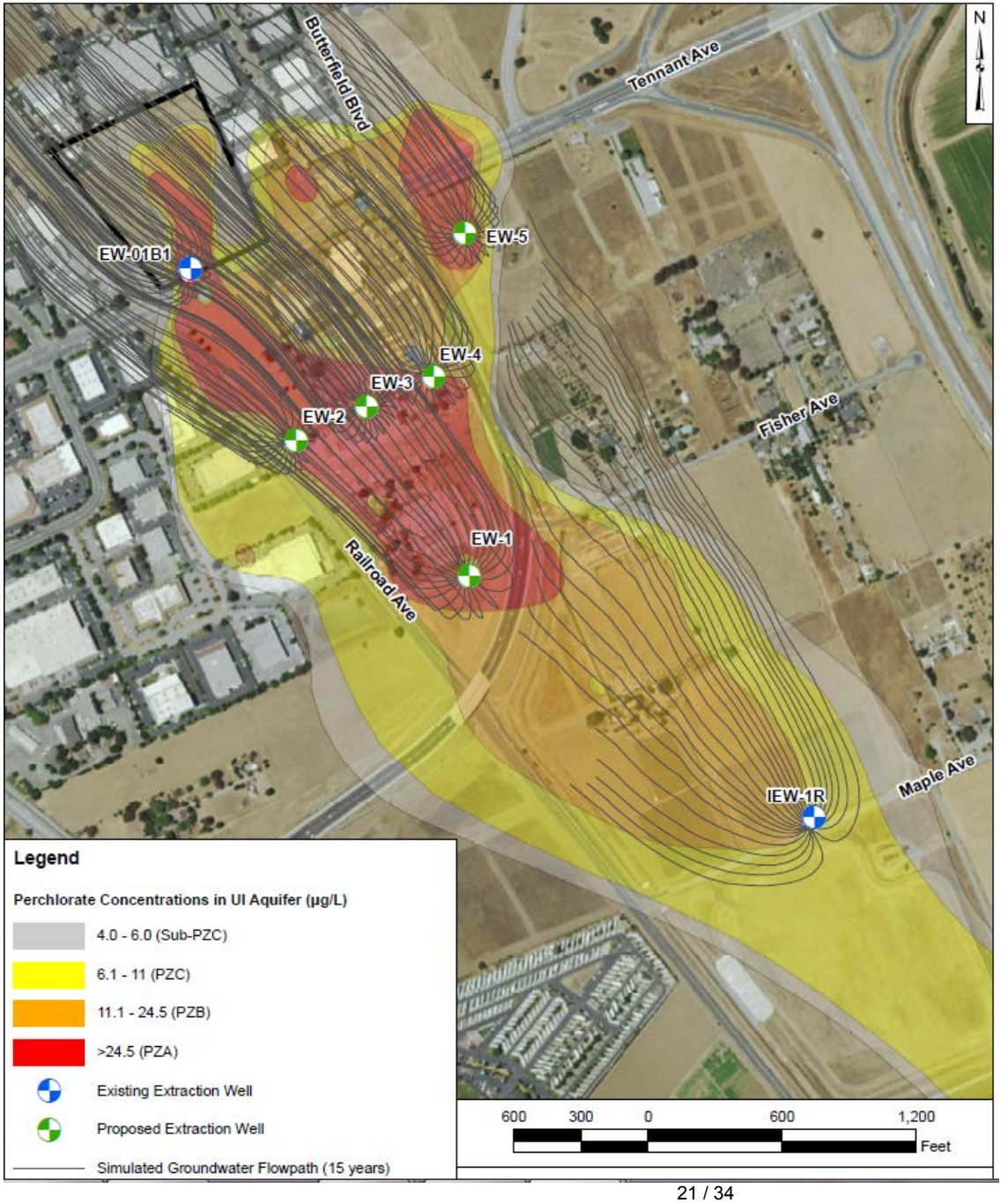


WHY SUCCESS?

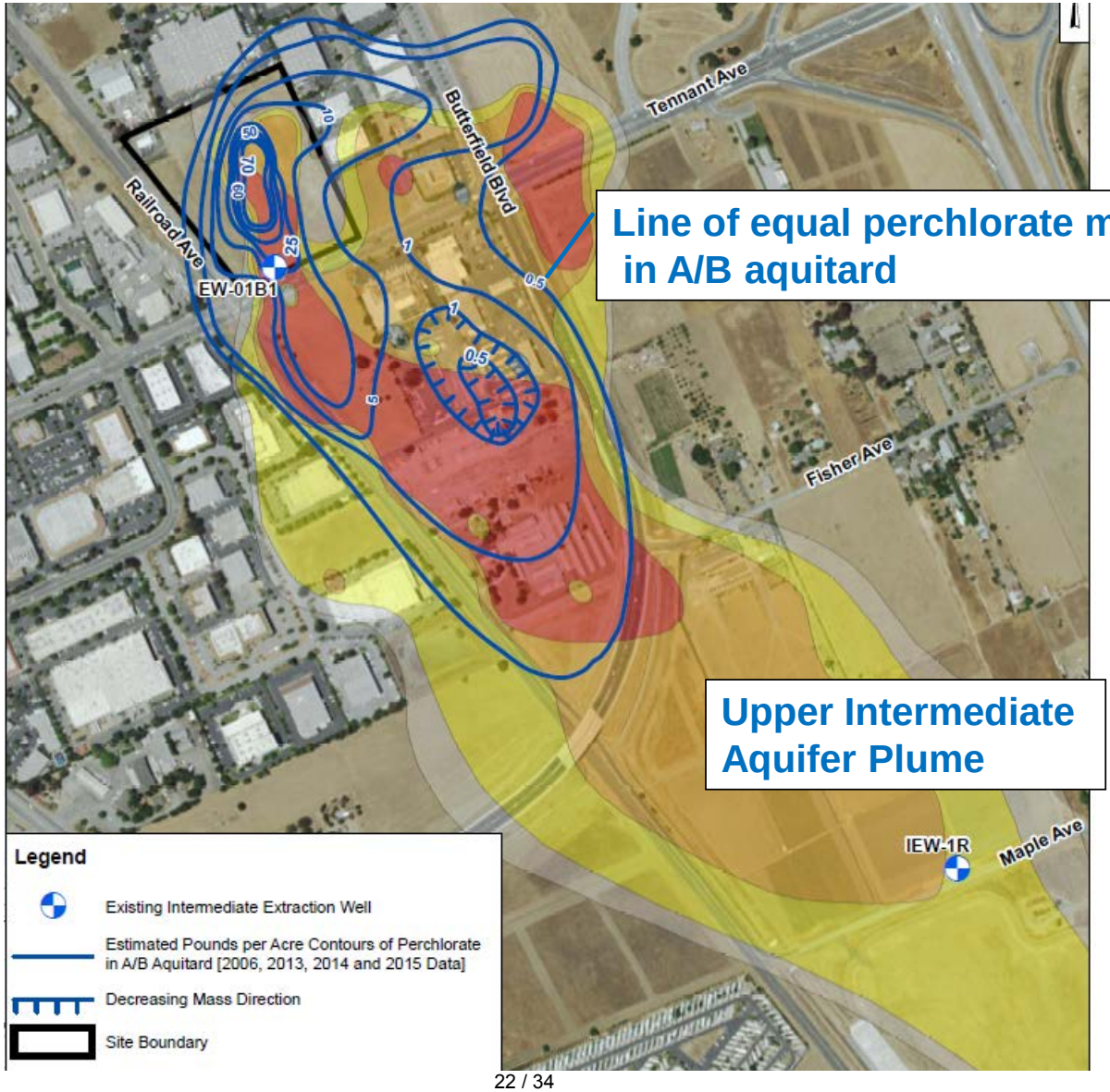
- **Olin is the responsible party**
- **Replacement water program implemented immediately**
- **Technical skills of consultants and staff**
- **Very effective soil and groundwater treatment system**
- **Natural attenuation**
- **Community outreach and support**

CONCLUSIONS (notes only?)

- **Phased cleanup approach has been successful at efficiently and effectively addressing perchlorate pollution in the basin via actively controlling & treating areas of highest concentration and allowing monitored attenuation for other areas. Staff evaluates monitoring results to see if additional active remediation could benefit cleanup efforts mna is progressing towards cleanup.**
- **Users of groundwater in the basin are protected by the Replacement Water Program and the monitoring program**
- **Upcoming groundwater extraction and treatment system enhancement for the upper intermediate will be more robust and efficient at controlling lateral and vertical movement of perchlorate.**


Butterfield Blvd
Tennant Ave
EW-01B1
EW-5
EW-4
EW-3
EW-2
EW-1
Railroad Ave
Fisher Ave
IEW-1R
Maple Ave
N
Legend
Perchlorate Concentrations in UI Aquifer (µg/L)
4.0 - 6.0 (Sub-PZC)
6.1 - 11 (PZC)
11.1 - 24.5 (PZB)
>24.5 (PZA)
Existing Extraction Well
Proposed Extraction Well
Simulated Groundwater Flowpath (15 years)
600 300 0 600 1,200
Feet

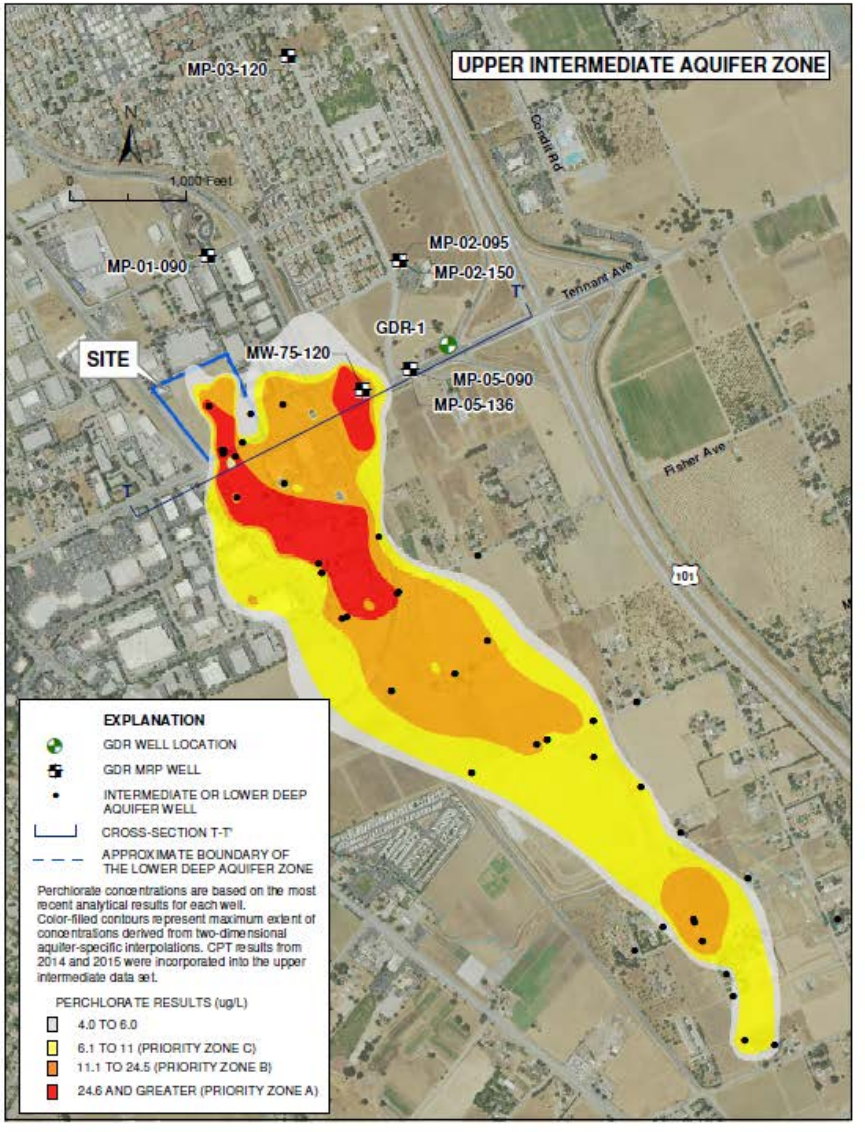
A/B AQUITARD
UPPER INTERMEDIATE AQUIFER

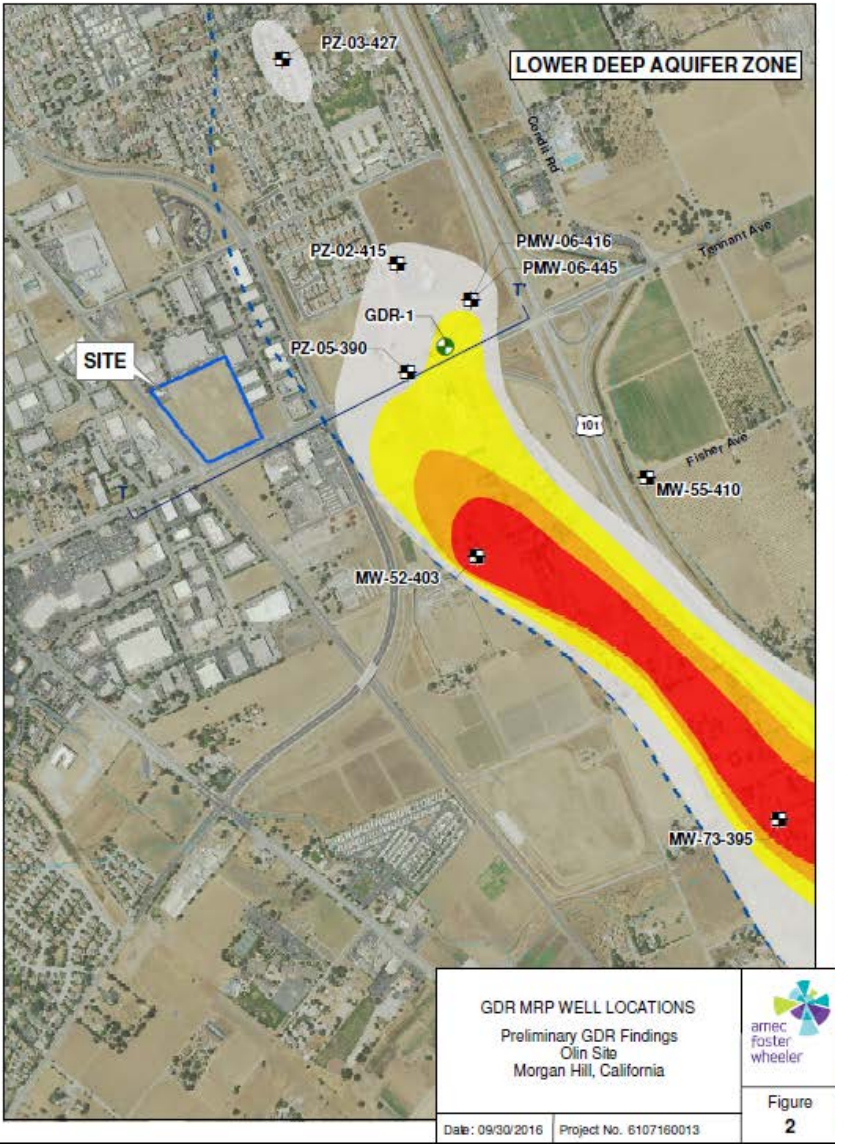


Line of equal perchlorate mass/acre in A/B aquitard

Upper Intermediate Aquifer Plume

GDR PILOT TEST





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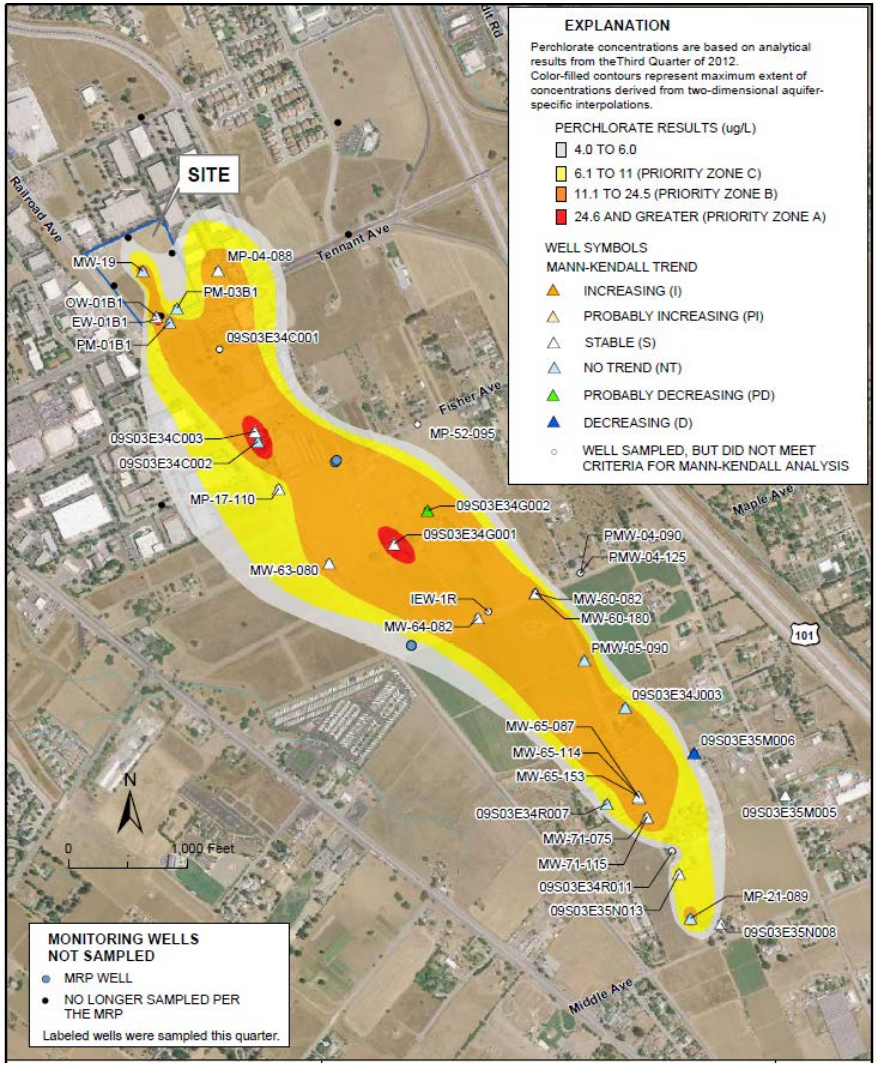
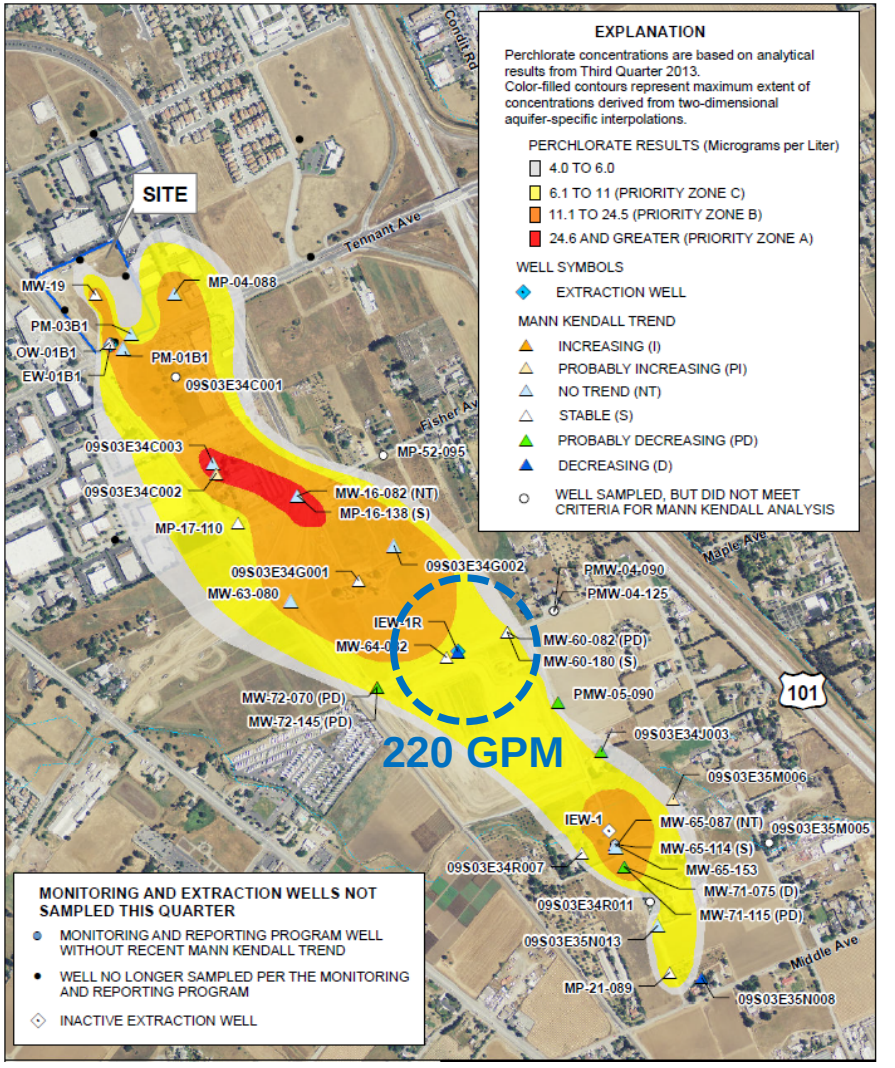
2012 - BEFORE STARTUP

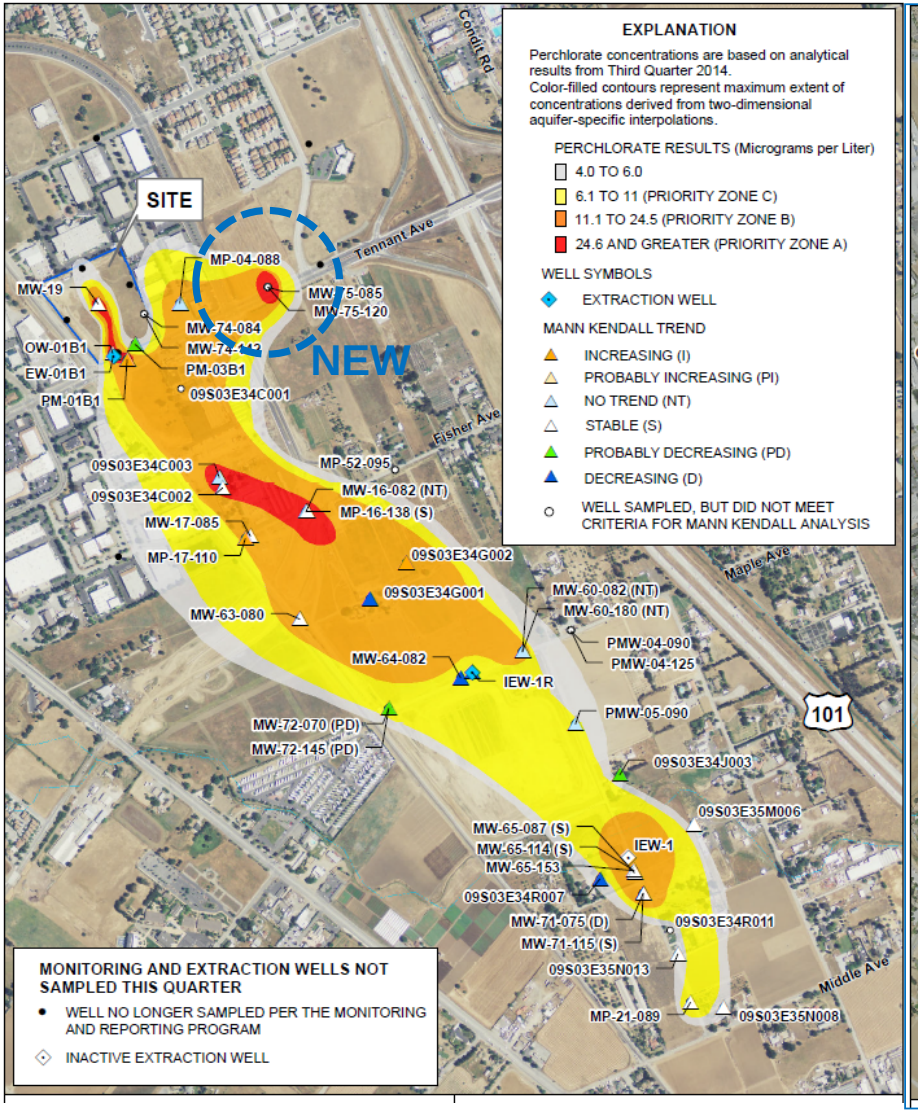


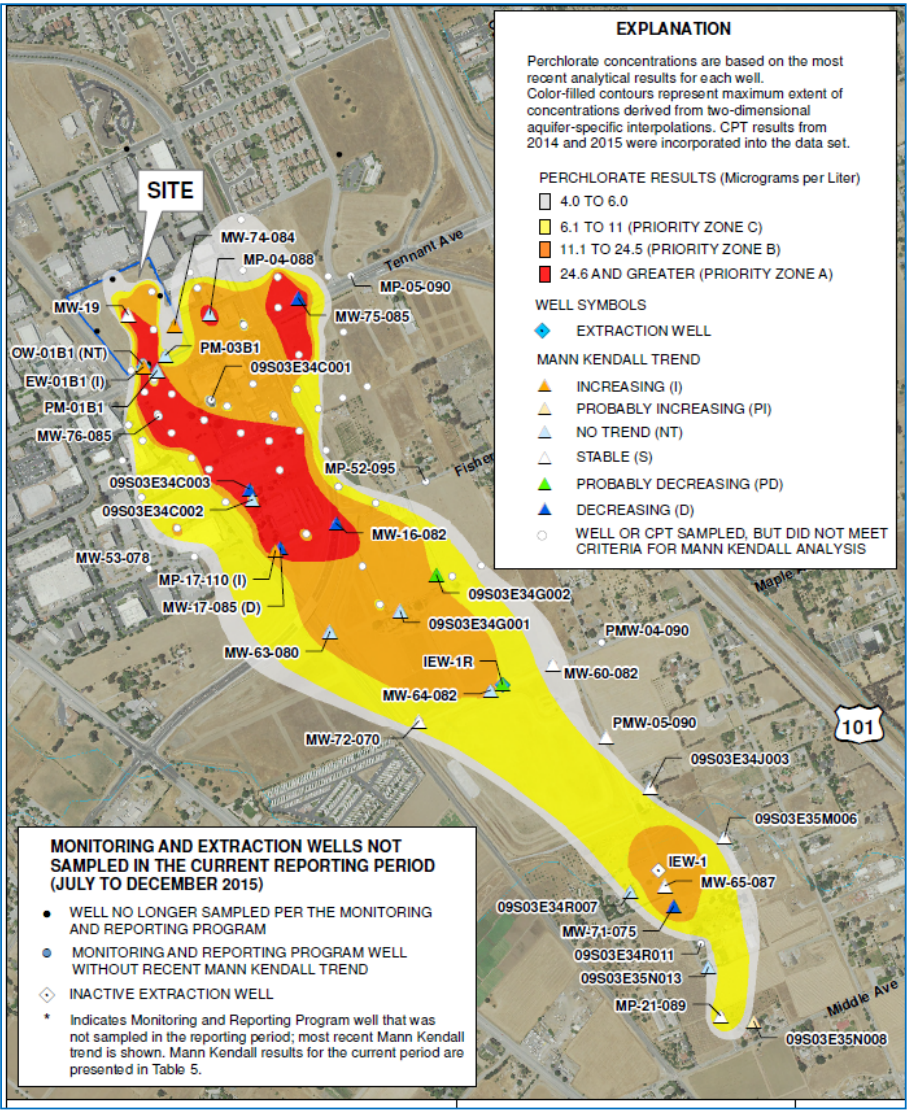
2013 - AFTER STARTUP



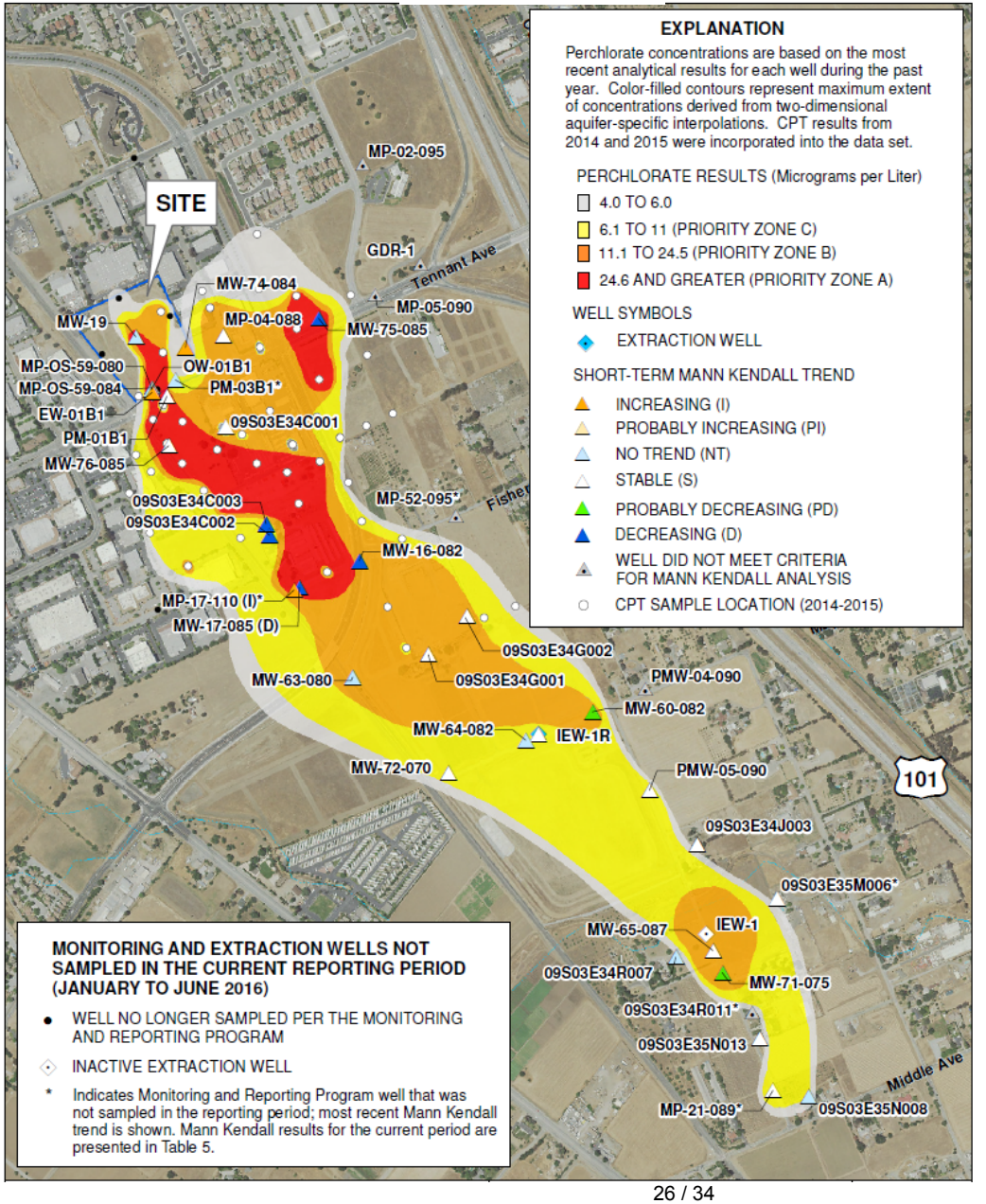
2014

2015- POST INVESTIGATION



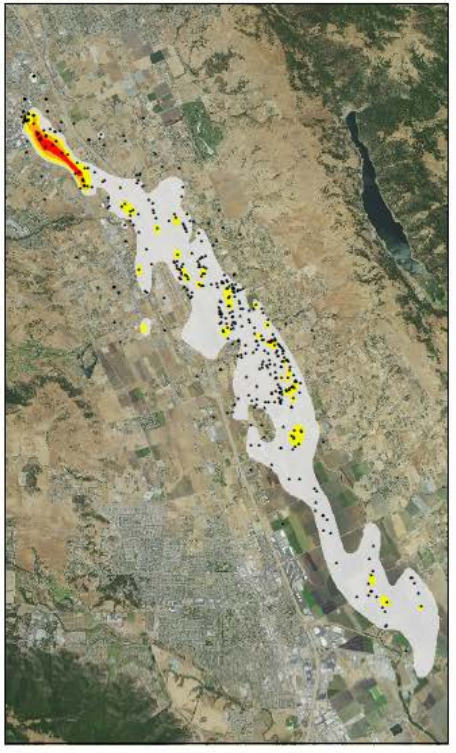


2016


EXPLANATION
Perchlorate concentrations are based on the most recent analytical results for each well during the past year. Color-filled contours represent maximum extent of concentrations derived from two-dimensional aquifer-specific interpolations. CPT results from 2014 and 2015 were incorporated into the data set.
PERCHLORATE RESULTS (Micrograms per Liter)
4.0 TO 6.0
6.1 TO 11 (PRIORITY ZONE C)
11.1 TO 24.5 (PRIORITY ZONE B)
24.6 AND GREATER (PRIORITY ZONE A)
WELL SYMBOLS
EXTRACTION WELL
SHORT-TERM MANN KENDALL TREND
INCREASING (I)
PROBABLY INCREASING (PI)
NO TREND (NT)
STABLE (S)
PROBABLY DECREASING (PD)
DECREASING (D)
WELL DID NOT MEET CRITERIA FOR MANN KENDALL ANALYSIS
CPT SAMPLE LOCATION (2014-2015)
MONITORING AND EXTRACTION WELLS NOT SAMPLED IN THE CURRENT REPORTING PERIOD (JANUARY TO JUNE 2016)
WELL NO LONGER SAMPLED PER THE MONITORING AND REPORTING PROGRAM
INACTIVE EXTRACTION WELL
* Indicates Monitoring and Reporting Program well that was not sampled in the reporting period; most recent Mann Kendall trend is shown. Mann Kendall results for the current period are presented in Table 5.
SITE
MP-02-095
GDR-1
Tennant Ave
MW-74-084
MP-04-088
MP-05-090
MW-75-085
MW-19
MP-OS-59-080
MP-OS-59-084
OW-01B1
PM-03B1*
EW-01B1
09S03E34C001
PM-01B1
MW-76-085
09S03E34C003
09S03E34C002
MP-52-095*
MW-16-082
MP-17-110 (I)*
MW-17-085 (D)
09S03E34G002
MW-63-080
09S03E34G001
PMW-04-090
MW-60-082
MW-64-082
IEW-1R
MW-72-070
PMW-05-090
101
09S03E34J003
09S03E35M006*
MW-65-087
IEW-1
09S03E34R007
MW-71-075
09S03E34R011*
09S03E35N013
Middle Ave
MP-21-089*
09S03E35N008

PERCHLORATE ATTENUATION

Third Quarter 2007



Third Quarter 2010

Third Quarter 2013

Third-Fourth Quarter 2016
Upper Intermediate

PERCHLORATE RESULTS (ug/L)

- 4.0 TO 6.0
- 6.1 TO 11 (PRIORITY ZONE C)
- 11.1 TO 24.5 (PRIORITY ZONE B)
- 24.6 AND GREATER (PRIORITY ZONE A)

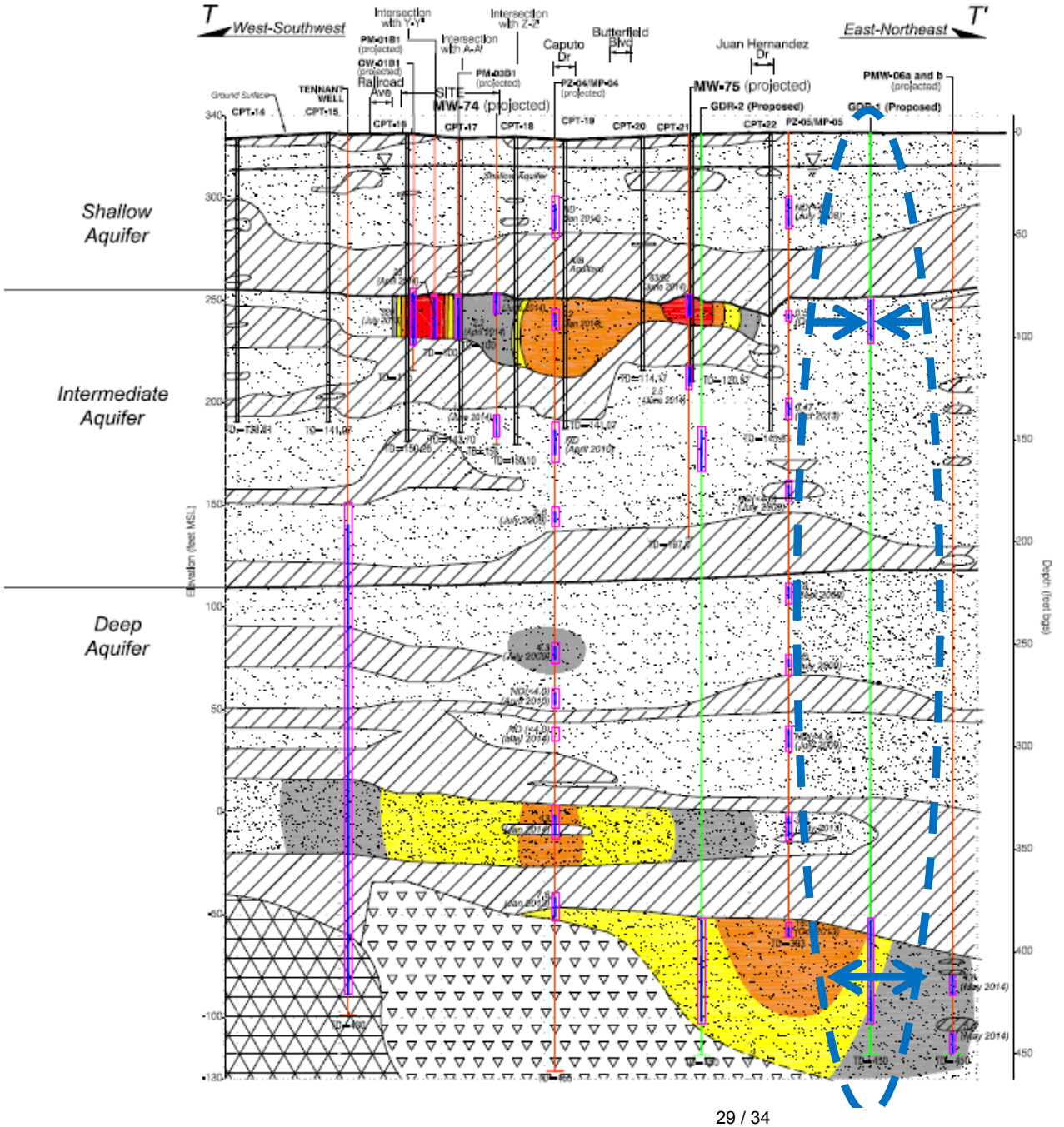
GROUNDWATER TREATMENT SYSTEM 2016 PERFORMANCE

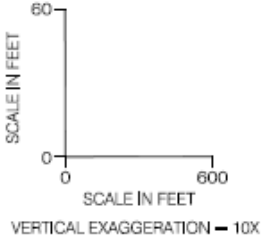
Location	Ave Flow (gpm)	Ave Perch Conc. (µg/L)	Mass Removal Rate (lbs/yr)
EW-01B1	12	140	6
IEW-1R	240	8.5	8
DEW-1	124	14.0	8
System	376	14.5	22

Total Removed Since 2004: 220 lbs
Total Gallons : 1 billion

GDR PILOT TEST

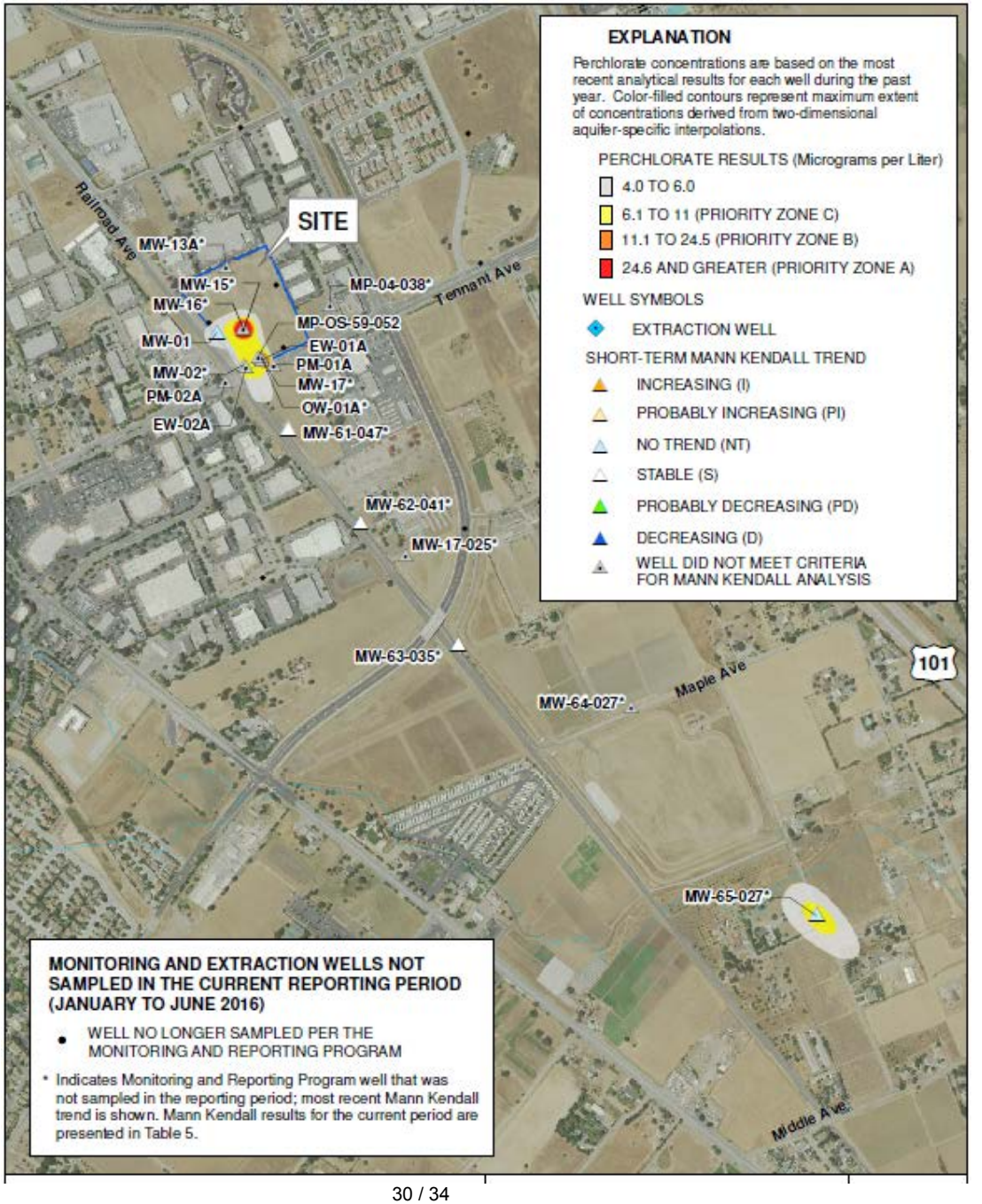
IN CROSS SECTION





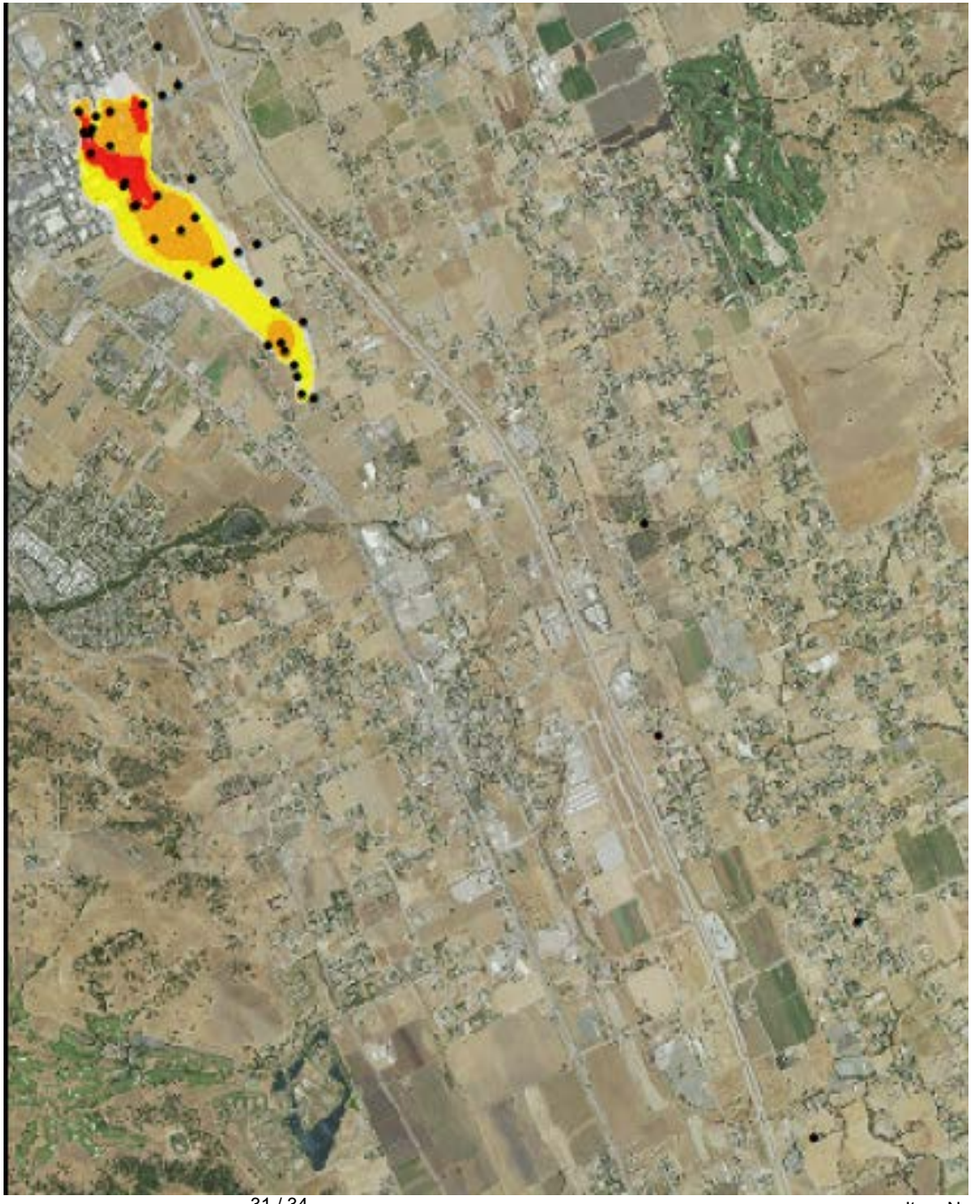
CURRENT PLUME

SHALLOW AQUIFER



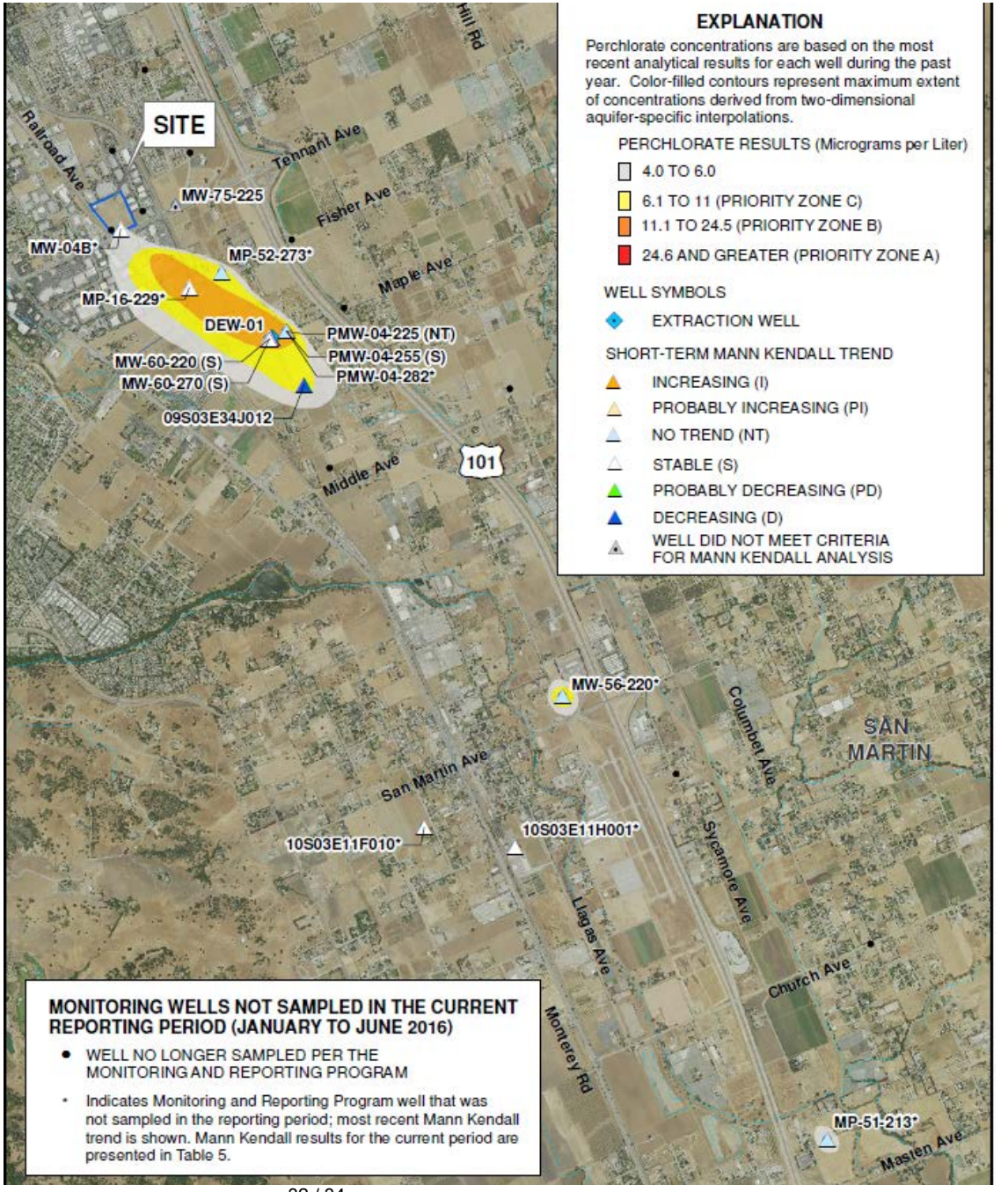
CURRENT PLUME

INTERMEDIATE AQUIFER



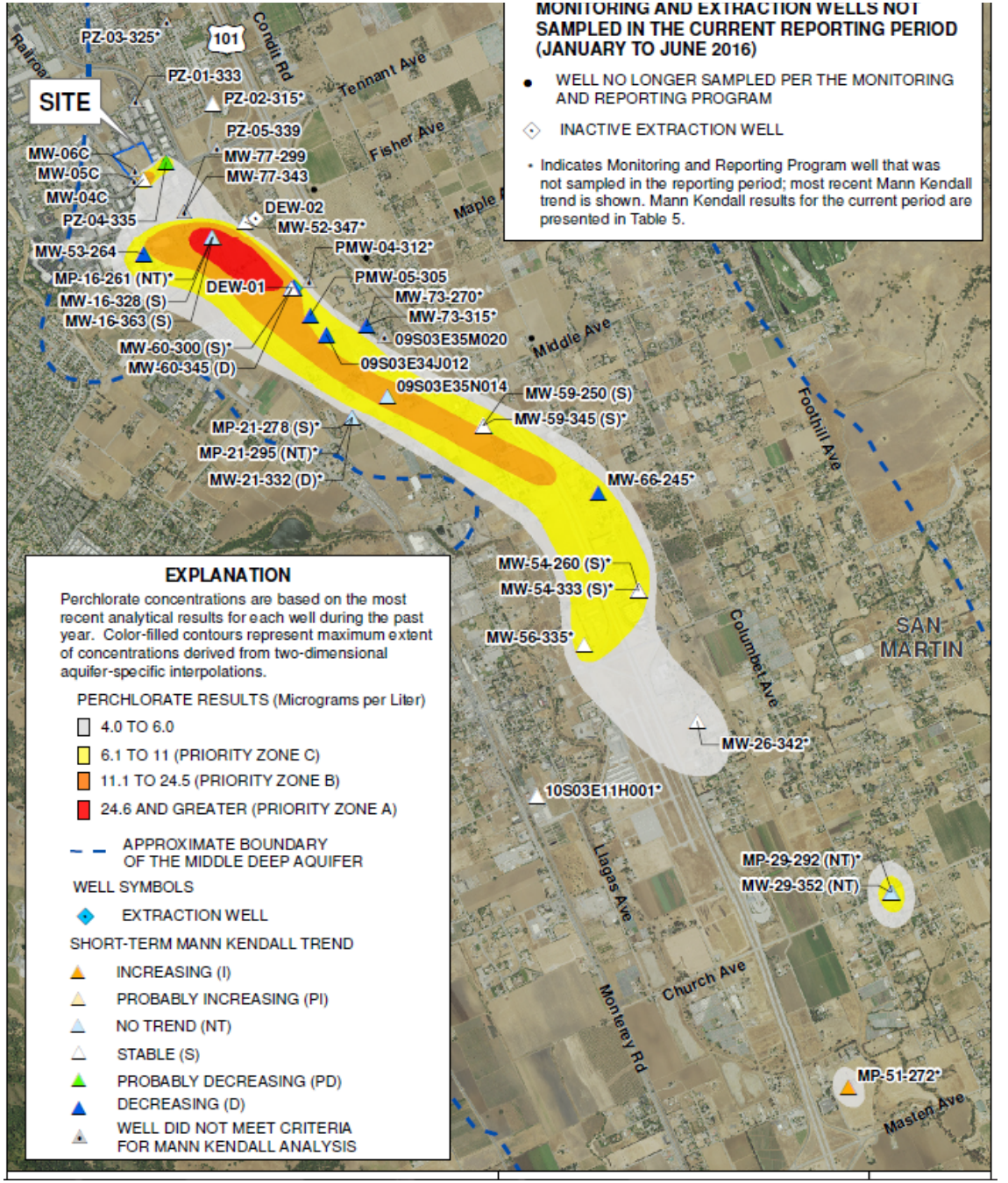
CURRENT PLUME

UPPER DEEP AQUIFER



CURRENT PLUME

MIDDLE DEEP AQUIFER



CURRENT PLUME

LOWER DEEP AQUIFER