

US EPA ARCHIVE DOCUMENT

WebH₂O: A Web-Based Environmental Information Management and Data Analysis System

Yoram Rubin
UC Berkeley, H2O2U.us

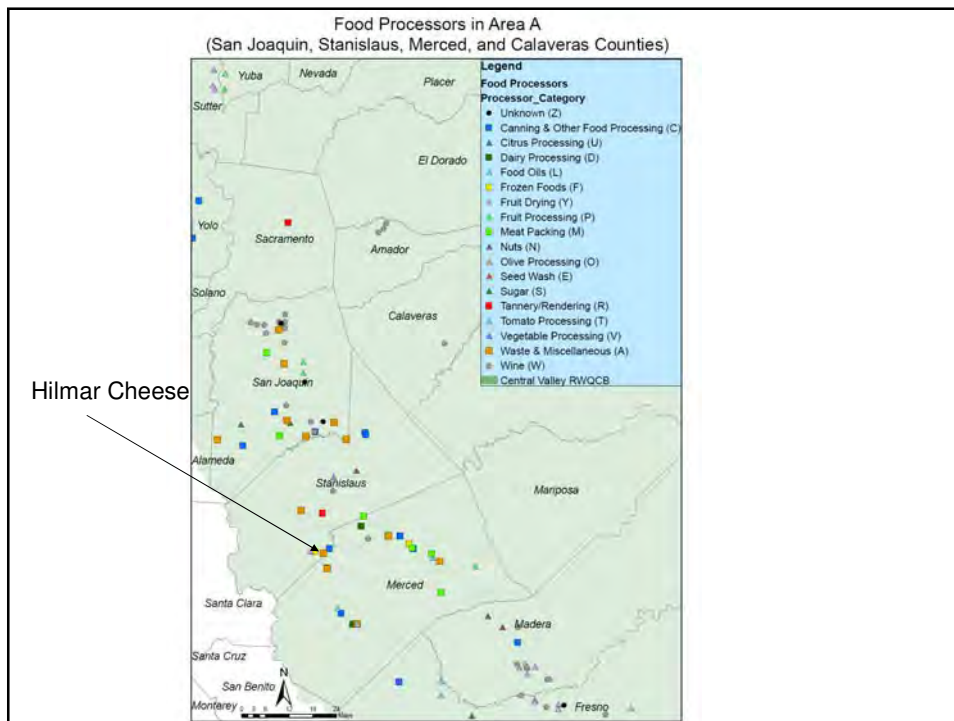
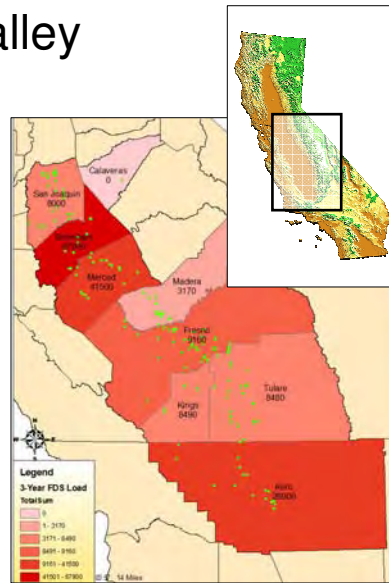


Outline

- Background and motivation: The Central Valley Salinity Study
- What is WebH₂O and how does it work?
- WebH₂O as a community-based application tool – Sonoma Valley
- Our vision for WebH₂O

Food Processing Wastewater in the Central Valley

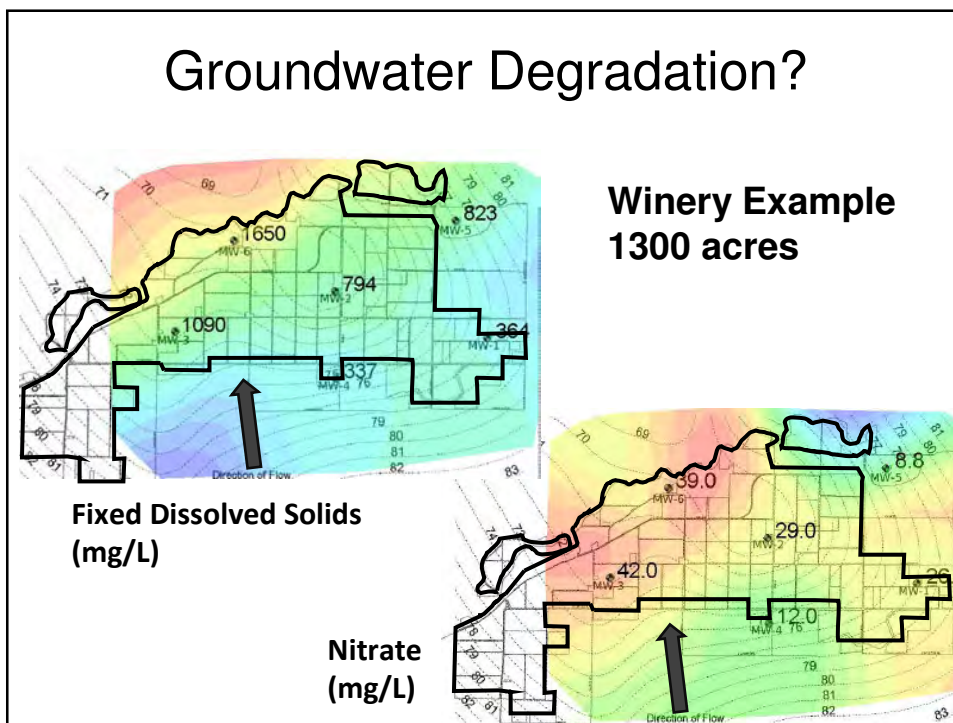
- Over 600 facilities
- >\$62 billion in revenue
- Water use: 80 million m³ yr⁻¹
- High in salinity (FDS), organic carbon, and nitrogen
- Typical disposal method: land application for irrigation
- Discharged to alluvial fan and floodplain deposits



An Environmental Threat?

Metric	Municipal Waste	Tomato Canner
BOD (mg-O ₂ L ⁻¹)	450	820
FDS(mg L ⁻¹)	720	1680
pH	6.7	5.4
Nitrogen (mg-N L ⁻¹)	25	51
Flow Rate (gal d ⁻¹)	2.6 x 10 ⁷	1.5 x 10 ⁶
Pathogens present?	Virtually certain	Very unlikely
Sources: food, disinfectants, processing chemicals		

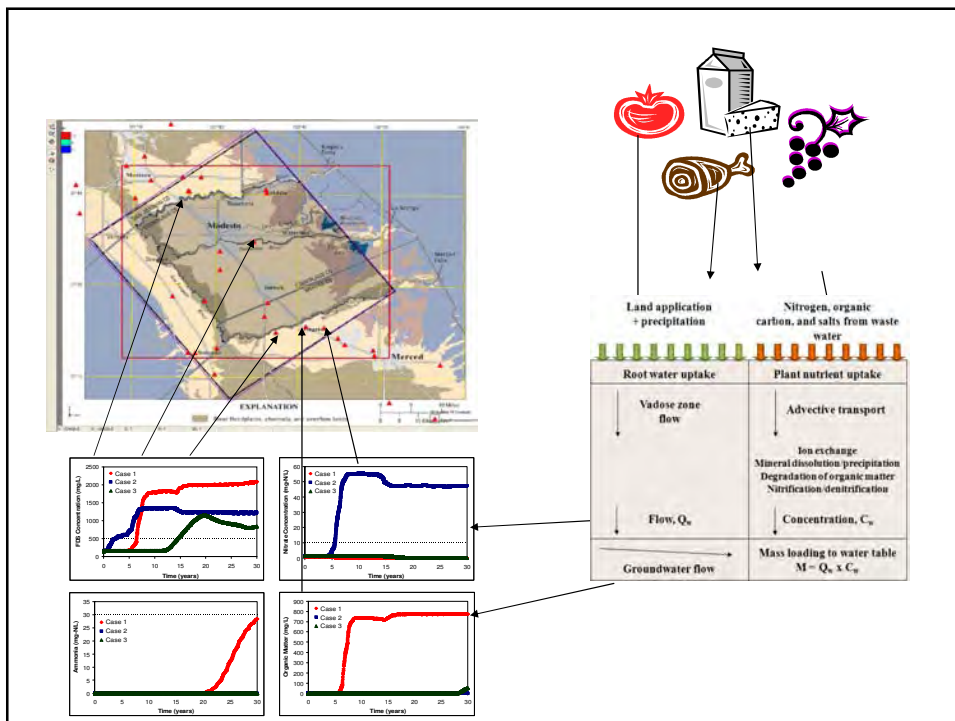
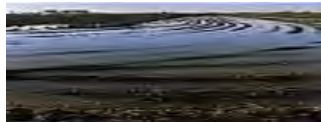
Groundwater Degradation?





	Volume (kgal)
Industry Average Daily Flow	68665
Industry Yearly Flow	25062854
Hilmar Daily Flow	1525
Hilmar Yearly Flow	556714

Land discharge area: 600 acres



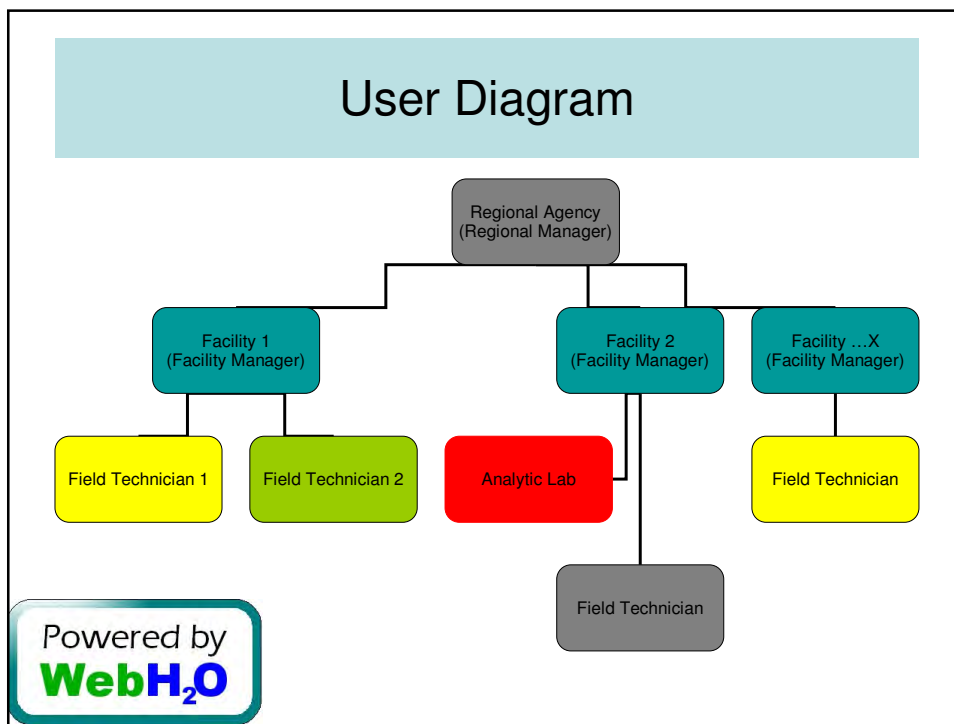
Modeling Challenges

- Modeling scale
 - 600+ producers with a large diversity in wastewater characteristics and in land application site hydrogeology
- Data Deficiency
 - Few measurements in vadose zone, none long-term
 - Regional scale hydrogeology



How to address these challenges?

- A system is needed for collecting, storing, sharing, displaying and analyzing of information
- Data sources
 - Multiple agencies and multiple facilities
 - Ontology
 - Format
 - Quality of data
- Community-based tool: Trust, Value
 - Data security and privacy: who can see what and when?
 - Encourage participation through added value

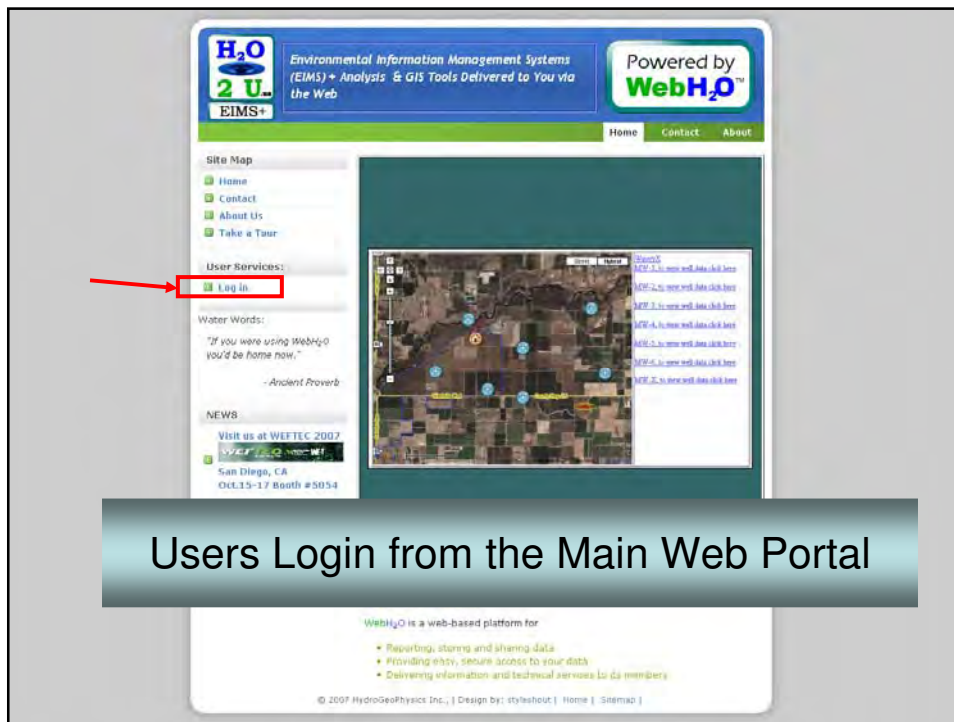


Privacy and Security

Complete Control over Data Management and Accessibility

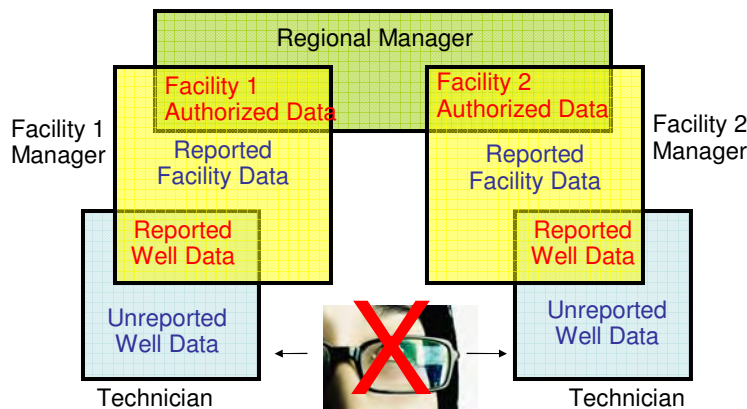
- Two complimentary aspects:
 - Labeling of data (when?)
 - Unreported / Reported / Authorized
 - Hierarchy of user roles / permissions (who?)
 - coordinator / facility manager / technician

WebH₂O



Different Levels of User Access

Regional Manager can NOT see Facility data unless it is "Reported"



Facilities can NOT see each other's data



Management Tools

- Access Data from Overview Maps
- Quick-View Status Dashboards
- Rapid Report Pull-down Menu for common Reporting tasks
- Automated Alerts can sent by email/text message when preset trigger events are reported
- Powerful Querying Tools

Powered by **WebH₂O**

Access Data from Overview Maps



Powered by **WebH₂O**

Quick-View Dashboards show Status of all monitored locations

Map of facilities with compliance flags

Back to welcome page
Logged as Admin Log out

Map controls: Map, Satellite, Hybrid

Facility demo 1
Facility demo 2
Wine190
Wine240
Sugar156
Nuts125
Canning & Other Food Processing130
Wine149
Tomato Processing181
Food Oils188
Meat Packing189
Sugar203
Dairy Processing222

Select All Reset All

All Data Up-to-Date Missing Well Data Missing Well and Effluent Data Missing Effluent Data

Powered by **WebH₂O**

Non-Compliance Report selection

Select a report: Facilities with TDS (in mg/L) above level

Enter report Title: _____

Enter report preparer name: _____

Facilities with TDS (in mg/L) above level 700

Prepared by: P. Bento
Preparation date: 10/30/2007

Facility ID	Facility Name	County	Industry Group	State	Address	City	State	Zip
423601781	Dairy Processing11	Merced	Dairy Processing	3115	Food Processing11 St.	LISS BARGE	CA	95328
583020831	Wine234	San Joaquin	Wine	31213	Wine	WINE234 St.	WFOUN	CA 95368
621023481	Wine121	Elmore	Wine	31111	Food Processing11	COALBURN	CA	95216
62420481	Wine180	Merced	Wine	31213	Wine	Wine180 St.	LISS BARGE	CA 95328
583020831	Waste & Miscellaneous17	San Joaquin	Waste & Miscellaneous	unknown	unknown	Waste & Miscellaneous17 St.	STOCKTON	CA 95216
682422003	Fruit Drying22	Merced	Fruit Drying	31143	Fruit & dehydrated food only	WINE22 St.	MADERA	CA 95371
583421301	Other Processing17	Tulare	Other Processing	31421	Fruit & vegetable canning	Other Processing17 St.	ESCALON	CA 95321
621023481	Wine180	Merced	Wine	31213	Wine	Wine180 St.	REDFEEL	CA 95348
621023481	Tomato Processing21	Kings	Tomato Processing	31421	Fruit & vegetable canning	Tomato Processing21 St.	LEMOORE	CA 95245
583020831	Wine190	San Joaquin	Wine	31213	Wine	Wine190 St.	ACAMPO	CA 95220
583020831	Wine115	San Joaquin	Wine	31213	Wine	Wine115 St.	ESCALON	CA 95328
621023481	Fruit Processing24	Merced	Fruit Processing	31142	Fruit and vegetable Canning, Pickling, etc.	Fruit Processing24 St.	DEL REY	CA 95616
621023481	Wine145	Merced	Wine	31213	Wine	Wine145 St.	FRESNO	CA 93727
583020831	Waste & Miscellaneous17	San Joaquin	Waste & Miscellaneous	unknown	unknown	Waste & Miscellaneous17 St.	TRACY	CA 95376

Powered by **WebH₂O**

WellsTab
MapView

effluenttabextended
Advanced search

Search for: All conditions condition Any condition

	NOT			
Universal_Identifier_WDID	<input type="checkbox"/>	Contains	▼	<input type="text"/>
DateReported	<input type="checkbox"/>	Contains	▼	<input type="text"/>
MonthReported	<input type="checkbox"/>	More than ...	▼	<input type="text" value="5"/>
YearReported	<input type="checkbox"/>	Equals	▼	<input type="text" value="2004"/>
Volume	<input type="checkbox"/>	Contains	▼	<input type="text"/>
Flow	<input type="checkbox"/>	Contains	▼	<input type="text"/>
Application_Area	<input type="checkbox"/>	Contains	▼	<input type="text"/>
pH	<input type="checkbox"/>	Contains	▼	<input type="text"/>
Conductivity	<input type="checkbox"/>	Equal or more than ...	▼	<input type="text" value="10000"/>
Fixed_Dissolved_Solids_FDS	<input type="checkbox"/>	Equal or more than ...	▼	<input type="text" value="9000"/>
Volatile_Dissolved_Solids_VDS	<input type="checkbox"/>	Contains	▼	<input type="text"/>
Total_Dissolved_Solids_TDS	<input type="checkbox"/>	Contains	▼	<input type="text"/>

Advanced Queries can be made on the data

Powered by
WebH₂O

GIS Map Server

- **WebH₂O™ is compatible with existing GIS files and data (shape files, DEM, ortho-photos, etc...).**
- **GIS Layers can be added and accessed from internet browser.**

Spatial Query Tools: Links Database + GIS Info

Powered by **WebH₂O™**

SPATIAL QUERY FORM

Selected objects will be highlighted on the map


Select Facility With ...

volume (kg/L)	Equals	
flow (kgal/day)	Equals	
application_area (acres)	Equals	
ph	Equals	
conductivity (mic-S/cm)	Equals	
fixed_dissolved_solids_fdr (mg/L)	Equals	
volatile_dissolved_solids_vds (mg/L)	Equals	
total_dissolved_solids_tds (mg/L)	More than	700
total_suspended (mg/L)	Equals	
total_pod_or_cod (mg/L)	Equals	
total_bod5_or_bod5 (mg/L)	Equals	
total_organic_carbon_toc (mg/L)	Equals	
solids_bod (mg/L)	Equals	

Having a Surface Water Body

Within ... Kilometers

Between ... 2001-01-01 and 2007-10-15



The map displays a geographical area with various GIS layers. A legend on the right lists layers: Surface Water, Water Area, Urban Area, Precipitates, and Wells. Numerous data points are plotted on the map, corresponding to the query results.

WebH₂O: Registered User Area - Mozilla Firefox

welldata, Add new record

Back to list

mw_id	MW-1
datereported	September 10, 2007
monthreported	9
yearreported	2007
dept_to_groundwater_n	77 52
ec_umhos_cm	
tds_mg_l	
no3_as_n_mg_l	
toc_mg_l	
nh3_mg_l	
fe_mg_l	
mn_mg_l	
view_status	Private
reported_by	Jim Brown
supporting_docs	

Required field

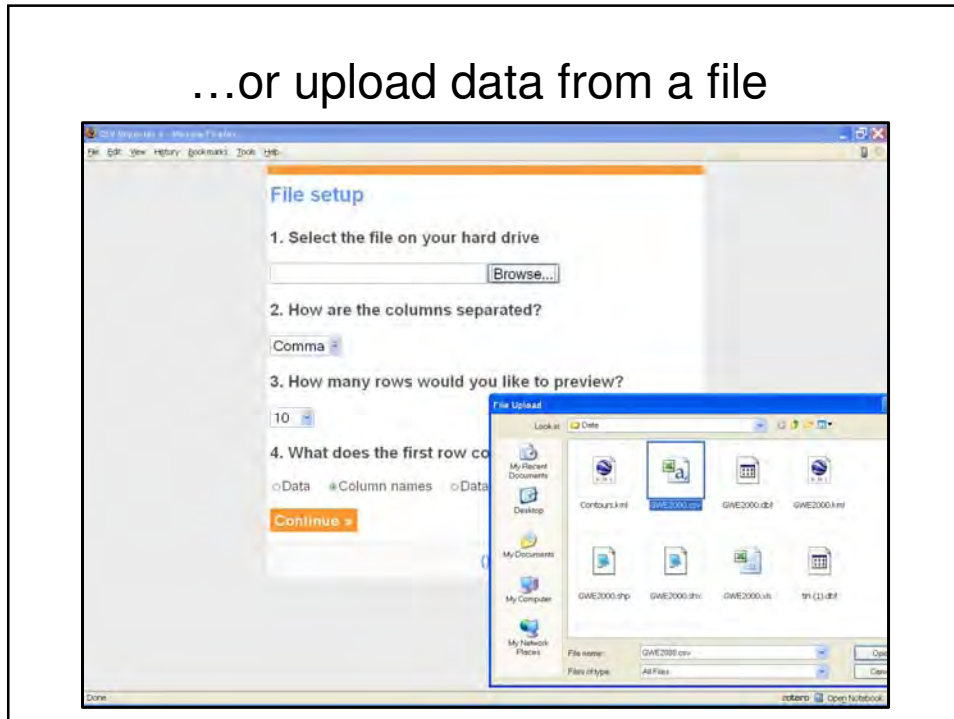
Powered by **WebH₂O™**

Done

zotera Open Notebook

Add new data using interactive online web forms

...or upload data from a file



Data Validation

Completeness, Consistency, Integrity

- **Completeness**
 - Required fields for data entry
 - Pre-populated fields
 - Error detection for well names - state plane and USGS well coordinate systems
- **QA through Consistency**
 - Alerts generated when new data inconsistent with historical records
- **Integrity**
 - Data capture and storage
 - Unique facility id's, well names, user logins



WebH2O: Home WebH2O: Registered User...

Powered by **WebH₂O™**

Instant Data Validation and Alerts

public.welldata, Add new record

Back to list

mw_id: MW-1

datereported: 10/30/2007 0:55:08

dept_to_groundwater_ft: 120

ec_umhos_cm: 2154

tds_mg_l:

no3_as_n_mg_l:

toc_mg_l: 02sd

nh3_mg_l:

fe_mg_l: 120

mn_mg_l:

view_status: Unreported

reported_by: pascual

supporting_docs:

Warning: > 20% from last (=78.14) Warning: > 20% difference from min or max (min=77.33,max=84.4)

Critical Error: ec_umhos_cm cannot contain non numeric characters

Critical Error: toc_mg_l cannot contain non numeric characters

last measurement is null Warning: > 20% difference from min or max (min=0.17,max=3.8)

The page at <http://206.71.179.192> says:

⚠ Critical errors found, please correct and save again

OK

Save Reset

Supporting Documents & Chain of Custody

Report # _____ Field Log / Groundwater Sampling Form Date: 3/7/05

Client: _____ Well Name: _____

Project Name: _____ Well Type: _____

Consultant: _____ Sampler: _____

Proj. Manager: _____ Sampler: _____

Purge Method: _____ Purge Volume: _____

Total Well Depth: _____ Well Casing (ID, Yd) Depth: _____ Water Column Length: _____

Well	Date	Salinity	gl	Conductivity	µmhos/cm
Well 1	3/7/05	2.3	6.25	490	
Well 2	3/7/05	5.0	6.64	477	
Well 3	3/7/05	7.3	6.64	462	
Well 4					
Well 5					

Supporting Documents (reports, certificates, well logs, etc....) can be associated with each measurement

Powered by **WebH₂O**

Science Modules

- Can be mounted directly on top of map interface to collected data and GIS Layers
- Can be used for real-time data analysis such as risk assessment, contouring, vector plots, fate & transport models, etc...



WebH₂O™ Science Modules

- **WebH₂O™** combines Engineering and Science Expertise with enterprise quality IT.
- Integrated Science Modules can be applied to your data to make preliminary assessments of field conditions and risks.

Science Modules:
<input type="checkbox"/> Contaminant Transport
Instantaneous Point Source
Continuous Point Source
Multiple Point Sources
<input checked="" type="checkbox"/> Well Test Analysis
<input type="checkbox"/> Remote Sensing Tools
Airborne
Satellite
<input checked="" type="checkbox"/> Contour Maps
<input checked="" type="checkbox"/> Well Head Protection
<input checked="" type="checkbox"/> Statistical Analysis

In Progress

Create Contour Maps of Online Data

Powered by **WebH₂O**

GIS Layers

- Surface Water & Watersheds
- DWR Wells
- Weather Stations
- Technical Modules Layer
- Interpolated Depthwise

Science Modules

- Contaminant Transport
- Remote Sensing Tools
- Contour Maps
 - Contour Depth To Ground
 - Water
- Well Head Protection

This will interpolate well depth contours inside the watershed
03-14-2000

Clear Today Close

Prev Today Next

March 2000

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4		
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

OK (Then click in a watershed.)

Example: Instantaneous Point Source Release

SHIP - Sonoma Hydrological Information Portal (Beta) Powered by **WebH₂O**

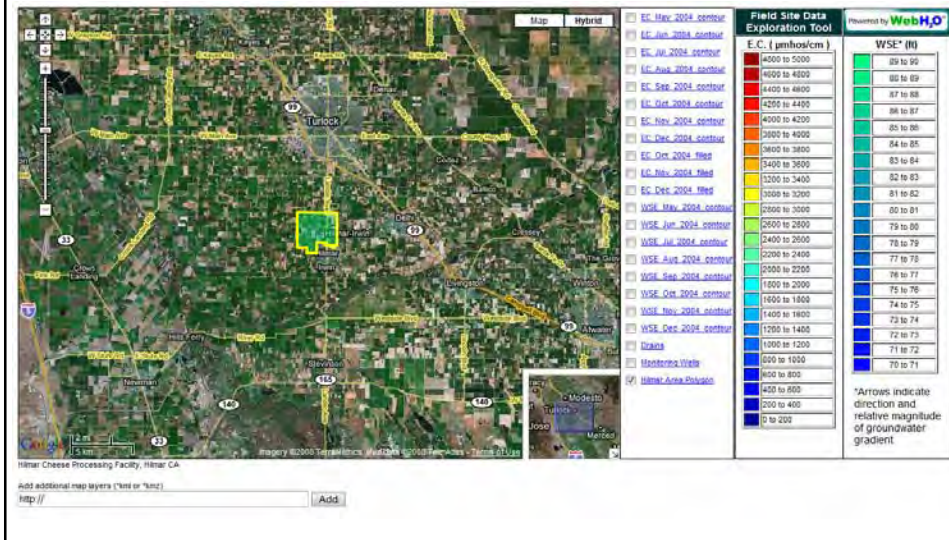
GIS Layers

- Surface Water & Watersheds
- DWR Wells
- Private Wells
- Weather Stations
- Point Source Contaminant
- Contour for 2006-01-01 to 2007-12-31

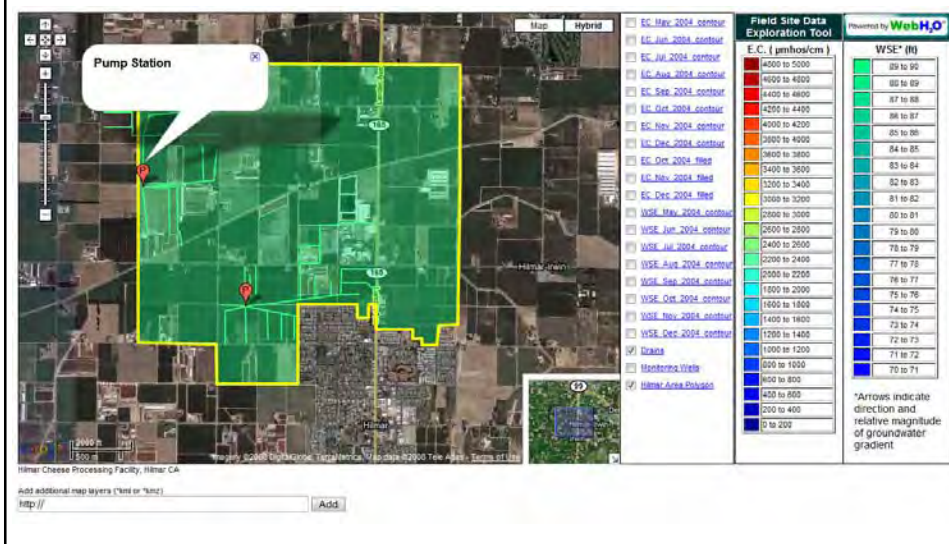
Science Modules

- Contaminant Transport
 - Instantaneous Point Source
- Contour Maps

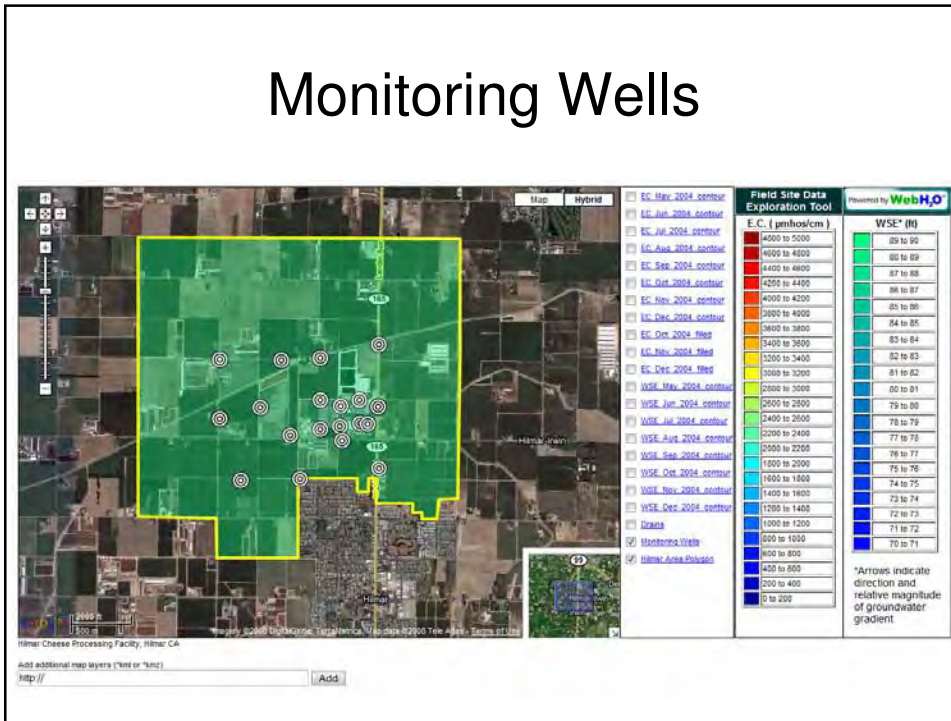
Field Site Exploration Tool



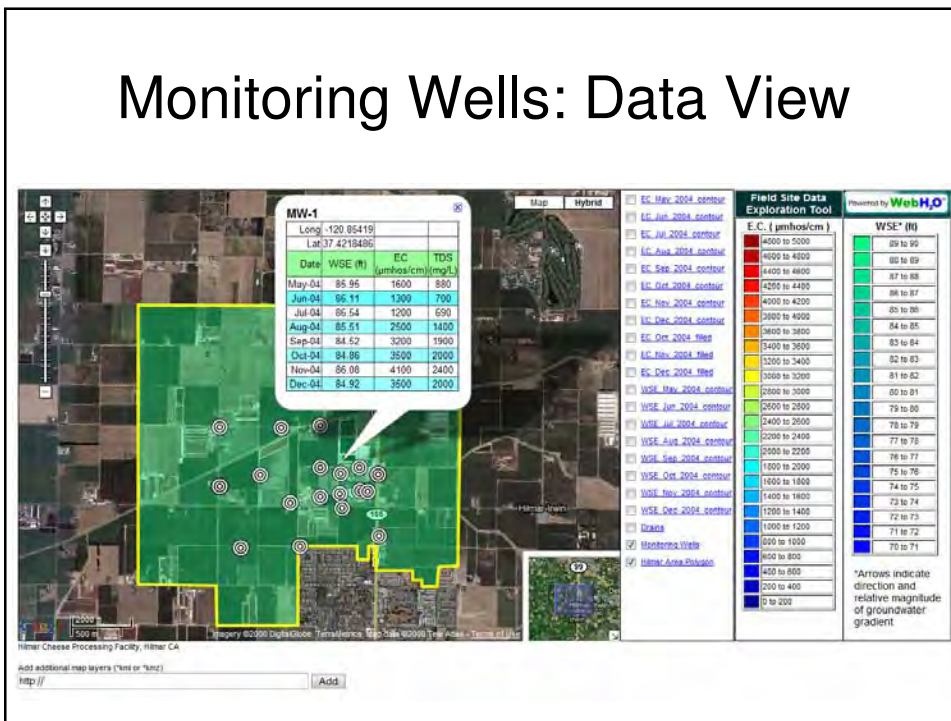
Site Infrastructure: Drains + Pumps



Monitoring Wells



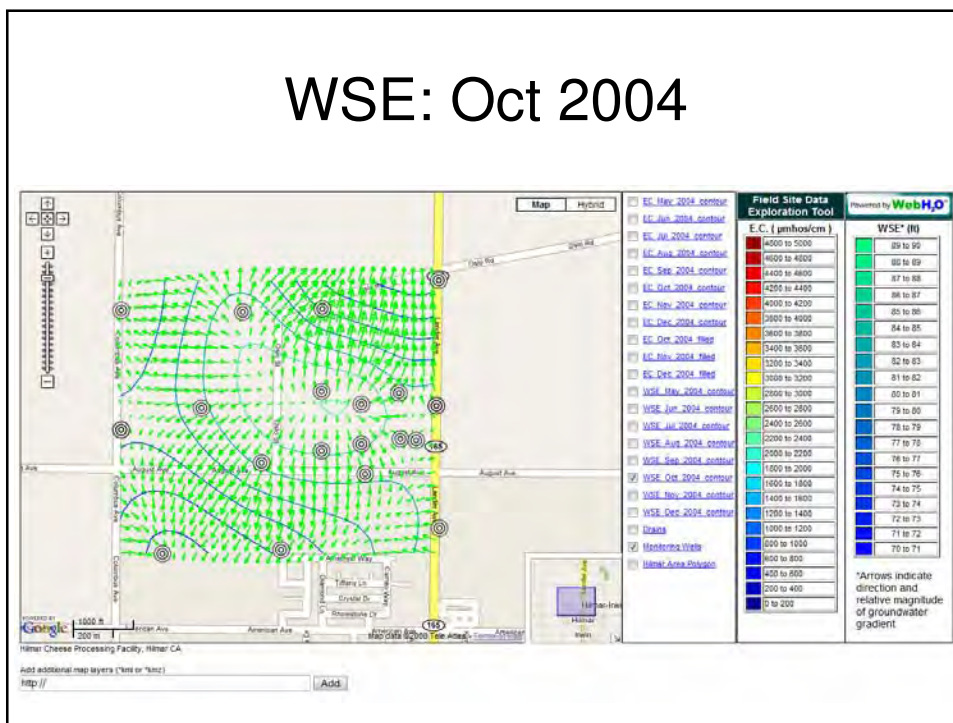
Monitoring Wells: Data View



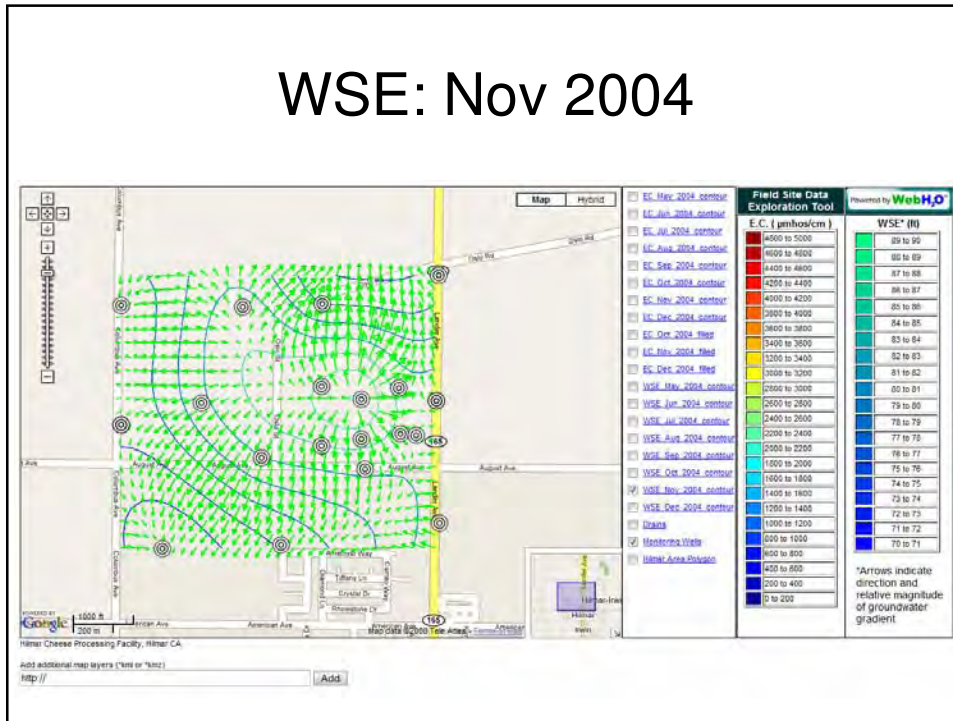
Monitoring Wells: MW-1 Chart View



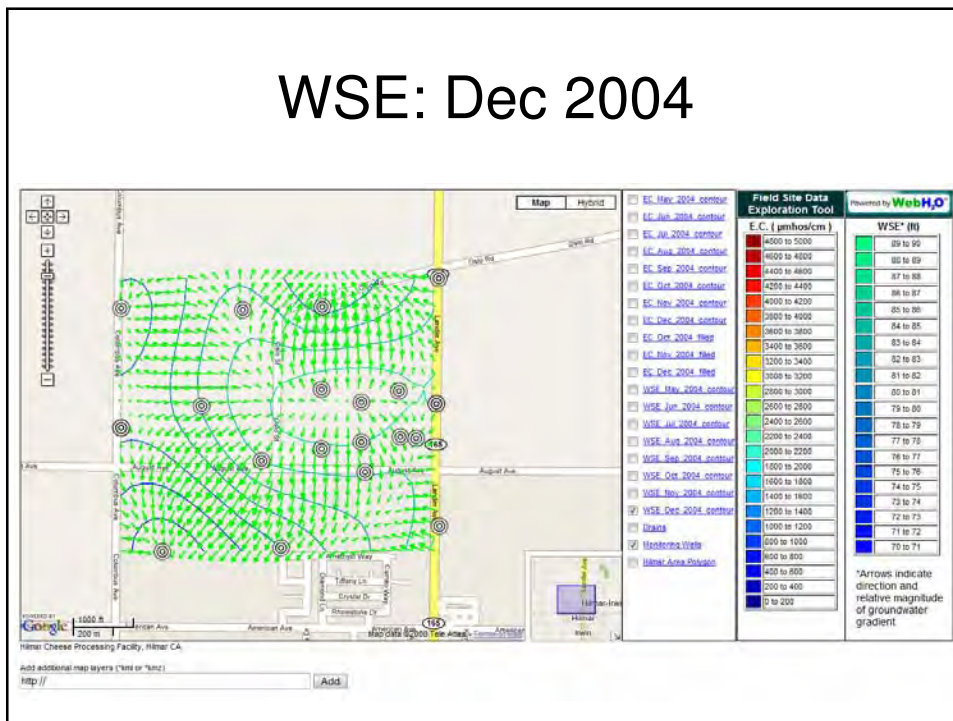
WSE: Oct 2004



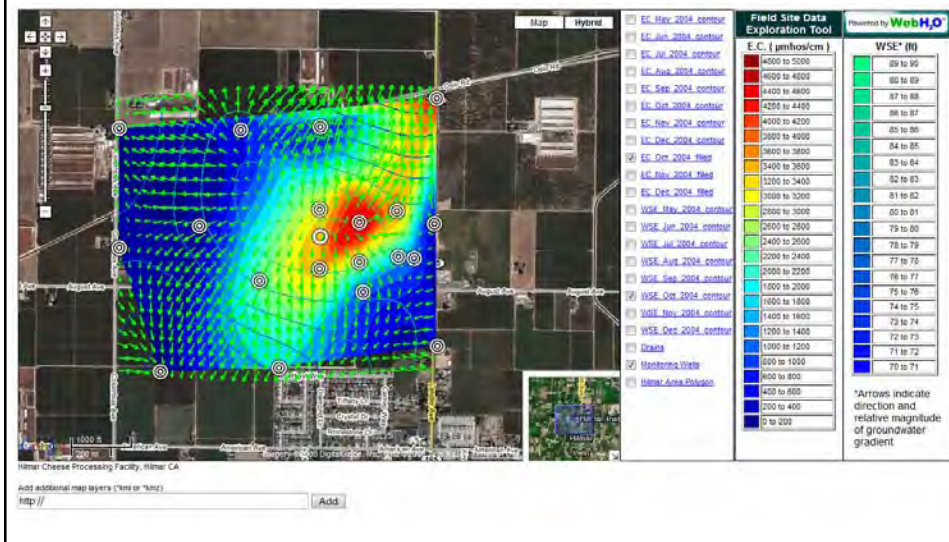
WSE: Nov 2004



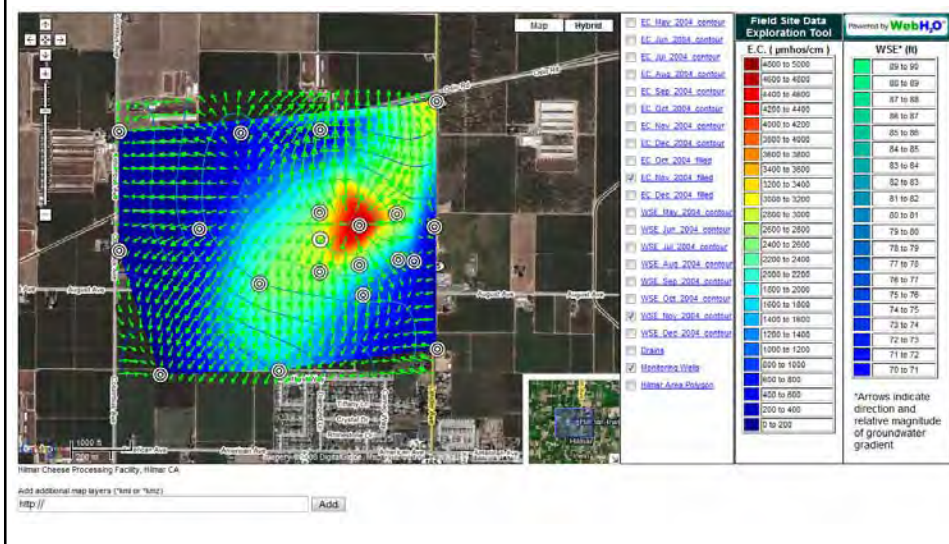
WSE: Dec 2004



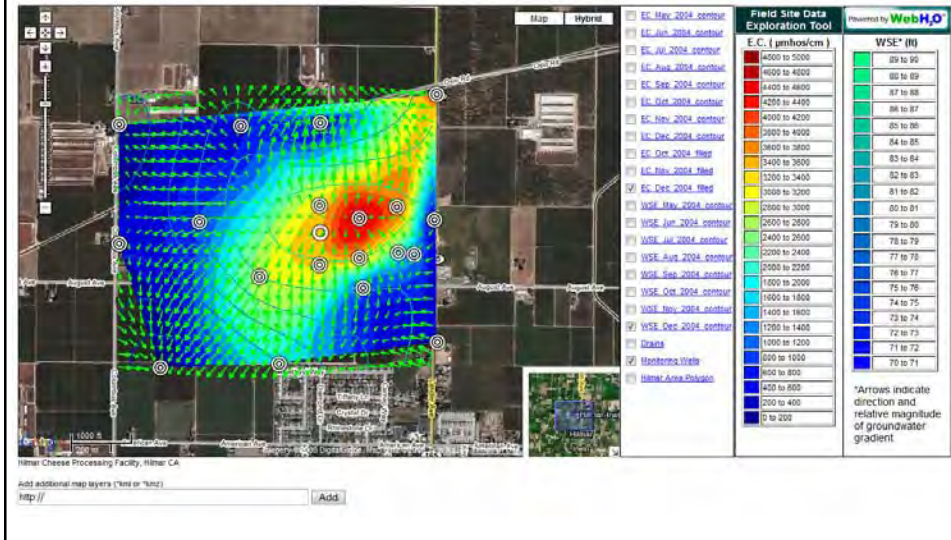
EC + WSE: Oct 2004



EC + WSE : Nov 2004

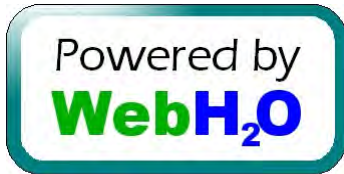


EC + WSE: Dec 2004



Sonoma Hydrological Information Portal

SHIP 1.0 Beta 1 Release



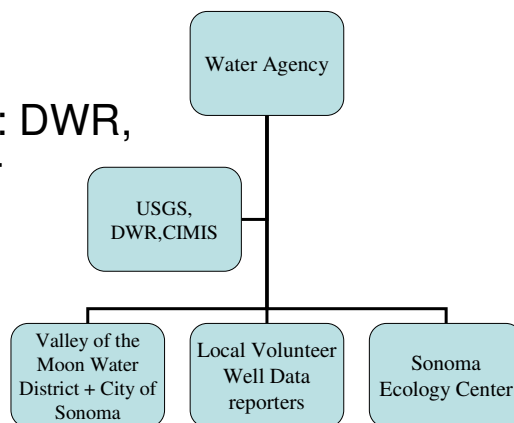
SHIP Goals

- SCWA-led multi-stakeholders groups collaborating on developing the Sonoma Valley' groundwater basin plan
- Data needs include groundwater elevations, groundwater quality, well construction data and well logs
- Goals:
 - Management of groundwater resources
 - Development of groundwater numerical model
- Provide added value to stakeholders as an incentive to participate

WebH₂O

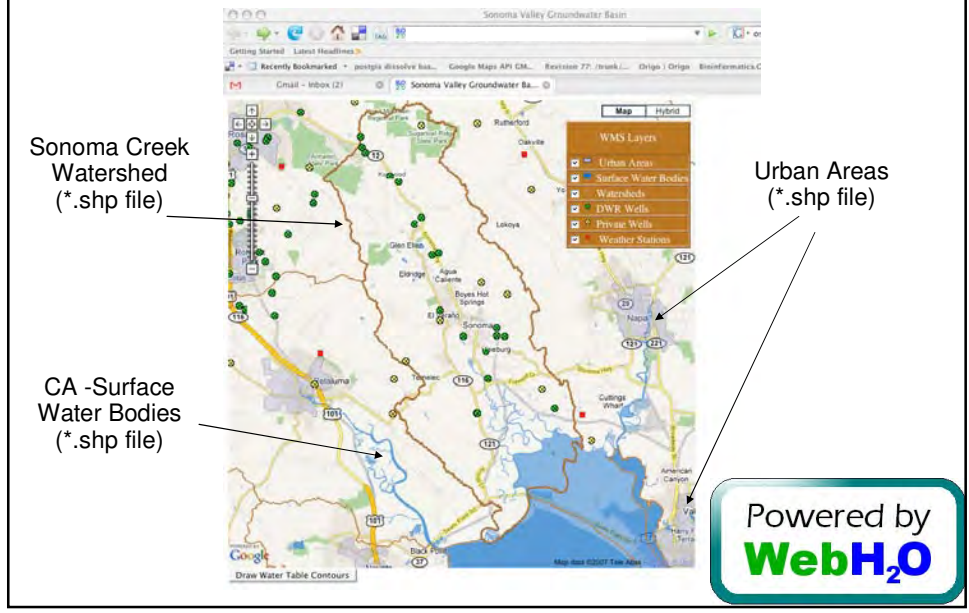
Sources of Data

- Local
- Public agencies: DWR, California Water Service, USGS

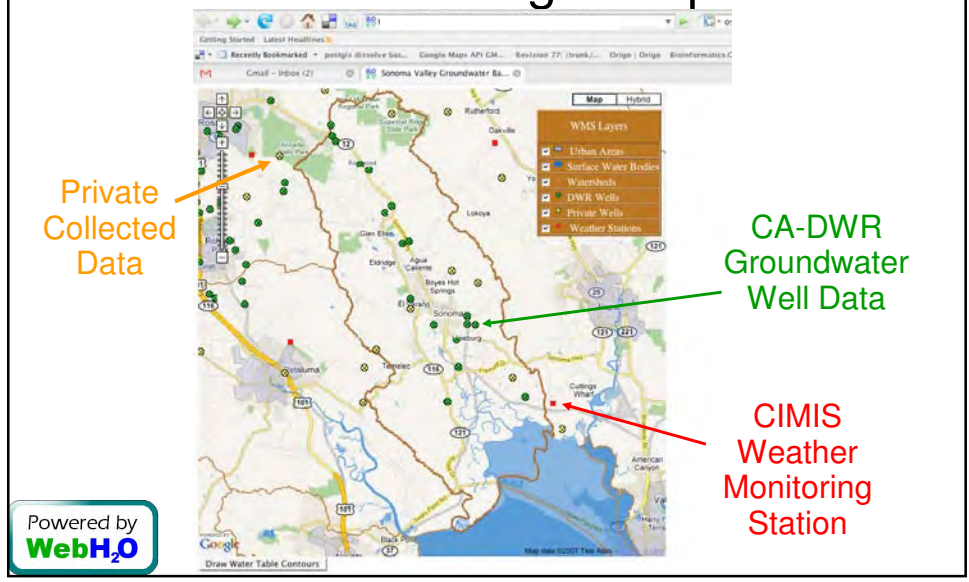


WebH₂O

View GIS Layer Overlays



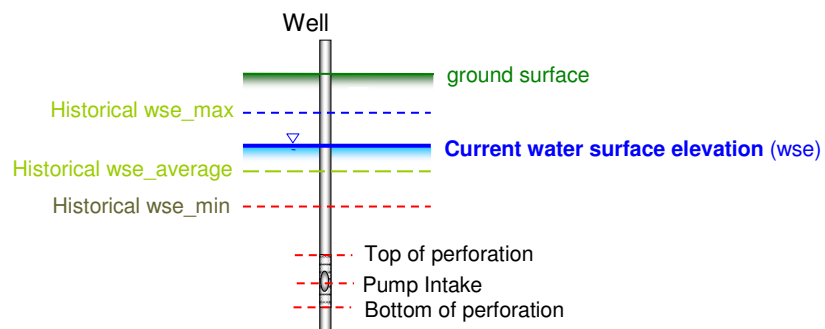
View Collected Data and Public Data on single map



Data Analysis

Statistics, Historical Trends, and Mapping Capabilities

- Automated statistics calculations
 - Well statistics for *wse* - water surface elevation

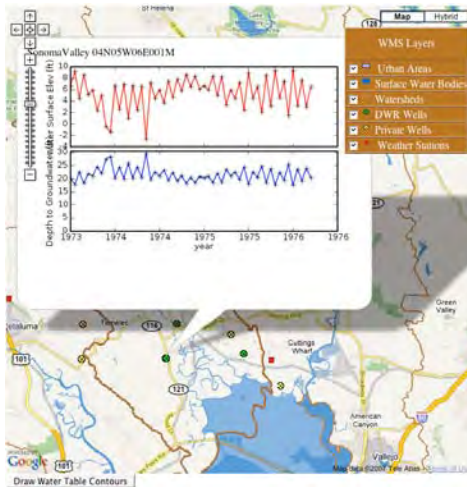


Data Analysis

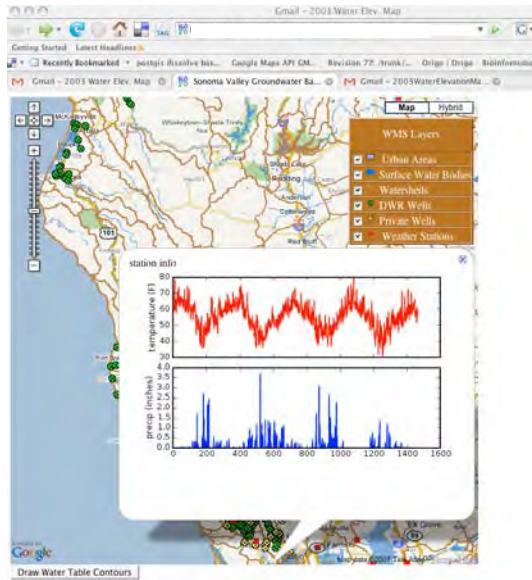
Statistics, Historical Trends, and Mapping Capabilities

- Alerts for water surface elevation
 - *wse* is less than *wse_critical_lower* + 5ft
 - *wse* is less than *wse_min* (the historical minimum)
 - *wse* is less than $0.8 * wse_avg$ (the average *wse*)
 - *wse* is less than the *perforation_elevation_bottom* +3ft
 - See SHIP user guide for additional alerts

Click Wells to see Public Groundwater Data



Weather Station Data



Data Analysis

Statistics, Historical Trends, and Mapping Capabilities

- Contour mapping



Vision

- Expand integration with science modules
 - EPA’s on-line tools such as Domenico Model, BIOSCREEN, BIOCHLOR
 - Water resources management: e.g., conjunctive use of water resources
 - Access to powerful/parallelized computing resources
- Integrate with environmental sensors
- Access on-line data bases for parameter determination (e.g., USDA’s Rosetta)



The image displays two software interfaces. The top interface is the BIOSCREEN Natural Attenuation Decision Support System, version 1.3, which includes sections for Hydrogeology, Dispersion, Adsorption, and Source Data. The bottom interface is the EPA On-line Tools for Site Assessment Calculation, specifically the 'Unsteady transport with the Domenico Model' module. It features a graph showing concentration over distance at a time of 500.0 days, with a peak concentration of 10.00. A 'Powered by WebH₂O' logo is positioned to the right of the screenshots.

Built Using Open-Source Software Components

- PostgreSQL (database)
- PostGIS (spatial data and queries)
- MapServer (render and serve images over the web)
- Python (programming language for web, science, ...)
 - Scipy/Numpy/Matplotlib (provide Matlab+++ type functionality)
- PHP (scripting language for web development)
 - Excellent support for user administration
- Apache (fast, popular web server)
- **How is this part of our vision?**
 - Making science affordable
 - Get a broad community of developers to share and contribute

Powered by
WebH₂O