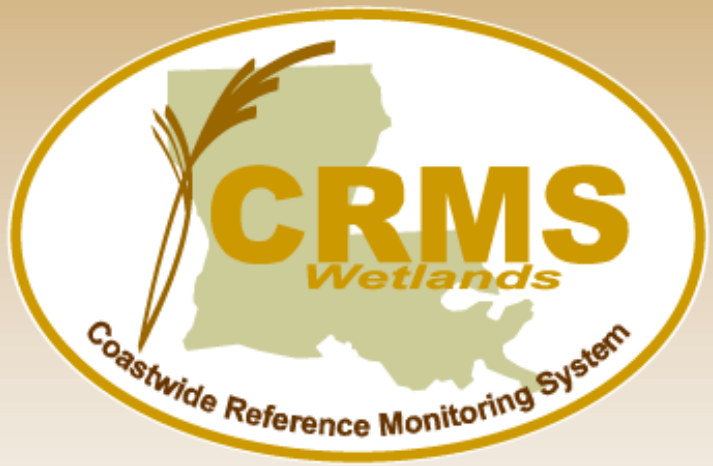
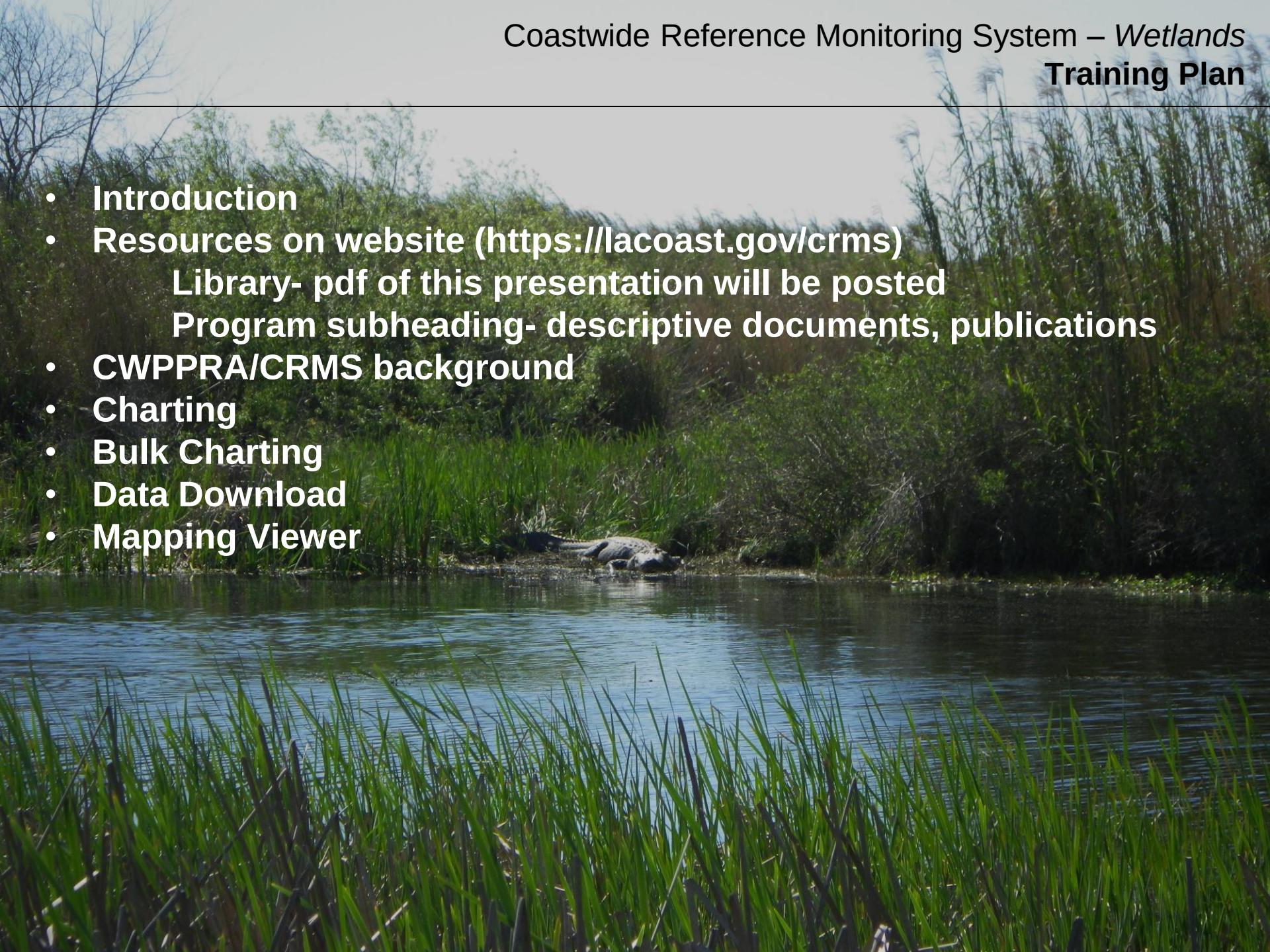
CRMS Website Training

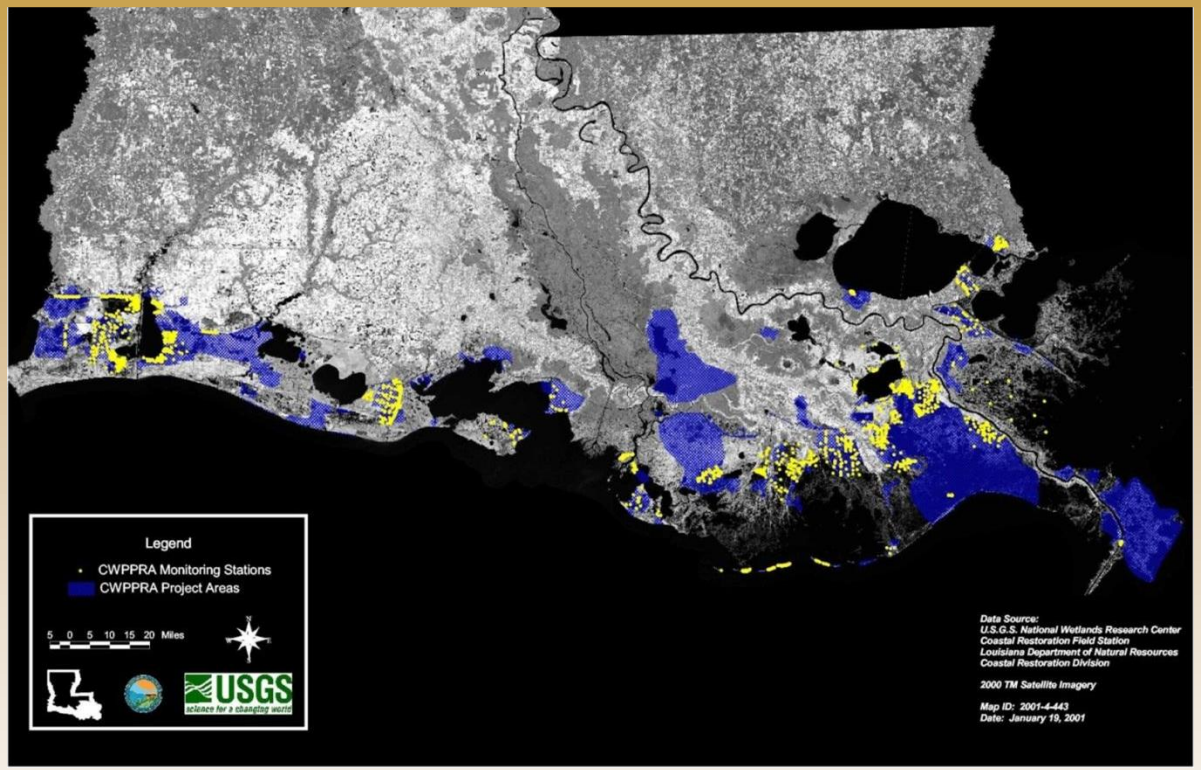


April 2017

https://lacoast.gov/crms
703.648.4848
69619006#



- **Introduction**
- **Resources on website (https://lacoast.gov/crms)**
  - **Library- pdf of this presentation will be posted**
  - **Program subheading- descriptive documents, publications**
- **CWPPRA/CRMS background**
- **Charting**
- **Bulk Charting**
- **Data Download**
- **Mapping Viewer**

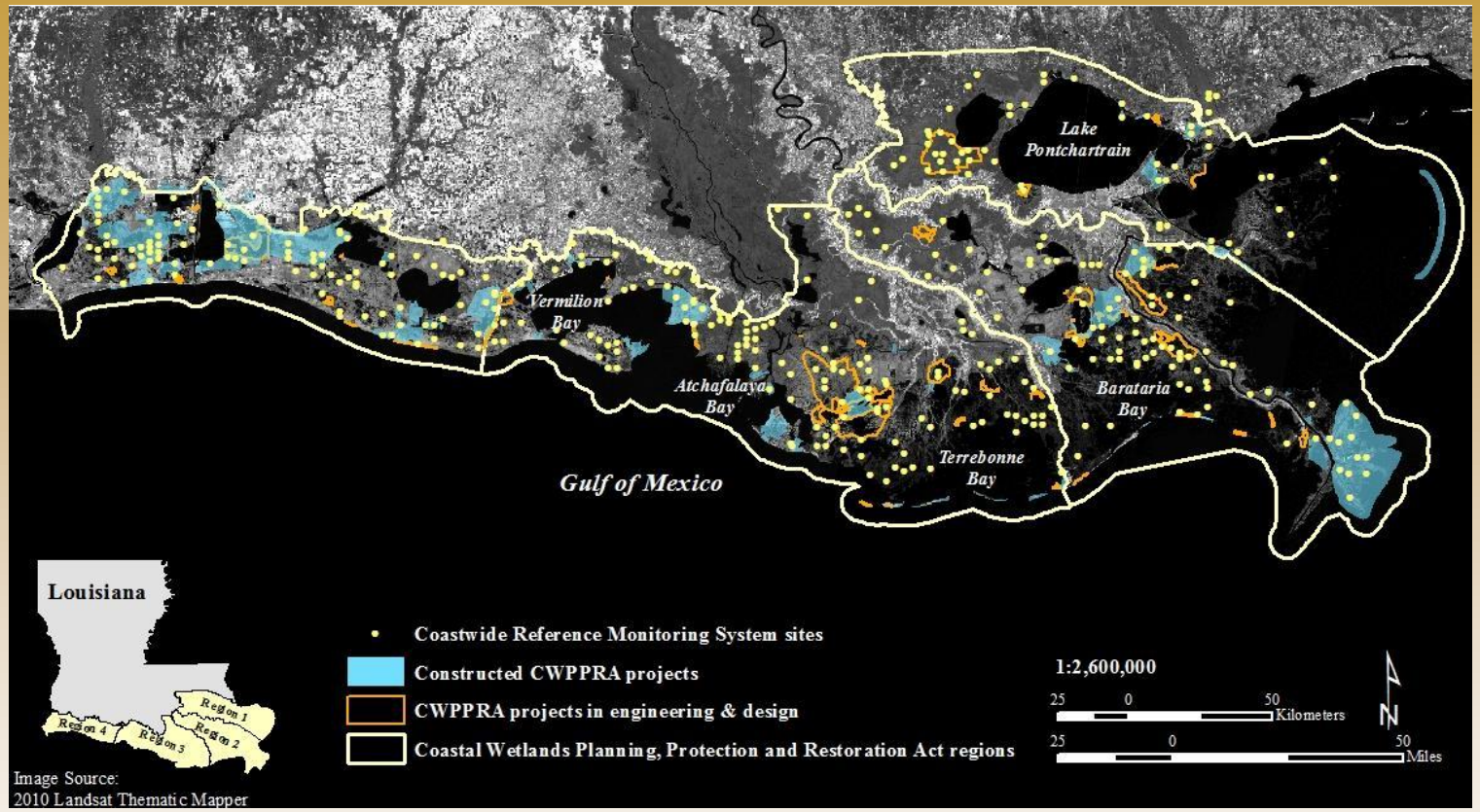


Restoration project types: diversions of freshwater and sediments, marsh creation, shoreline protection, sediment and nutrient trapping, hydrologic restoration, and vegetation planting

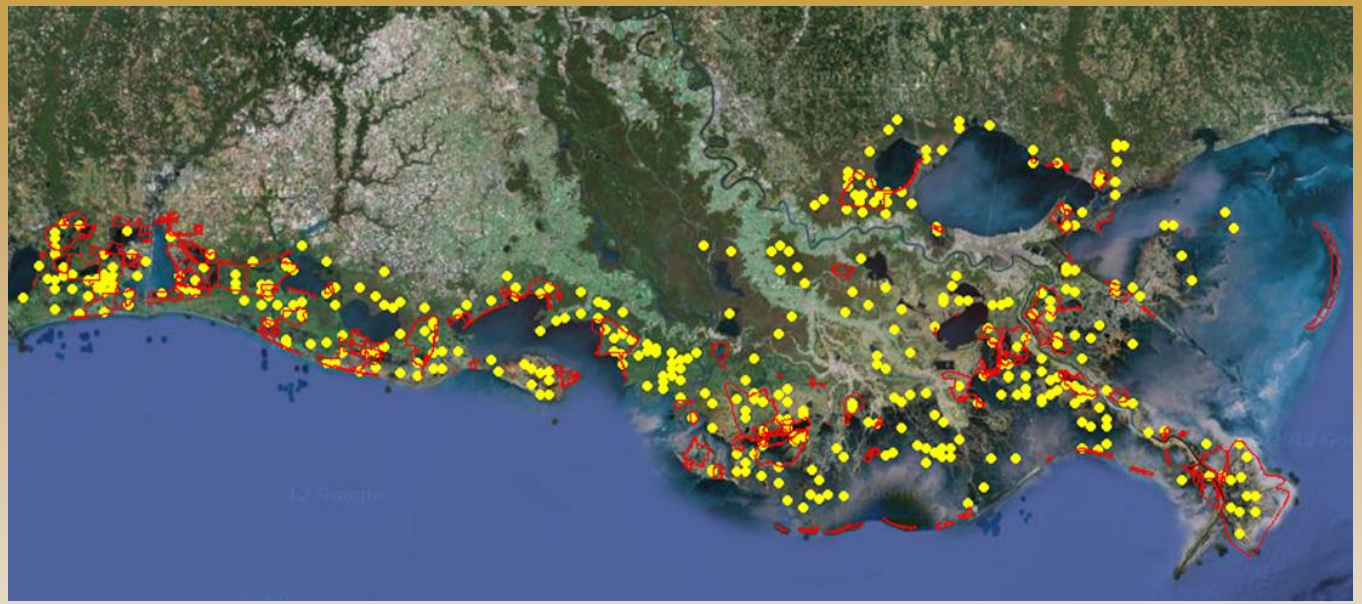
- CWPPRA was congressionally funded in 1990 and mandated 20 years of restoration project monitoring
- CWPPRA program uses multiple restoration techniques
  - size and types of projects vary
- Initially the program used paired project and reference sites
  - difficult to find “uninfluenced” reference
  - pre-construction vs. post-construction time scales
- Inconsistent monitoring variables and collection frequencies across projects with short data records

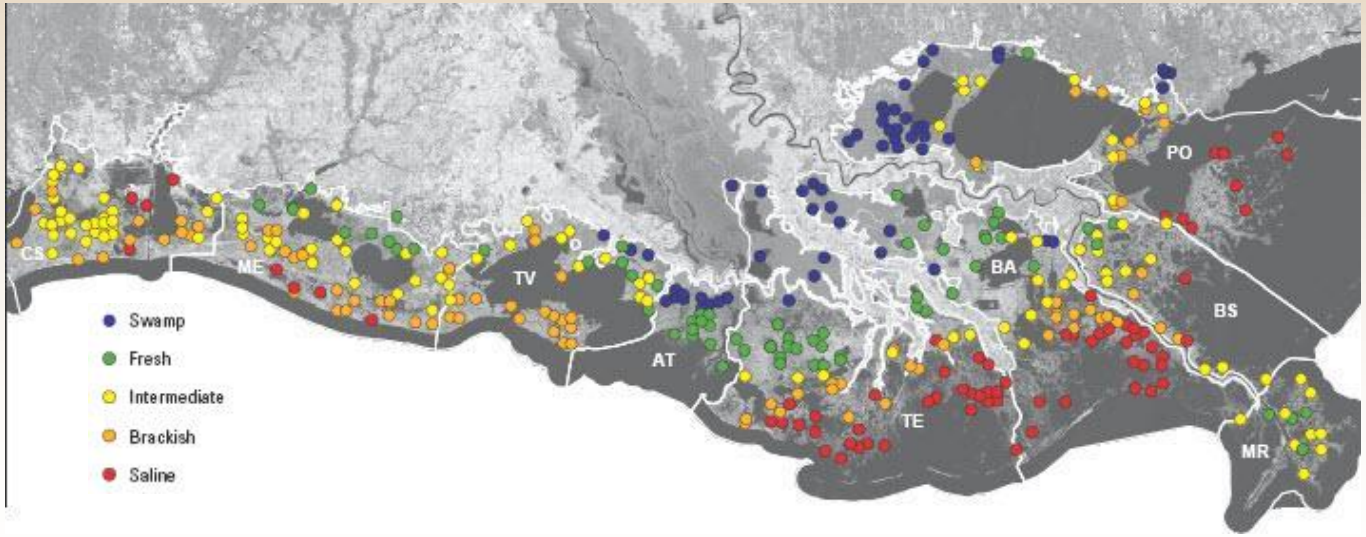
Coastwide Reference Monitoring System – *Wetlands*

Purpose

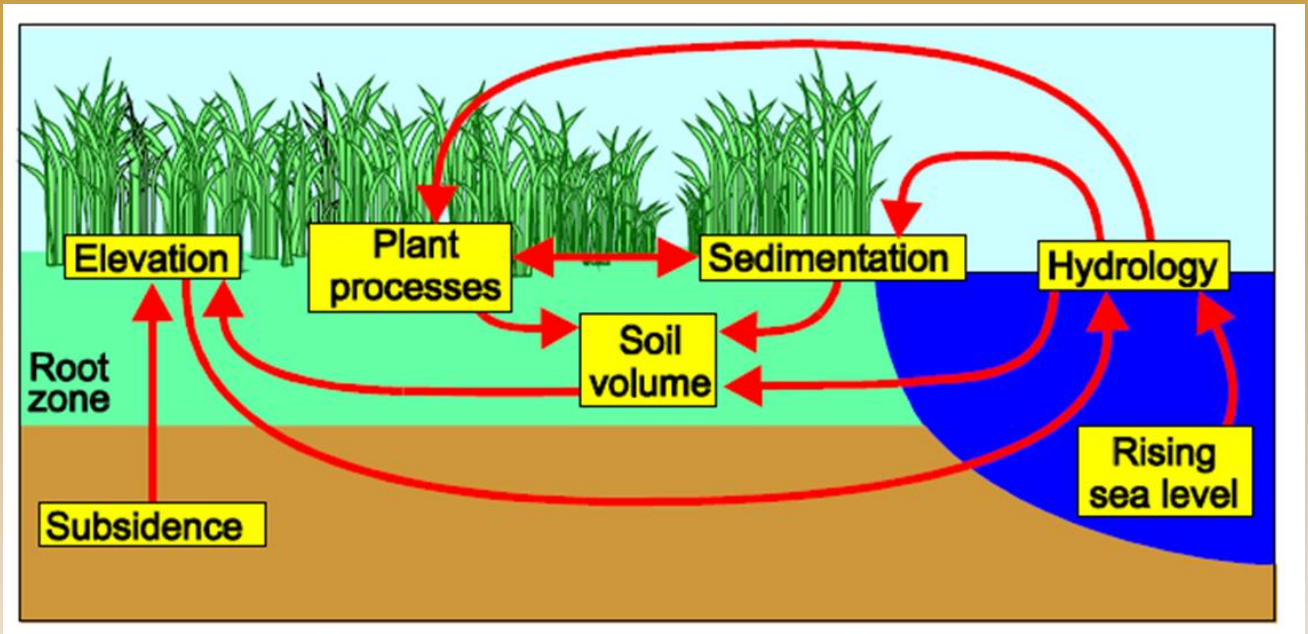


- **To improve our ability to determine the effectiveness of individual coastal restoration projects.**
- **Provide information to evaluate coastal wetlands at the project, basin, and coastwide scales.**
- **To determine the ecological condition of coastal wetlands to ensure that the strategic coastal planning for Louisiana (Coast 2050, LCA, Louisiana Master Plan) is effective in recreating a sustainable coastal ecosystem.**





- **Funded by CWPPRA in 2003 & State of LA**
- **CPRA/USGS Sponsors**
- **~ 390 CRMS sites**
- **Long-term dataset (2006-2019)**
- **Sites inside & outside of CWPPRA projects**
- **Sites in swamp, fresh, intermediate, brackish, and salt marsh**
- **Barrier islands monitored through BICM, not CRMS**
- **Allows for multi-scale assessments through CRMS report cards**
- **Data used for future scenario modeling**



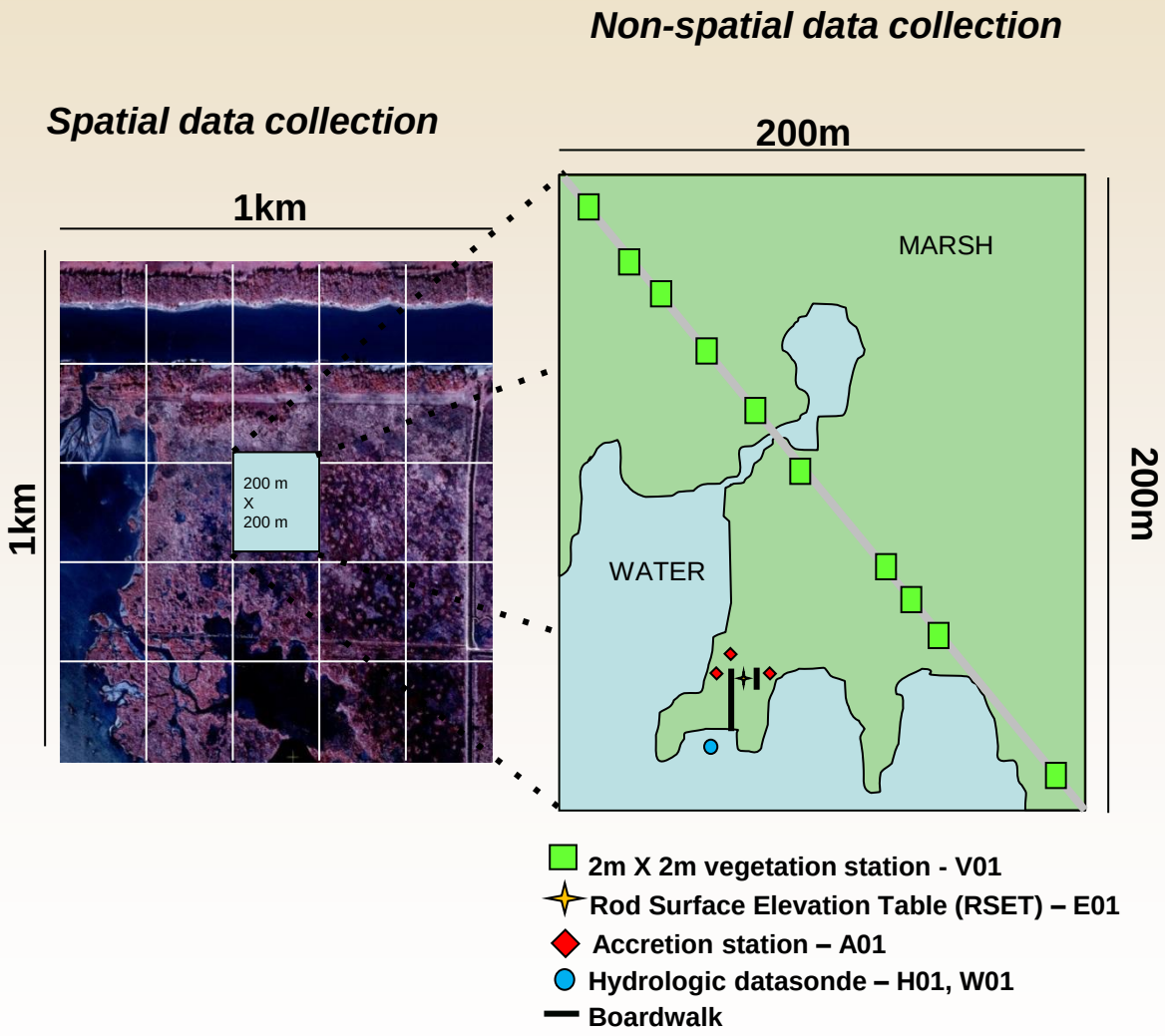
Questions to address through CRMS:

Did the restoration program:

- reduce coastal wetland loss?
- sustain a diversity of vegetation types within basins?

Is the restoration program effective in reducing major stressors on wetlands (e.g., flooding regime, salinity, elevation change)?

Coastwide Reference Monitoring System – *Wetlands*
Site Design



Typical Marsh Site

Typical Swamp Site

CRMS sites contain numerous CRMS stations

See cheat sheet for details of the standardized naming conventions

CRMS DATA COLLECTION INFORMATION AND SCHEDULE

CRMS website: http://lacoast.gov/crms

Standard operating procedures: CRMS website-Program/Administration/Support Docs/Folse et al. 2014.

Download "raw" data from Coastal Information Management System (CIMS): CRMS website-Data/Tabular/CIMS Data Tool (http://cims.coastal.louisiana.gov/)

Hydrographic: Station number (H01): Continuous hourly salinity, temperature, and water level data are collected. At most sites the data sonde is in an open water body or bayou.

- Station number (W01): Continuous hourly salinity, temperature, and water level but the data sonde is in a well in the marsh instead of an open water body.
- Station number (M01): Marsh mat stations are established in floating marshes where the marsh mat rises and falls with water level.

CRMS sites with *realtime* hydro gages: CRMS0061, 0282, 0411, 0465, 0568, 0609, 0615, 0651, 2418, 5373 -- http://waterdata.usgs.gov/la/nwis/current/?type=flow

Soil Porewater Salinity: Station number (P01, P02, P03): Discrete collections near the CRMS boardwalks: 1) intermittently throughout the year during hydro data sonde servicing and 2) twice annually during spring and fall RSET/accretion sampling. Collected at each vegetation station (10 herbaceous vegetation stations per CRMS site) during vegetation sampling in the late summer/early fall.

Herbaceous Vegetation: Station number (V01, V02, etc.): Species composition, percent cover, and dominant height once annually (late summer/early fall) at 10 stations per CRMS site. Plots are 2X2m.

Vertical Accretion (Station number (A01, A02, etc.)) **& Surface Elevation** (Station number E01 or E02): Collected twice annually (spring and fall) using cryo-coring and rod-surface elevation tables.

Swamp Forest:

1) Overstory Station number (F01, F02, etc.) (at least every 3 years): species composition and diameter at breast height (DBH) for woody shrubs and trees > 5 cm DBH in late summer/early fall. Canopy cover with a densiometer annually during herbaceous vegetation sampling. Plots are 20X20m.
2) Understory Station number (F01**U**NW, **U**C, **U**SE, etc.) (every 3 years): species composition, height, DBH, stem density of woody shrubs and trees < 5 cm DBH (late summer/ early fall). Plots are 6X6m.
3) Swamp Herbaceous Vegetation Station number (F01**V**NW, **V**C, **V**SE, etc.) (annually in the late summer/early fall): same as for herbaceous vegetation as described above but at 9 stations per swamp CRMS site. Plots are 2X2m.

Soil Properties: Station number (S01, S02, etc): Collected upon site establishment and every 10 years in marshes and 6 years in swamps.

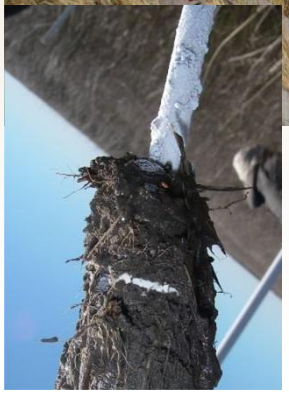
- pH, salinity, bulk density, soil moisture, percent organic matter, wet/dry volume

Cheat Sheet:

Provided via email (4/7/17) and available in the FAQ's on home page

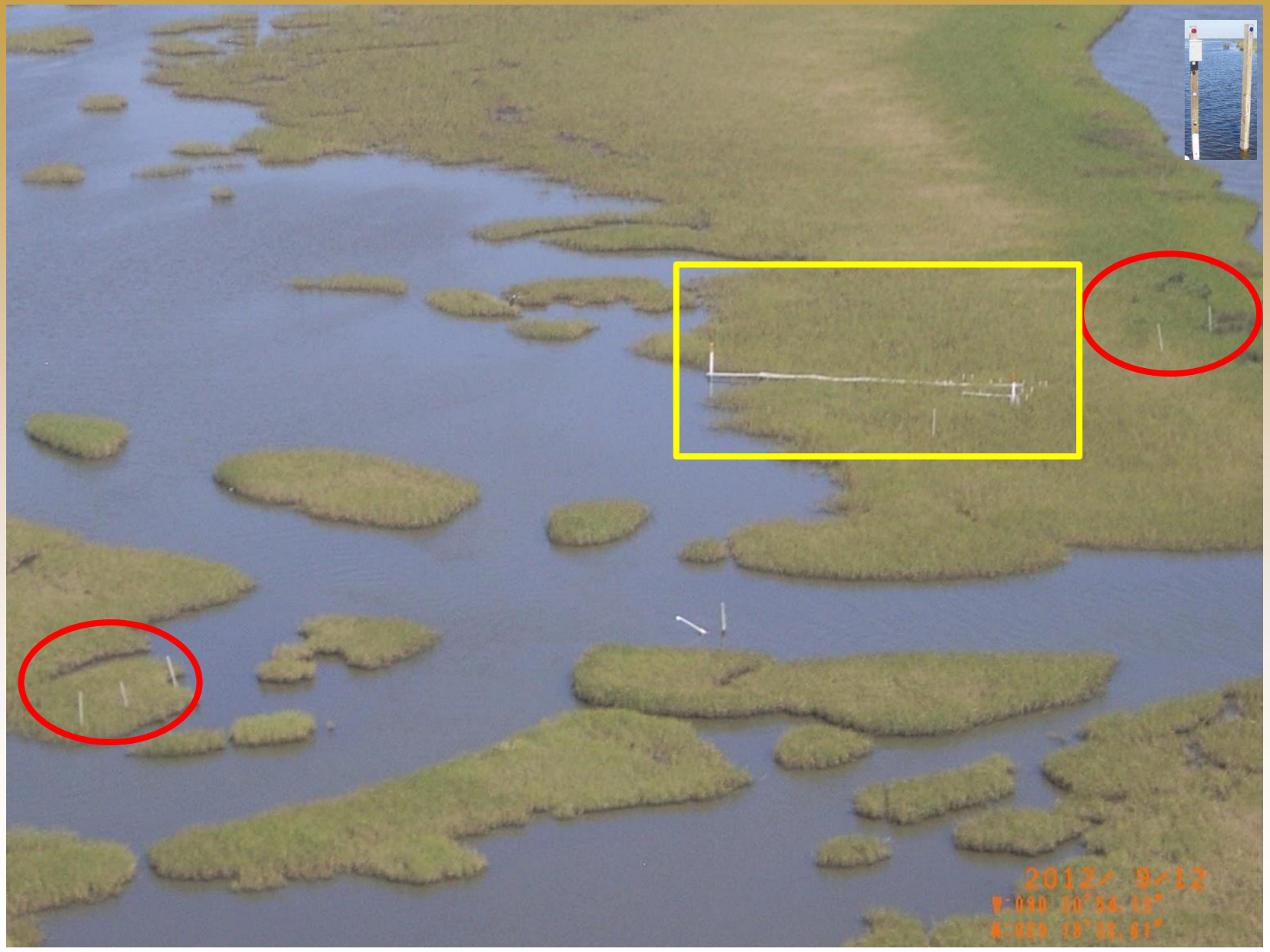
Aerial photo **2005** **2008**

1km² scale:
High resolution aerial photography based land:water analyses to investigate land change through time.



200m² scale: Field data collection using standardized data collection protocols and consistent sampling intervals

Site Layout



Coastwide Reference Monitoring System – *Wetlands*

Site Layout

H01 - Installed in open water, this sonde captures hourly salinity, water surface elevation, and water temperature data.

M01 Floating System:
This monitoring system is deployed in thick marsh mats that can support instrument weight. The data sonde is suspended in the fluid ooze layer and records vertical mat movement, salinity, and water temperature.

M01 Static System:
An anchored pulley system is used to record vertical mat movement in thin marsh mats that cannot support the weight of the monitoring equipment.

P01, P02 - Water samples are extracted from 10 cm and 30 cm depths using a syringe. The salinity of the collected water is used to assess the salt exposure expere-inced within the root zone of the marsh.

E01 - This station uses a Rod Surface Elevation Table (RSET) instrument to measure surface elevation changes relative to a steel rod that is set deep (~100 ft) into the marsh subsurface. An RSET table connects to the rod using a permantly attached collar and measurements are taken by loweing 9 fiberglass pins to the marsh surface. Data is collected over time to measure changes in surface elevation.

A01- Soil accretion, or land building, data is collected by measuring soil that accumulates above a feldspar marker horizon that has been previously placed on the marsh surface. A specialized cryogenic coring device is used to ensure accuate readings of the feldspar location within the core.

Site Data Collection

Data Type	Parameter	Method	Scale	Frequency
Land change	Land:Water Ratio	Satellite Imagery	Hydrologic Basin	3 years
	Land:Water Ratio	Digital Aerial Photography	CRMS Site (1 km^2)	3 years
Vegetation	Emergent Vegetation	Braun Blanquet: % Cover, Species Richness, Height of Dominant Species	(10) 2m x 2m plots per marsh site or (9) plots per swamp sites	Annually during peak biomass
	Forested Vegetation	DBH, Canopy Cover, Understory veg	(3) 20m x 20m Forested plots & (9) 6m X6m Understory plots per site	3 yrs during peak biomass
Soils	Soil Characteristics	Core samples profiled into 4 cm increments to 24 cm. Bulk Density, OM%, Soil Salinity, pH, and Moisture.	3 cores, 18 archived samples per site	6 to 10 years
	Vertical Accretion	Feldspar Plots/Cryogenic Cores	3 plots per site	Twice per year
	Marsh Elevation Change	Rod Surface Elevation Table (RSET)	4 directions per site	Twice per year
Hydrology	Soil Porewater	10 and 30 cm syringe sippers	3 samples per depth per site and at vegetation plots	Variable and annually
	Surface Water Salinity, Temp and Water Level	Submersible Data Logger	in available water within 200m of CRMS site or in a well	Hourly

A STANDARD OPERATING PROCEDURES MANUAL FOR THE COAST-WIDE REFERENCE MONITORING SYSTEM-*WETLANDS*:

Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control

Todd M. Folse, Jonathan L. West, Melissa K. Hymel, John P. Troutman, Leigh A. Sharp, Dona Weifenbach, Tommy E. McGinnis, Laurie B. Rodrigue, William M. Boshart, Danielle, C. Richardi, C. Mike Miller, and. W. Bernard Wood

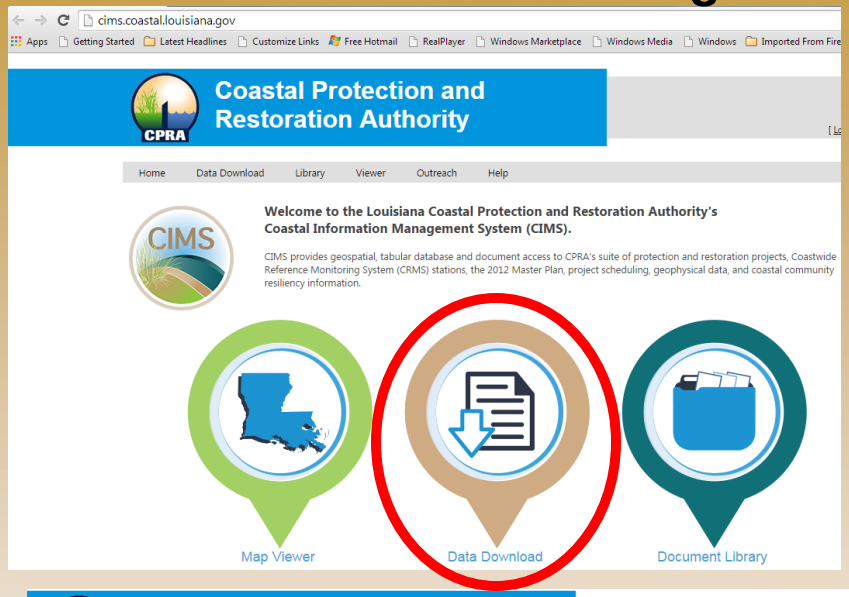
The Louisiana Coastal Protection and Restoration Authority

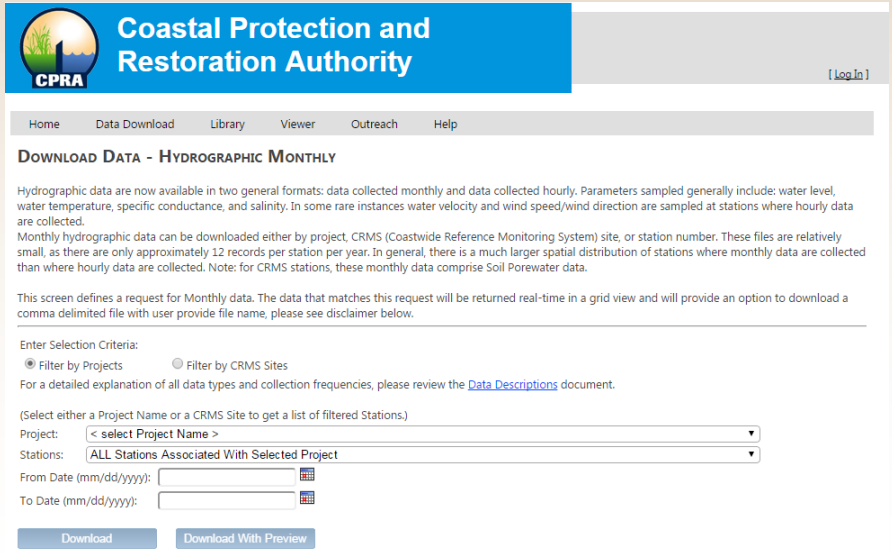
- **QA/QC procedure for each data type**
- **Field procedures**
- **Data entry**
- **Initial data review**
- **Automated review during submission into database buffer**
- **CPRA regional office review**
- **Final approval and acceptance into CIMS database-- data lag varies by data type**

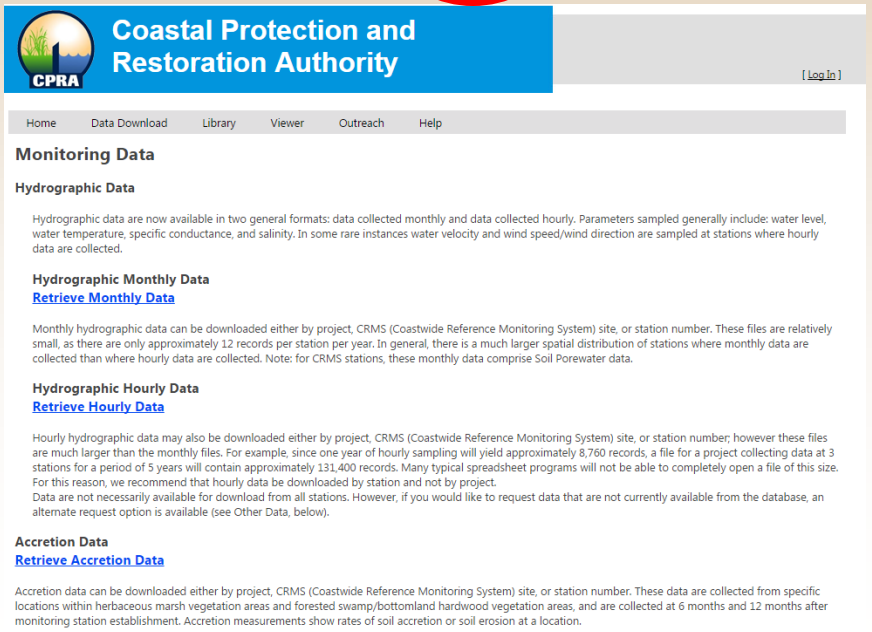
Coastwide Reference Monitoring System – *Wetlands* **Database**

lacoast.gov/crms

cims.coastal.louisiana.gov







Coastwide Reference Monitoring System – *Wetlands* **Database**

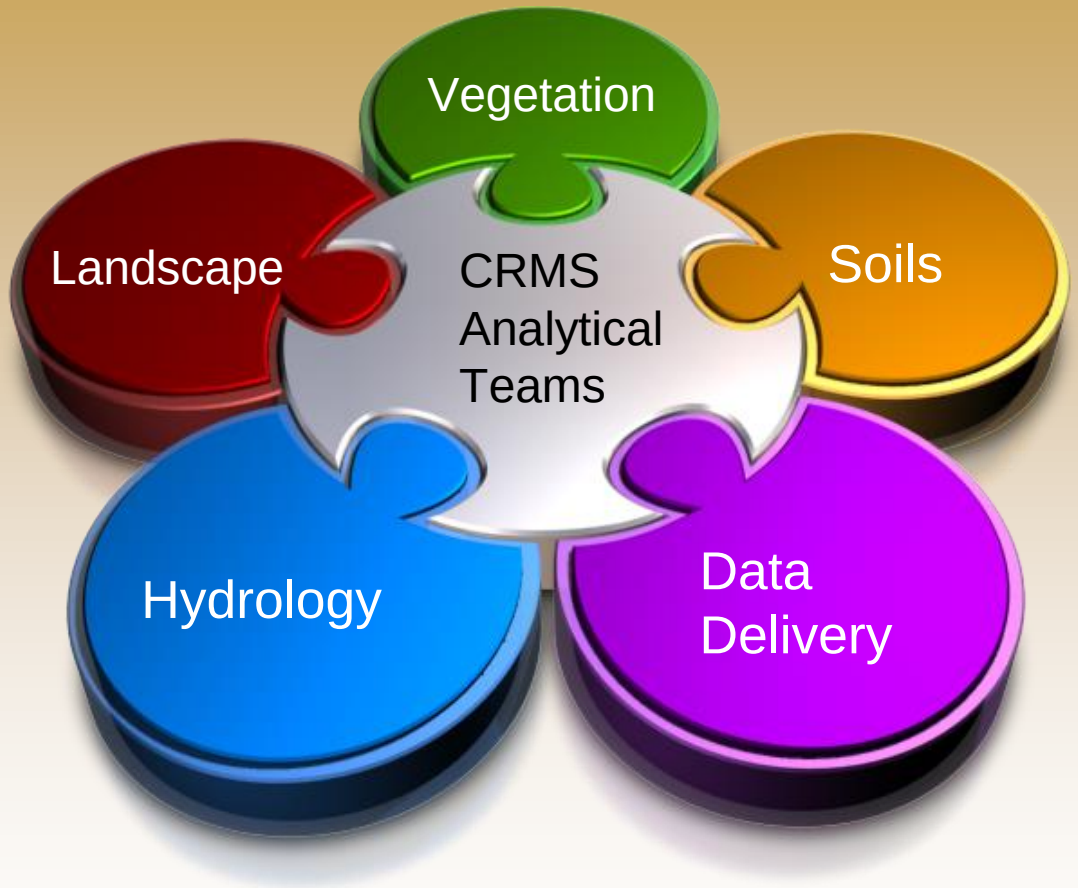
lacoast.gov/crms

cims.coastal.louisiana.gov

CRMS Data Records:

Continuous Hydro – 57.2 million
Marsh Veg - 356K
Surface Elevation - 277K
Discrete Hydro - 221K
Forested Veg - 53K
Accretion - 43K
Soils – 8K

Analytical Teams



- Federal and State Scientists
- Academics
- WARC's Advanced Applications Team
- Oversight by CWPPRA Monitoring Work Group

Coastwide Reference Monitoring System – *Wetlands*
Analytical Teams

- Web mapping viewer
- Summarize and visualize data at multiple scales
- On-the-fly user defined graphics and tools
- Simple queries and data downloads
- Develop multi-metric ecological indices
- Develop report card
- Continually evolving

Overview of Report Card Indices

Vegetation:

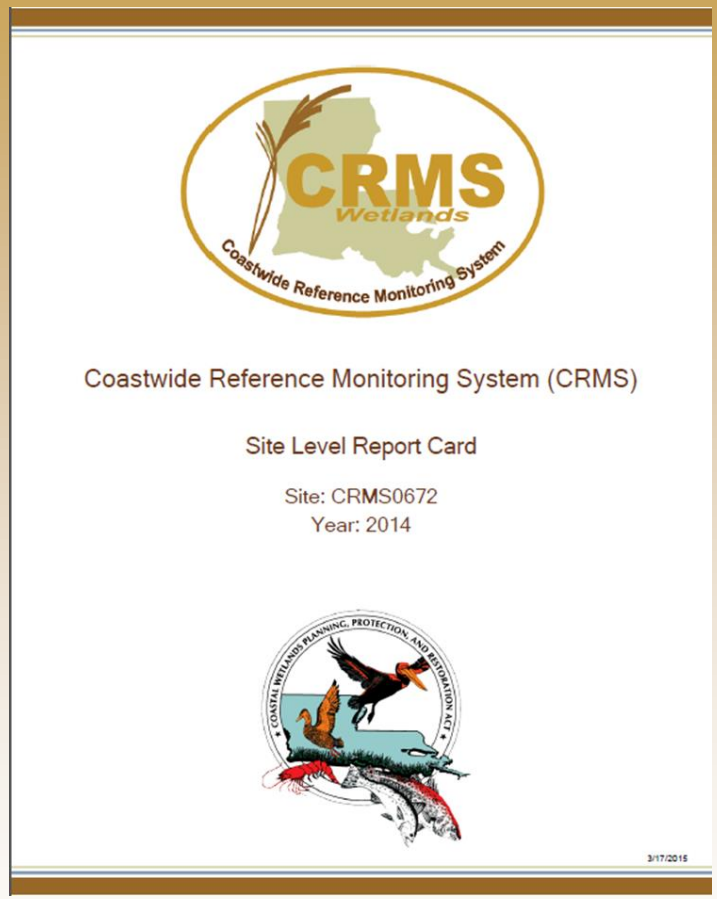
- **Floristic Quality Index (FQI) used to determine wetland quality based on plant species composition.**
- **Vegetation Volume Index (VVI) quantifies the 3D vegetative structure irrespective of species.**

Hydrology:

- **Hydrologic Index (HI) assesses the suitability of average salinity and percent time flooded in maximizing vegetation primary productivity.**

Soils:

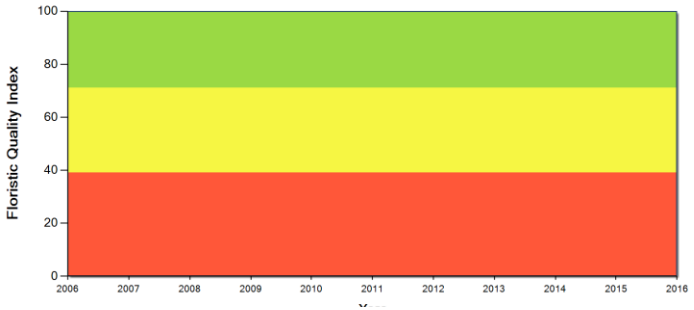
- **Submergence Vulnerability Index (SVI) assesses the vulnerability of a site to submergence based on it's elevation relative to ESLR.**



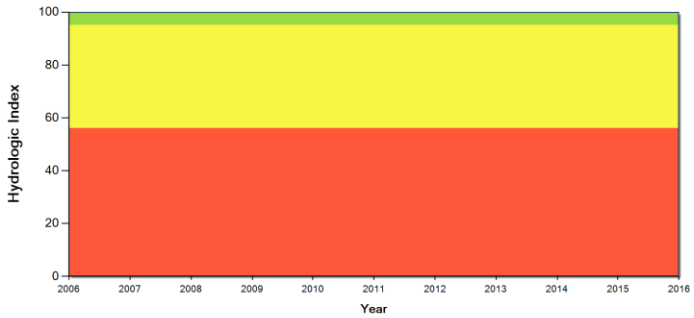
Overview of Report Card Indices

- **Developed using CRMS dataset**
  - **2006-2009**
- **Good (>75%), fair (25-50%), poor (<25%)**
- **Category thresholds vary by index**
- **SVI is a continuous scale without defined thresholds**

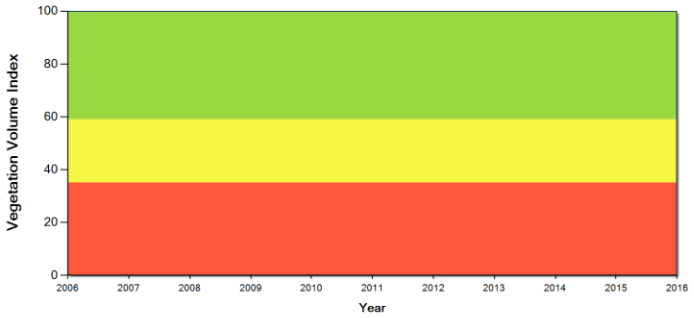
FQI



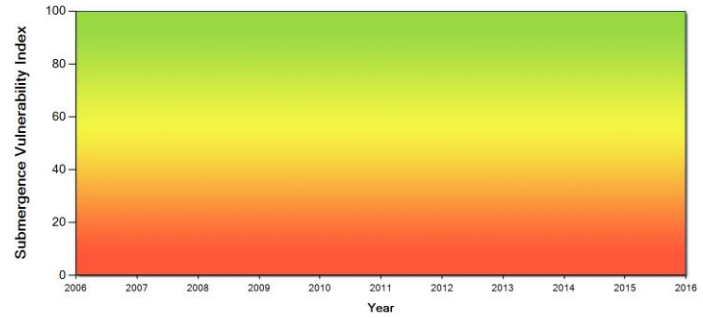
HI



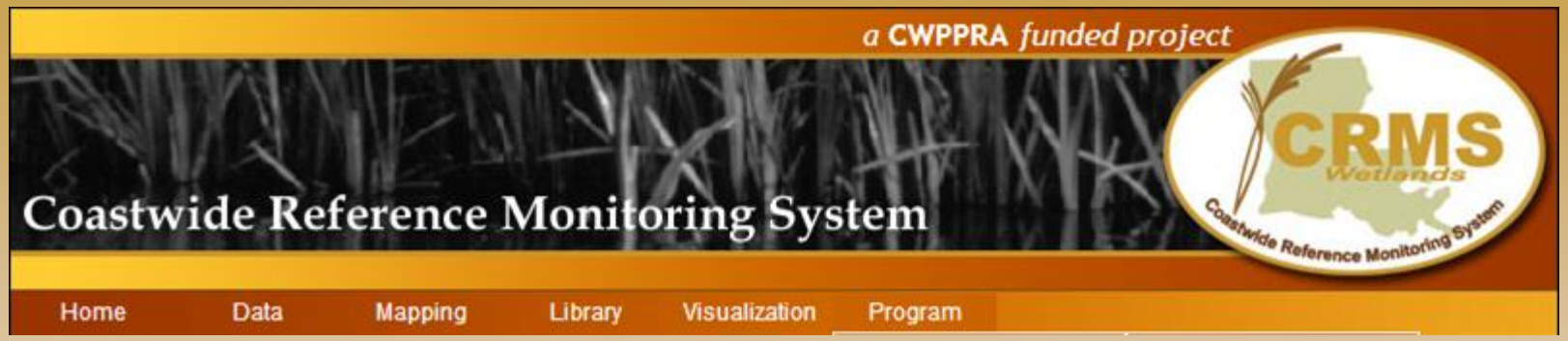
VVI



SVI

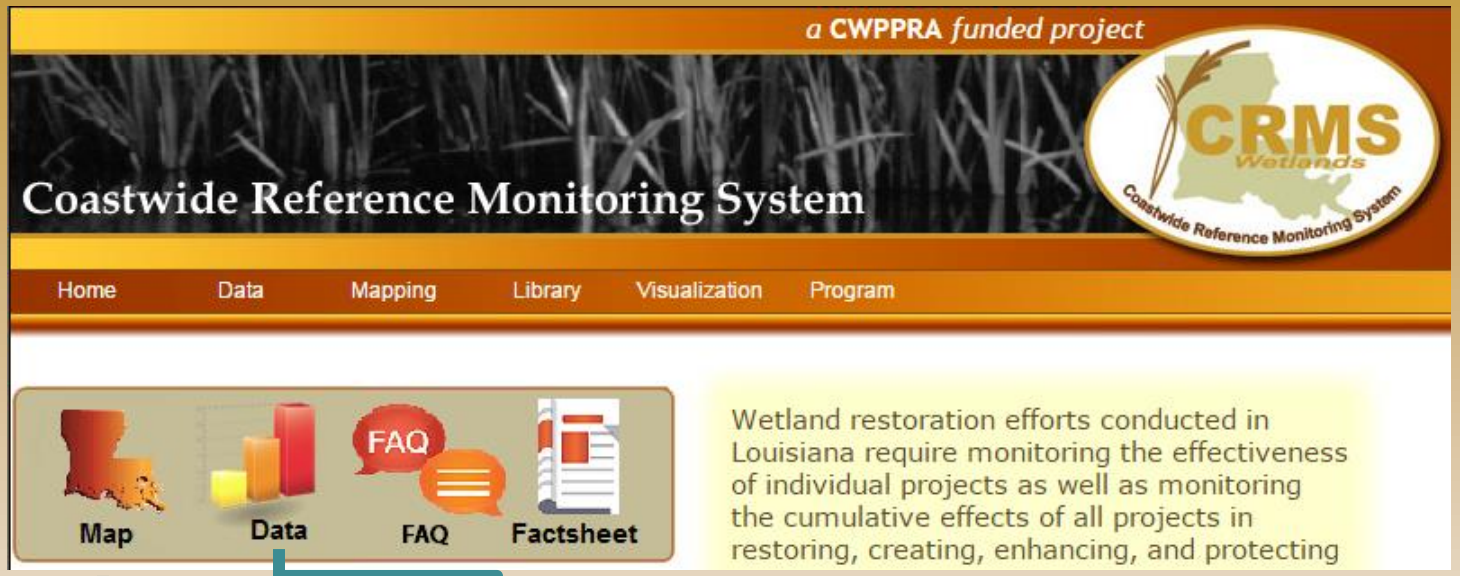


https://lacoast.gov/crms

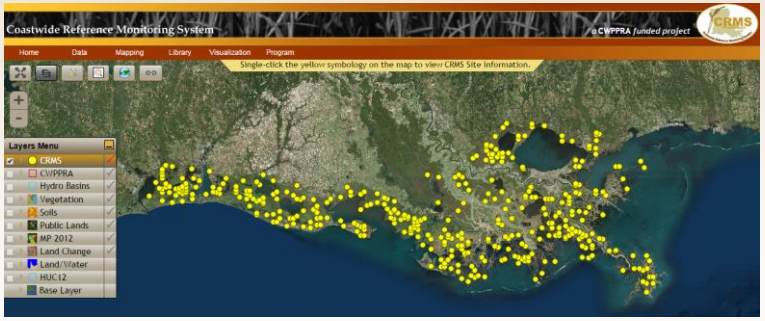


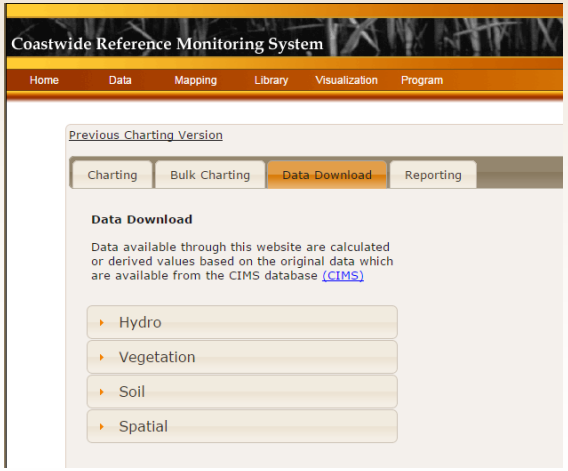
- **Main menu with a series of submenus**
- **Largely self explanatory**
  - **Program Subheading- LOTS of documentation**
    - **Support documents and publications**
    - **Contact information-USGS/CPRA CRMS Leads**
  - **FAQs**
- **Best functionality in Google Chrome**
- **OPM dictated website security changes may result in slower functionality**
- **This presentation focuses on most used features**

Coastwide Reference Monitoring System – *Wetlands*
Site Navigation

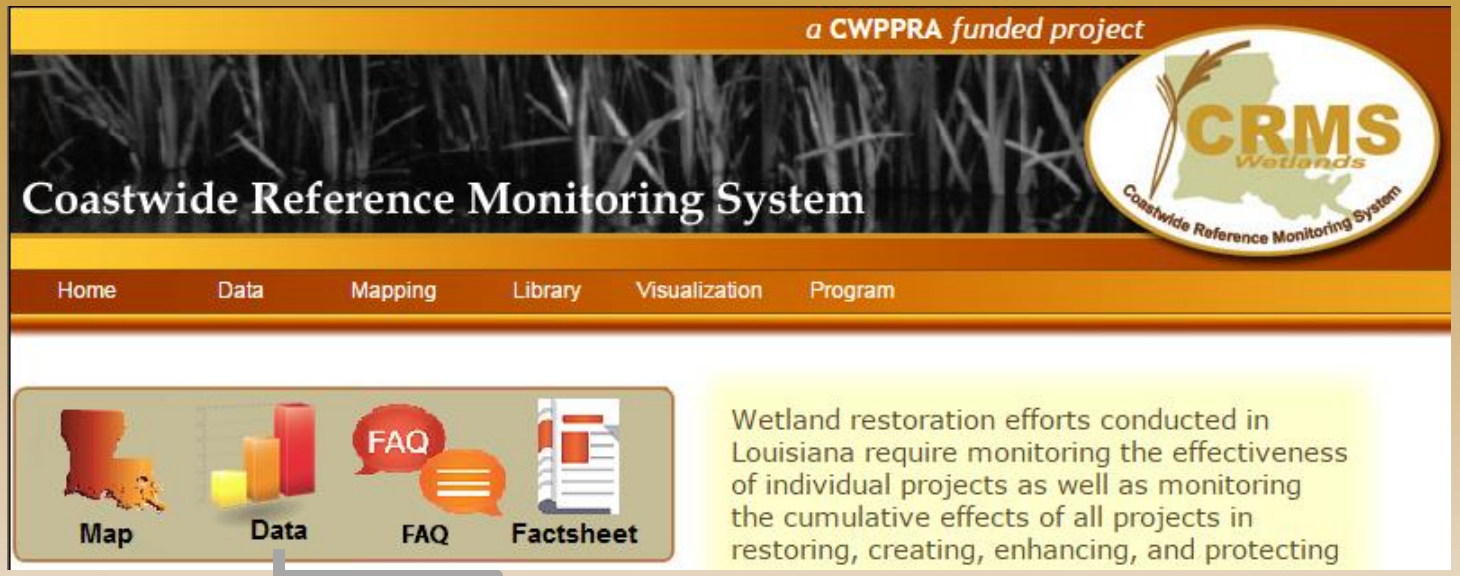


Data → **Charting**

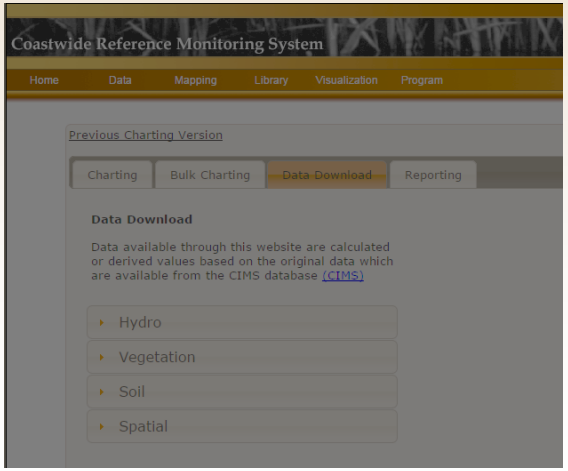


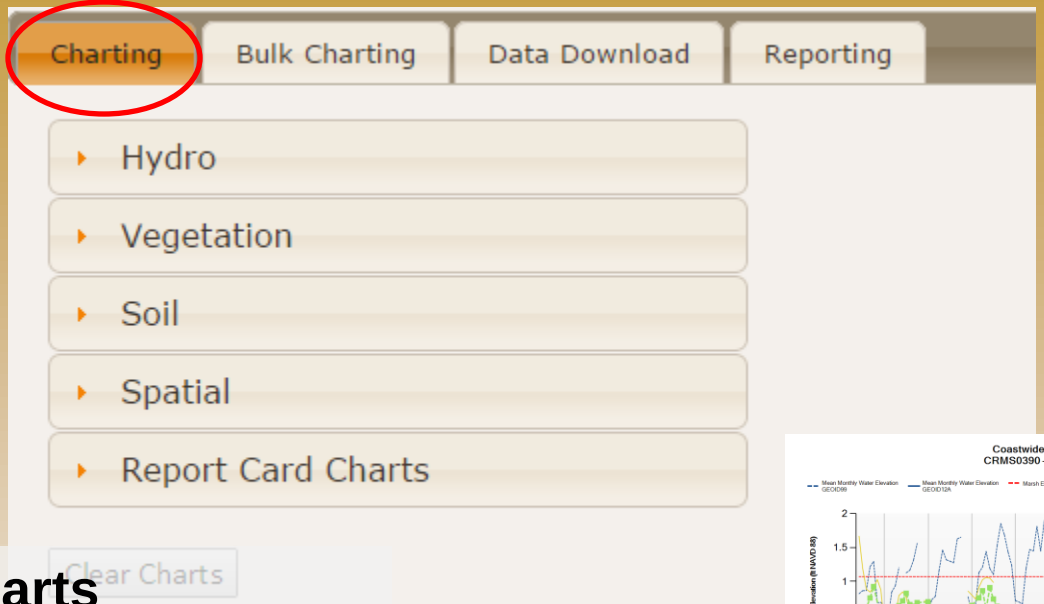


Coastwide Reference Monitoring System – *Wetlands*
Site Navigation



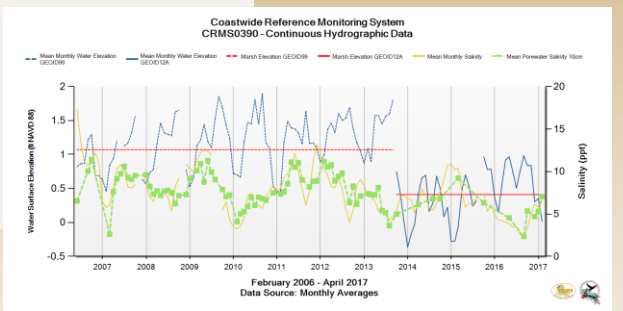
Data → **Charting**

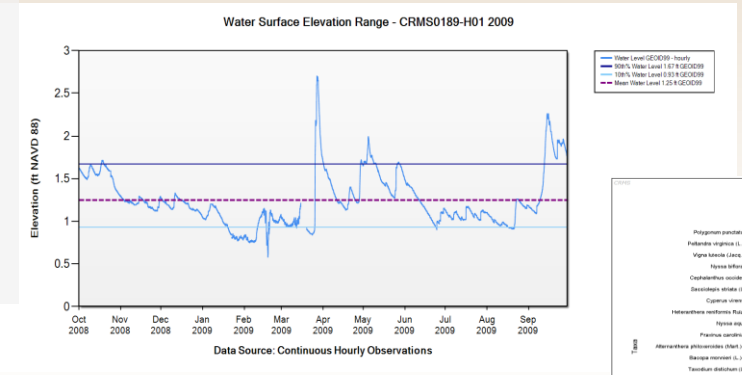


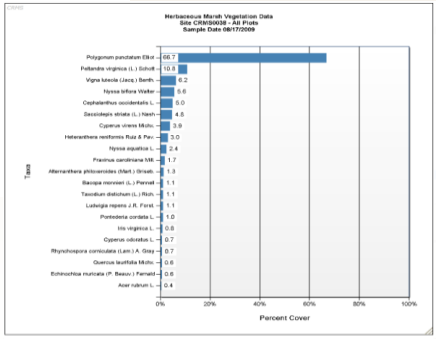


Charts…Lots of Charts

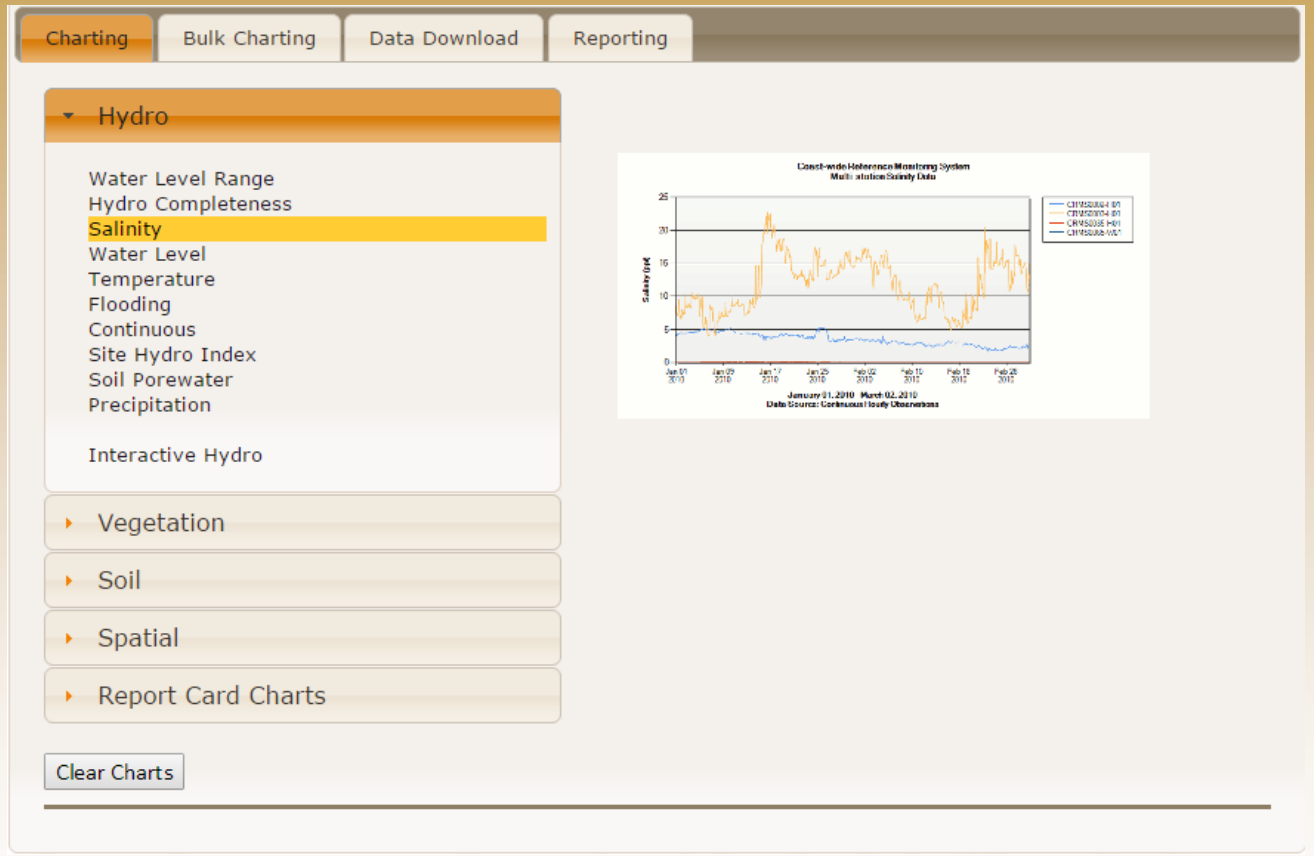
- Surface Elevation/Accretion
- % Organic / Bulk Density
- Vegetation
- Forested
- Porewater
- Hydrographic (Salinity, Temp, Water Level)
- Precipitation
- Report Card



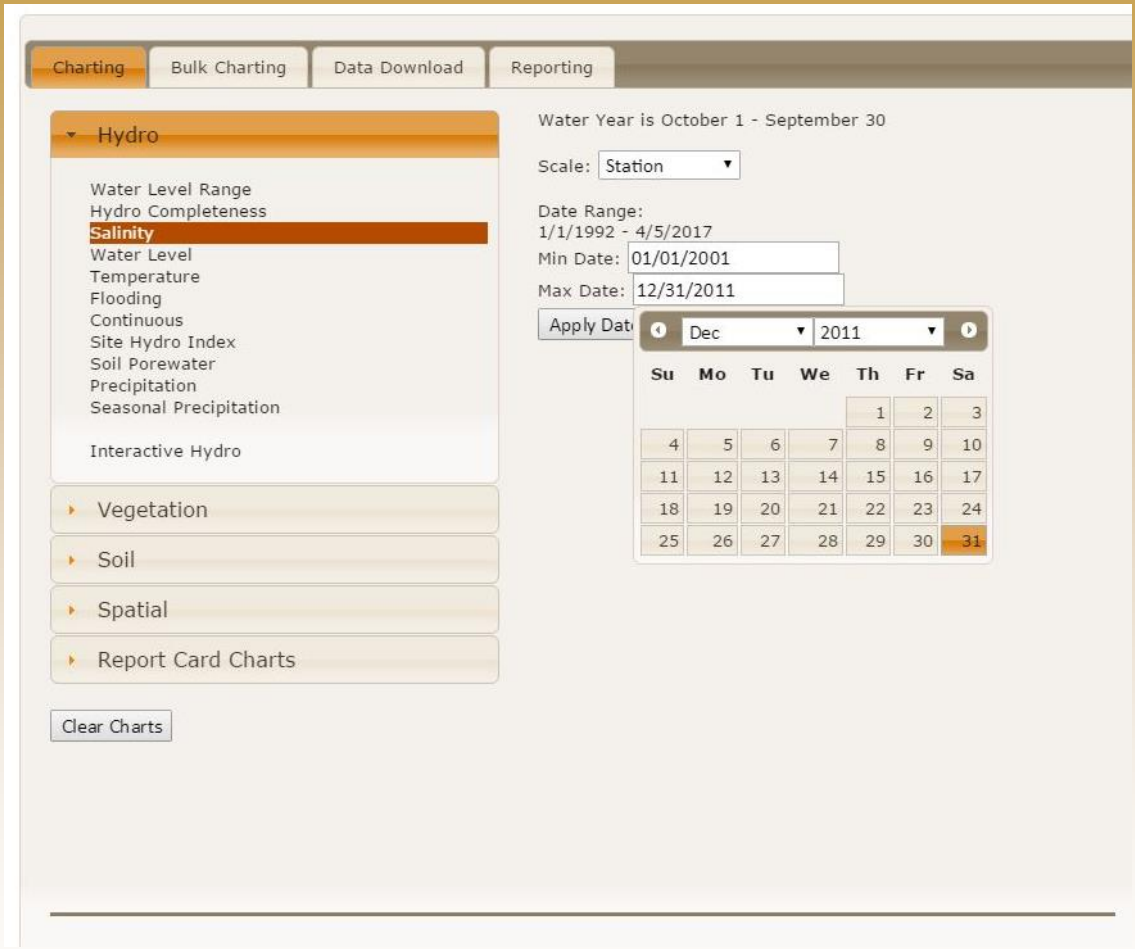




1. **Pick a Data Category**
   Hydro
2. **Pick a Parameter**
   Salinity

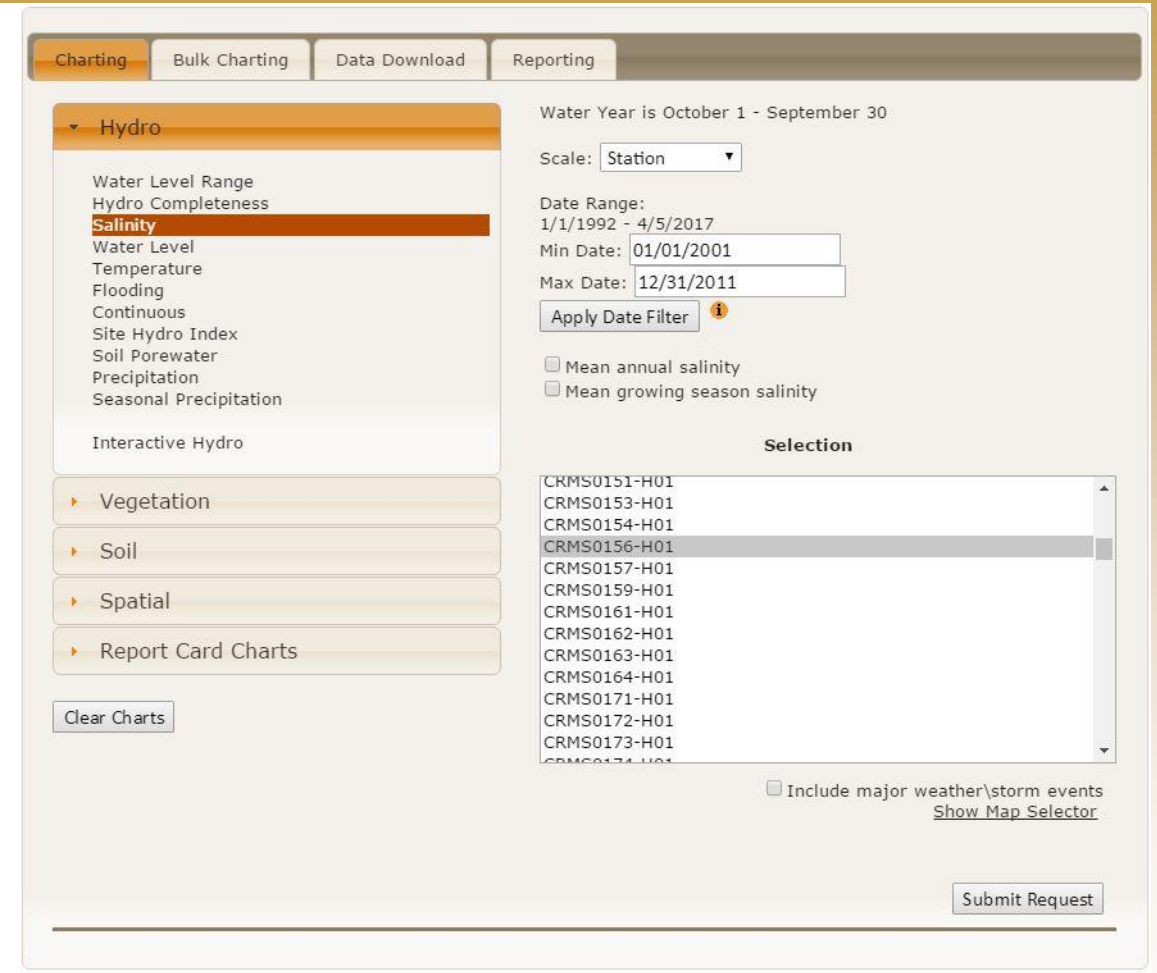


1. **Pick a Data Category**
   Hydro
2. **Pick a Parameter**
   Salinity
3. **Pick a Scale**
   Station
4. **Enter Start / End Dates**
   1/1/2001
   12/31/2011
   Apply Date Filter



Using the Charting Interface

1. **Pick a Data Category**
   Hydro
2. **Pick a Parameter**
   Salinity
3. **Pick a Scale**
   Station
4. **Enter Start / End Dates**
   1/1/2001
   12/31/2011
   Apply Date Filter
5. **Pick Station**
   Submit Request



Using the Charting Interface

1. **Pick a Data Category**
   Hydro
2. **Pick a Parameter**
   Salinity
3. **Pick a Scale**
   Station
4. **Enter Start / End Dates**
   1/1/2001
   12/31/2011
   Apply Date Filter
5. **Pick Station**
   Submit Request

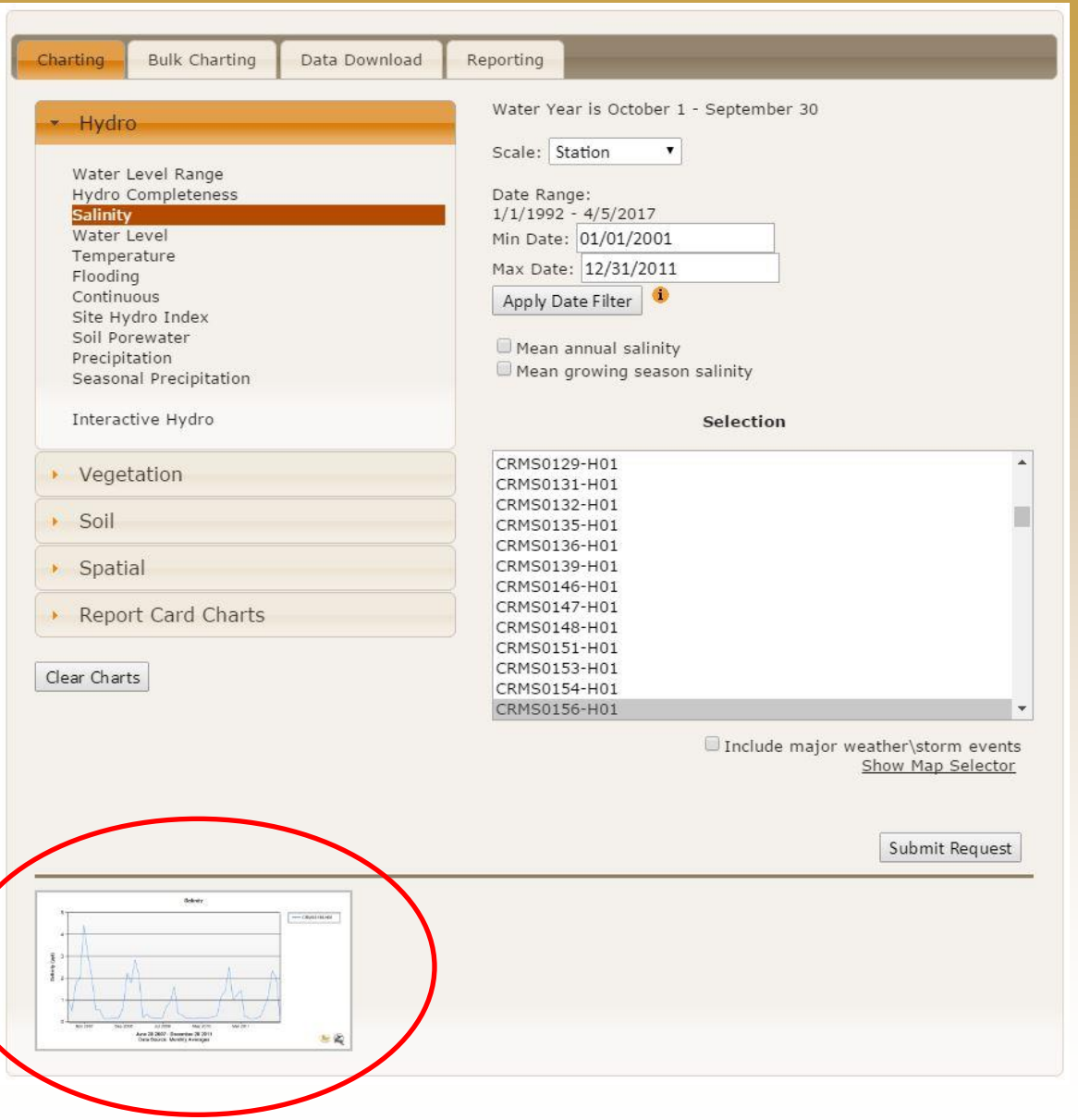
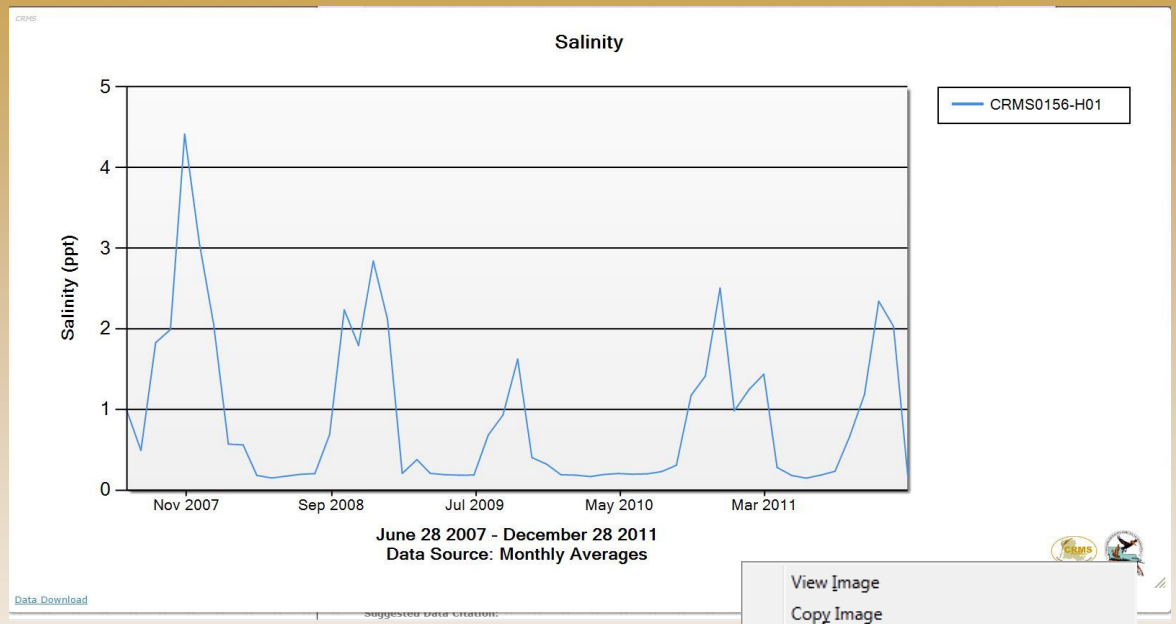


Chart Gallery

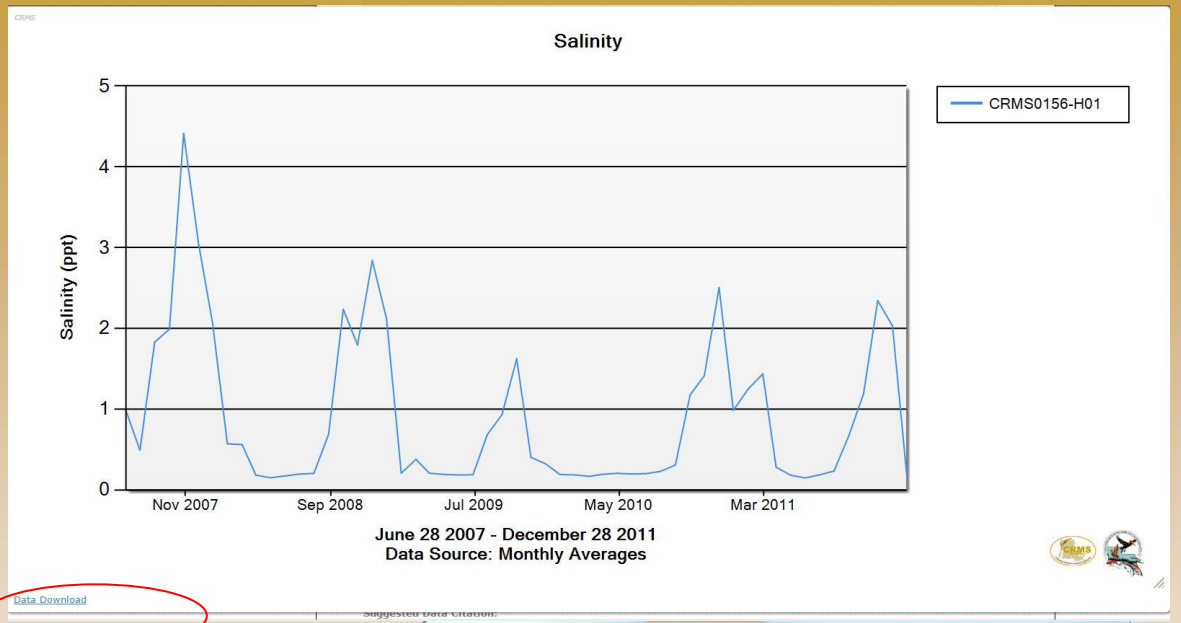
Using the Charting Interface

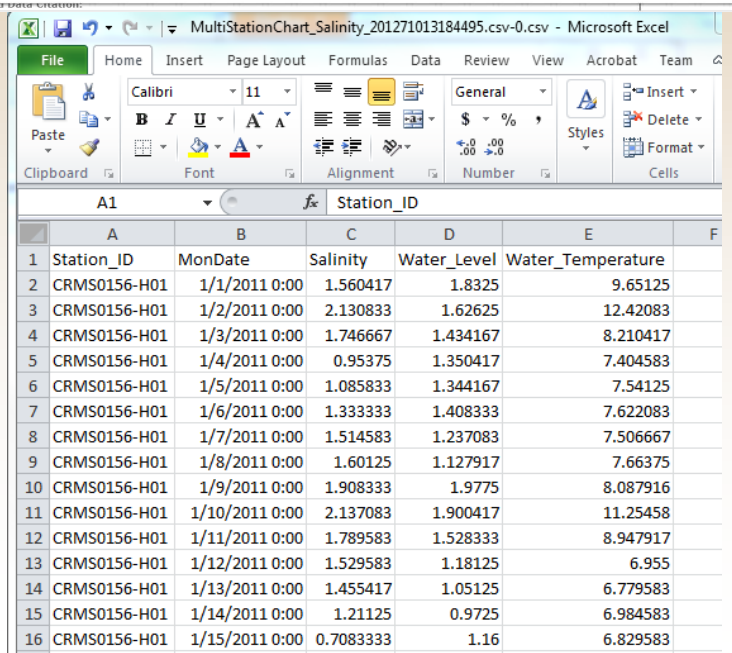
1. Pick a Data Category
    1. Hydro
2. Pick a Parameter
    1. Salinity
3. Pick a Scale
    1. Site
4. Enter Start / End Dates
    1. 1/1/2001
    2. 12/31/2011
    3. Apply Date Filter
5. Pick Site
6. **View Chart**
7. **Save Chart Image**



Using the Charting Interface

1. Pick a Data Category
   - Hydro
2. Pick a Parameter
   - Salinity
3. Pick a Scale
   - Station
4. Enter Start / End Dates
   - 1/1/2001
   - 12/31/2011
   - Apply Date Filter
5. Pick Station
6. Save Chart Image
7. View Chart
8. **Download Data (optional)**





	A	B	C	D	E
1	Station_ID	MonDate	Salinity	Water_Level	Water_Temperature
2	CRMS0156-H01	1/1/2011 0:00	1.560417	1.8325	9.65125
3	CRMS0156-H01	1/2/2011 0:00	2.130833	1.62625	12.42083
4	CRMS0156-H01	1/3/2011 0:00	1.746667	1.434167	8.210417
5	CRMS0156-H01	1/4/2011 0:00	0.95375	1.350417	7.404583
6	CRMS0156-H01	1/5/2011 0:00	1.085833	1.344167	7.54125
7	CRMS0156-H01	1/6/2011 0:00	1.333333	1.408333	7.622083
8	CRMS0156-H01	1/7/2011 0:00	1.514583	1.237083	7.506667
9	CRMS0156-H01	1/8/2011 0:00	1.60125	1.127917	7.66375
10	CRMS0156-H01	1/9/2011 0:00	1.908333	1.9775	8.087916
11	CRMS0156-H01	1/10/2011 0:00	2.137083	1.900417	11.25458
12	CRMS0156-H01	1/11/2011 0:00	1.789583	1.528333	8.947917
13	CRMS0156-H01	1/12/2011 0:00	1.529583	1.18125	6.955
14	CRMS0156-H01	1/13/2011 0:00	1.455417	1.05125	6.779583
15	CRMS0156-H01	1/14/2011 0:00	1.21125	0.9725	6.984583
16	CRMS0156-H01	1/15/2011 0:00	0.7083333	1.16	6.829583

Multi-Station Charting- Plots data from multiple stations on the same chart

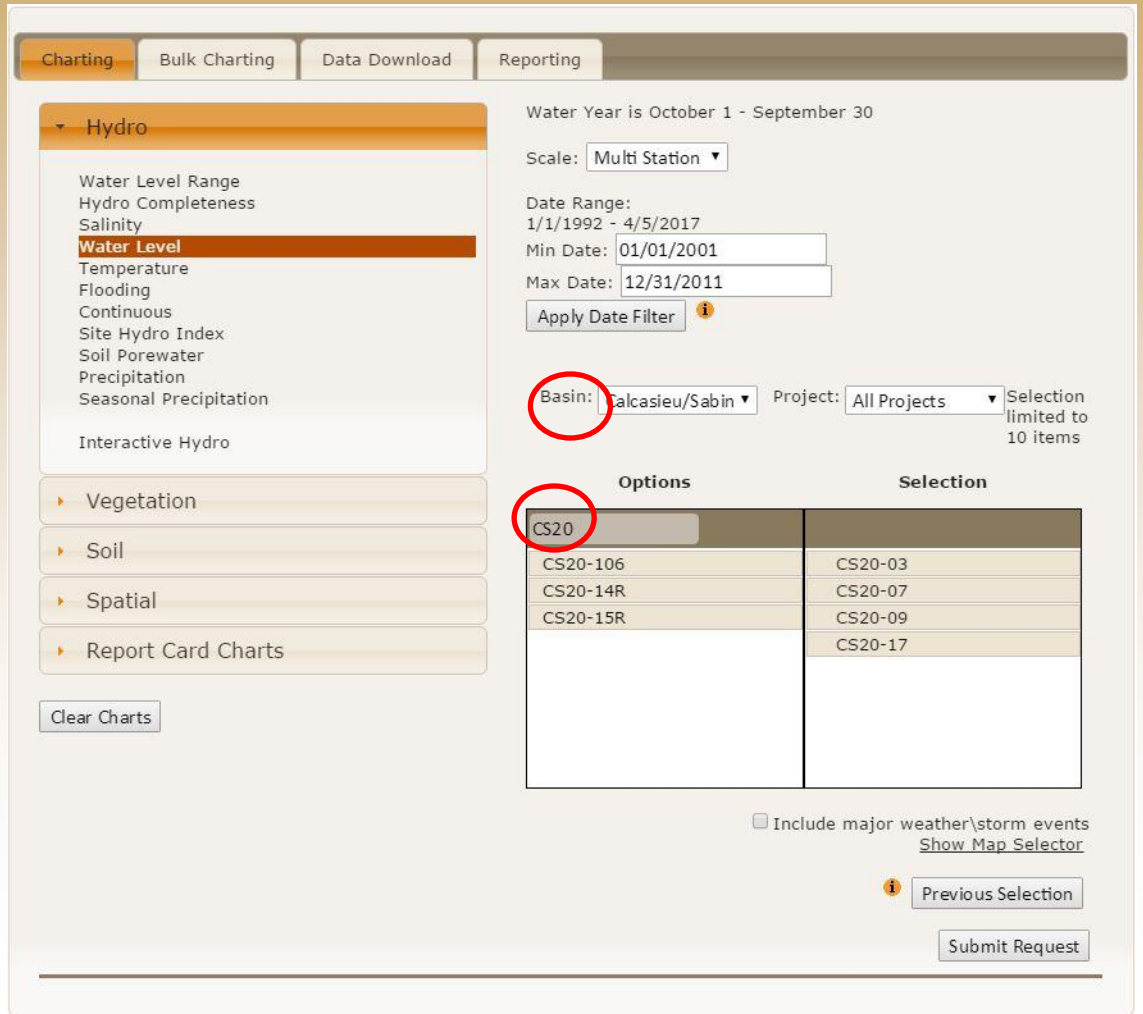
Pick a Data Category
- **Hydro**

Pick a Parameter
- **Water Level**

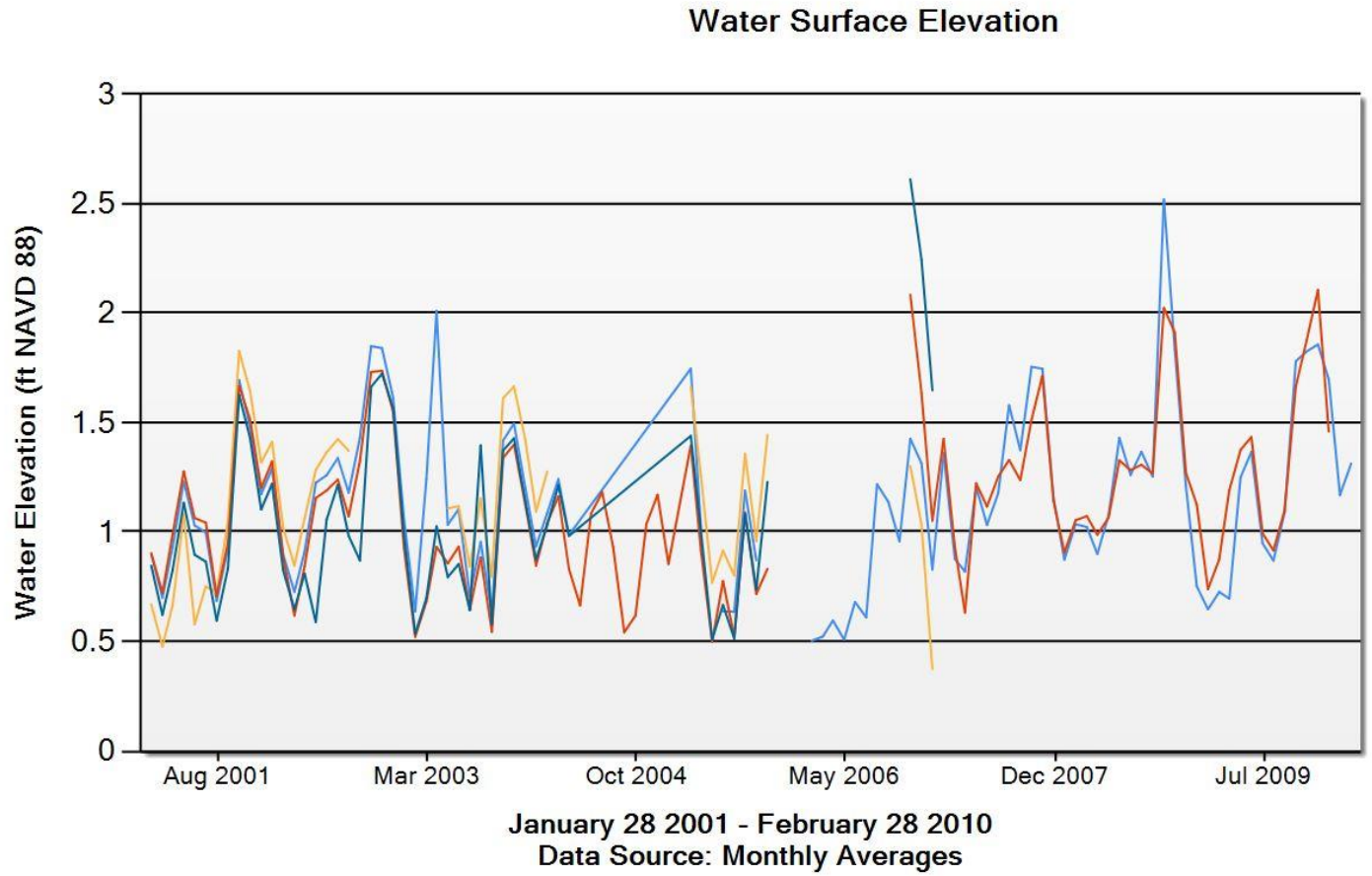
Pick a Scale
- **Multi Station**

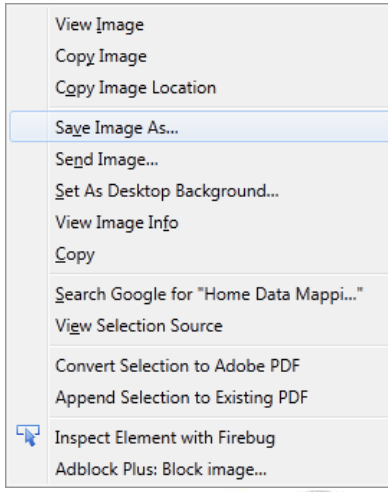
Enter Start / End Dates
- **1/1/2001**
- **12/31/2011**
- **Apply Date Filter**

Pick Stations



Multi-Station Water Level Chart

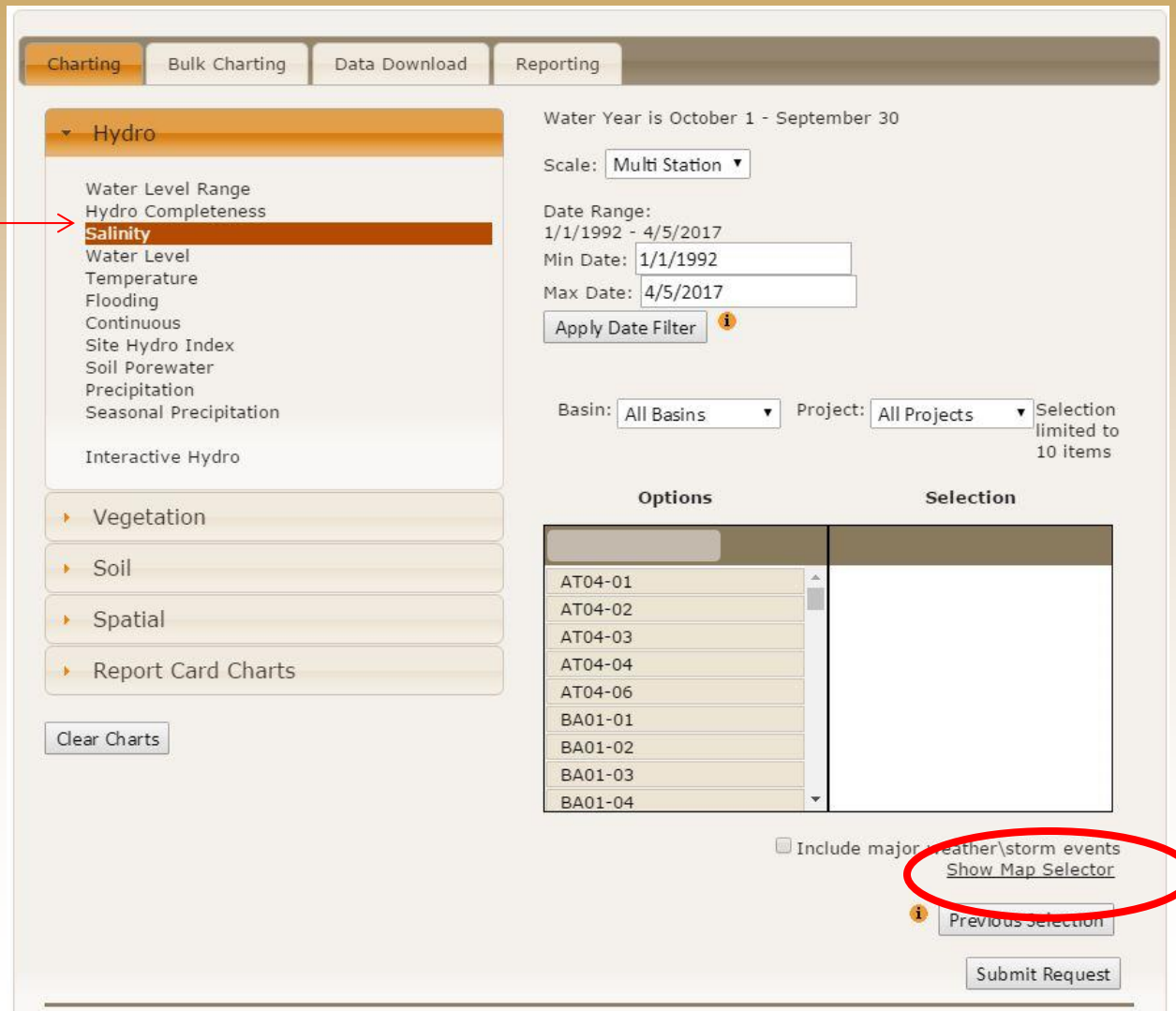




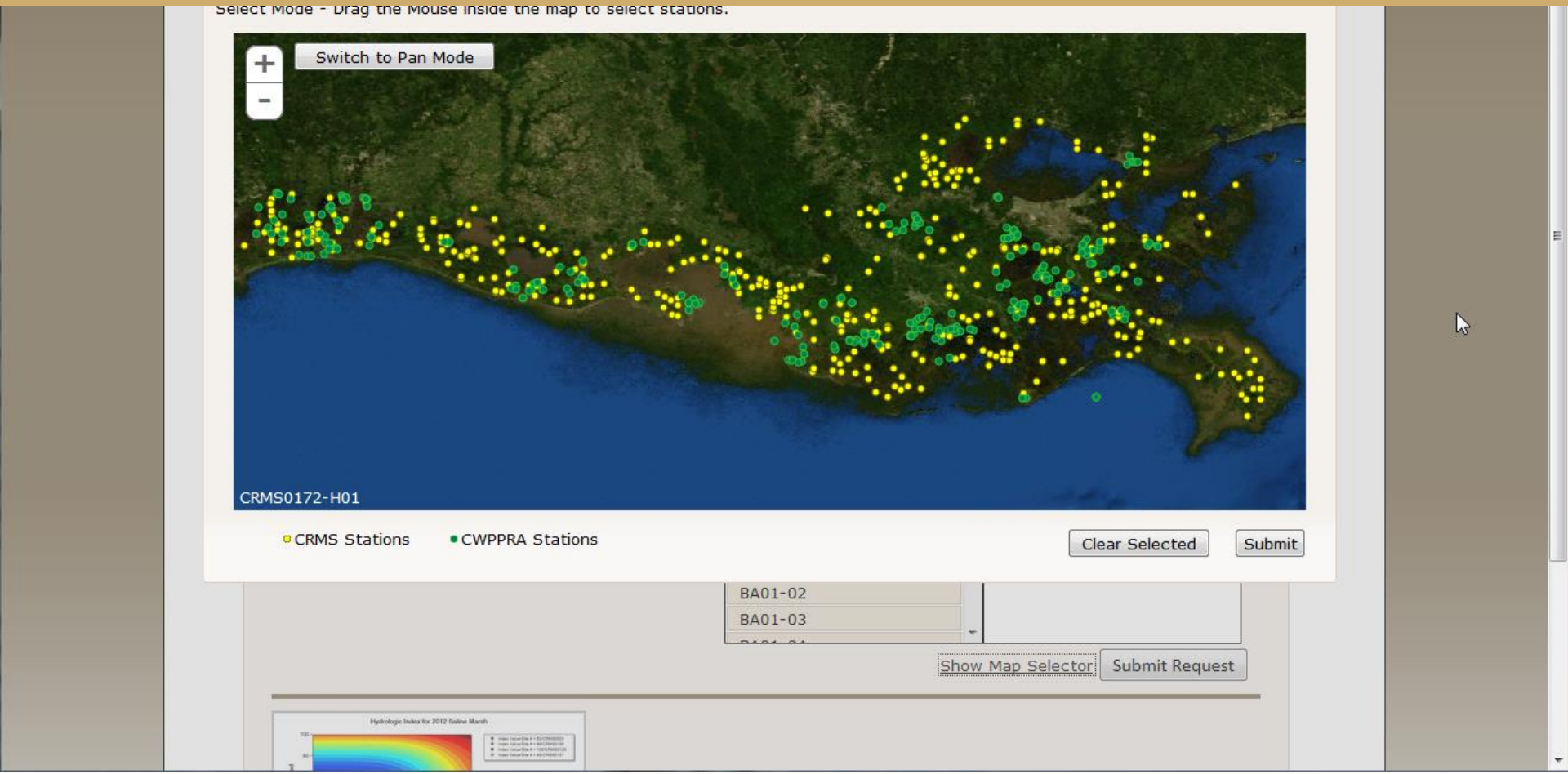
Data Download

“Map Selector” allows chart stations to be picked in a mapping interface.

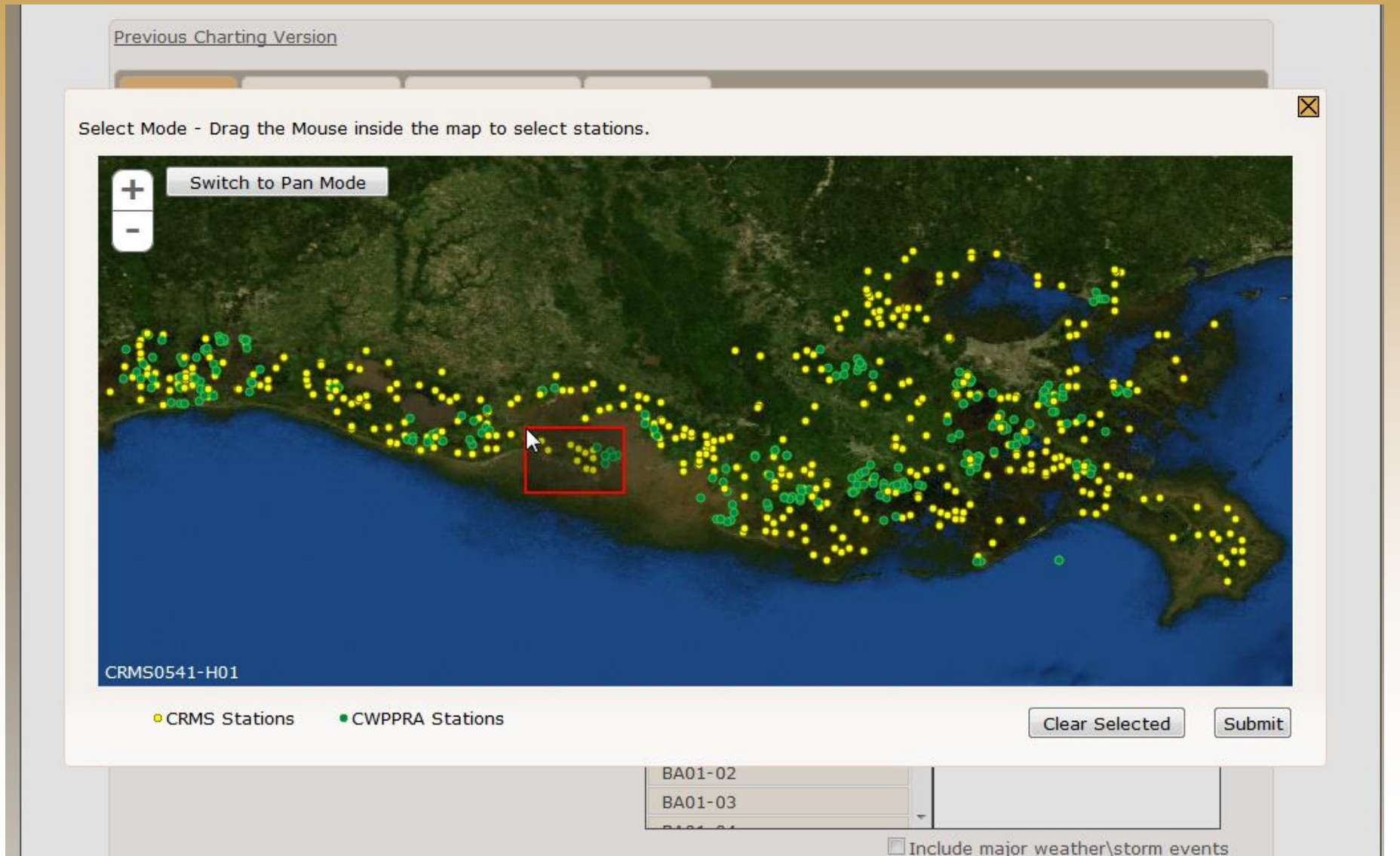
Great if you have an area of interest, but don’t know the station IDs.



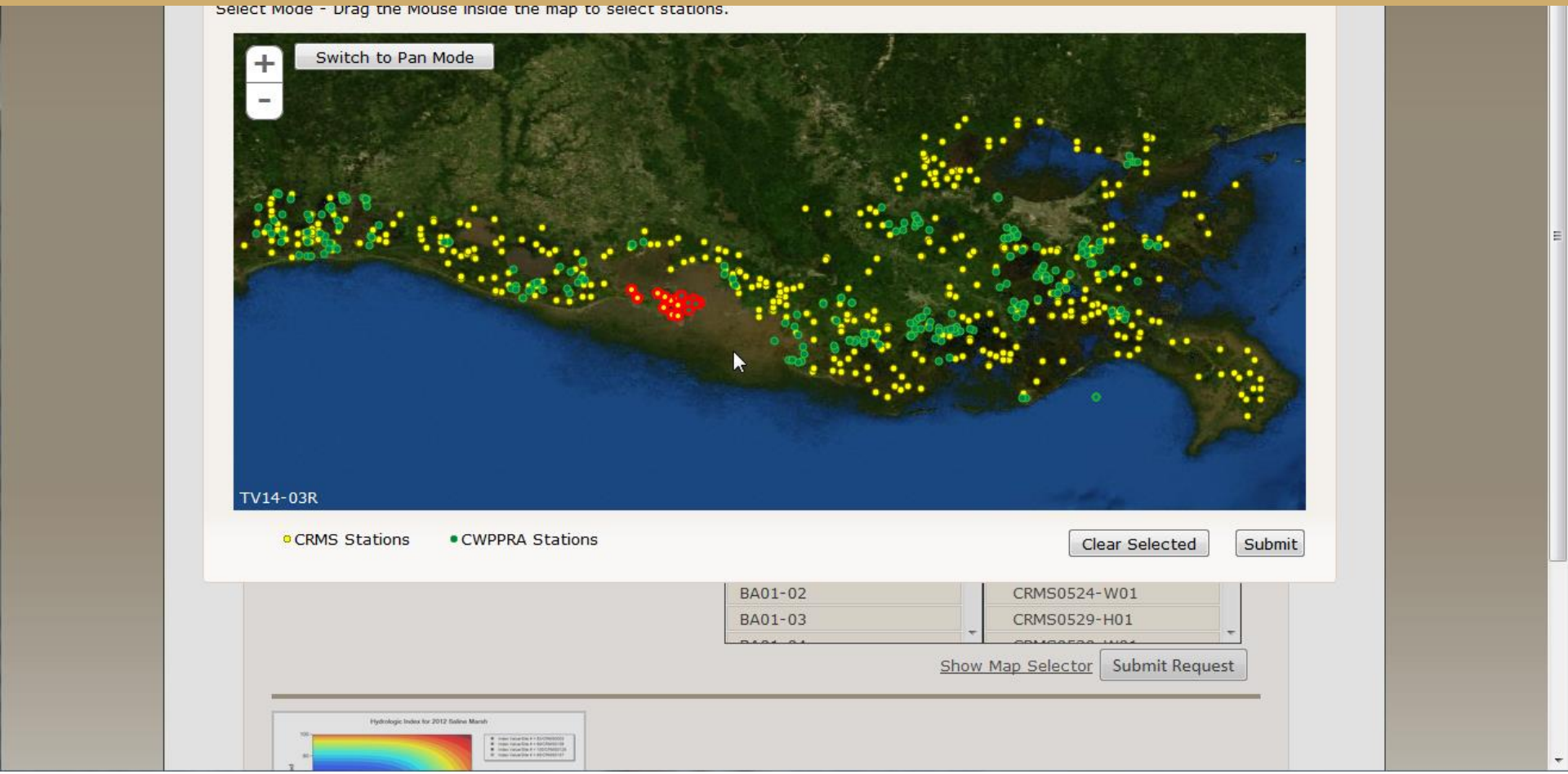
Pairing the Charting Interface with the Map Selector



Pairing the Charting Interface with the Map Selector

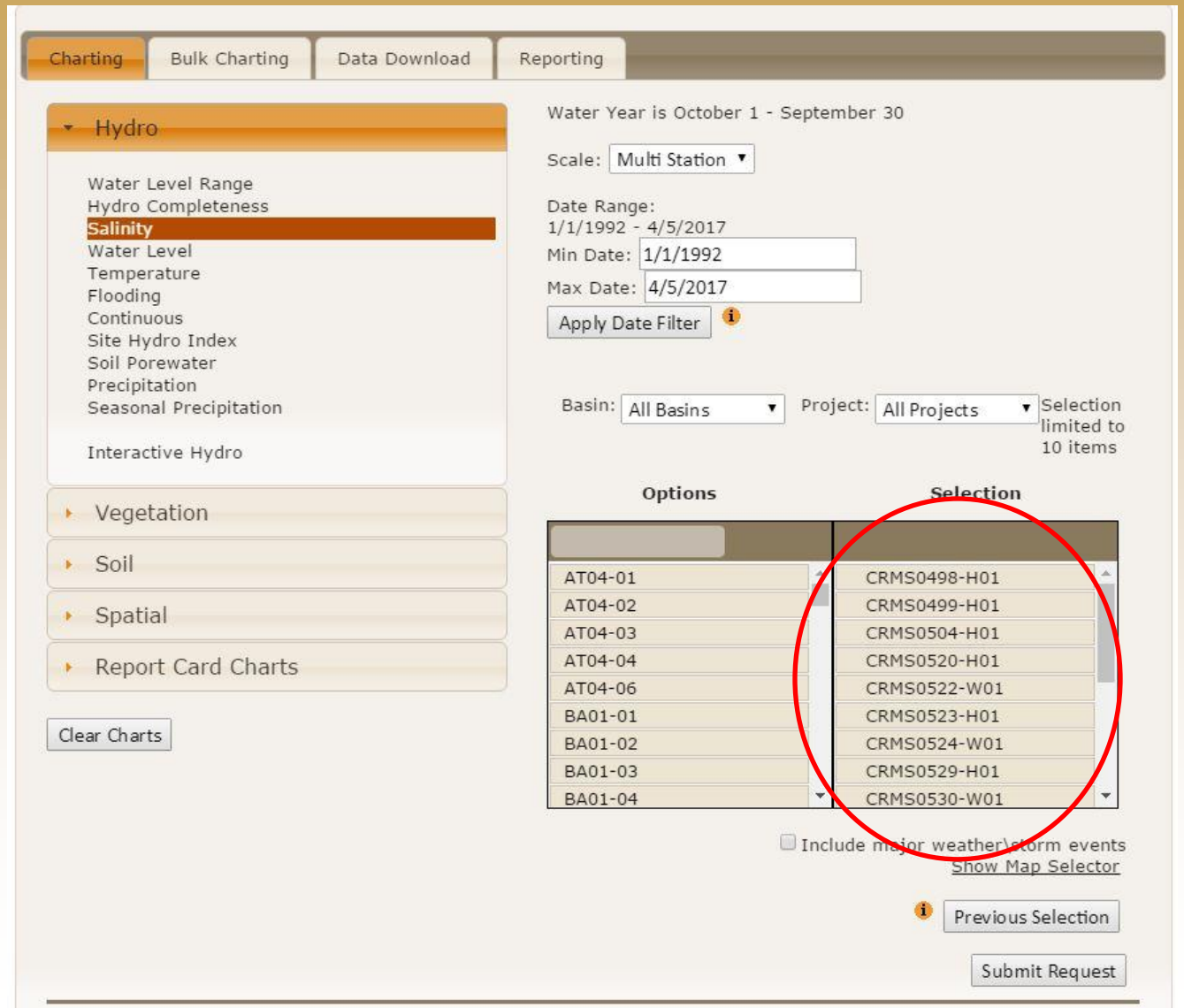


Pairing the Charting Interface with the Map Selector



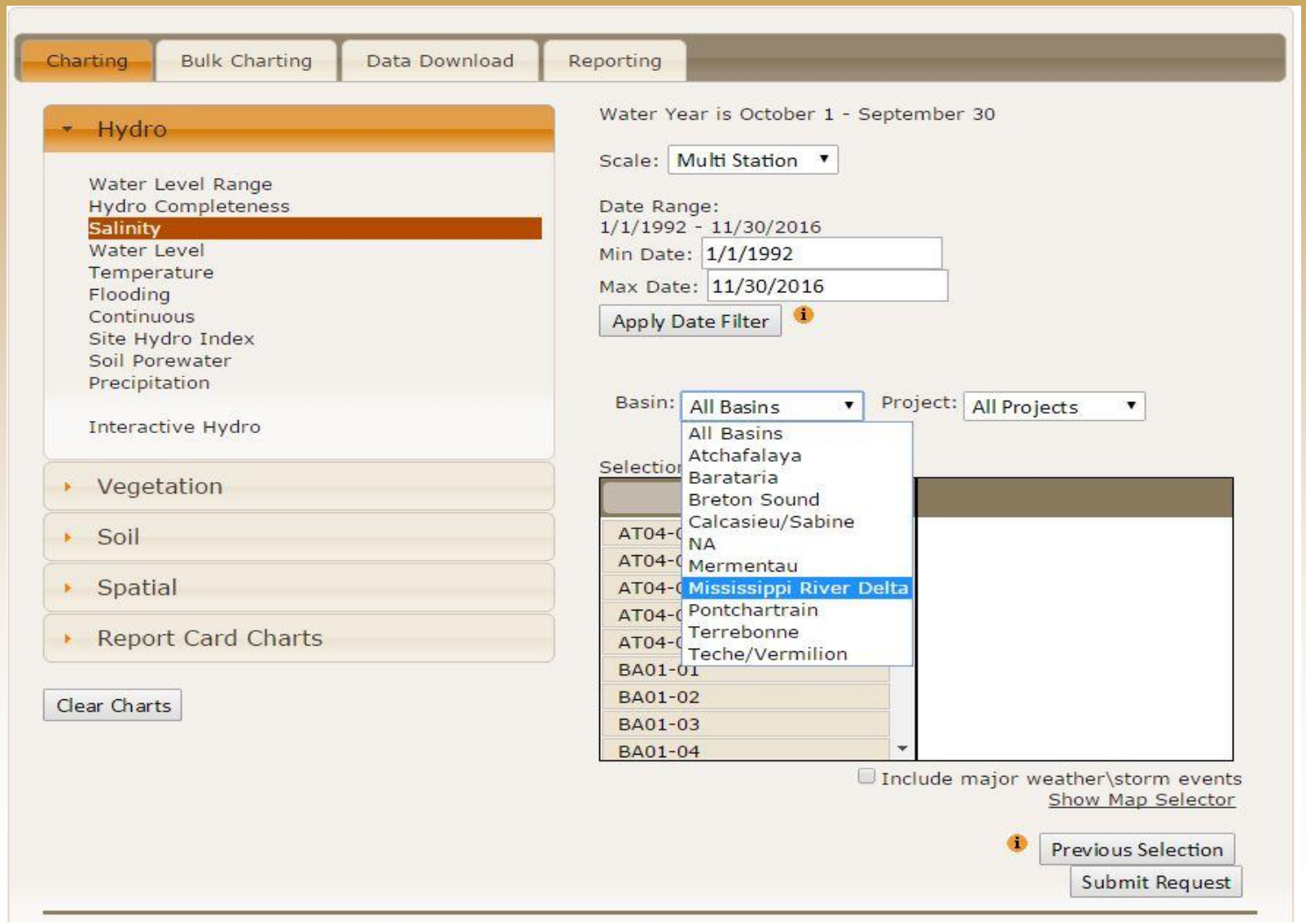
Pairing the Charting Interface with the Map Selector

The sites/stations that were selected on the map appear in the right side of the selection box.

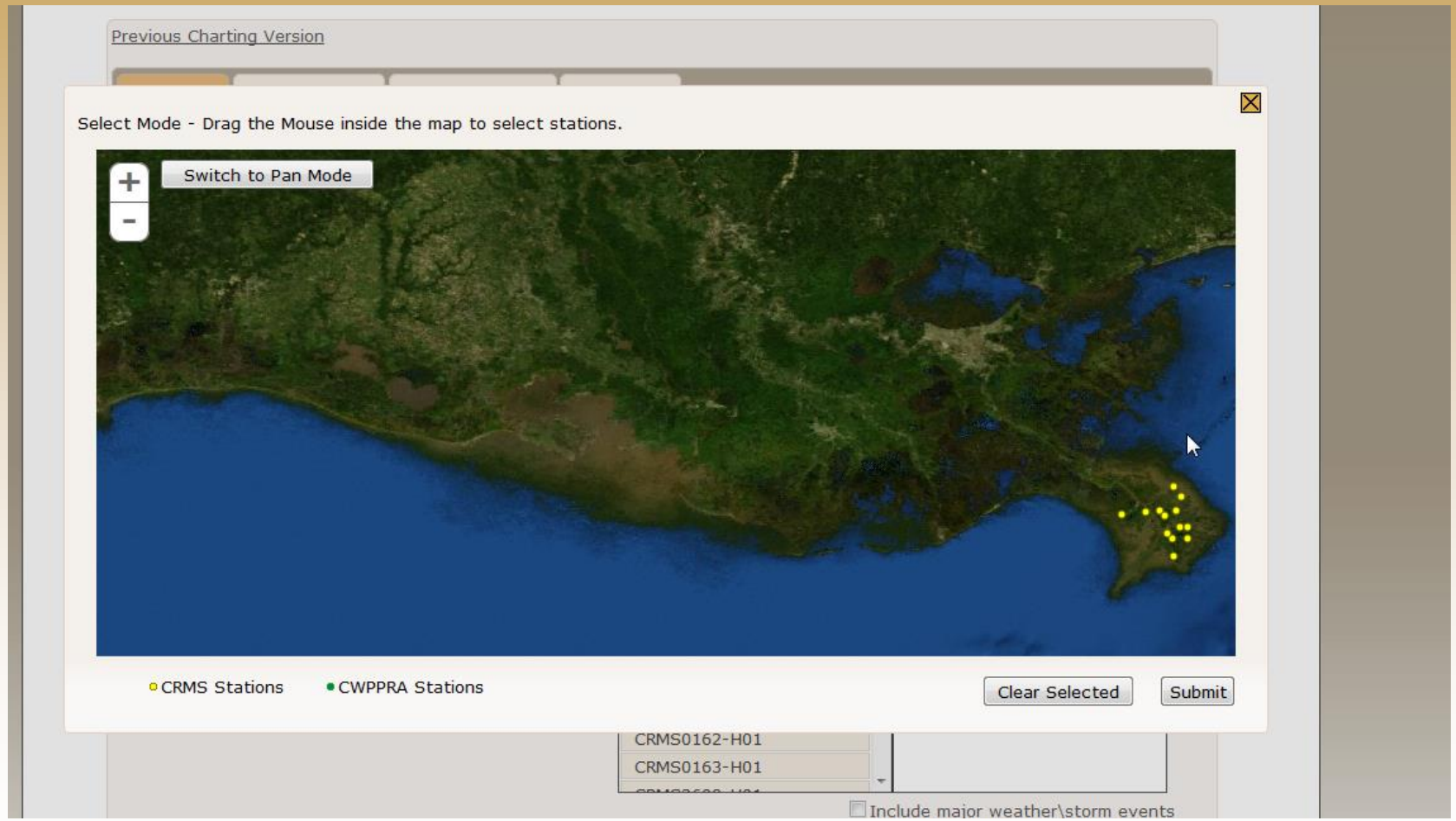


Pairing the Charting Interface with the Map Selector

Filter the list by a Basin

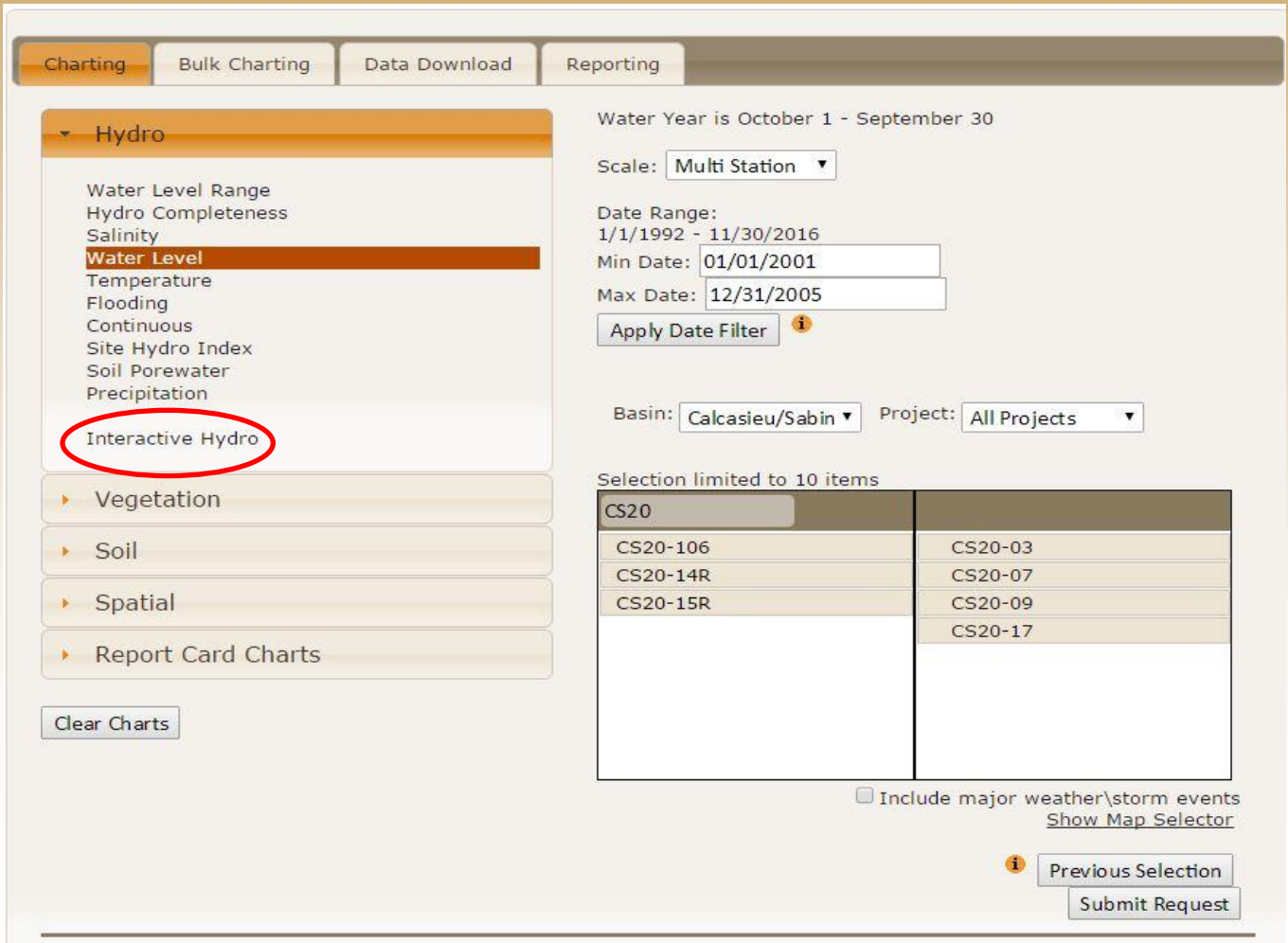


Pairing the Charting Interface with the Map Selector

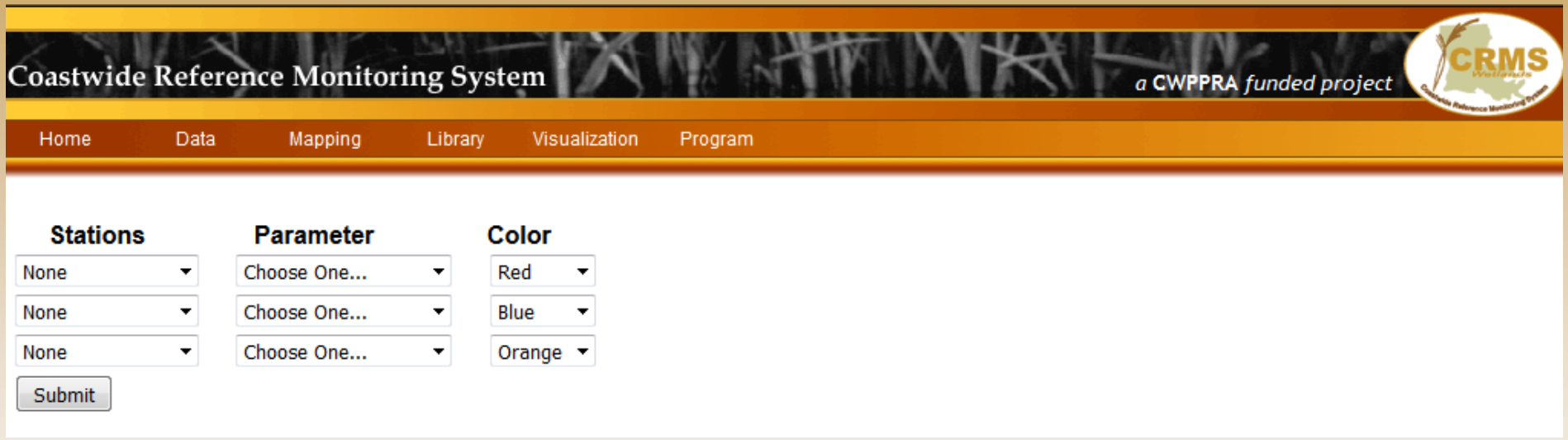


Interactive Hydro Chart

Great for hydro **data exploration** without having to download data.



Great for data discovery, fast manipulation, and comparison of sites without having to generate charts.



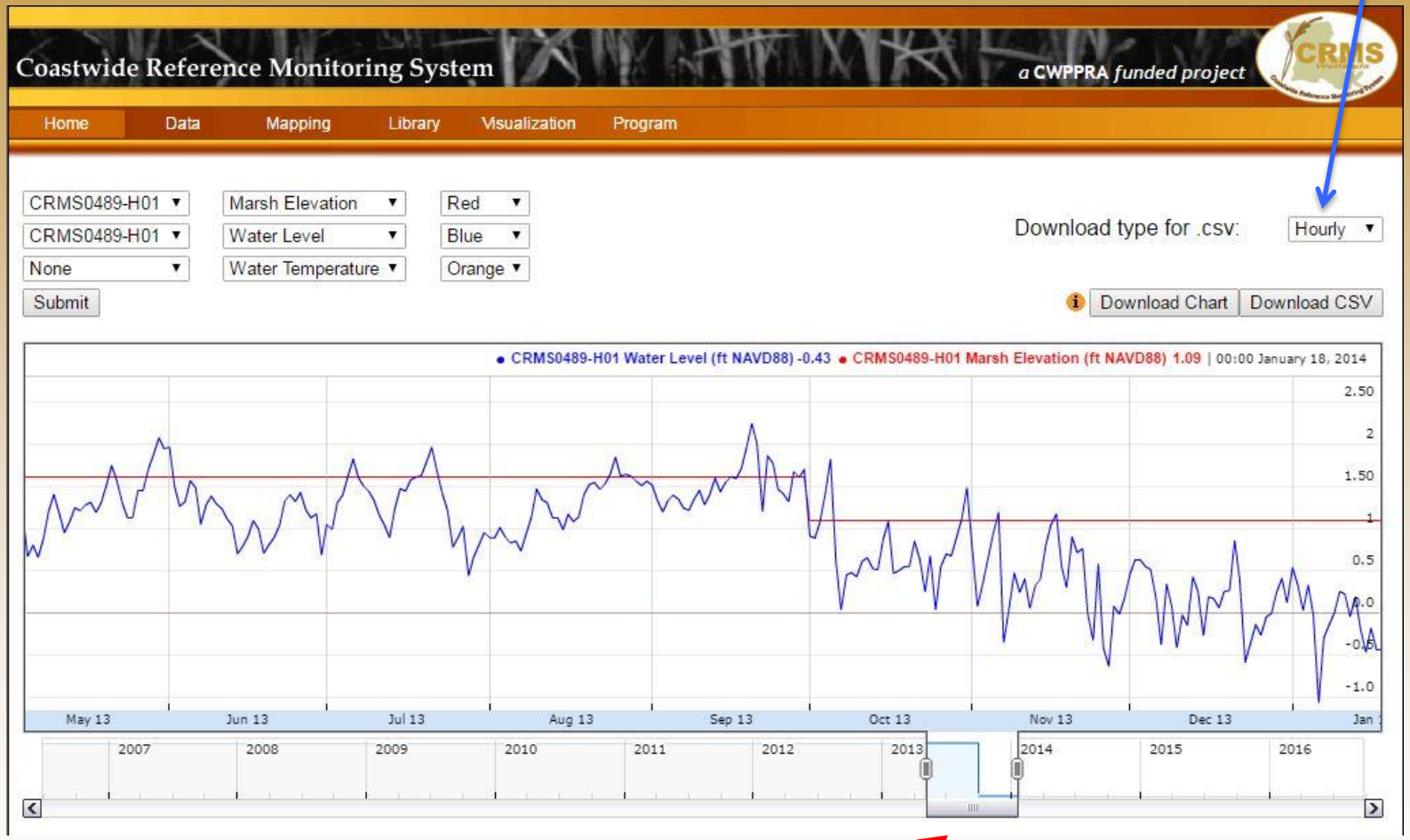
Same station with multiple parameters

Charted data for POR

Period of record (POR)

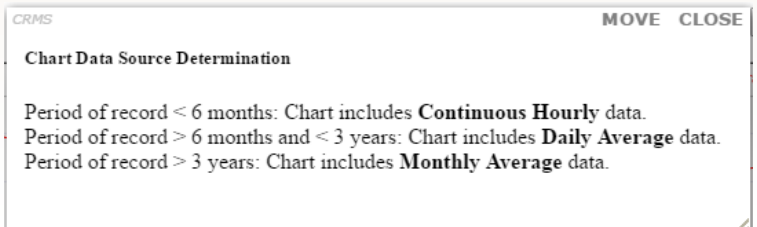
Same station with multiple parameters

Frequency Type



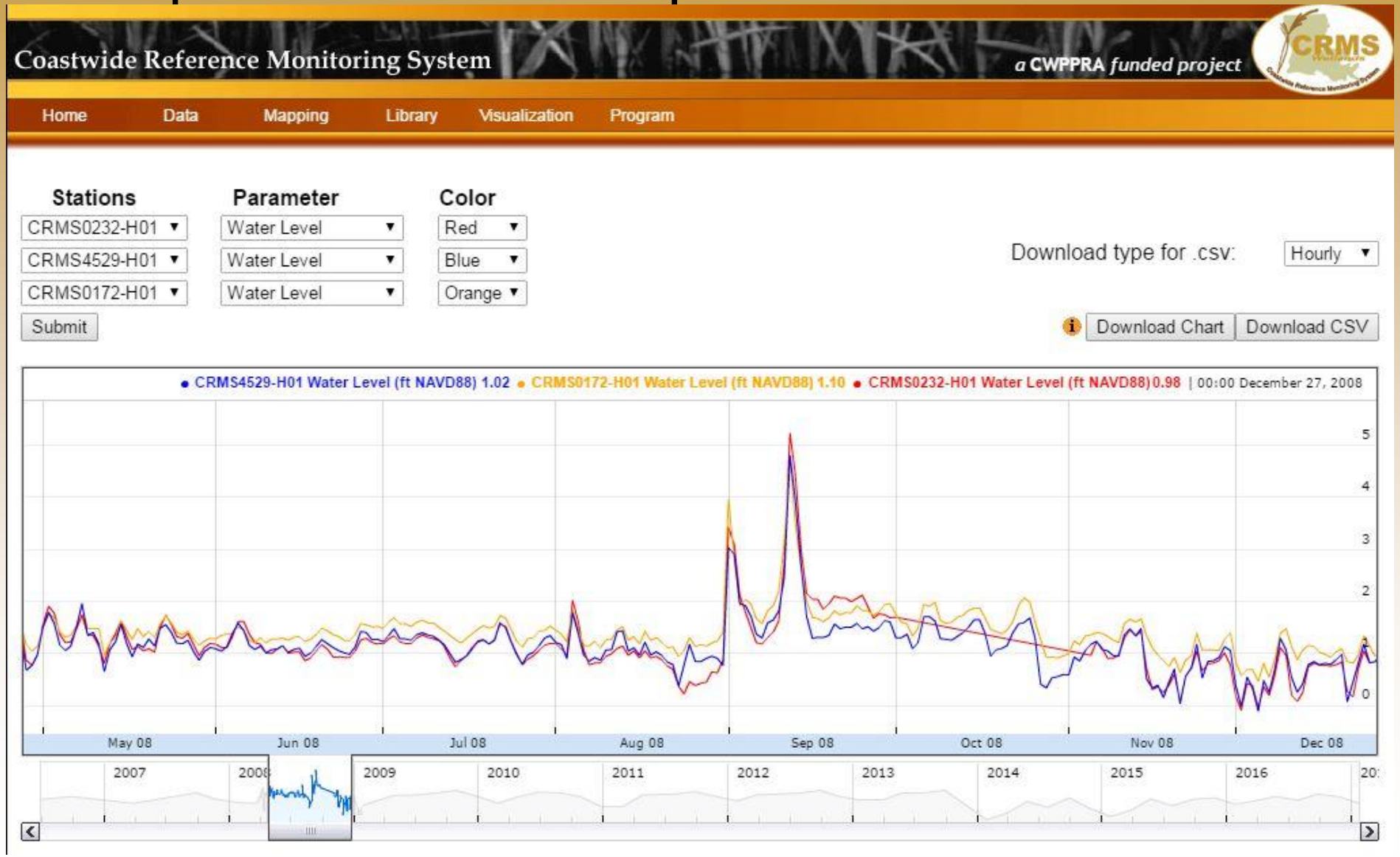
Data availability time extent:

- **Window can slide along time line**
- **Changing window size controls temporal accuracy of chart**



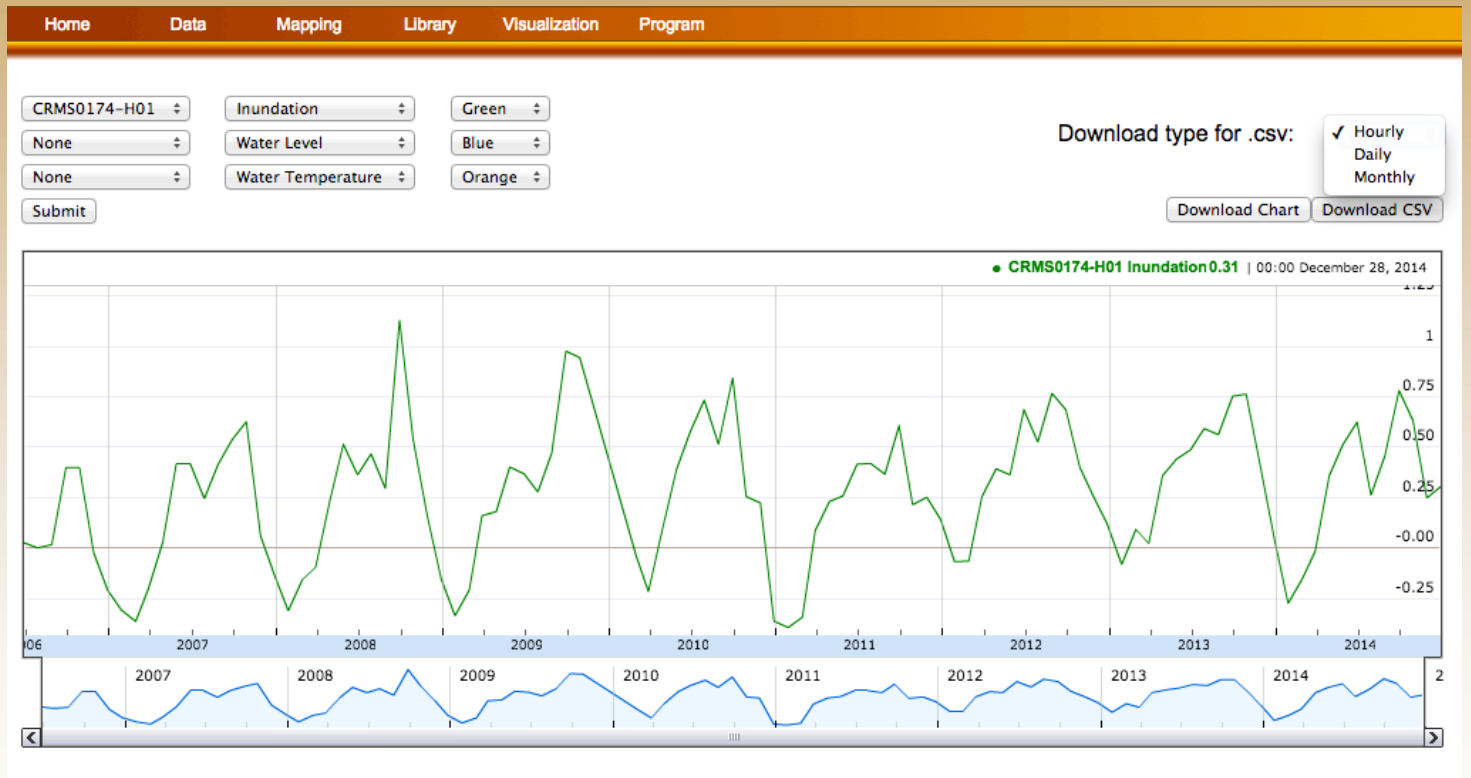
Same station with multiple parameters

Multiple stations with the same parameter

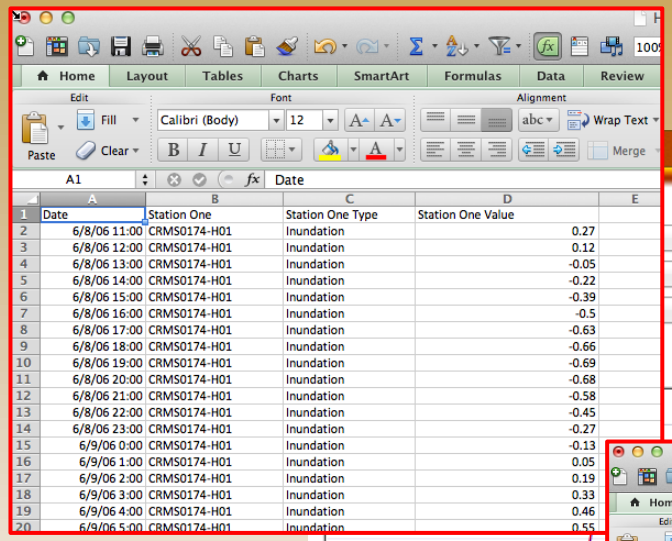


Downloading

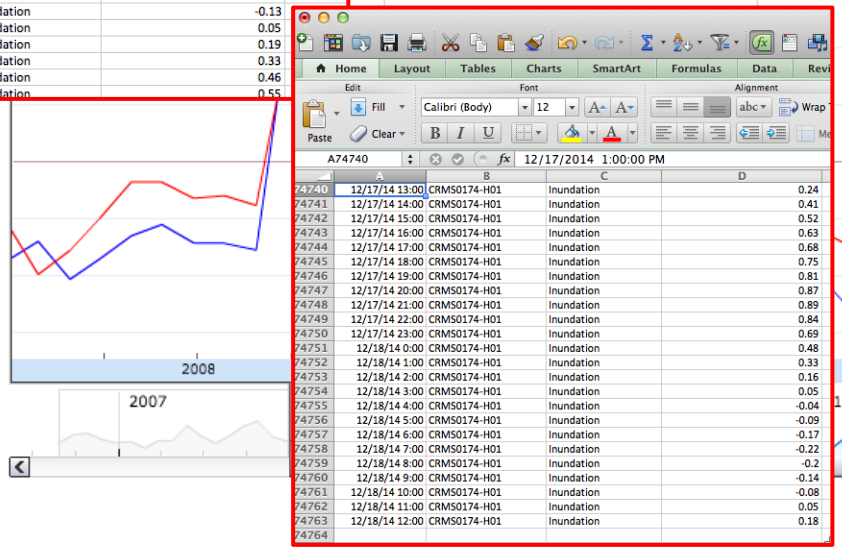
- Set time frequency of data (i.e., hourly, daily, monthly)
- Data in CSV format



Downloaded CSV



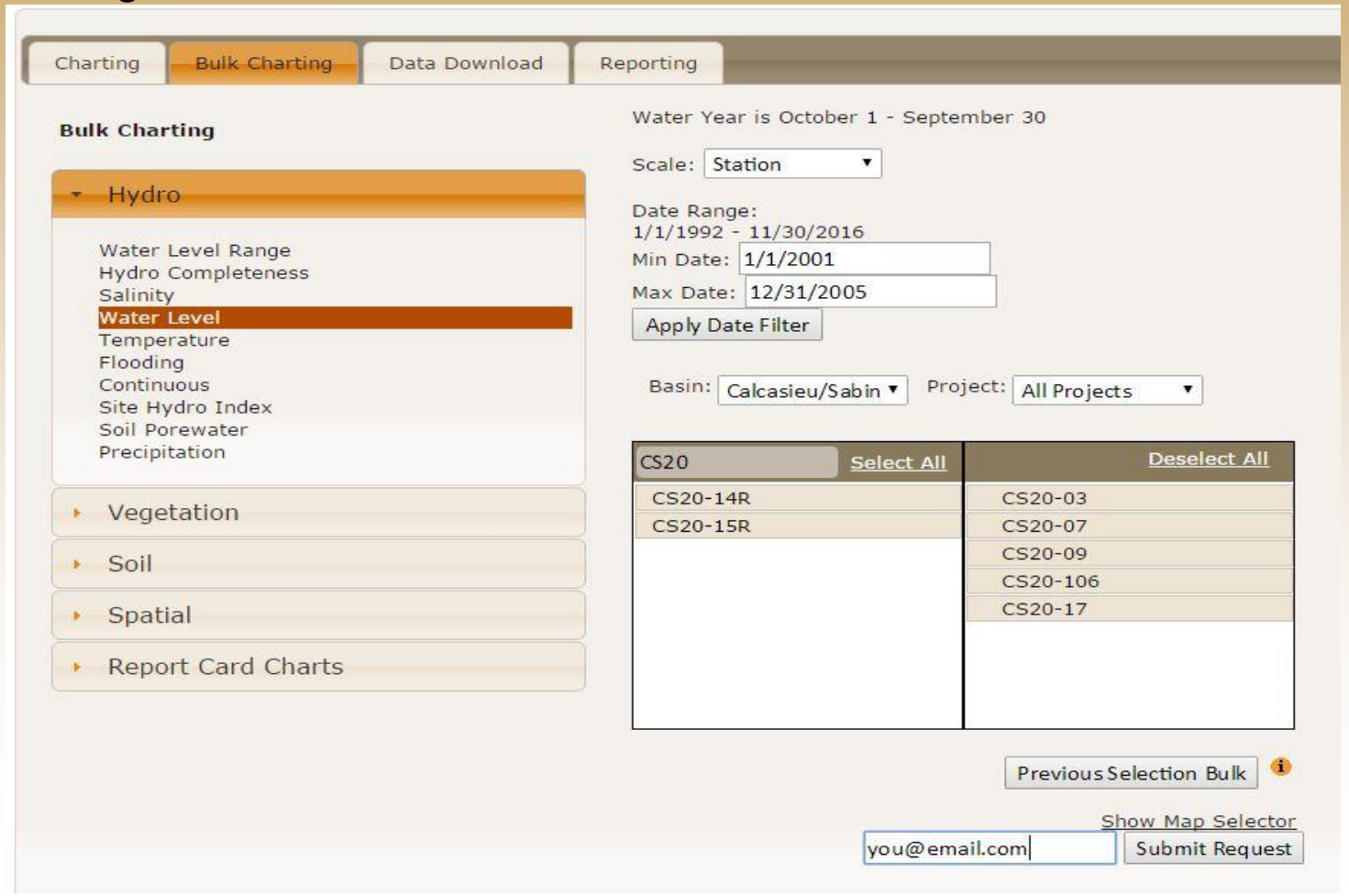
	A	B	C	D	E
1	Date	Station One	Station One Type	Station One Value	
2	6/8/06 11:00	CRMS0174-H01	Inundation	0.27	
3	6/8/06 12:00	CRMS0174-H01	Inundation	0.12	
4	6/8/06 13:00	CRMS0174-H01	Inundation	-0.05	
5	6/8/06 14:00	CRMS0174-H01	Inundation	-0.22	
6	6/8/06 15:00	CRMS0174-H01	Inundation	-0.39	
7	6/8/06 16:00	CRMS0174-H01	Inundation	-0.5	
8	6/8/06 17:00	CRMS0174-H01	Inundation	-0.63	
9	6/8/06 18:00	CRMS0174-H01	Inundation	-0.66	
10	6/8/06 19:00	CRMS0174-H01	Inundation	-0.69	
11	6/8/06 20:00	CRMS0174-H01	Inundation	-0.68	
12	6/8/06 21:00	CRMS0174-H01	Inundation	-0.58	
13	6/8/06 22:00	CRMS0174-H01	Inundation	-0.45	
14	6/8/06 23:00	CRMS0174-H01	Inundation	-0.27	
15	6/9/06 0:00	CRMS0174-H01	Inundation	-0.13	
16	6/9/06 1:00	CRMS0174-H01	Inundation	0.05	
17	6/9/06 2:00	CRMS0174-H01	Inundation	0.19	
18	6/9/06 3:00	CRMS0174-H01	Inundation	0.33	
19	6/9/06 4:00	CRMS0174-H01	Inundation	0.46	
20	6/9/06 5:00	CRMS0174-H01	Inundation	0.55	

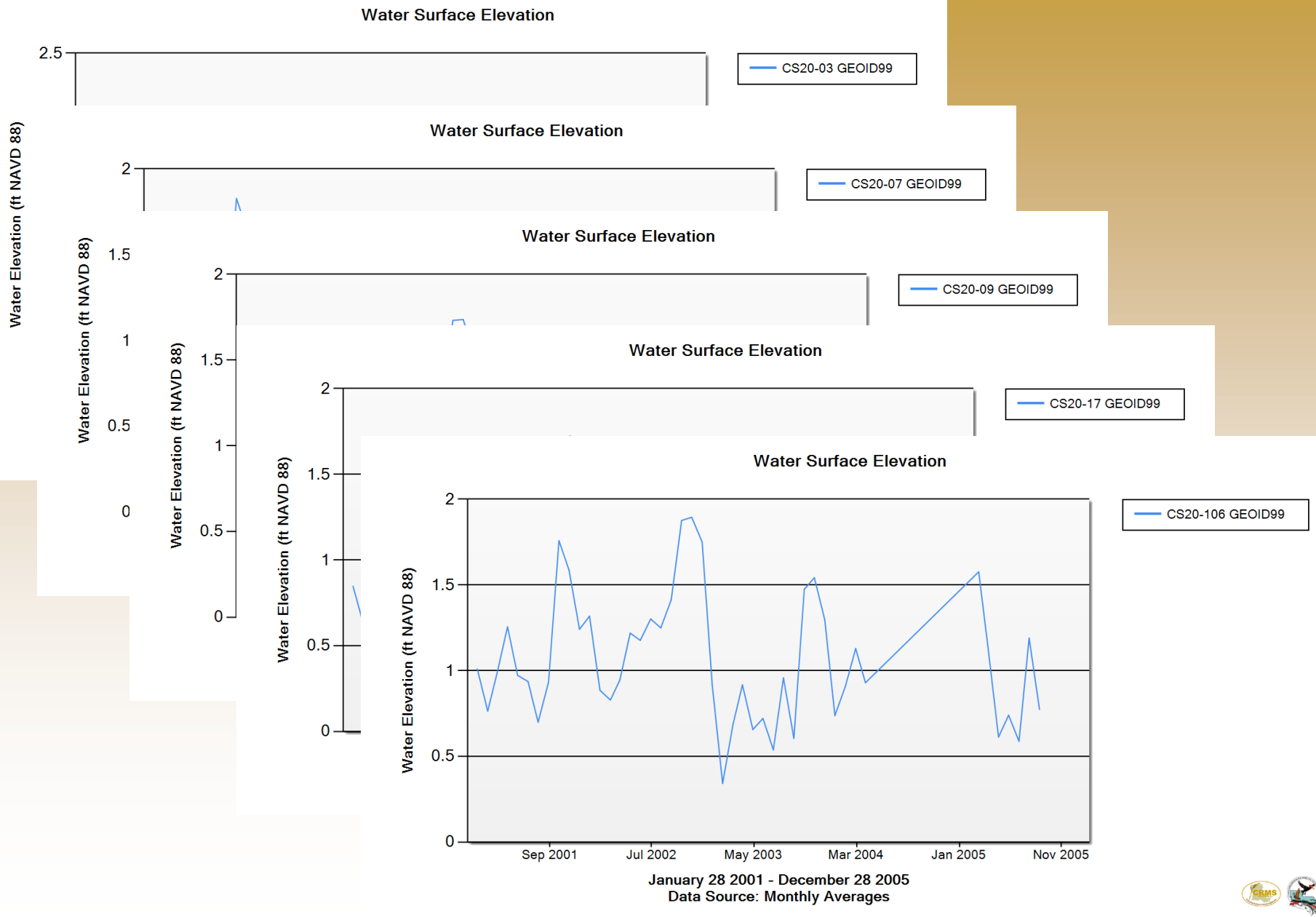


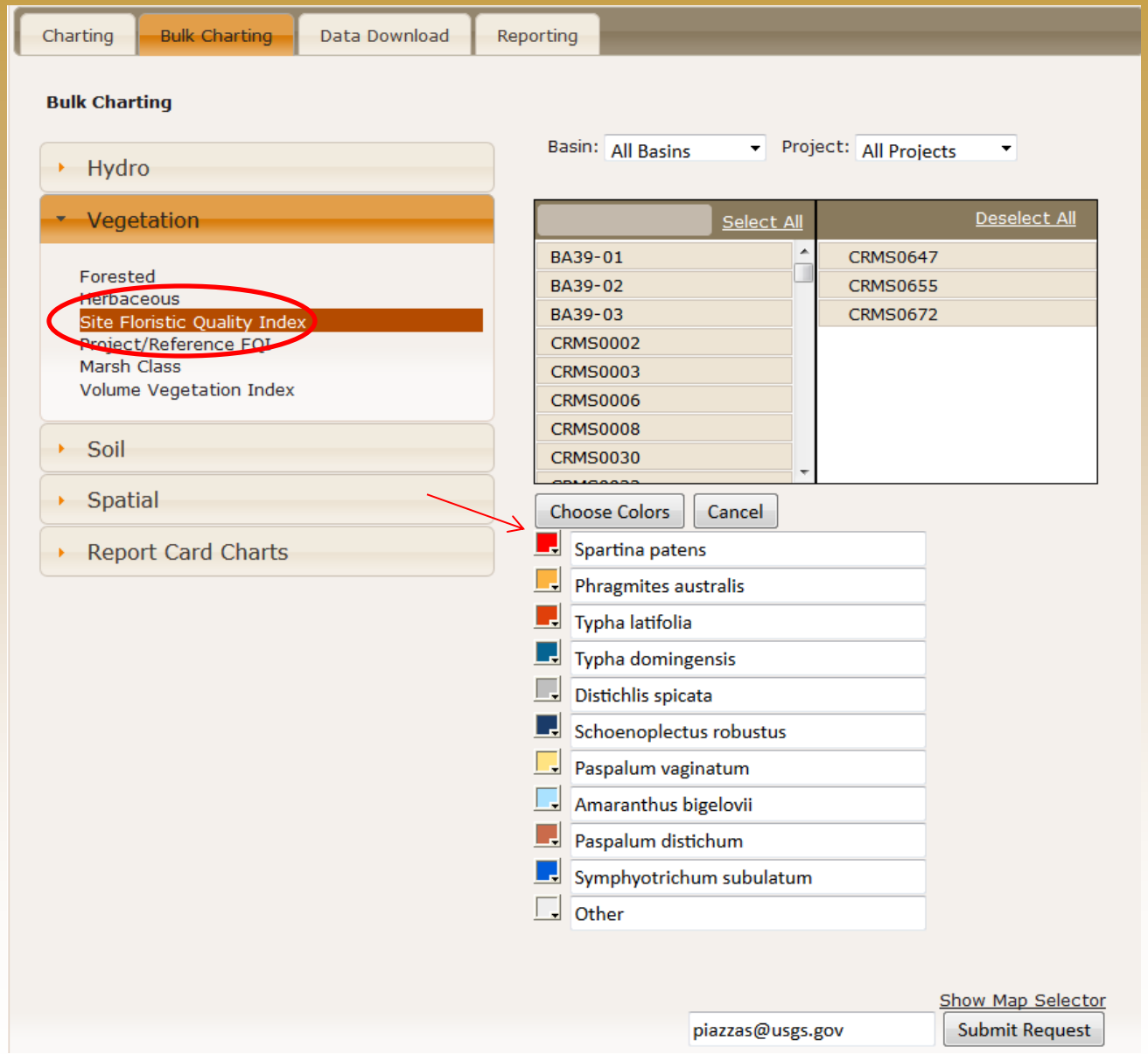
	A	B	C	D
74740	12/17/14 13:00	CRMS0174-H01	Inundation	0.24
74741	12/17/14 14:00	CRMS0174-H01	Inundation	0.41
74742	12/17/14 15:00	CRMS0174-H01	Inundation	0.52
74743	12/17/14 16:00	CRMS0174-H01	Inundation	0.63
74744	12/17/14 17:00	CRMS0174-H01	Inundation	0.68
74745	12/17/14 18:00	CRMS0174-H01	Inundation	0.75
74746	12/17/14 19:00	CRMS0174-H01	Inundation	0.81
74747	12/17/14 20:00	CRMS0174-H01	Inundation	0.87
74748	12/17/14 21:00	CRMS0174-H01	Inundation	0.89
74749	12/17/14 22:00	CRMS0174-H01	Inundation	0.84
74750	12/17/14 23:00	CRMS0174-H01	Inundation	0.69
74751	12/18/14 0:00	CRMS0174-H01	Inundation	0.48
74752	12/18/14 1:00	CRMS0174-H01	Inundation	0.33
74753	12/18/14 2:00	CRMS0174-H01	Inundation	0.16
74754	12/18/14 3:00	CRMS0174-H01	Inundation	0.05
74755	12/18/14 4:00	CRMS0174-H01	Inundation	-0.04
74756	12/18/14 5:00	CRMS0174-H01	Inundation	-0.09
74757	12/18/14 6:00	CRMS0174-H01	Inundation	-0.17
74758	12/18/14 7:00	CRMS0174-H01	Inundation	-0.22
74759	12/18/14 8:00	CRMS0174-H01	Inundation	-0.2
74760	12/18/14 9:00	CRMS0174-H01	Inundation	-0.14
74761	12/18/14 10:00	CRMS0174-H01	Inundation	-0.08
74762	12/18/14 11:00	CRMS0174-H01	Inundation	0.05
74763	12/18/14 12:00	CRMS0174-H01	Inundation	0.18
74764				

Bulk Charting: creates multiple charts with the same parameter input

Great for creating figures for reports that all need to be uniformly designed.



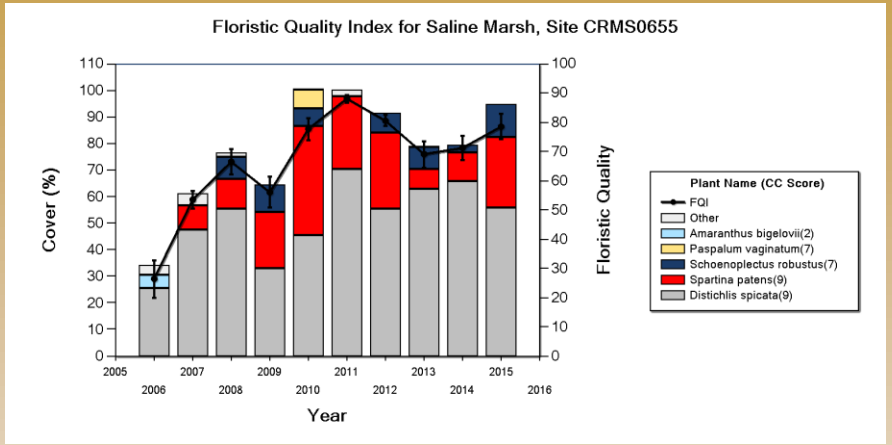

Water Surface Elevation
CS20-03 GEOID99
Water Surface Elevation
CS20-07 GEOID99
Water Surface Elevation
CS20-09 GEOID99
Water Surface Elevation
CS20-17 GEOID99
Water Surface Elevation
CS20-106 GEOID99
Water Elevation (ft NAVD 88)
2.5
2
1.5
1
0.5
0
Sep 2001
Jul 2002
May 2003
Mar 2004
Jan 2005
Nov 2005
January 28 2001 - December 28 2005
Data Source: Monthly Averages

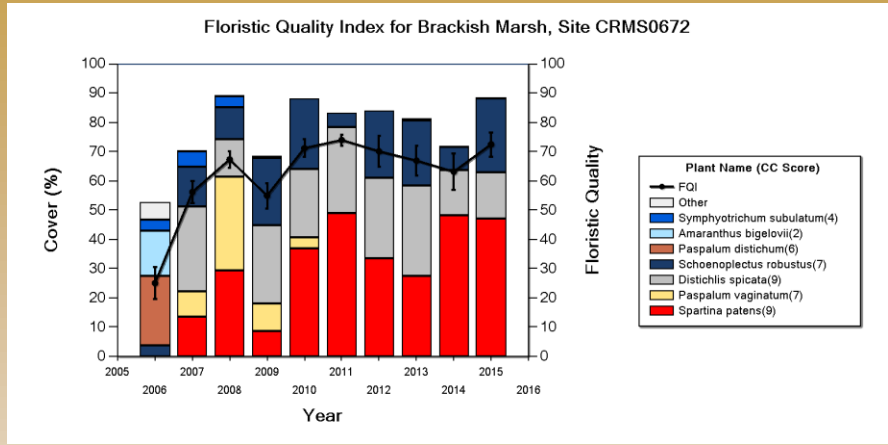


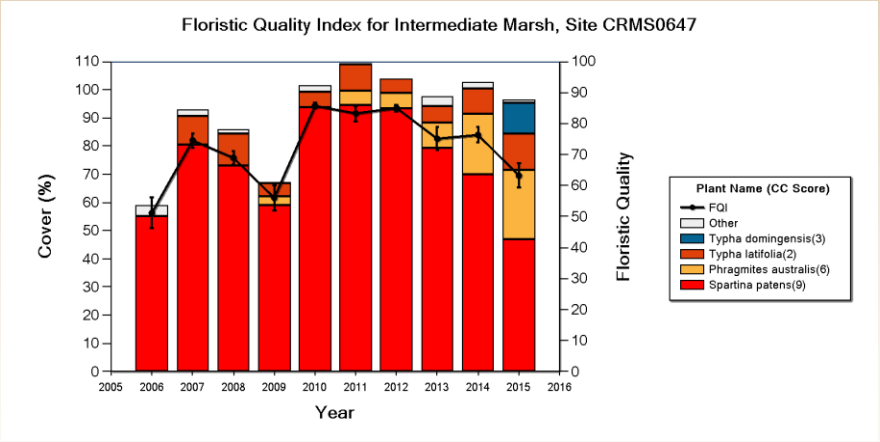
Site Floristic Quality Index:

User can define color ramp for species of interest in all charts generated by one request.

Great for looking at species presence/absence or tracking invasive species

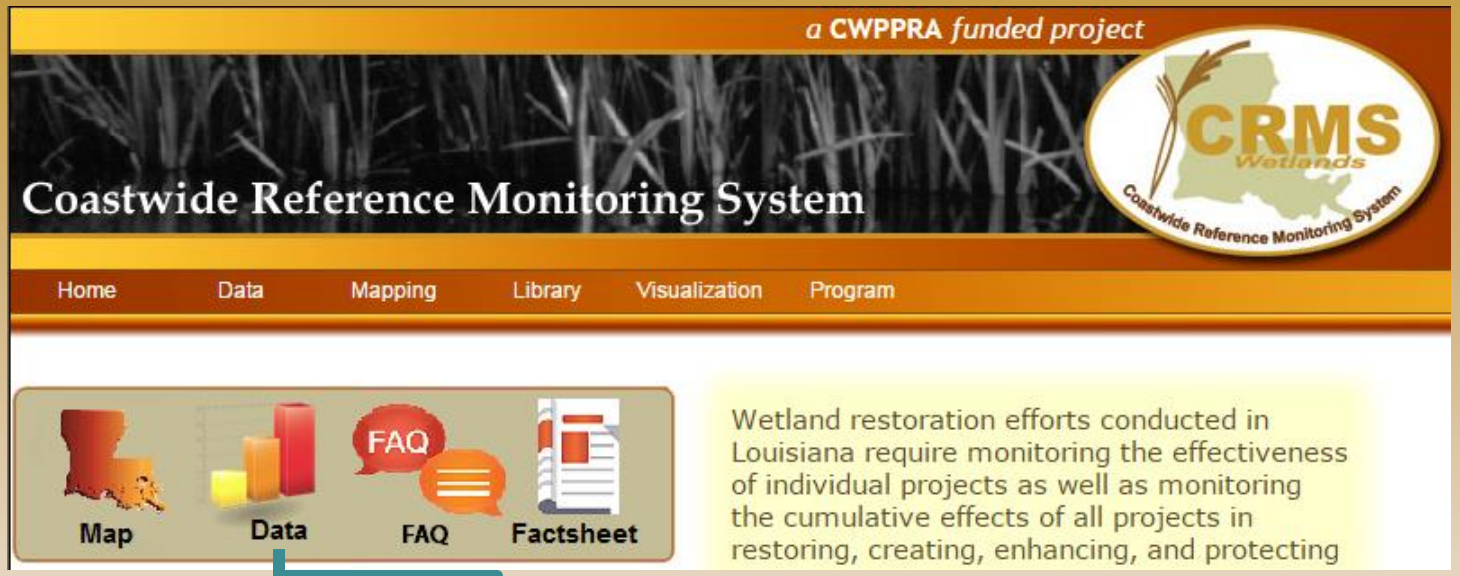






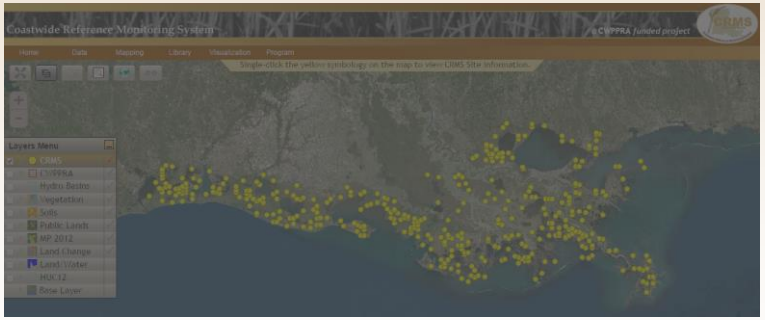
Ex: All *Spartina patens* are red as defined by user.

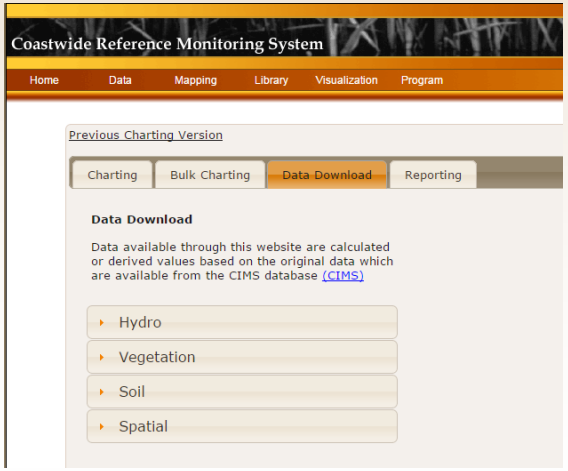
Coastwide Reference Monitoring System – *Wetlands*
Site Navigation

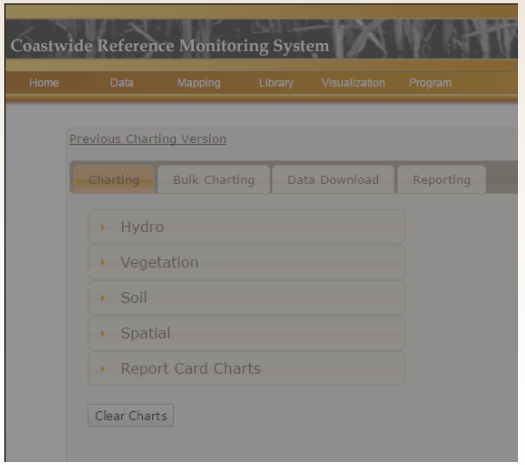


Data

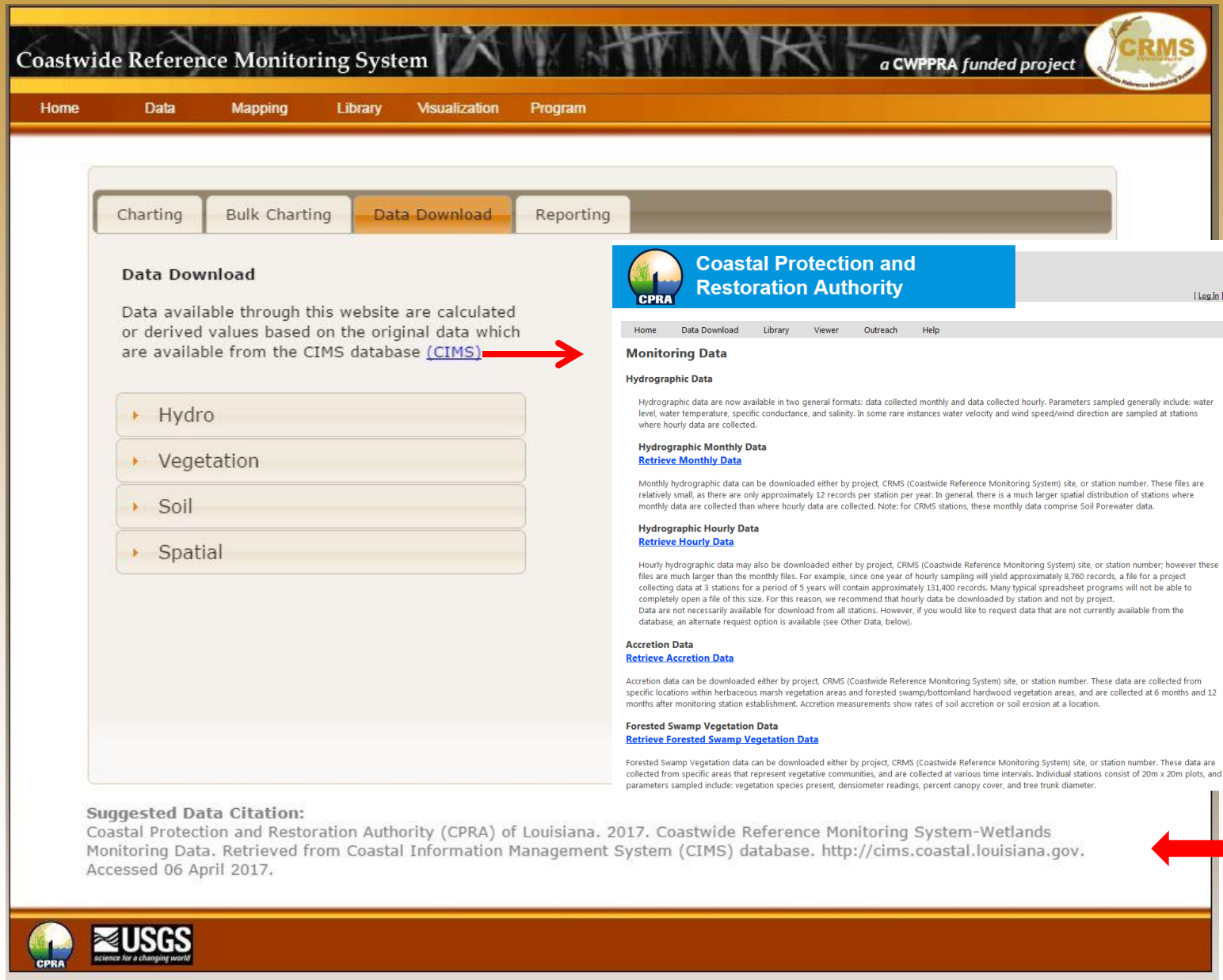
Charting







Coastwide Reference Monitoring System – *Wetlands*
Bulk Data Download



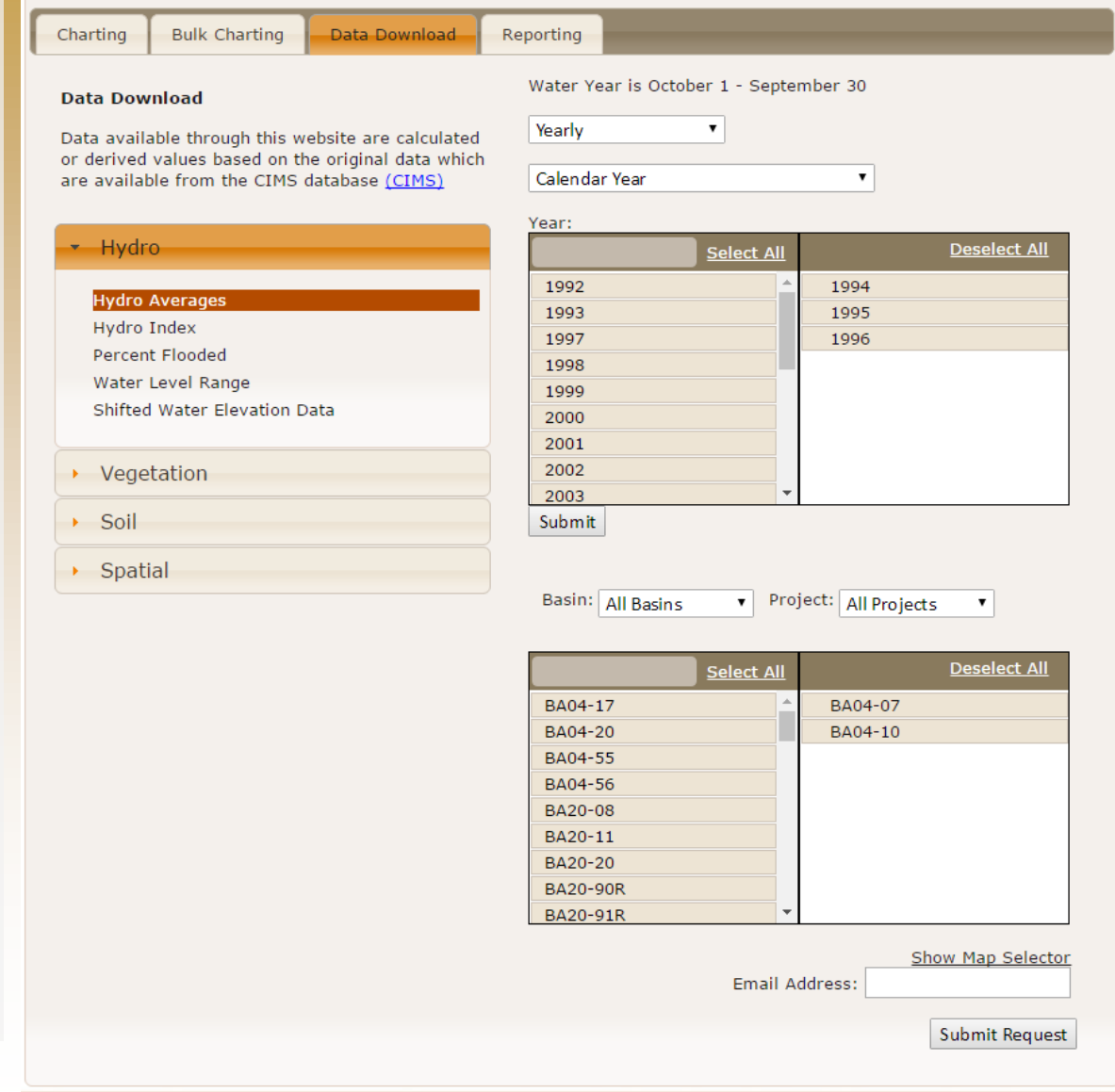
- **CRMS bulk data download**

All values for selected years, for selected stations

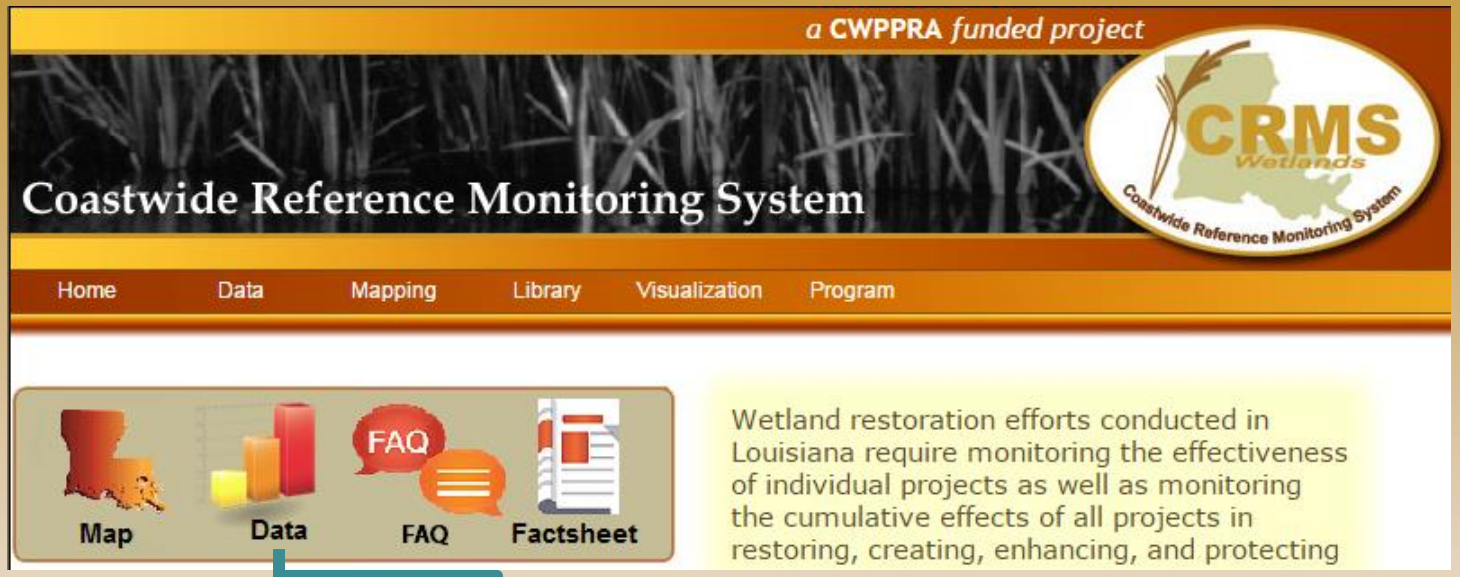
(queue processes first come first serve)

- Hydro
  - Hydro Averages
  - Hydro Index
  - Percent Flooded
  - Water Level Range
  - Shifted Water Elevation Data
- Vegetation
  - Basal Area
  - Floristic Quality Index
  - Marsh Class
  - Veg Percent Cover
  - Vegetation Volume Index
- Soil
  - Surface Elevation Change Rate
  - Submergence Vulnerability Index
  - Vertical Accretion Rates
- Spatial
  - Percent Land
  - 1km Land/Water

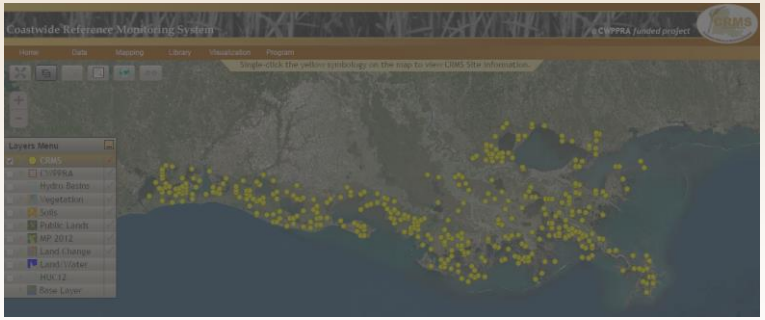
Same interface for data selection as charting

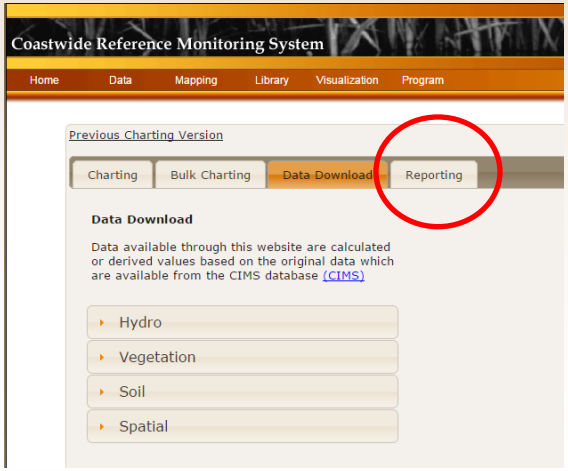


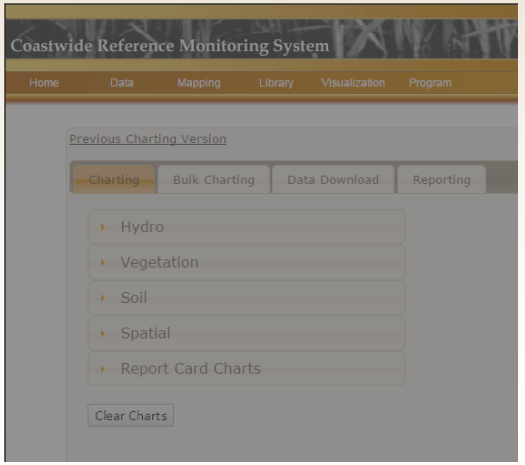
Coastwide Reference Monitoring System – *Wetlands*
Site Navigation/Reporting

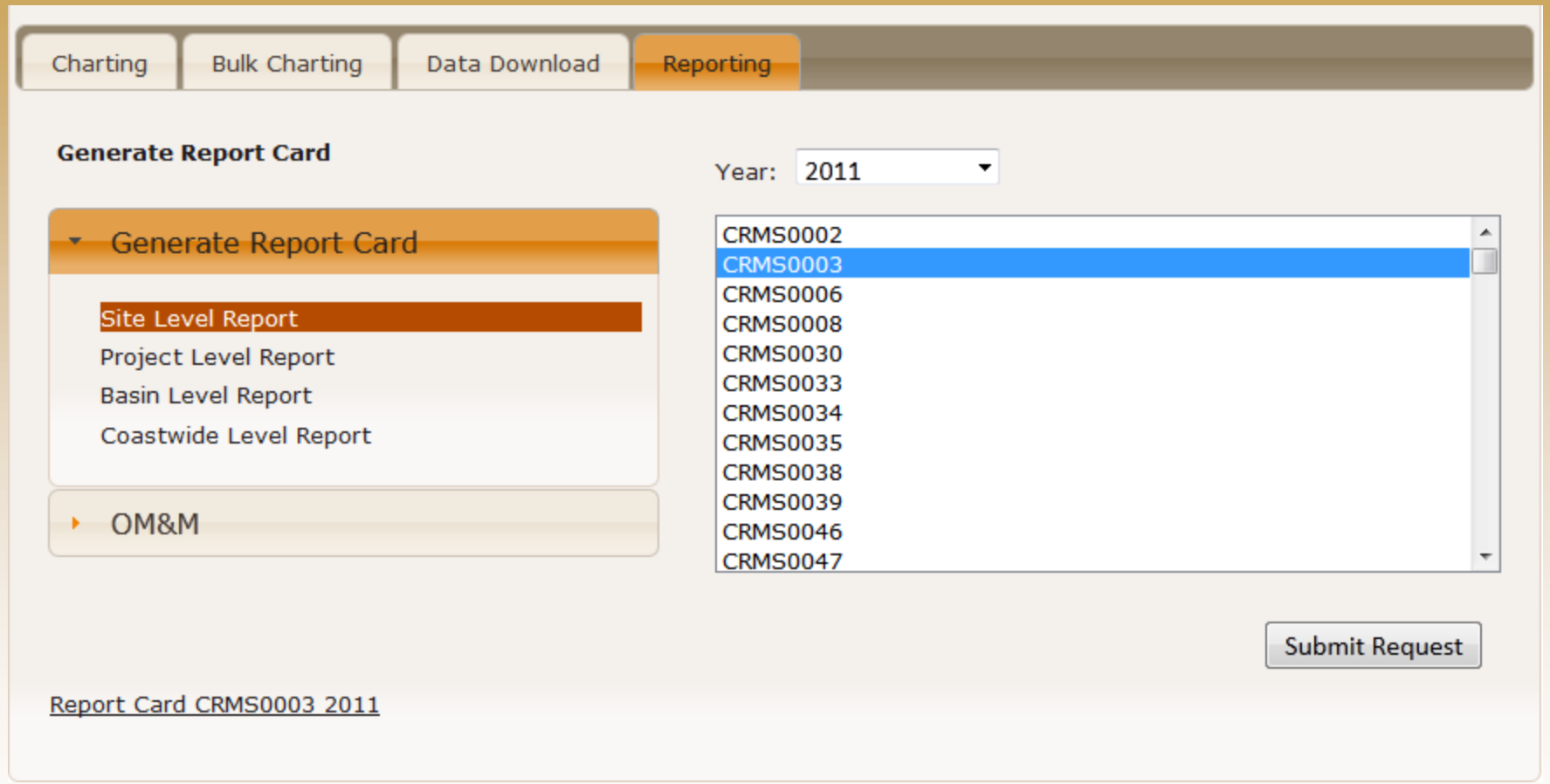


Data/Reporting Charting








Charting
Bulk Charting
Data Download
Reporting
Generate Report Card
Year: 2011
Generate Report Card
Site Level Report
Project Level Report
Basin Level Report
Coastwide Level Report
OM&M
CRMS0002
CRMS0003
CRMS0006
CRMS0008
CRMS0030
CRMS0033
CRMS0034
CRMS0035
CRMS0038
CRMS0039
CRMS0046
CRMS0047
Submit Request
Report Card CRMS0003 2011

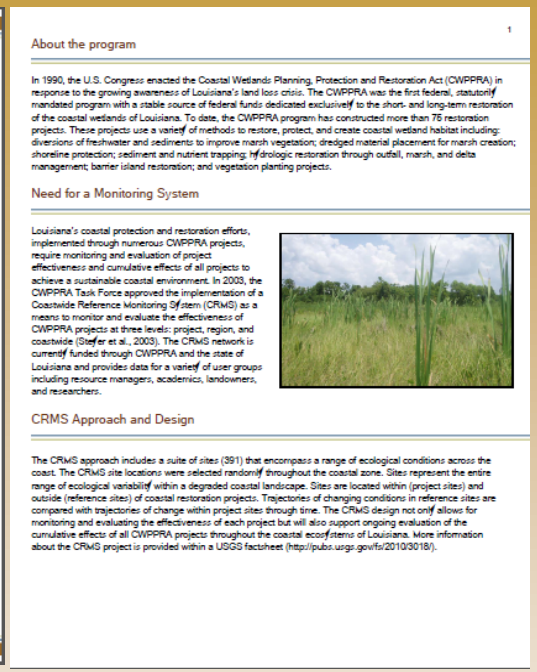
Coastwide Reference Monitoring System – *Wetlands*
Report Cards


Coastwide Reference Monitoring System (CRMS)

Site Level Report Card

Site: CRMS0003
Year: 2011

7/16/2012


1

About the program

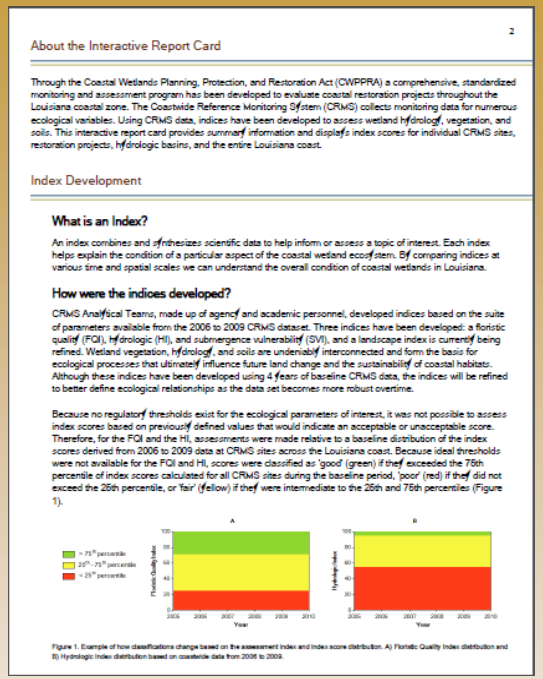
In 1990, the U.S. Congress enacted the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) in response to the growing awareness of Louisiana's land loss crisis. The CWPPRA was the first federal, statutorily mandated program with a stable source of federal funds dedicated exclusively to the short- and long-term restoration of the coastal wetlands of Louisiana. To date, the CWPPRA program has constructed more than 76 restoration projects. These projects use a variety of methods to restore, protect, and create coastal wetland habitat including: diversions of freshwater and sediments to improve marsh vegetation; dredged material placement for marsh creation; shoreline protection; sediment and nutrient trapping; hydrologic restoration through outfall, marsh, and delta management; barrier island restoration; and vegetation planting projects.

Need for a Monitoring System

Louisiana's coastal protection and restoration efforts, implemented through numerous CWPPRA projects, require monitoring and evaluation of project effectiveness and cumulative effects of all projects to achieve a sustainable coastal environment. In 2003, the CWPPRA Task Force approved the implementation of a Coastwide Reference Monitoring System (CRMS) as a means to monitor and evaluate the effectiveness of CWPPRA projects at three levels: project, region, and coastwide (Steyer et al., 2003). The CRMS network is currently funded through CWPPRA and the state of Louisiana and provides data for a variety of user groups including resource managers, academics, landowners, and researchers.

CRMS Approach and Design

The CRMS approach includes a suite of sites (391) that encompass a range of ecological conditions across the coast. The CRMS site locations were selected randomly throughout the coastal zone. Sites represent the entire range of ecological variability within a degraded coastal landscape. Sites are located within (project sites) and outside (reference sites) of coastal restoration projects. Trajectories of changing conditions in reference sites are compared with trajectories of change within project sites through time. The CRMS design not only allows for monitoring and evaluating the effectiveness of each project but will also support ongoing evaluation of the cumulative effects of all CWPPRA projects throughout the coastal ecosystems of Louisiana. More information about the CRMS project is provided within a USGS factsheet (http://pubs.usgs.gov/fs/2010/3018/).


2

About the Interactive Report Card

Through the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) a comprehensive, standardized monitoring and assessment program has been developed to evaluate coastal restoration projects throughout the Louisiana coastal zone. The Coastwide Reference Monitoring System (CRMS) collects monitoring data for numerous ecological variables. Using CRMS data, indices have been developed to assess wetland hydrology, vegetation, and soils. This interactive report card provides summary information and displays index scores for individual CRMS sites, restoration projects, hydrologic basins, and the entire Louisiana coast.

Index Development

What is an Index?

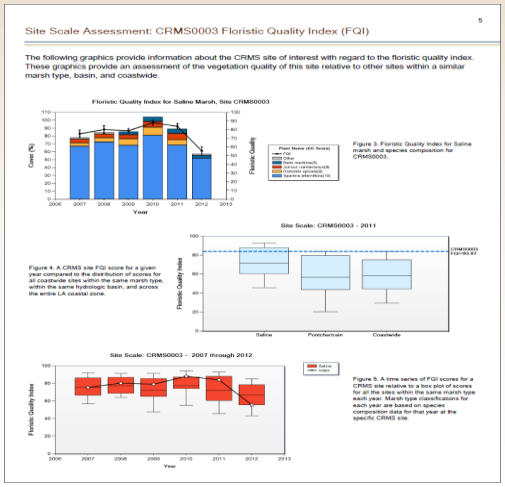
An index combines and synthesizes scientific data to help inform or assess a topic of interest. Each index helps explain the condition of a particular aspect of the coastal wetland ecosystem. By comparing indices at various time and spatial scales we can understand the overall condition of coastal wetlands in Louisiana.

How were the indices developed?

CRMS Analytical Teams, made up of agency and academic personnel, developed indices based on the suite of parameters available from the 2006 to 2009 CRMS dataset. Three indices have been developed: a floristic quality (FQI), hydrologic (HI), and submergence vulnerability (SVI), and a landscape index is currently being refined. Wetland vegetation, hydrology, and soils are undeniably interconnected and form the basis for ecological processes that ultimately influence future land change and the sustainability of coastal habitats. Although these indices have been developed using 4 years of baseline CRMS data, the indices will be refined to better define ecological relationships as the data set becomes more robust overtime.

Because no regulatory thresholds exist for the ecological parameters of interest, it was not possible to assess index scores based on previously defined values that would indicate an acceptable or unacceptable score. Therefore, for the FQI and the HI, assessments were made relative to a baseline distribution of the index scores derived from 2006 to 2009 data at CRMS sites across the Louisiana coast. Because ideal thresholds were not available for the FQI and HI, scores were classified as 'good' (green) if they exceeded the 75th percentile of index scores calculated for all CRMS sites during the baseline period, 'poor' (red) if they did not exceed the 25th percentile, or 'fair' (yellow) if they were intermediate to the 25th and 75th percentiles (Figure 1).

Figure 1. Example of how classifications change based on the assessment index and index score distribution. A) Floristic Quality Index distribution and B) Hydrologic Index distribution based on coastwide data from 2006 to 2009.


5

Site Scale Assessment: CRMS0003 Floristic Quality Index (FQI)

The following graphics provide information about the CRMS site of interest with regard to the floristic quality index. These graphics provide an assessment of the vegetation quality of this site relative to other sites within a similar marsh type, basin, and coastwide.

Floristic Quality Index for Saline Marsh, Site CRMS0003

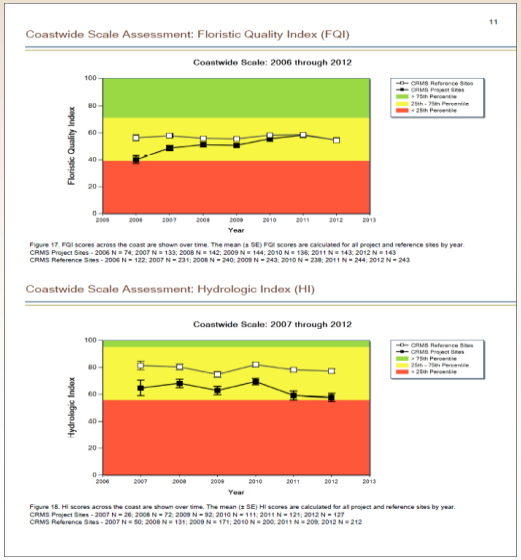
Figure 3. Floristic Quality Index for Saline marsh and species composition for CRMS0003.

Site Scale: CRMS0003 - 2011

Figure 4. A CRMS site FQI score for a given year compared to the distribution of scores for all coastwide sites within the same marsh type, within the same hydrologic basin, and across the entire LA coastal zone.

Site Scale: CRMS0003 - 2007 through 2012

Figure 5. A time series of FQI scores for a CRMS site relative to a box plot of scores for all the sites within the same marsh type each year. Marsh type classifications for each year are based on species composition data for that year at the specific CRMS site.


11

Coastwide Scale Assessment: Floristic Quality Index (FQI)

Coastwide Scale: 2006 through 2012

Figure 17. FQI scores across the coast are shown over time. The mean (± SE) FQI scores are calculated for all project and reference sites by year.
CRMS Project Sites - 2006 N = 74; 2007 N = 133; 2008 N = 142; 2009 N = 144; 2010 N = 136; 2011 N = 143; 2012 N = 143
CRMS Reference Sites - 2006 N = 122; 2007 N = 231; 2008 N = 240; 2009 N = 243; 2010 N = 238; 2011 N = 244; 2012 N = 243

Coastwide Scale Assessment: Hydrologic Index (HI)

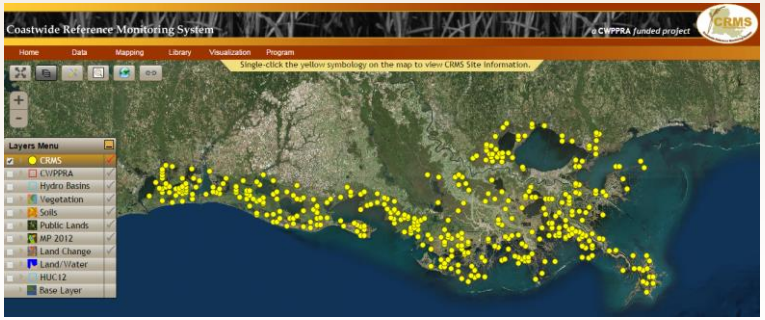
Coastwide Scale: 2007 through 2012

Figure 18. HI scores across the coast are shown over time. The mean (± SE) HI scores are calculated for all project and reference sites by year.
CRMS Project Sites - 2007 N = 26; 2008 N = 73; 2009 N = 92; 2010 N = 111; 2011 N = 121; 2012 N = 127
CRMS Reference Sites - 2007 N = 50; 2008 N = 131; 2009 N = 171; 2010 N = 200; 2011 N = 209; 2012 N = 212

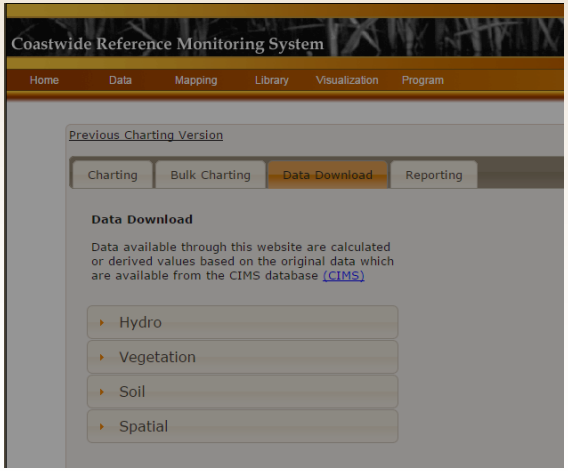
- **Dynamic documents**
- **Program and Index explanations**
- **Multi-scale assessments site, project, basin, coastwide**

Coastwide Reference Monitoring System – *Wetlands*
Site Navigation/Mapping Viewer

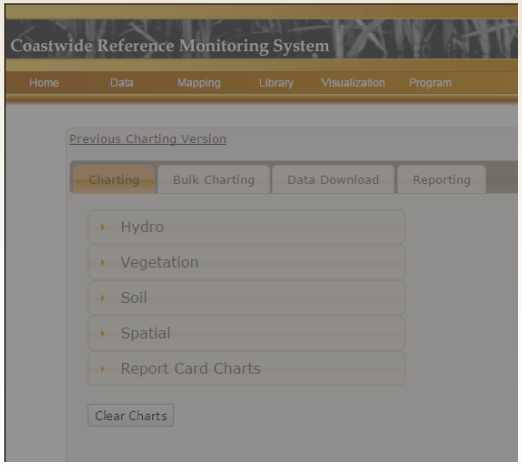
Map



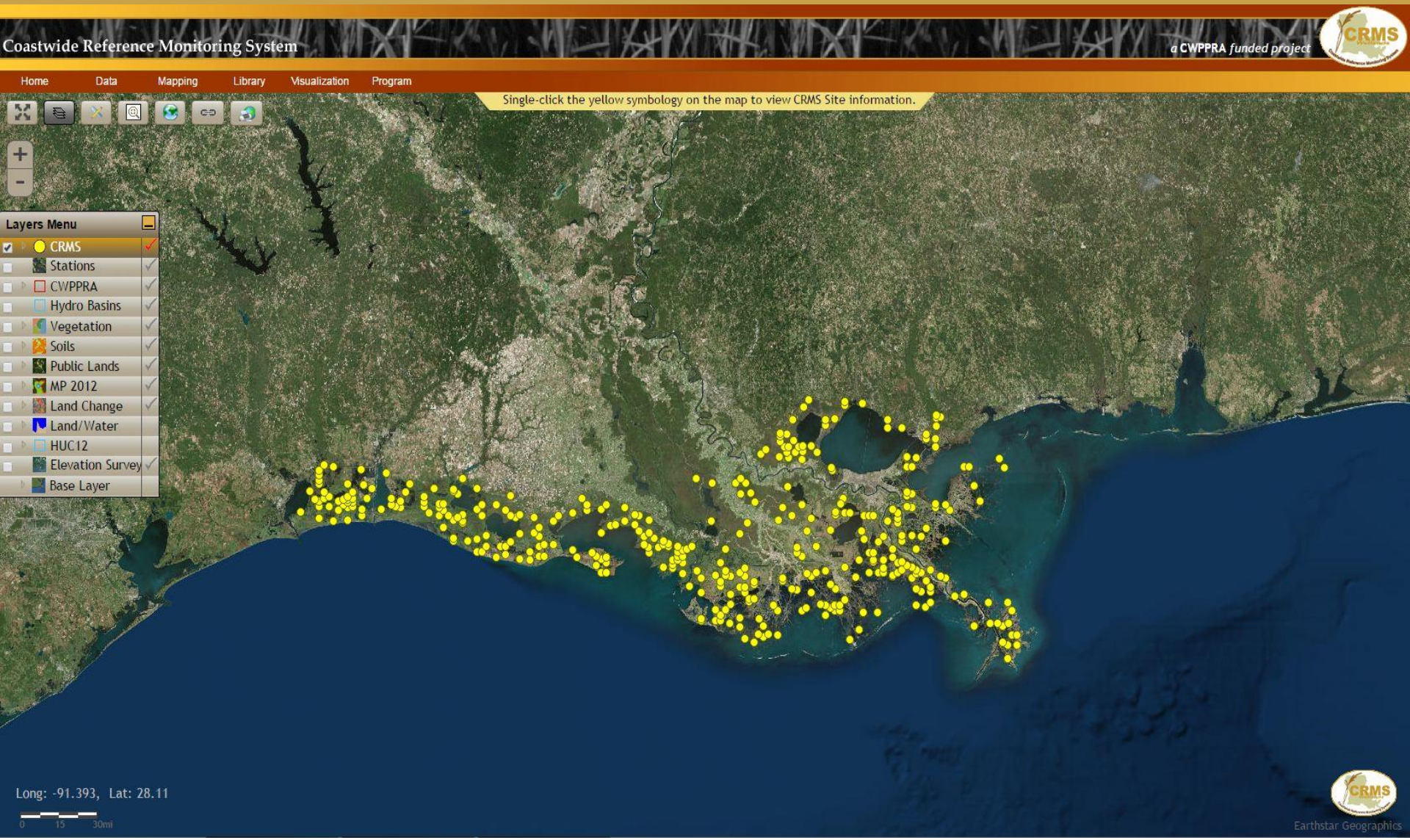
Data



Charting

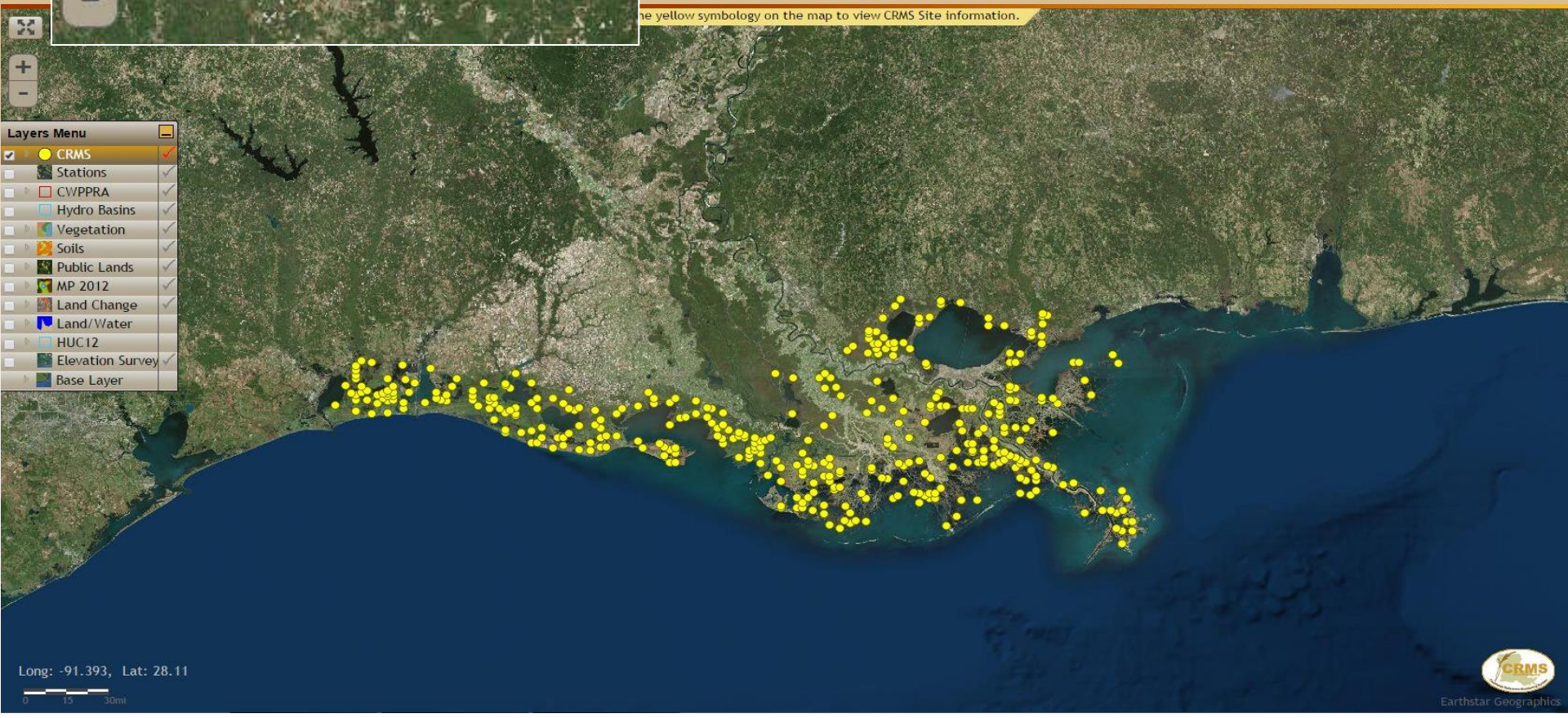


Coastwide Reference Monitoring System – *Wetlands*
Mapping Viewer



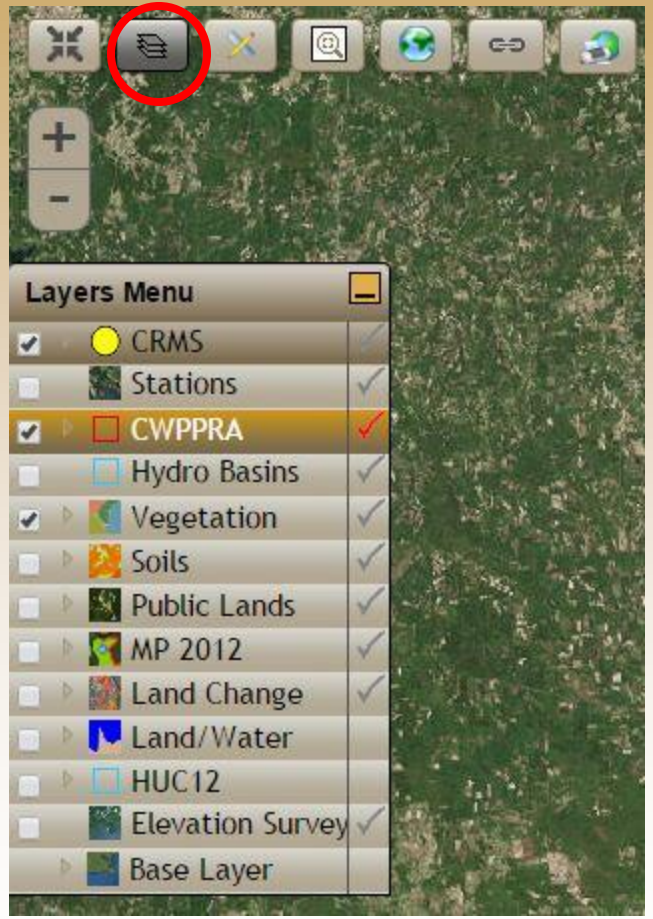
Full Screen Button

Hides the CRMS Website banner and menu.
Allows for more map viewing space.

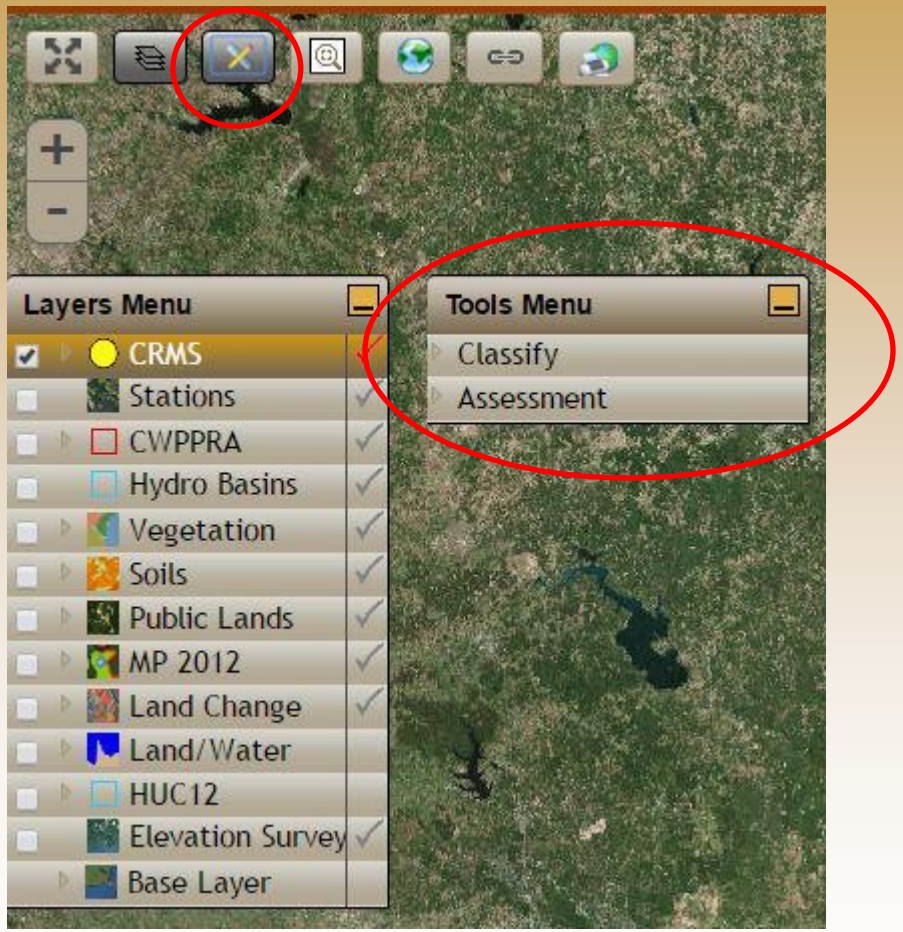


Layers Button

Shows and hides the Layers Menu



Activate Tools Menu



Zoom:

By rectangle

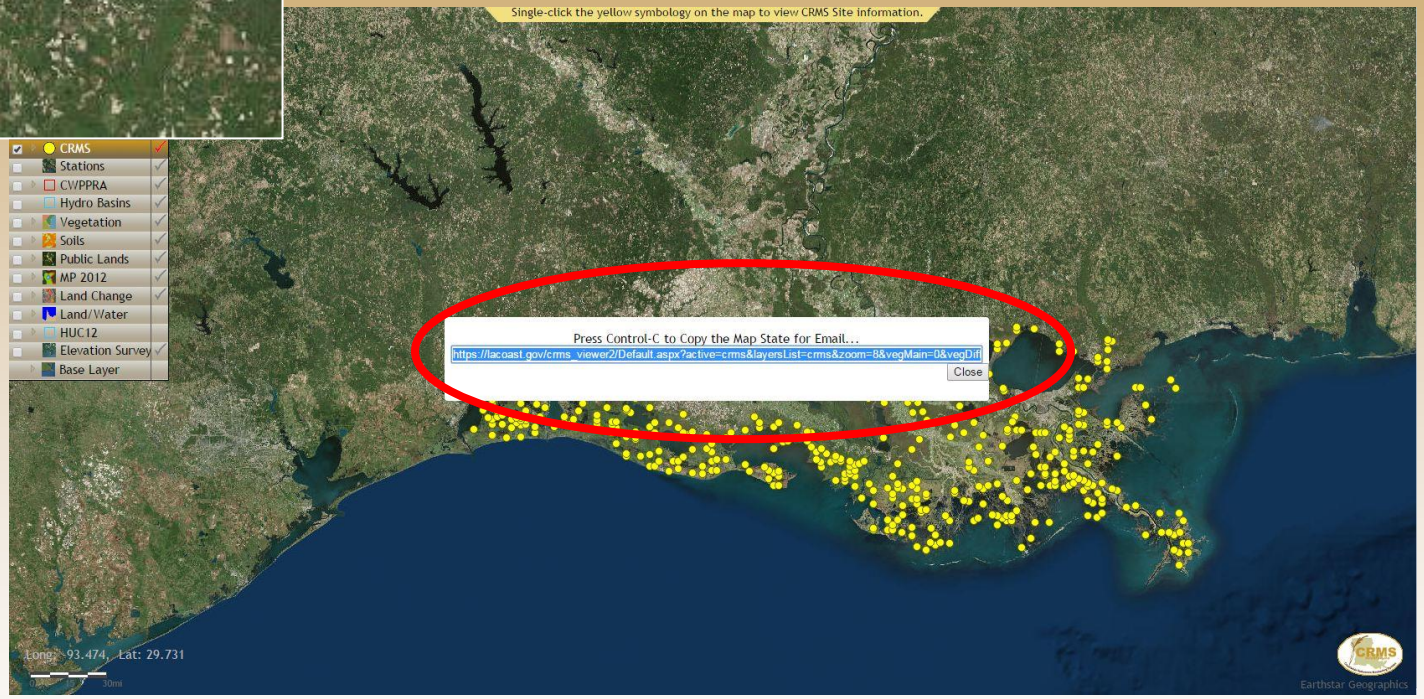
To Full Extent

In & out

Save State Button

Used to create a save state on the map.

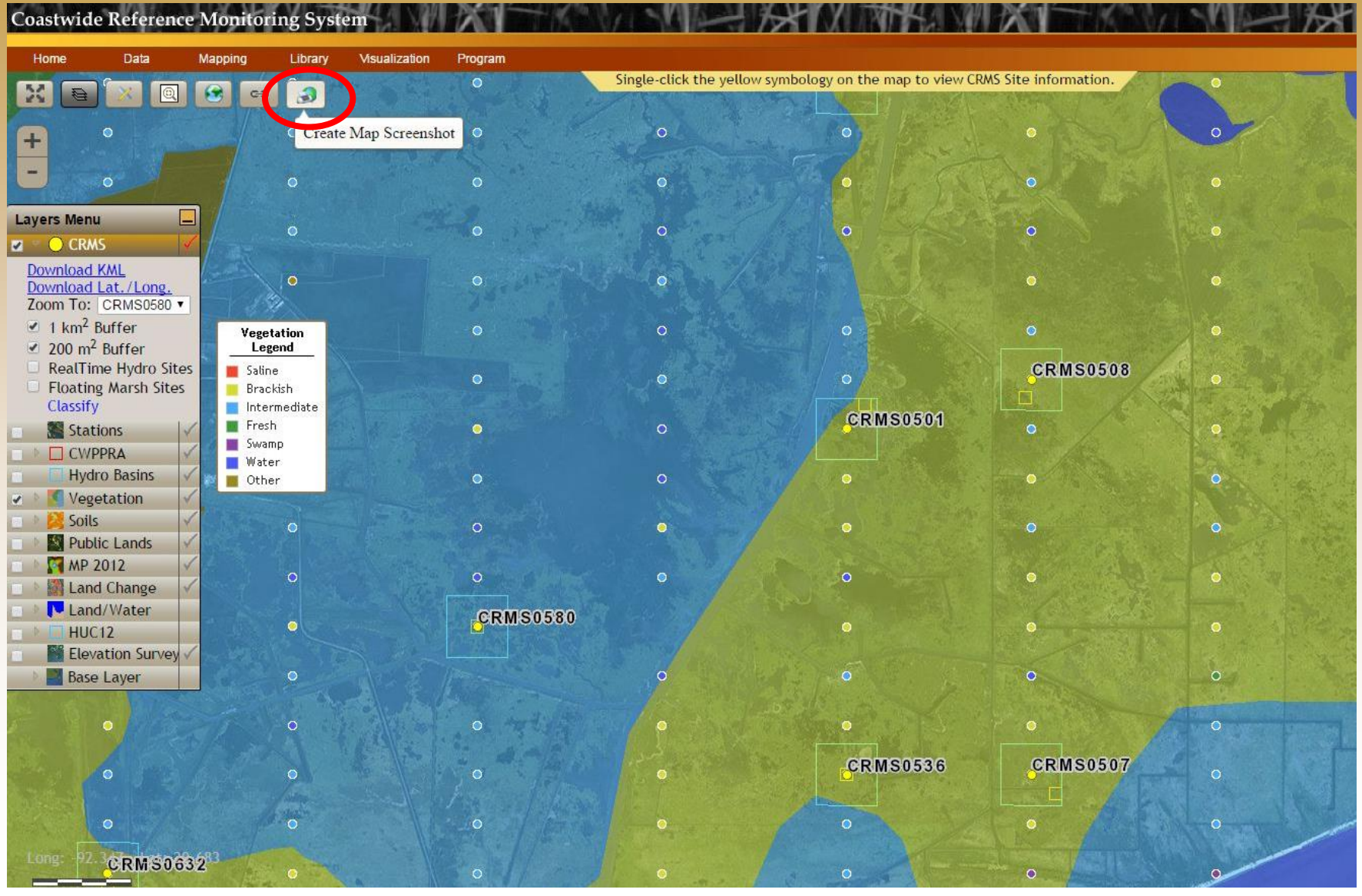
Link created to save the current state of the map.



Email this link to someone so you are both looking at the same information on individual computers.

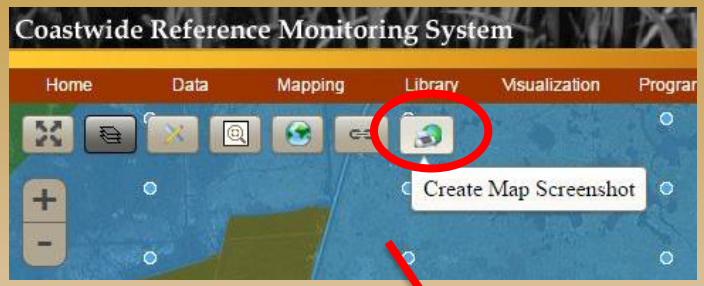
Create Map Screenshot Button

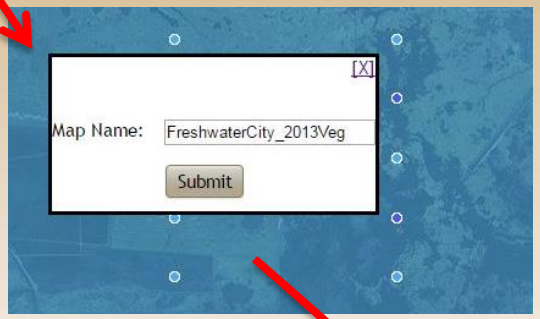
Used to create a screenshot in pdf format.

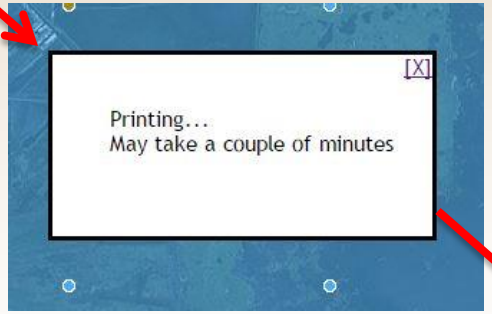


Create Map Screenshot Button

Used to create a screenshot in pdf format.

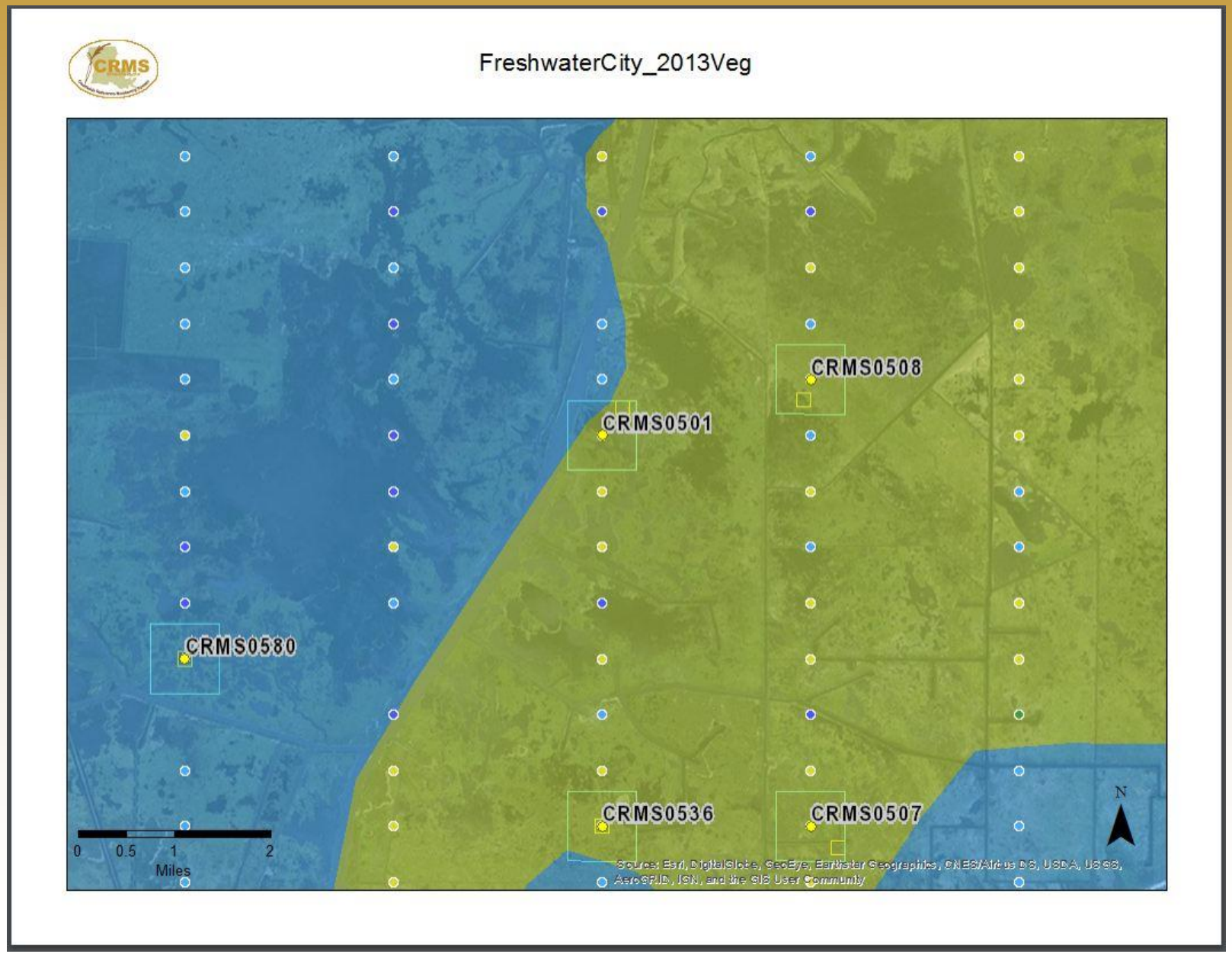




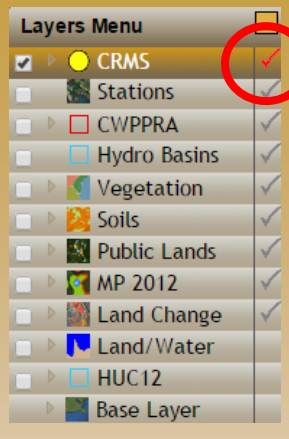


Generates .pdf

Create Map Screenshot Output

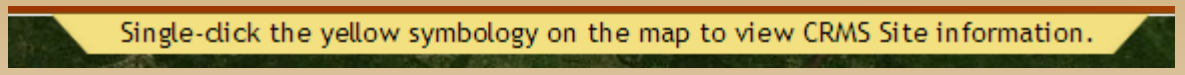


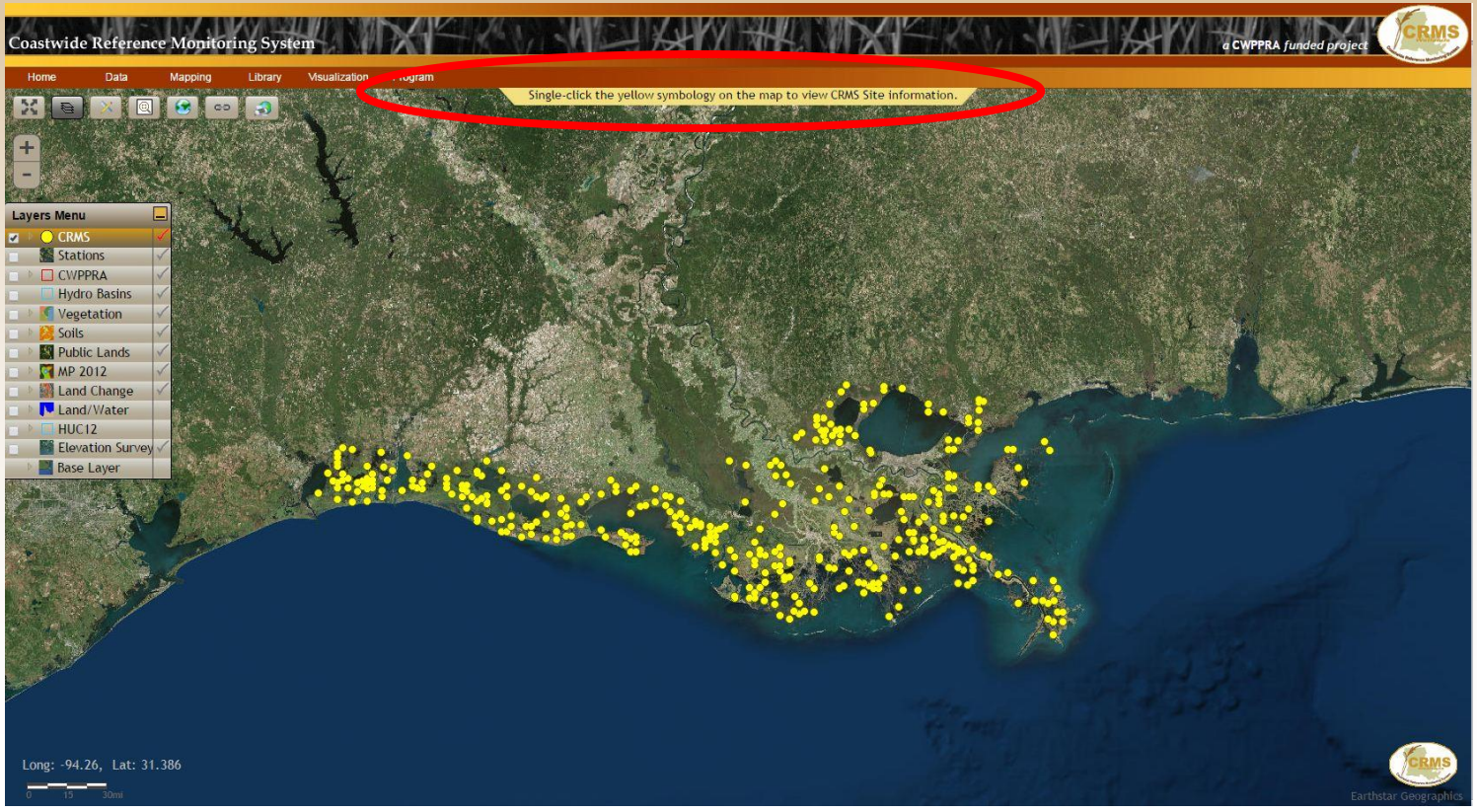
Activating Layers



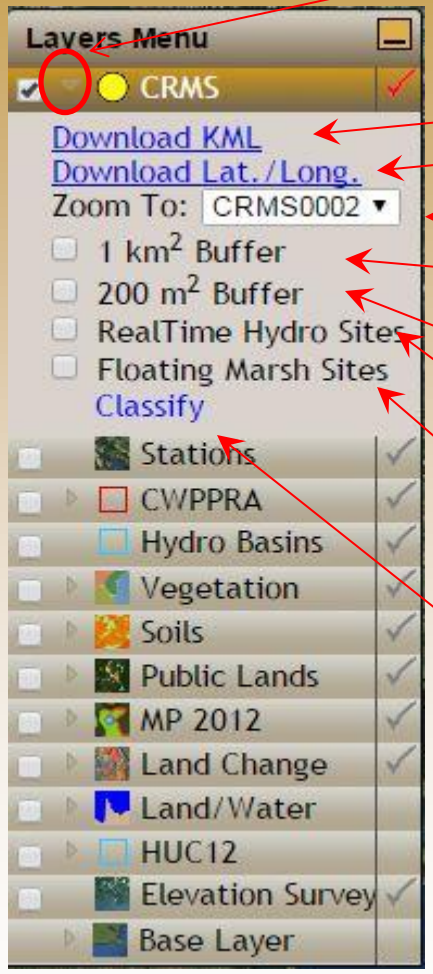
You must activate the layer to interact with it on the map!!!!

Manila dropdown shows how to interact with the current active layer.





CRMS Active Layer Features



Expands CRMS layer menu

Download a KML file to used in Google Earth.

Download a csv file of latitude and longitude.

Zooms to the site and shows the site information bubble.

Adds/removes the 1 km² buffer layer

Aerial Photography Boundary

Adds/removes the 200 m² buffer layer

Ecological Data Collection Area

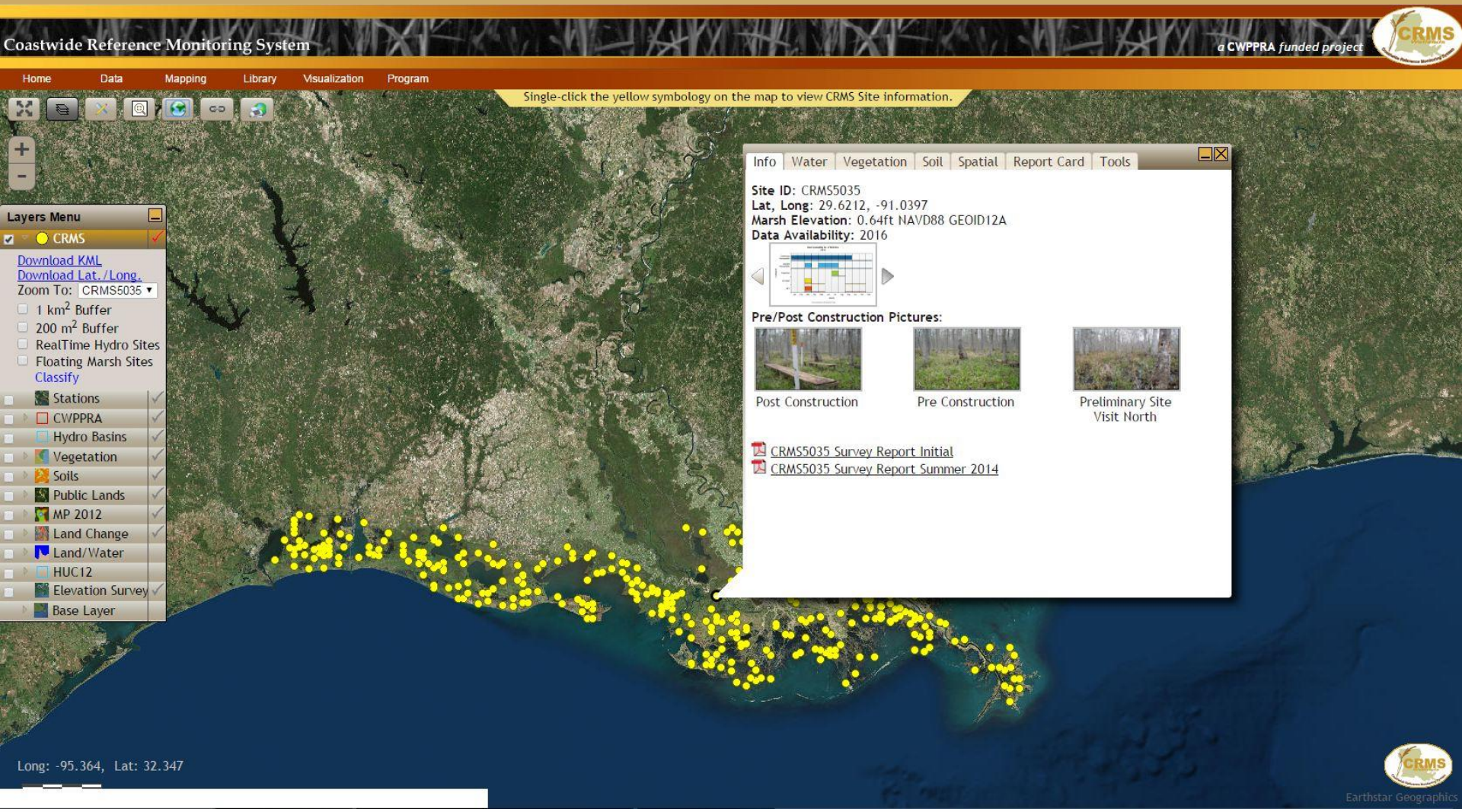
Highlights realtime hydro sites in blue

Highlights floating marsh sites in red

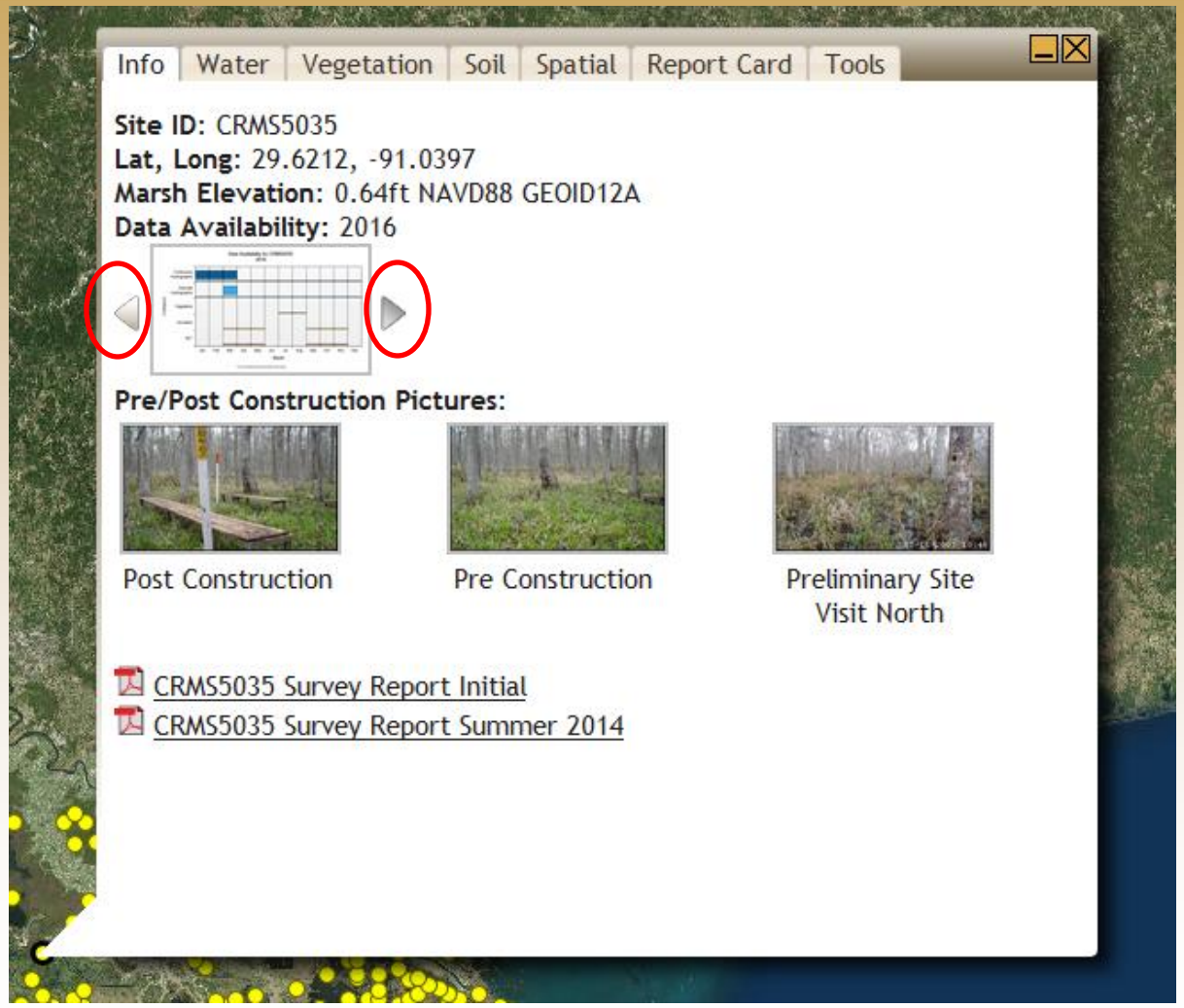
Classify invokes the tools menu with the classification option selected.

Site Bubbles

Click a point for site level information bubble



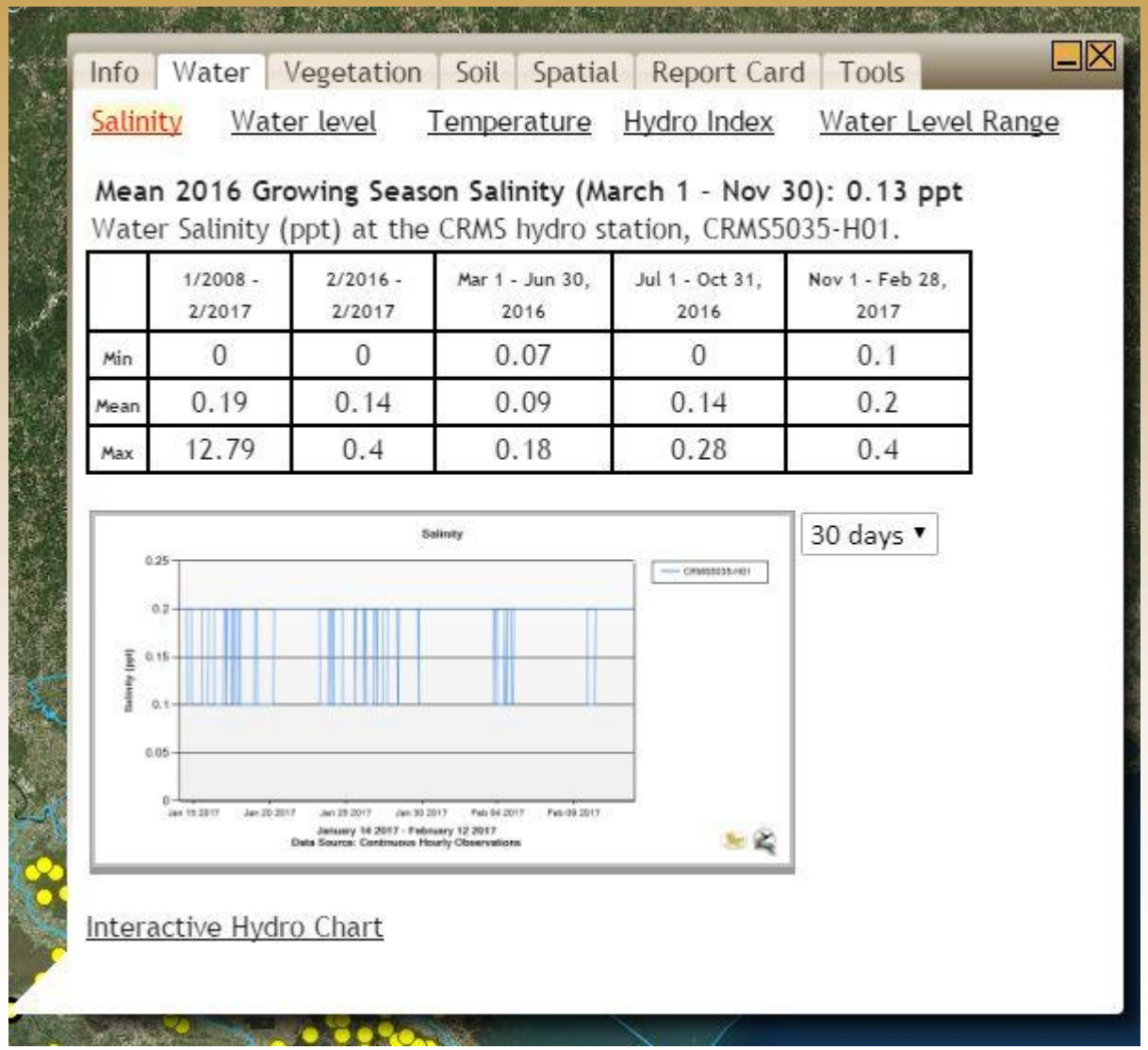
Site Information Bubble



General information about the CRMS site including data availability, site photos, and survey reports.

Arrows allow user to scroll through data availability by year.

Site Information Bubble

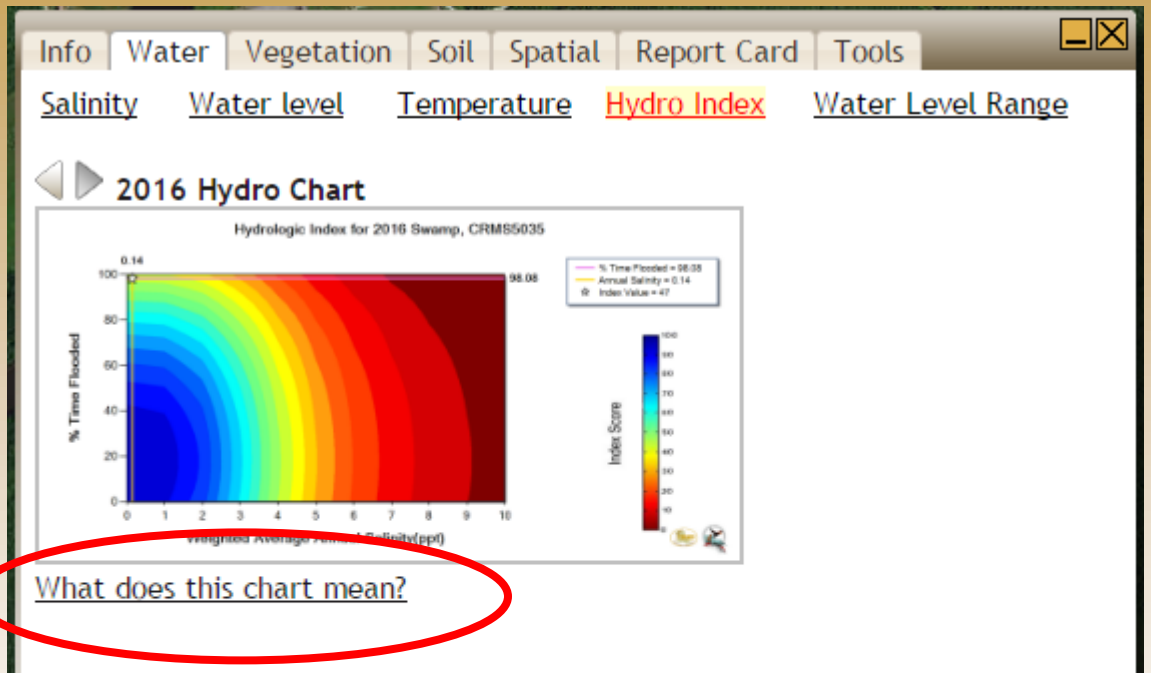


	1/2008 - 2/2017	2/2016 - 2/2017	Mar 1 - Jun 30, 2016	Jul 1 - Oct 31, 2016	Nov 1 - Feb 28, 2017
Min	0	0	0.07	0	0.1
Mean	0.19	0.14	0.09	0.14	0.2
Max	12.79	0.4	0.18	0.28	0.4

The Water tab contains all hydrologic information for the selected site.

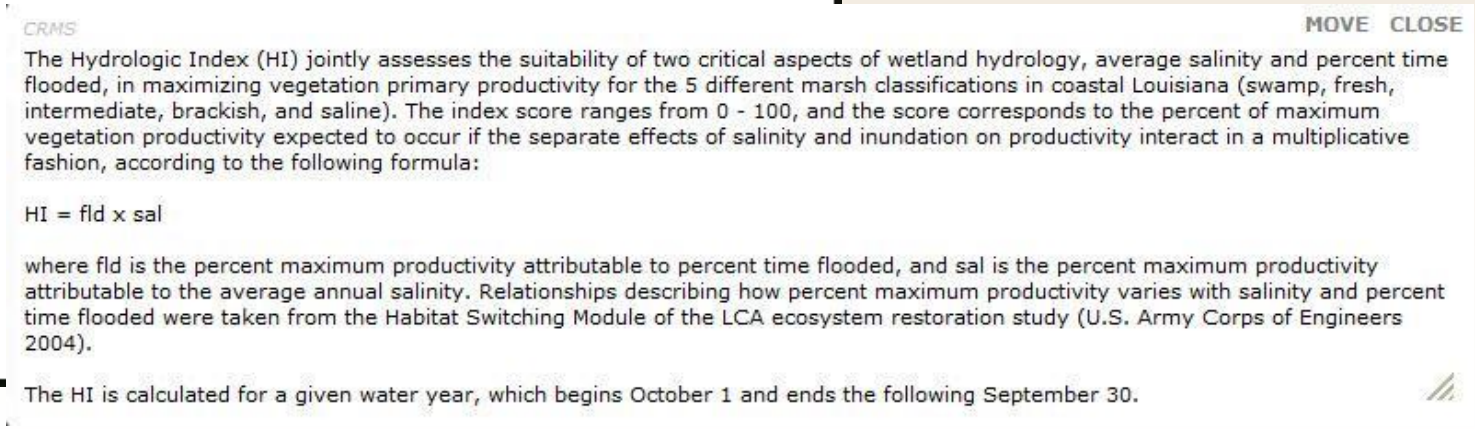
Salinity – Brief overview of salinity data for the site. Also charts most recent salinity data for the site.

Site Information Bubble

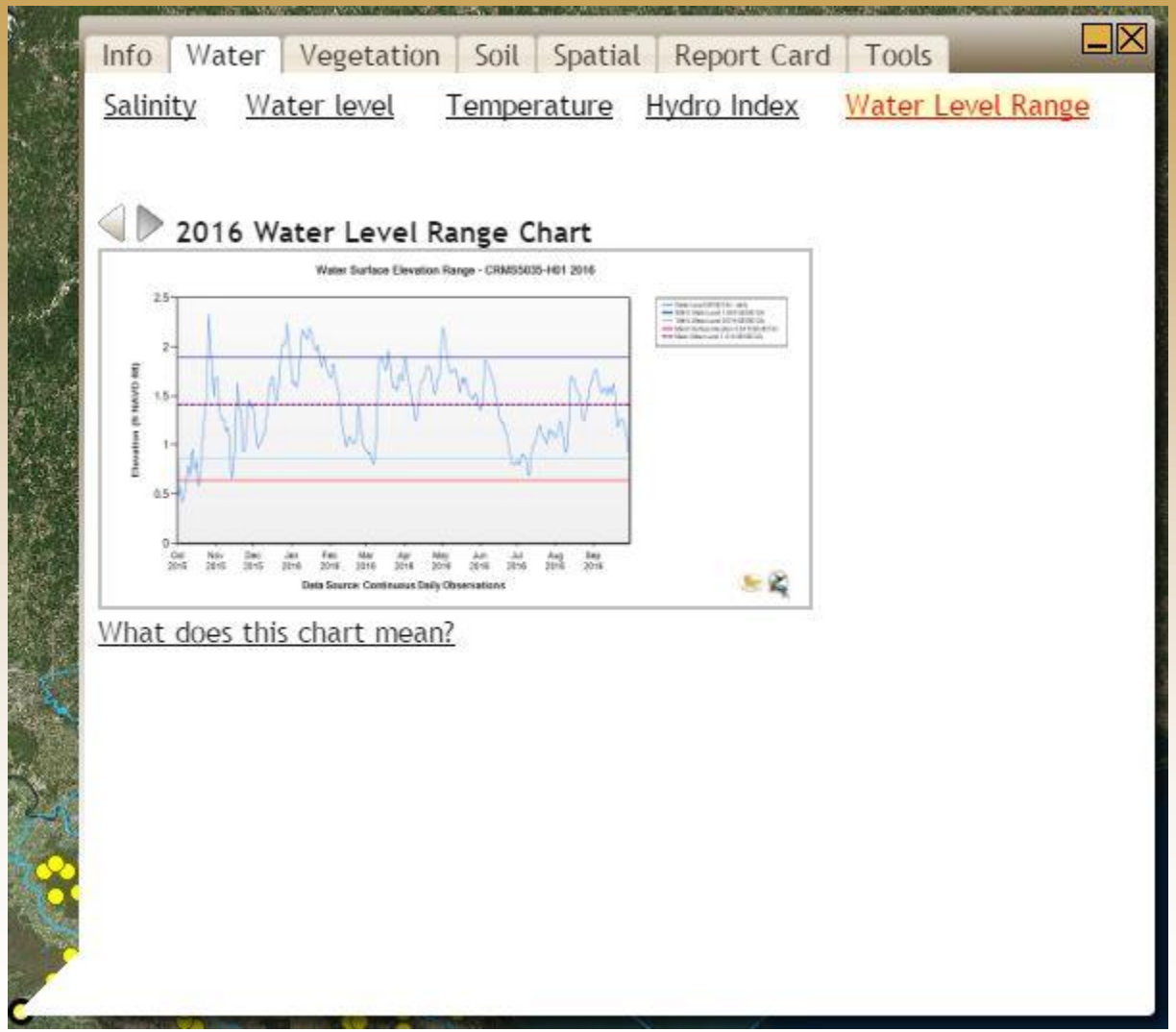


The Water tab contains all hydrologic information for the selected site.

Hydro Index – All Hydro Index charts available for the site.



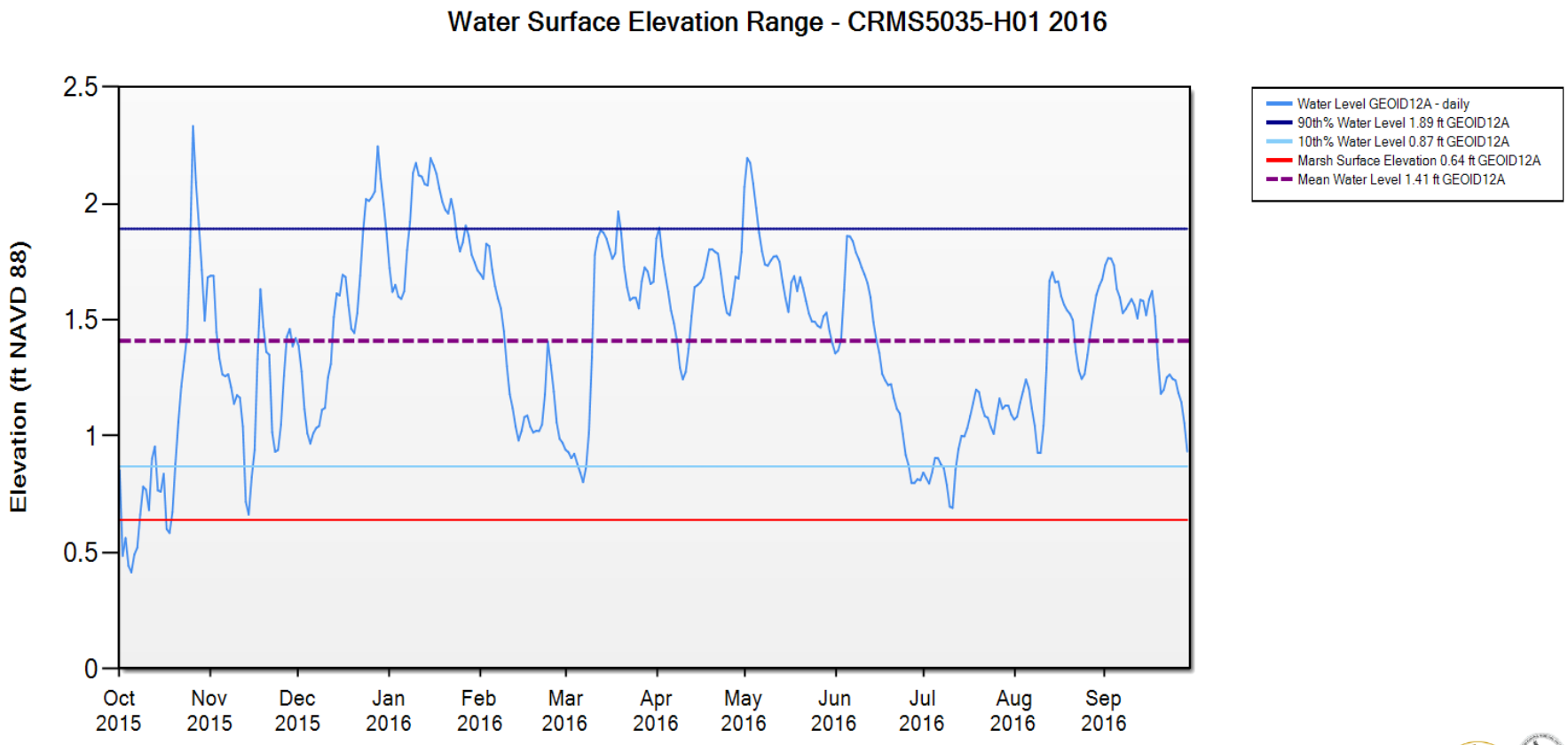
Site Information Bubble



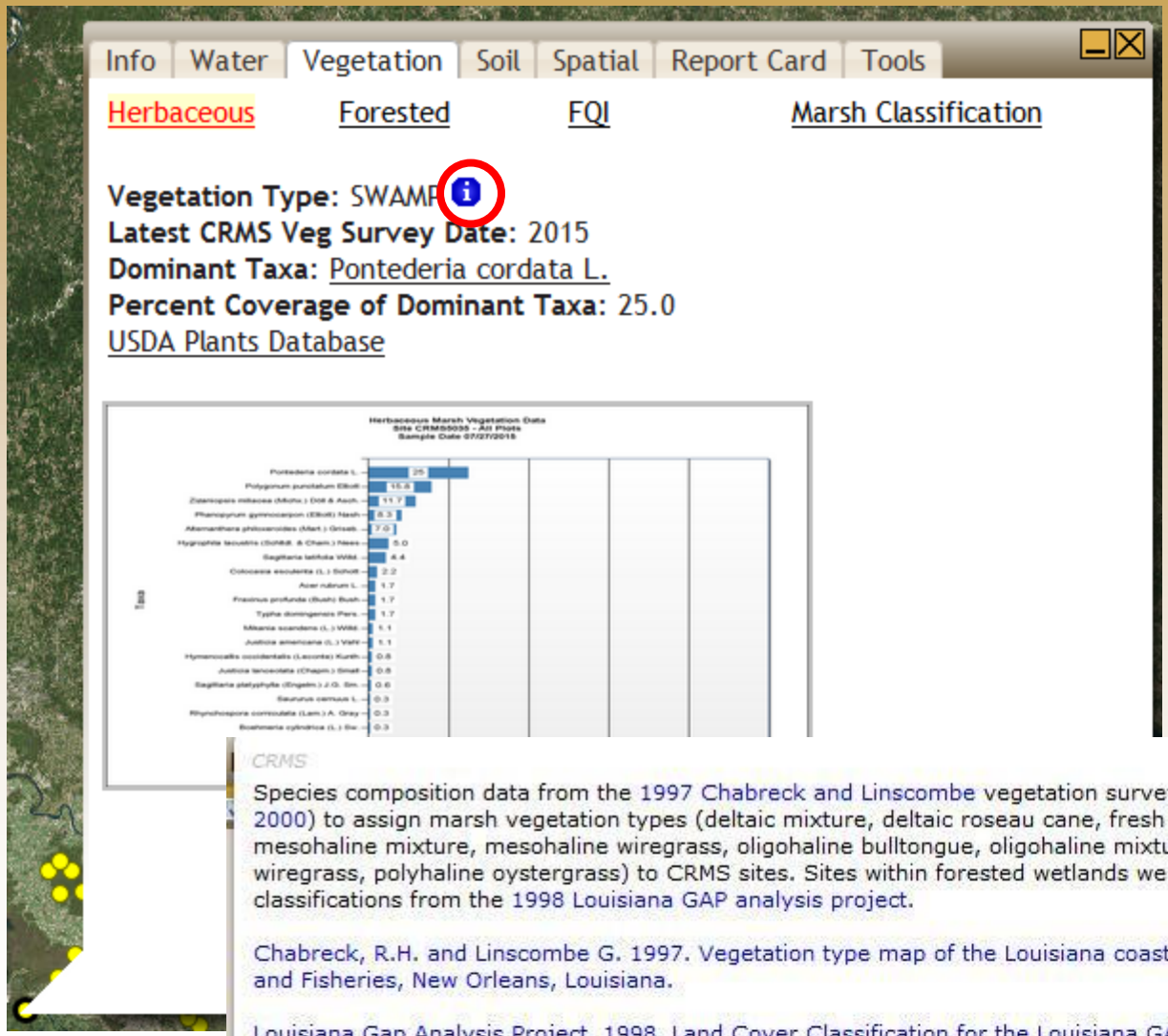
The Water tab contains all hydrologic information for the selected site.

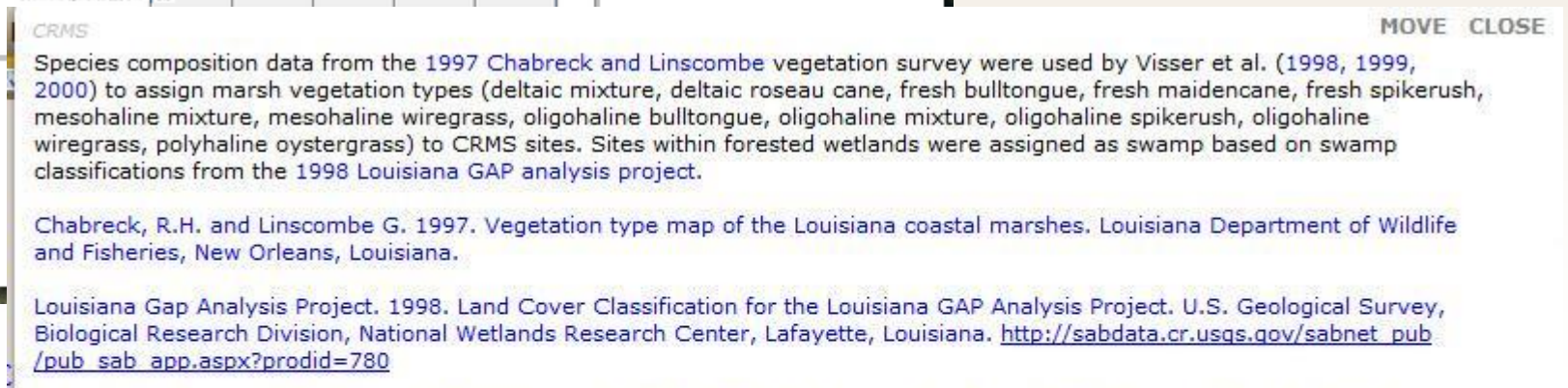
Water Level Range – All water level range charts available for the current site.

Site Information Bubble



Site Information Bubble

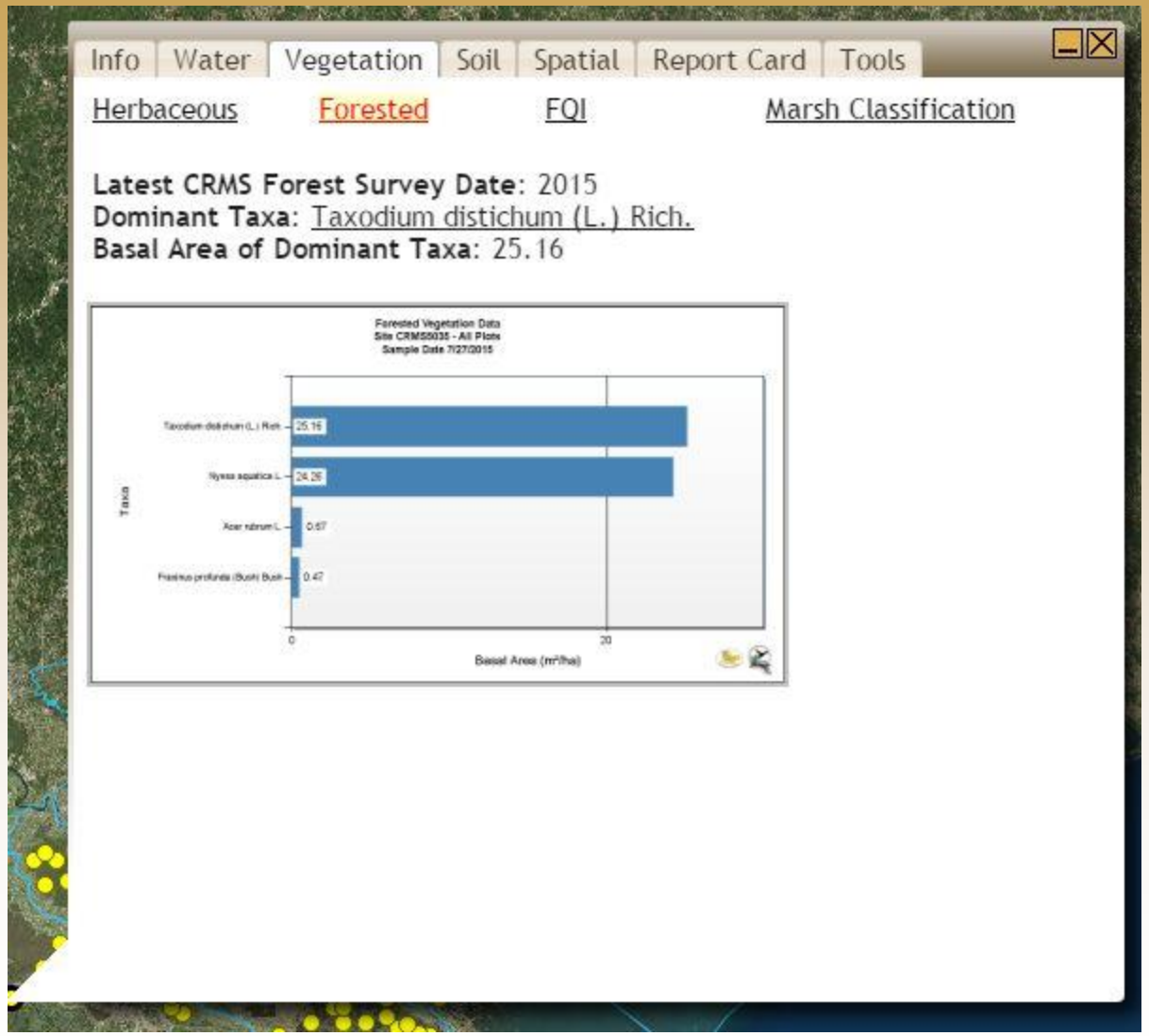




The Vegetation tab contains all vegetation information for the selected site.

Herbaceous – Species driven percent cover chart.

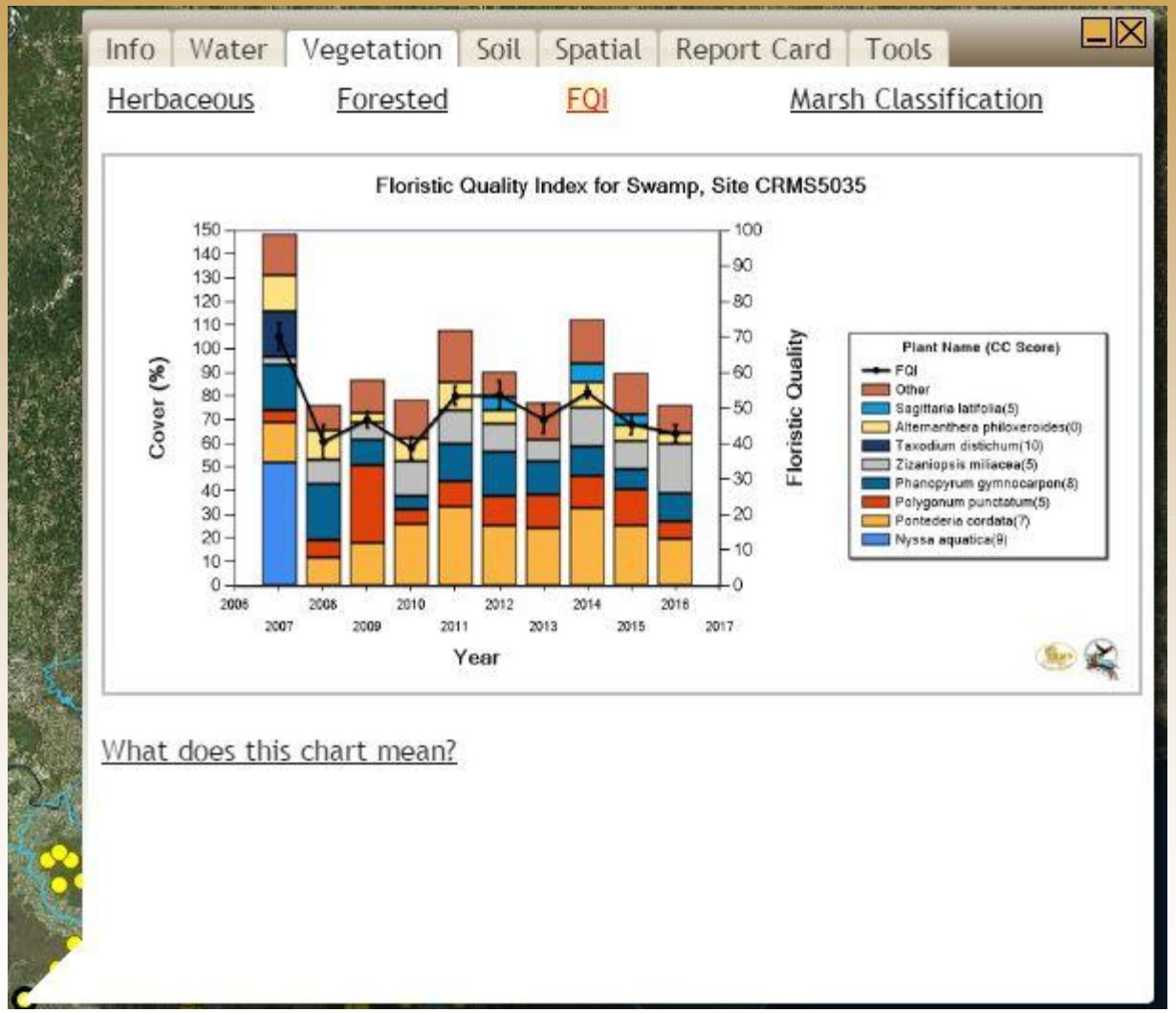
Site Information Bubble



The Vegetation tab contains all vegetation information for the selected site.

Forested – Species driven basal area chart.

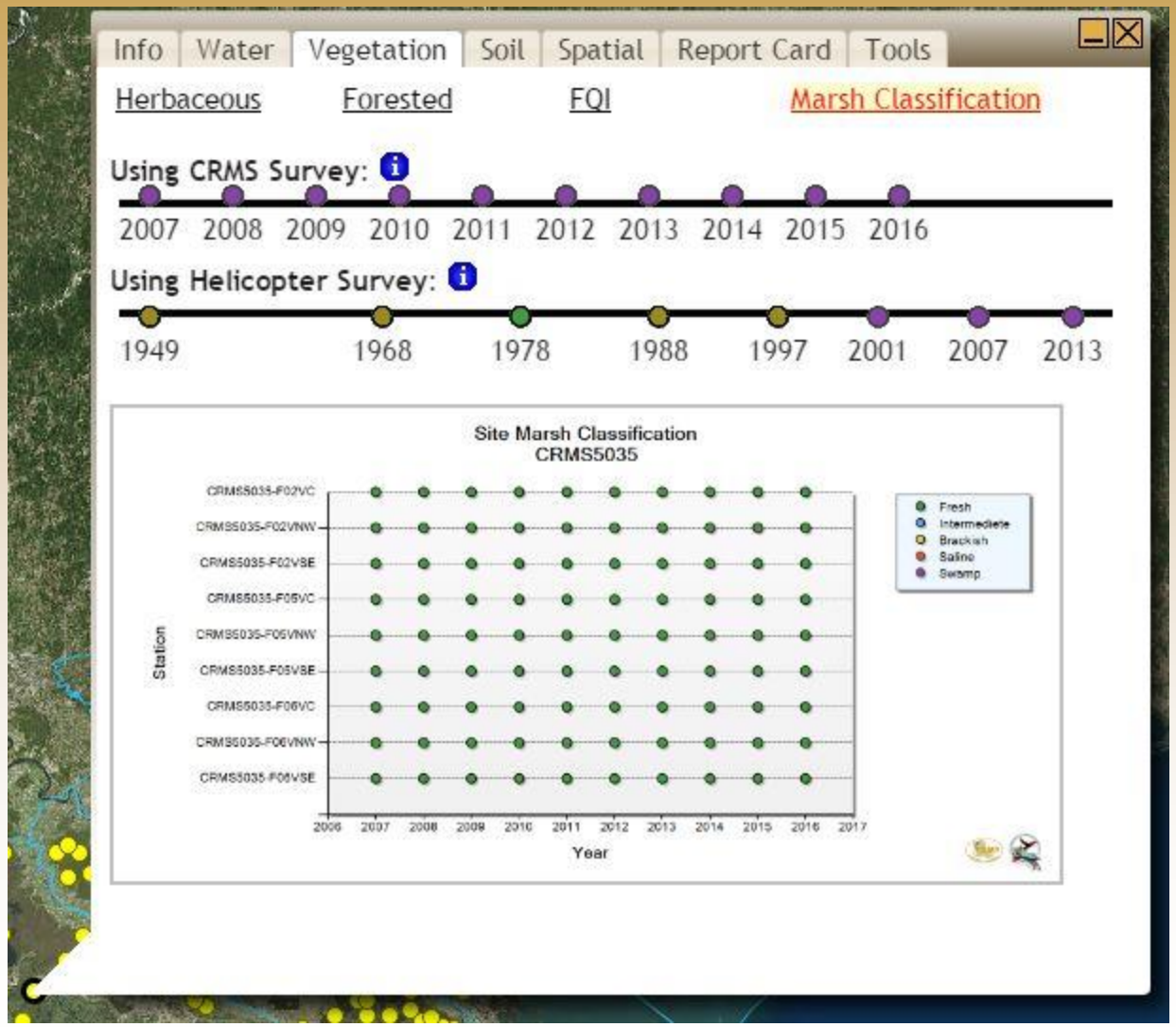
Site Information Bubble



The Vegetation tab contains all vegetation information for the selected site.

Floristic Quality Index (FQI) chart showing vegetative species composition and FQI score annually.

Site Information Bubble



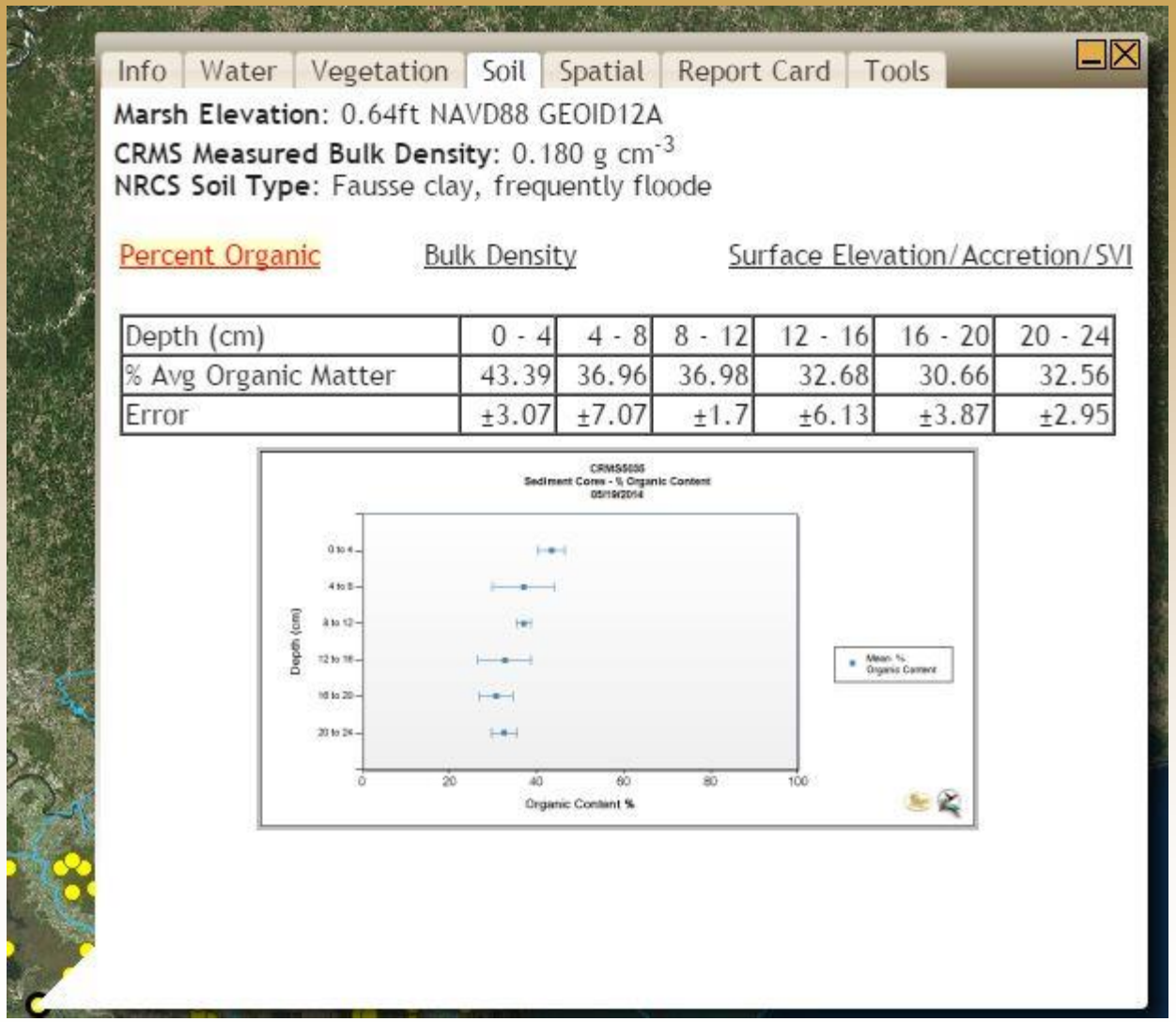
The Vegetation tab contains all vegetation information for the selected site.

Marsh Classification – The chart displays marsh class by site over time.

Top bar is marsh class at the site level using annual on-the-ground vegetation survey data.

Bottom bar is marsh class at the site level using the helicopter survey data.

Site Information Bubble



The Soil tab contains all soil information for the selected site.

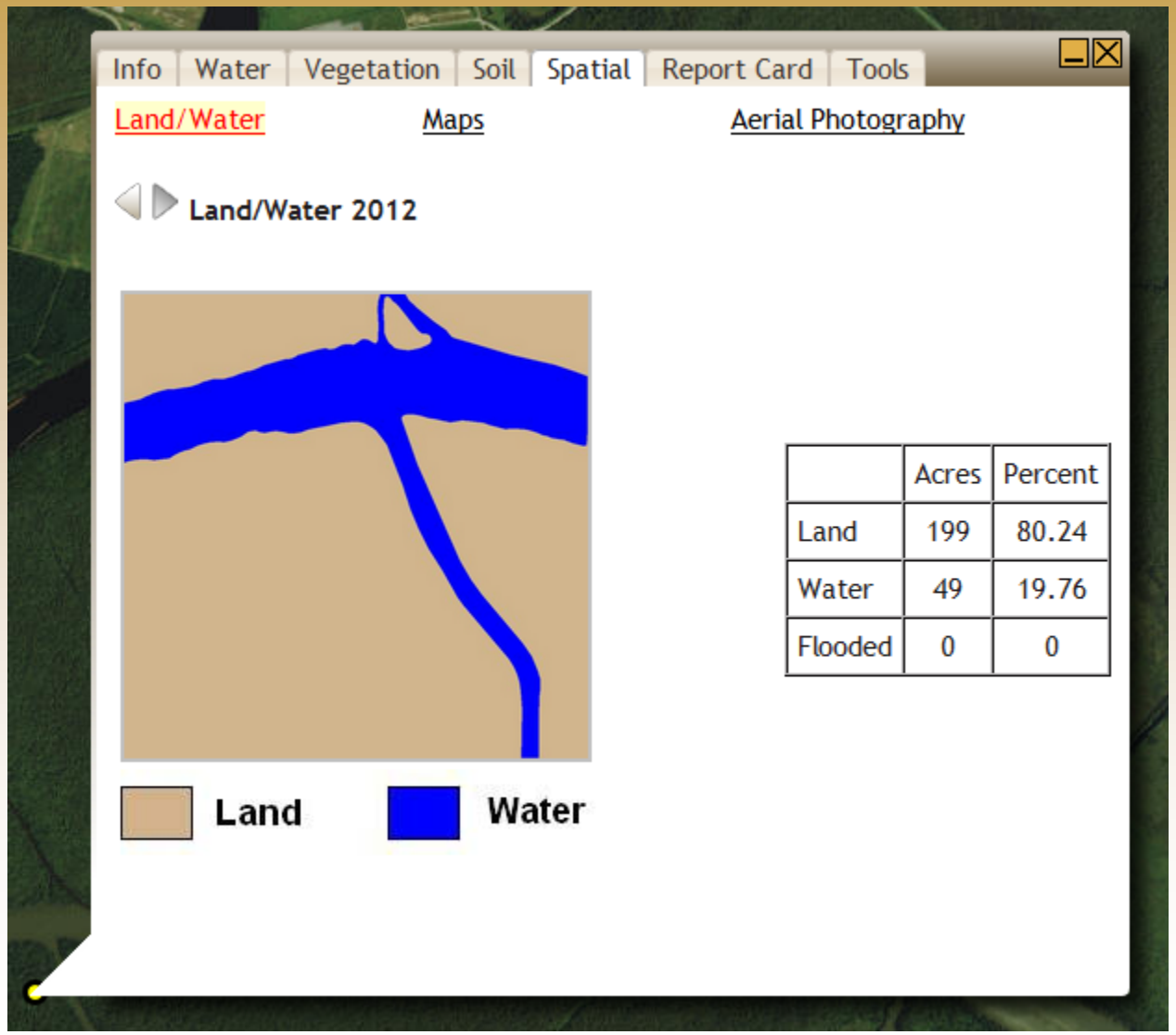
Percent Organic – Soil profiles taken at site establishment.

Site Information Bubble

The Soil tab contains all soil information for the selected site.

Surface Elevation/Accretion – currently displays site level elevation change and accretion and gives rates for shallow subsidence.

Site Information Bubble



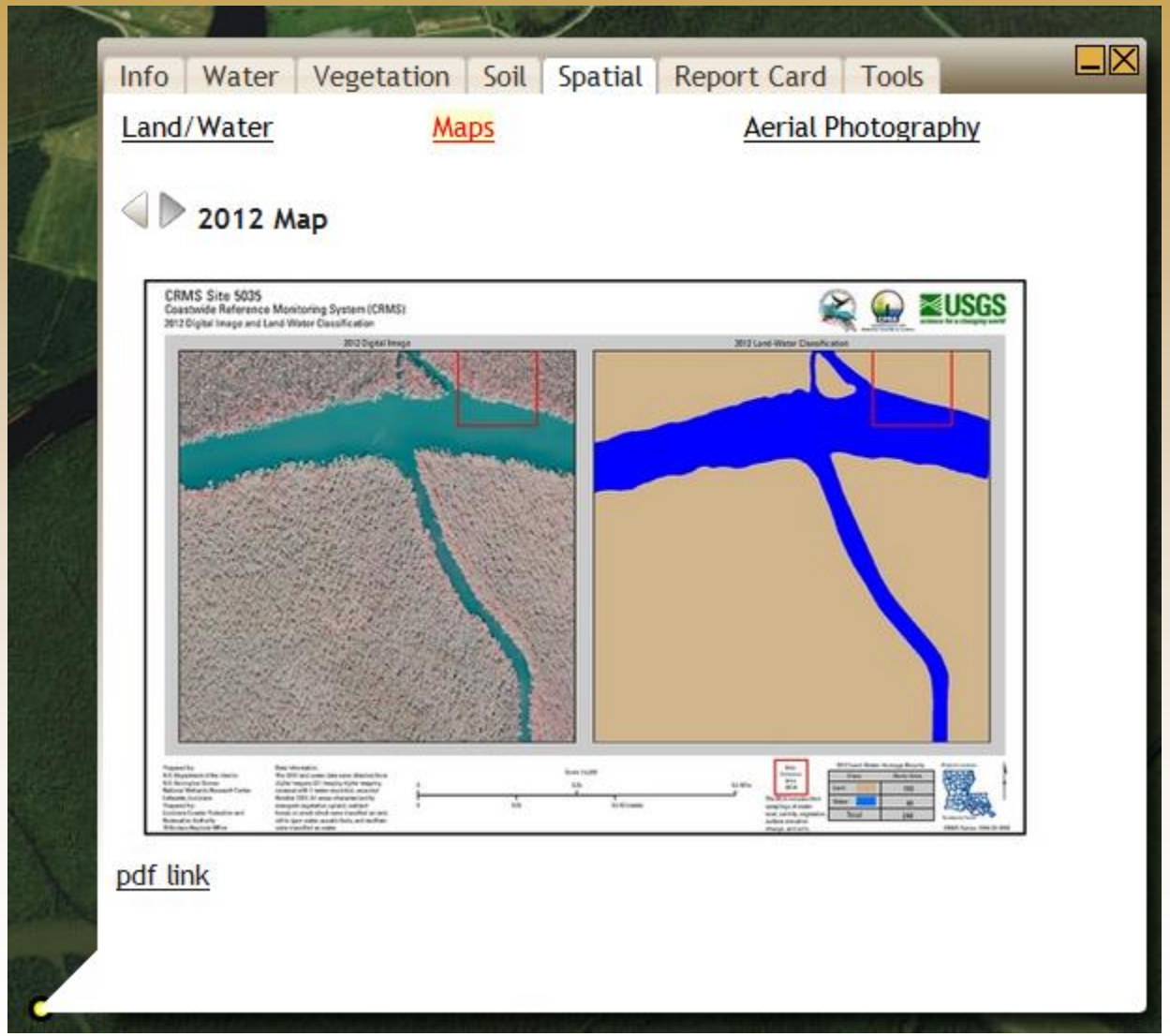
	Acres	Percent
Land	199	80.24
Water	49	19.76
Flooded	0	0

The Spatial tab contains all spatial information for the selected site.

Land/Water with acreage breakdowns.

2015/2016 Land/Water classification in progress.

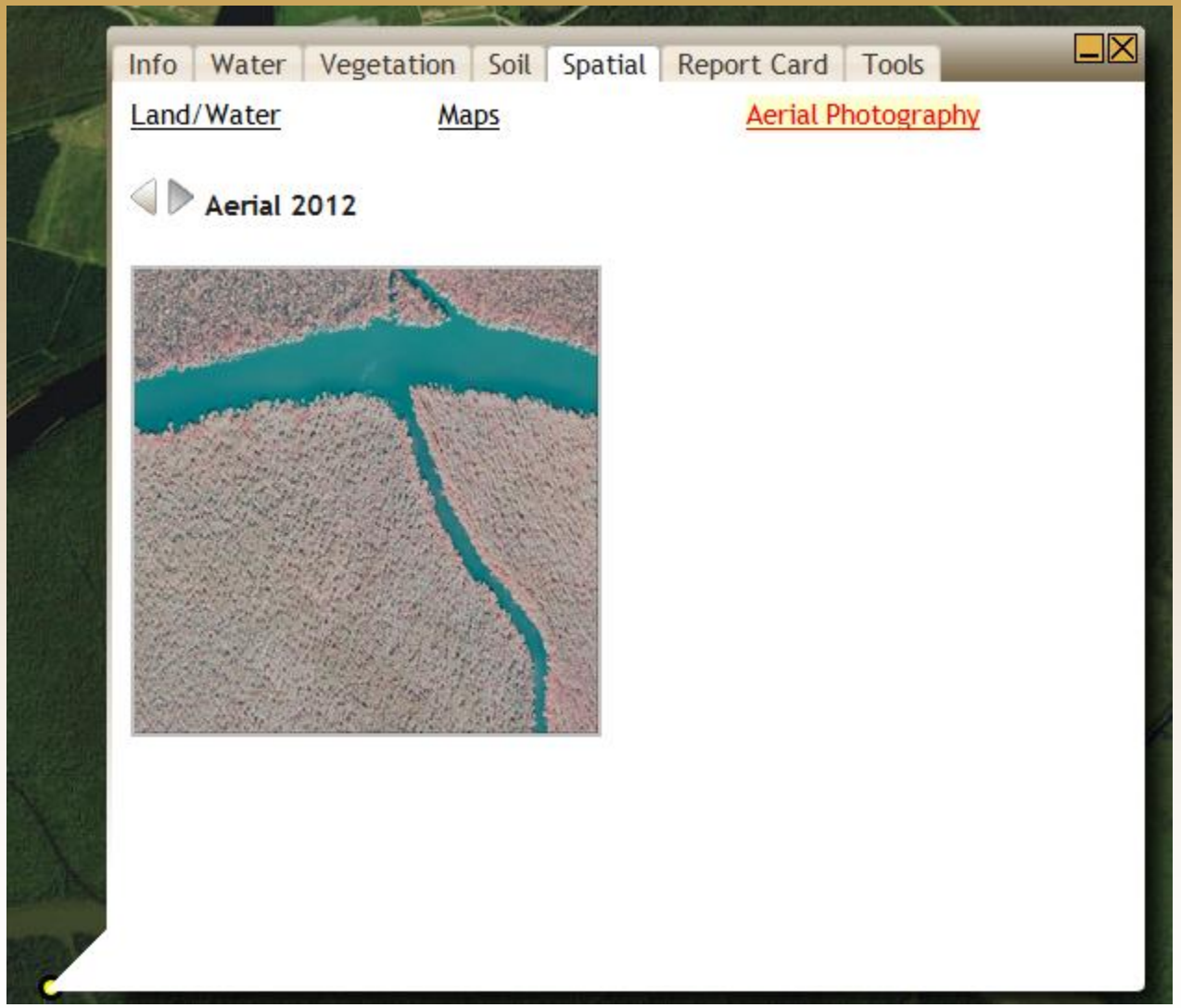
Site Information Bubble



The Spatial tab contains all spatial information for the selected site.

CRMS site land/water maps at the 1km^2 scale.

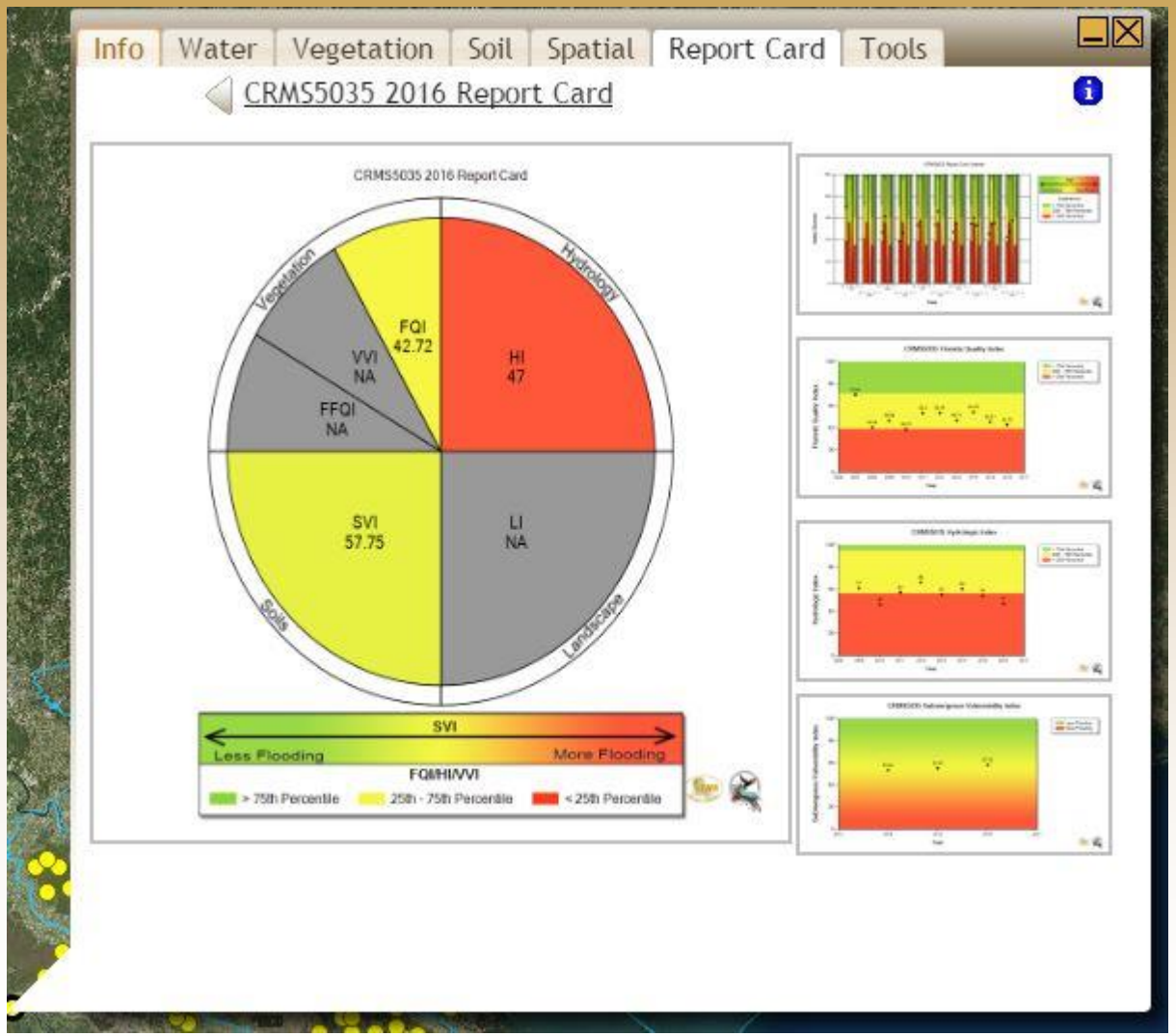
Site Information Bubble



The Spatial tab contains all spatial information for the selected site.

Aerial Photography

Site Information Bubble

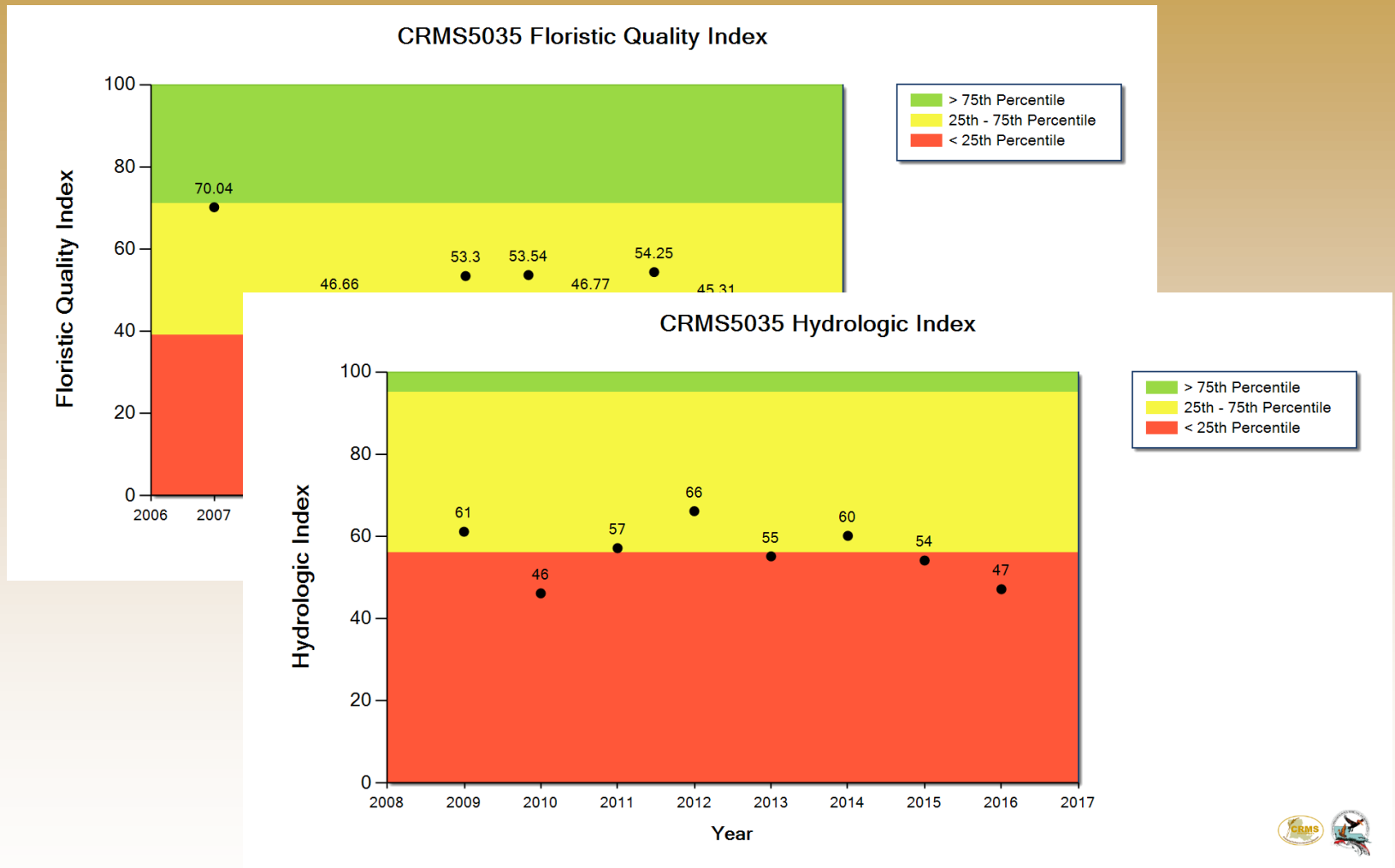


The Report Card tab contains all report card information for the selected site.

Report Card- Generate site report cards for previous years in the bubble or look at summary graphics.

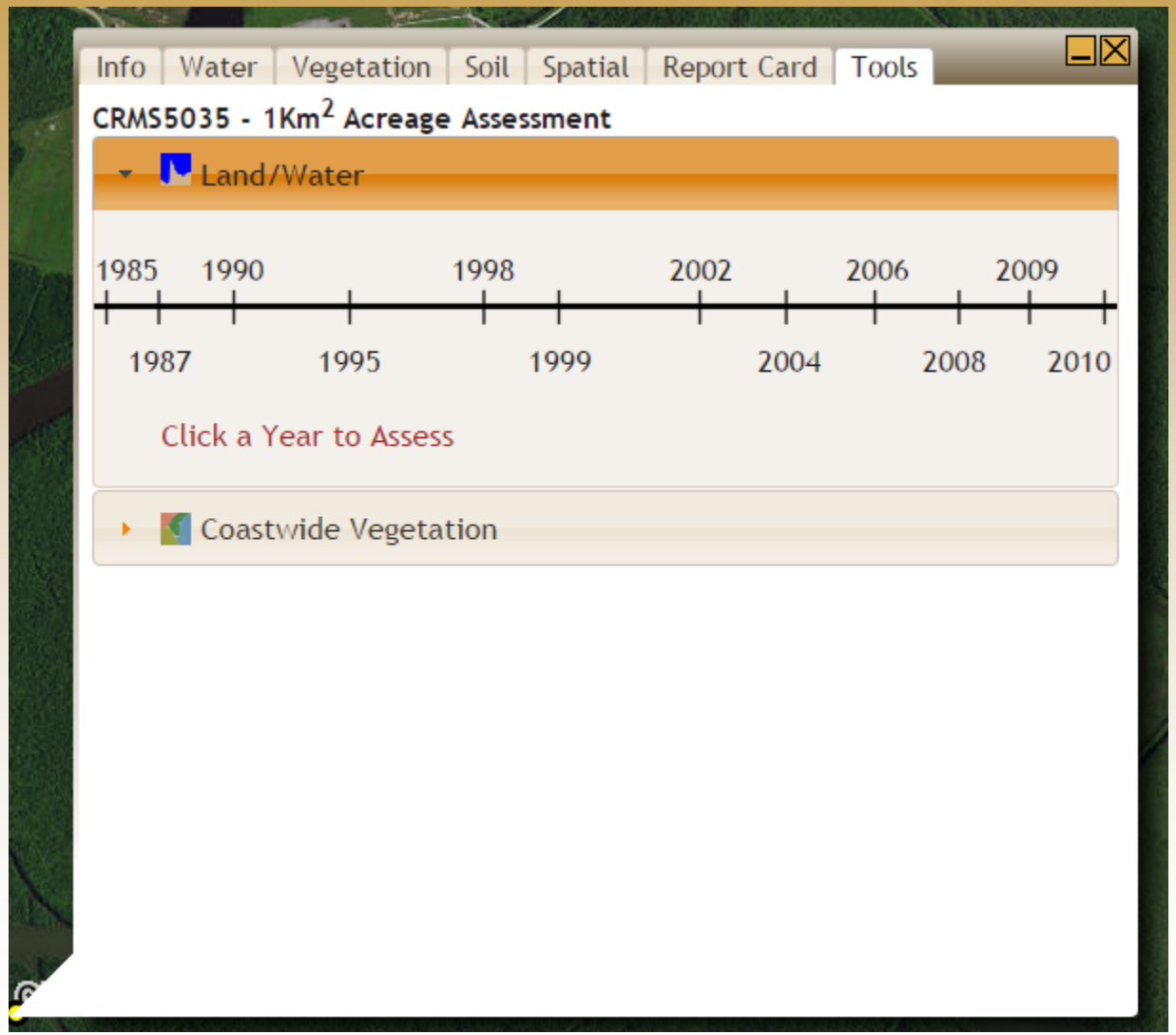
Click on thumbnails to expand graphics.

Site Information Bubble



Report Card Summary Graphics- Allow you to visualize individual index scores through time for a particular site.

Site Information Bubble



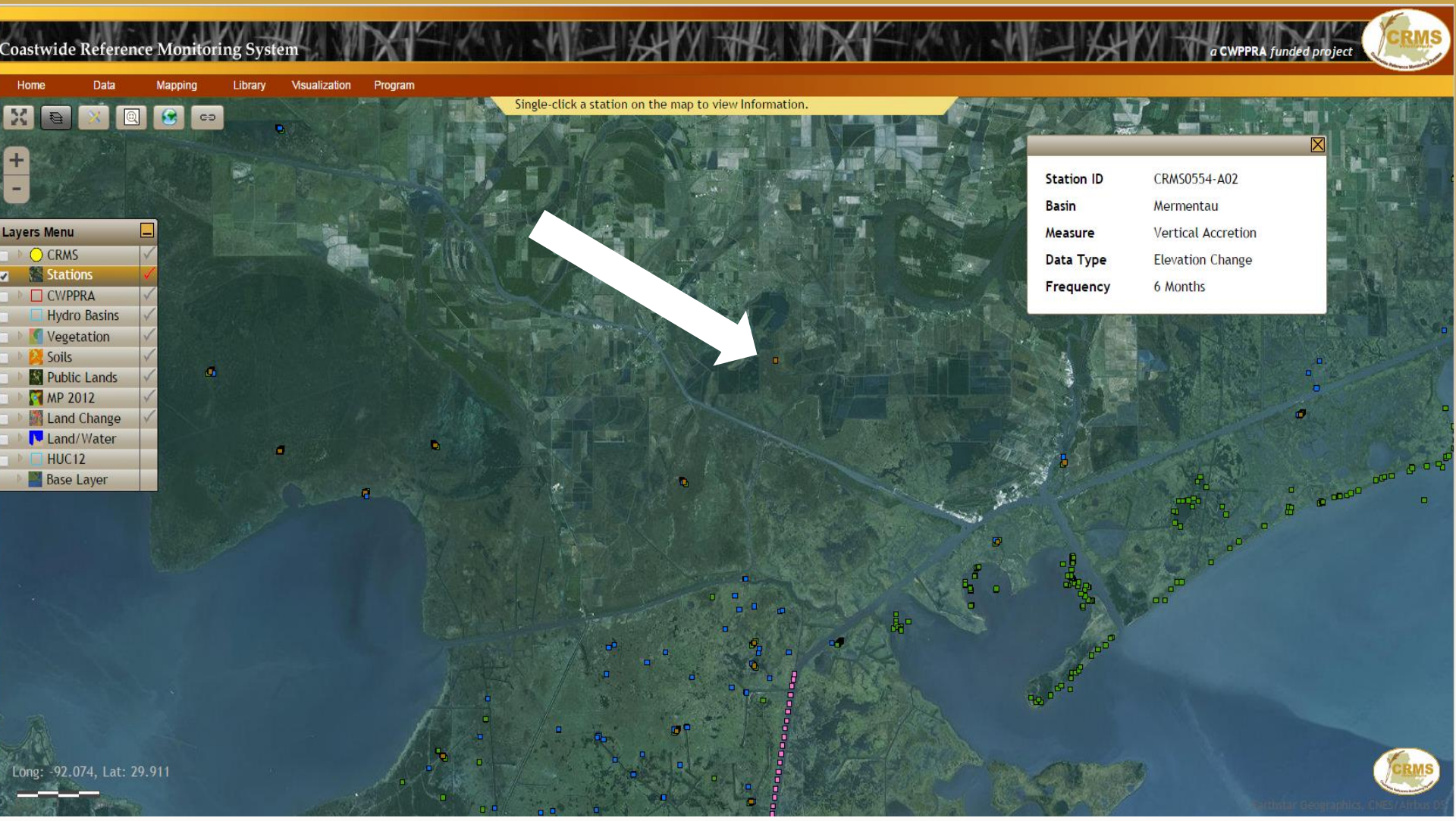
The Tools tab lets you do an Acreage Assessment on the selected site.

Acreage Assessment – Use the acreage assessment tool to determine acreage breakdowns of the available coastwide vegetation surveys or land/water data.

Coastwide Reference Monitoring System – *Wetlands*

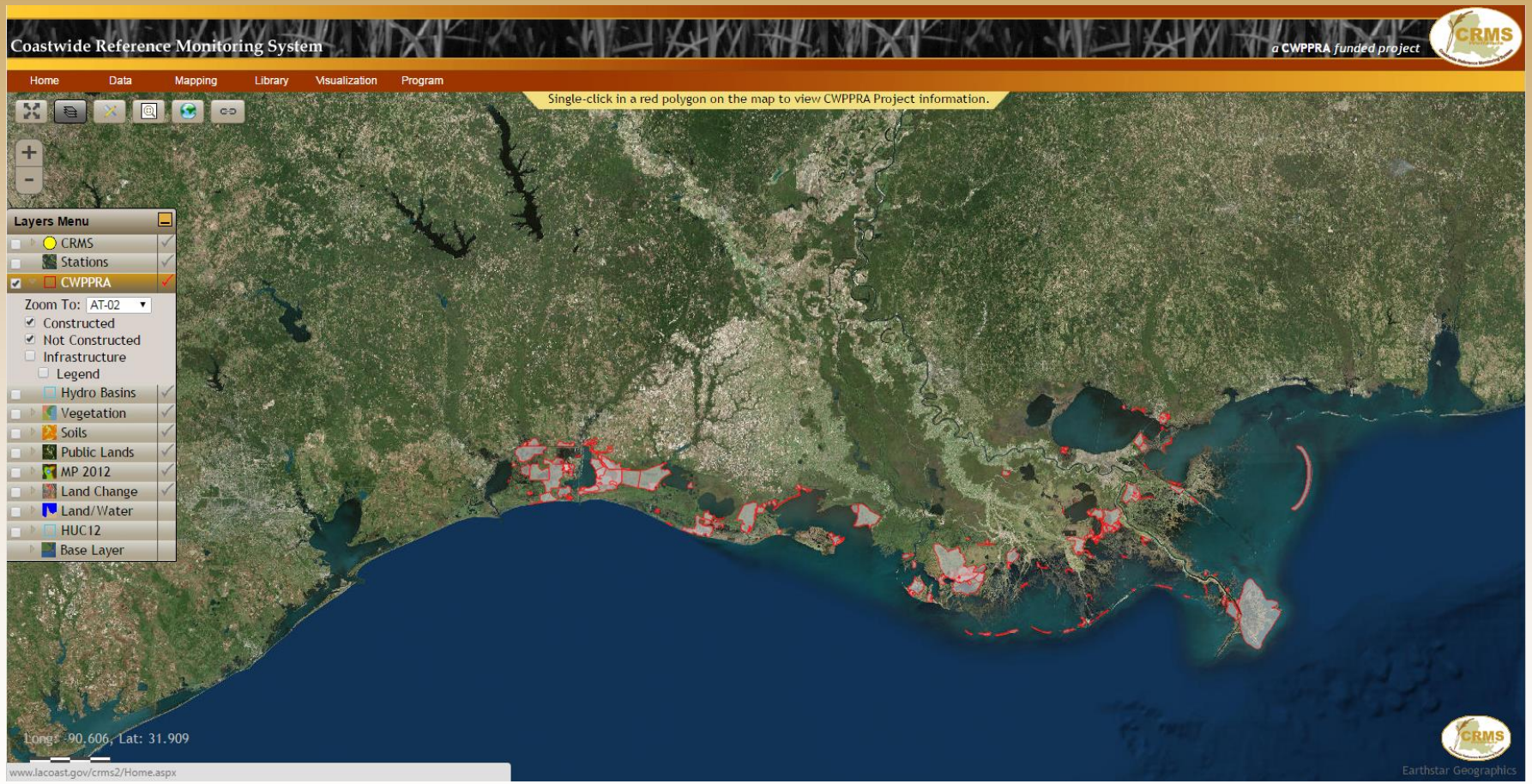
Stations Layer

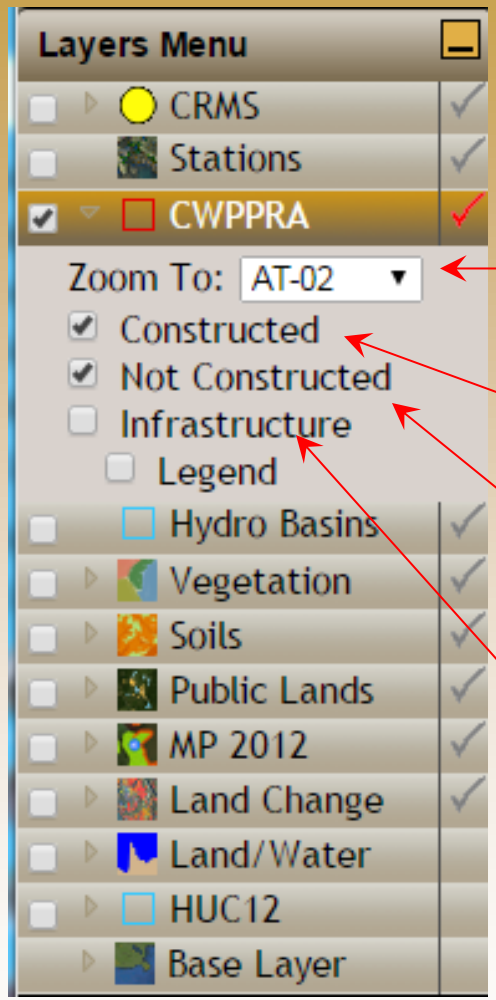
Coastwide Reference Monitoring System – *Wetlands*
Stations Layer



Points on the map display a brief description of the station's information

Coastwide Reference Monitoring System – *Wetlands*
Project Level Information





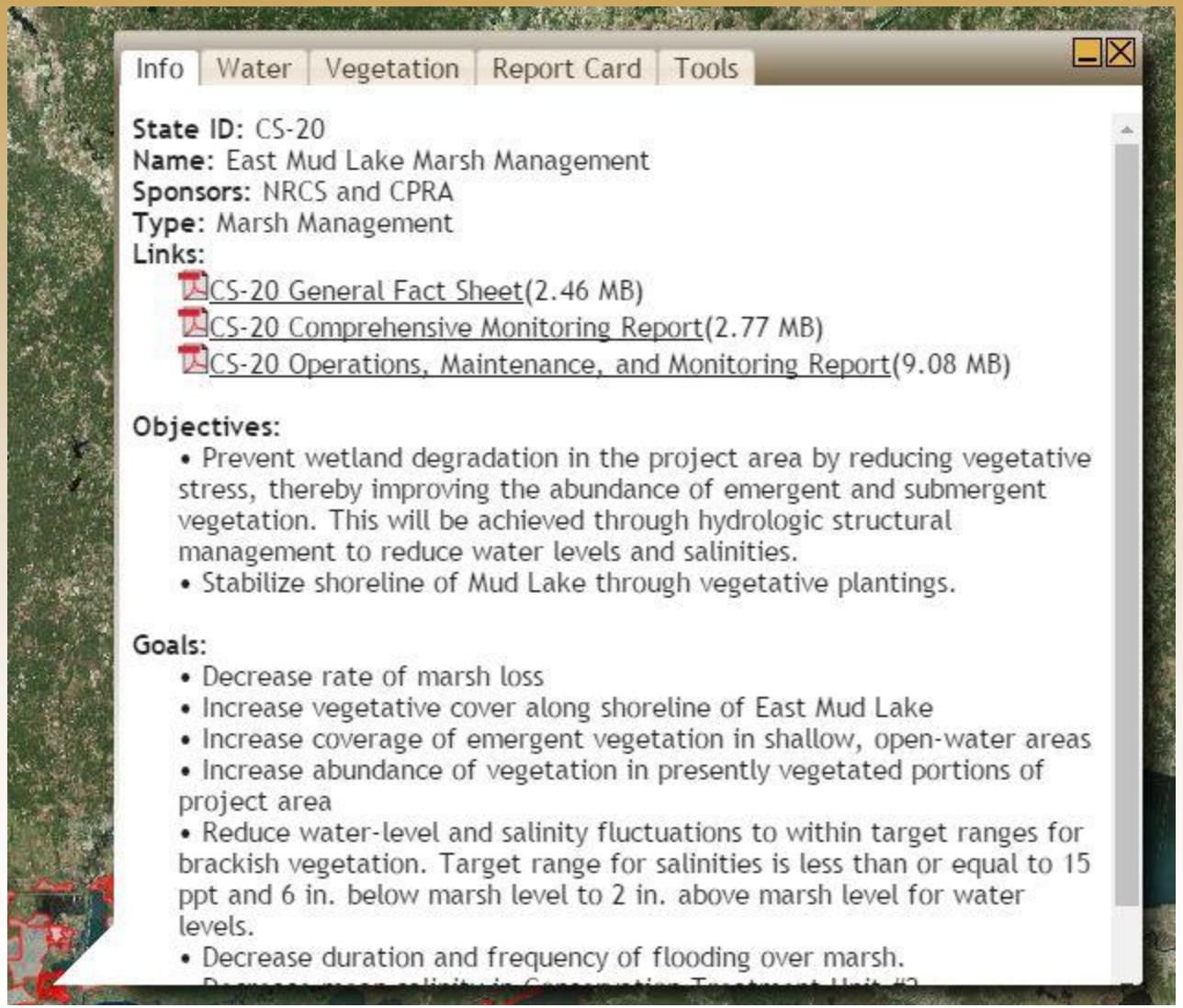
Zoom to function zooms to the project and shows the information bubble for it.

Adds/removes the Constructed projects layer to the map.

Adds/removes the “planning” projects layer to the map.

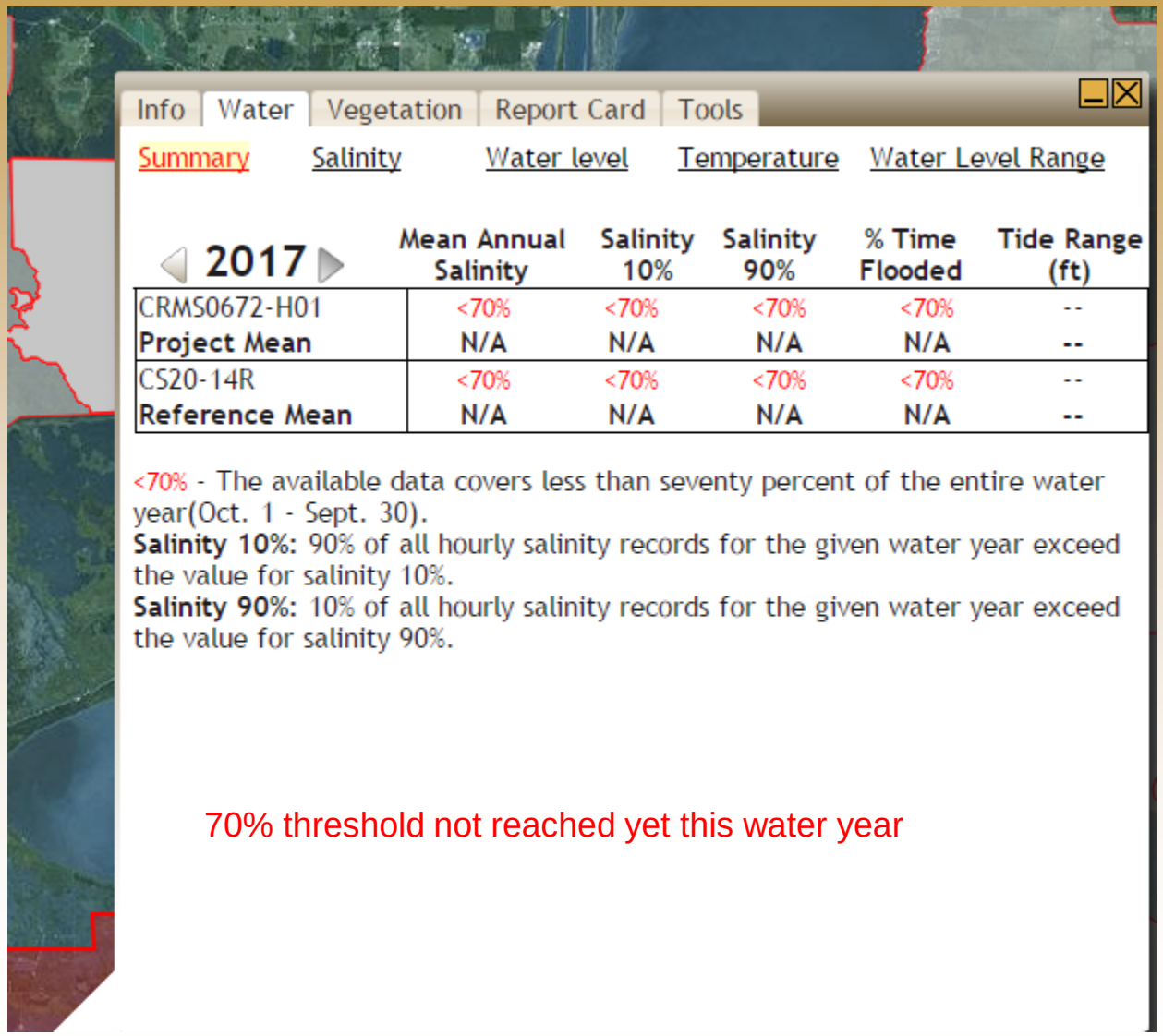
Adds/removes the Project Infrastructure layer to the map and shows the legend

Project Information Bubble



The information bubble appears when a CWPPRA project is clicked. The Project Info tab is automatically chosen when the bubble pops up on the screen.

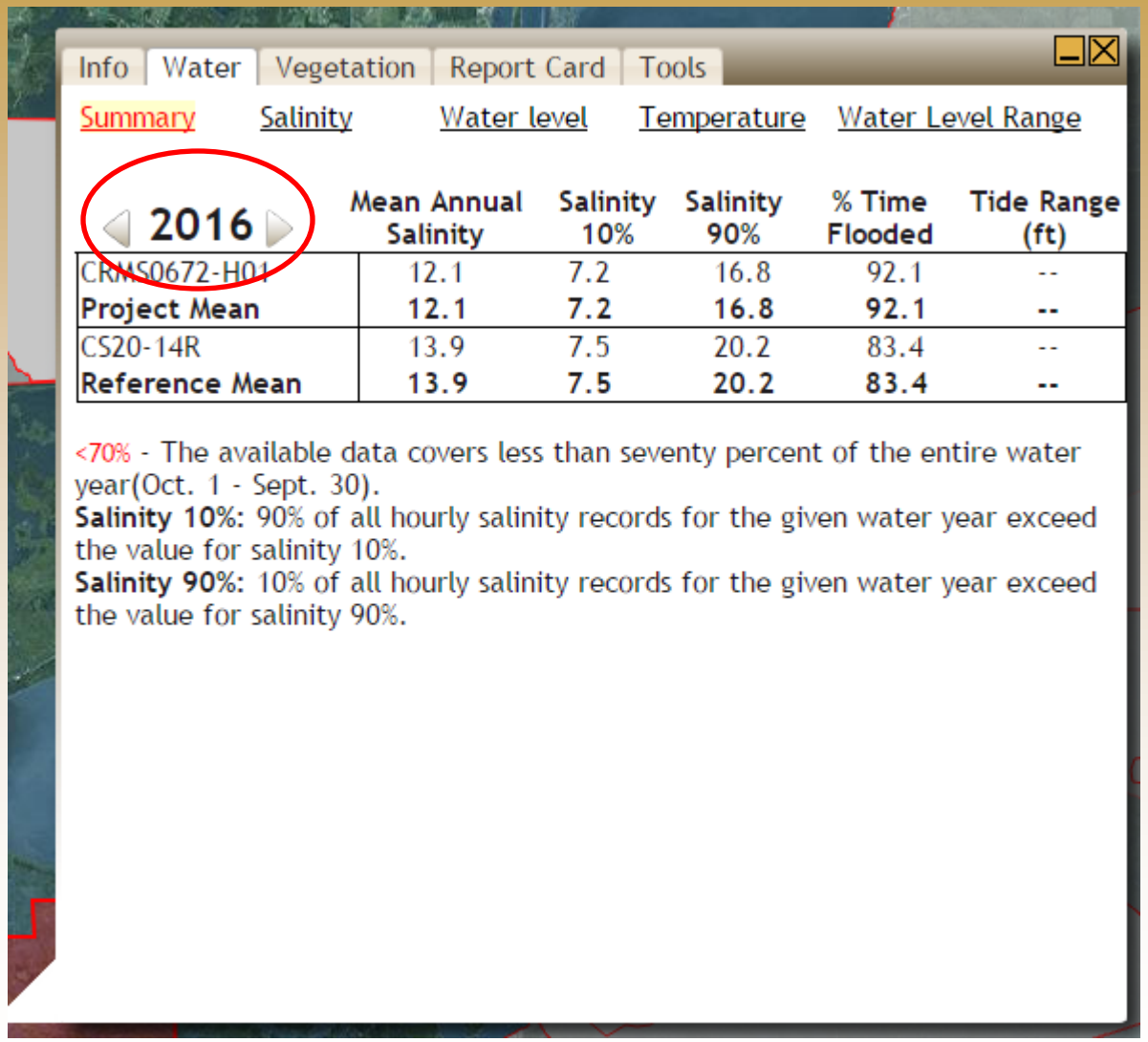
Project Information Bubble



The Water tab contains all hydrologic information for the selected project.

Summary – Gives a brief overview of the hydro data available for the project.

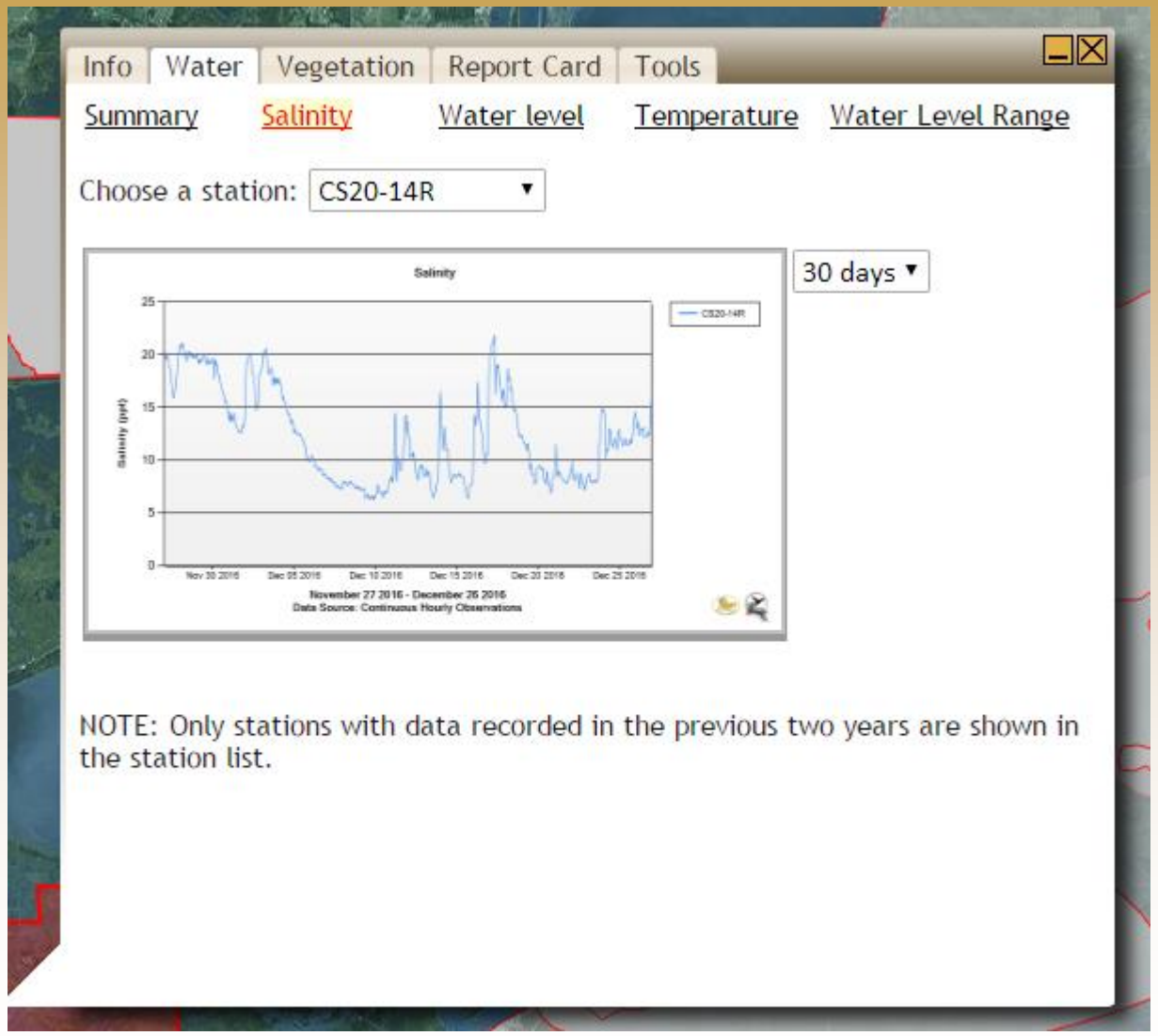
Project Information Bubble



The Water tab contains all hydrologic information for the selected project.

Summary – Gives a brief overview of the hydro data available for the project.

Project Information Bubble



The Water tab contains all hydrologic information for the selected project.

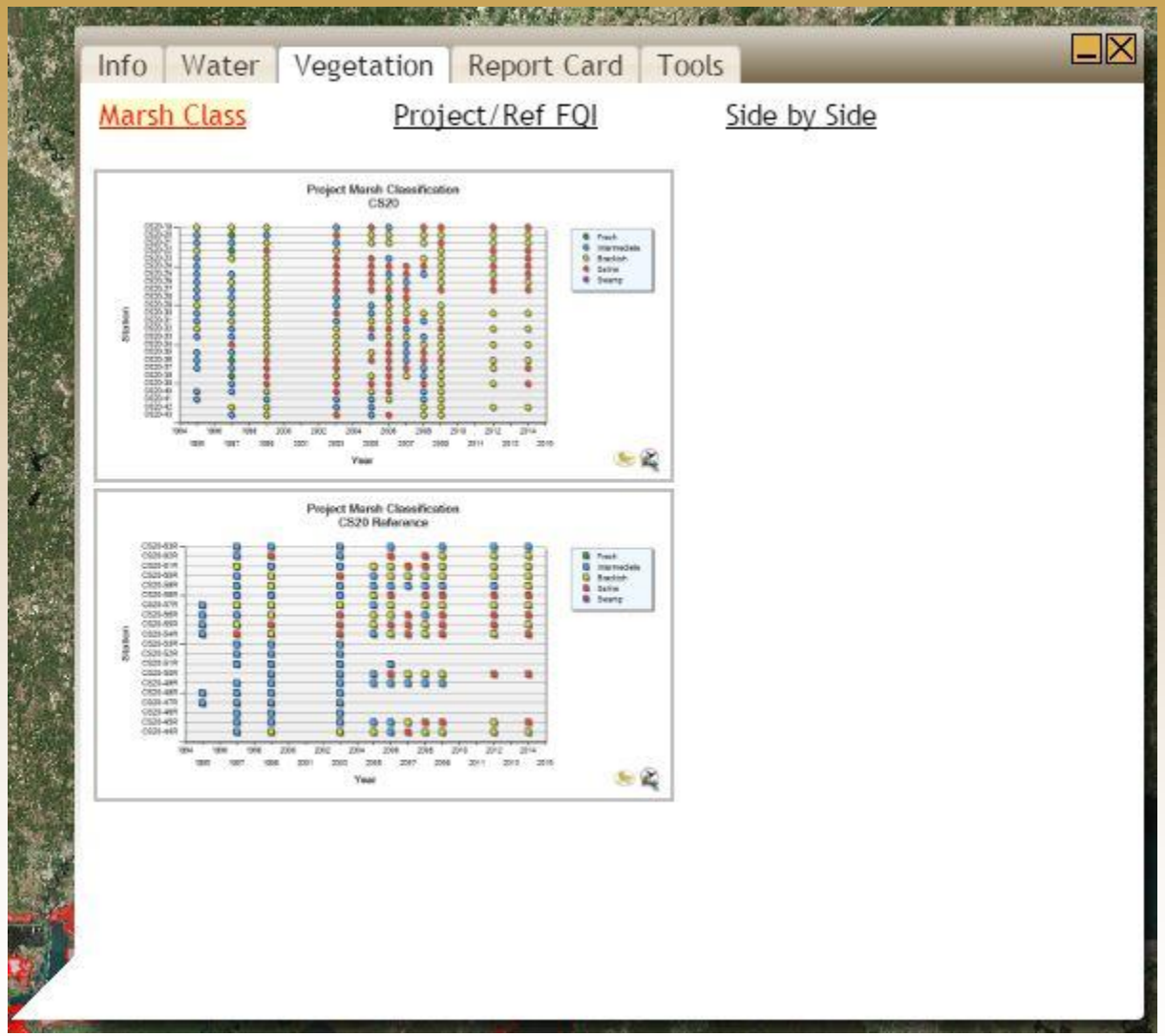
Salinity – Charts most recent data for hydro stations located within the project.

Project Information Bubble

The Water tab contains all hydrologic information for the selected project.

Water Level Range – Charts water level range data for **hydro stations located within** the project.

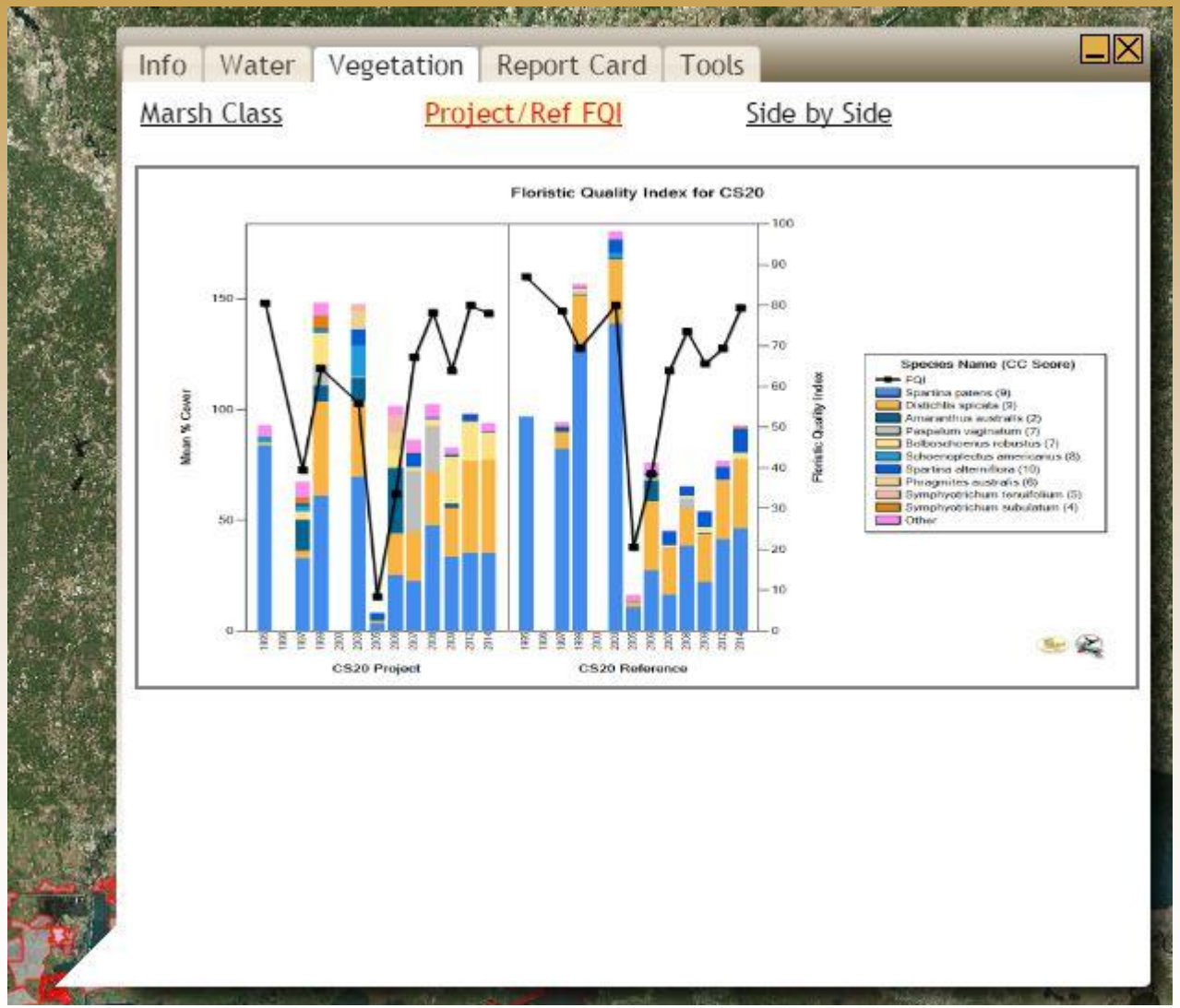
Project Information Bubble



The Vegetation tab contains all vegetation information for the selected project.

Marsh classification at project and reference stations over multiple years.

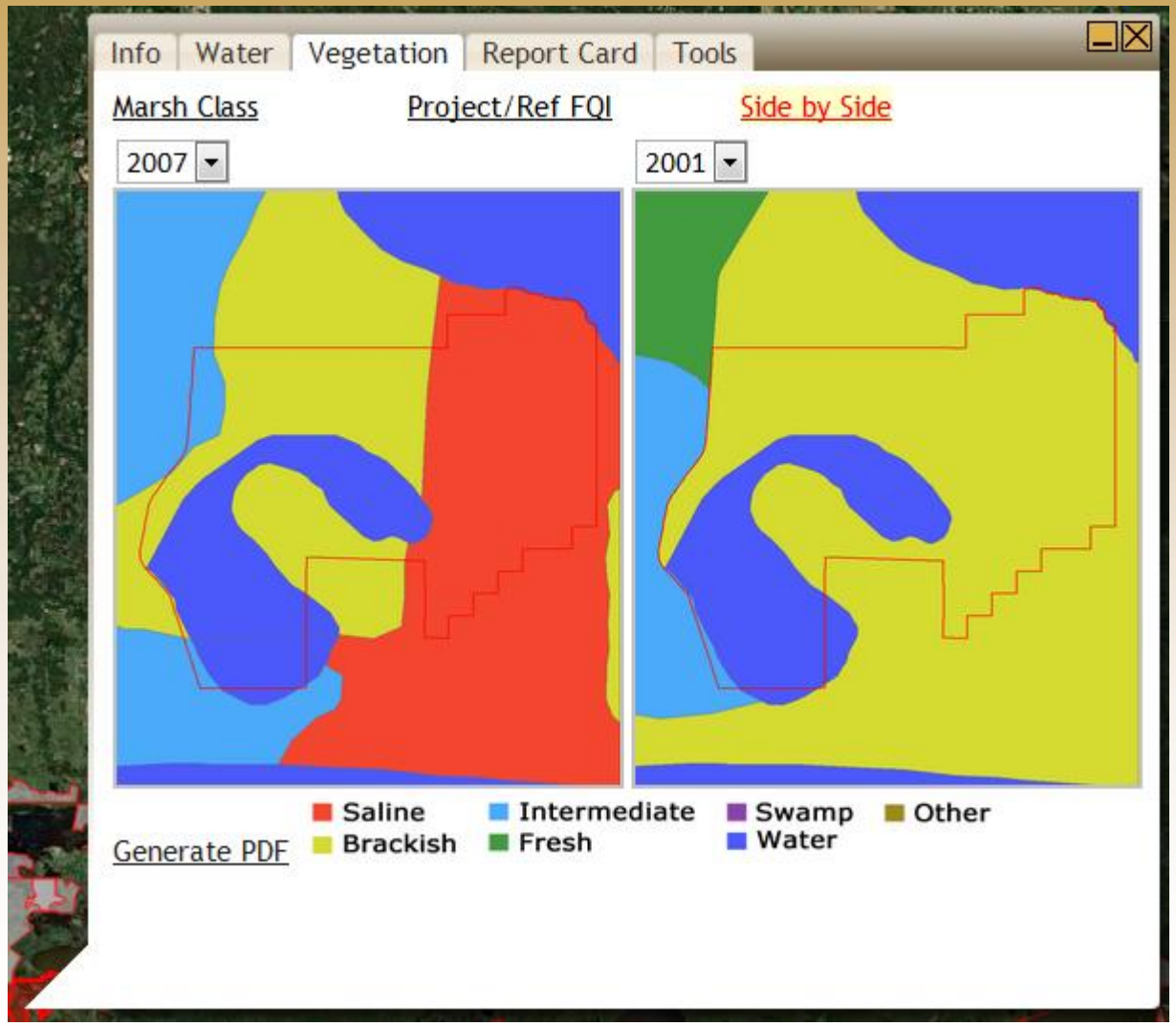
Project Information Bubble



The Vegetation tab contains all vegetation information for the selected project.

Project/Ref FQI – Project Scale Floristic Quality Index Chart.

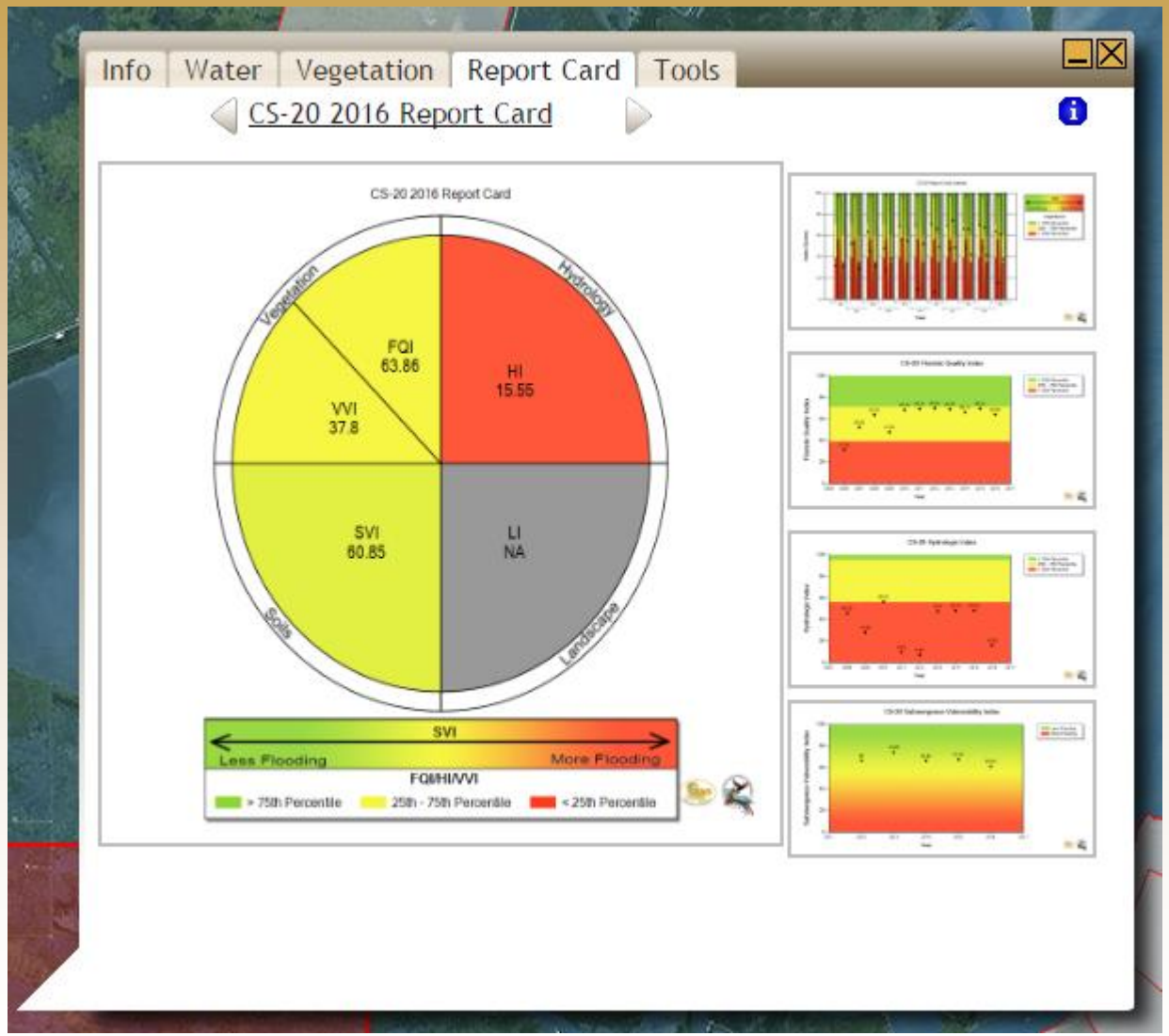
Project Information Bubble



The Vegetation tab contains all vegetation information for the selected project.

Side by Side – Side by side comparison of Marsh Class using the raster image created from helicopter surveys.

Project Information Bubble



The Report Card tab contains all report card information for the selected project.

Report Card-Summary of project scale information compiled into a report card.

Hydrologic basins as defined by CWPPRA

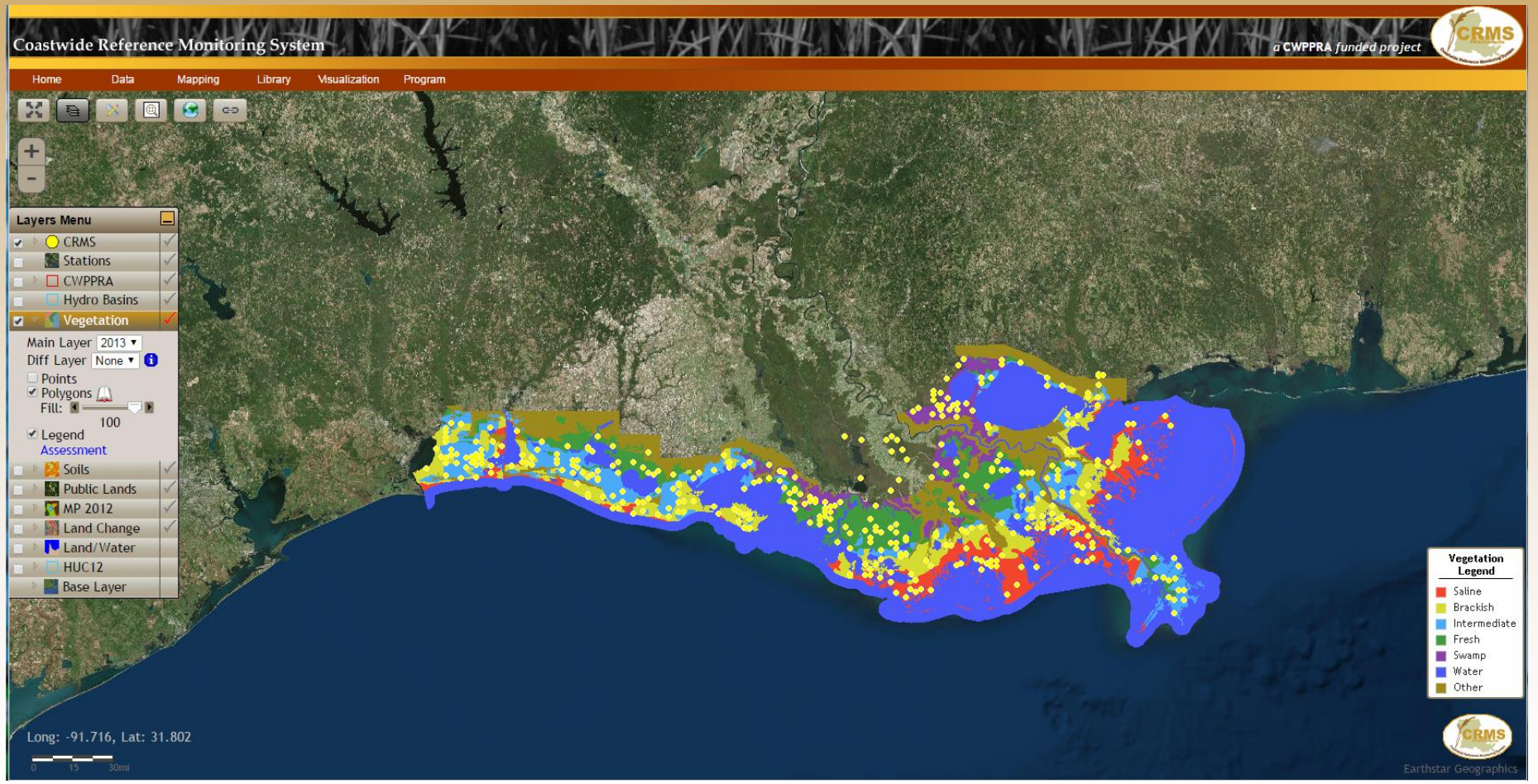
Basin Information Bubble

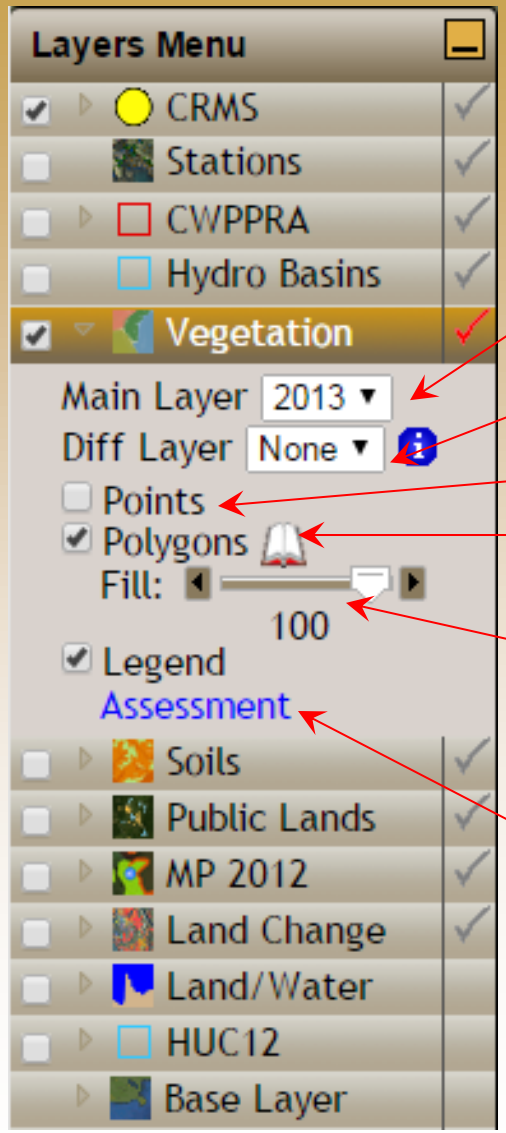
The Report Card tab contains all report card information for the selected basin.

Report Card – Summary of basin scale information compiled into a report card.

Vegetation classification based on helicopter surveys,

***O'Neil 1949* through *Sasser et al. 2013*, 8 surveys**





Main Year selects the primary polygon layer on the map.

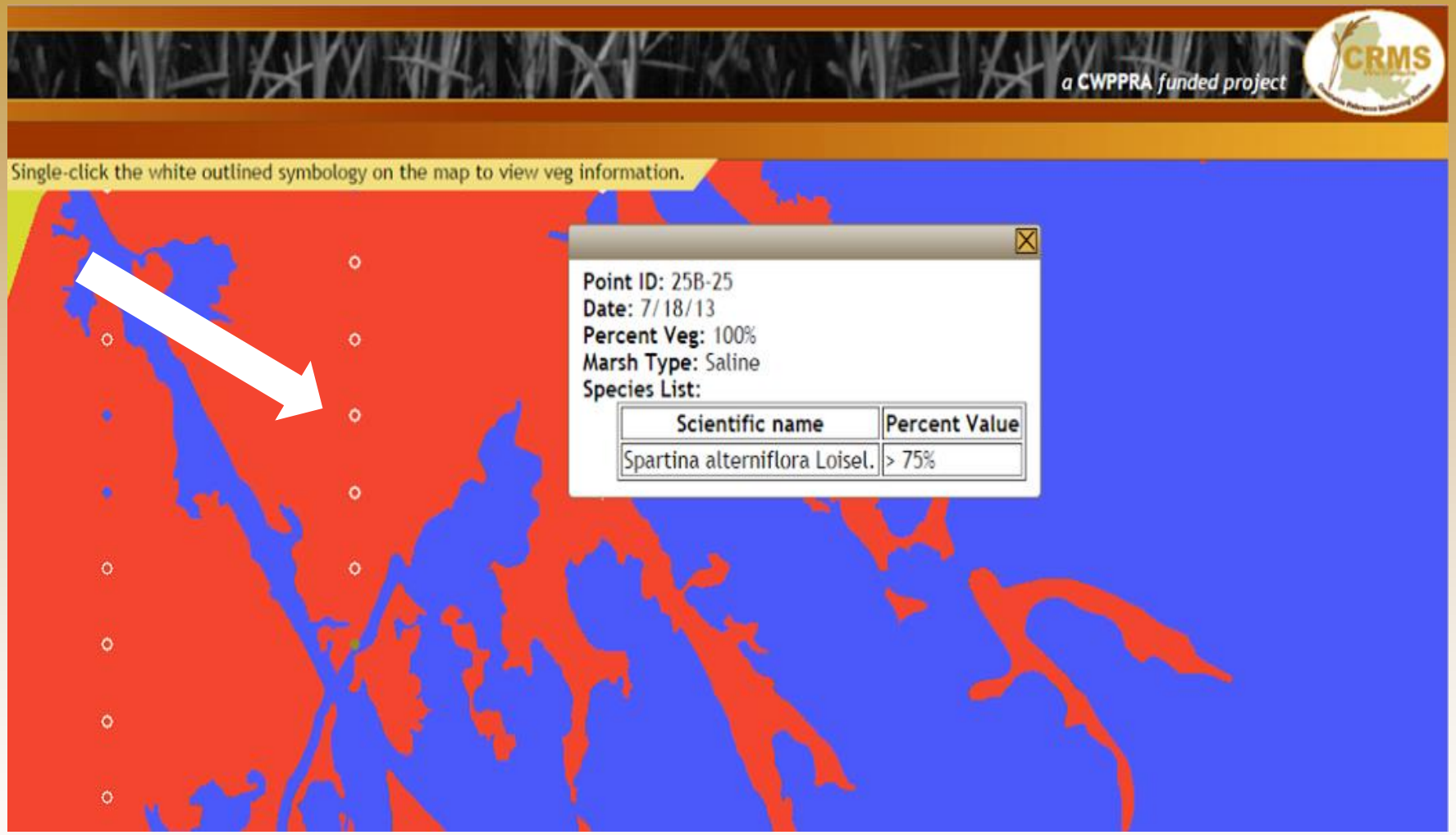
Diff Year selects the secondary polygon layer on the map.

Adds/removes the vegetation data points.

Adds/removes the vegetation polygons layer.

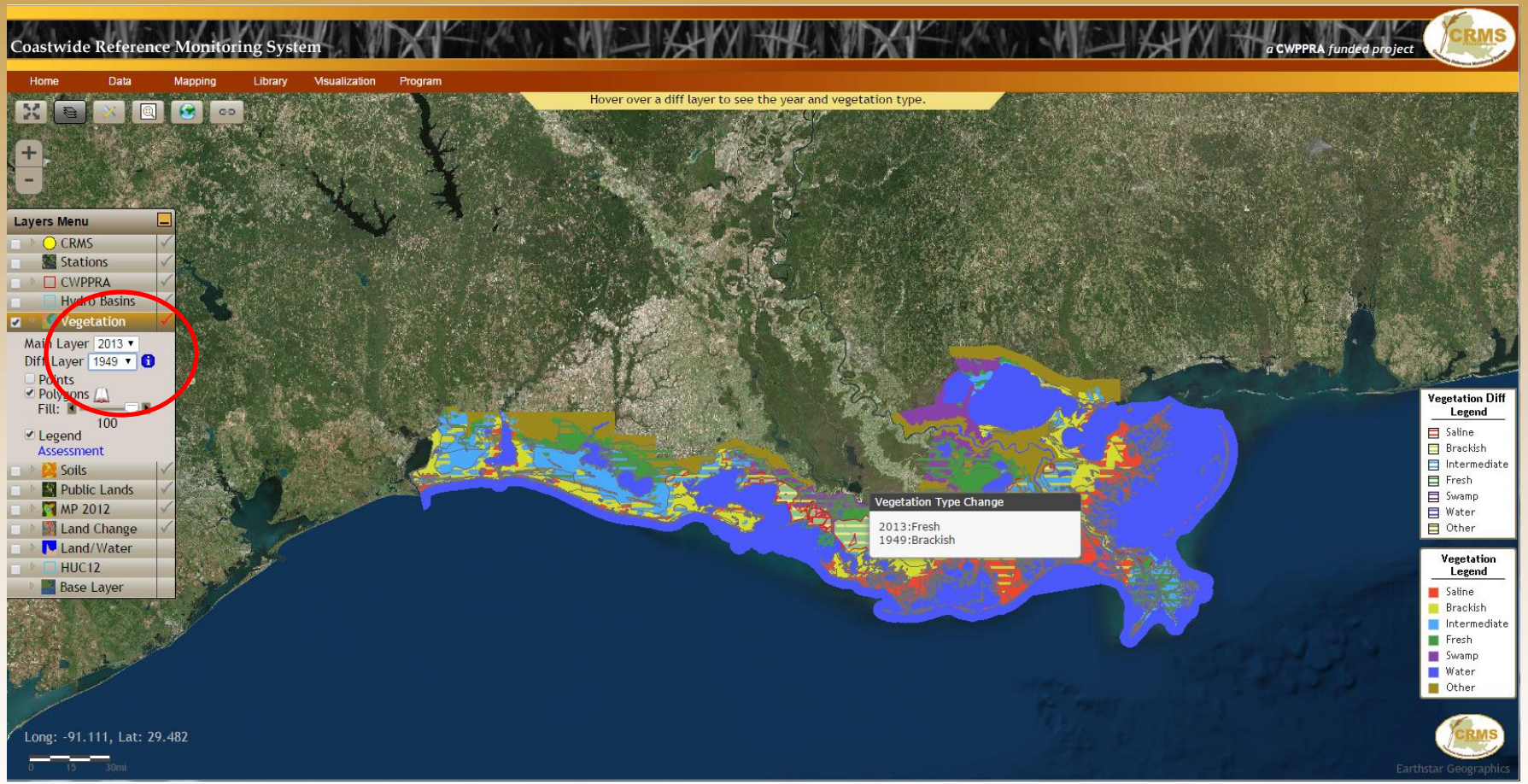
The slider changes the transparency of the layer.

Assessment link invokes the acreage assessment tool menu for the currently selected year.



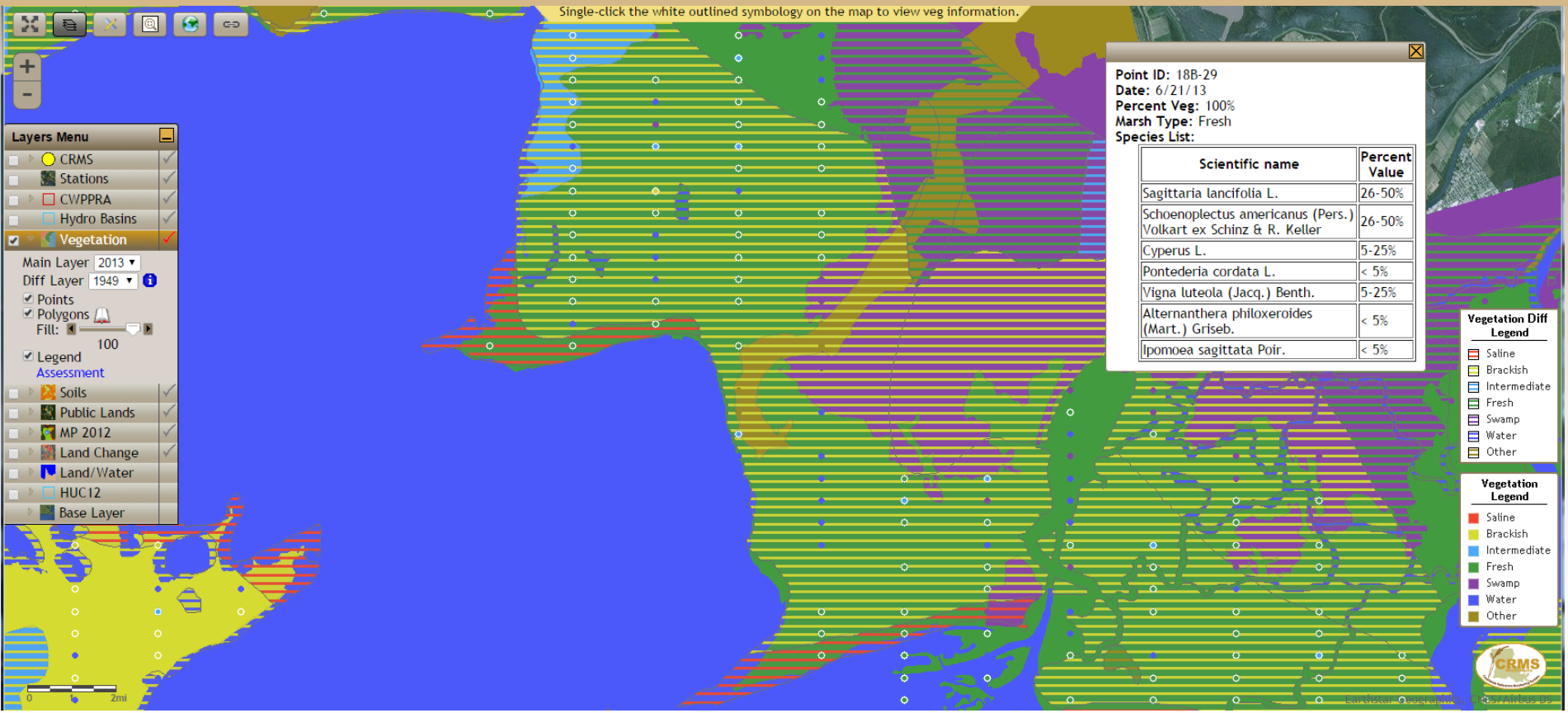
Points display the site specific vegetation data when clicked.

Vegetation Difference Layer Functionality

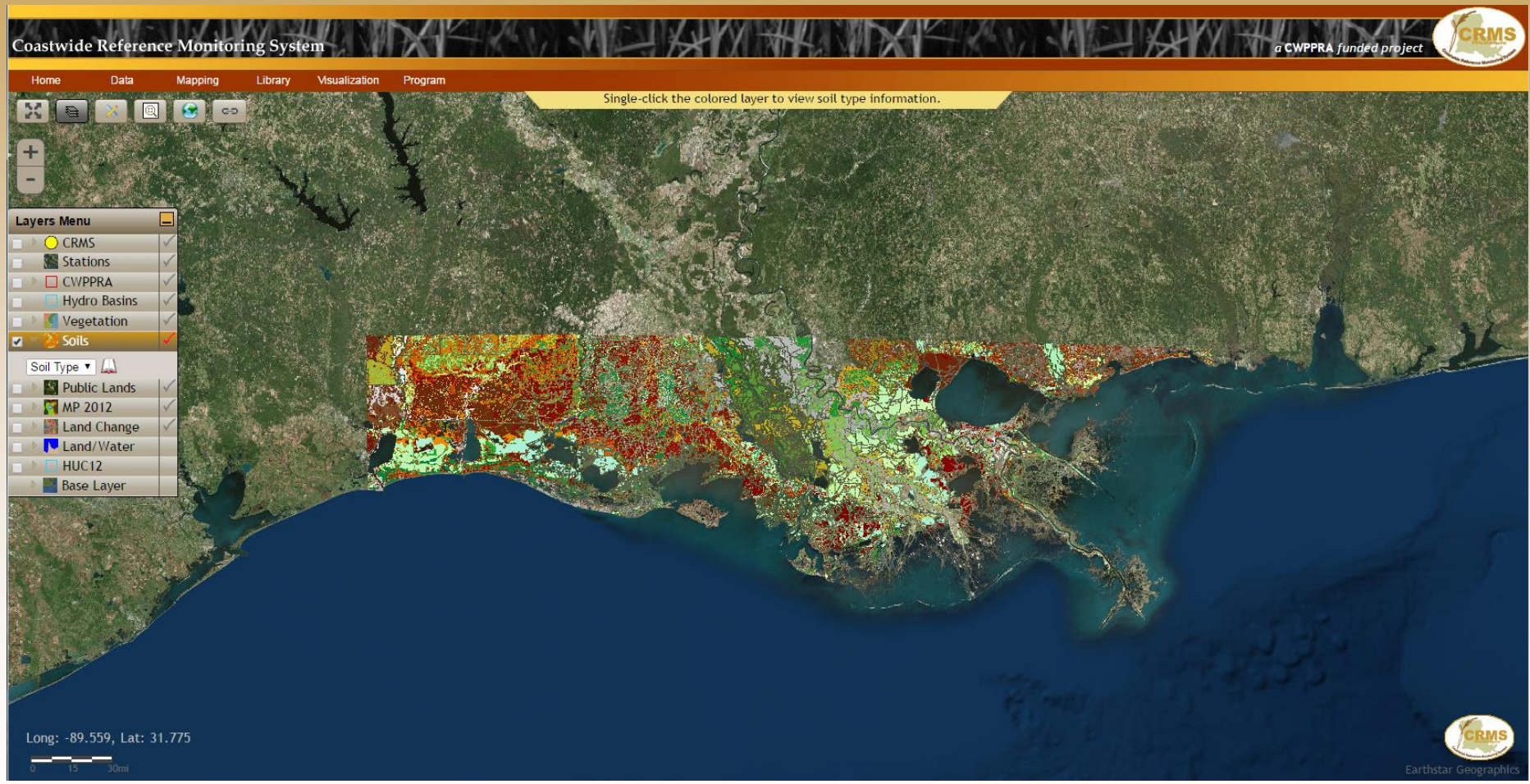


The "Vegetation Change" is shown when two different years are chosen for the Main Layer and Diff Layer.

Vegetation Difference Layer Functionality



NRCS SSURGO data displayed

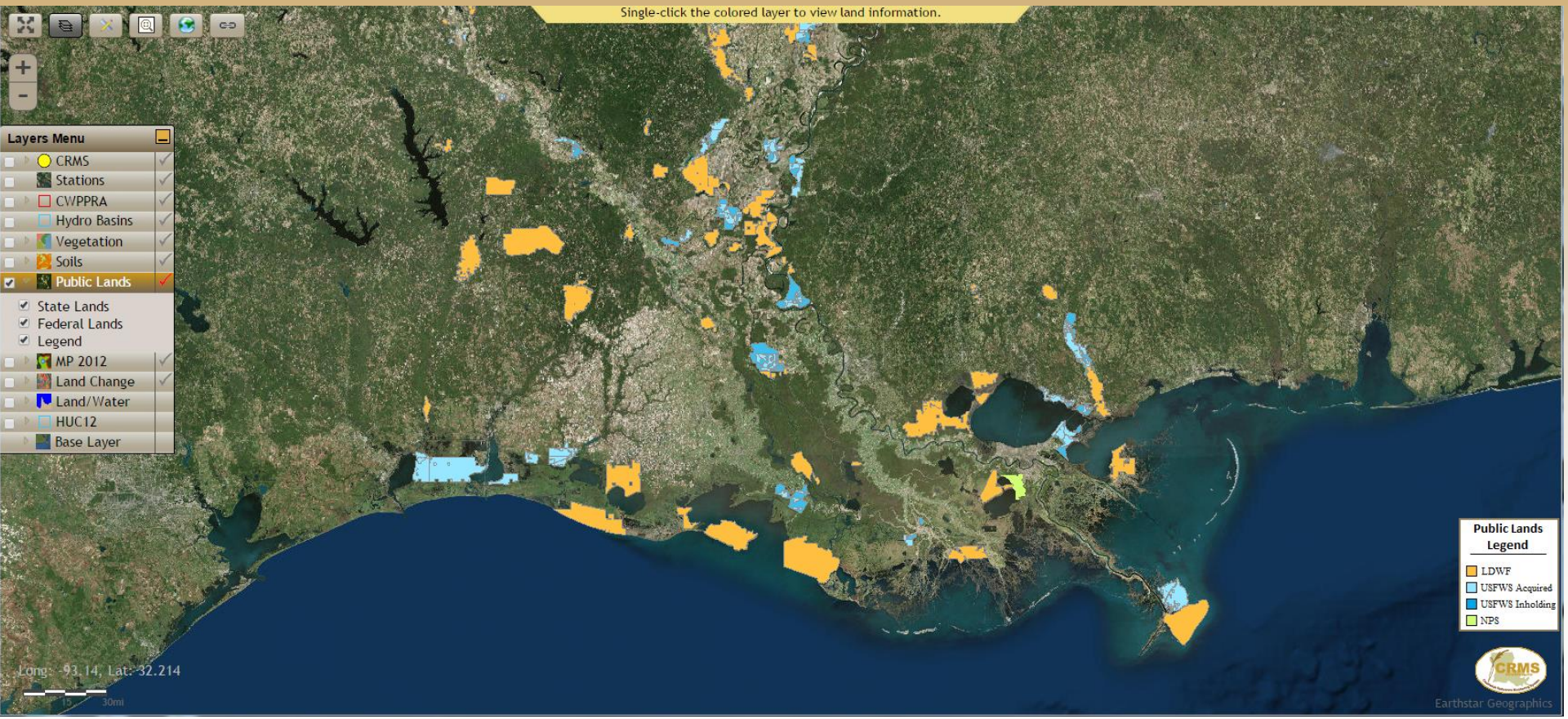


Soils Layer

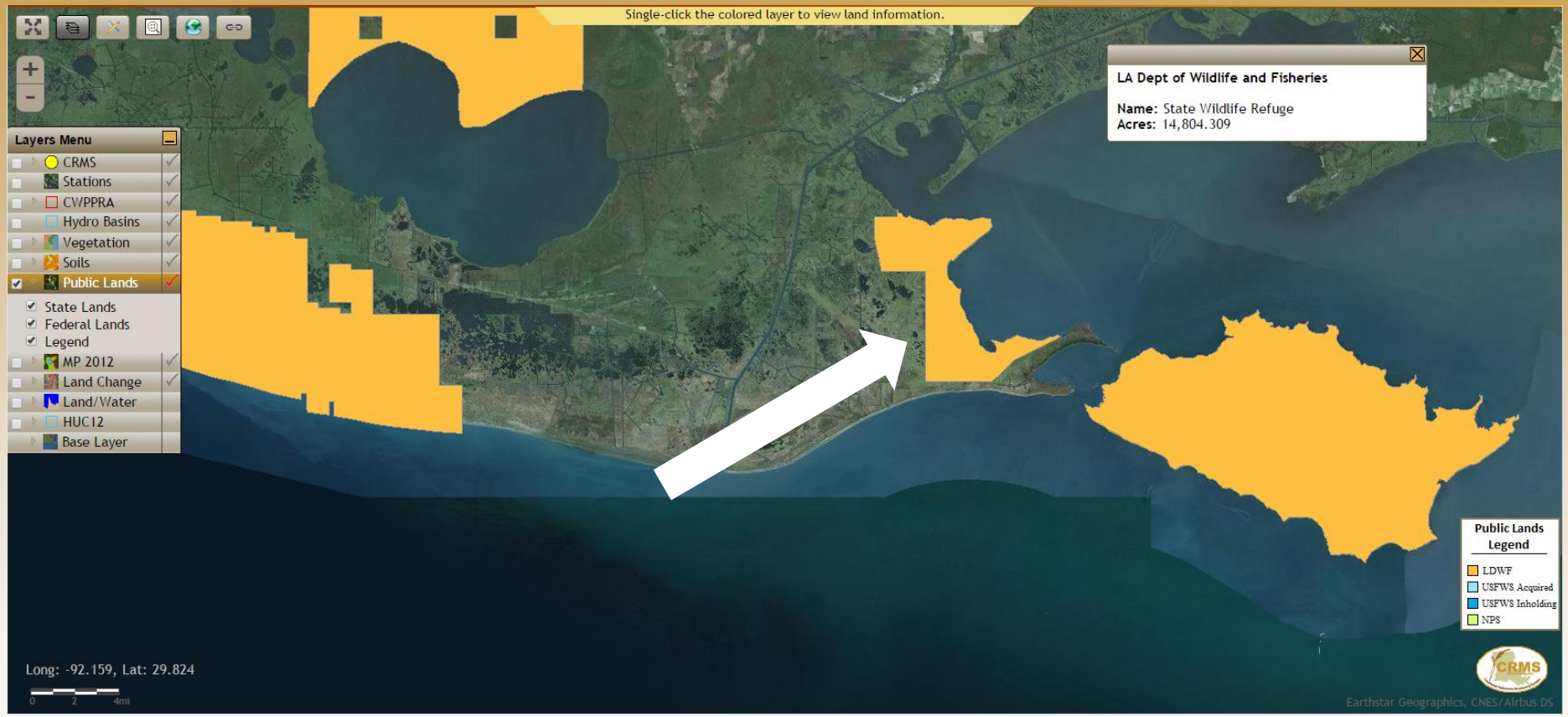
The Soil Type information window pops up when a soil area is clicked.

Public Lands Layer

Displays Federal (USFWS and NPS) and State (LDWF) land holdings.



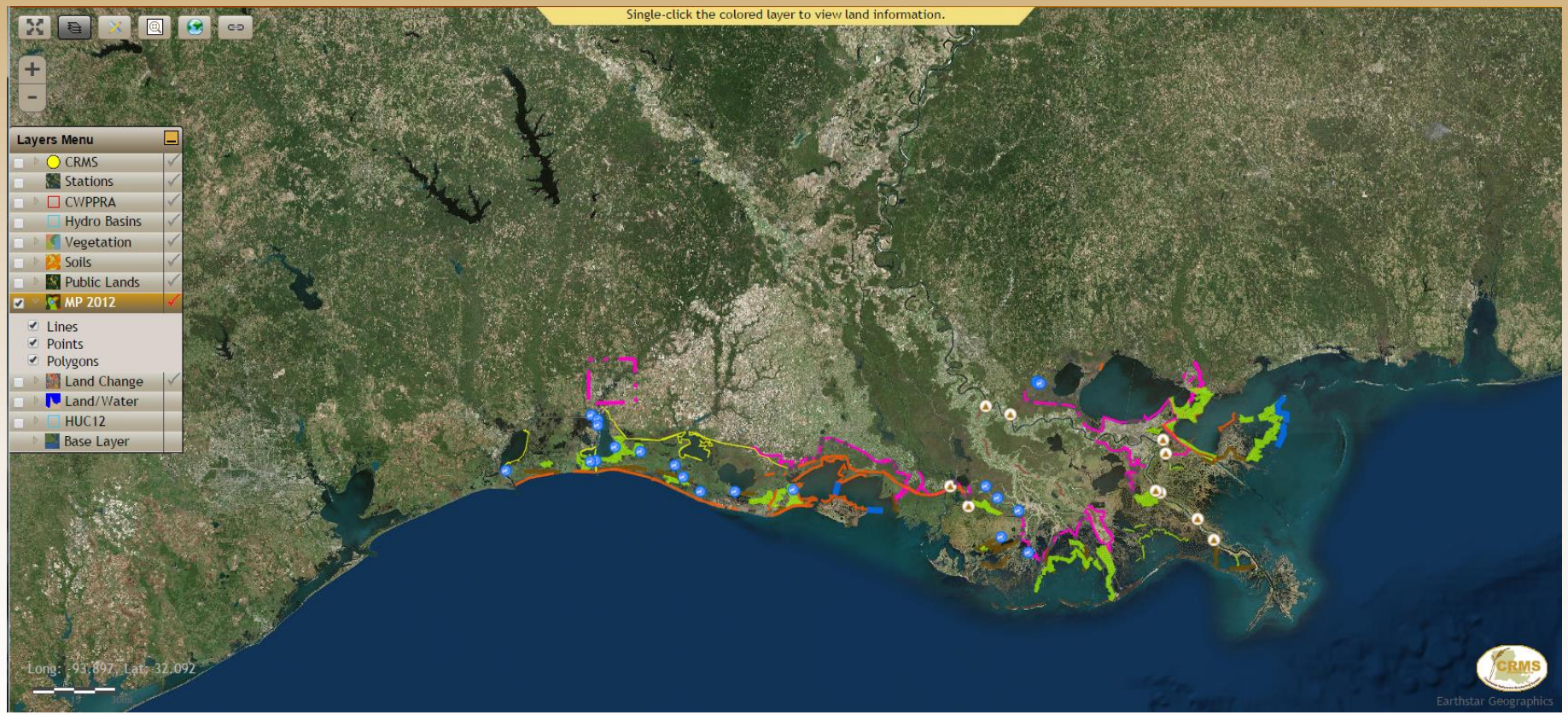
Public Lands Layer

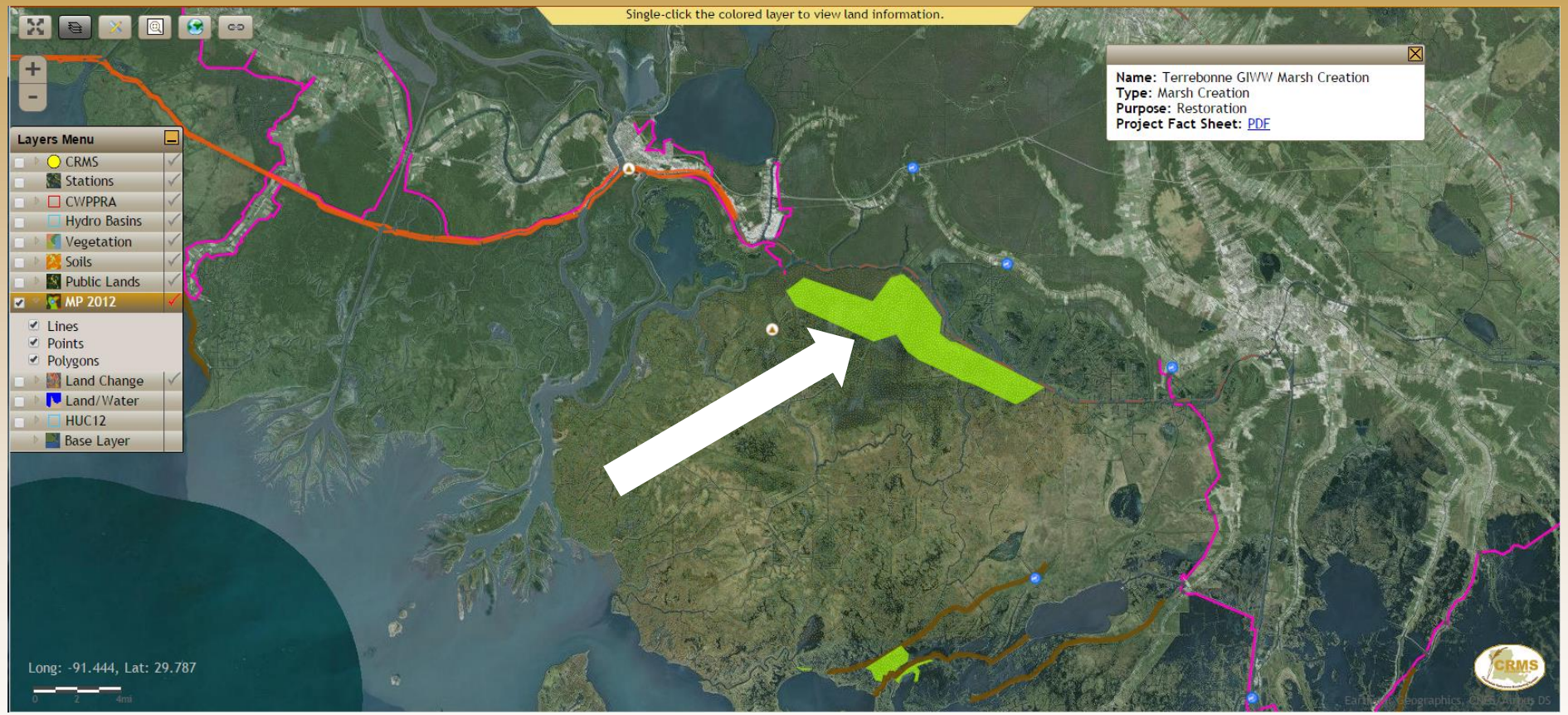


The Public Lands information window pops up when a Public Lands polygon is clicked.

Master Plan project types and general project areas.

Additional visualizations of this information available through CIMS.





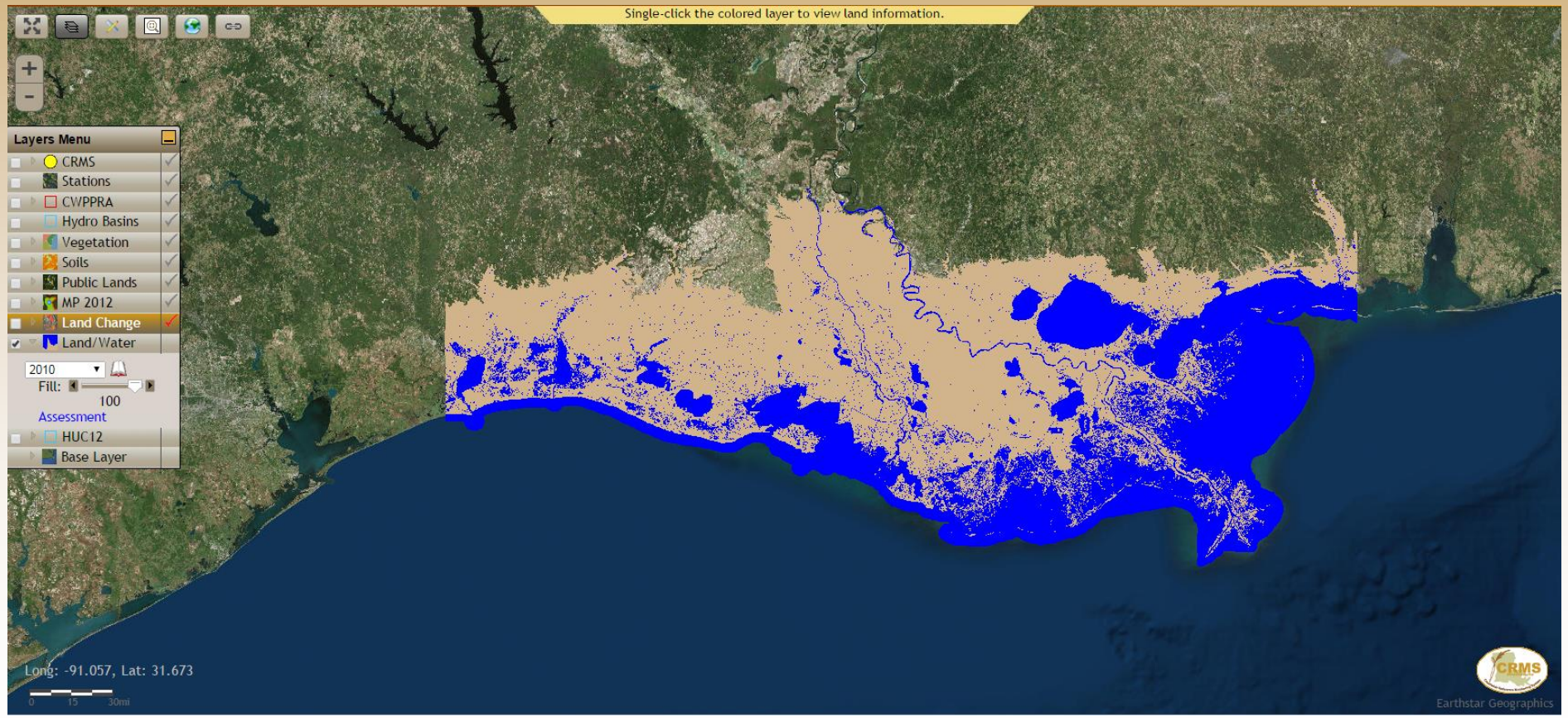
The Master Plan information window providing project information pops up when a symbology is clicked.

Couvillion et al., 2011. Land Area Change in Coastal Louisiana from 1932 to 2010.

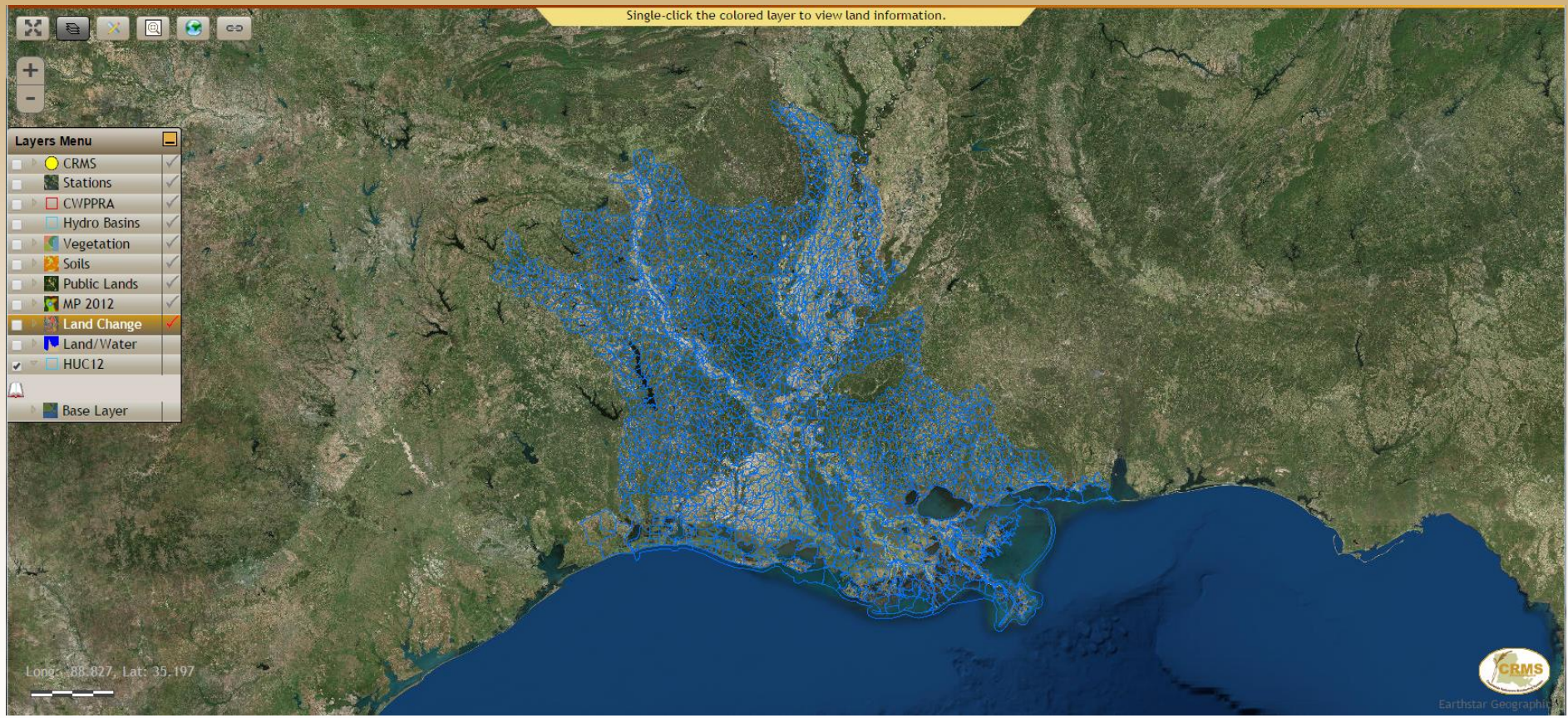
Displays land change (both loss and gain) broken down by time intervals.

Land/Water classifications from 1932 to 2010

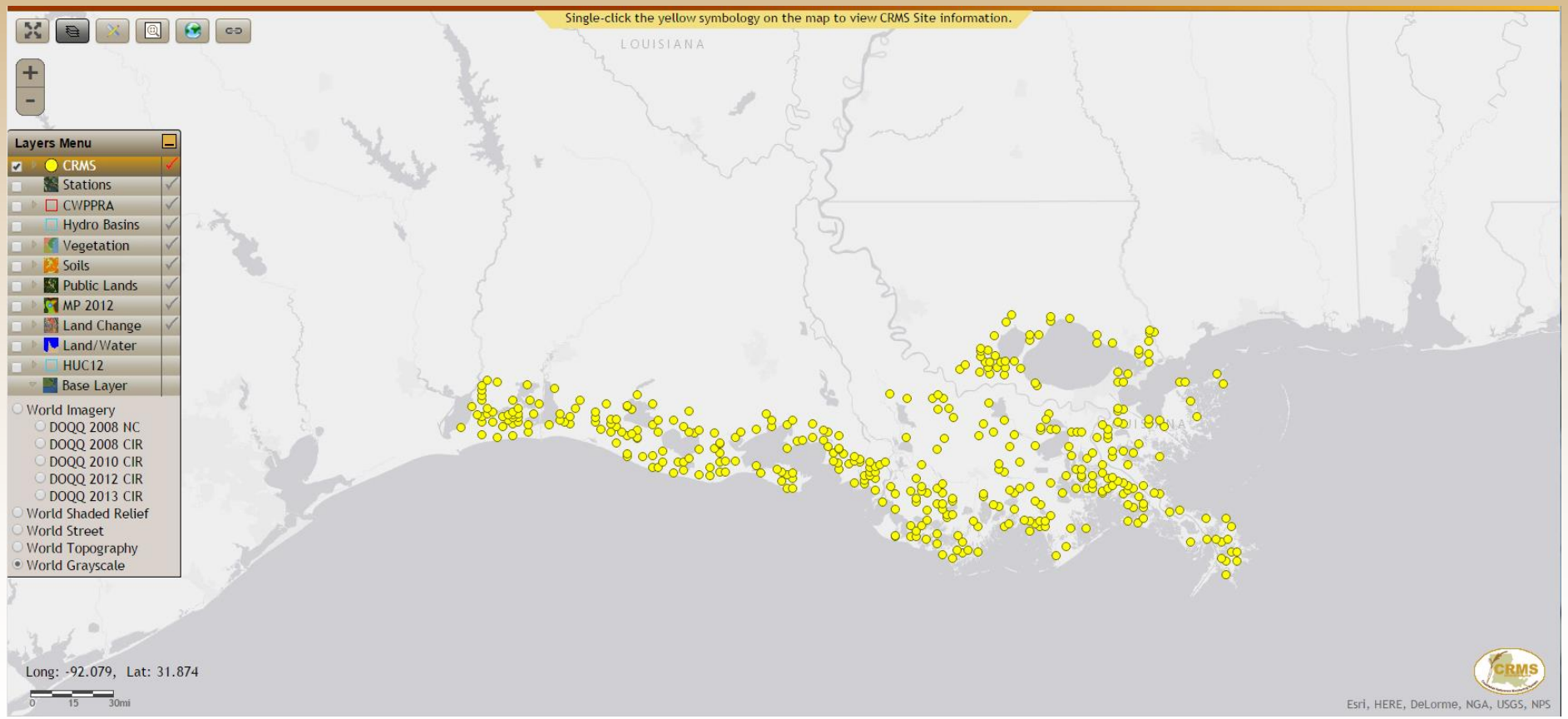
18 classification dates based on satellite imagery, 30m resolution.



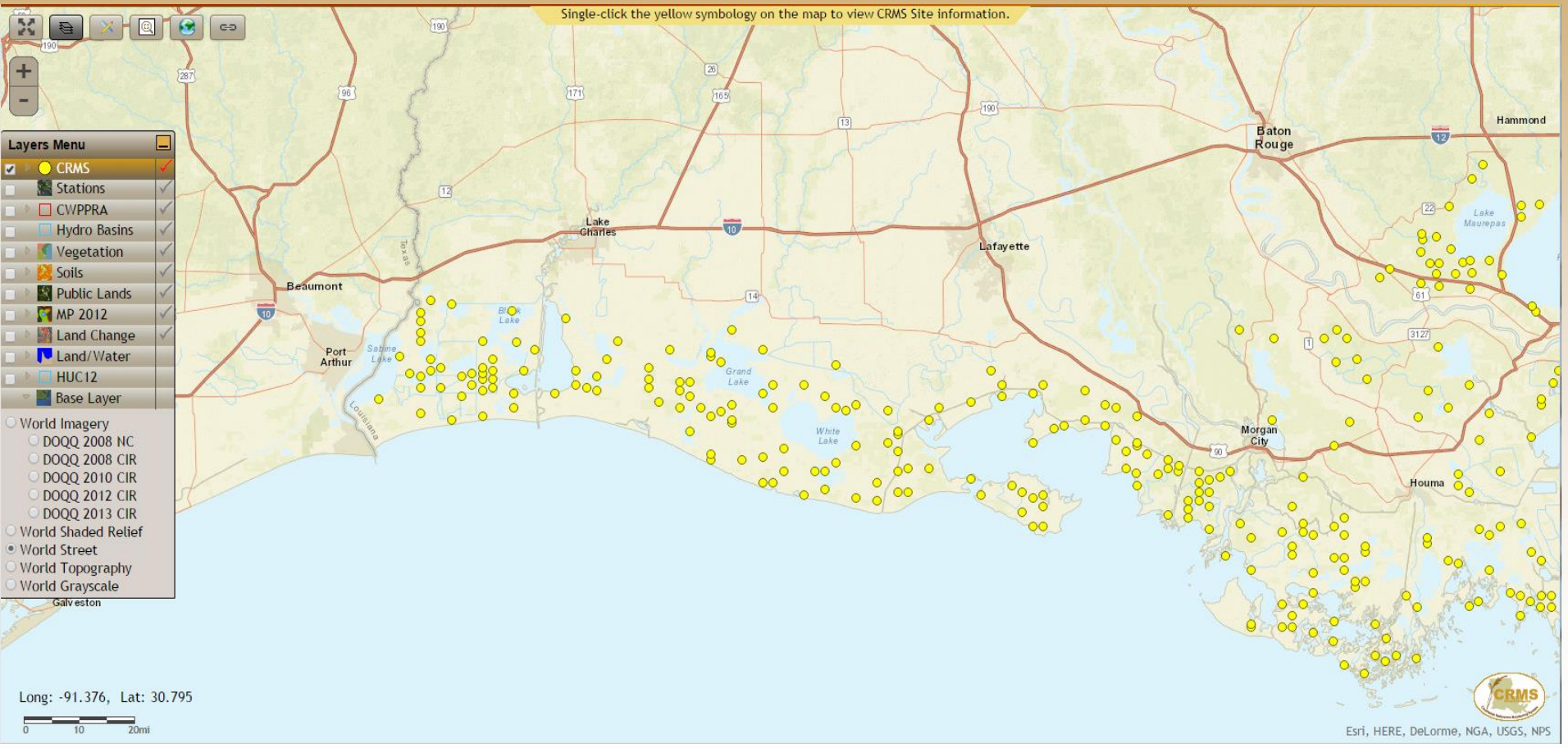
NRCS's Hydrologic Unit Code (HUC) Boundaries—12 digit subwatershed classification

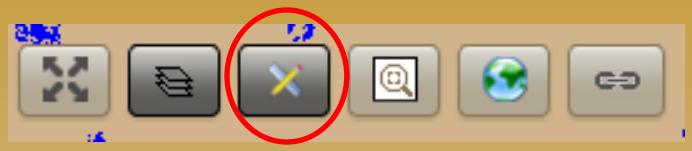


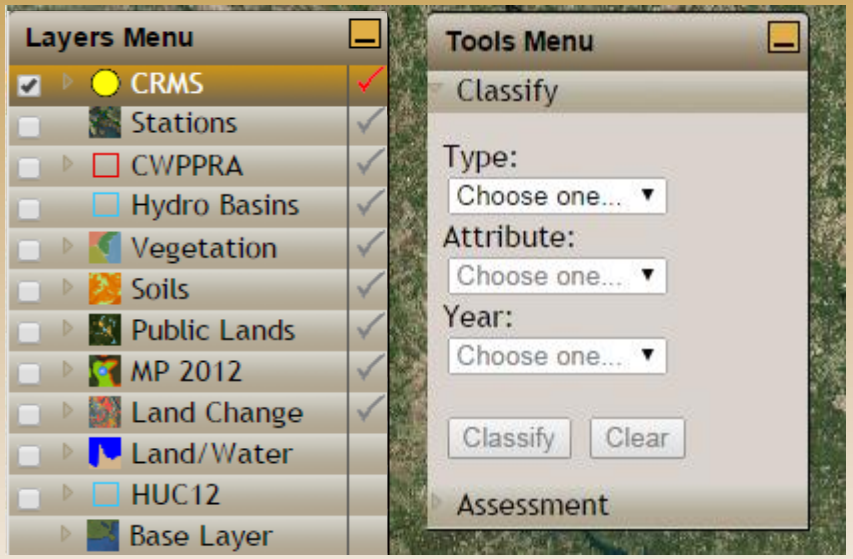
Ability to visualize the base map layer as different years of aerial photography or world imagery.

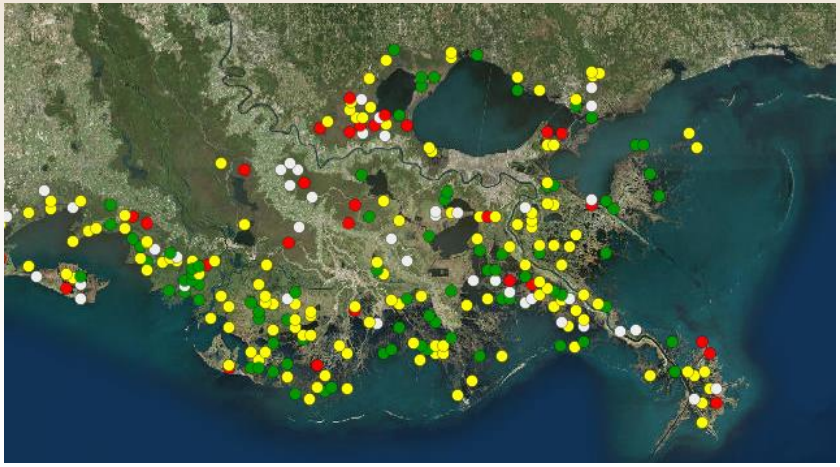


Streets Base Layer







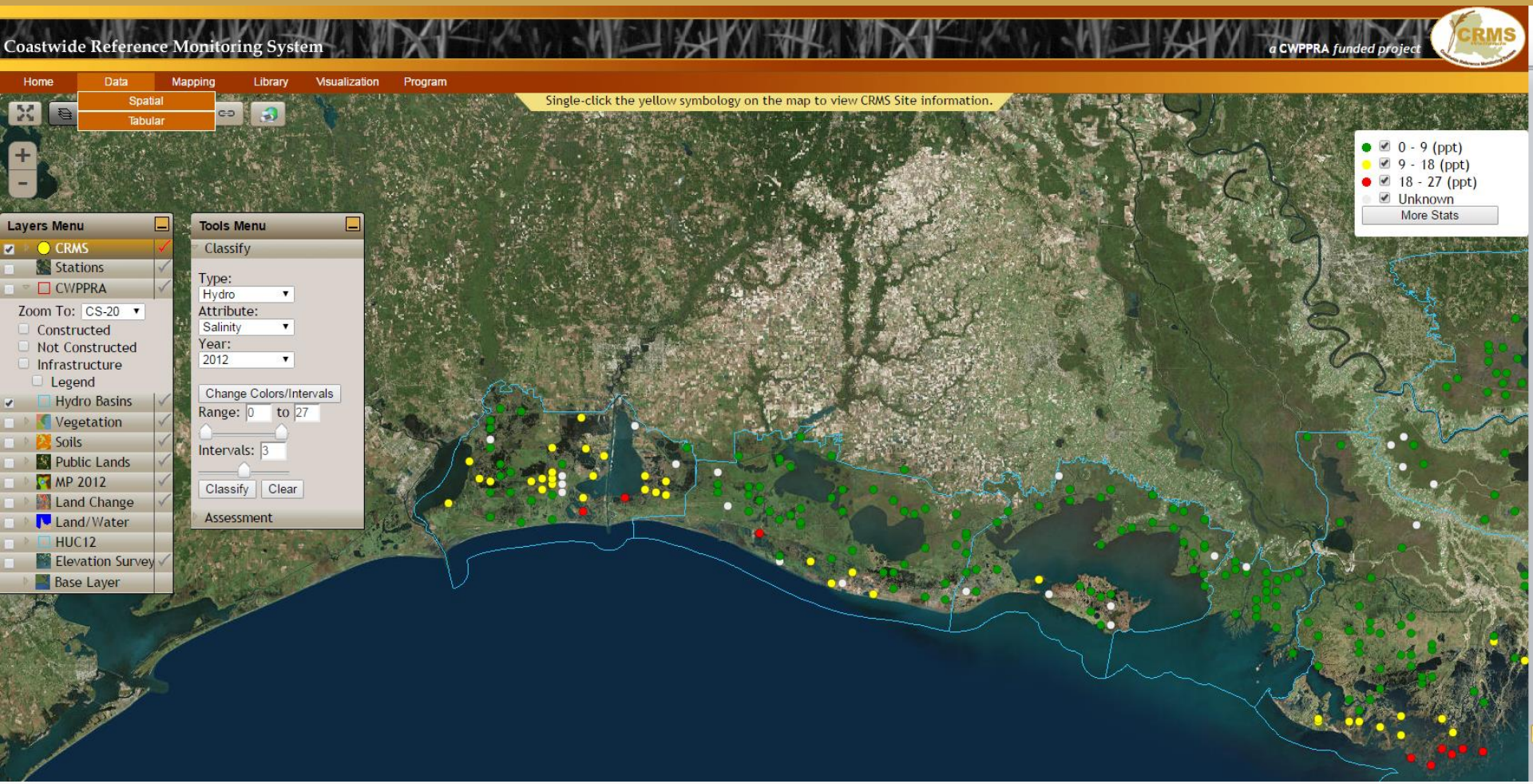


Classify Tool- allows all CRMS sites to be visualized based on user-selected parameters.

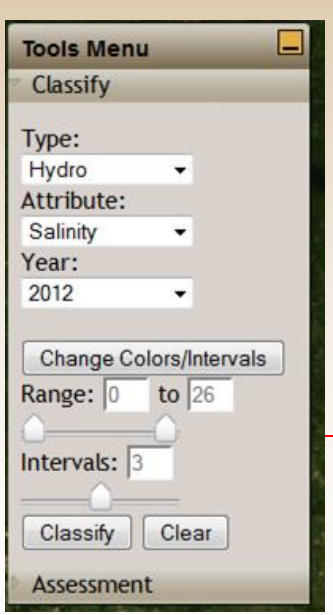
A Type, Attribute, and Year must be chosen to Classify the CRMS sites.

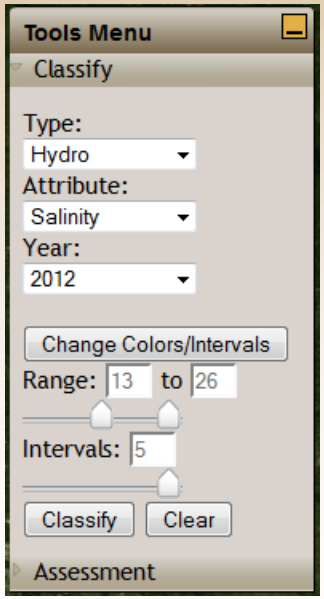
- **Vegetation**
  - FQI
  - Vegetation Percent Cover
  - Marsh Classification
- **Hydro**
  - Flooding
  - Hydro Index
  - Salinity
  - Water Level
- **Soil**
  - Cumulative Elevation Change (CEC)
  - Submergence Vulnerability Index (SVI)
  - Bulk Density (mean 0-16cm, 3 cores)
  - Percent Organic (mean 0-16cm, 3 cores)

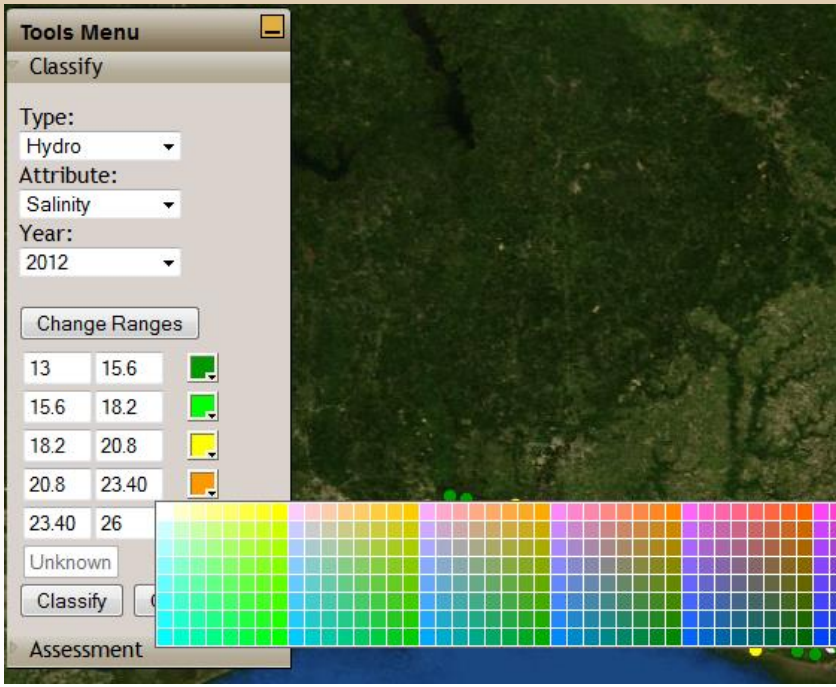
Coastwide Reference Monitoring System – *Wetlands*
CRMS Classify Tool



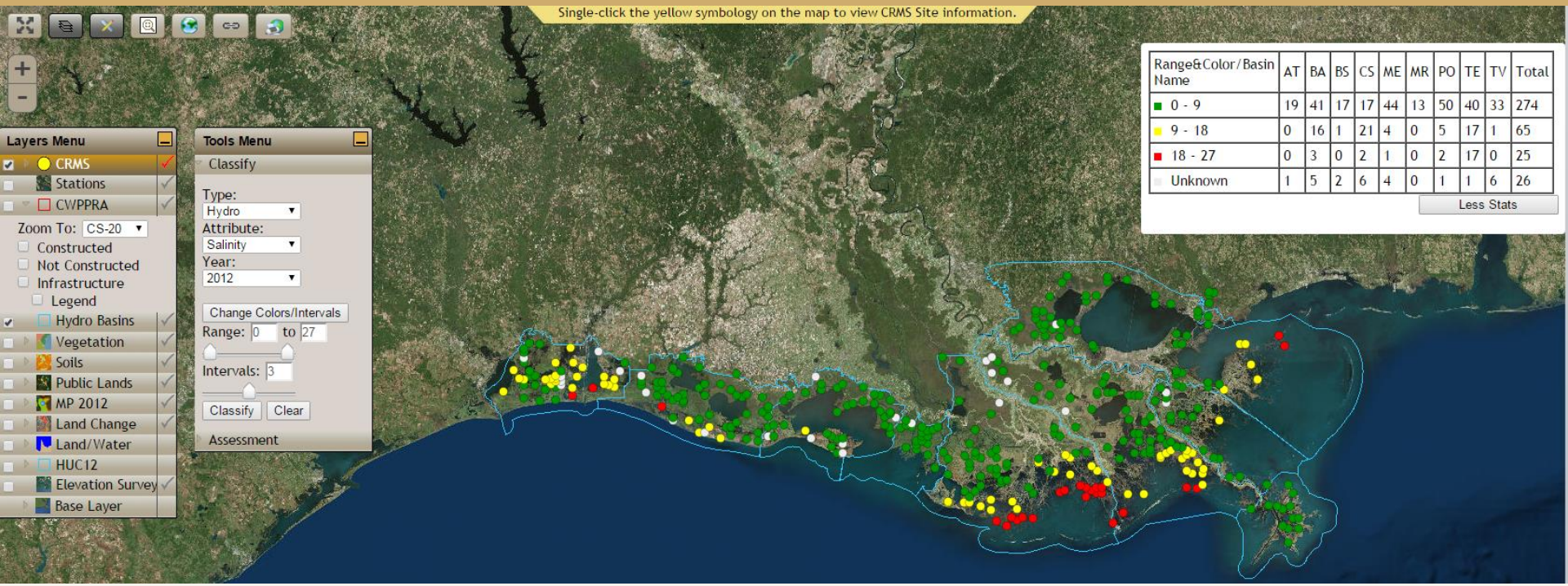
User defines classification intervals and color ramp. For each CRMS index the defaults are red, yellow, green (as in the report card).







The tool will tally the classification categories by hydrologic basin.



Acreage Assessment Tool provides area estimates of a chosen layer given a defined polygon.

Layers:

- Coastwide Vegetation
- Land/Water

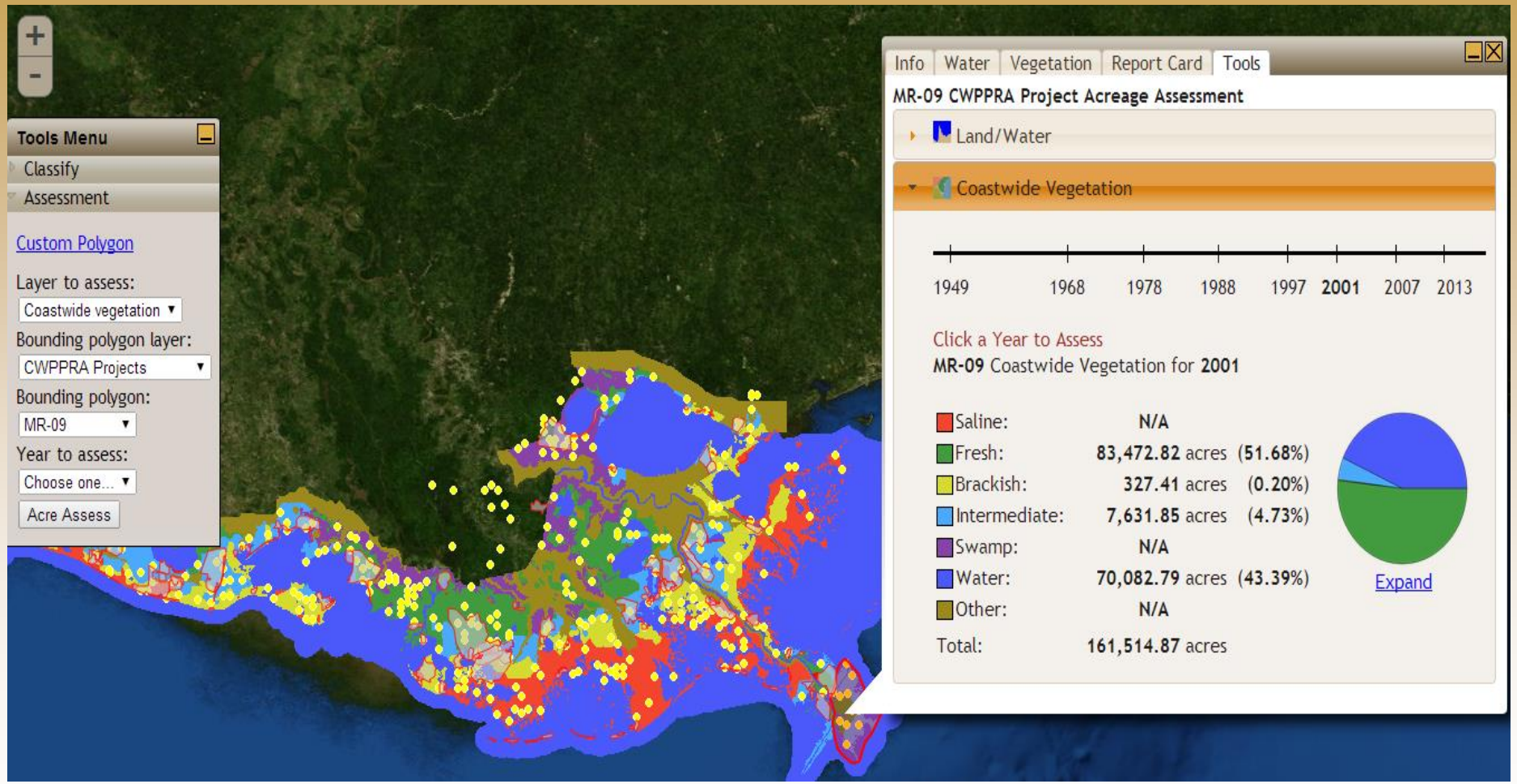
Area:

- CWPPRA Projects
- Hydro basins
- CRMS Sites (1km buffer)

Years:

- Varies based on layer dataset

Acreage Assessment Tool



Questions?

https://lacoast.gov/crms

Sarai Piazza

piazzas@usgs.gov