CREDIT DETERMINATION

INTERAGENCY REVIEW TEAM (IRT) COURSE

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PRESENTATION TOPICS

- Federal policy and regulations
- Overview of Crediting Approaches
- Assessment Methodologies
- Examples – National

WHAT IS A "CREDIT"

- A unit of measure *332.8 (o)(1)*
- Represents accrual or attainment of aquatic functions at a site *332.2*
- Based on resources restored, established, enhanced, or preserved (buffers too)



CREDIT DETERMINATION

- Credit determination has multiple economic, ecological, and regulatory aspects
- Often significant point of dispute
  - Between the regulator and permit applicant
  - Between regulator and mitigation provider
  - Between members of IRT and mitigation provider
  - Between members of the IRT

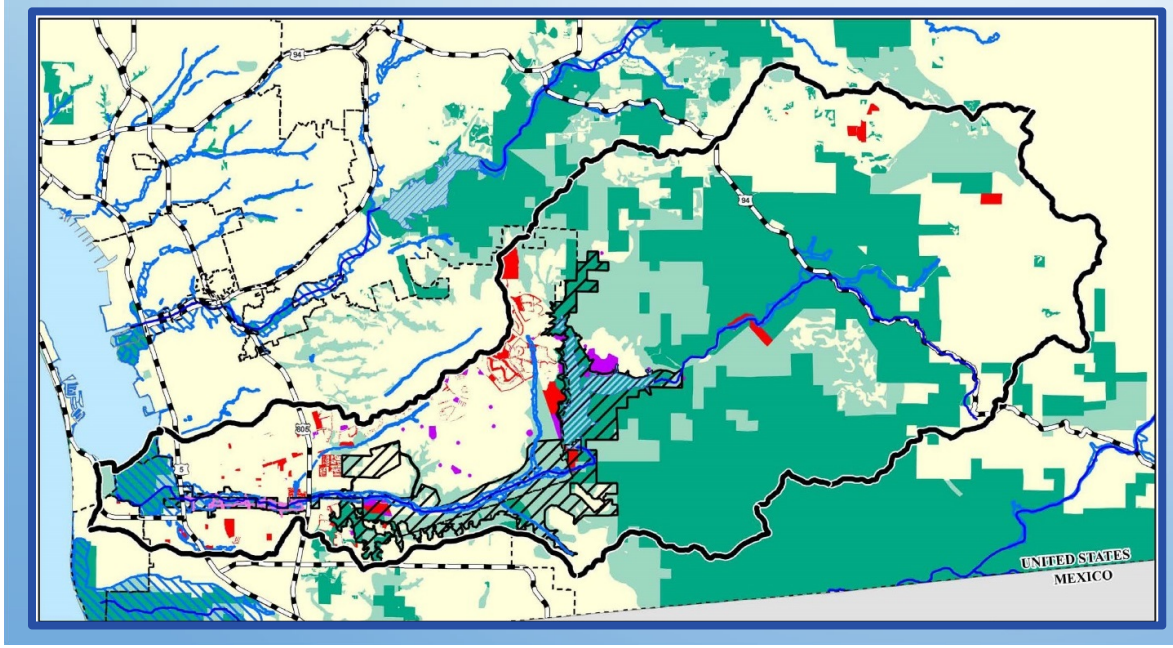
ECONOMIC CONSIDERATIONS

- Mitigation provider's perspective:
  - Credits are currency
- Maximize credit yield from mitigation projects:
  - Credits for as much of compensation site as possible
  - Credits for restoration, establishment, enhancement, preservation, as well as upland buffers/habitats
  - Credits for multiple resources (wetlands and species)

ECOLOGICAL CONSIDERATIONS

The size, location, and functions of the proposed impact and mitigation sites to ensure that losses are adequately replaced

Goal: replace lost functions by obtaining the "best attainable" condition at any site in light of existing constraints



Problem: how to measure ecological quality, functions, and services at impact sites and mitigation sites

REGULATORY CONSIDERATIONS

CREDIT ALLOCATION PROCEDURES THAT ARE:

- Principled
- Consistent
- Predictable
- Science-based

TYPES OF MITIGATION PRACTICES

- Restoration
  - Re-establishment – returning functions to a former resource
  - Rehabilitation - returning natural or historic functions
- Establishment (creation)
  - Manipulating an upland site to develop an aquatic resource
- Enhancement
  - Manipulating an existing resource to increase one or more specific functions
- Preservation (33 CFR 332.3(h))
  - Remove a threat to an existing aquatic resource

Buffer Areas – Floodplains, Riparian Zones, Uplands

MEASURING IMPACTS AND DETERMINING CREDITS

- NUMBER OF CREDITS MUST REFLECT THE DIFFERENCE BETWEEN PRE- AND POST-MITIGATION PROJECT SITE CONDITIONS

  33 CFR 323.8(O)(3)

- PRESERVATION- HIGHER RATIOS SHOULD BE APPLIED BY CONSIDERING THE RELATIVE IMPORTANCE OF THE IMPACTED AND PRESERVED RESOURCE IN SUSTAINING WATERSHED FUNCTIONS

  33 CFR 323.8(O)(6)

- RIPARIAN AREAS, BUFFERS, UPLANDS - ONLY WHEN ESSENTIAL TO MAINTAINING THE ECOLOGICAL VIABILITY OF ADJOINING AQUATIC RESOURCES *33 CFR 323.8(O)(7)*

AMOUNT OF COMPENSATION

- Use a function/condition assessment when/where practicable. *332.8(o)(2)*
- If not, apply minimum 1 to 1 ratio,

  But increase based on:

  - Method of compensation
  - Differences between functions lost/gained
  - Likelihood of success, risk, difficulty
  - Temporal loss/time lag
  - Distance from impact site *332.3(f)*

APPROACHES TO CREDIT DETERMINATION

- Best professional judgment
  - Ratio method
- Scoring tables
  - Credit/debit tables - ratios with some use of qualitative condition assessment
  - Credit/debit tables - ratios with some use of functional/condition assessment
- Rapid assessments (quantitative)
  - Conditional assessments
  - Functional assessments

RATIO METHODS

- Qualitative approach to determining the amount of credits available at a proposed mitigation bank
- Credit units are usually acres and linear feet
  - Default approach if other methodologies are not practicable or available
- Examples:
  - New England district uses ratio method
  - Savannah district uses stand-alone method

RATIO METHOD – NEW ENGLAND

- **RATIOS ARE BASED ON:**
  - **TYPE OF SYSTEM IMPACTED**
  - **TYPE OF MITIGATION PROPOSED**
  - **LIKELIHOOD OF MITIGATION SUCCESS**

Type of Mitigation	Wetland Community	
	Forested	Scrub-Scrub & Emergent
Restoration	2:1-3:1	2:1
Establishment	3:1- 4:1	2:1-3:1
Enhancement	5:1-10:1	3:1-10:1
Preservation	---------15:1----------	

RATIO WITH MODIFIER TABLES

TABLE 1 - RECOMMENDED COMPENSATORY MITIGATION RATIOS FOR DIRECT PERMANENT IMPACTS

Mitigation / Impacts	Restoration[1] (re-establishment)	Creation (establishment)	Enhancement (rehabilitation)	Preservation (protection/ management)
Emergent Wetlands (ac)	2:1	2:1 to 3:1	3:1 to 10:1[2]	15:1
Scrub-shrub Wetlands (ac)	2:1	2:1 to 3:1	3:1 to 10:1[2]	15:1
Forested Wetlands (ac)	2:1 to 3:1	3:1 to 4:1	5:1 to 10:1[2]	15:1
Open Water (ac)	1:1			
Submerged Aquatic Vegetation (ac)	5:1			
Streams[6] (lf)	2:1[7]			
Mudflat (ac)	2:1 to 3:1			
Upland[10] (ac)	≥10:1[11]			

TABLE 2 - RECOMMENDED COMPENSATORY MITIGATION FOR TEMPORARY AND/OR SECONDARY IMPACTS

IMPACT	% OF STANDARD[13] AMOUNT[14]
Temporary fill (swamp mats, fill over membrane) in forested wetlands; area to revegetate to forest.	10-25%
Temporary fill in emergent or scrub-shrub; area to revert to previous condition.	5-20%
Temporary fill in forest and will be permanently converted to scrub-shrub or emergent	15-45%[15]
Permanent conversion of forested wetlands to other cover types	15-40%
Removal of forested wetland cover for new corridor	Project specific
Removal of forested cover of vernal pool buffer (w/in 250' of pool) when percentage of disturbance exceeds 25% of the total VP buffer area	Project specific[16]
Streams – clearing of upland forest and/or scrub-shrub vegetation within 100' of stream bank or outermost channel of braided stream	Project specific[17]
Wetlands within subdivisions	Project specific

EXAMPLE RATIO CREDIT CALCULATION

Wetland Type	Acreage	Functions & Values	Proposed Credit Ratio	Credit Type	Cover Type	Proposed Credit (acres)
PFO	62	WH, GWD, SS, NR, AQ	15:1	Preservation	HW	4.13
PEM	2	WH, GWD, SS, AQ	15:1	Preservation	OF	0.13
PSS	56	WH, GWD, SS, NR, AQ	15:1	Preservation	SW	3.7
Intertidal	6	WH, AQ, SH	15:1	Preservation	SM/IF	0.43
Upland	315	WH, GWD, SS	15:1	Preservation	HW/MX	21.0
Upland	12	WH, GWD, SS	50:1	Preservation	HW/MX	0.24
Upland	47.8	WH, GWD, SS	30:1	Preservation	HW/MX	1.59
TOTALS	500.8					31.22

8.39

22.83

Scoring Tables

- Generally in SOPs
- Use of Ratios or Ranges
- Assigns numeric values to qualitative assessments

- Incorporates multiple elements considered important:
  - Quality and type of resource
  - Scarcity
  - Net Improvement
  - Temporal loss

- Allows for some consideration of resource condition

- Examples include Savannah, Charleston, Little Rock, and South Pacific Division Checklist Methods

SCORING TABLES - SAVANNAH DISTRICT RESTORATION/ENHANCEMENT (OLD APPROACH)

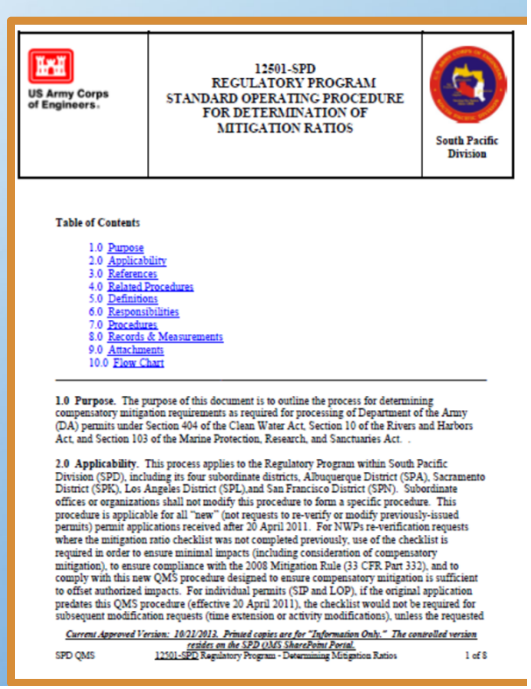
RESTORATION/ENHANCEMENT MITIGATION FACTORS

Factor	Options				
Net Improvement Vegetation	Minimal Enhancement 0.1 ---------- to ---------- Complete Restoration 1.4				
Net Improvement Hydrology	Minimal Enhancement 0.1 ---------- to ---------- Complete Restoration 1.4				
Credit Schedule	Schedule 5 0	Schedule 4 0.1	Schedule 3 0.2	Schedule 2 0.3	Schedule 1 0.4
Kind	Category 2 0.2	Category 1 0.6			
Maintenance	High 0	Moderate 0.1	Low 0.2	None 0.3	
Monitoring and Contingencies Plan	N/A 0	Minimum 0.1	Moderate 0.2	Substantial 0.3	Excellent 0.4
Control	RC 0.1	RC + CE or GPP 0.3	RC + CE + GPP 0.5		

SCORING TABLE (ON STEROIDS) - SPD

- MITIGATION RATIO CHECKLIST
- STRADDLES QUALITATIVE AND QUANTITATIVE APPROACHES
- DOES NOT ENDORSE ONE ASSESSMENT METHOD
- PROVIDES STRUCTURE WHEN ASSESSING DEBITS AND CREDITS IN THE ABSENCE OF A FUNCTION OR CONDITIONAL ASSESSMENT METHOD
- RATIO ADJUSTMENTS BASED ON 10 STEP PROCESS:
  - IMPACT-MITIGATION SITE LOCATIONS
  - NET LOSS OF AQUATIC RESOURCE AREA
  - TYPE CONVERSION
  - RISK AND UNCERTAINTY
  - TEMPORAL LOSS
  - MINIMUM RATIO 1:1

  (UNLESS FUNCTIONAL/CONDITIONAL ASSESSMENT USED)



US Army Corps of Engineers.

12501-SPD
REGULATORY PROGRAM
STANDARD OPERATING PROCEDURE
FOR DETERMINATION OF
MITIGATION RATIOS

South Pacific Division

Table of Contents

1.0 Purpose
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1.0 Purpose. The purpose of this document is to outline the process for determining compensatory mitigation requirements as required for processing of Department of the Army (DA) permits under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbors Act, and Section 103 of the Marine Protection, Research, and Sanctuaries Act. .

2.0 Applicability. This process applies to the Regulatory Program within South Pacific Division (SPD), including its four subordinate districts, Albuquerque District (SPA), Sacramento District (SPK), Los Angeles District (SPL),and San Francisco District (SPN). Subordinate offices or organizations shall not modify this procedure to form a specific procedure. This procedure is applicable for all "new" (not requests to re-verify or modify previously-issued permits) permit applications received after 20 April 2011. For NWPs re-verification requests where the mitigation ratio checklist was not completed previously, use of the checklist is required in order to ensure minimal impacts (including consideration of compensatory mitigation), to ensure compliance with the 2008 Mitigation Rule (33 CFR Part 332), and to comply with this new QMS procedure designed to ensure compensatory mitigation is sufficient to offset authorized impacts. For individual permits (SIP and LOP), if the original application predates this QMS procedure (effective 20 April 2011), the checklist would not be required for subsequent modification requests (time extension or activity modifications), unless the requested

Current Approved Version: 10/21/2013. Printed copies are for "Information Only." The controlled version resides on the SPD QMS SharePoint Portal.

MITIGATION RATIO CHECKLIST

(QUALITATIVE ASSESSMENT)

Columns can be used for separate mitigation types/sites or to compare several proposals

Attachment 12501.1 - SPD Mitigation Ratio Setting Checklist

1	Date: January 23, 2014 Corps file no.: SPL-2014-00999-RJV Project Manager: R.J. Van Sant Impact site name: Drainage A ORM impact resource type: SWS wetland waters of the U.S. Hydrology: Perennial Impact Cowardin or HGM type: Palustrine – scrub shrub/riparian Impact area (acres): 0.145 acre (permanent) Impact distance (linear feet): NA	Column A: Mitigation site name: on-site Mitigation type: establishment/re-est. Resource type: coastal salt marsh/SWS Cowardin/HGM type: Palustrine	Column B (optional): Mitigation site name: _____ Mitigation type: _____ Resource type: _____ Cowardin/HGM type: _____	Column C (optional): Mitigation site name: _____ Mitigation type: _____ Resource type: _____ Cowardin/HGM type: _____
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: [illegible] Baseline ratio: 2:1 PM justification: See Table 1, below	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 exclusi[illegible] 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): __:__	[illegible]	

I < M, use adjustment between 0 and -2, if I = M, use adjustment of 0; or if I > M, use adjustment between 0 and 4.

Ratio will generally increase for preservation only mitigation

MITIGATION RATIO CHECKLIST

(QUALITATIVE ASSESSMENT)

Table 1. Qualitative comparison of functions (functional loss vs. gain):

Function	Impact site	Mitigation site
Short- or long-term surface water storage	Good	Excellent
Subsurface water storage	Good	Excellent
Moderation of groundwater flow or discharge	Good	Good
Dissipation of energy	Excellent	Moderate
Cycling of nutrients	"	Good
Removal of elements and compounds	"	"
Retention of particulates	"	"
Export of organic carbon	Excellent	"
Maintenance of plant and animal communities	"	"

Step 2 Table 1 instructions:

1. Describe amount of functional loss (impact) and gain (mitigation) in each respective column. Gain and loss can be described in text (for example, small loss, moderate loss, large loss, no loss, etc.) or symbolically (for example, +, ++, +++, 0, ---, --, -).
2. Note: alternate lists of functions may be used.
3. Note: a single adjustment should be used to account for all functions combined (see example 7 in attachment 12501.3)

MITIGATION RATIO CHECKLIST (OTHER FACTORS)

4	**Mitigation site location:**	Ratio adjustment: 0 PM justification: Mitigation and impact site are in same watershed.	Ratio adjustm PM justificati	justment: fication:
5	**Net loss of aquatic resource surface area:**	Ratio adjustment: +0.5 PM justification: Mitigation is establishment/re-establishment = 0. Indirect impacts (vehicle noise, increased lighting, domestic pets) from newly proposed roads and structures adjacent to mitigation site and open space areas = +0.5.	Ratio adjustment: PM justification:	adjustment:
6	**Type conversion:**	Ratio adjustment: -0.5 PM justification: Impact site is SWS and mitigation site is coastal salt marsh/SWS	Ratio PM	Ratio PM ju
7	**Risk and uncertainty:**	Ratio adjustment: +0.6 PM justification: Permittee responsible mitigation = +0.2, 2 outfalls and 1 inlet are located in mitigation site which will require maintenance in future = +0.2, Site was formerly farmed and soil has been significantly altered (fertilizers, pesticides, grading) = +0.2	Ratio PM justification:	Ratio PM ju
8	**Temporal loss:**	Ratio adjustment: +3 PM justification: +3 as mitigation site is salt marsh with some SWS, which establishes slowly.	Ratio PM j	

Is mitigation located outside of the impact watershed? If yes, +1.0, if no, +0.

Re-establishment or establishment +0, rehabilitation, enhancement, preservation +1.0

Conversion from a highly valuable/rare habitat type to a common type? If yes, +0.25 to +4.0; If no, 0 to -4.0.

PRM? Maintenance needed?
Each factor +0.1 to +0.3

If too many risk factors site may not be appropriate for mitigation.

Mitigation implemented concurrently with impacts? How long does habitat take to reach full functions? Trees/woodlands or saltmarsh, +3; if shrubs, +2; if herbaceous, +1

MITIGATION RATIO CHECKLIST
RATIO = CREDIT CALC

9	**Final mitigation ratio(s):** Indirect and cumulative effects should also be analyzed. Cumulative effects should be supported with SAMP, watershed plans, land use/cover assessment, etc.	Column A: 1. Baseline ratio from step 2 or 3 = 2: 1 2. Total adjustments = 3.6 3. Final ratio: 5.6 : 1 Proposed impact (total): 0.145 acre ___ linear feet to Resource type: SWS wetland Cowardin or HGM: Palustrine – scrub shrub/riparian Required mitigation: 0.812 acre ___ linear feet of Mitigation type: re-establishment/establishment Resource type: coastal salt marsh/SWS Cowardin or HGM: Palustrine – emergent/herb and palustrine scrub-shrub Additional PM comments:	Column B: 1. Baseline ratio from step 2 or 3 = __:__ 2. Total adjustments = ___ 3. Final ratio: __:__ Required m ___ acre ___ linear f of Mitigation type: _____ Resource type: _____ Cowardin or HGM: _____ Additional PM comments:	Column C: 1. Baseline ratio from step 2 or 3 = __:__ 2. Total adjustments = ___ 3. Final ratio: __:__ aining impact: _____ ired mitigation: acre linear feet of Mitigation type: _____ Resource type: _____ Cowardin or HGM: _____ Additional PM comments:
10	**Final compensatory mitigation requirements:**	PM summary: The Permittee will mitigate impacts to SWS wetlands through establishment/re-establishment of 0.812 acre of coastal salt marsh intermixed with some SWS.		

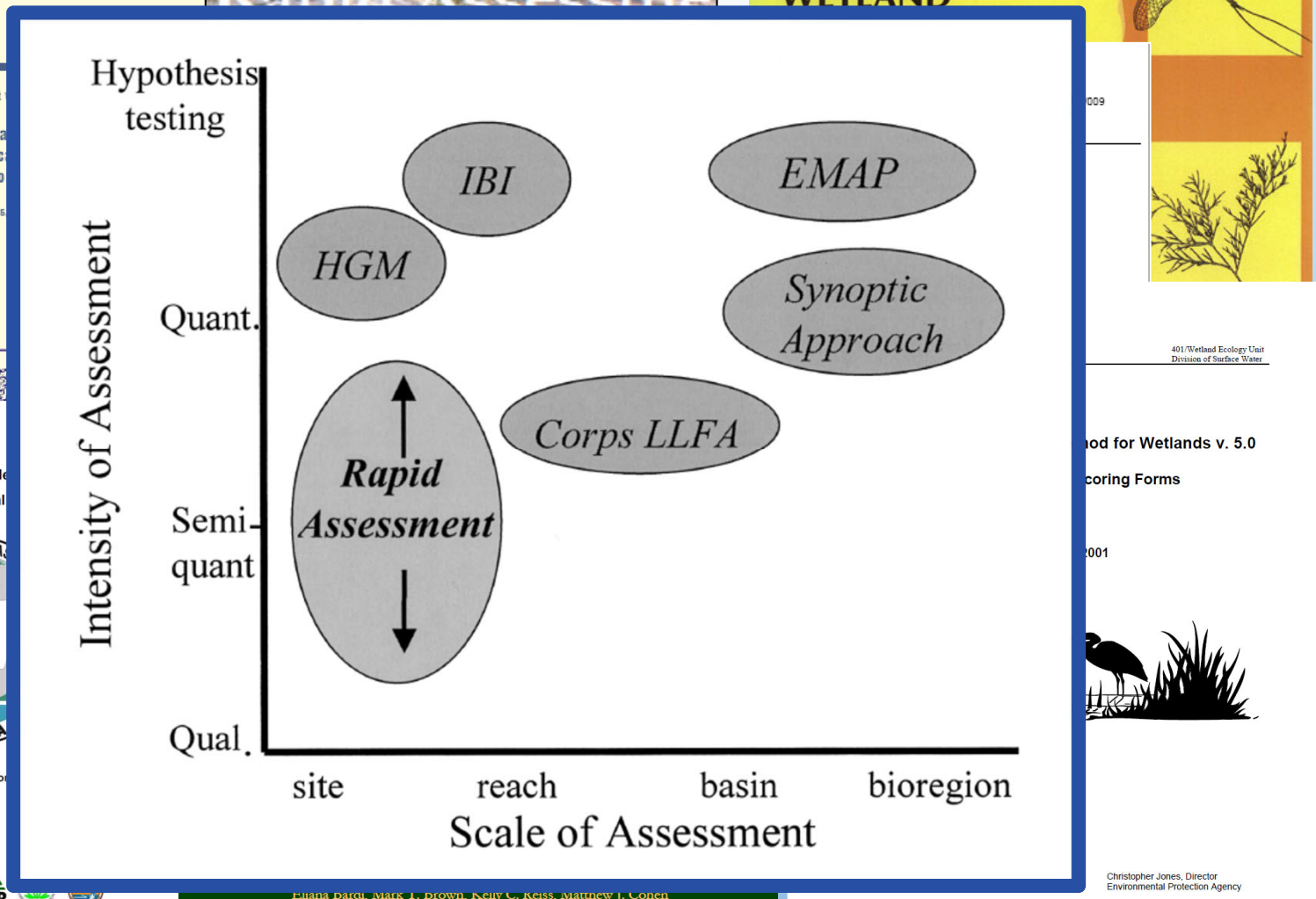
Minimum 1:1 ratio if step 2 used.

POTENTIAL USE OF RATIO CHECKLIST TO CREATE CREDITS

Table 2. Colusa Basin Mitigation Bank Credit Table

Restored Habitat Type	Credit Type	Acres	Credit Ratio	Credits
Seasonal Wetlands	Waters of the U.S. Creation	42	1:1	41
Open Water, Perennial Marsh, Semi-Permanent Marsh, Upland Berms and Refugia	Covered Species and Covered Species Habitat Creation for GGS	118	1:1	119
	TOTALS	160	1:1	160

RAPID ASSESSMENT TOOLS



US Army Corps of Engineers
Waterways Experiment Station

Wetlands Research Program Technical Report

An Approach for Assessing Wetla
Using Hydrogeomorphic Classific
Reference Wetlands, and Functio

by R. Daniel Smith, Alan Ammann, Candy Bartoldus

A COMPREHENSIVE REVIEW of WETLAND

N.C. Wetland Assessment Me
User Manual

NORTH CAROLINA WETLAND A
N C W A

Prepared by the N.C. Wetland Functio

US Army Corps of Engineers
NCDENR

Version 4.1
October 2010

Eliana Bardi, Mark T. Brown, Kelly C. Reiss, Matthew J. Cohen

401/Wetland Ecology Unit
Division of Surface Water

od for Wetlands v. 5.0
coring Forms

2001

Christopher Jones, Director
Environmental Protection Agency

P.O. Box 1049, Lazarus Government Center, 122 S. Front Street, Columbus, Ohio 43216-1049

Functional and Conditional Assessments

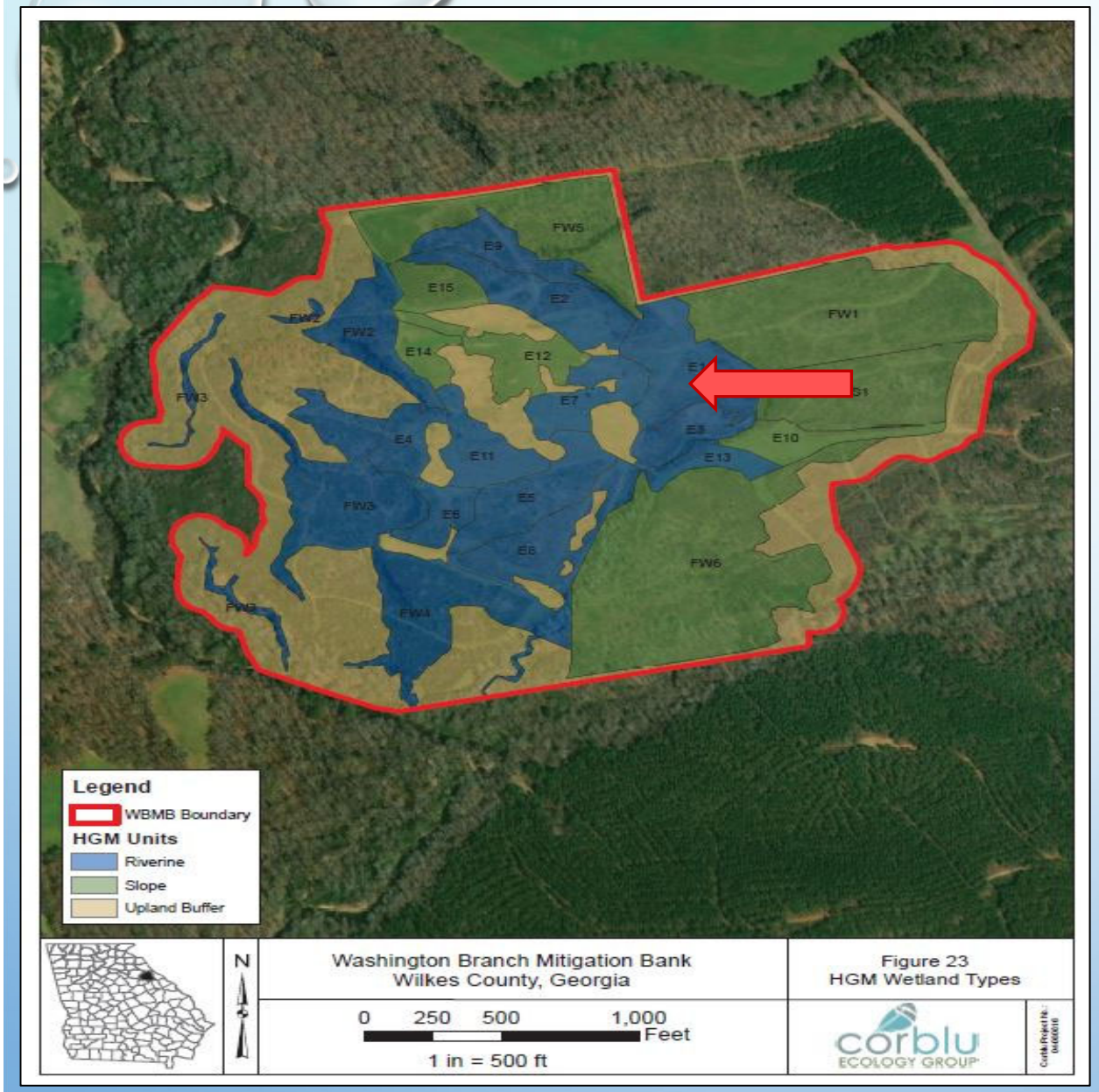
- Reference data set prerequisite
- Classification of resources
- Functional assessment tools measure ***features or indicators of ecological processes*** (not actual functions)
  - Time consuming and expensive to measure functions
- Condition assessment tools ***measure bundles of processes as indicators of condition or quality***
  - Rapid and cost effective assessment of simple field indicators to provide a coarse scale assessment.

ATTRIBUTES OF A GOOD ASSESSMENT

- Incorporates the landscape context of the site (e.g. location in a priority conservation area, potential threats, connectivity, patch size);
- Is valid (e.g. repeatable, sensitive, accurate, and transparent);
- Is practical, economical, and easy to use by multiple incentive programs; and
- Can be applied at different scales (e.g. can be used on 10,000 acres just as well as 1 acre).

SAVANNAH DISTRICT – USING HGM TO DETERMINE WETLAND RESOURCE CREDITS

- WE UTILIZED THE HGM WETLAND CLASSIFICATION SYSTEM TO INFORM THE DEVELOPMENT OF THE 2018 WETLAND CREDIT TYPES.
- THE FOLLOWING WETLAND CREDIT TYPES WERE COLLAPSED INTO CREDIT CATEGORIES BASED UPON DOMINANT WATER SOURCE:
  - FRESHWATER TIDAL
  - SALTWATER TIDAL
  - RIVERINE/LACUSTRINE FRINGE
  - SLOPE
  - DEPRESSIONAL/FLAT



Bank Mitigation Areas – Plan View

WASHINGTON BRANCH MITIGATION BANK 2018

FRESHWATER WETLAND HGM

WETLAND E3 - EXISTING CONDITIONS

Existing Conditions Worksheet for Wetland Mitigation Actions

Project Information and Existing Conditions Summary

Project Name:	Washington Branch Mitigation Bank
Mitigation Wetland Name:	E3
Acres of Mitigation (*Acres*):	1.63
Wetland Type:	Riverine
WAA Center Coordinates:	33.635162, -82.76207
County:	Wilkes
Date of Assessment:	May 7, 2018

Summary of Existing Wetland Function

Existing Condition - V_{HYDRO} Index Score	1.00
Existing Condition - V_{COMP} Index Score	0.00
Existing Condition - V_{STRUCT} Index Score	0.29
Existing Condition - V_{WD} Index Score	0.00
Existing Condition - V_{UP} Index Score	0.00
Existing Condition Functional Score	0.54

WETLAND E3 – PROPOSED CONDITIONS

Proposed Conditions Worksheet for Wetland Mitigation Actions

Project Information and Proposed Conditions Summary

Project Name:	Washington Branch Mitigation Bank
Mitigation Wetland Name:	E3
Acres of Mitigation (*Acres*):	1.63
Wetland Type:	Riverine
Mitigation Potential:	Enhancement
WAA Center Coordinates:	33.635162, -82.76207
County:	Wilkes
Date of Wetland Credit Assessment:	May 15, 2018

Summary of Proposed Wetland Function

Proposed Condition - V_{HYDRO} Index Score	1.00
Proposed Condition - V_{COMP} Index Score	1.00
Proposed Condition - V_{STRUCT} Index Score	0.33
Proposed Condition - V_{WD} Index Score	1.00
Proposed Condition - V_{UP} Index Score	1.00
Proposed Condition Functional Score	0.92
Net Functional Lift (Δ)	0.38
Total Wetland Credits Generated	**0.62**

WETLAND E3 - EXISTING CONDITIONS

Upland Buffer (V_{UP}) Calculator

Total Length of Wetland Perimeter: 1,490

Buffer Segment	Length of Segment (L.F.)	Width of Buffer (L.F.)	Segment Index Score	Weighted Segment Score
Buffer Segment 1	1,490	0 Feet	0.00	0.00
Buffer Segment 2				
Buffer Segment 3				
Buffer Segment 4				
Buffer Segment 5				
Buffer Segment 6				
Buffer Segment 7				
Buffer Segment 8				
Buffer Segment 9				
Buffer Segment 10				
Total Length of Buffer Segments	1,490			

0.00 V_{UP} Index Score

Legend

- Green Cells = User must manually input information.
- Orange Cells = User must select the index choice from the drop-down list.
- Grey Cells = The calculation of these cells is automated.
- Yellow Cells = These automated cells summarize the functional index scores.

0 Species in Group 1

0 Species in Group 2

0 Species in Group 3

Initial Quality Index

Adjusted Quality Index

0.00 V_{COMP} Index Score

WETLAND E3 – PROPOSED CONDITIONS

Wetland Vegetation Composition (V_{COMP}) Calculator

Large Woody Debris (V_{LWD}) Calculator

Upland Buffer (V_{UP}) Calculator

Total Length of Wetland Perimeter: 1,490

Buffer Segment	Length of Segment (L.F.)	Width of Buffer (L.F.)	Segment Index Score	Weighted Segment Score
Buffer Segment 1	1,490	100 Feet	1.00	1.00
Buffer Segment 2				
Buffer Segment 3				
Buffer Segment 4				
Buffer Segment 5				
Buffer Segment 6				
Buffer Segment 7				
Buffer Segment 8				
Buffer Segment 9				
Buffer Segment 10				
Total Length of Buffer Segments	1,490			

1.00 V_{UP} Index Score

Legend
Green Cells = User must manually input information.
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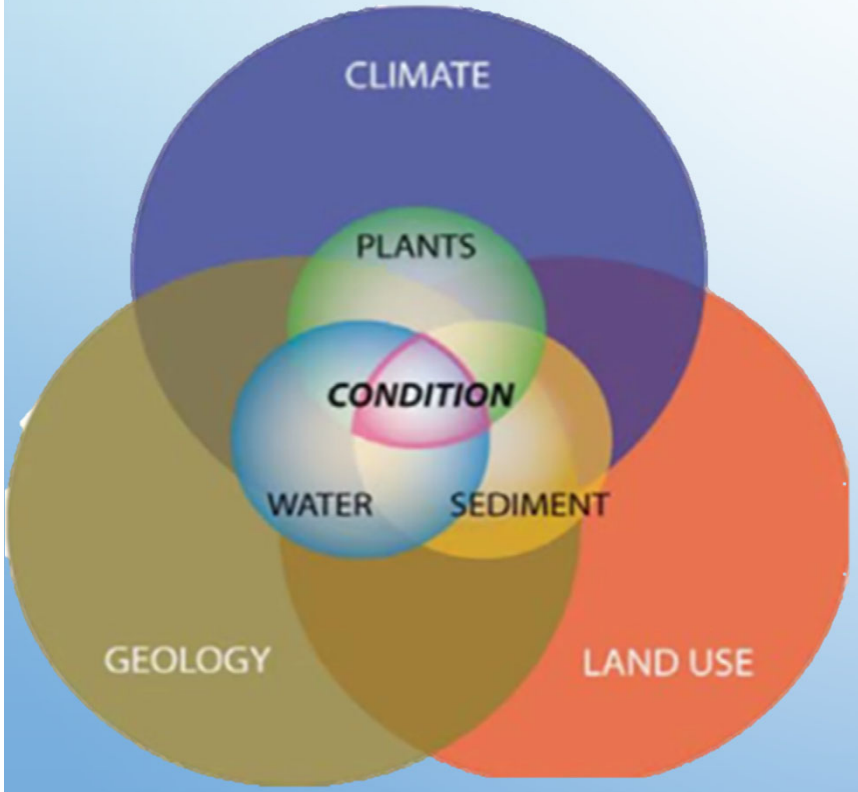
Grey Cells = The calculation of these cells is automated.
Yellow Cells = These automated cells summarize the functional index scores.

1.00 V_{COMP} Index Score

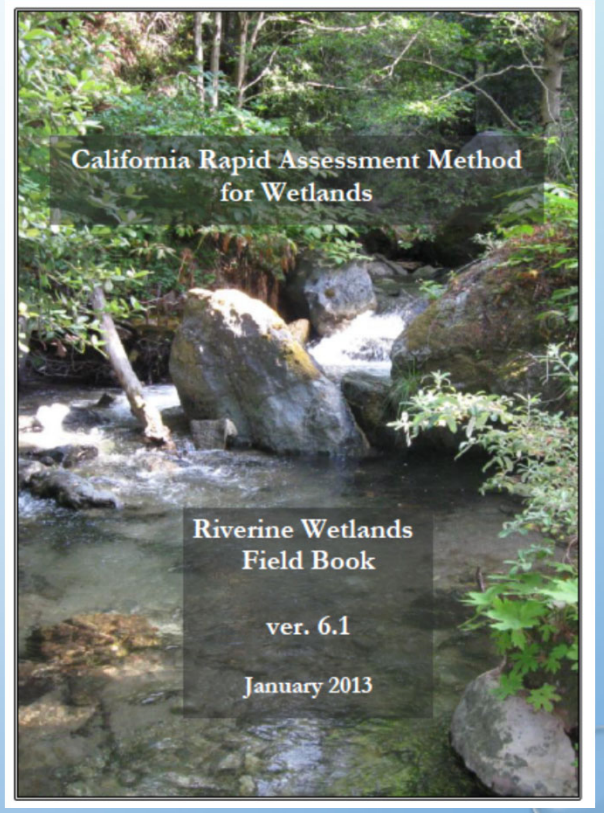
CALIFORNIA RAPID ASSESSMENT METHOD FOR WETLANDS (CRAM) RIVERINE MODULE



- CONDITION ASSESSMENT - MEASURES BUNDLES OF PROCESSES AS INDICATORS OF CONDITION OR QUALITY
- REGIONAL AND SITE SCALE INFLUENCES
- OVERALL VALUE BASED ON DIVERSITY AND LEVEL OF SERVICES
  - FAVORS LARGER MORE STRUCTURALLY COMPLEX SYSTEMS
- SCORING REPRESENTS THE PERCENT OF BEST AVAILABLE CONDITION AS DEFINED BY STATEWIDE AMBIENT SURVEYS

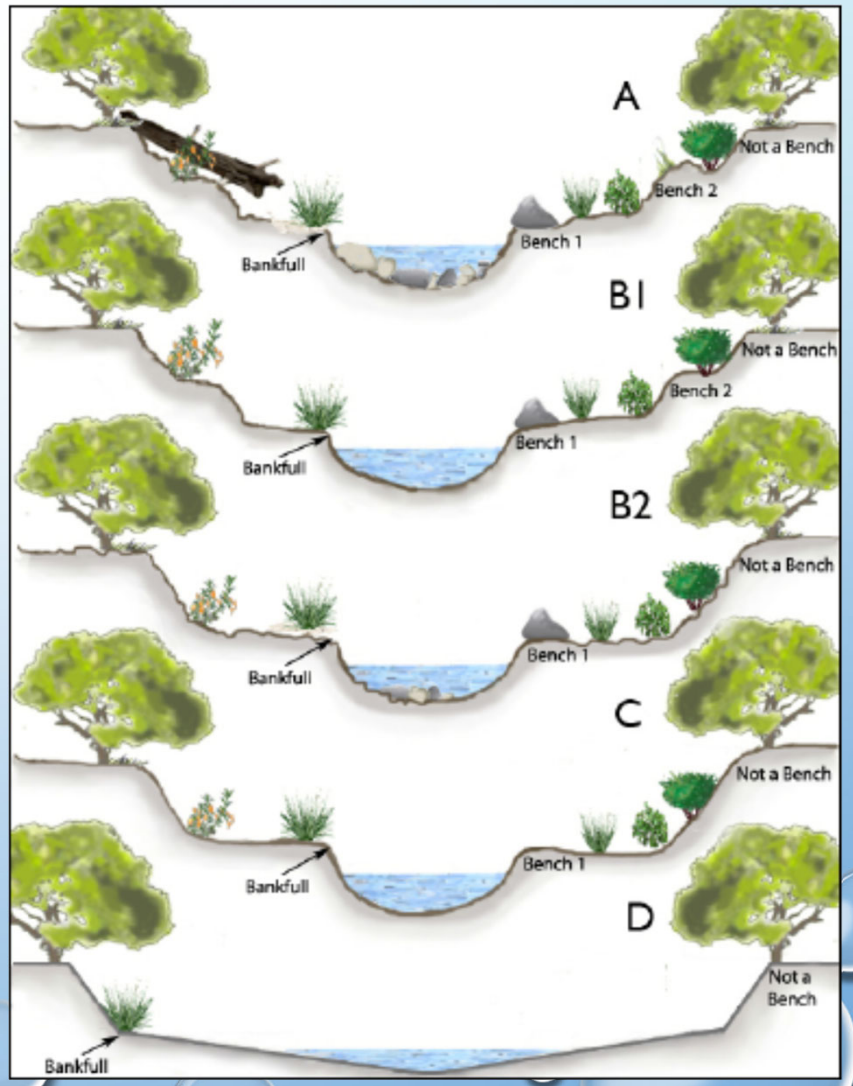
CRAM: PROCEDURE

- STEP 1: ASSEMBLE BACKGROUND INFORMATION
- STEP 2: CLASSIFY WETLAND
  - RIVERINE – CONFINED / NONCONFINED
- STEP 3: VERIFY THE APPROPRIATE SEASON
  - VEGETATION GROWING SEASON
- STEP 4: SKETCH THE CRAM ASSESSMENT AREA (AA)
  - CHANNEL, ACTIVE FLOODPLAIN AND ESSENTIAL RIPARIAN AREA
  - 10X MEAN BANKFULL
- STEP 5: CONDUCT THE OFFICE ASSESSMENT OF AA
- STEP 6: CONDUCT THE FIELD ASSESSMENT OF AA
- STEP 7: COMPLETE CRAM QA/QC
- STEP 8: SUBMIT ASSESSMENT RESULTS USING *E*CRAM

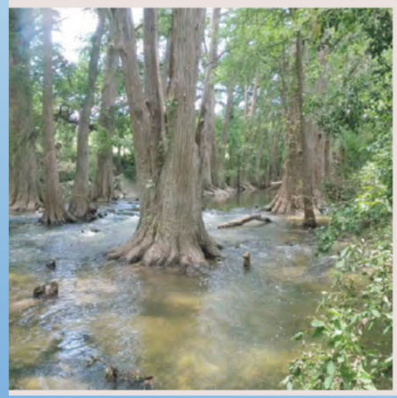


CRAM: ASSESSMENT

- Buffer and Landscape Context
- Hydrology
- Physical Structure
- Biotic Structure
- Stressor Checklist
  - To inform more effective responses



EXAMPLE: TXRAM



THE TEXAS RAPID ASSESSMENT METHOD (TXRAM)

Wetlands and Streams Modules

Version 2.0 - Final

U.S. Army Corps of Engineers - Regulatory Divis

For use within the Fort Worth District in the State of Texas

September 2015

Table 3. TXRAM Metrics Related to Ecosystem Processes

Ecosystem Process	Metrics
Physical	Aquatic Context
	Buffer
	Water Source
	Hydroperiod
	Hydrologic Flow
	Sedimentation
	Topographic Complexity
Chemical	Organic Matter
	Soil Modification
	Herbaceous Cover
Biological	Edge Complexity
	Physical Habitat Richness
	Plant Strata
	Species Richness
	Non-native/Invasive Infestation
	Interspersion
	Strata Overlap
	Vegetation Alterations

Figure 3. Example of a bed and banks that contain a wetland with minor braided channels where the area functions primarily as a wetland and is assessed using the wetland module.

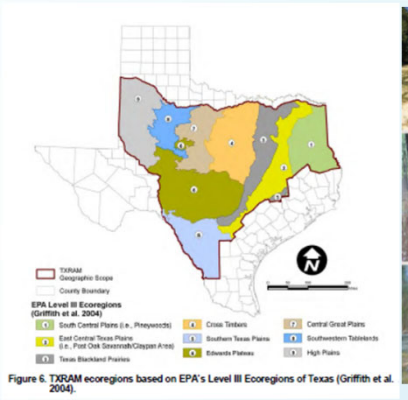
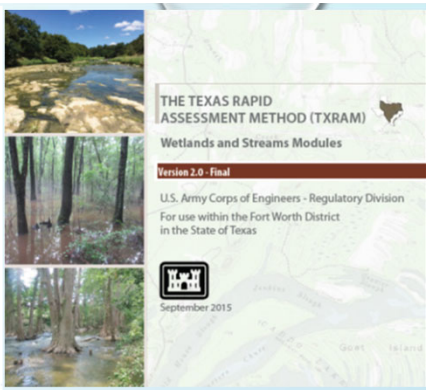


Figure 6. TXRAM ecoregions based on EPA's Level III Ecoregions of Texas (Griffith et al. 2004).



TXRAM

DEVELOPED FOR:

- FORT WORTH DISTRICT
- STREAMS AND WETLANDS
- PERENNIAL, INTERMITTENT AND EPHEMERAL STREAMS
- USE COMPARING CREDITS AND DEBITS WITHIN ECOREGION AND RESOURCE TYPE

DISCUSSIONS OF:

- LAYING OUT THE ASSESSMENT AREA
- WHEN TXRAM NEEDS TO BE USED BASED ON PROJECT SIZE ETC
- CONDITION VERSE FUNCTION AND WHEN MORE DETAILED ANALYSIS MAY BE NEEDED

TXRAM – PHYSICAL STRUCTURE METRIC

PHYSICAL STRUCTURE

Topographic Complexity – See figures in section 2.3.4.1. Record % micro-topography and % WAA for each elevation gradient.

Elevation gradients (EG): _____ Evidence: ☐ Plant assemblages ☐ Level of saturation/inundation ☐ Path of water flow ☐ Slope

Micro-topography: _____% of WAA (By EG: _____)

Types: ☐ Depressions ☐ Pools ☐ Burrows ☐ Swales ☐ Wind-thrown tree holes ☐ Mounds ☐ Gilgai ☐ Islands

☐ Variable shorelines ☐ Partially buried debris ☐ Debris jams ☐ Plant hummocks/roots ☐ Other:_____ **Score:** _____

Edge Complexity – Confirm in office review. See figure in section 2.3.4.2 to evaluate wetland boundary.

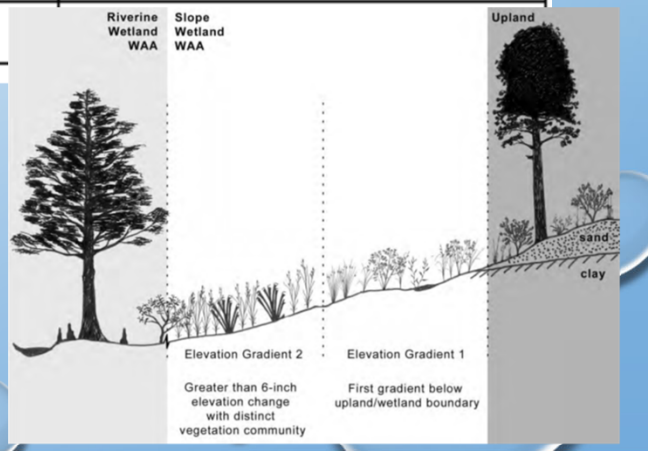
WAA: ☐ In seasonal floodplain ☐ Contiguous to other wetland ☐ Edge vertical structure variation: _____

Horizontal variability: ☐ High ☐ Moderate ☐ Low ☐ None **Score:** _____

Physical Habitat Richness – See definitions and table in section 2.3.4.3 for habitat types applicable to each wetland type.

Label of habitat types qualifying as present in WAA: _____ Total: _____ **Score:** _____

Score	1 Elevation Gradient	2 Elevation Gradients	≥ 3 Elevation Gradients
4	≥ 50% Micro-topography	≥ 30% Micro-topography	≥ 15% Micro-topography
3	30–49% Micro-topography	10–29% Micro-topography	< 15% Micro-topography
2	10–29% Micro-topography	< 10% Micro-topography	–
1	< 10% Micro-topography	–	



TXRAM WETLAND FINAL SCORING SHEET

Project/Site Name/No.: Rockin K Project Type: ☐ Fill/Impact (☐ Linear ☐ Non-linear) ☐ Mitigation/Conservation

Wetland ID/Name: Forest WAA No.: 4 Size: 240 ac Date: 8/22/13 Evaluator(s): M Forbes

Wetland Type: Riverine Ecoregion: TX Blackland prairie Delineation Performed: ☒ Previously ☐ Currently

Aerial Photo Date and Source: GE 2012 Site Photos: Representative: ☒ Yes ☐ No

Notes:

Core Element	*Metric*	*Metric Score*	*Core Element Score Calculation*	*Core Element Score*
Landscape	Connectivity	3	Sum of metric scores / 8 x 20	15.5
	Buffer	3.2		
Hydrology	Water source	3	Sum of metric scores / 12 x 20	15.0
	Hydroperiod	3		
	Hydrologic flow	3		
Soils	Organic matter	2	Sum of metric scores / 12 x 20	16.67
	Sedimentation	4		
	Soil modification	4		
Physical Structure	Topographic complexity	2	Sum of metric scores / 12 x 20	11.67
	Edge complexity	1		
	Physical habitat richness	4		
Biotic Structure	Plant strata	4	Sum of metric scores / 28 x 20	12.86
	Species richness	3		
	Non-native/invasive infestation	4		
	Interspersion	1		
	Strata overlap	3		
	Herbaceous cover	1		
	Vegetation alterations	2		

Sum of core element scores = overall TXRAM wetland score	71.7
Additional points for unique resources = overall TXRAM wetland score x 0.10 if: ☐ Area of Caddo Lake designated a "Wetland of International Importance" under the Ramsar Convention ☐ Bald cypress – water tupelo swamp ☐ Pitcher plant bog ☐ Spring	0
Additional points for limited habitats = overall TXRAM wetland score x 0.05 if: ☐ Dominated by native trees greater than 24-inch diameter at breast height ☐ Dominated by hard mast (i.e., acorns and nuts) producing native species in the tree strata	0
Sum of overall TXRAM wetland score and additional points = **total overall TXRAM wetland score**	71.7

EXAMPLE ASSESSMENT SUMMARY TABLE

EXAMPLE CREDIT SUMMARY TABLE

WAA No.	Wetland Name	Wetland Type	Size (ac)	Landscape Condition		Landscape Score	Hydrology Condition			Hydrology Score	Soils Condition			Soils Score	Physical Structure Condition			Physical Structure Score	Biotic Structure Condition							Biotic Structure Score	Sum of Core Elements	Addn'l Points Hard Mast	Total Overall Score	Credits		Total Credits
				Connectivity	Buffer		Water Source	Hydroperiod	Hydrologic Flow		Organic matter	Sediment retention	Soil Modification		Topo Complexity	Edge complexity	Physical habitat richness		Plant strata	Species richness	Non-native/invasive	Interspersion	Strata overlap	Herbaceous cover	Vegetation alterations					Depres	Riverine	
Proposed Condition[1&2]		Riverine	120	3	3.20	15.50	4	4	4	20.00	2	4	4	16.67	2	1	4	11.67	4	4	4	1	3	1	4	15.00	78.83	1.97	80.80	NA	NA	NA
Proposed Lift:																															
1	Ditch	Depres	0.05	4	1.20	13.00	3	2	2	11.67	1	4	4	15.00	1	1	1	5.00	1	2	4	1	0	4	3	10.71	55.38	0.00	55.38	-0.03	0.00	-0.03
2	Ditch	Depres	0.40	3	1.05	10.13	3	2	2	11.67	1	4	4	15.00	2	1	1	6.67	3	3	4	2	3	2	4	15.00	58.46	0.00	58.46	-0.23	0.00	-0.23
3	Ditch	Depres	0.45	2	1.10	7.75	3	2	2	11.67	1	4	4	15.00	2	1	1	6.67	3	3	4	2	3	2	4	15.00	56.08	0.00	56.08	-0.25	0.00	-0.25
W1		Depres	0.72	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	0.58	0.00	0.58
W2		Depres	1.80	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	1.44	0.00	1.44
W3		Depres	1.73	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	1.39	0.00	1.39
W4		Depres	4.88	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	3.91	0.00	3.91
W5		Depres	4.25	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	3.41	0.00	3.41
W6		Depres	5.00	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	4.01	0.00	4.01
W7		Depres	3.63	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	2.91	0.00	2.91
W8		Depres	1.99	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	1.59	0.00	1.59
Stock Ponds		Depres	2.37	3	2.20	13.00	4	4	4	20.00	1	4	3	13.33	4	3	3	16.67	3	4	4	3	3	3	4	17.14	80.14	0.00	80.14	1.90	0.00	1.90
Riverine/ Forested		Riverine	63.02	0	0.00	0.00	1	1	1	5.00	0	0	0	0.00	0	0	0	0.00	0	1	0	0	0	0	2	2.14	7.14	1.97	9.11	0.00	5.74	5.74
TOTAL																													20.61	5.74	26.36

For WAA #4

Original score of 71.69 for the 63 acres

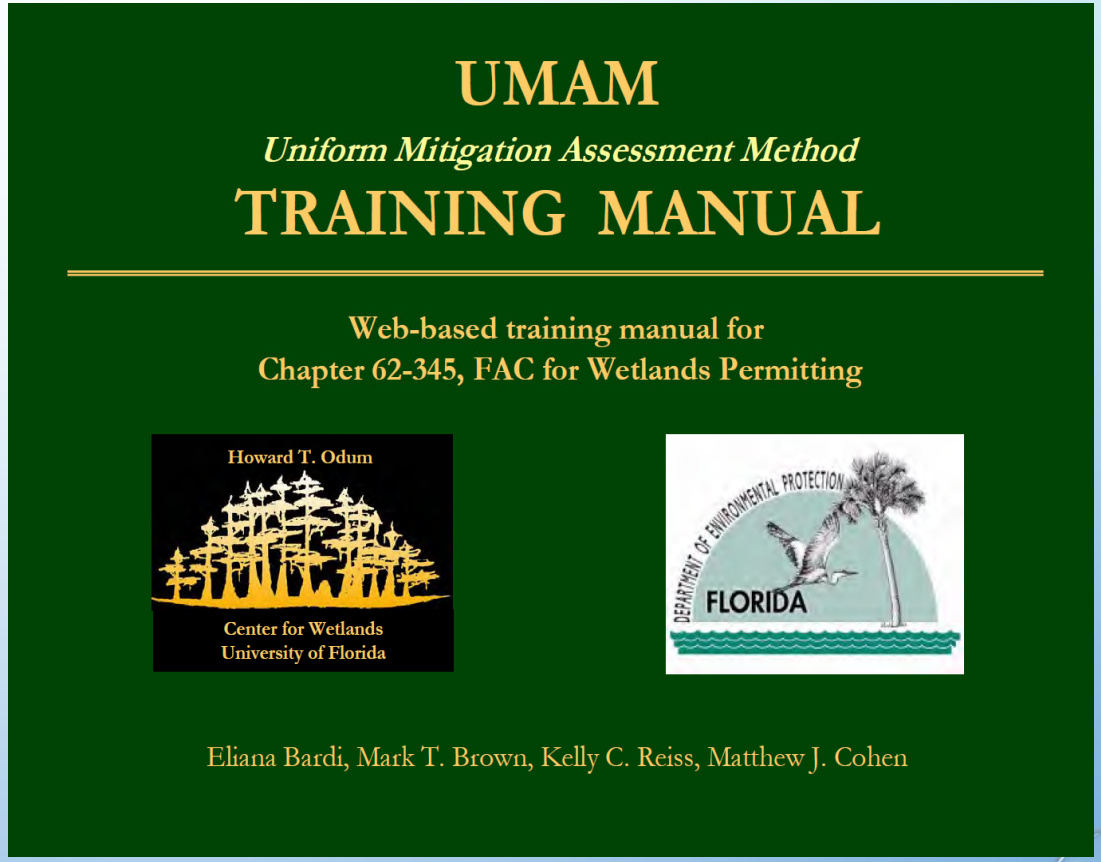
"Uplift" of 9.11 points for post-restoration condition

Uplift % x Acreage = Generated Credits

.0911 x 63 = 5.74

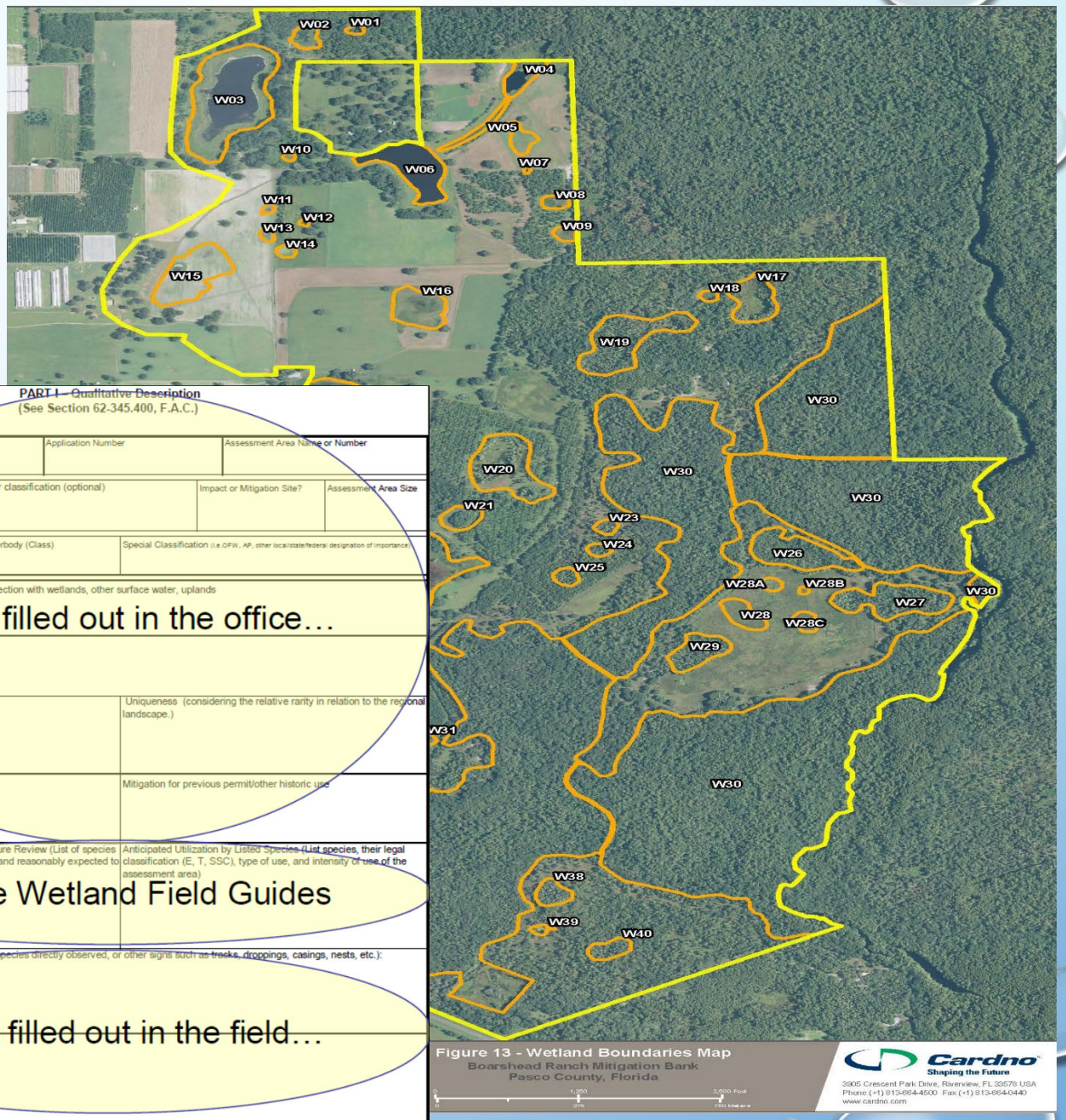
BOARSHEAD RANCH MITIGATION BANK

- UMAM
- Conditional Assessment
  - Qualitative and Quantitative Procedures
  - Baseline Assessment
  - Mitigation Assessment
- Jacksonville District Credit Classification System
  - Credit Conversion for Net Gain in function
- 171.64 Potential Credits



http://www.dep.state.fl.us/water/wetlands/mitigation/umam/index.htm

PART 1: QUALITATIVE BASELINE ASSESSMENT



PART I - Qualitative Description
(See Section 62-345.400, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number	
FLUCCs code	Further classification (optional)	Impact or Mitigation Site?	Assessment Area Size
Basin/Watershed Name/Number	Affected Waterbody (Class)	Special Classification (i.e.OFW, AP, other local/state/federal designation of importance)	

Geographic relationship to and hydrologic connection with wetlands, other surface water, uplands

Can be filled out in the office…

Assessment area description

Significant nearby features	Uniqueness (considering the relative rarity in relation to the regional landscape.)
Functions	Mitigation for previous permit/other historic use
Anticipated Wildlife Utilization Based on Literature Review (List of species that are representative of the assessment area and reasonably expected to be found.)	Anticipated Utilization by Listed Species (List species, their legal classification (E, T, SSC), type of use, and intensity of use of the assessment area)

Use the Wetland Field Guides

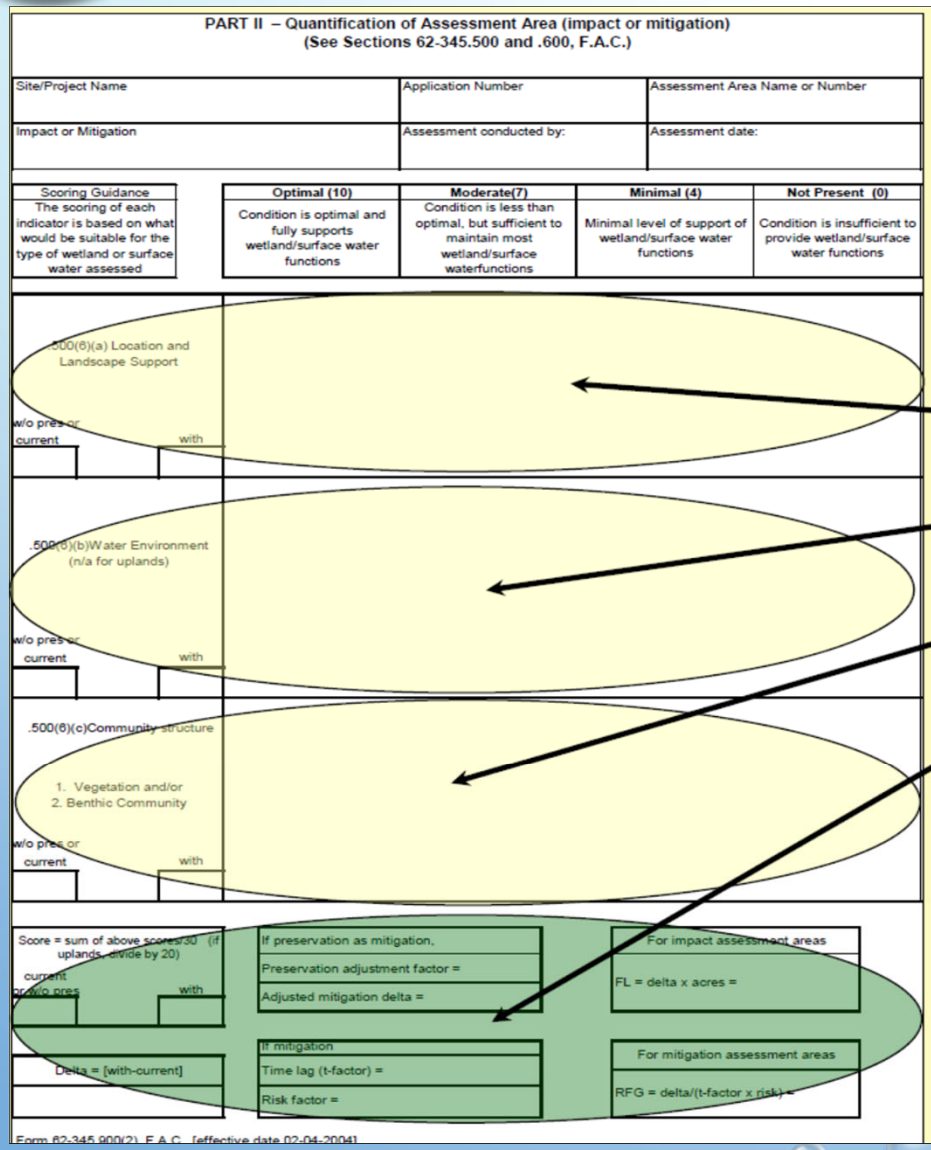
Observed Evidence of Wildlife Utilization (List species directly observed, or other signs such as tracks, droppings, casings, nests, etc.):

Can be filled out in the field…

Additional relevant factors:

Assessment conducted by:	Assessment date(s):

PART 2: QUANTITATIVE ASSESSMENT



PART II – Quantification of Assessment Area (impact or mitigation)
(See Sections 62-345.500 and .600, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Impact or Mitigation	Assessment conducted by:	Assessment date:

Scoring Guidance	Optimal (10)	Moderate(7)	Minimal (4)	Not Present (0)
The scoring of each indicator is based on what would be suitable for the type of wetland or surface water assessed	Condition is optimal and fully supports wetland/surface water functions	Condition is less than optimal, but sufficient to maintain most wetland/surface waterfunctions	Minimal level of support of wetland/surface water functions	Condition is insufficient to provide wetland/surface water functions

.500(6)(a) Location and Landscape Support

w/o pres or current | with

.500(6)(b)Water Environment (n/a for uplands)

w/o pres or current | with

.500(6)(c)Community structure

1. Vegetation and/or
2. Benthic Community

w/o pres or current | with

Score = sum of above scores/30 (if uplands, divide by 20)

current or w/o pres | with

If preservation as mitigation,
Preservation adjustment factor =
Adjusted mitigation delta =

For impact assessment areas
FL = delta x acres =

Delta = [with-current]

If mitigation
Time lag (t-factor) =
Risk factor =

For mitigation assessment areas
RFG = delta/(t-factor x risk) =

Form 62-345.900(2), F.A.C., [effective date 02-04-2004]

Scoring UMAM Part II…

There are three sections for scoring:

- Location and Landscape Support
- Water Environment
- Community Structure

…and a final section that is the overall score of the assessment area as well as adjustments to scoring based on preservation vs. mitigation, time lag, and risk factors.

MITIGATION DETERMINATION FORMULAS

Mitigation Determination Formulas
(See Section 62-345.600(3), F.A.C.)

For each impact assessment area:
(FL) Functional Loss = Impact Delta X Impact acres

For each mitigation assessment area:
(RFG) Relative Functional Gain = Mitigation Delta (adjusted for preservation, if applicable)/((t-factor)(risk))

(a) Mitigation Bank Credit Determination

The total potential credits for a mitigation bank is the sum of the credits for each assessment area where assessment area credits equal the RFG times the acres of the assessment area scored

Bank Assessment Area	RFG	X	Acres	=	Credits
example					
a.a.1					
a.a.2					
total					

(b) Mitigation needed to offset impacts, when using a mitigation bank

The number of mitigation bank credits needed, when the bank or regional offsite mitigation area is assessed in accordance with this rule, is equal to the summation of the calculated functional loss for each impact assessment area.

Impact Assessment Area	FL	=	Credits needed
example			
a.a.1			
a.a.2			
total			

(c) Mitigation needed to offset impacts, when not using a bank

To determine the acres of mitigation needed to offset impacts when not using a bank or a regional offsite mitigation area as mitigation, divide functional loss (FL) by relative functional gain (RFG). If there are more than one impact assessment area or more than one mitigation assessment area, the total functional loss and total relative functional gain is determined by summation of the functional loss (FL) and relative functional gain (RFG) for each assessment area.

	FL	/	RFG	=	Acres of Mitigation
example					
a.a.1					
a.a.2					
total					

Form 62-345.900(3), F.A.C. [effective date 02-04-2004]

After calculating the FL and RFL, you can use the Mitigation Determination Formulas on the left to determine:

1. Total Potential credits for a mitigation bank
2. Mitigation needed to offset impacts when using a bank
3. Mitigation needed to offset impacts, when not using a bank

CREDIT DETERMINATION/CREDIT RELEASE

UMAM Summary Table (Revised 12/20/15)

AA ID	Acres	Mitigation Activity	CC loc	With loc	CC water	With water	CC comm	With comm	CC sum	With sum	Time Lag	Risk	Delta	RFG	FG	
1-002	6.36	Herbaceous Wetland Preservation	7	9	7	7	7	7	0.70	0.77	1.017	1	0.07	0.065552278	0.42	
1-003	3.56	Forested Wetland Preservation	8	9	8	8	8	8	0.80	0.83	1.017	1	0.03	0.032776139	0.12	
1-004	223.95	Forested Wetland Preservation	8	9	9	9	9	9	0.87	0.90	1.017	1	0.03	0.032776139	7.34	
1-004a	9.26	Forested Wetland Preservation (buffer)	8	8	9	9	9	9	0.87	0.87	0.000	0.00	0.00	0.000000	0.00	
1-027	4.97	Forested Wetland Enhancement	8	9	6	6	7	9	0.70	0.80	1.478	1.25	0.10	0.054127199	0.27	
1-029	219.3	Forested Wetland Enhancement	8	9	8	9	8	9	0.80	0.90	1.070	1.25	0.10	0.074794316	16.40	
1-029a	15.04	Forested Wetland Enhancement (buffer)	8	8	8	9	8	9	0.80	0.87	1.070	1.25	0.07	0.049862877	0.75	25.30 Unit 1 total credits

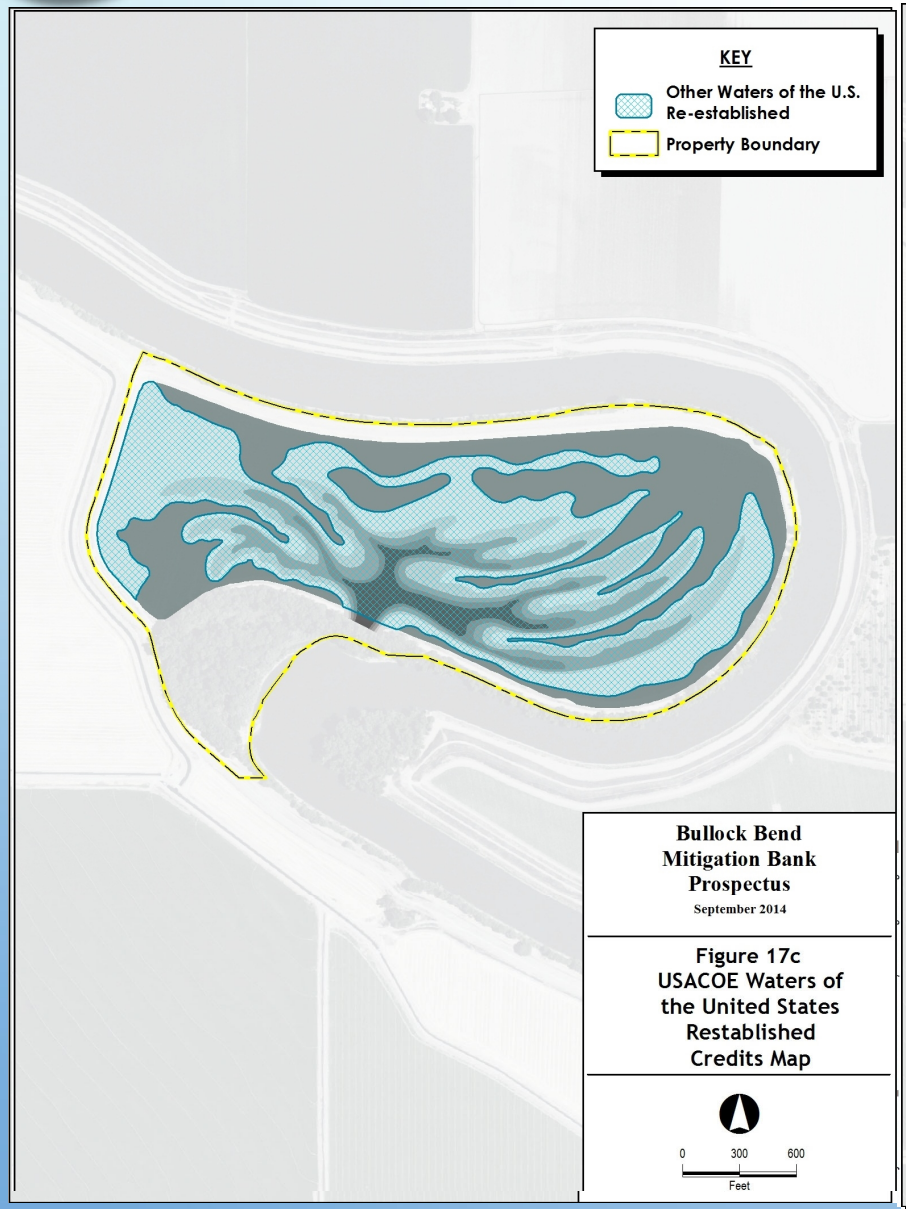
Unit 1 Credit Release Schedule by Assessment Area

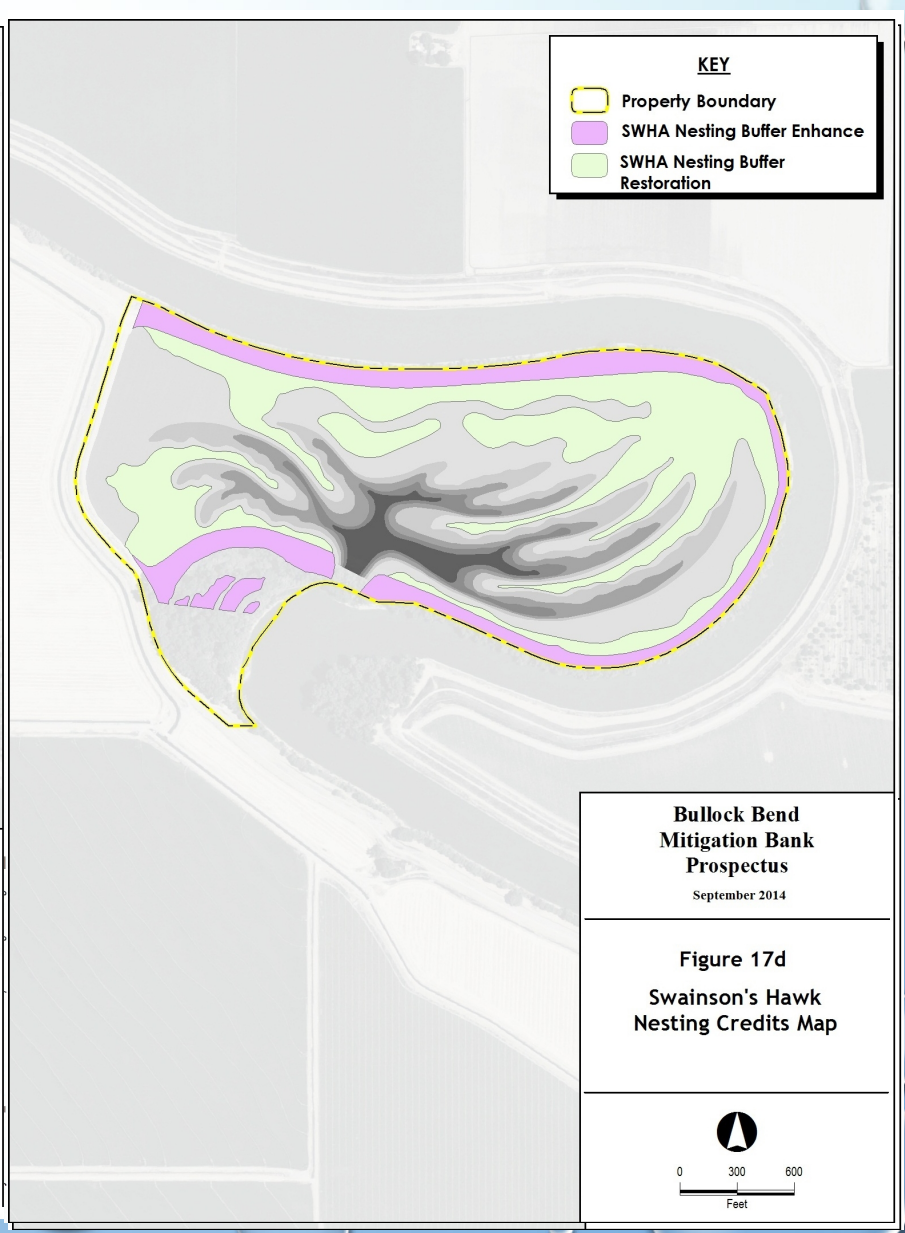
				Palustrine Emergent Credits					Palustrine Forested Credits					TOTAL CREDITS	Total Credits by Unit
AA ID	Acreage	Mitigation Activity	FG	First Release	Second Release	Third Release	Fourth Release	Final Release	First Release	Second Release	Third Release	Fourth Release	Final Release		
1-002	6.36	Herbaceous Wetland Preservation	0.42	0.42										0.42	
1-003	3.56	Forested Wetland Preservation	0.12						0.12					0.12	
1-004	223.95	Forested Wetland Preservation	7.34						7.34					7.34	
1-004a	9.26	Forested Wetland Preservation	0.00												
1-027	4.97	Forested Wetland Enhancement	0.27						0.03	0.04	0.03	0.04	0.14	0.27	
1-029	219.30	Forested Wetland Enhancement	16.40						1.64	2.46	1.64	2.46	8.20	16.40	
1-029a	15.04	Forested Wetland Enhancement	0.75						0.08	0.11	0.08	0.11	0.38	0.75	25.30

	Unit 1	
Credit Release	% of Credits at Each Credit Release	# of credits
First	100% of credits for wetland preservation, 10% of credits for wetland enhancement	**9.62**
Second	15% of credits for wetland enhancement	**2.61**
Third	10% of credits for wetland enhancement	**1.74**
Fourth	15% of credits for wetland enhancement	**2.61**
Final	50% of credits for wetland enhancement	**8.71**
Total		**25.30**

Total Palustrine Emergent credits in Unit 1	0.42
Total Palustrine Forested credits in Unit 1	24.88
Total credits in Unit 1	25.30

BUNDLED CREDITS – BULLOCKS BEND





BULLOCK BEND BUNDLED CREDITS

Table 3: Bullock Bend Mitigation Bank Credit Table

		JURISDICTION			CREDITS
CREDIT TYPE		**NOAA**	**CDFW**	**ACOE**	**(in acres)**
RESTORATION					
A	Salmonid[1] / Floodplain Riparian	X	X	X	57.42
B	Salmonid[1] / Swainson's Hawk Nesting Buffer / Associated Riparian	X	X		33.55
ENHANCEMENT					
C	Salmonid[1] / Riverine Riparian	X			5.14
D	Salmonid[1] / Swainson's Hawk Nesting Buffer	X	X		20.13
			BANK TOTAL[2]		116.24
DOCUMENTED PRESENCE OF SWAINSON'S HAWK UTILIZATION[3]					
E	Existing Swainson's Hawk Nesting Use (In Enhancement Area)		**1 to 2**		N/A
F	New Swainson's Hawk Nesting Use (In Restoration Area)		**1 to 2**		N/A

[1] Includes:	NOAA	CDFW
California Central Valley steelhead (DPS)	T	T
Chinook salmon - Central Valley fall-/late-fall run (ESU)	EFH	CSC
Chinook salmon - Central Valley spring run (ESU)	T	T
Chinook salmon -Sacramento River winter run ESU)	E	E

(E - Endangered, T – Threatened, CSC - CA species of concern), and EFH-Essential Fish Habitat

2 – Amount of Acerage-Based Credit Types (A-D) Allocated to Projects Would Not Exceed Bank Total

3 – Swainson's Hawk Tree Nesting Not Tied to Acreage but Actual Presence with Releases Based on Monitoring Results

REGIONAL GUIDANCE LETTER 18-01

CREDITS FOR REMOVAL OF OBSOLETE DAMS AND OTHER STRUCTURES IN RIVERS AND STREAMS

GOALS:

- RESTORE STRUCTURE, FUNCTIONS, AND DYNAMICS OF RIVERS AND STREAMS THROUGH REMOVAL OF
    - OBSOLETE DAMS AND OTHER OBSOLETE STRUCTURES
    - REMOVAL OR REPLACEMENT OF UNDERSIZED OR PERCHED CULVERTS
- USACE INFRASTRUCTURE INITIATIVE
- ACCELERATE THE DELIVERY OF INFRASTRUCTURE PROJECTS
- INCENTIVIZE REMOVAL OF OBSOLETE DAMS AND OTHER OBSOLETE STRUCTURES TO RESTORE CONNECTIVITY IN RIVERINE SYSTEMS
- PERMIT PROCESSING IMPROVEMENTS

OBJECTIVES OF RGL 18-01

- FACTORS DISTRICT ENGINEERS SHOULD CONSIDER FOR DETERMINING AMOUNT OF MITIGATION CREDITS GENERATED BY REMOVAL OF OBSOLETE DAMS AND OTHER STRUCTURES
- RECOMMENDATIONS FOR:
  - QUANTIFYING THOSE MITIGATION CREDITS
  - TREATING WETLAND LOSSES THAT MIGHT OCCUR AFTER REMOVAL OF OBSOLETE DAMS OR OTHER STRUCTURES
- THESE ACTIVITIES CAN BE CONDUCTED FOR:
  - MITIGATION BANKS
  - IN-LIEU FEE PROJECTS
  - PERMITTEE-RESPONSIBLE MITIGATION

GENERAL FACTORS TO CONSIDER IN CREDIT CALCULATIONS

- ECOSYSTEM RESTORATION PROJECTS HAVE SHORT-TERM ADVERSE ENVIRONMENTAL EFFECTS
  - *E.G.*, REMOVING STRUCTURES OR FILLS THAT DISRUPT NATURAL ECOSYSTEM PROCESSES
  - RESTORATION ACTION IS OFTEN A DISTURBANCE
- EXPECTATION (PROJECT GOAL) IS THAT THERE WILL LONG-TERM FUNCTIONAL IMPROVEMENTS AS STRESSORS REDUCED OR ELIMINATED
- MITIGATION CREDITS SHOULD BE BASED ON LONG-TERM RESTORATION OUTCOMES, NOT SHORT TERM ADVERSE IMPACTS

GENERAL FACTORS TO CONSIDER IN CREDIT CALCULATIONS

- WATERSHED CONDITIONS THAT INFLUENCE STREAM STRUCTURE, FUNCTIONS, AND DYNAMICS
- ENVIRONMENTAL AND WATERSHED CHANGES THAT OCCURRED AFTER THE IN-STREAM STRUCTURE WAS CONSTRUCTED AND THEIR EFFECTS ON STREAM RESTORATION POTENTIAL
  - STREAM SHOULD NOT BE EXPECTED TO BE RESTORED TO A HISTORIC ECOLOGICAL STATE THAT EXISTED PRIOR TO CONSTRUCTION OF THE IN-STREAM STRUCTURE
  - WHAT DEGREE OF RECOVERY IN CURRENT WATERSHED CONTEXT?
- SHOULD USE FUNCTIONAL OR CONDITION ASSESSMENTS, IF APPROPRIATE AND AVAILABLE
- NUMBER OF CREDITS SHOULD REFLECT DIFFERENCE IN FUNCTIONS
  - BEFORE REMOVAL VERSUS POST-REMOVAL

GENERAL FRAMEWORK FOR CREDIT GENERATION

THREE ZONES:

1. AREA OF STREAM CHANNEL/IMPOUNDMENT THAT PHYSICALLY RESPONDS TO REMOVAL OF THE OBSOLETE STRUCTURE

- CHANGE FROM LENTIC TO LOTIC AQUATIC SYSTEM
- RECOVERY OF STREAM CHANNEL AND RIPARIAN AREA
  - BASE VALUE FOR CREDIT CALCULATIONS

2. CHANGES IN FUNCTIONS UPSTREAM OF FORMER IMPOUNDMENT

- ABILITY OF AQUATIC SPECIES TO MOVE UPSTREAM, PLUS TRIBUTARIES
  - ADJUSTMENT TO BASE CREDIT VALUE

3. CHANGES IN FUNCTIONS DOWNSTREAM OF FORMER STRUCTURE

3 CREDIT GENERATION ZONES

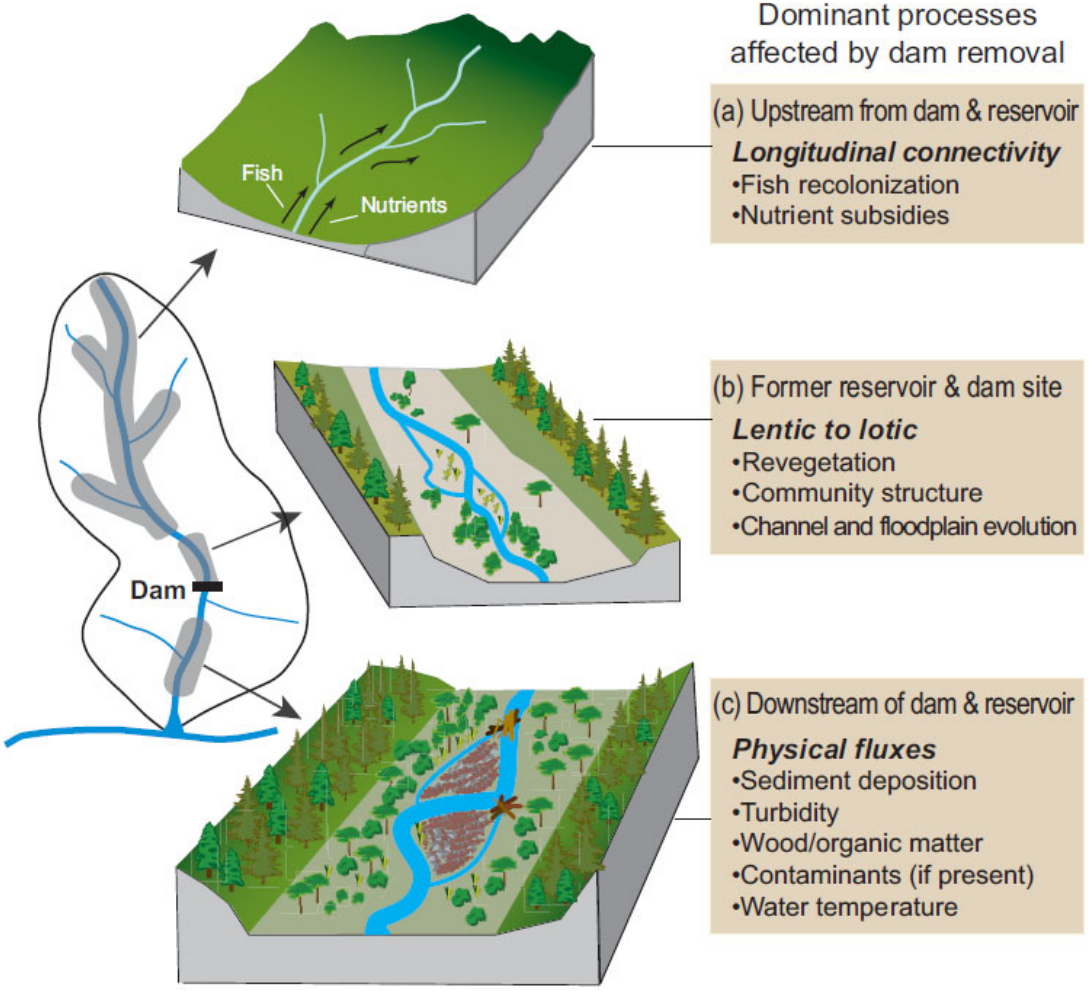
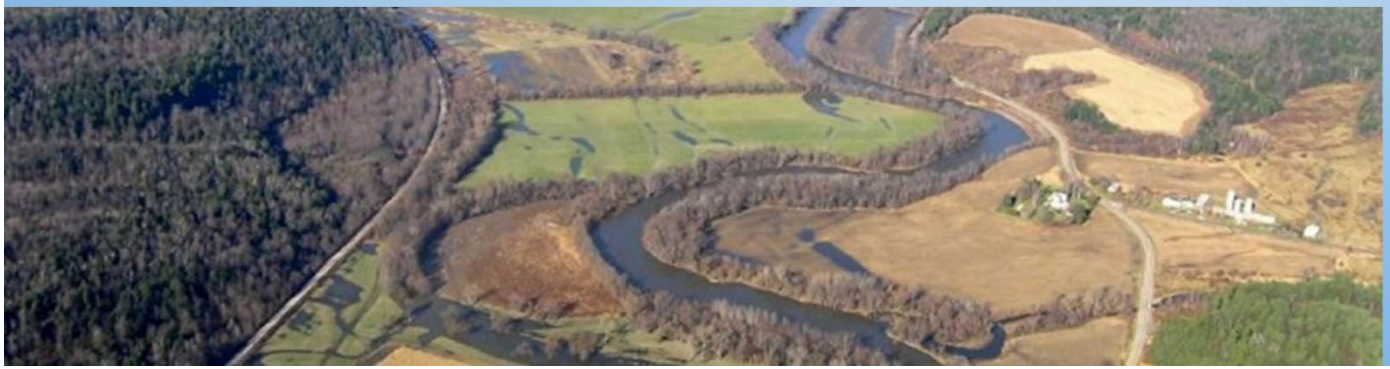


Figure 1. Spatial domains influenced by dam removal: (a) upstream of the reservoir, (b) within the reservoir or former impoundment, and (c) downstream of the dam. The boxes on the right represent the dominant processes that influence ecological responses in each domain.

Bellmore et al. 2019. Bioscience 69: 26-39

CREDIT CALCULATION FACTORS

- AREAS CONSIDERED FOR CREDIT PRODUCTION (BASE CREDIT VALUE)
  - AREA OF STREAM CHANNEL THAT PHYSICALLY RESPONDS TO REMOVAL OF THE OBSOLETE STRUCTURE
  - RESTORATION, ENHANCEMENT, OR PROTECTION OF RIPARIAN AREAS
- CONSIDERATIONS FOR CREDIT ADJUSTMENTS (ADD TO BASE CREDIT VALUE)
  - ENDANGERED AND/OR THREATENED SPECIES
  - DIADROMOUS FISH
  - IMPROVEMENTS IN STREAM HABITAT, INCLUDING WATER QUALITY



CREDIT DETERMINATION CONCLUSIONS

- RECOMMEND IRT…
  - COLLECTIVELY EVALUATE METHODS AVAILABLE
  - REACH CONSENSUS ON METHOD TO BE USED
  - DOCUMENT SELECTION AND COMMUNICATE
  - FOLLOW METHOD
  - ADJUST AS NEEDED

Questions?