California Rapid Assessment Method

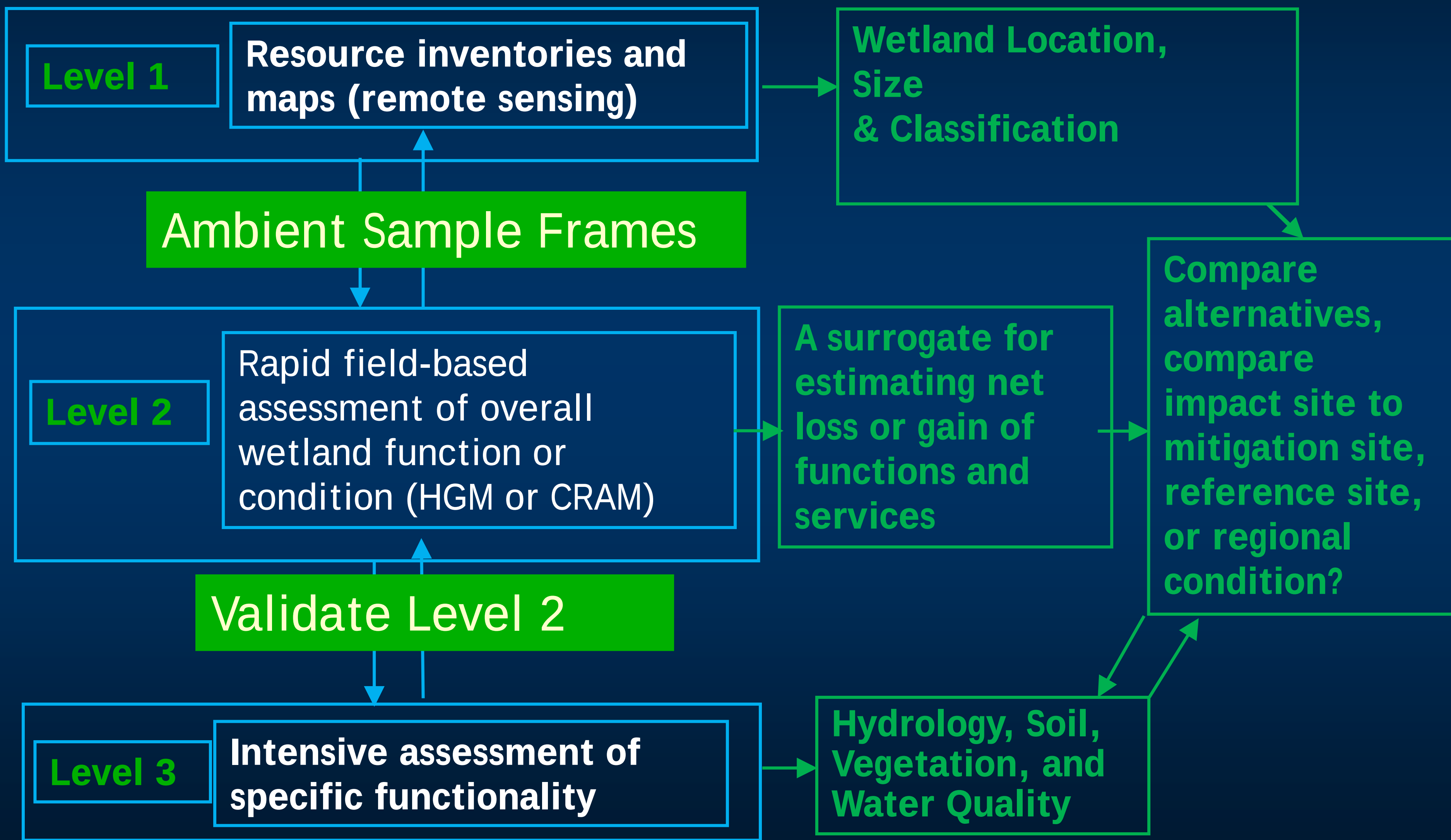
Applications and Regulatory Context



How is CRAM Being Used?

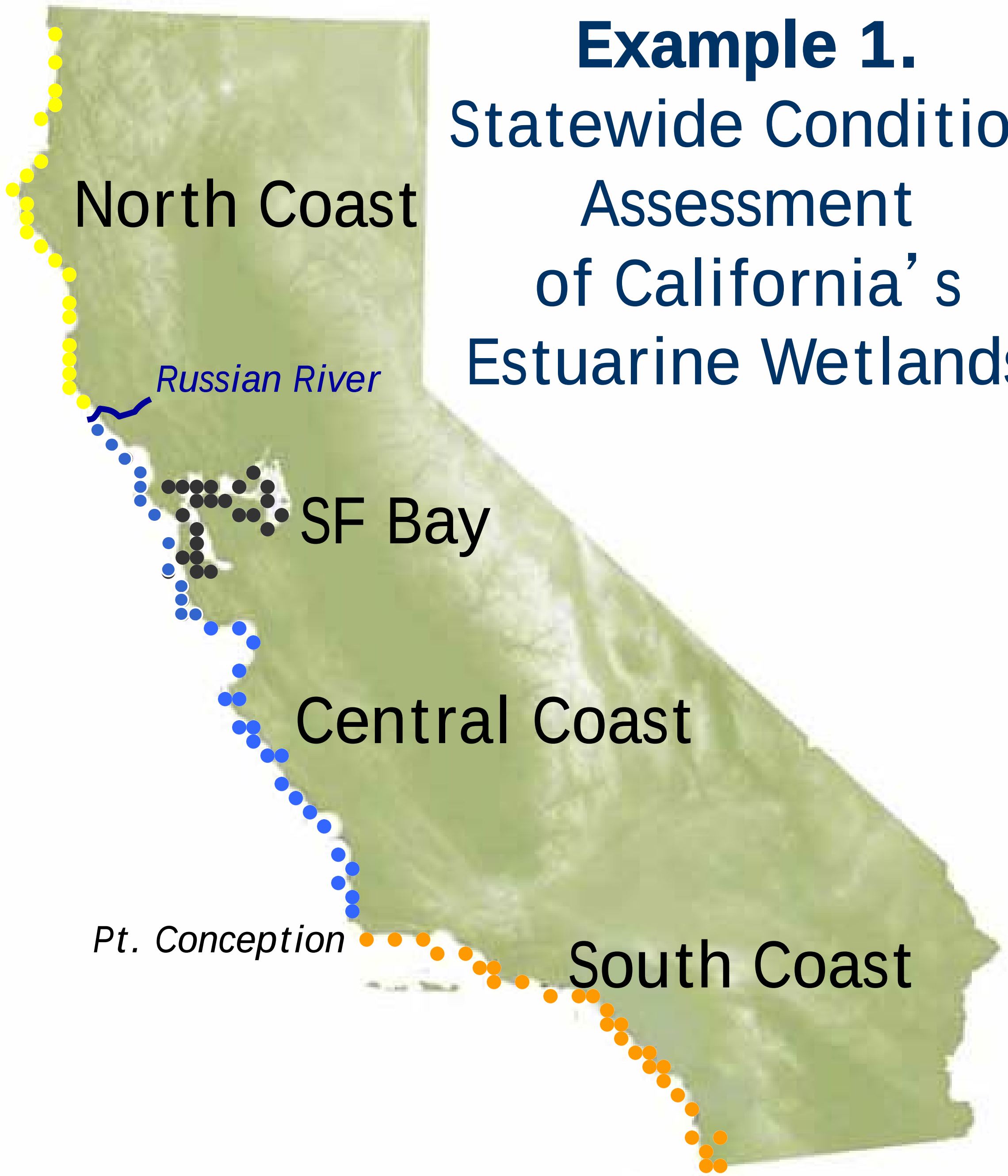
- Statewide Assessments
- Watershed Assessments
- Project Assessments
  - Baseline Conditions
  - Alternative Comparison
  - Impact Assessment and Avoidance
  - Restoration/Mitigation Planning and Permitting
  - Long-term Monitoring
- Regulatory Context

EPA 3-Level Approach Assessment Tools



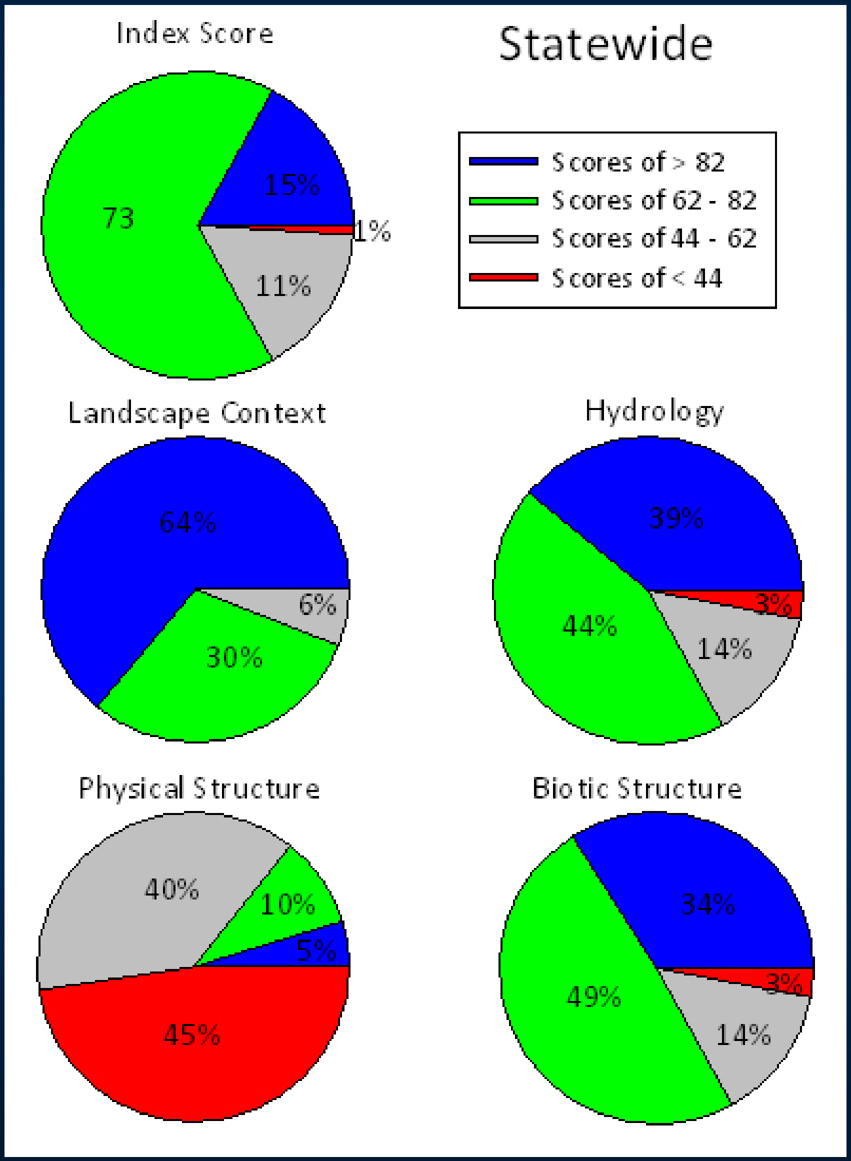
Example 1.

Statewide Condition Assessment of California's Estuarine Wetlands



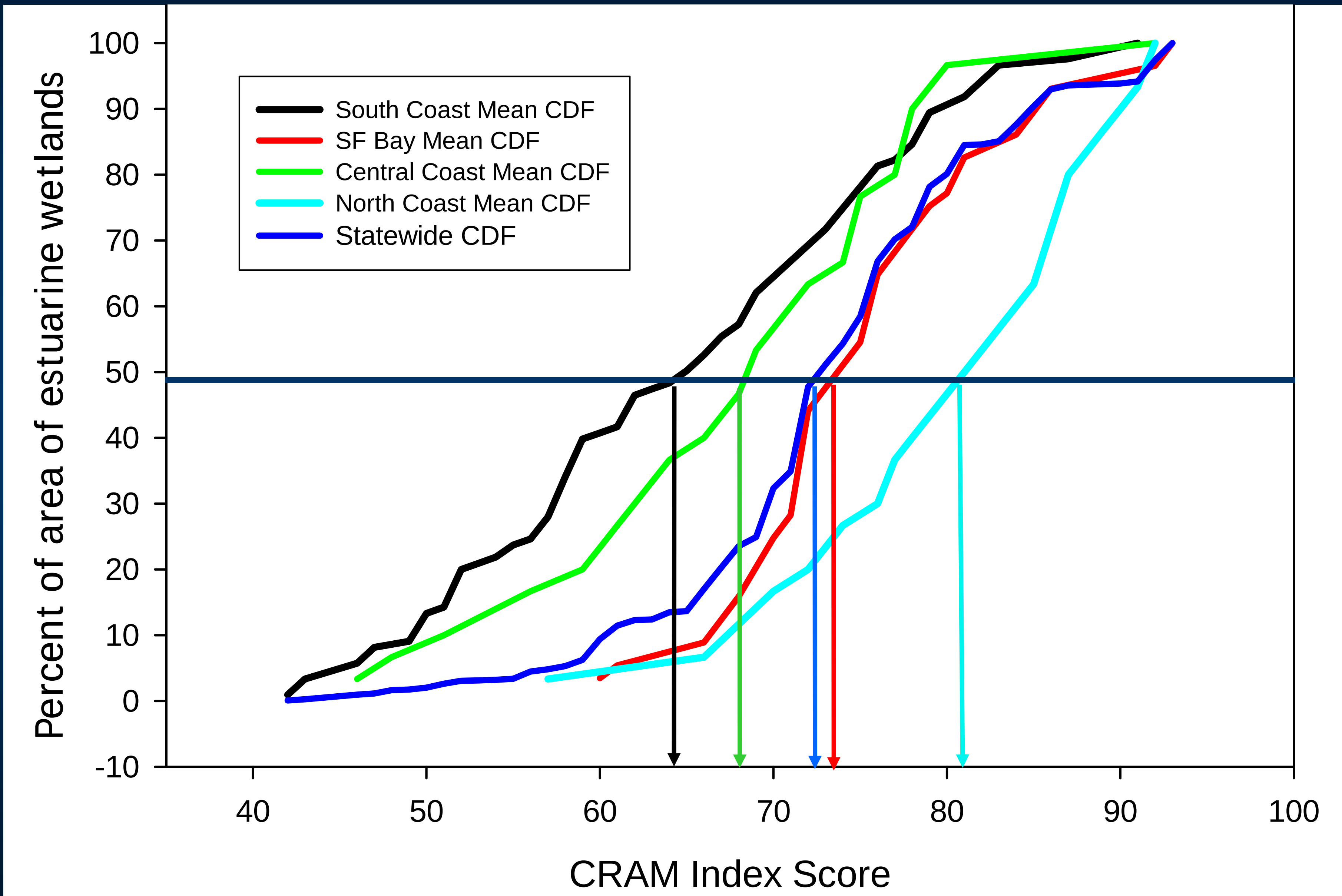
- California coast sampled in four regions
- Perennially tidal saline estuaries targeted
- 150 sites probabilistically selected (i.e., an ambient survey)
- CRAM used to assess condition

Summary of Statewide Condition

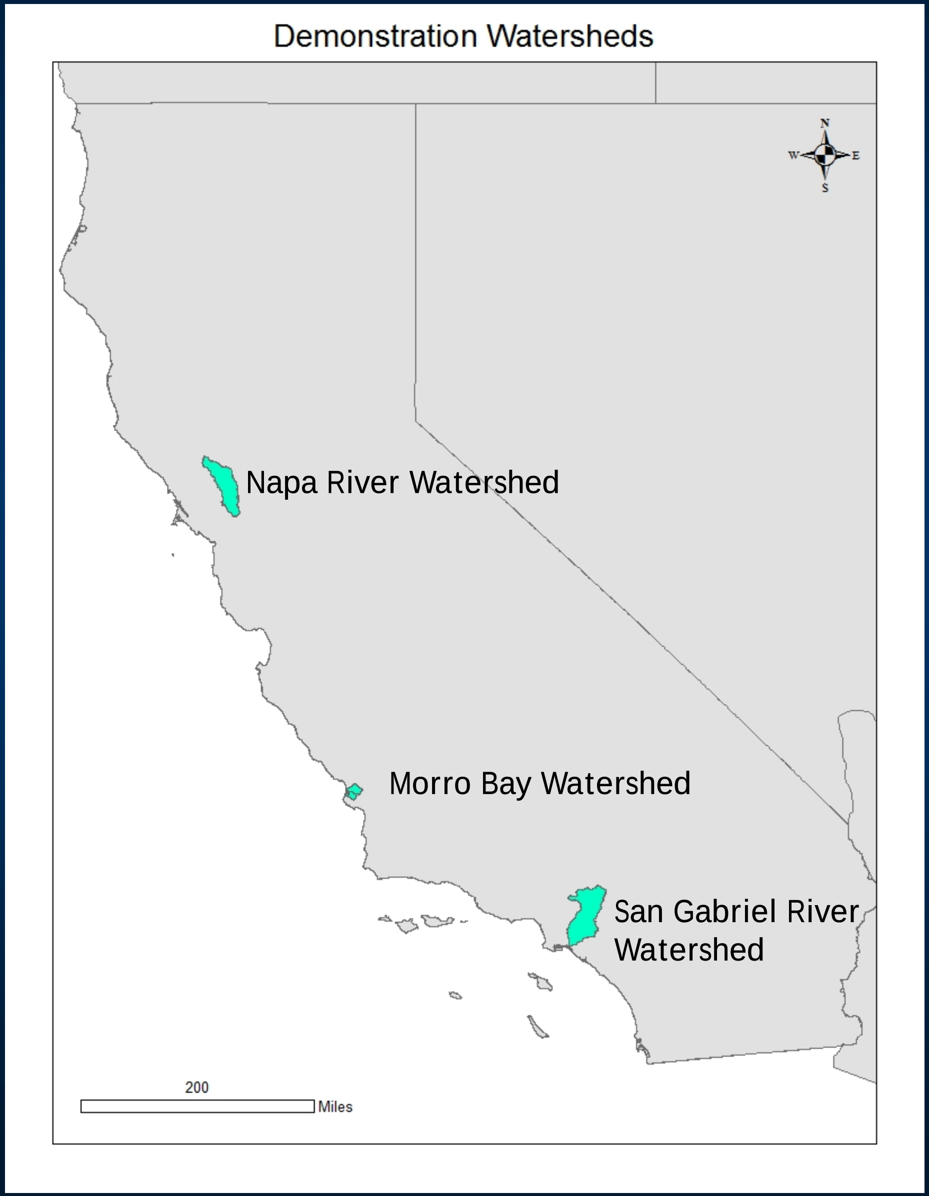


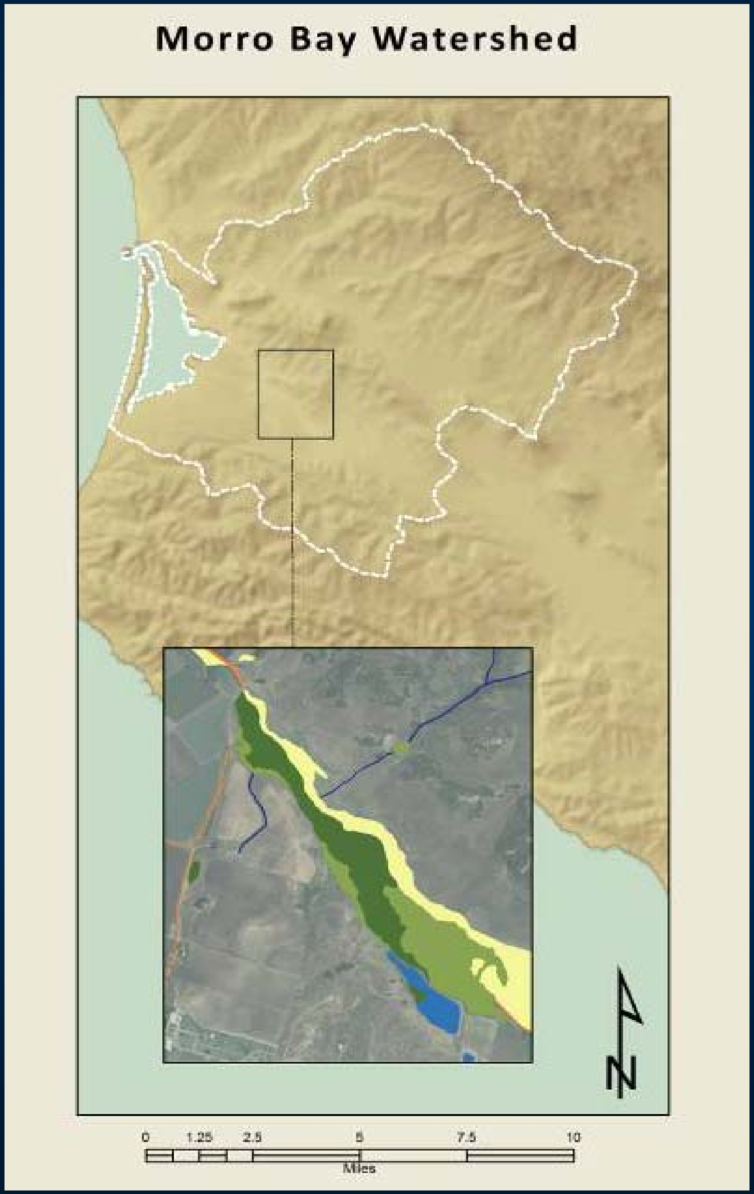
- Statewide estuarine ambient survey results:
  - Only 15% of State's estuarine marsh acreage is in the top quartile of CRAM scores
  - Stressors causing degraded physical structure require management attention

Cumulative Distributions of CRAM Scores



Example 2.
Ambient Riverine Surveys at Watershed Scale

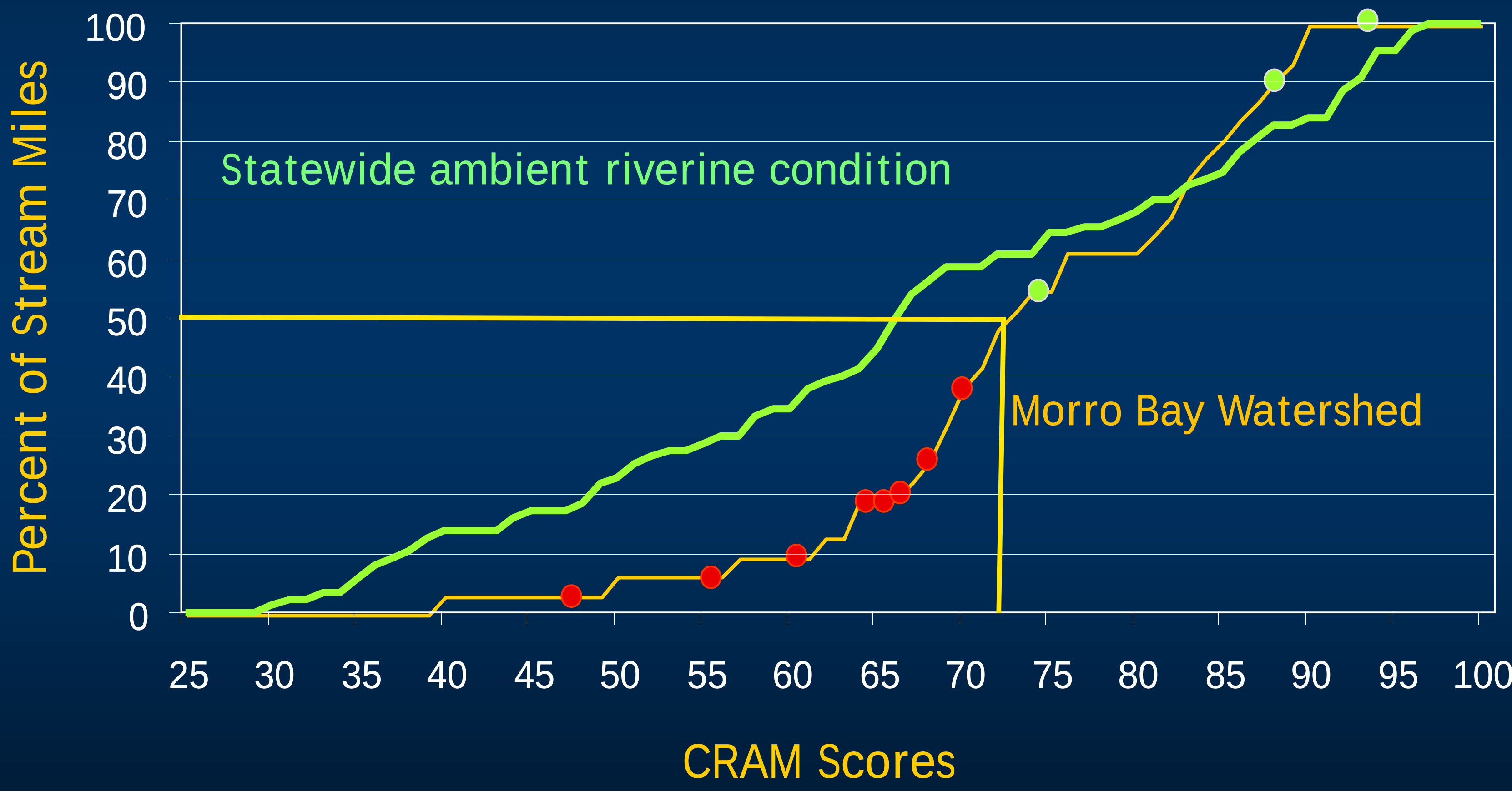




Morro Bay Watershed Ambient Assessment 2007

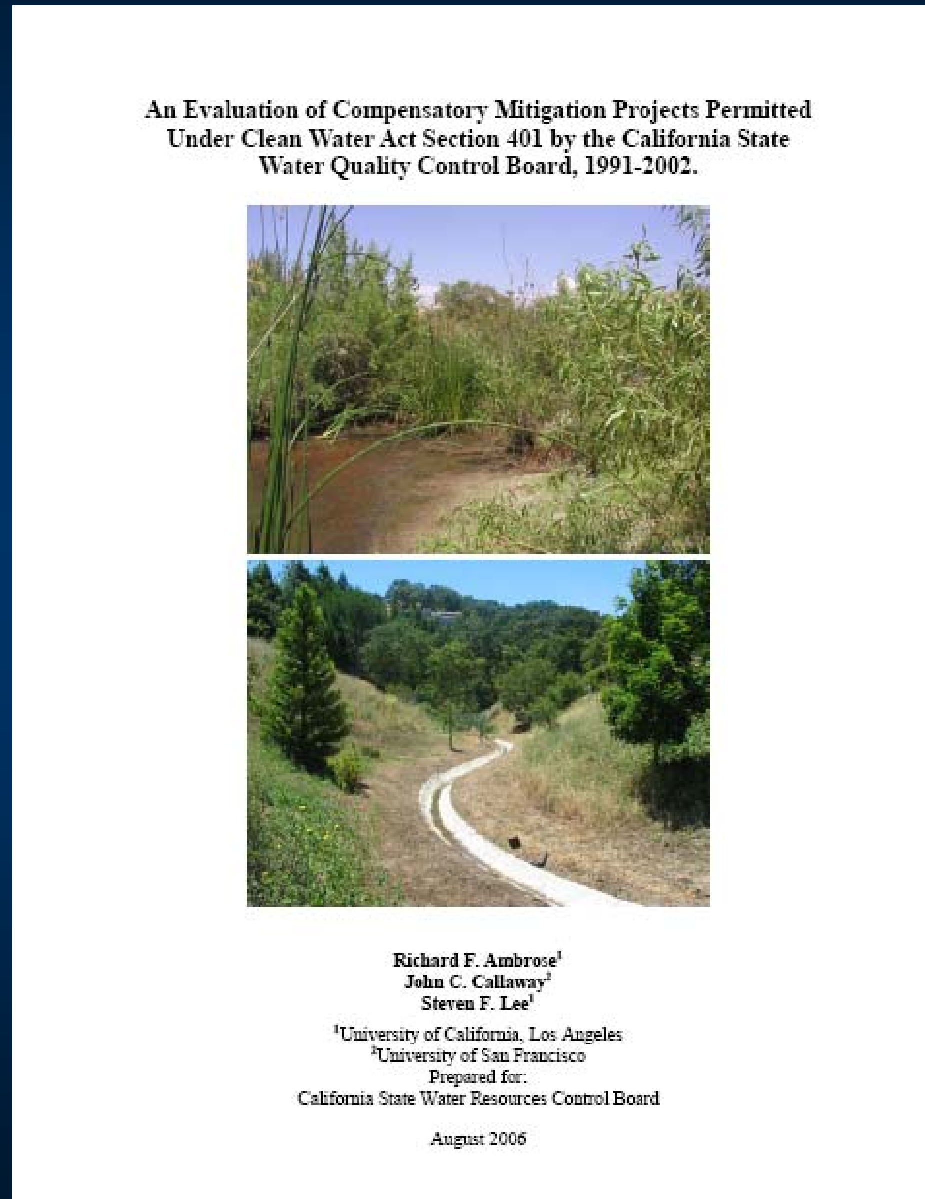
- Probabilistic sampling of 30 “ambient sites”
- Targeted sampling at restoration projects
- Major Issue: Access to private land
  - Los Osos Creek >90% private
  - Chorro Creek ~40% private

Morro Bay Riverine Projects of Statewide and Local Ambient Condition



Example 3. Program Evaluation

Evaluate the compliance and wetland condition of compensatory wetland mitigation projects associated with Section 401 Water Quality Certifications throughout California



An Evaluation of Compensatory Mitigation Projects Permitted Under Clean Water Act Section 401 by the California State Water Quality Control Board, 1991-2002.

Richard F. Ambrose[1]
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Steven F. Lee[1]

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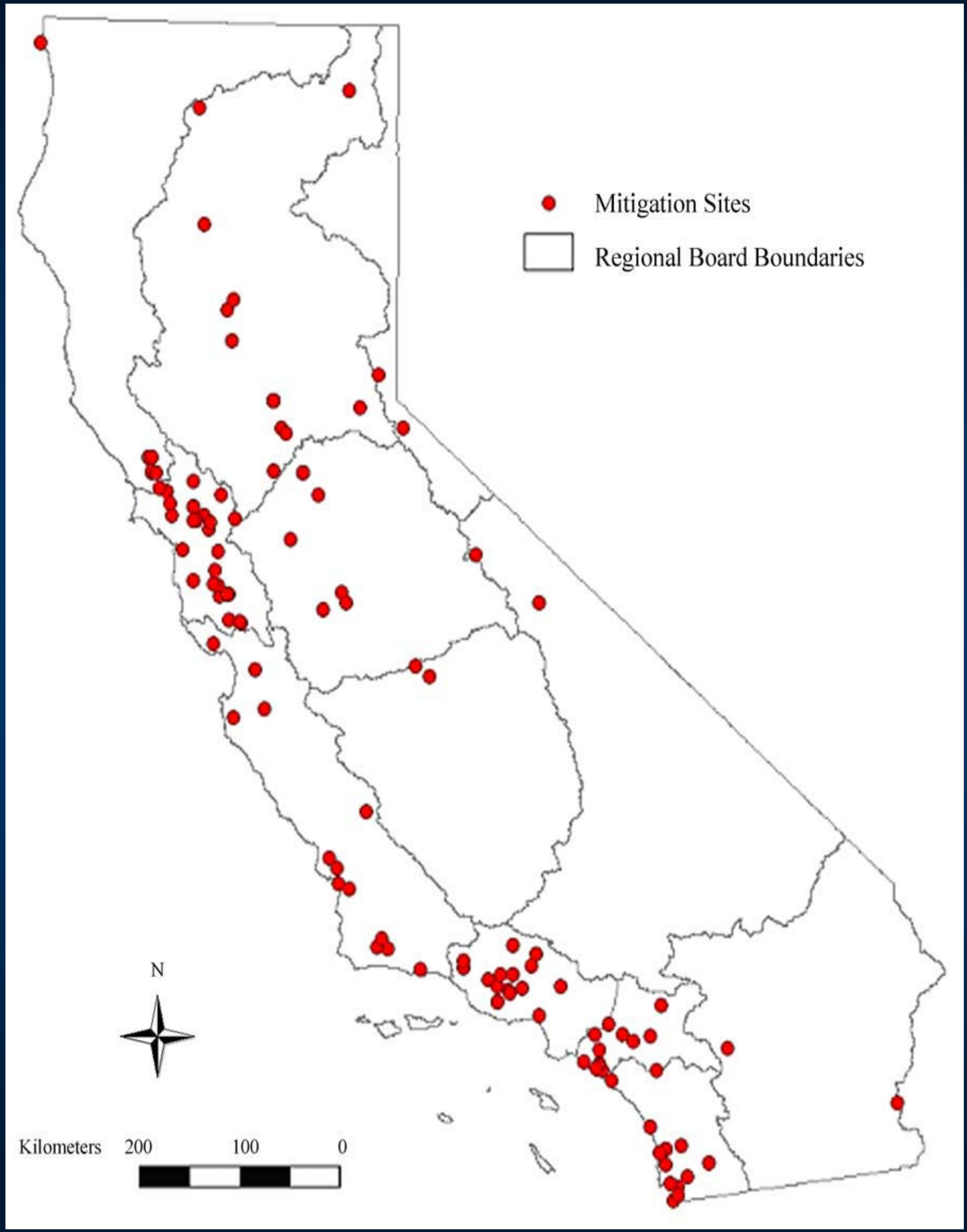
[2]University of San Francisco

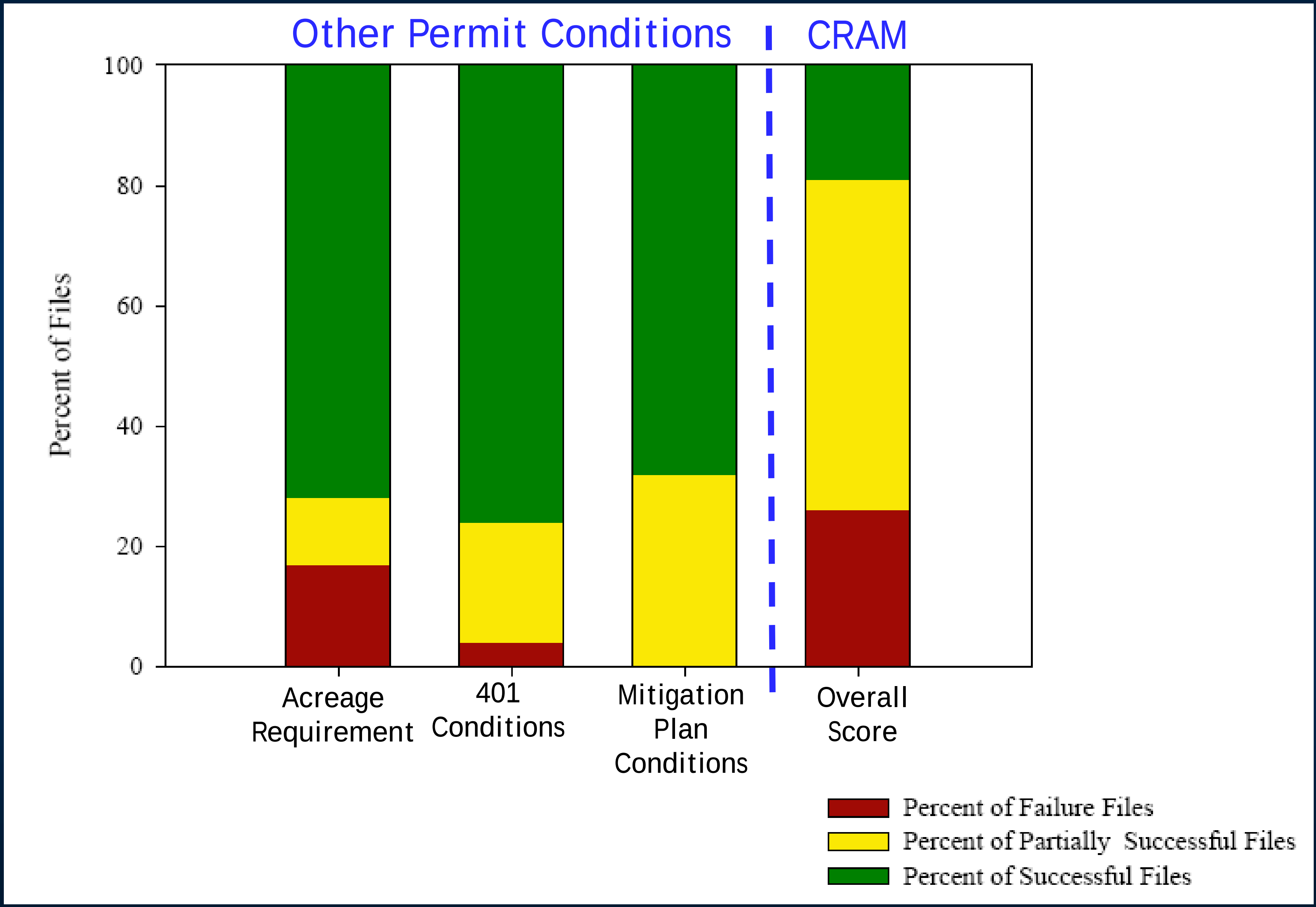
Prepared for:
California State Water Resources Control Board

August 2006

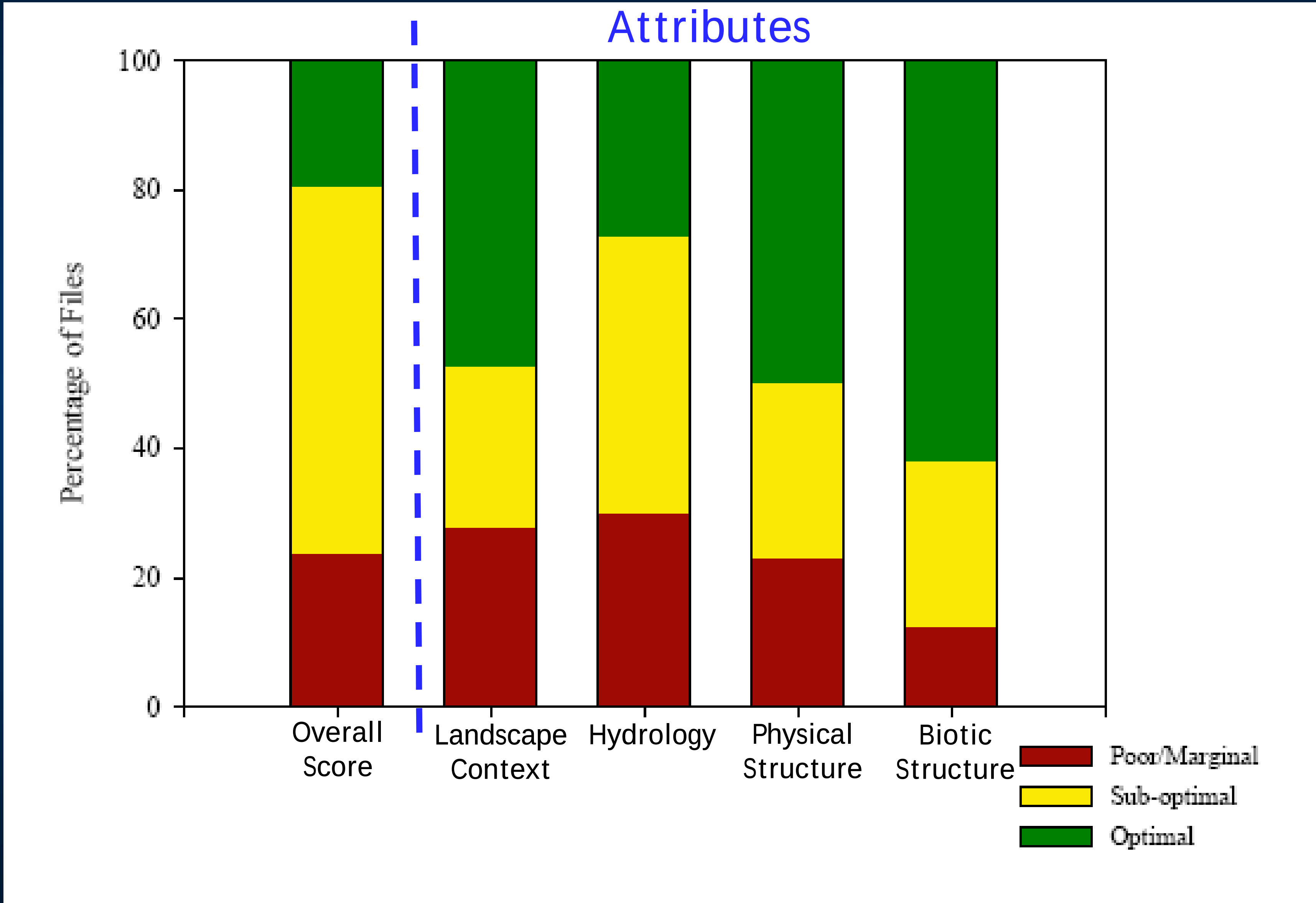
- 204 mitigation sites
- Review permit files for compliance
- Evaluate condition using CRAM (an earlier version)



Was the Mitigation Successful??



CRAM Condition Breakdown



Project Impact/ Mitigation Assessment Using CRAM

- Approach depends on objectives of assessment
- Impact Assessments:
  - Probabilistic survey (watershed or reach effects)
  - Targeted survey (project specific)
- Restoration/Mitigation Assessments:
  - Mitigation opportunities/alternatives
  - Performance standards
    - Short term (5-10 yrs)
    - Long term (every 5 yrs in perpetuity)

Example 4. CRAM for Linear Projects

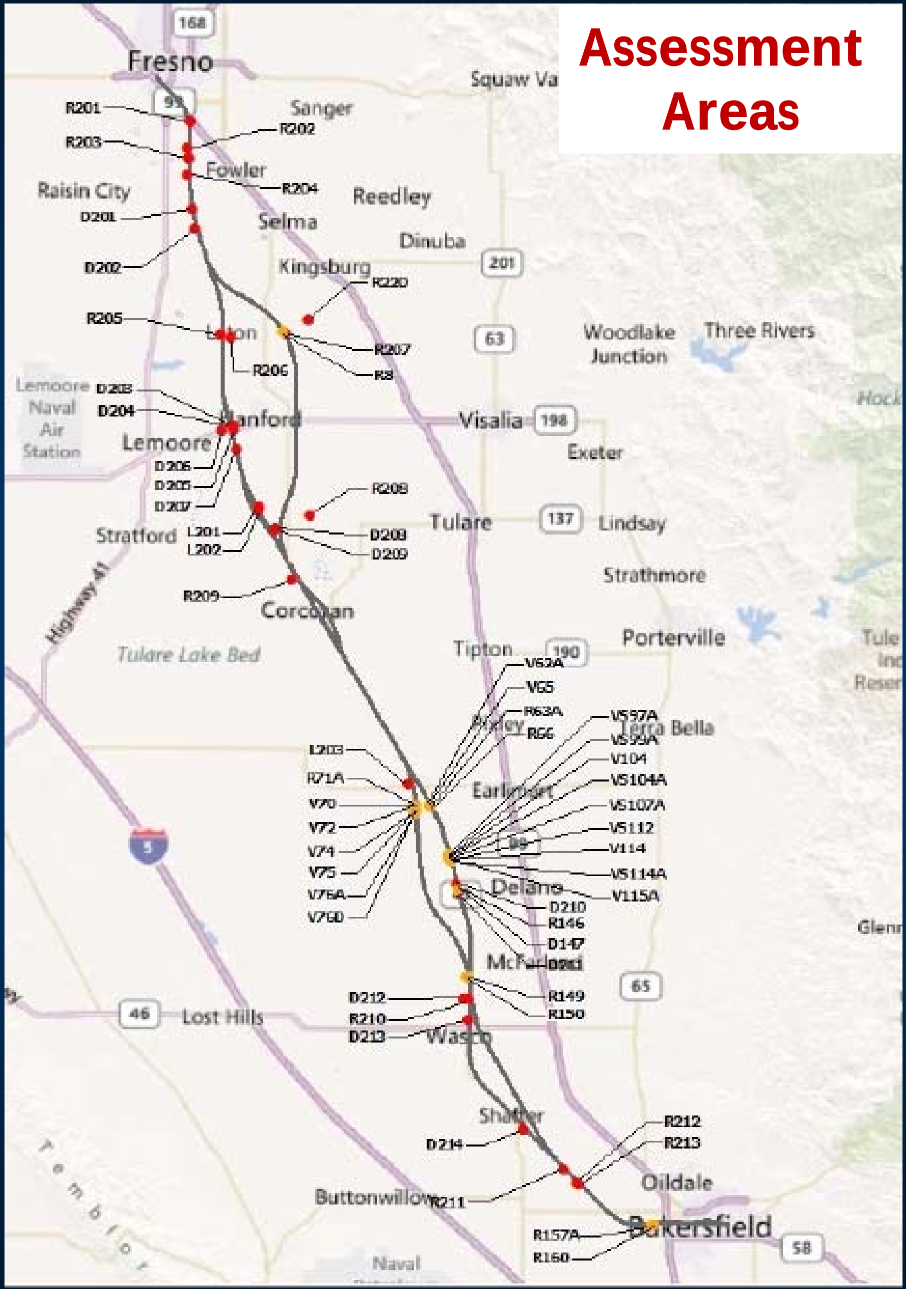
Example Projects

- High Speed Train
- Sunrise Powerlink
- Orange County Freeways
- Caltrans I-5 Corridor

Many types of wetlands including:

- Riverine, Depressional, Vernal Pools, Estuarine

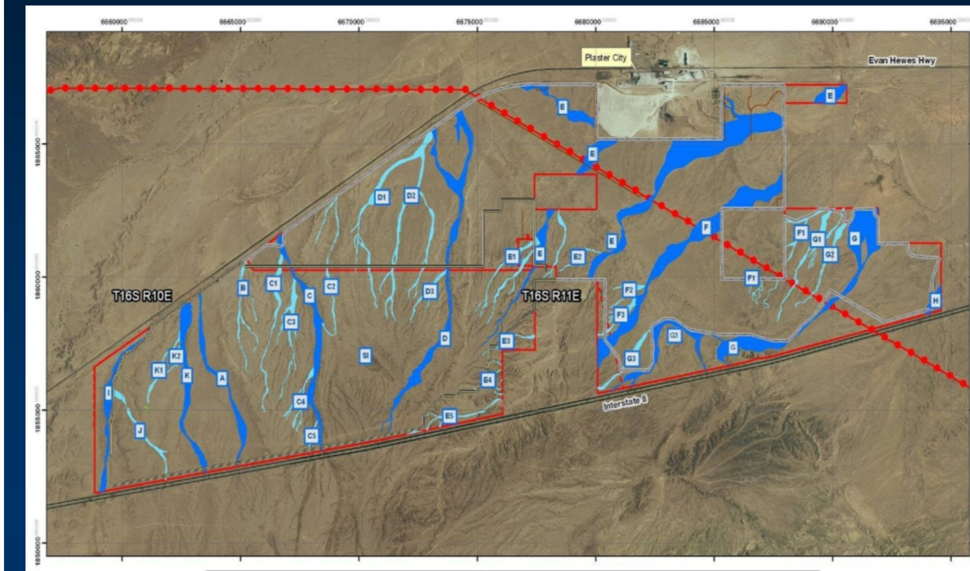
CRAM provides a common language to assess them.



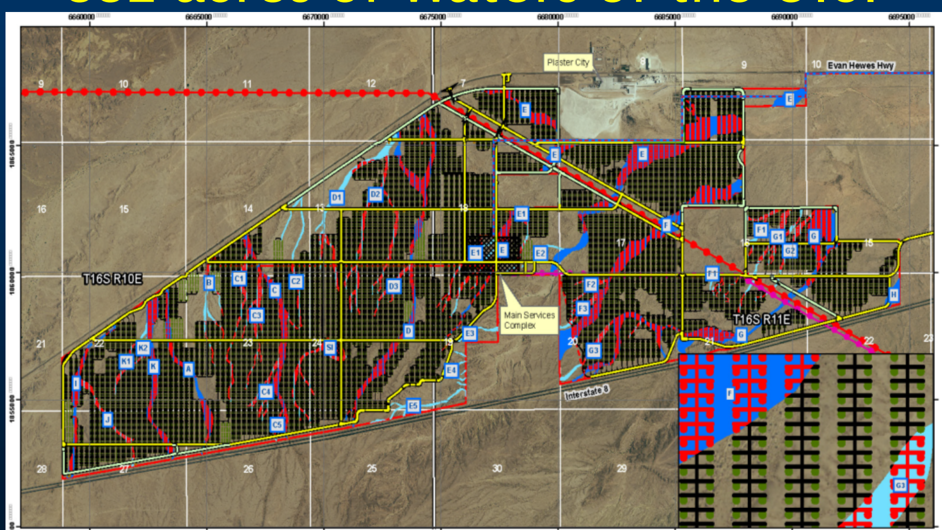
Many Types of Wetlands

Example 5. Alternatives Evaluation

Imperial Valley Solar Project



881 acres of Waters of the U.S.

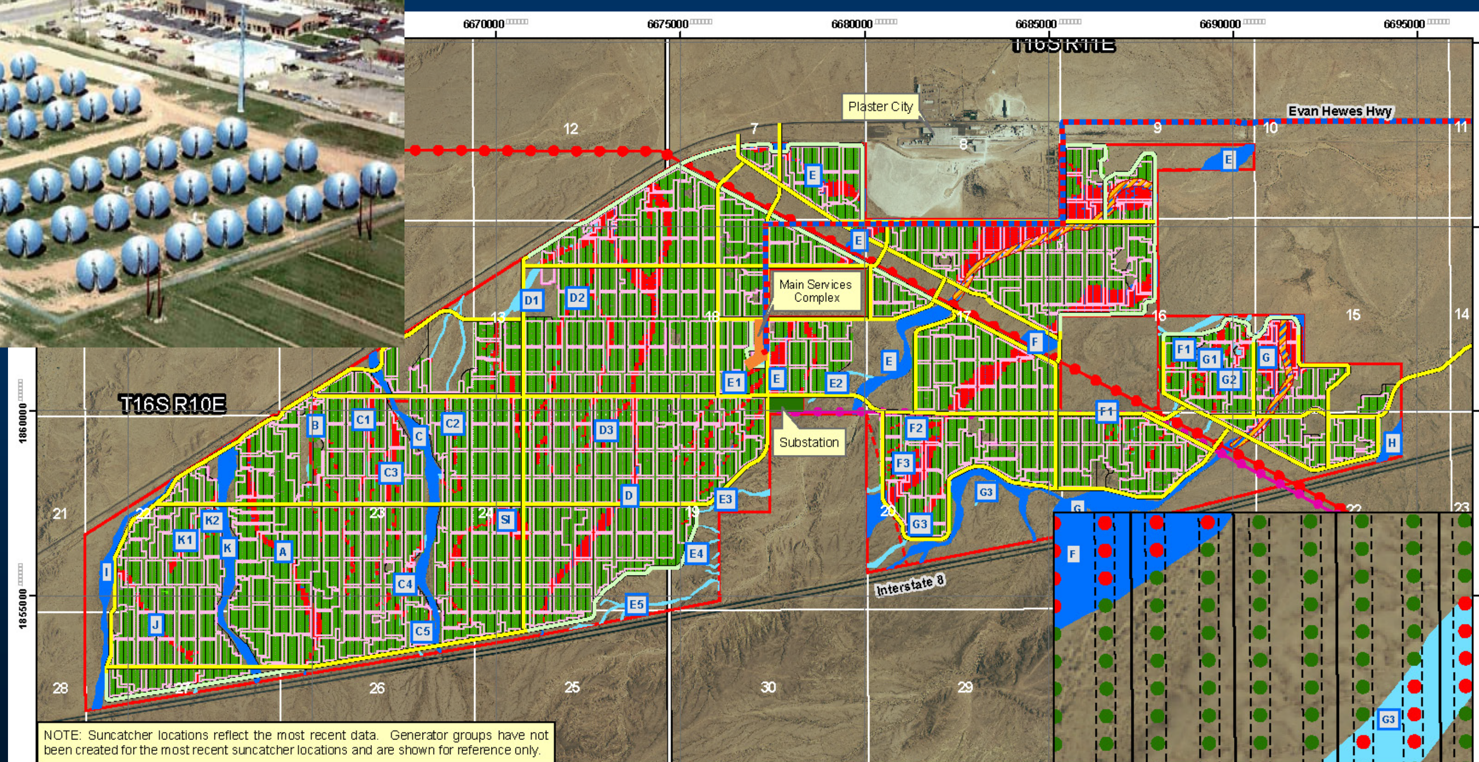


Proposed Project to fill 165 acres

- 84 CRAM AAs
- Data Used in 404(b)(1)
- Evaluate Baseline Stream Condition
- Analyze Direct and Indirect Impacts of 6 Alternatives
- Redesign Alternatives to Avoid and Minimize
- Identify Mitigation Need

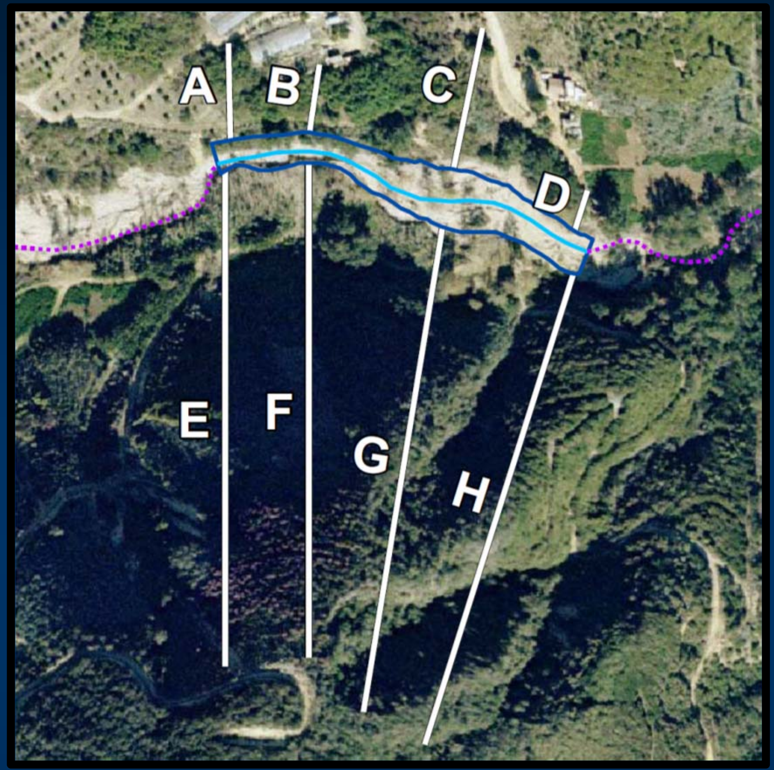
Permitted Project

- Avoidance of high quality primary streams
- Minimization of direct and indirect impacts through reduction of roads, redesign of crossings, and suncatcher layout
- Reduced fill, somewhat reduced energy generating capacity



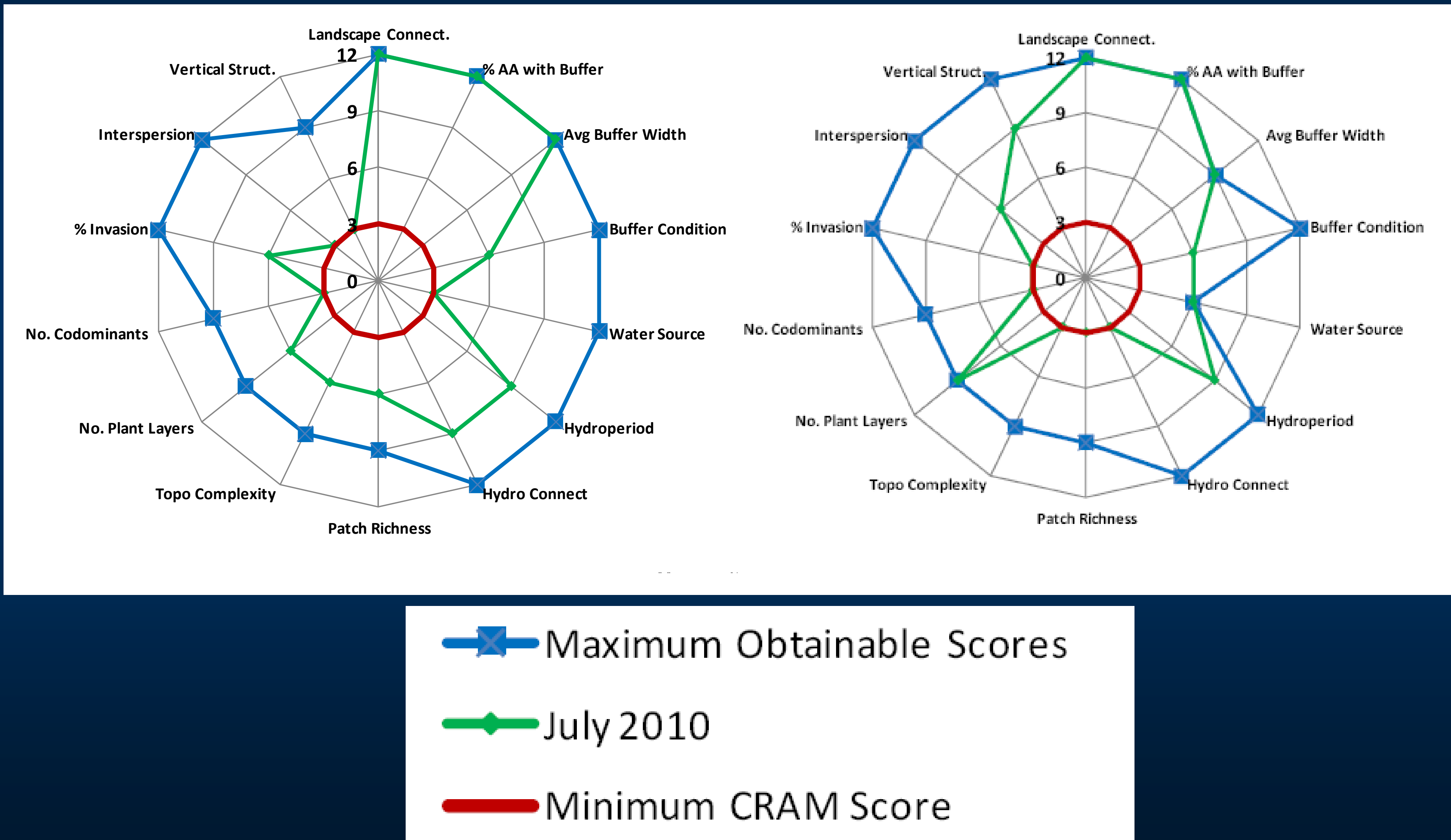
Example 6. Assessing Mitigation Site Potential

- Confidential project in San Diego
- Compare two potential sites
- Project maximum CRAM score following restoration
- Determine if site(s) meet the mitigation needs of project
- Allow for comparison of mitigation opportunities and potential “lift”
- Inform decision making prior to large financial output



Visual Comparison

Site 1 | Site 2



CRAM Score Comparison

CRAM Attributes	CRAM Metric and Submetrics		Site 1 Baseline`	Site 1 Max Obtainable	Site 2 Baseline	Site 2 Max Obtainable
Buffer and Landscape Connectivity		**Attribute Score**	**20**	**24**	**20**	**23**
	Landscape Connectivity		12 (A)	12 (A)	12 (A)	12 (A)
	Buffer Submetrics	% of AA with Buffer	12 (A)	12 (A)	12 (A)	12 (A)
		Average Buffer Width	12 (A)	12 (A)	9 (B)	12 (A)
		Buffer Condition	12 (A)	12 (A)	6 (C)	6 (C)
		Buffer Submetric Score	8.49	12.00	7.90	11.17
Hydrology		**Attribute Score**	**21**	**36**	**18**	**30**
	Water Source		3 (D)	12 (A)	6 (C)	6 (C)
	Hydroperiod		9 (B)	12 (A)	9 (B)	12 (A)
	Hydrologic Connectivity		9 (B)	12 (A)	3 (D)	12 (A)
Physical Structure		**Attribute Score**	**12**	**18**	**6**	**18**
	Structural Patch Richness		6 (C)	9 (B)	3 (D)	9 (B)
	Topographic Complexity		6 (C)	9 (B)	3 (D)	9 (B)
Biotic Structure		**Attribute Score**	**11**	**31**	**20**	**34**
	Plant Community Submetrics	No. of plant layers	9 (B)	9 (B)	9 (B)	6 (C)
		No. of co-dominants	9 (B)	9 (B)	3 (D)	3 (D)
		Percent Invasion	12 (A)	12 (A)	3 (D)	6 (C)
		Plant Community Submetric Score	5	10	5	10
	Horizontal Interspersion		3 (D)	12 (A)	6 (C)	12 (A)
	Vertical Biotic Structure		3 (D)	9 (B)	9 (B)	12 (A)
		Overall AA Score	**54**	**91**	**53**	**88**

Example 7. Sulphur Creek Ecosystem Restoration Project

7.7 acres/ 2,000 linear feet (part of larger 2.5 miles/50 aces)

September 2005

City of Laguna Niguel, Orange County, California

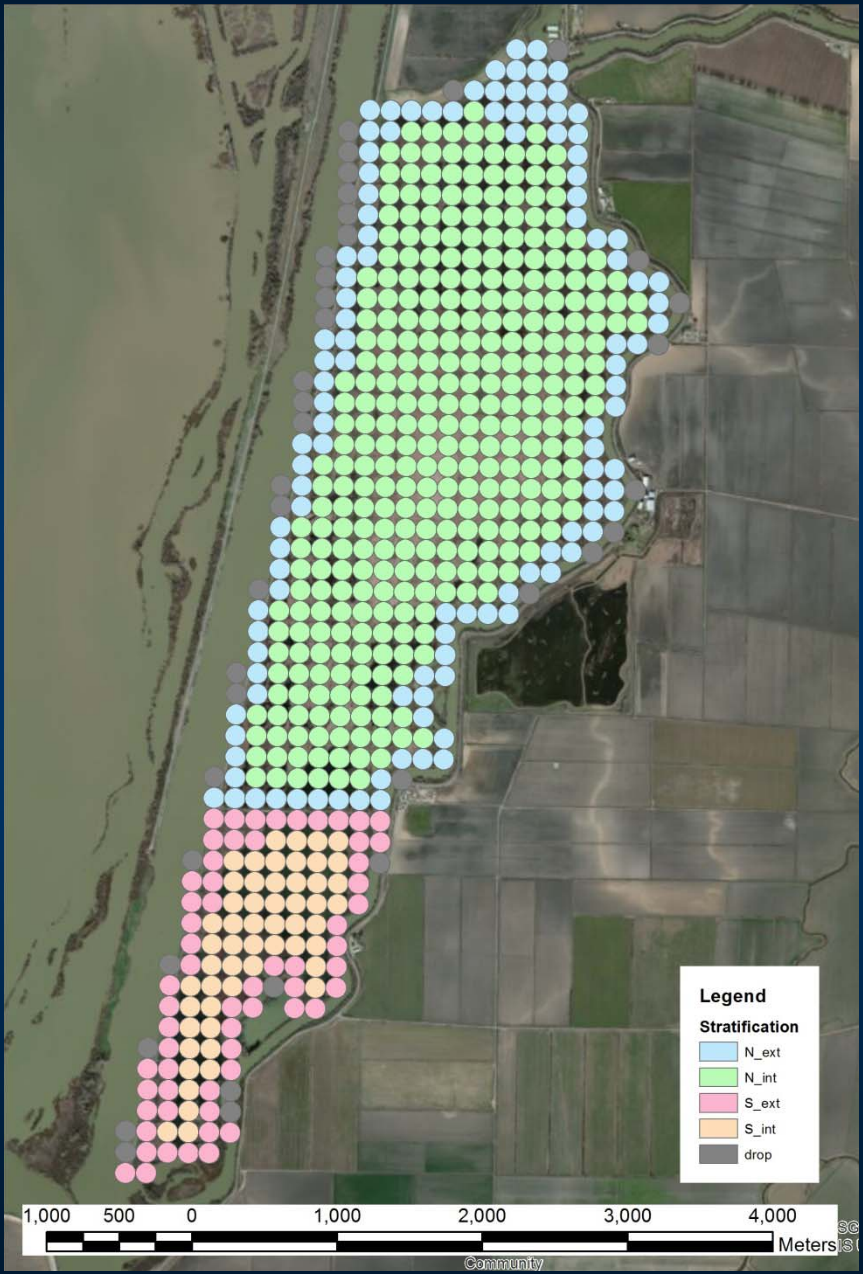
Site Overview

- **CRAM and HGM Used to Assess △Wetland Condition**
- **Other Level III Data Included (Vegetation)**


July 2010
Floodplain restored in expanded area

Example 8. Prospect Island Restoration

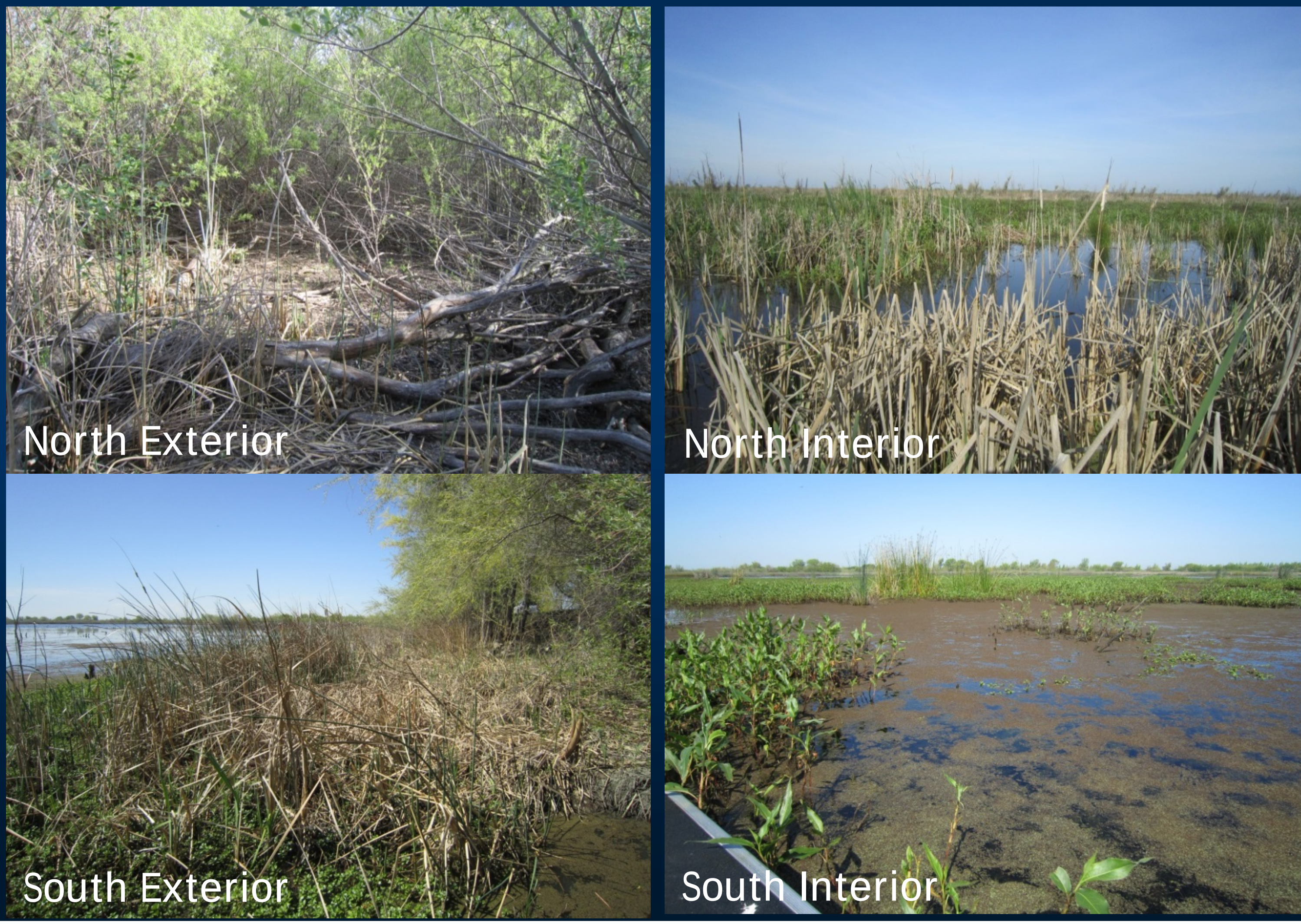
- DWR and CDFW restoration project
- The island is currently two large depressional wetlands
- Restoration will breach levees and return tidal action, transforming into a brackish estuarine wetland
- CRAM used to assess current and post-restoration condition

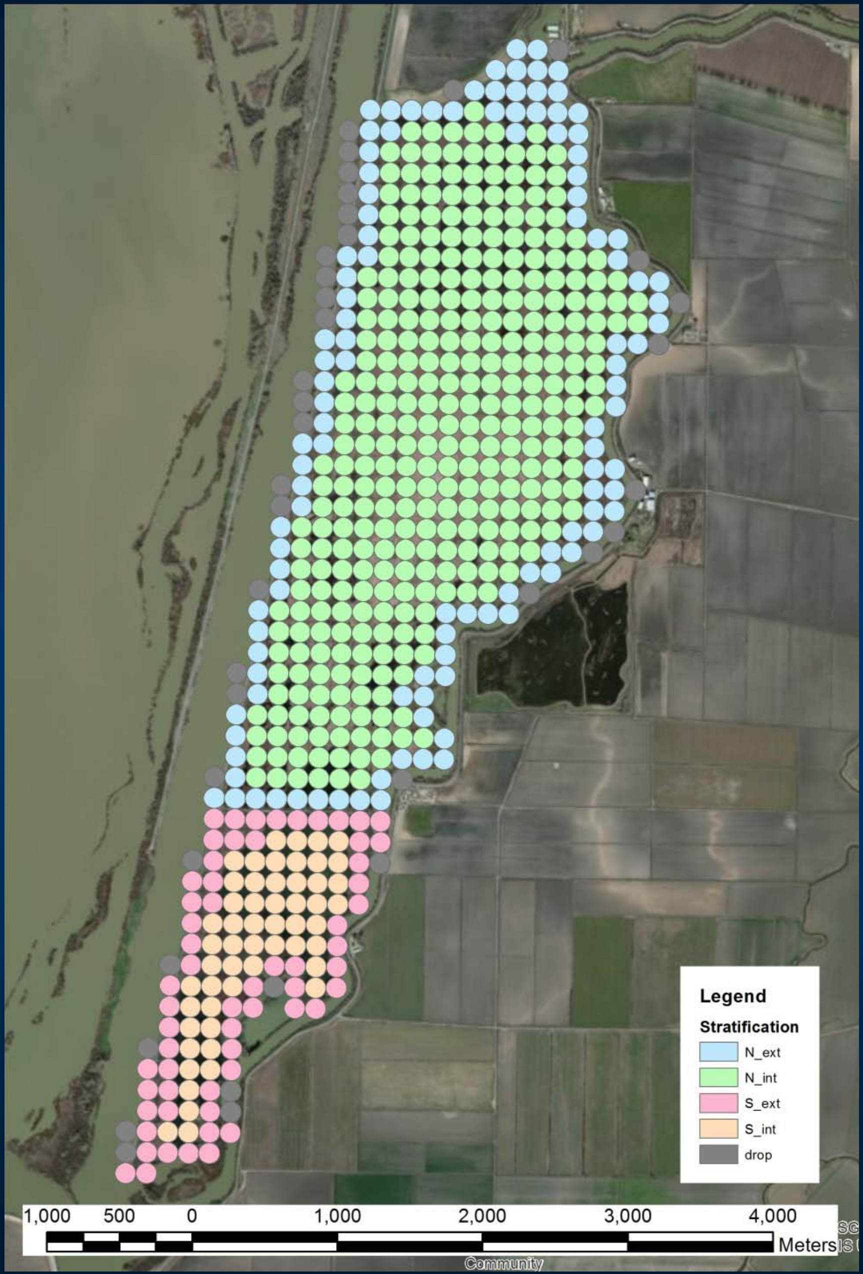


- Very large project
- Stratified into 4 classes:
  - North interior
  - North exterior
  - South interior
  - South exterior
- A grid of 1 ha circles representing potential AAs was overlain on the project area
- Random number generator used to select a sequence of AAs within each class

Why Stratify?

- Future restoration and management may be different
- The vegetation structure is visibly different



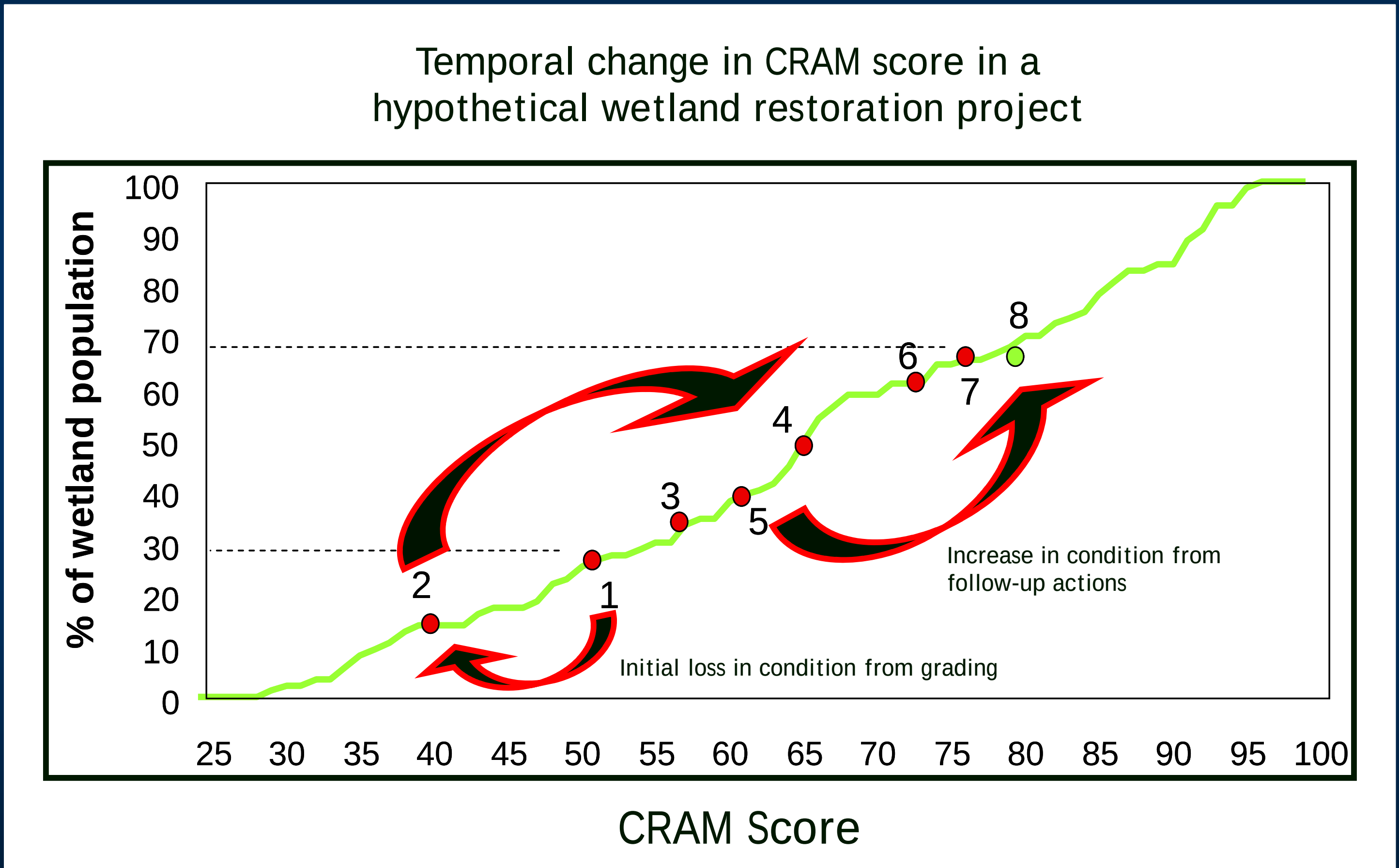


- Within each class, the first 3 AAs selected were assessed sequentially
- By attribute, the scores for AA1 and AA2 were averaged, and compared to AA3
- If the scores for AA3 were within 10 points of the average of AA1 and AA2, no other AAs were assessed
- If the score was >10 points, the fourth selected AA was assessed, then compared to the average of AA1, 2, 3

- Table shows example from the South Interior class, where 4 AAs were needed to achieve <10 point difference
- Ultimately 18 AAs in total were assessed on the island
- Captured the likely full variability of condition present within each class
- Gathered baseline condition in only 6 days of fieldwork

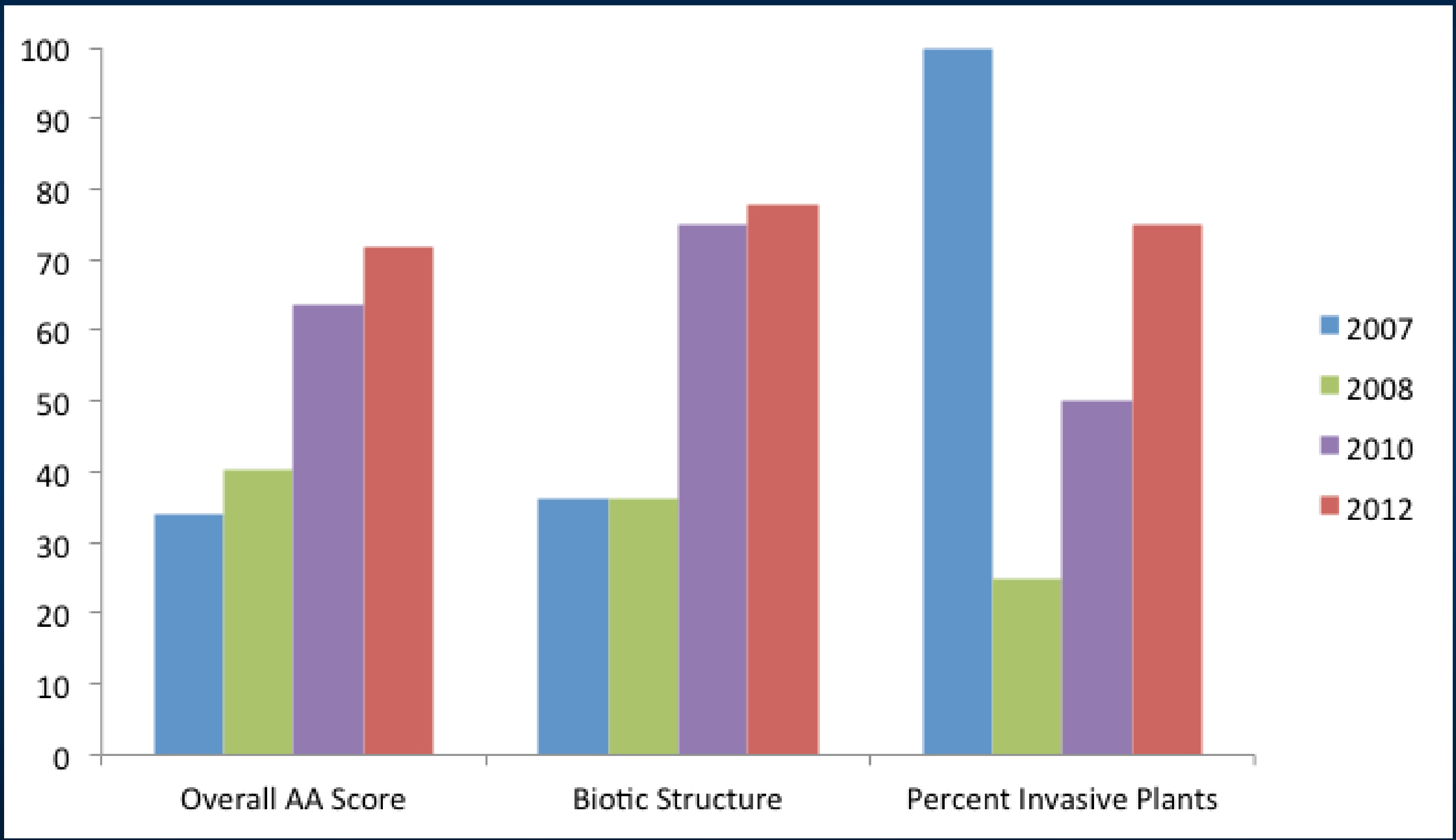
	South Interior		
	Average of first 3 AAs	Last AA	Difference
Buffer and Landscape Context	95.53	93.30	2.23
Hydrology	83.33	83.33	0.00
Physical Structure	50.00	50.00	0.00
Biotic Structure	61.11	55.56	5.56
Overall Score	73	71	2

Example 9. Monitoring Restoration Site Condition Through Time



Monitoring Change Over Time - Manabe Site

Manabe Restoration Site Condition Through Time

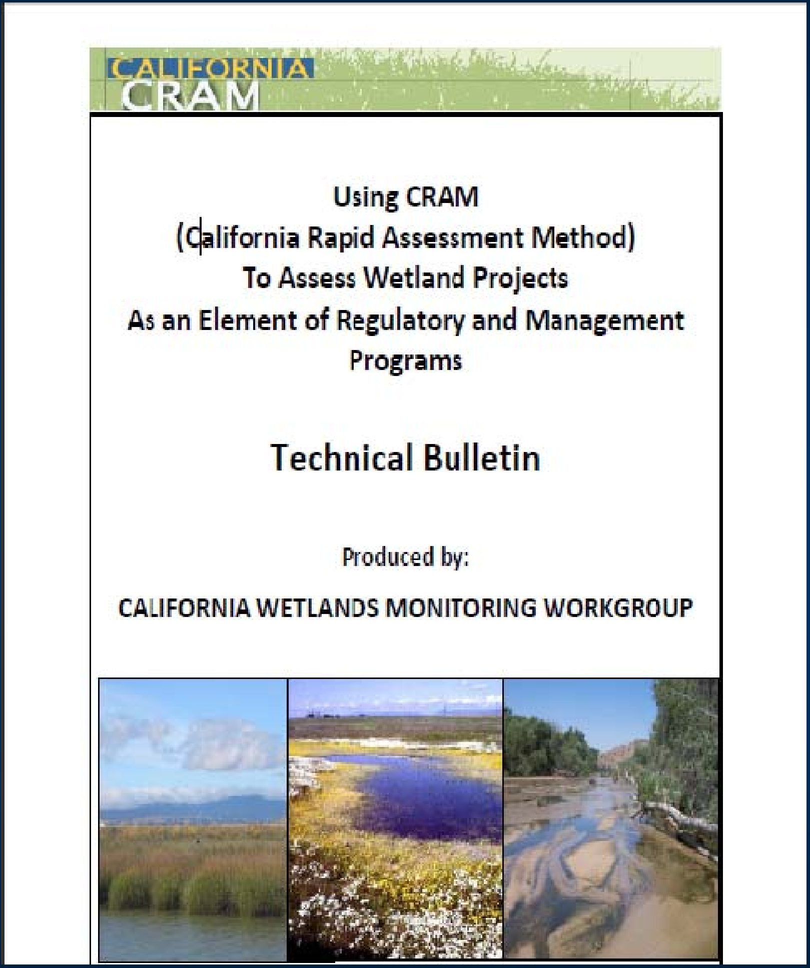


Restoration Project Monitoring

CRAM is one tool in the toolbox and is not intended to replace Level 1 or Level 3 data

Appropriate Uses of CRAM

- CRAM is designed to evaluate the ecological condition of a wetland in terms of its ability to support characteristic plants and animals. Evaluation of pre-project conditions at mitigation sites
- Baseline Information
- Assessment of mitigation compliance as condition-based performance criteria (along with Level 1 and 3 measures)
- Comparison of alternatives or different sites



CRAM Technical Bulletin, cramwetlands.org

Example of 5-Year Comprehensive Monitoring Plan

- Level 1: Vegetation Mapping and Delineation
- Level 2: CRAM and other Site Conditions
  - Plant survival and plant condition
  - Erosion issues, trash, trespass/vandalism
- Level 3: Quantitative Assessments
  - Vegetation transects (Cover, Richness, and Diversity)
  - Bird counts/focused surveys
  - IBI (Macroinvertebrates, Algae, etc.)
  - Soil development
  - Hydrology (depth of groundwater, flooding interval)
  - Hydrogeomorphic (HGM) Method

CRAM In Regulatory Process

The USACE Mitigation Rule (2008)

"In cases where appropriate functional or condition assessment methods or other suitable metrics are available, these methods *should* be used *where practicable* to determine how much compensatory mitigation is required."

Local Guidance/Resources (USACE):

- 2011 Mitigation Ratio Checklist
- 2012 Uniform Performance Standards
- 2013 Updated Mitigation Ratio Checklist – ongoing updates in 2012 and 2013 (a living document)
- 2015 Final Mitigation and Monitoring Guidelines

USACE SPD Mitigation Ratio Setting Checklist

Attachment 12501.1 - SPD Mitigation Ratio Setting Checklist

1	Date: __________ Corps file no.: __________ Project Manager: __________ Impact site name: __________ ORM impact resource type: __________ Hydrology: __________ Impact Cowardin or HGM type: __________ Impact area (acres): __________ Impact distance (linear feet): __________			
		Column A: Mitigation site name: __________ Mitigation type: __________ Resource type: __________ Cowardin/HGM type: __________ Hydrology: __________	Column B (optional): Mitigation site name: __________ Mitigation type: __________ Resource type: __________ Cowardin/HGM type: __________ Hydrology: __________	Column C (optional): Mitigation site name: __________ Mitigation type: __________ Resource type: __________ Cowardin/HGM type: __________ Hydrology: __________
2	**QUALITATIVE impact-mitigation comparison:** Has a Corps-approved functional/condition assessment been obtained? If not, complete step 2; otherwise, complete step 3. Yes ☐ No ☐ Optional: use Table 1 (page 3).	Note: steps 2 and 3 are mutually exclusive. If step 2 is used, then complete the rest of the checklist (steps 4-10). Starting ratio: 1:1 Ratio adjustment: ___ Baseline ratio: __:__ PM justification:	Starting ratio: 1:1 Ratio adjustment: ___ Baseline ratio: __:__ PM justification:	Starting ratio: 1:1 Ratio adjustment: ___ Baseline ratio: __:__ PM justification:
3	**QUANTITATIVE impact-mitigation comparison:** Use step 3 if a Corps-approved functional/condition assessment has been obtained. Use Before-After-Mitigation-Impact (BAMI) spreadsheet (attachment 12501.4) (if a district-approved functional/condition method is not available, use step 2 instead). See example in attachment 12501.2.	Note: steps 2 and 3 are mutually exclusive. If step 3 is used, steps 3 and 5 may also be mutually exclusive. If a functional/ condition assessment method is used that explicitly accounts for area (such as HGM), steps 3 and 5 are mutually exclusive; however, if a method is used that does *not* explicitly account for area (such as CRAM), then both steps should be used. Complete the rest of the checklist (steps 4-10 or steps 4 and 6-10, as appropriate). Baseline ratio from BAMI procedure (attached): __:__	Baseline ratio from BAMI procedure (attached): __:__	Baseline ratio from BAMI procedure (attached): __:__
4	**Mitigation site location:**	Ratio adjustment: PM justification:	Ratio adjustment: PM justification:	Ratio adjustment: PM justification:

2013 USACE Mitigation Ratio Procedure

Step 3: Before After Mitigation Impact (BAMI)

Functions/conditions	$Impact_{Before}$	$Impact_{After}$	$Impact_{delta}$	$Mitigation_{Before}$	$Mitigation_{After}$	$Mitigation_{delta}$
4.1 Buffer and Landscape Context						
4.1.1 Landscape Connectivity	9	3	-6	6	6	0
4.1.2 Percent of AA with Buffer	12	6	-6	3	9	6
4.1.3 Average Buffer Width	3	3	0	3	12	9
4.1.4 Buffer Condition	6	6	0	3	9	6
RAW SCORE	**15.0**	**8.0**	**-7**	**9.0**	**15.7**	**7**
FINAL SCORE	**76.0**	**33.6**	**-42**	**37.5**	**65.3**	**28**
4.2 Attribute 2: Hydrology						
4.2.1 Water Source	6	6	0	6	6	0
4.2.2 Hydroperiod or Channel Stability	9	12	3	3	9	6
4.2.3 Hydrologic Connectivity	12	9	-3	3	12	9
RAW SCORE	**27.0**	**27.0**	**0**	**12.0**	**27.0**	**15**
FINAL SCORE	**75.0**	**75.0**	**0**	**33.4**	**75.0**	**42**
4.3 Attribute 3: Physical Structure						
4.3.1 Structural Patch Richness	6	3	-3	3	9	6
4.3.2 Topographic Complexity	6	3	-3	3	6	3
RAW SCORE	**12.0**	**6.0**	**-6**	**6.0**	**15.0**	**9**
FINAL SCORE	**63.0**	**25.0**	**-38**	**25.0**	**62.5**	**38**
4.4 Attribute 4: Biotic Structure						
4.4.1 Number of Plant Layers	12	9	-3	6	9	3
4.4.2 Co-Dominant Species	6	6	0	6	12	6
4.4.3 Percent Invasion	6	9	3	3	12	9
4.4.4 Interspersion/Zonation	9	3	-6	3	9	6
4.4.5 Vertical Structure	6	3	-3	3	6	3
RAW SCORE	**23**	**14**	**-9**	**11**	**26**	**15**
FINAL SCORE	**38.0**	**38.9**	**1**	**30.6**	**72.3**	**42**
OVERALL SCORE	**63.0**	**44.0**	**-20**	**32.0**	**69.0**	**38**

$Quotient=ABS(M/I)_d$	**1 9/10**
Baseline ratio:	**1 : 1.9**

1. Assess existing condition at project (impact) site and post impact
2. Assess existing condition at mitigation site and project future
3. Look at Delta Loss vs. Delta Gain. Add into SOP, Step 2.

Example: Functional Loss < Functional Gain Mitigation Ratio is Adjusted down

Mitigation Ratio Procedure SPD FAQs

Q: How can I base a ratio on CRAM scores using a numerical formula?

A: Using the checklist, CRAM is used quantitatively to compare functional gain and loss at the mitigation and impact sites, respectively; however, this is just one of among several steps of the checklist, each with its own adjustment. In other words, the numerical impact-mitigation comparison result does not directly, by itself, determine the mitigation ratio.

Mitigation Ratio Procedure SPD FAQs

Q: CRAM has a documented level of user error. How does this affect the ratio determination?

A: Every functional/condition assessment method has some level of error. In addition, using a quantitative (or arguably semi-quantitative) method to compare functional gain and loss at the mitigation and impact sites, respectively, likely has less error than the undocumented error associated with "BPJ"-based determinations. Also, this is just one of among several steps of the checklist, each with its own adjustment.

Thank You