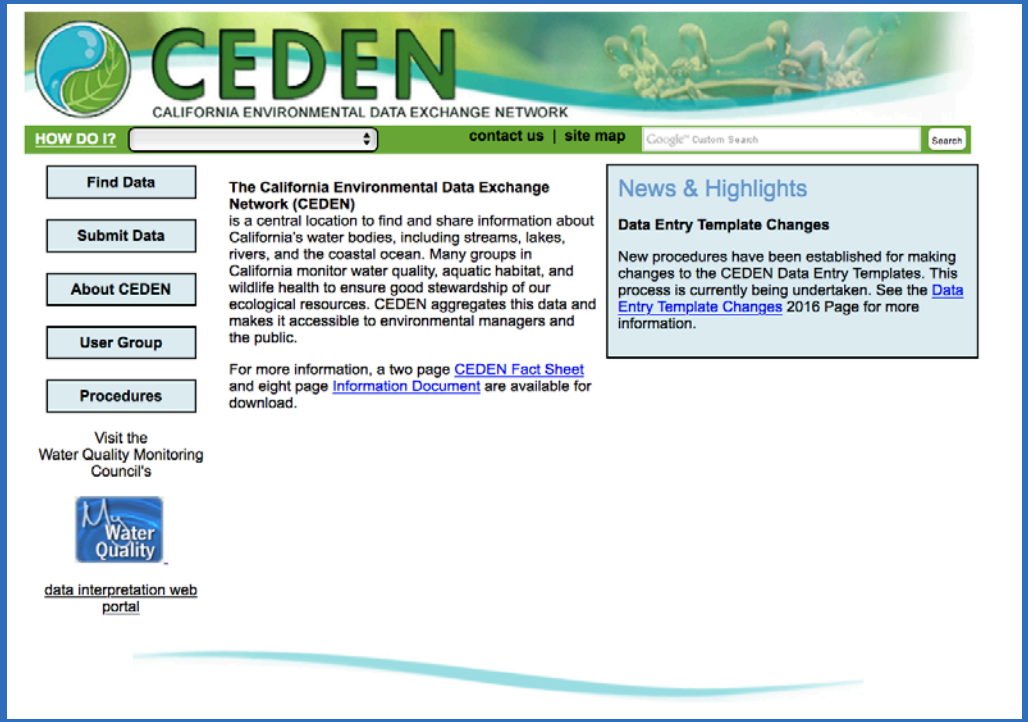
SWAMP
Surface Water Ambient Monitoring Program

Central Coast Ambient Monitoring Program Data Integration and Healthy Watershed Assessments

Karen R. Worcester, California Central Coast Water Board
David M. Paradies, Central Coast Ambient Monitoring Program

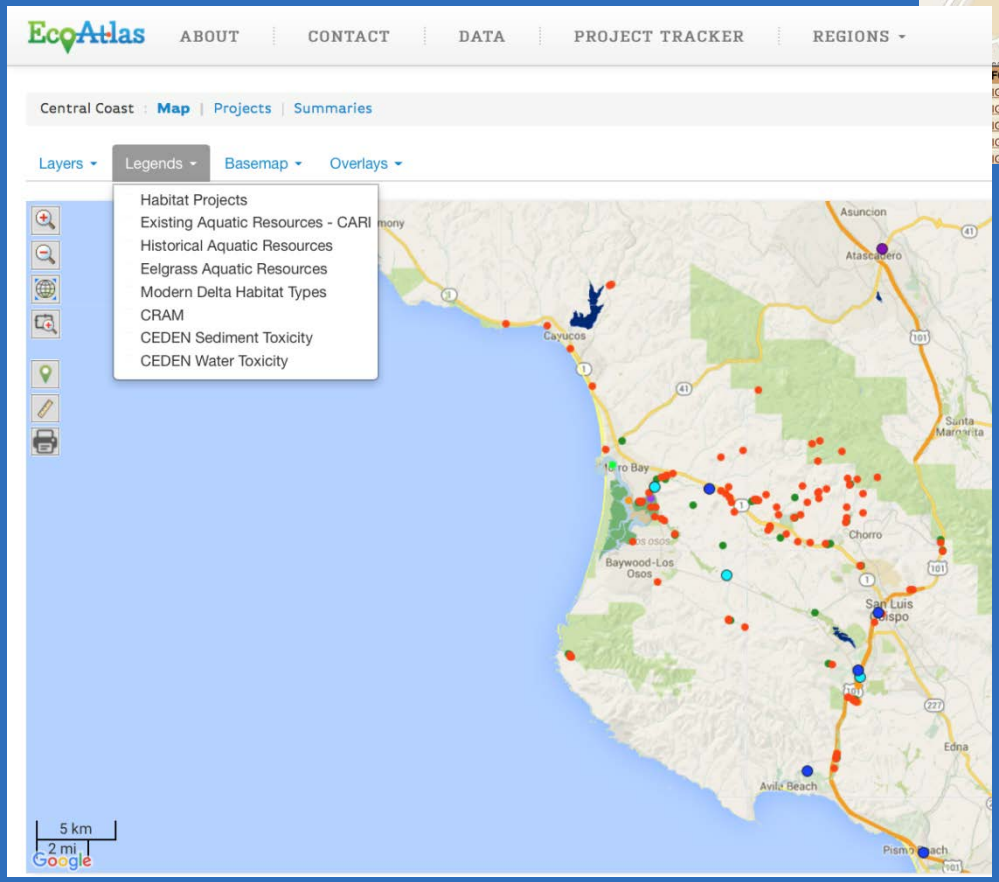
Data Repositories and Portals (some with mappers)

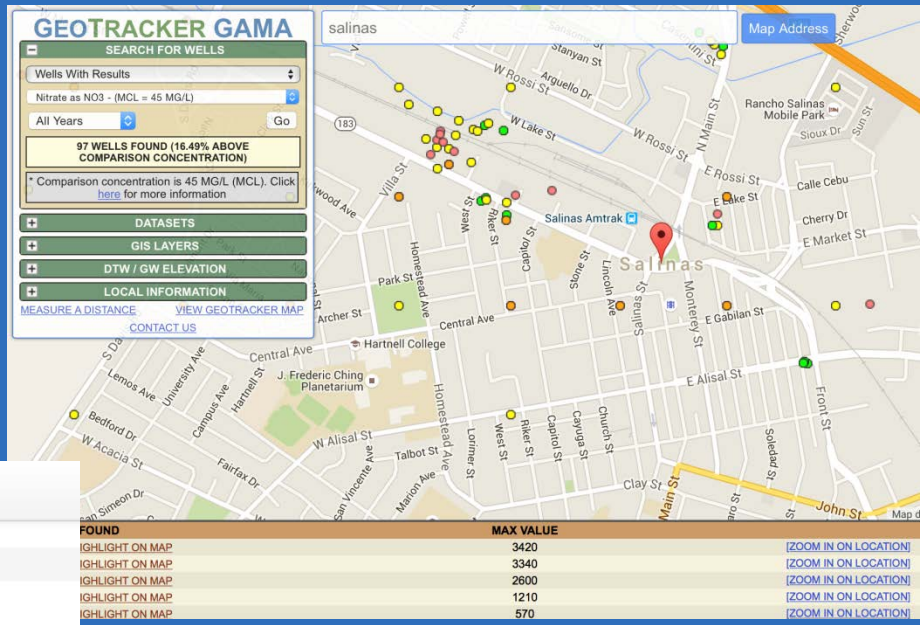
- CEDEN
- EPA Waters
- EPA WQX
- USGS NWIS
- NWQMC Water Quality Data Portal



Data Repositories with associated analytical tools

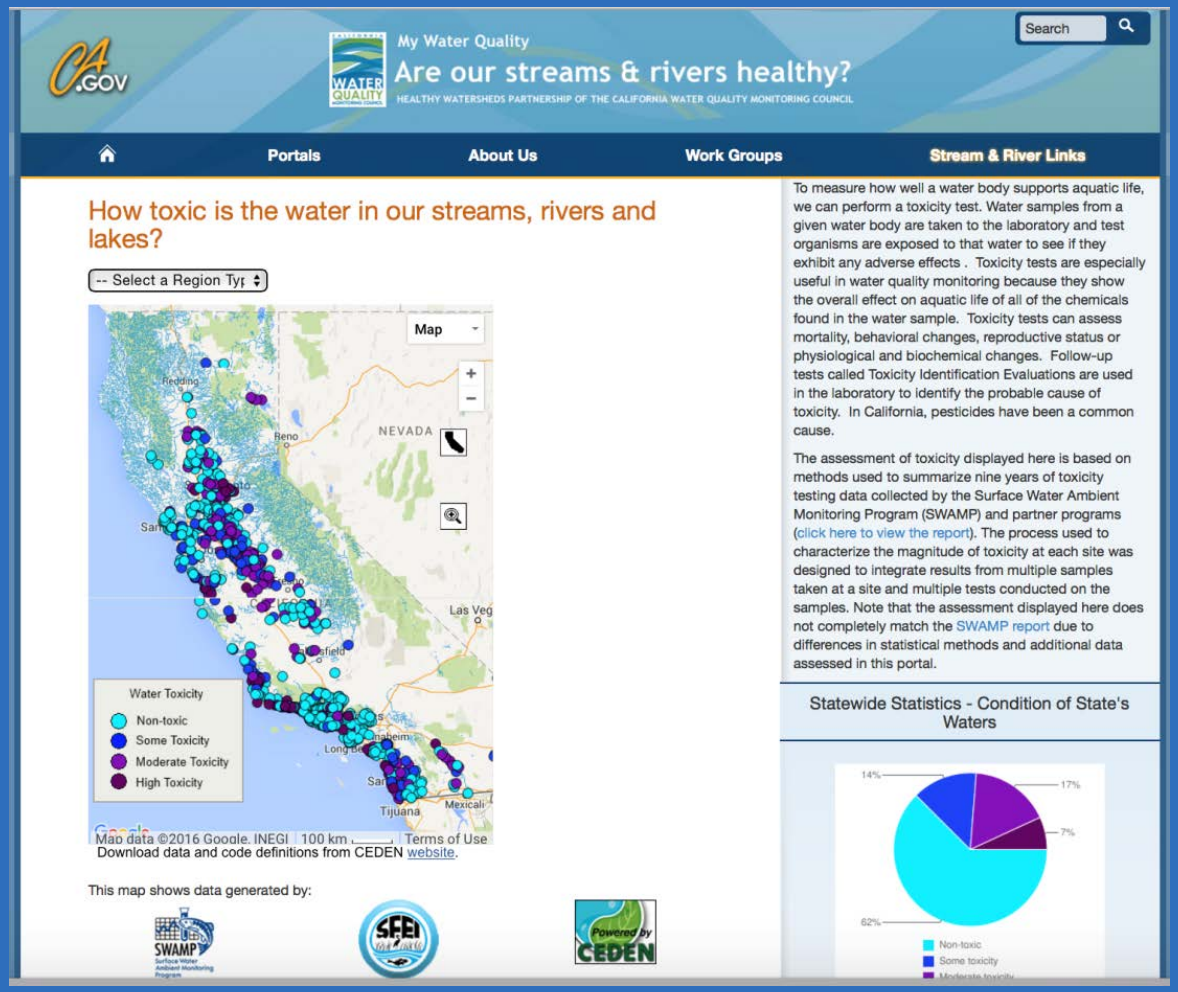
EcoAtlas for wetlands and other data





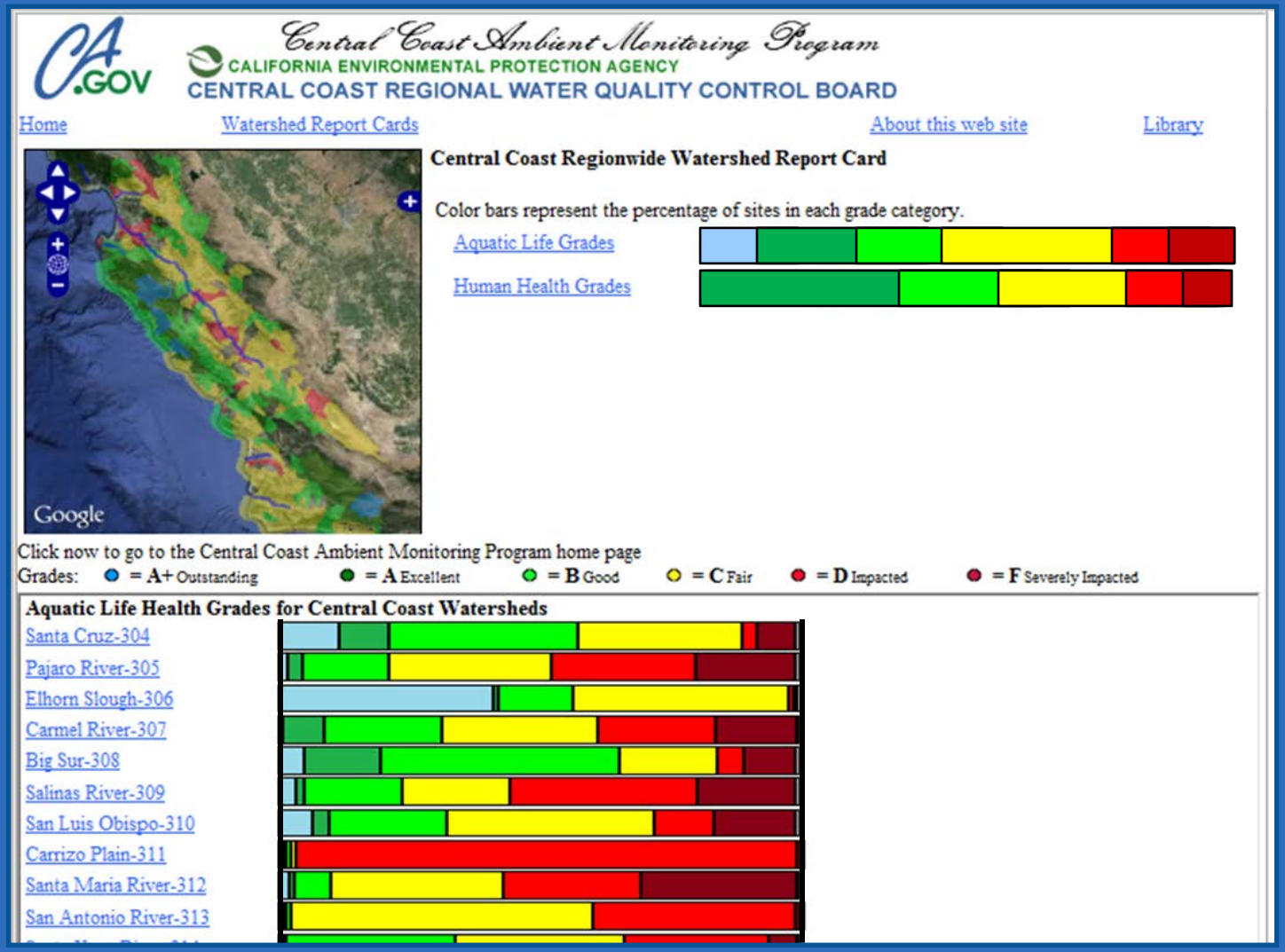
Geotracker GAMA for groundwater data

Data assessment and mapping



CWQMC “My Water Quality” Data Portal provides question driven assessments in map, graph and text format.

Healthy Watersheds Web Report Card



(not yet publically available)

Our Vision for the Central Coast…

Healthy Watersheds

By 2025:

Healthy Aquatic Habitat - 80% of aquatic habitat is healthy; remaining 20% exhibit positive trends in key parameters

Proper Land Management - 80% of land is managed to maintain proper watershed functions; remaining 20% exhibit positive trends in key parameters

Clean Groundwater- 80 percent of ground water is clean, and the remaining 20 percent will exhibit positive trends in key parameters

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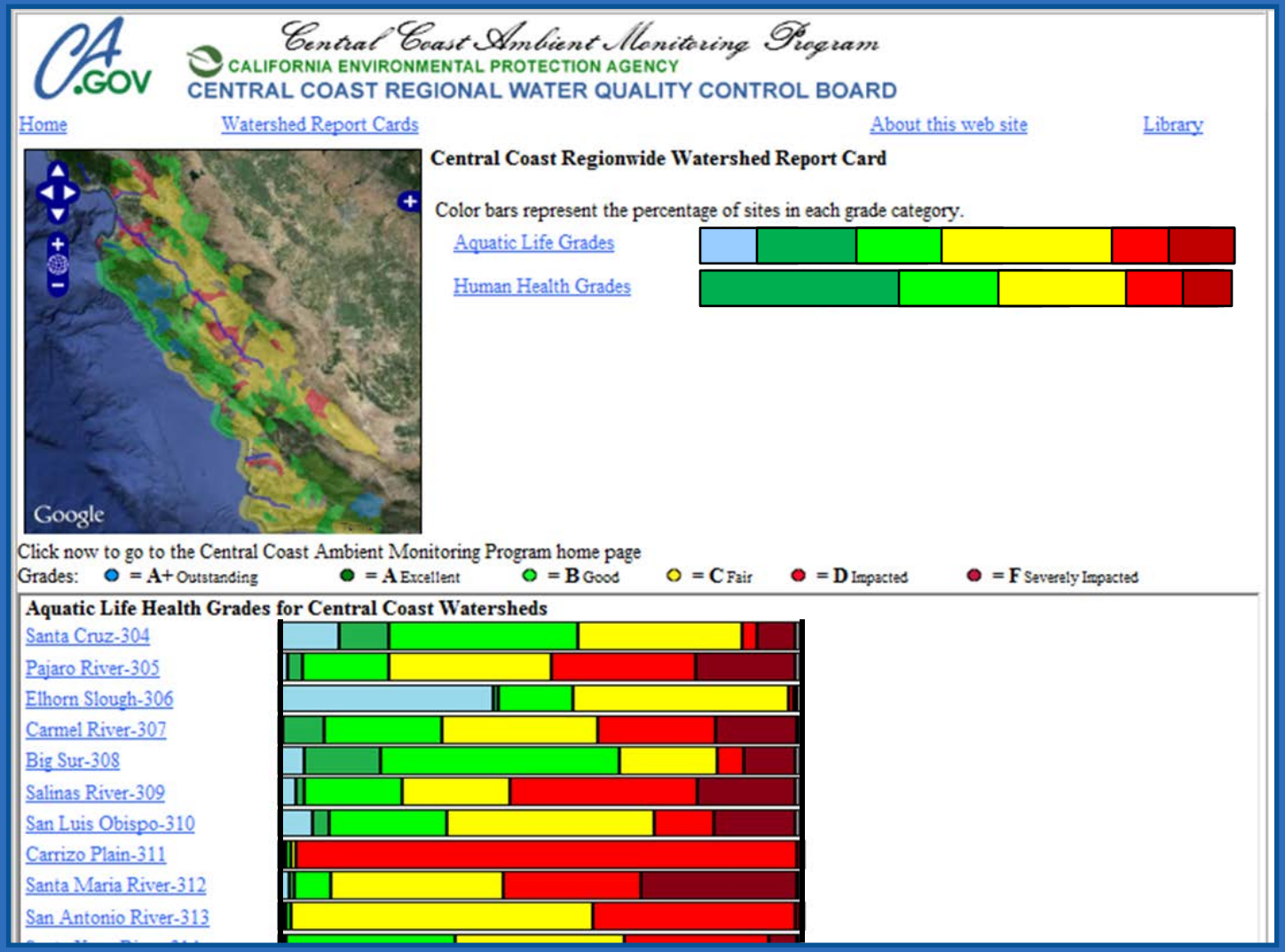

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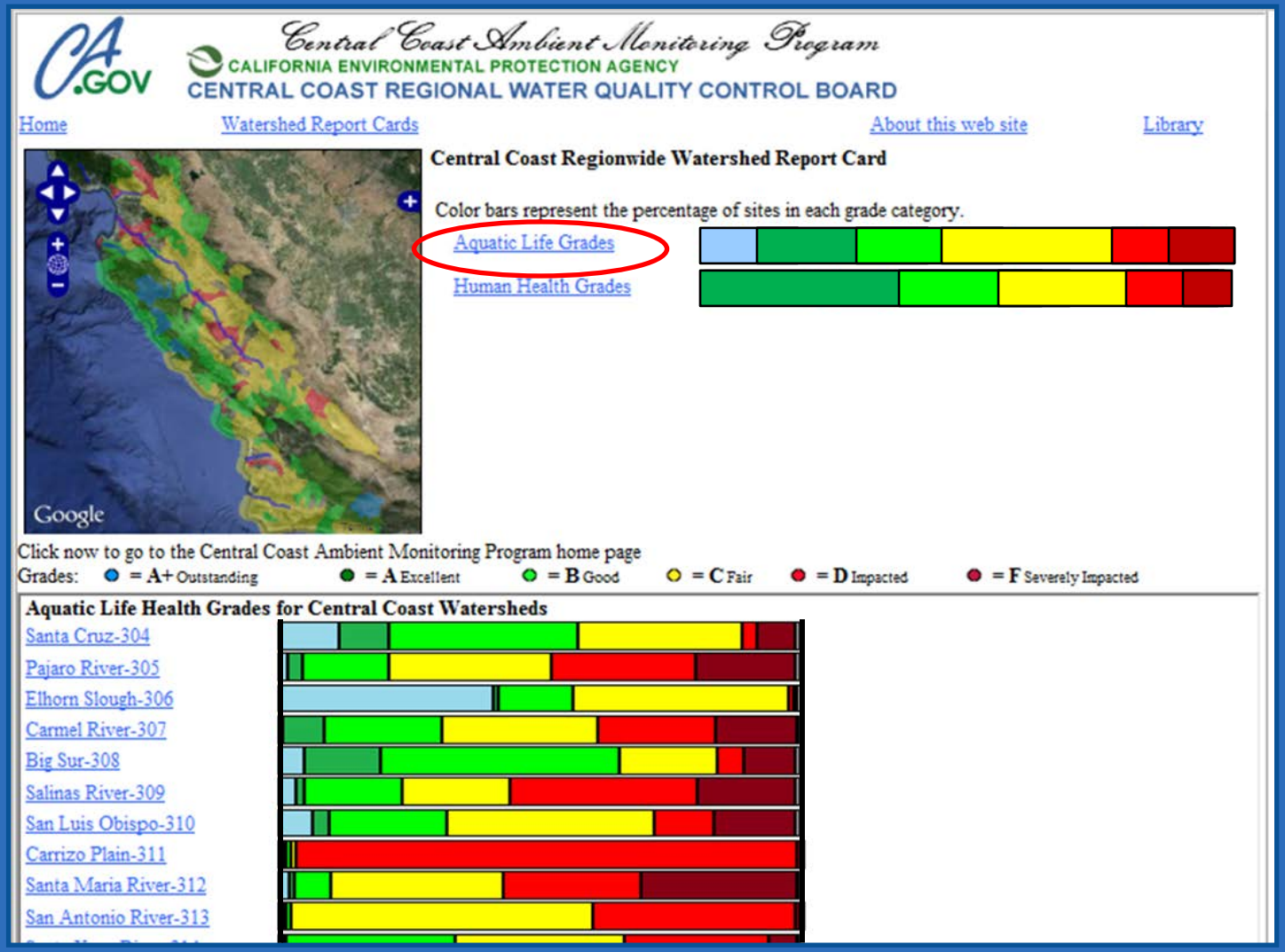

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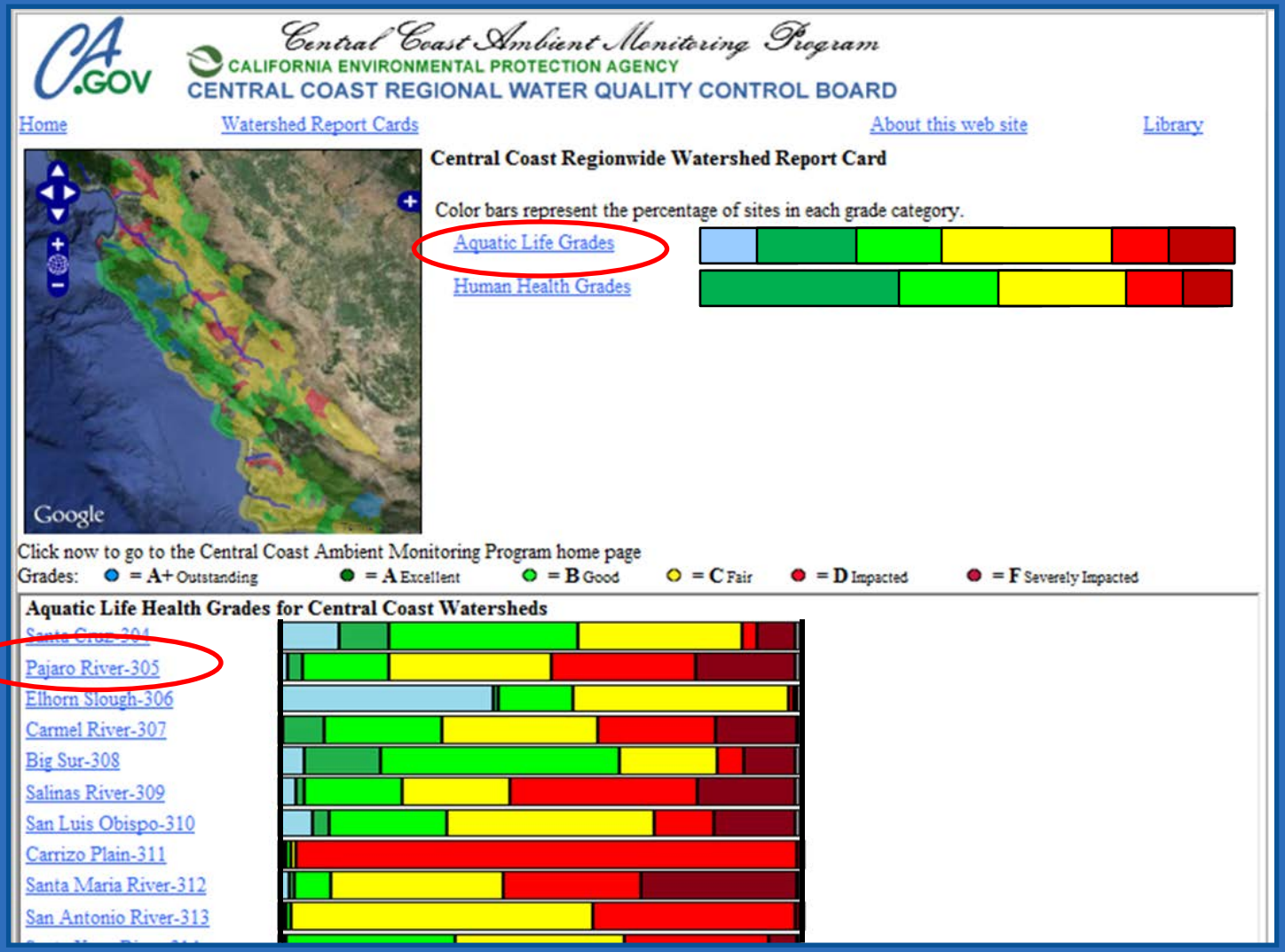

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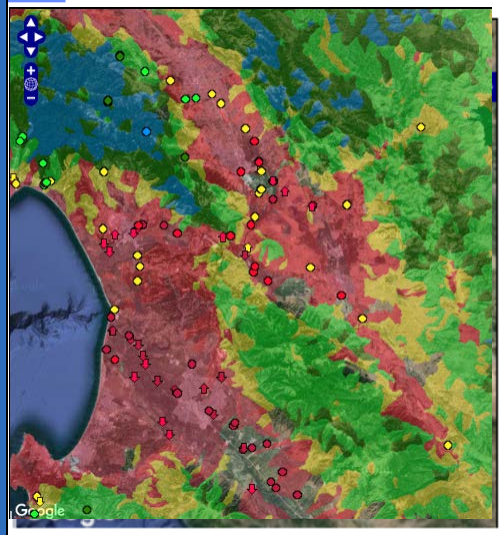
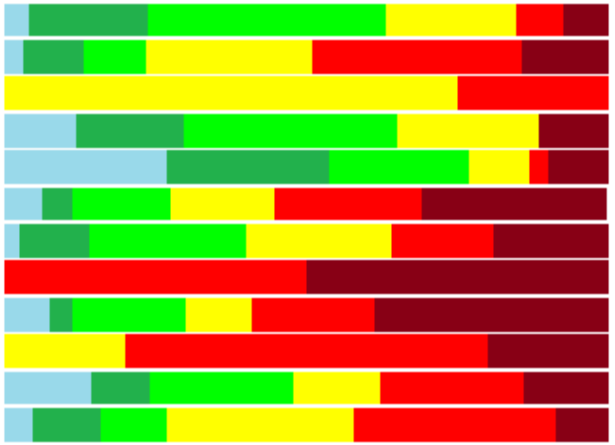
Central Coast Ambient Monitoring Program

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

CENTRAL COAST REGIONAL WATER QUALITY CONTROL BOARD



Aquatic Life Health Grades for Central Coast Watersheds



This map changes as you navigate this site (IT IS NOT YET FULLY CONNECTED TO THE DATA).

Grades: = **A+** Outstanding = **A** Excellent = **B** Good = **C** Fair = **D** Poor = **F** Very Poor

Aquatic Life Grades in the Pajaro River Watershed

Watersheds

Waterbody	Aquatic Life Grade	Aquatic Life Score
Bodfish Creek	A	94
Carnadero Creek	C	67
Clear Creek (San Benito County)	C	73
Corralitos Creek	C	72
Furlong Creek	C	72
Harkins Slough	C	79
Laguna Creek	B	85
Little Arthur Creek	A	97
Llagas Creek	B	82
Llagas Creek (above Chesbro Reservoir)	B	88
Llagas Creek (below Chesbro Reservoir)	D	58
Millers Canal	D	54

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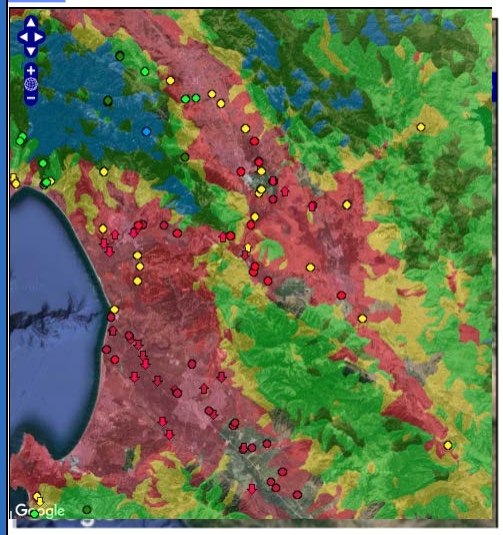

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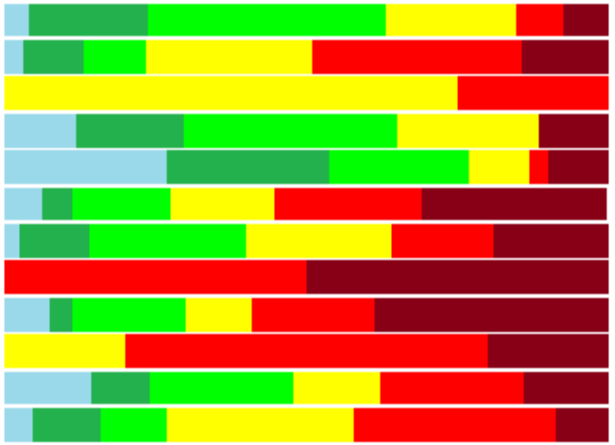

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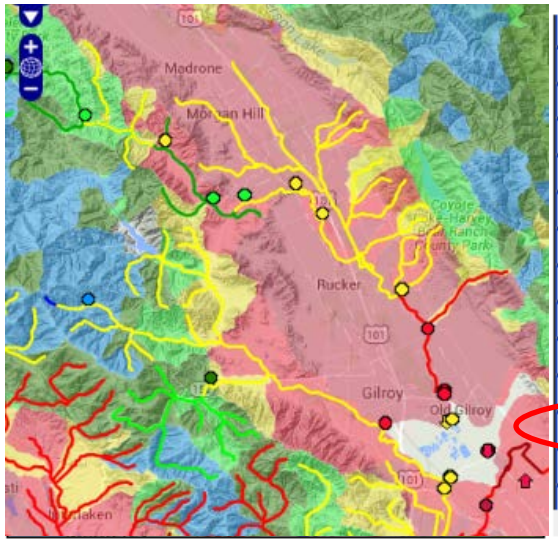

Beach Road Ditch	D	56
Bodfish Creek	A	94
Carnadero Creek	C	70
Clear Creek (San Benito County)	C	72
Corralitos Creek	B	88
Furlong Creek	D	63
Harkins Slough	C	74
Laguna Creek	B	84
Little Arthur Creek	A	97
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Millers Canal	D	54
Pacheco Creek	C	72

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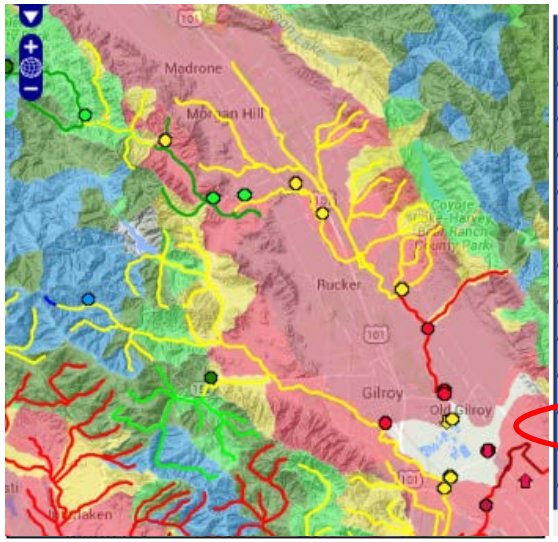
Aquatic Life Health Grades for Sites - Llagas Creek (below Chesbro Reservoir)

Watersheds Waterbodies

Site	Site Name	Aquatic Life Grade	Aquatic Life Score
305CE0484	Llagas Creek Below Sycamore Avenue	B	85
305HOL	Llagas Creek at Holsclaw below Leavesley Rd.	D	52
305LEA	Llagas Creek at Leavesley Rd	D	55
305LGCABR	Llagas Creek @ Bloomfield Rd. above bridge	F	35
305LHB	Llagas Creek at Highway 152	D	45
305LLA	Llagas Creek at Bloomfield Avenue	D	58
305LUC	Llagas Creek at Luchessa Avenue-Southside Drive	C	66
305MON	Llagas Creek at Monterey Rd	C	66
305OAK	Llagas Creek at Oak Glen Avenue	B	80
305PS0061	Llagas Creek below E San Martin Ave	C	71



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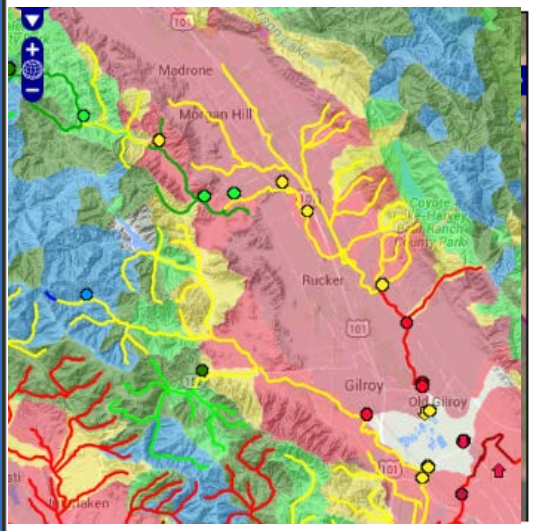

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Llagas Creek at Bloomfield Avenue (305LLA)

Watersheds Waterbodies Sites

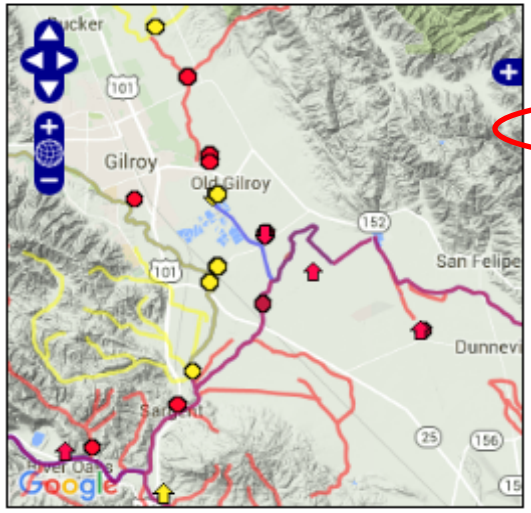
Aquatic Life	Conventional Analytes	Biostimulation	Biology	Toxicity	Metals	Organic Chemicals
D (61)	72	53			90	16

Human Health	Nitrogen Species	Salts	Pathogens	Metals	Organic Chemicals
D (61)	25	53	30	100	100

Healthy Watersheds Home

View Report Cards

About this web site



*	Analyte	Units	Matrix	Min	Mean	Max	Samples	Grade	Score	Threshold
	Water Temperature	degrees c	water	9.4	16.4	20.1	162	C	79	18
	Ammonia as N,Total	mg/l	water	0.01	0.07	0.34	59	A	97	1.9
	Nitrate,Nitrite as N	mg/l	water	1.42	12.1	22	59	F	4	1
	OrthoPhosphate as P	mg/l	water	0.003	0.04	0.23	59	B	81	0.13
	Suspended Solids,Total	mg/l	water	3.2	16	64	52	C	78	30
	Turbidity	ntu	water	0	37.3	224	61	D	64	25

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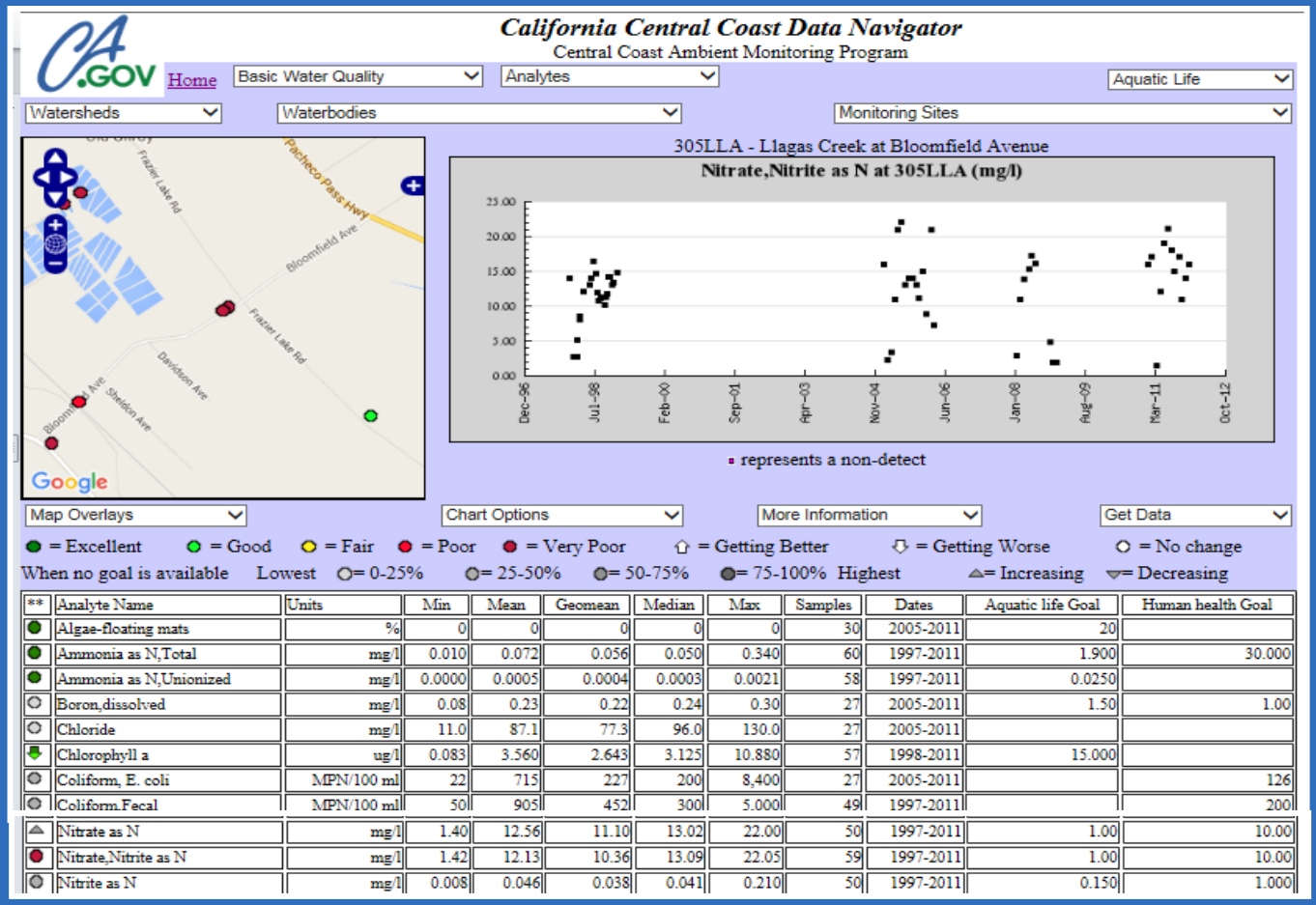
Llagas Creek at Bloomfield Avenue (305LLA)

Watersheds Waterbodies Sites

Aquatic Life	Conventional Analytes	Biostimulation	Biology	Toxicity	Metals	Organic Chemicals
D (58)	67	53			90	16

Human Health	Nitrogen Species	Salts	Pathogens	Metals	Organic Chemicals
D (61)	25	53	30	100	100

"Report Card" provides index scores for different data types and access to individual analyte scores. It also provides wiki space for written assessments by staff.



California Central Coast Data Navigator
Central Coast Ambient Monitoring Program

Home | Basic Water Quality | Analytes | Aquatic Life | Watersheds | Waterbodies | Monitoring Sites

305LLA - Llagas Creek at Bloomfield Avenue

Nitrate,Nitrite as N at 305LLA (mg/l)

▫ represents a non-detect

Map Overlays | Chart Options | More Information | Get Data

● = Excellent ● = Good ● = Fair ● = Poor ● = Very Poor ⇧ = Getting Better ⇩ = Getting Worse ○ = No change

When no goal is available Lowest ○= 0-25% ○= 25-50% ○= 50-75% ○= 75-100% Highest ▲= Increasing ▼= Decreasing

**	Analyte Name	Units	Min	Mean	Geomean	Median	Max	Samples	Dates	Aquatic life Goal	Human health Goal
●	Algae-floating mats	%	0	0	0	0	0	30	2005-2011	20	
●	Ammonia as N,Total	mg/l	0.010	0.072	0.056	0.050	0.340	60	1997-2011	1.900	30.000
●	Ammonia as N,Unionized	mg/l	0.0000	0.0005	0.0004	0.0003	0.0021	58	1997-2011	0.0250	
○	Boron,dissolved	mg/l	0.08	0.23	0.22	0.24	0.30	27	2005-2011	1.50	1.00
○	Chloride	mg/l	11.0	87.1	77.3	96.0	130.0	27	2005-2011		
⇩	Chlorophyll a	ug/l	0.083	3.560	2.643	3.125	10.880	57	1998-2011	15.000	
○	Coliform, E. coli	MPN/100 ml	22	715	227	200	8,400	27	2005-2011		126
○	Coliform,Fecal	MPN/100 ml	50	905	452	300	5,000	49	1997-2011		200
▲	Nitrate as N	mg/l	1.40	12.56	11.10	13.02	22.00	50	1997-2011	1.00	10.00
●	Nitrate,Nitrite as N	mg/l	1.42	12.13	10.36	13.09	22.05	59	1997-2011	1.00	10.00
○	Nitrite as N	mg/l	0.008	0.046	0.038	0.041	0.210	50	1997-2011	0.150	1.000

Report Card connects to CCAMP Data Navigator to access data, maps, graphs, summary stats, trend analysis and other statistical tools

California Central Coast Data Navigator

Central Coast Ambient Monitoring Program

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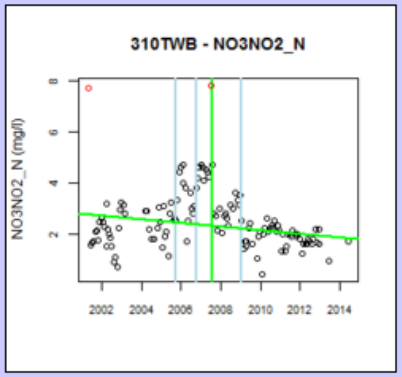
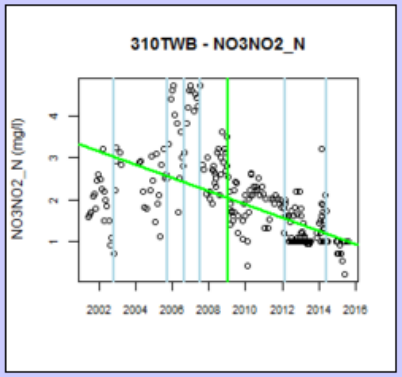
Watersheds | Waterbodies | Monitoring Sites

310TWB - Chorro Creek at South Bay Boulevard
Nitrate,Nitrite as N





Map Overlays | Chart Options | More Information | Get Data

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When no goal is available Lowest ○= 0-25% ○= 25-50% ○= 50-75% ○= 75-100% Highest △= Increasing ▽= Decreasing

*	Analyte	Units	Change	Trend	Date of Change	Mean Before	Mean After	% Change	p-value
○	Ammonia as N,Total - instantaneous load (NH3_N_L)	mg/l	No change	Decreasing				0%	1
▽	Ammonia as N,Total - modeled load per month (NH3_N_ML)	mg/l	Decreasing	Decreasing	Oct 18 2011	20.8	6.4	-69%	5.3E-5
⇧	Ammonia as N,Unionized (NH3U_N)	mg/l	Decreasing	Decreasing	Jul 28 2005	0.0025	0.0008	-68%	0.002128
○	Ammonia as N,Unionized - instantaneous load (NH3U_N_L)	mg/l	No change	Decreasing				0%	1
⇩	Aquatic Life Index (INDEX_AQUATIC_LIFE)	score	Decreasing	No trend		68.2	68	-0%	0
⇧	Basic water quality Index - Aquatic Life (INDEX_WQ_AQUATIC_LIFE)	score	Increasing	No trend		71.5	71.9	1%	0
⇩	Biostimulation Index (INDEX_BIOSTIM_RISK)	score	Decreasing	No trend		56.6	54.6	-4%	0
▽	Boron,dissolved (BORON_DIS)	mg/l	Decreasing	Decreasing	Jul 16 2009	0.14	0.12	-14%	3.0E-6
▽	Chloride (CHLORIDE)	mg/l	Decreasing	No trend	Jul 16 2009	88.5	96	8%	0.000409

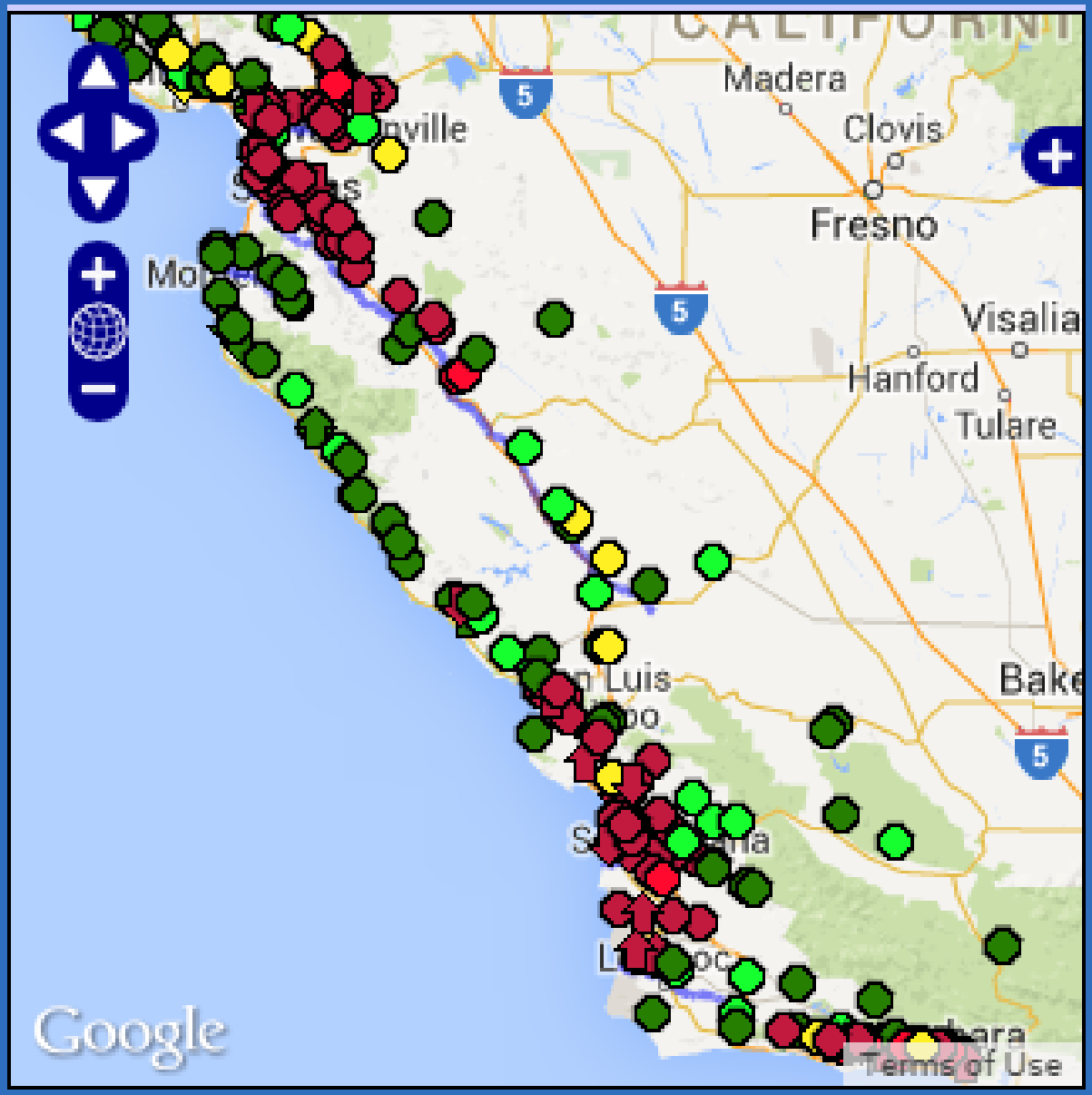
Scoring Approach

- Adapted from Canadian Water Quality Index (CCME)
- Requires a threshold
- Magnitude and exceedance components
- Follows report card paradigm

A+	Combined score over 95		
A	90	to	100
B	80	to	90
C	65	to	80
D	45	to	65
F	1	to	45

Outstanding (A+) designation for “Blue Water Streams” that have an overall Index score of 95 or higher.

Scoring at site/analyte level….



Combining Measures into an Aquatic Life Index

Sub-Indices

- Conventional Analytes
- Toxicity
- Biostimulatory Risk
- Metals
- Organic Chemicals
- Biology (bugs, algae)
- Habitat

Integrating Site level data into a spatial assessment of whole watersheds

- Measured data overlaid on modeled data to adjust scoring
- Site scores (including change scores) are attributed to upstream reaches
- Land Use boundaries define spatial extent of scoring

Modeled data from California's Healthy Watersheds (CADMUS) Assessment

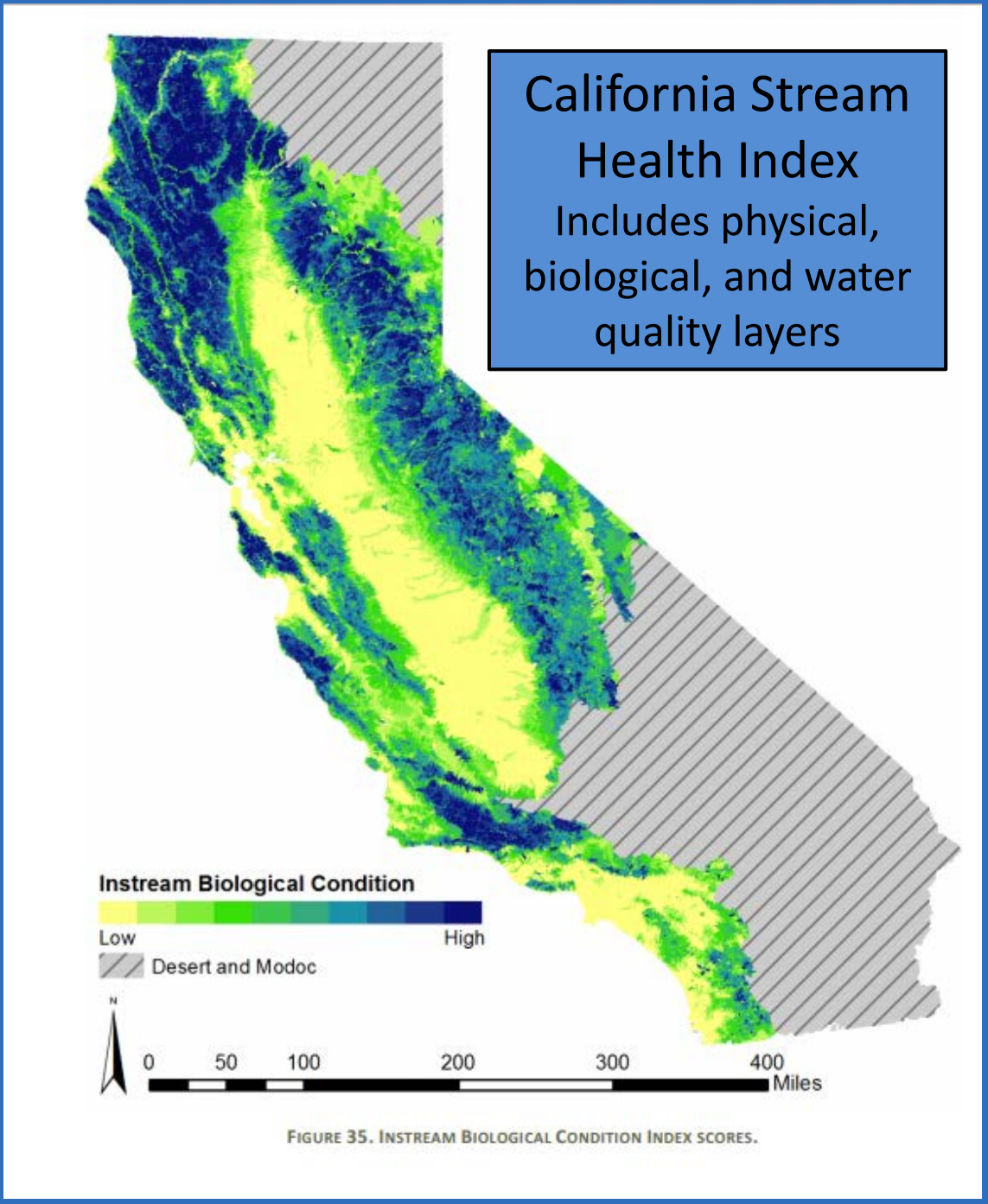
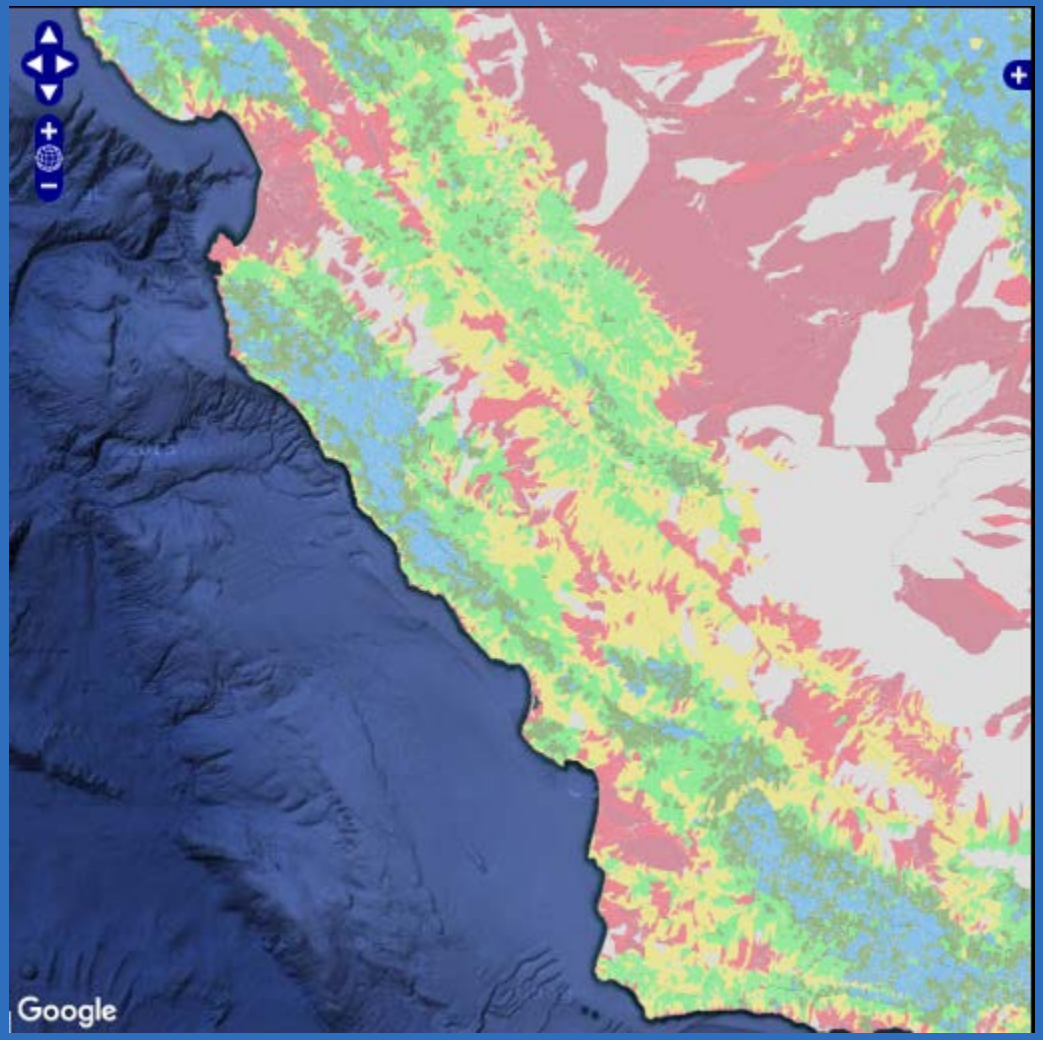
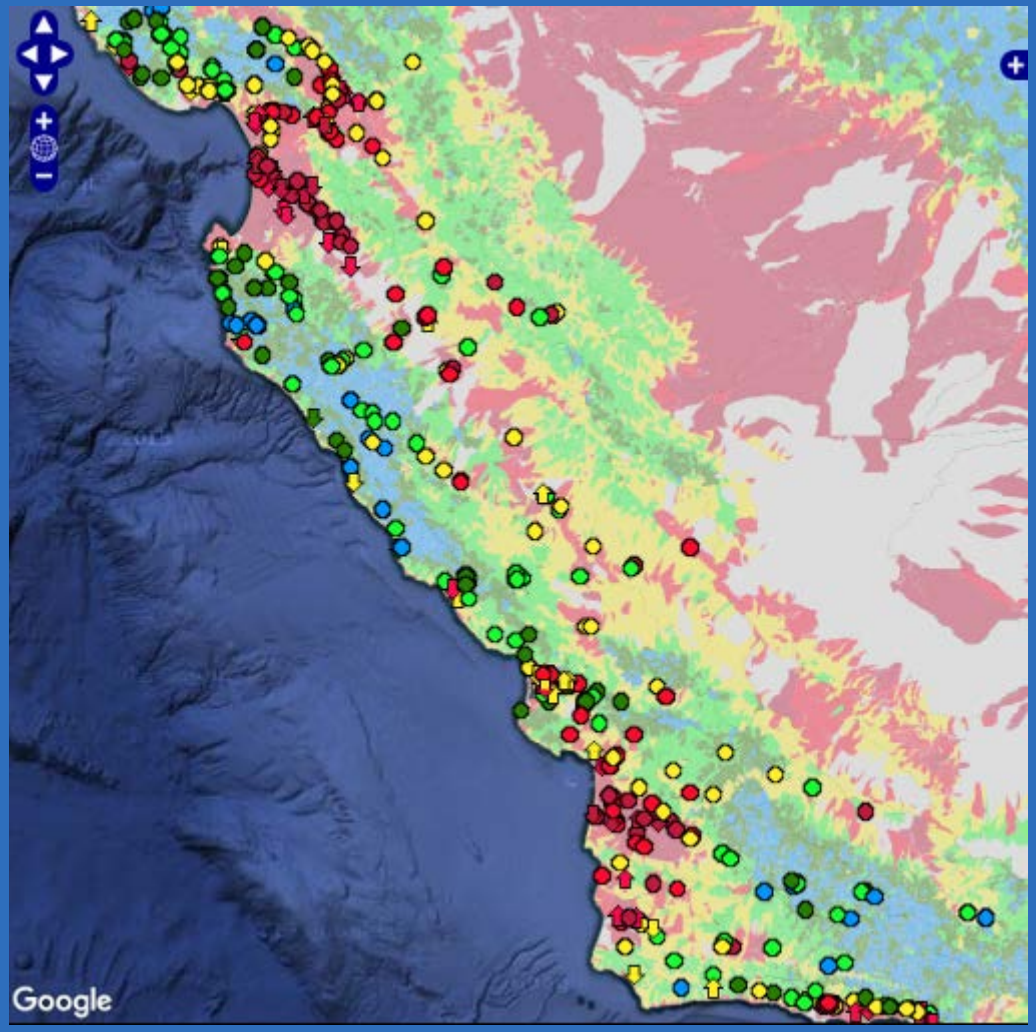


FIGURE 35. INSTREAM BIOLOGICAL CONDITION INDEX SCORES.

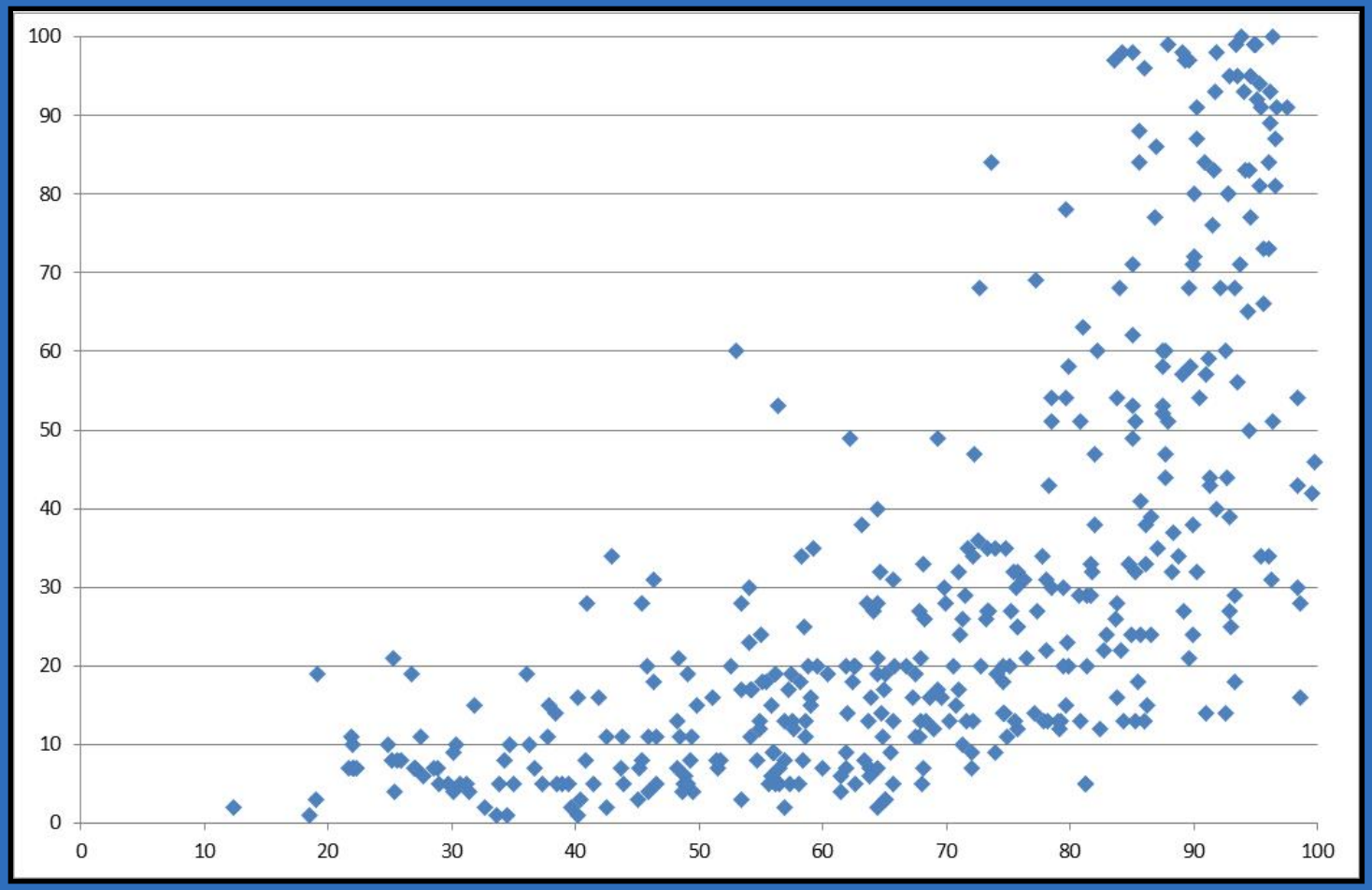
CADMUS Stream Health Index in the Central Coast Region, using report card coloring paradigm

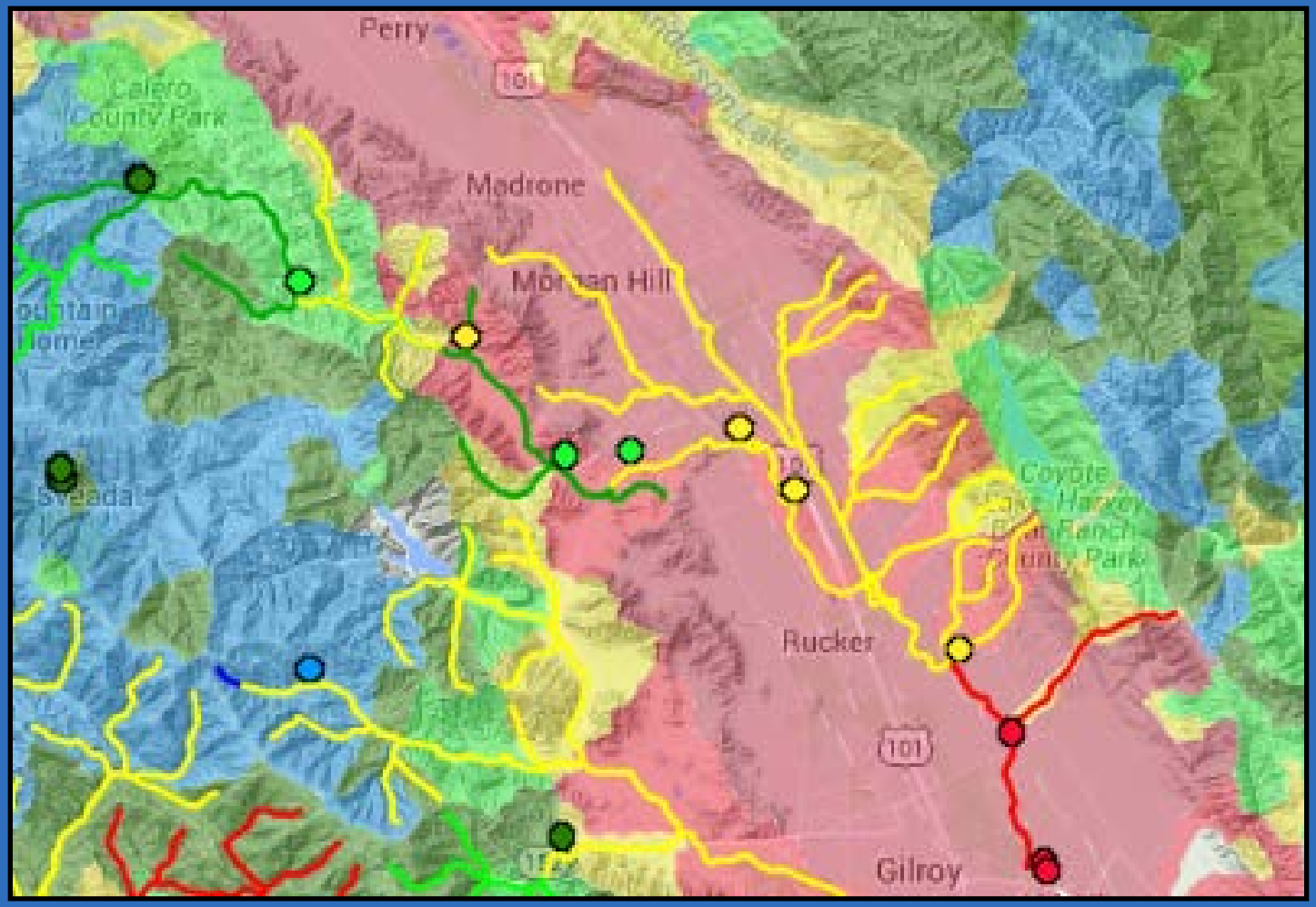


Central Coast Aquatic Life Index scores and CADMUS Stream Health

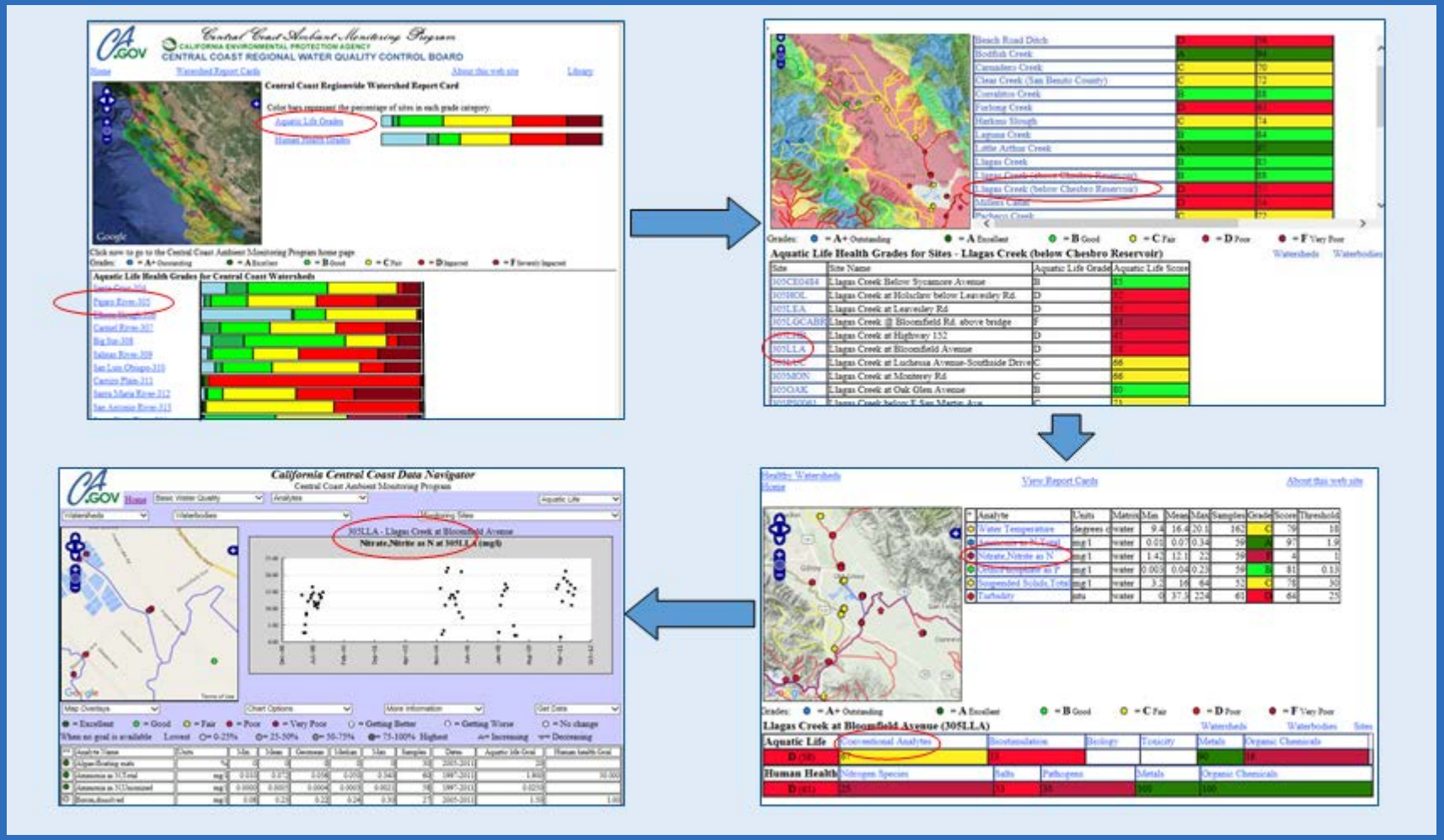


Modeled Stream Health vs. Central Coast Aquatic Life Index (from measured data)



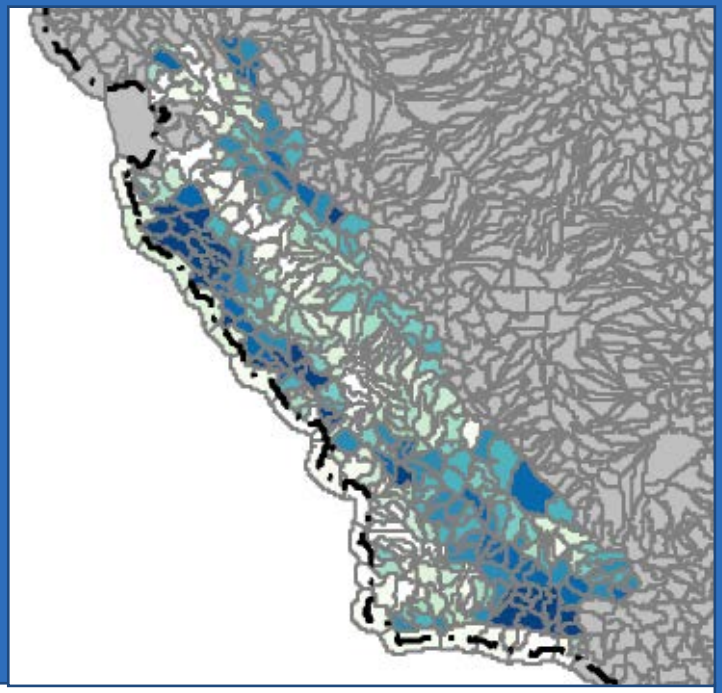


Site scores are modifying upstream reaches, overlaid on California HSP “Stream Health” data layer



This versatile tool provides “big picture” assessment and detailed supporting information, on the desktop, to support smart decision-making

An Application You Can Use Today: EPA's Recovery Potential Scoring Spreadsheet allows you to select from hundreds of indicators to create Ecological, Stressor, and Social metrics at a HUC12 watershed basis. Additional indicators can be added from locally collected data.



Select Ecological Indicators

Select the Ecological Indicators of interest below:

Ecological Indicator	Weight
% Forest (2006) in Watershed	1
% Natural Cover, N-index2 (2006) in Watersh	2
% Natural Cover, N-index1 (2006) in HCZ	2
% NEF2001, National Ecological Framework,	1
Slope, Mean Value in Watershed	1

Select Stressor Indicators

Select the Stressor Indicators of interest below:

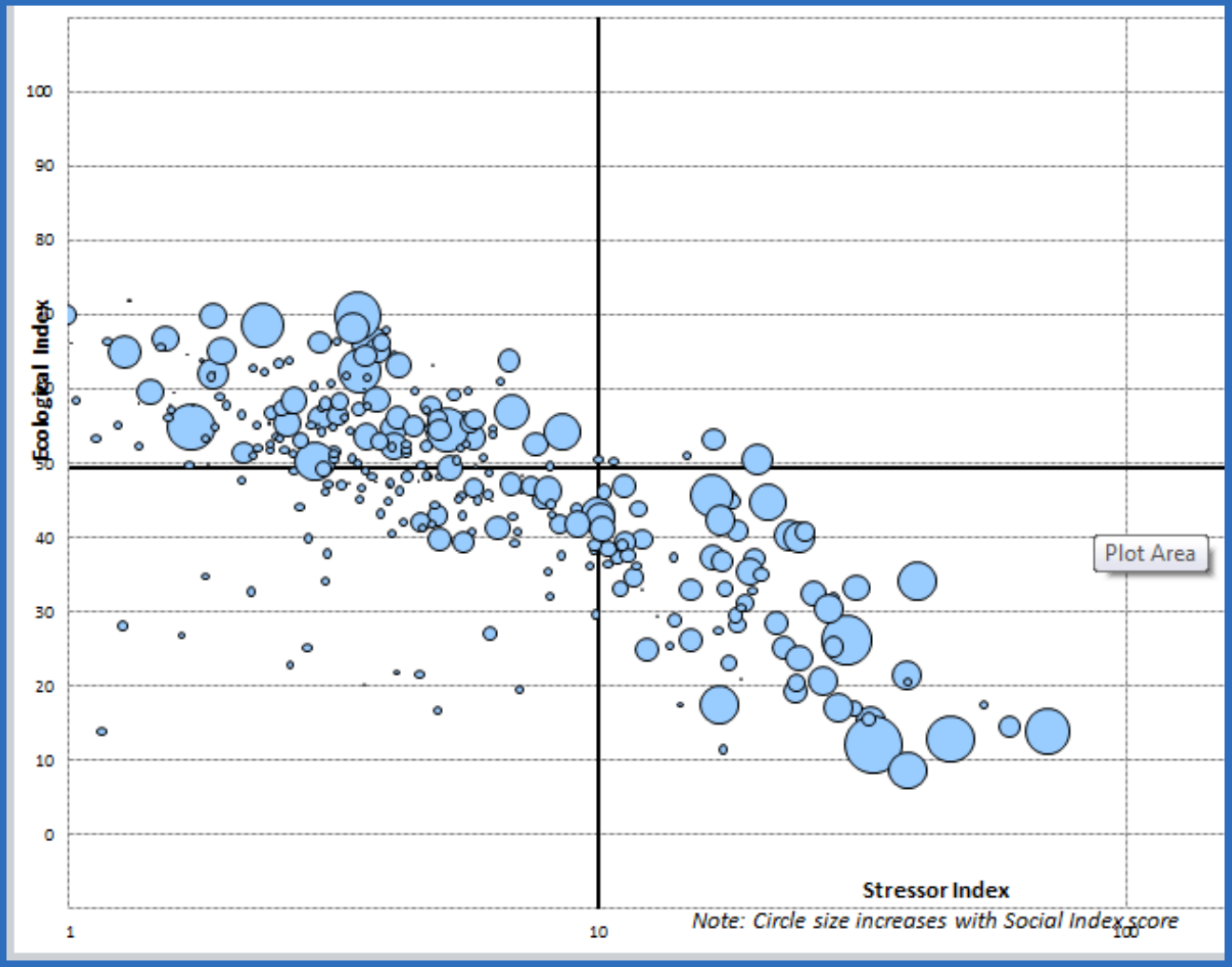
Stressor Indicator	Weight
% Developed, Low intensity (2006) in Watersh	1
% Developed, Medium intensity (2006) in Wat	2
% Developed, High intensity (2006) in Waters	3
% Cultivated Crops (2006) in Watershed	2
% Contiguous Agriculture (2006) in Watershe	1
% Contiguous Urban (2006) in Watershed	1
% of Stream length contiguous to 2006 IC ≥ 5	1
Impervious Cover (2006) IC ≥ 5%, PCT of Wat	2
Road Density 2003, Mean Value (mi /sq mi) H	1
Number 2010 Road Stream Crossings in Wa	1
% Watershed Streamlength 303d-Listed	1
Watershed 303d-Listed Segments Count	1

Select Social Indicators

Select the Social Indicators of interest below:

Social Indicator	Weight
% Watershed Streamlength Assessed	1
% Watershed Waterbody Area with TMDLs	1
Percent Drinking Water Source Protection Are	1

Recovery Potential provides a way to assess ability to implement protection and/or recovery for streams and watersheds

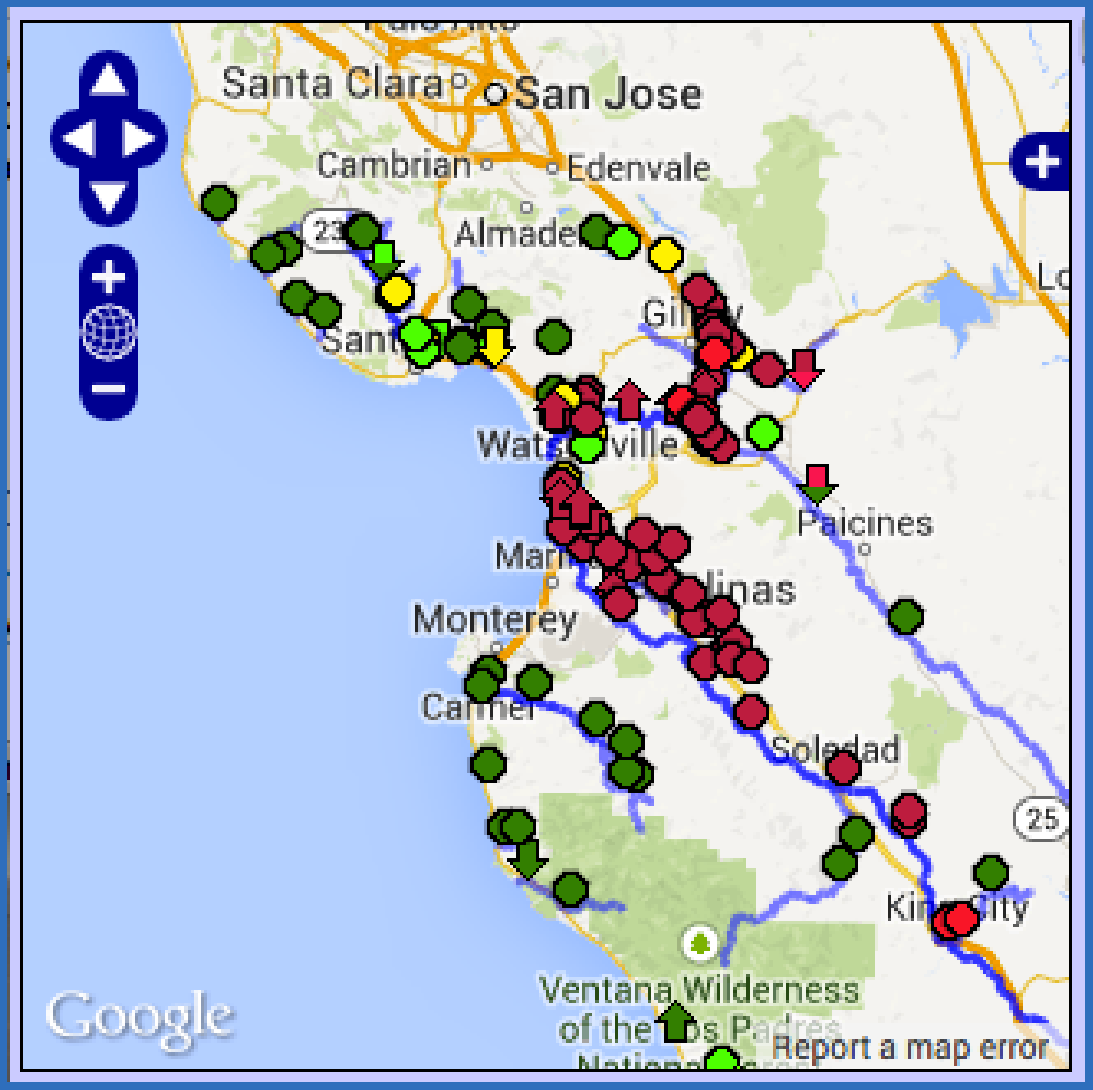


Ecological Index

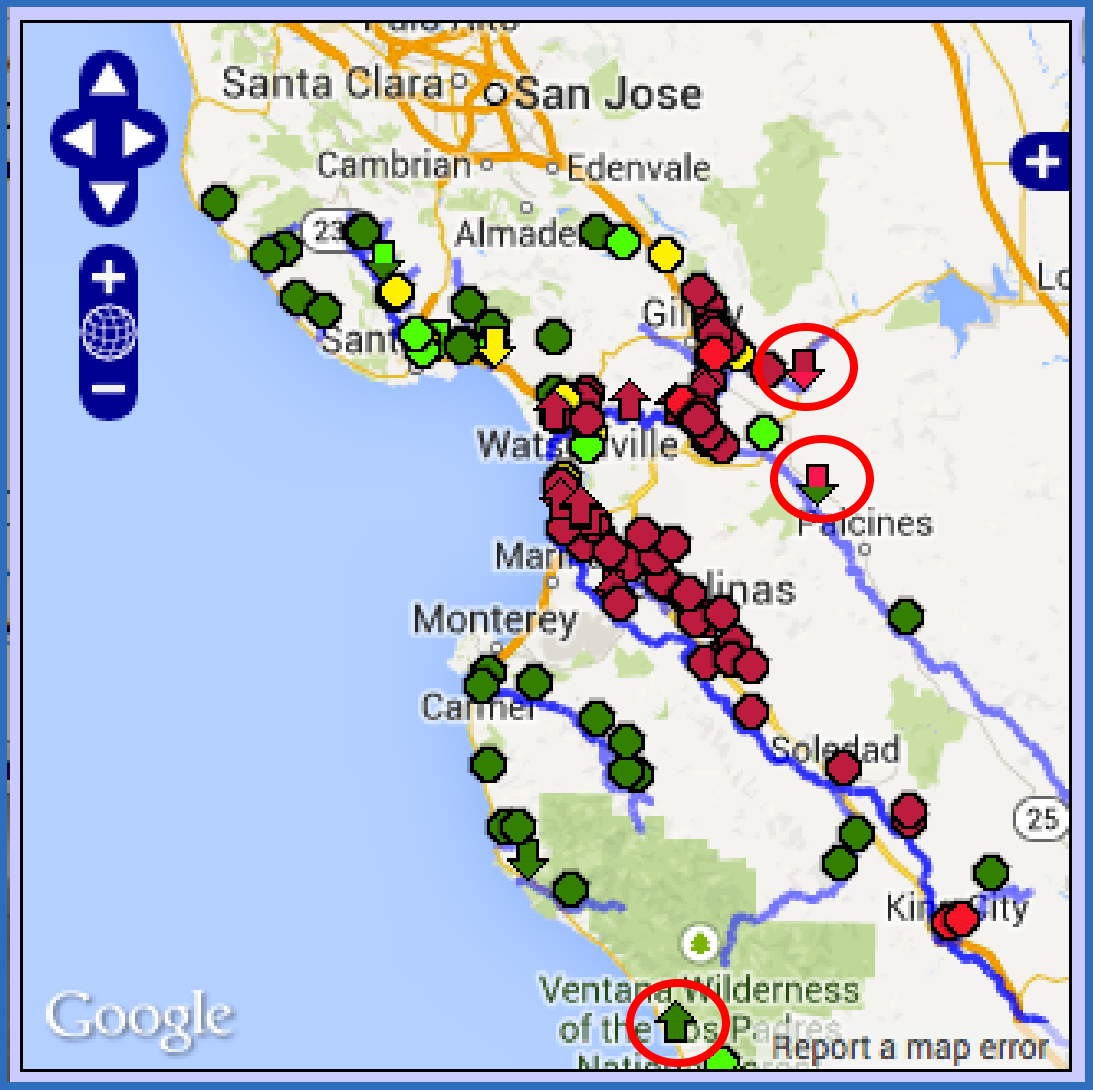
Stressor Index

To support the Open Data Initiative:

- Build tools with compatibility with other systems in mind
- Provide data transfer tools to move data into a standard format to facilitate tool development
- Focus on high priority applications in support of Water Board programs and decision-making (303(d), 305(b), enforcement, TMDL attainment, etc.). Design with the end in mind!

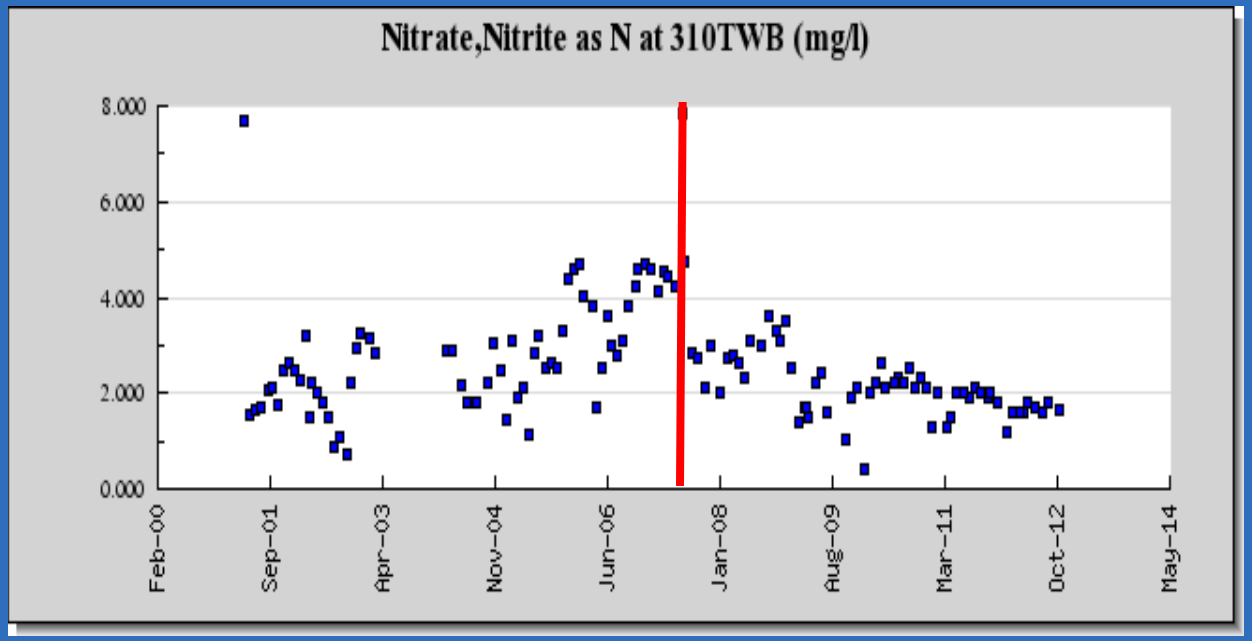


From our website: Nitrate in the Monterey Area



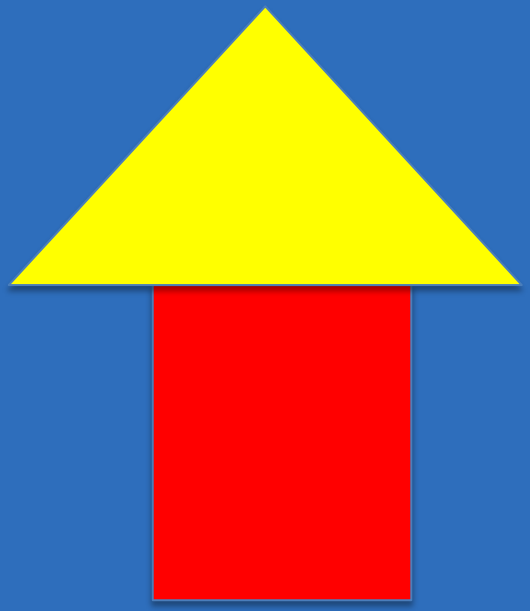
From our website: Nitrate in the Monterey Area (note arrow icons denoting change).

Change Point Analysis defines probable change points in a time series of data



In this case, a treatment plant upgrade went online in May, 2007

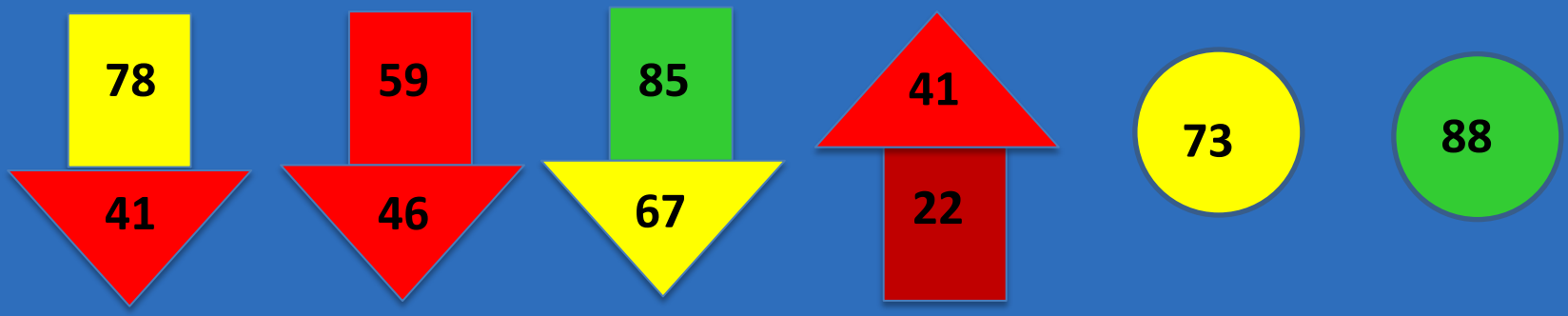
Apply MEQ scoring to data on each side of Change Point to grade (color) two sections of arrow icon



We have found Change Point Analysis to be more useful than traditional trend analysis and are relying on it as our primary change scoring approach.

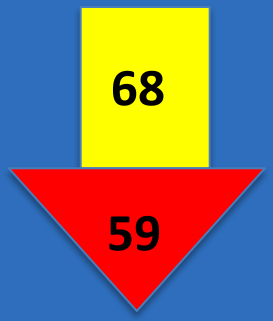
One Way to Aggregate Change Across Multiple Measures

MEQ Grading Key			
A	100	to	90
B	90	to	80
C	80	to	65
D	65	to	40
F	45	to	1

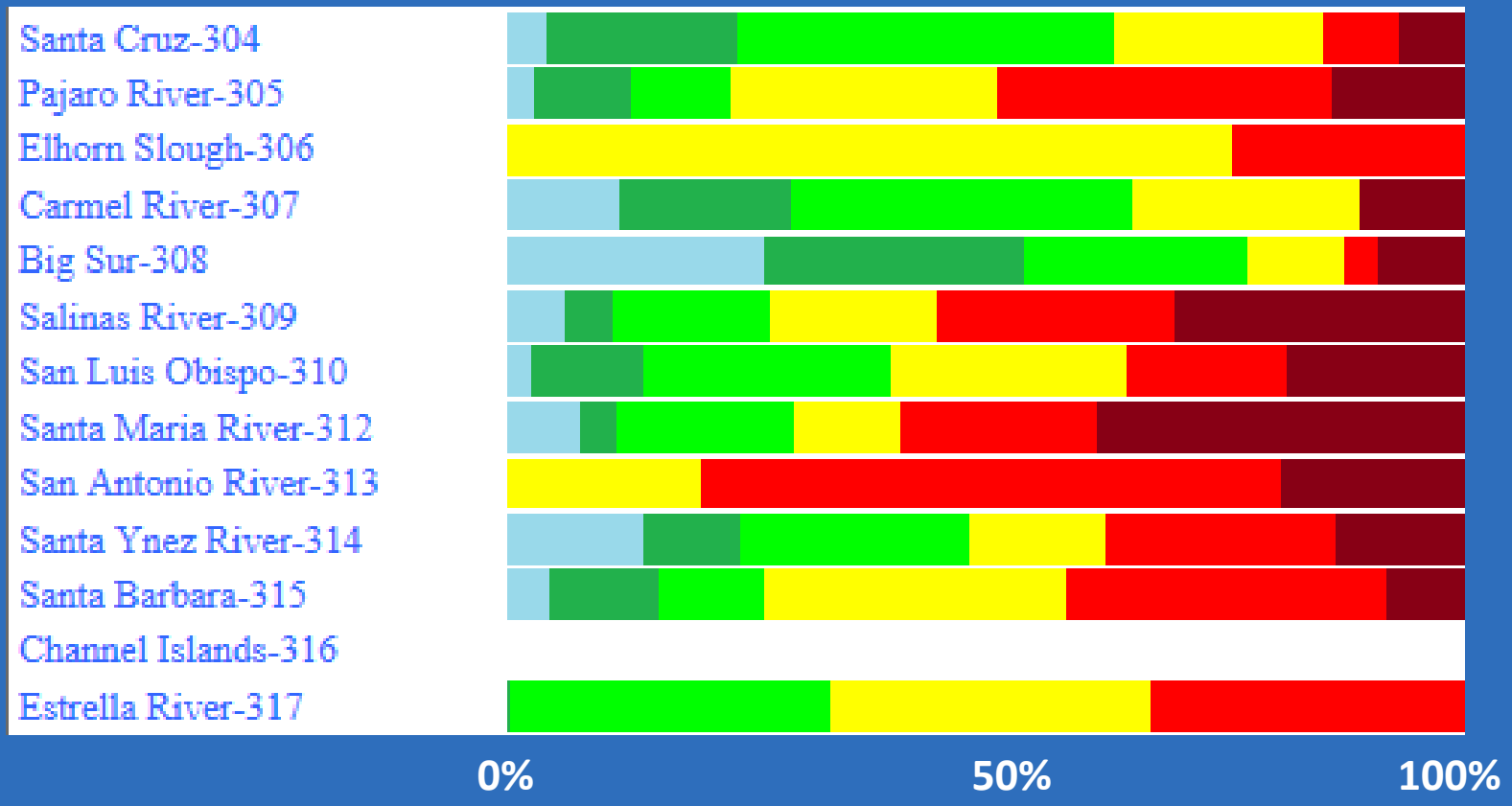


Analyte 1 Analyte 2 Analyte 3 Analyte 4 Analyte 5 Analyte 6

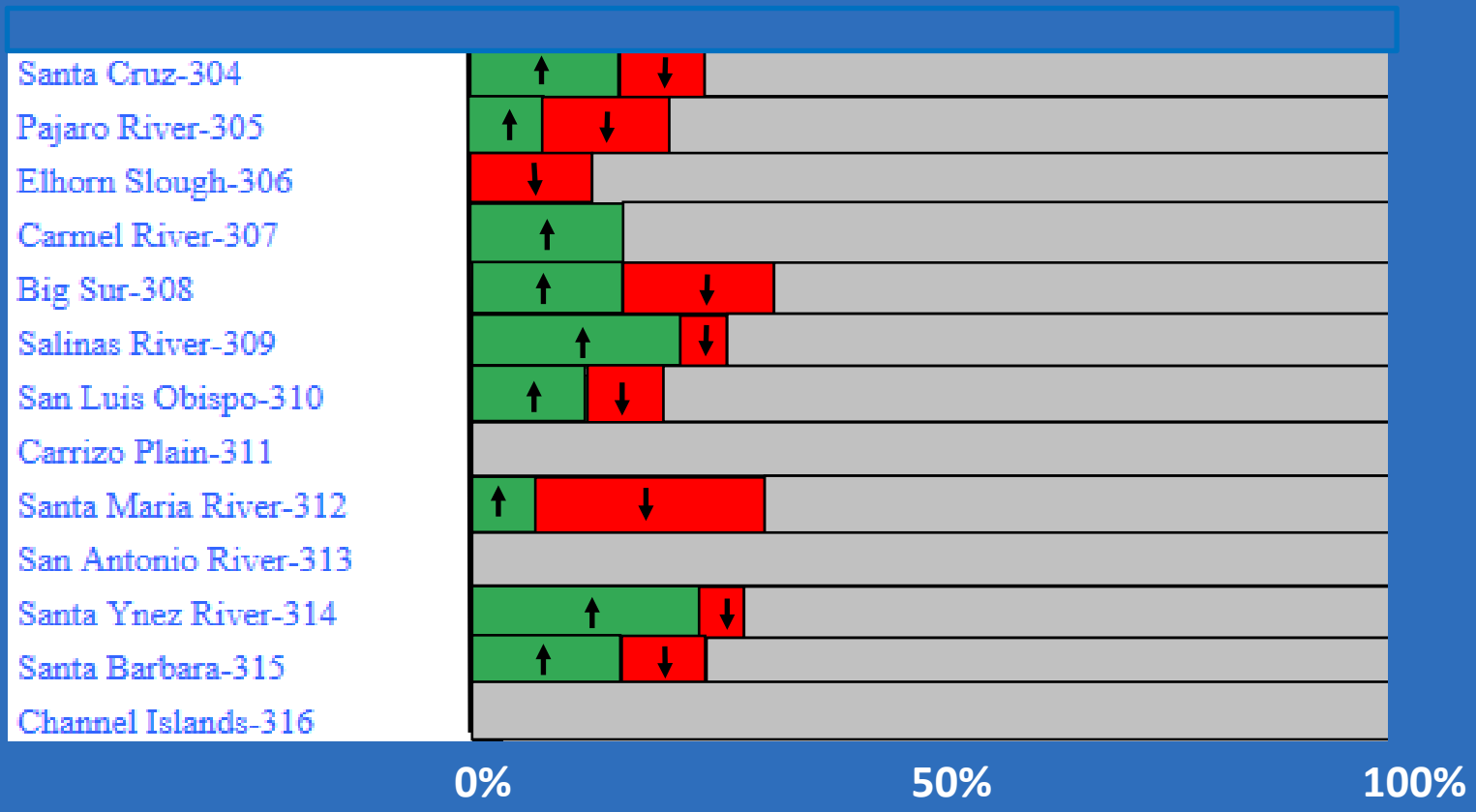
Before period: Mean (78 + 59 + 85 + 22 + 73 + 88) = 68
After period: Mean (41 + 46 + 67 + 41 + 73 + 88) = 59



At the level of the index, the site is getting worse



Report Card Scores for Hydrologic Unit areas



Percent of Hydrologic Unit areas showing improvement (green) or degradation (red) in health scores.

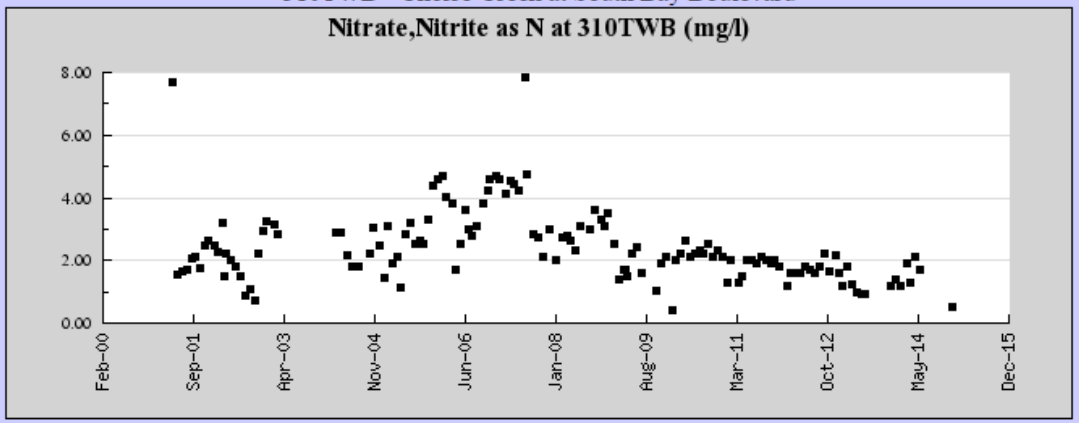
California Central Coast Data Navigator

Central Coast Ambient Monitoring Program

Home | Basic Water Quality | Analytes | Aquatic Life

Watersheds | Waterbodies | Monitoring Sites

310TWB - Chorro Creek at South Bay Boulevard



▪ represents a non-detect

Map Overlays | Chart Options | More Information | Get Data

● = Excellent ● = Good ● = Fair ● = Poor ● = Very Poor ⇧ = Getting Better ⇩ = Getting Worse ○ = No change

When no goal is available Lowest ○= 0-25% ○= 25-50% ○= 50-75% ●= 75-100% Highest △= Increasing ▽= Decreasing

**	Analyte Name	Units	Min	Mean	Geomean	Median	Max	Samples	Dates	Aquatic life Goal	Human health Goal
○	Algae-filamentous	%	0	22	15	5	100	25	2001-2004	50	
●	Algae-floating mats	%	0	0	3	0	10	107	2005-2015	20	
●	Ammonia as N,Total	mg/l	0.010	0.046	0.035	0.030	0.360	144	2001-2014	1.900	30.000
⇧	Ammonia as N,Unionized	mg/l	0.0001	0.0015	0.0008	0.0007	0.0368	140	2001-2014	0.0250	
▽	Boron,dissolved	mg/l	0.01	0.13	0.12	0.11	0.26	133	2001-2014	1.50	1.00
▽	Chloride	mg/l	29.0	83.1	79.5	83.0	130.0	134	2001-2014		
⇩	Chlorophyll a	ug/l	0.000	2.634	1.422	1.600	35.920	136	2001-2015	15.000	
○	Coliform, E. coli	MPN/100 ml	4	402	87	86	19,000	109	2005-2014		126
○	Coliform,Fecal	MPN/100 ml	8	664	142	155	50,000	140	2001-2014		200
○	Coliform,Total	mpn/100 ml	46	4,810	1,171	920	160,000	139	2001-2014		1,000
▽	Dissolved Solids,Total	mg/l	270.0	611.6	604.8	610.0	890.0	141	2001-2014		500.0

AQUATIC LIFE GOAL: 80% of aquatic habitat is healthy; remaining 20% exhibit positive trends in key parameters

INTEGRATION OF:

I. Multiple data types into a report card assessment of "healthy aquatic habitat"

III. Trends in analytes, indices and spatial areas

II. Site level data and modeled data into a spatial assessment of whole watersheds