Stream Compensatory Mitigation - Monitoring for Sustainability

(33 CFR 332.5, 332.6 & 332.7)

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US Army Corps of Engineers
Institute for Water Resources (IWR)
ELI, February 2019

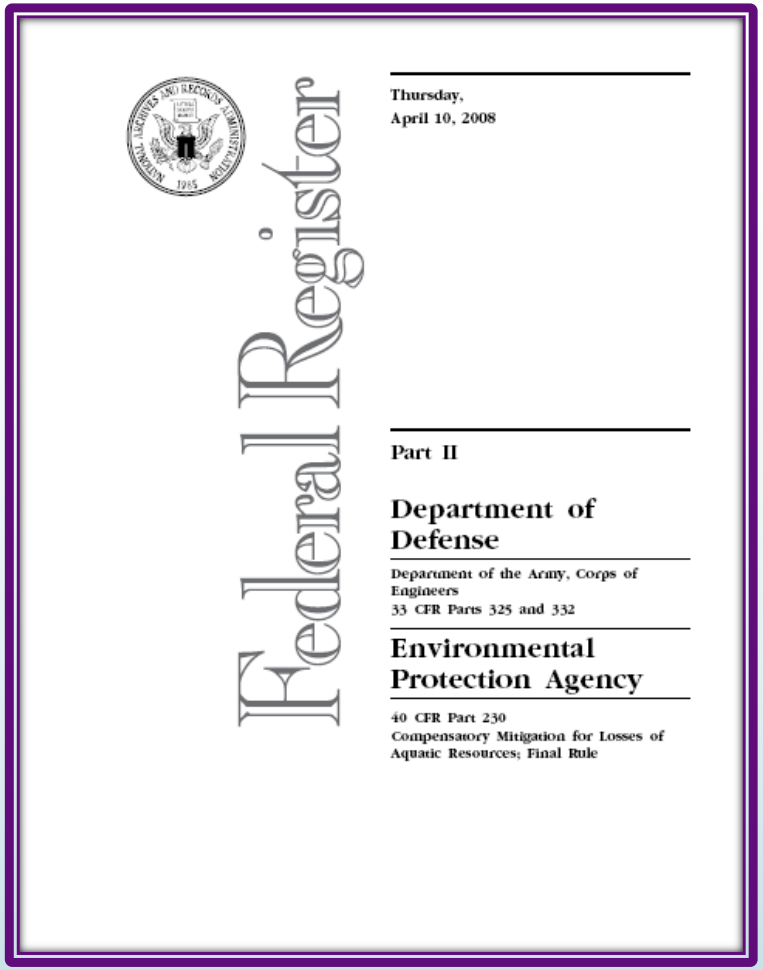
Presentation Outline

- Regulatory Setting
- Performance Standards
- Monitoring Programs
- Management
  - Interim and Long-term management
  - Adaptive management

2008 Mitigation Rule

"Compensatory mitigation involves actions taken to offset unavoidable adverse impacts to wetlands, streams and other aquatic resources authorized by Clean Water Act section 404 permits and other Department of the Army (DA) permits."

[73 Fed Reg 19594]


Federal Register

Thursday,
April 10, 2008

Part II

Department of Defense

Department of the Army, Corps of Engineers
33 CFR Parts 325 and 332

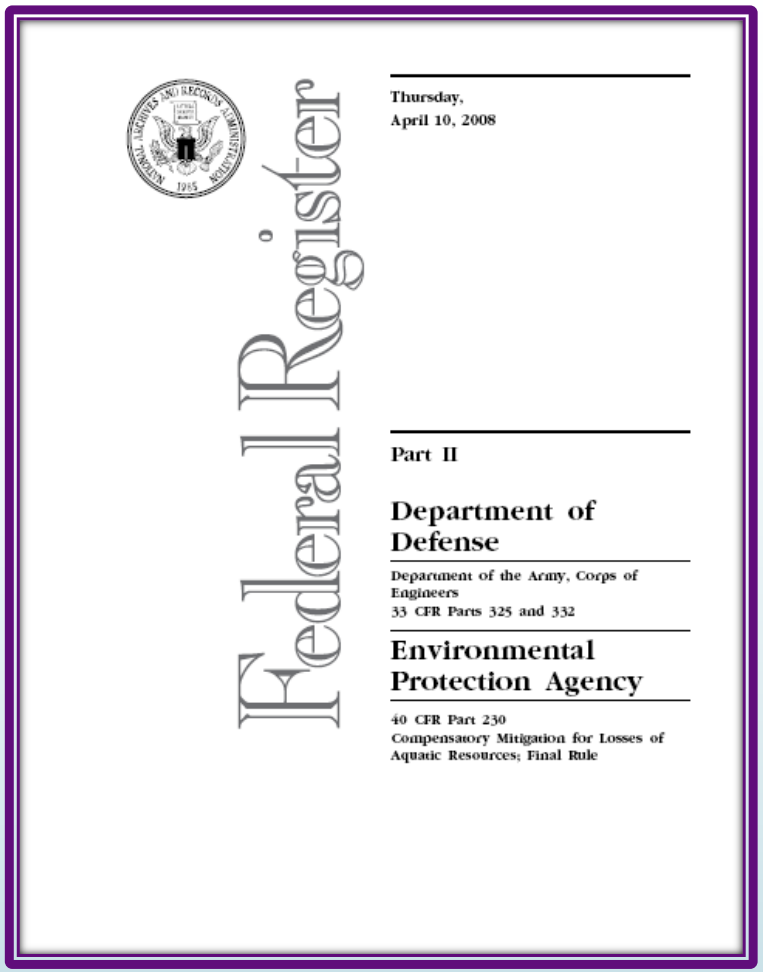
Environmental Protection Agency

40 CFR Part 230
Compensatory Mitigation for Losses of Aquatic Resources; Final Rule

Mitigation Plan Components

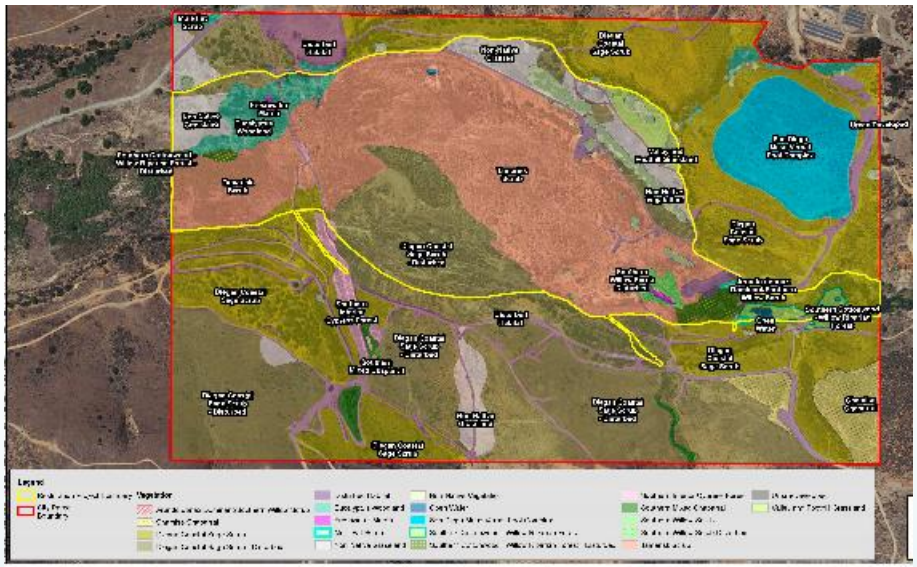
(33 CFR 332.4(c))

1. Objectives
2. Site selection
3. Site protection instrument
4. Baseline information
5. Determination of credits
6. Mitigation work plan
7. Maintenance plan
8. Performance standards
9. Monitoring requirements
10. Long-term management plan
11. Adaptive management plan
12. Financial assurances



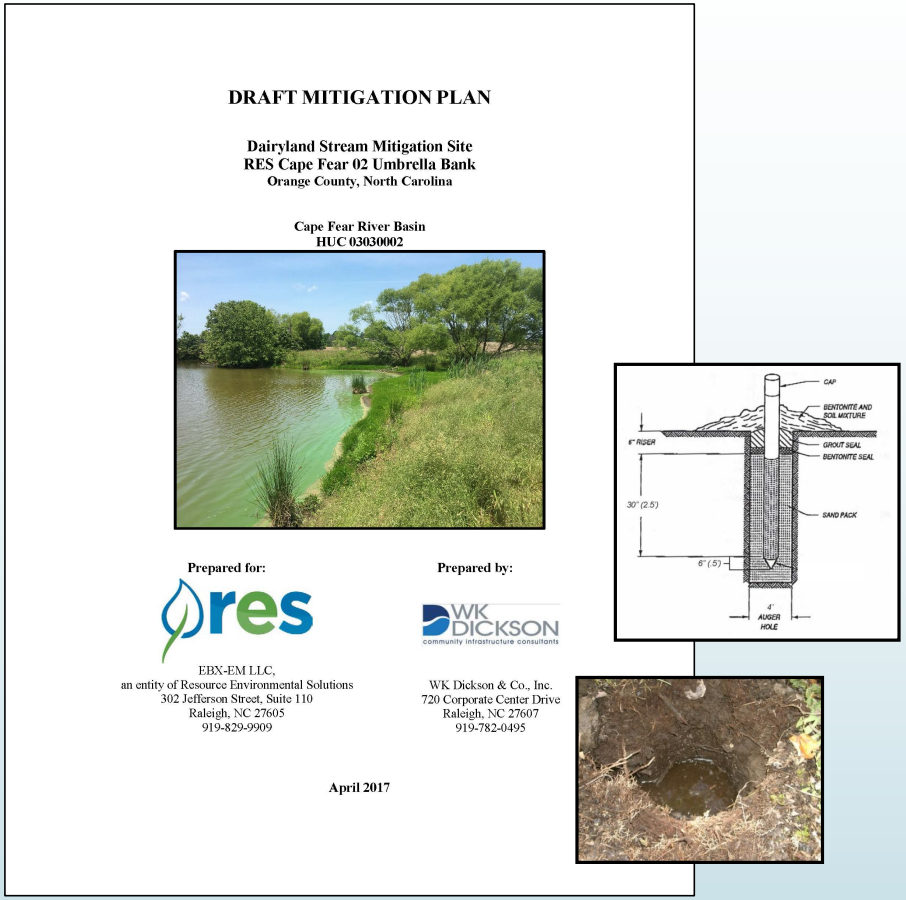
It's all connected……

- Projects Goals & Objectives
- Performance
- Suitable Metrics & Protocols
- Monitoring
- Management



Measuring Mitigation Performance

- Administrative Measures
- Ecological Performance Standards
  - Observable
  - Measureable
  - Achievable
- Adaptive Management



DRAFT MITIGATION PLAN

Dairyland Stream Mitigation Site
RES Cape Fear 02 Umbrella Bank
Orange County, North Carolina

Cape Fear River Basin
HUC 03030002

Prepared for:

res

EBX-EM LLC,
an entity of Resource Environmental Solutions
302 Jefferson Street, Suite 110
Raleigh, NC 27605
919-829-9909

Prepared by:

WK DICKSON
community infrastructure consultants

WK Dickson & Co., Inc.
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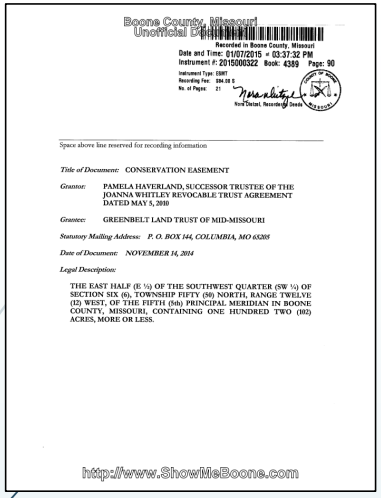
Raleigh, NC 27607
919-782-0495

April 2017

Administrative Measures



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Grantee: GREENBELT LAND TRUST OF MID-MISSOURI

Statutory Mailing Address: *P. O. BOX 144, COLUMBIA, MO 65205*

Date of Document: *NOVEMBER 14, 2014*

Legal Description:

THE EAST HALF (E ½) OF THE SOUTHWEST QUARTER (SW ¼) OF SECTION SIX (6), TOWNSHIP FIFTY (50) NORTH, RANGE TWELVE (12) WEST, OF THE FIFTH (5th) PRINCIPAL MERIDIAN IN BOONE COUNTY, MISSOURI, CONTAINING ONE HUNDRED TWO (102) ACRES, MORE OR LESS.

http://www.ShowMeBoone.com

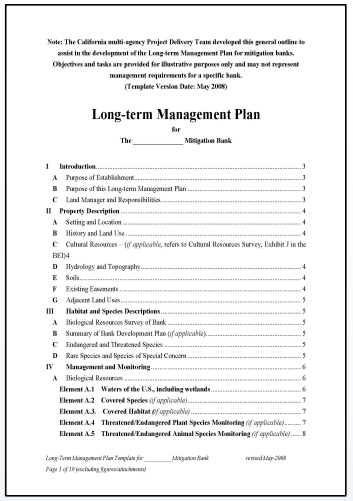
Site Protection

332.7 (a), 332.8(m) & (t)

PERFORMANCE BOND

Financial Assurances

332.8(m)



Note: The California multi-agency Project Delivery Team developed this general outline to assist in the development of the Long-term Management Plan for mitigation banks. Objectives and tasks are provided for illustrative purposes only and may not represent management requirements for a specific bank.
(Template Version Date: May 2008)

Long-term Management Plan

for

The _____ Mitigation Bank

Long Term Management

332.8(u)

Construction Work Plan

332.4 (c)(7) & 332.8(m)

Monitoring

332.6, 332.8(q)(2)

Maintenance

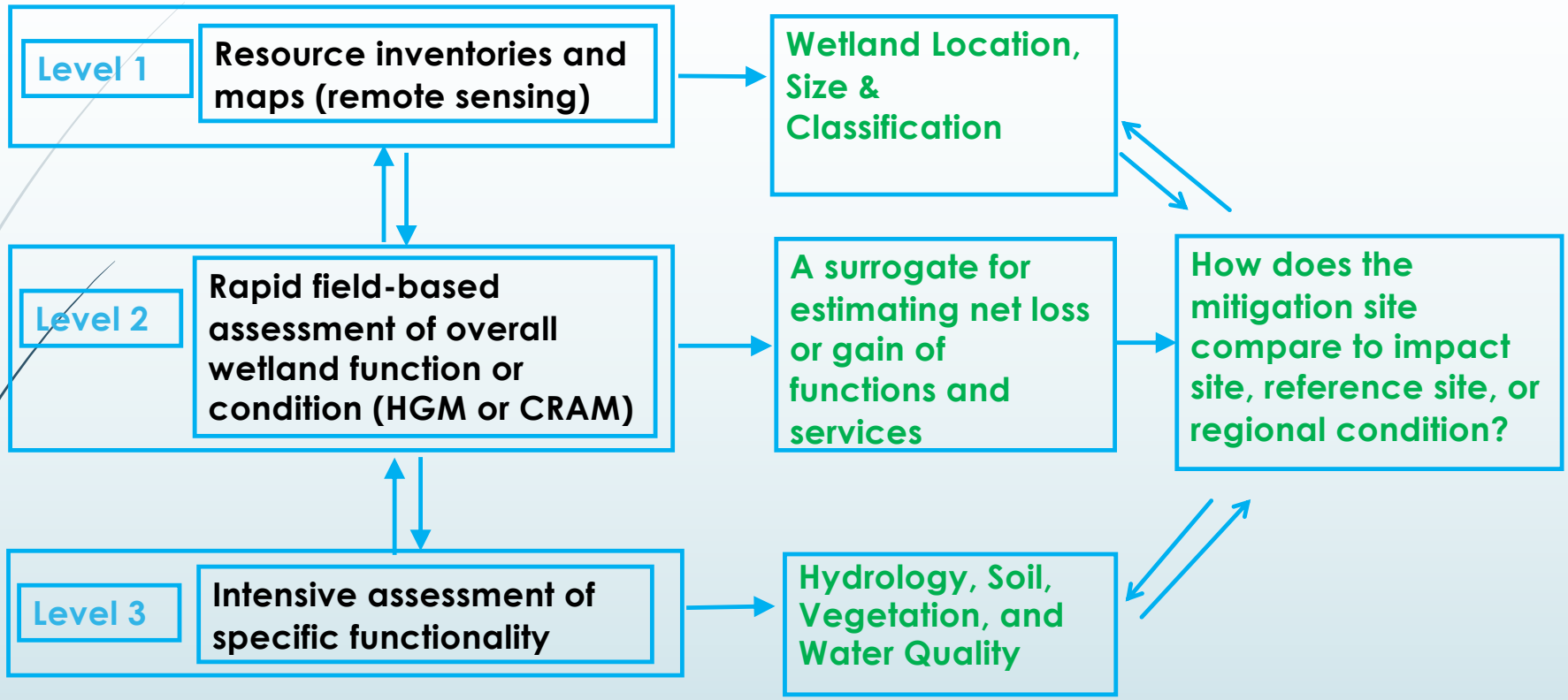
332.4(c)(8)

Ecological Performance Standards

(33 CFR 332.5)

- Based on attributes that are objective and verifiable
- Based on best available science assessed in a practicable manner
- Based on variables or measures of functional capacity
- **Performance standards across a spectrum of complexity**

Ecological Performance Standards & EPA 3-Level Approach to Monitoring



Developing Ecological Performance Standards

Goals

Statement of intended outcome

What will the mitigation project accomplish?

Objectives

Features critical to desired outcome

What functions/values will get us there?

Performance Standards

Demonstrate how each objective will be achieved:

Attribute, Level, Time Period

Monitoring:
Evaluate Performance

Adaptive Management:
Flexibility

Ecological Performance Standards

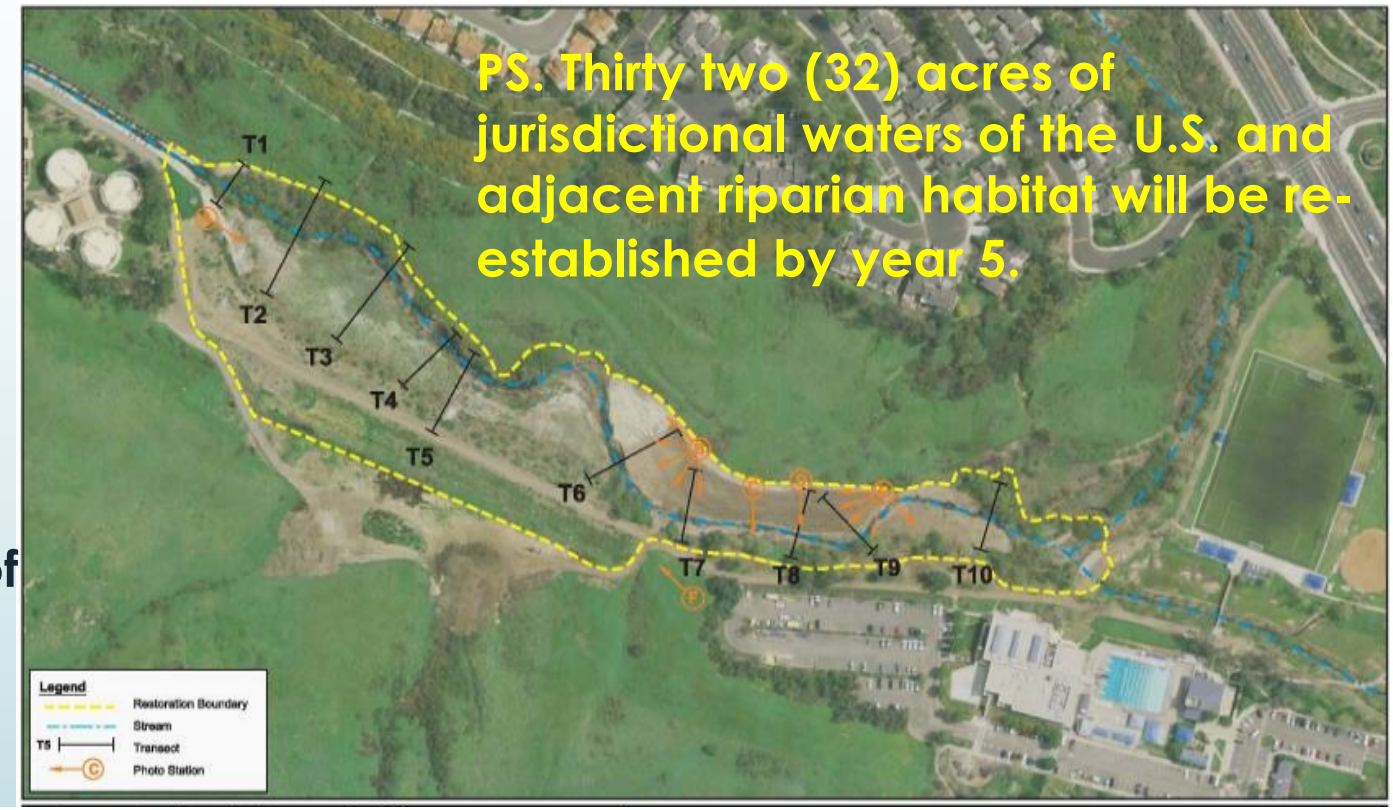
PHYSICAL (Hydrology/Soils)

BIOLOGICAL

CHEMICAL

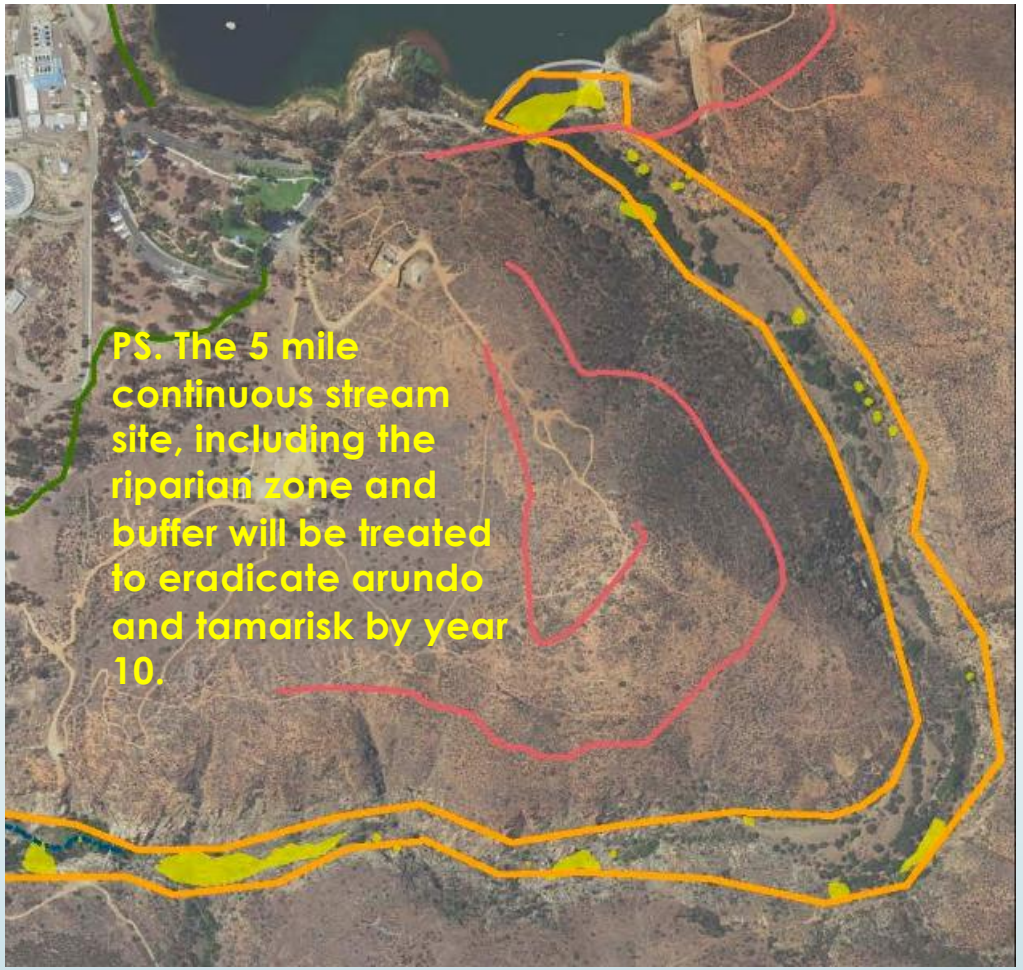
Level 1 Monitoring – Remote Sensing and Mapping

- Boundary of the Site
- Limits of each treatment: enhancement, re-establishment
- Jurisdictional limits or classification
- Identification of maintenance actions such as the location of invasive species, trespass - new trails, dumping



Level 1 Monitoring – Remote Sensing and Mapping

- Example of mapping invasive species with little ground trothing based on remote sensing (looking for species "signatures" on the aerial and digitizing)
- And mapping trail locations using remote sensing



Level 2 Monitoring – Rapid Assessments of Function or Condition (HGM, CRAM, TXRAM, ORAM, etc.)

PS: The 5 mile stream restoration site must meet or exceed the CRAM target scores for individual metrics by Year 3 and Year 5 as provided in Table 3.

Monitoring Program for CRAM: Assess the mitigation site and the reference site pre-construction, post-construction/baseline/as-built, and at Years 3 and 5 to evaluate meeting the PS targets by metric value. Conduct a CRAM assessment every 5 years thereafter as part of the LTMP.

Table 3
CRAM DATA SUMMARY

CRAM Attributes	METRICS		BASELINE SCORES			TARGET SCORES	
			Impact Site/ Pre-Rest[1]	Post-Rest[2] (Baseline)	Reference Site	Year 3	Year 5
Buffer and Landscape Context	Landscape Connectivity		12		3	12	12
	Buffer Sub-metrics:						
	- Percent of Assessment Area with		3		12	12	12
	- Average Buffer Width		3		3	3	3
	- Buffer Condition		3		9	9	12
	Attribute Score (Raw/Final)		**15/63**		**10/42**	**19/79**	**20/83**
Hydrology	Water Source		6		6	6	6
	Hydroperiod or Channel Stability		12		9	9	12
	Hydrologic Connectivity		9		12	9	12
	Attribute Score (Raw/Final)		**27/75**		**27/75**	**27/75**	**30/83**
Structure	Physical	Structural Patch Richness	9		9	9	9
		Topographic Complexity	3		6	6	6
	Attribute Score (Raw/Final)		**12/50**		**15/63**	**15/63**	**15/63**
	Biotic	Plant Community Sub-metrics:					
		- Number of Plant Layers	9		9	6	9
		- Number of Co-dominant Species	3		6	3	6
		- Percent Invasion	3		3	12	12
		Horizontal Interspersion and Zonation	6		6	6	6
		Vertical Biotic Structure	3		9	3	9
	Attribute Score (Raw/Final)		**14/39**		**21/58**	**16/44**	**24/67**
		Overall AA Score	**57**		**60**	**65**	**74**

Level 3 Monitoring - Shallow Groundwater Example

Hydrology Monitoring

PS: Shallow groundwater across floodplain wetland shall be within 18 inches of the ground surface during the wet season (Oct – Feb) and 36 inches of the ground surface during the dry season based on well data or as observed in the approved reference site by year 5.

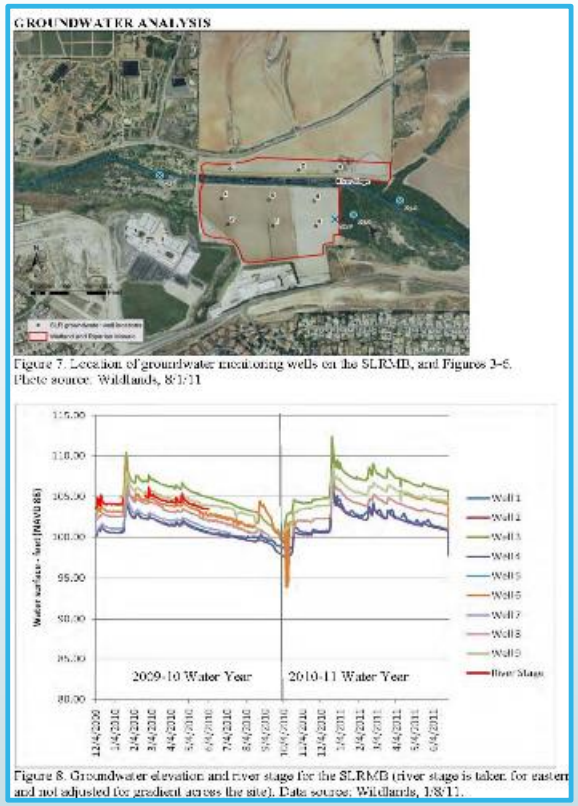
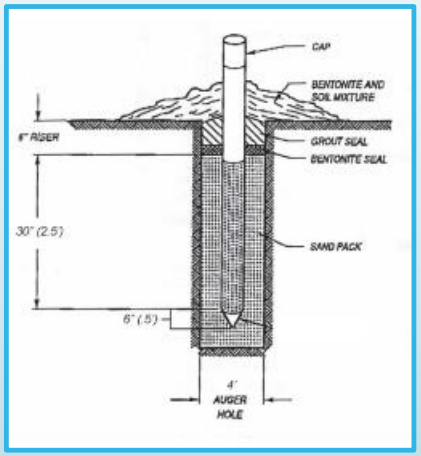
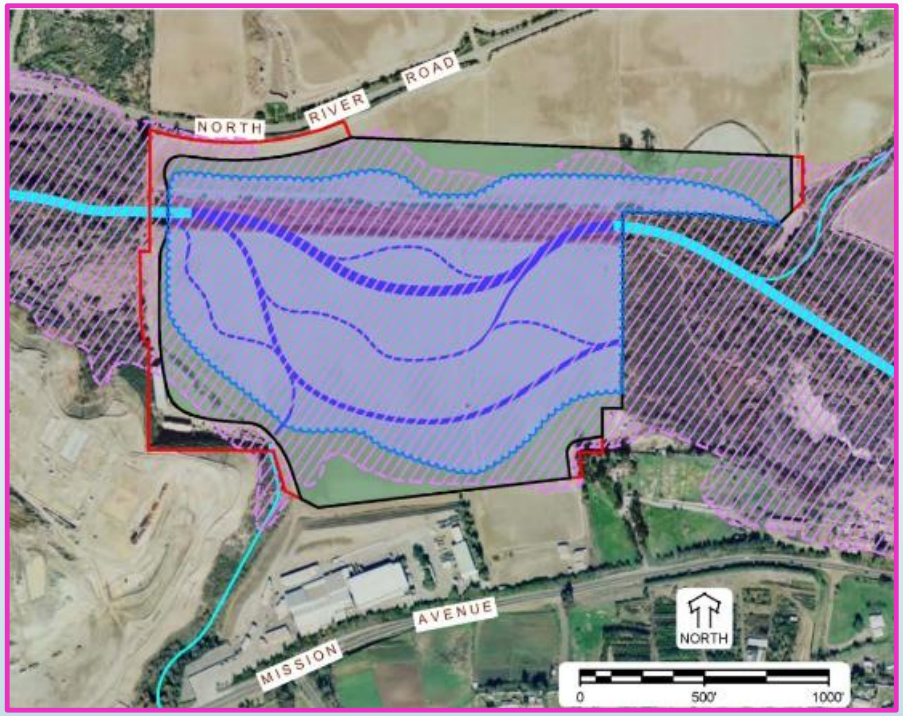


Figure 7. Location of groundwater monitoring wells on the SLRMB, and Figures 3-6. Photo source: Wildlands, 8/1/11

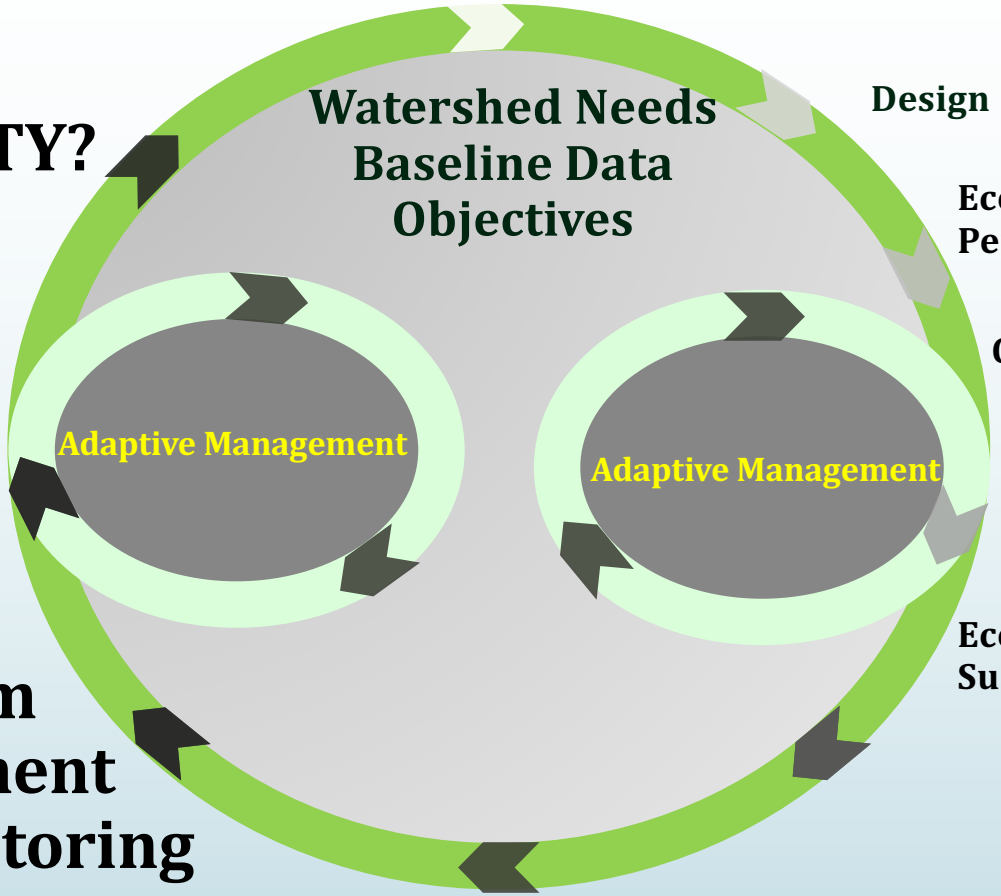
Figure 8. Groundwater elevation and river stage for the SLRMB (river stage is taken for eastern and not adjusted for gradient across the site). Data source: Wildlands, 1/8/11.





The Monitoring Program that Never Dies

SUSTAINABILITY?



Design

Ecological Performance Standards

Construction/Installation Monitoring 120-Days

Interim Monitoring 5-years min.

Ecological Performance Success and "Sign-Off"

Long-term Management and Monitoring

Overall Monitoring Program:
Links to objectives, performance standards & maintenance plan

Qualitative:

- Trash/Debris/Fencing/Tress pass
- Photo monitoring (Fixed Stations)
- Wetland hydrology observation
- Vegetation community
  - Visual Estimates of:
  - Plant death/replacement needs, nuisance species mgmt. needs (marking plants to be removed/treated)
- Wildlife utilization (scat, prints, photo monitoring)
- Biological integrity assessment

Quantitative:

- Hydrologic
  - Gauges/piezometers
- Vegetation
  - % cover and composition
  - Canopy, sub-canopy, shrub, groundcover layers
  - Stem counts
- Water Quality
  - PH, salinity, DO, bacteria
- Functional/Conditional assessments

Qualitative Monitoring

Annual Photo Monitoring: at fixed locations and direction.
Data should be record on photo log and attached to the Annual Monitoring Report

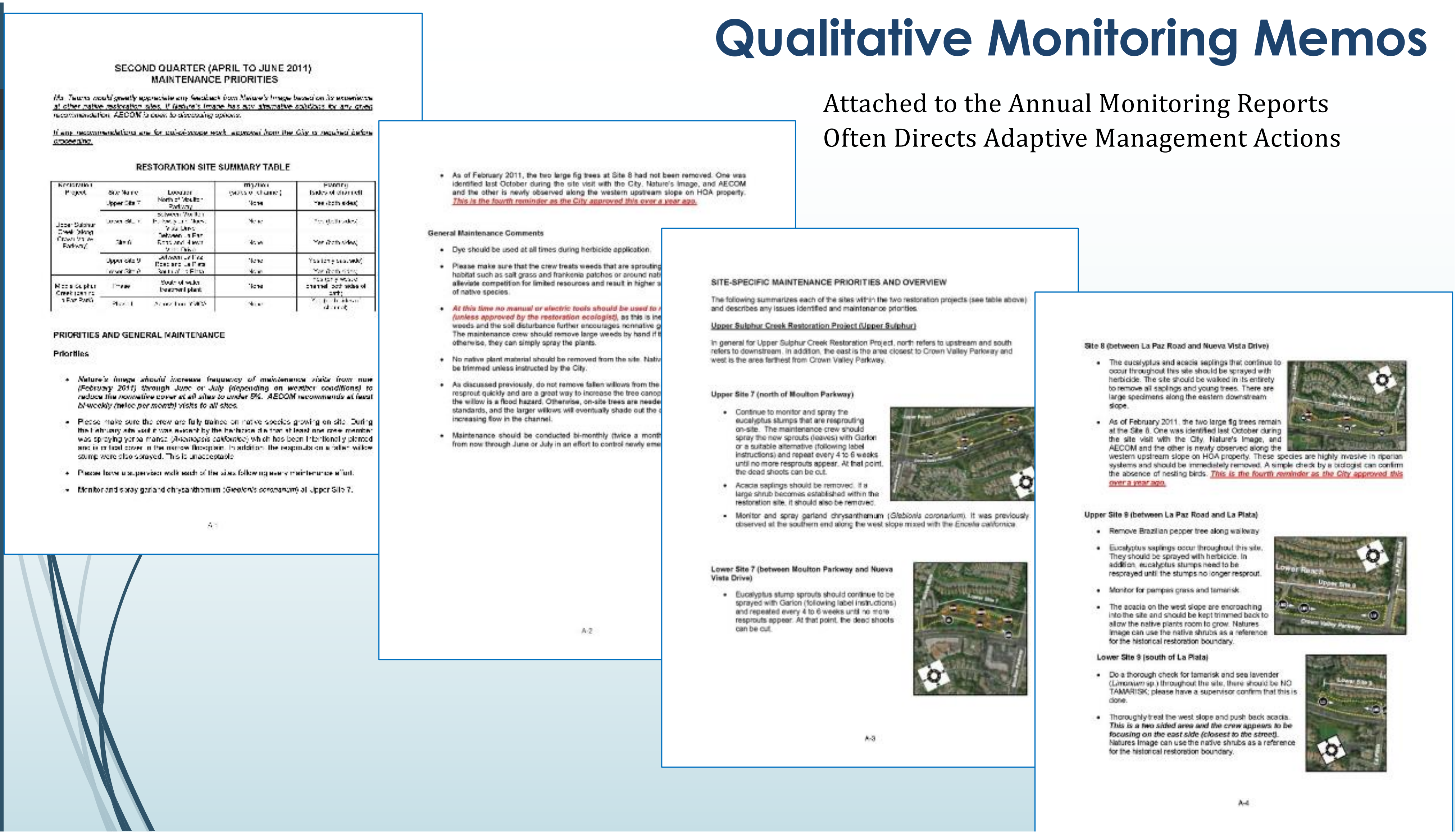
City of Laguna Niguel
Upper Sulphur Creek Restoration Project (Site 7 - Site 9)
PHOTO LOG
AECOM

* Photos taken before January 2009 were taken by Aspen Environmental Group. Work transitioned to AECOM in December of 2008. Due to the transition, photo monitoring was delayed until January 2009.
**Photo station UUW, UM1W, UM3W, UM4, UM4W, UDW, MMW, and MDW are supplemental photo stations that were added in Year 1 (2007-2008) to further document the progress of the restoration site.

Date*	Time	Photo Station**	Monitor	Panoramic or Single	Subject of Photo	Comments
01/09/2009	11:23am	UU	L. Teunis	P	Upper Site 7, upstream looking west	Riparian canopy filling in nicely
01/09/2009	11:10am	UUW	L. Teunis	P	Upper Site 7, upstream looking east	Riparian canopy filling in nicely
01/09/2009	11:38am	UM1	L. Teunis	P	Upper Site 7, middle looking west	Typha choking channel, cut channel to improve flow
01/09/2009	10:53am	UM1W	L. Teunis	P	Upper Site 7, middle looking east	Sage scrub species filling in, need riparian canopy
01/09/2009	11:46am	UM2	L. Teunis	P	Upper Site 7, downstream looking west	Downstream end looks great.
01/09/2009	12:53pm	UM3	L. Teunis	S	Lower Site 7, upstream looking west	Riparian canopy filling in. Tamarisk observed in cannel.
01/09/2009	12:16pm	UM3W	L. Teunis	S	Lower Site 7, upstream looking east	Riparian canopy filling in. Monitor Brazilian pepper.
01/09/2009	12:43pm	UM4	L. Teunis	P	Lower Site 7, middle looking west	Riparian great at site. Patches of sparse sage scrub on west bank.
01/09/2009	12:24pm	UM4W	L. Teunis	P	Lower Site 7, middle looking east	Riparian and sage scrub thriving.
01/09/2009	12:39pm	UD	L. Teunis	S	Lower Site 7, downstream looking west	Riparian coming in quickly
01/09/2009	12:28pm	UDW	L. Teunis	P	Lower Site 7, downstream looking east	Riparian great at site. Patches of sparse sage scrub on west bank.
01/09/2009	2:23pm	MU	L. Teunis	S	Site 8, upstream looking west	Need riparian cover
01/09/2009	2:29pm	MM	L. Teunis	P	Site 8, middle looking west	Need riparian cover

Qualitative Monitoring Memos

Attached to the Annual Monitoring Reports
Often Directs Adaptive Management Actions



Quantitative Monitoring

Detailed data collection for hydrology, soils, vegetation and sometimes wildlife if an objective and associated performance standard.

Some examples are provided later of monitoring programs for Streams and Vernal Pools

Stream Restoration Monitoring Requirements*

Pre-Construction:

- WQ: DO, Temperature, Conductivity, pH - STATE CERTIFIED LAB
- Benthic: Should follow standard protocols – STATE CERTIFIED LAB

Post-Construction:

- As-built survey: Cross-sections/profile
  - Permanent locations
  - Installed at frequency of 1 per 20 bkfl widths
  - 50% pools & 50% riffles
  - Profile for length of restored channel
- Crest gauges installed at mitigation and reference sites
- Vegetation Plots: Boundaries staked and marked.
  - Plots represent 2% of planted area
  - Planting should occur 11/15 – 3/15.
  - All stems (plots)tagged, numbered, and species noted.

*Charleston District

Adaptive Management

332.7 Management

Why?

- Address unforeseen changes
- Learn from success/failure
- Increased sustainability & reduces uncertainty

How?

- Plan, including contingencies
- Monitor
- Analyze outcomes
- Adapt
- Incorporate results into future actions!

Long-term Management

332.7 Management

a) Site Protection - Real Estate Instrument or other

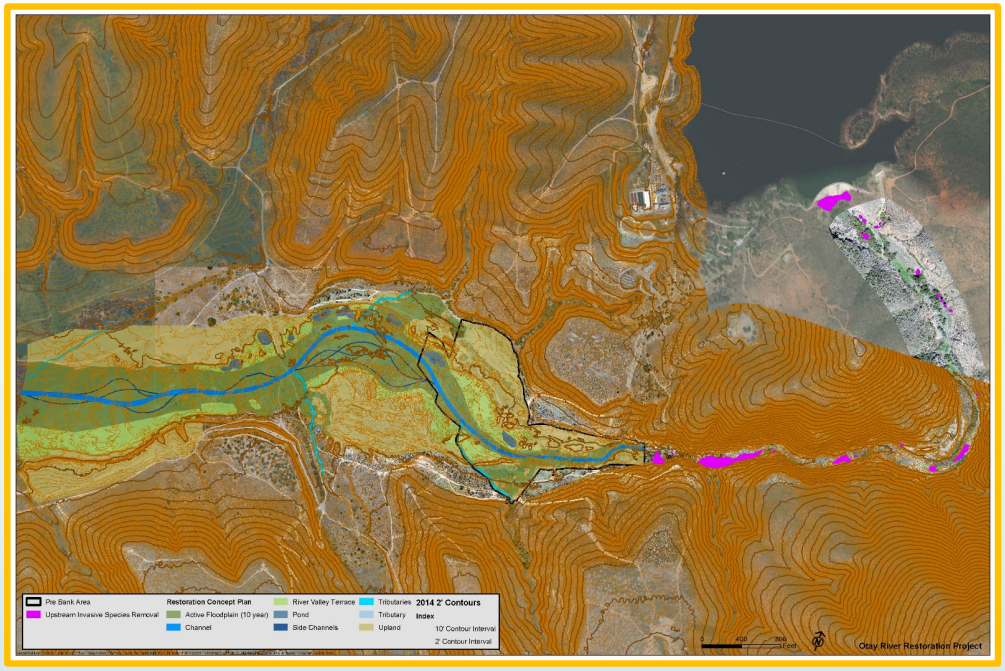
b) Sustainability - mitigation should be *"self-sustaining"* but management *may be needed* to meet objectives

c) Adaptive Management - measures to address unforeseen deficiencies

d) Long-term Management - Ensure sustainable mitigation *after* performance standards are met

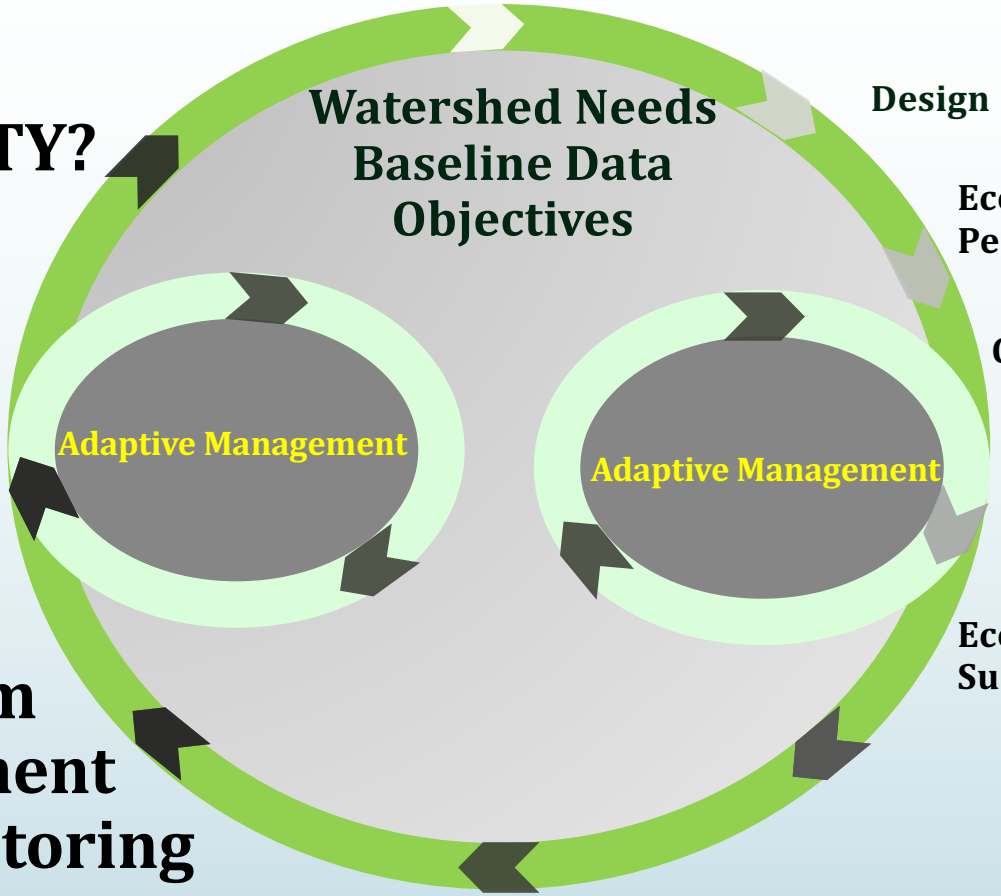
Long-Term Management and Monitoring Plan Elements

- Background conditions
- Characterize site
- Instrument requirements
- Management goals & objectives
- Management strategies & tasks
- Adaptive management plan & procedures
- Reporting procedures
- Contingencies
- Legal provisions
- Funding mechanism and task itemization



The Monitoring Program that Never Dies

SUSTAINABILITY?



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Questions?