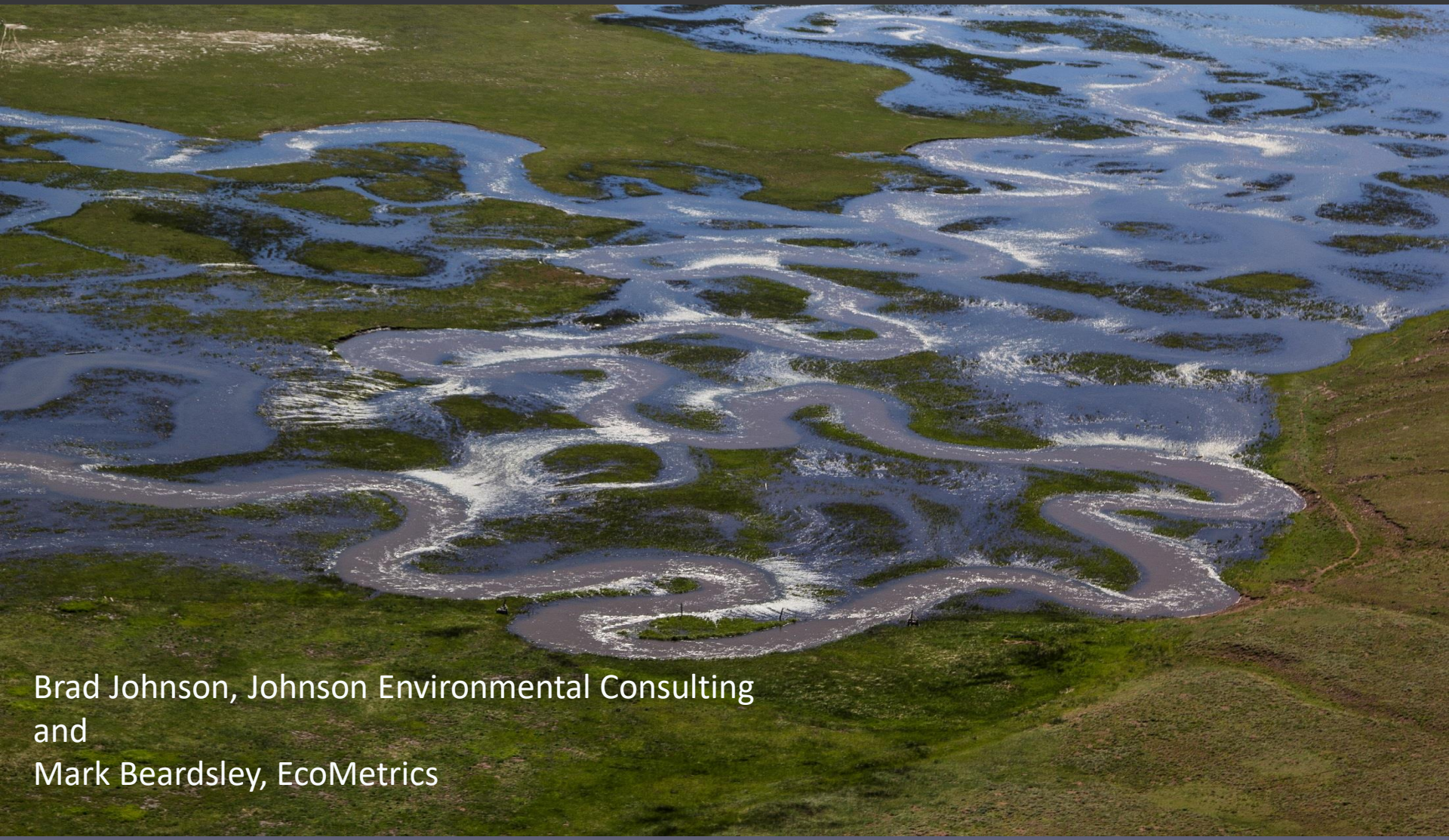
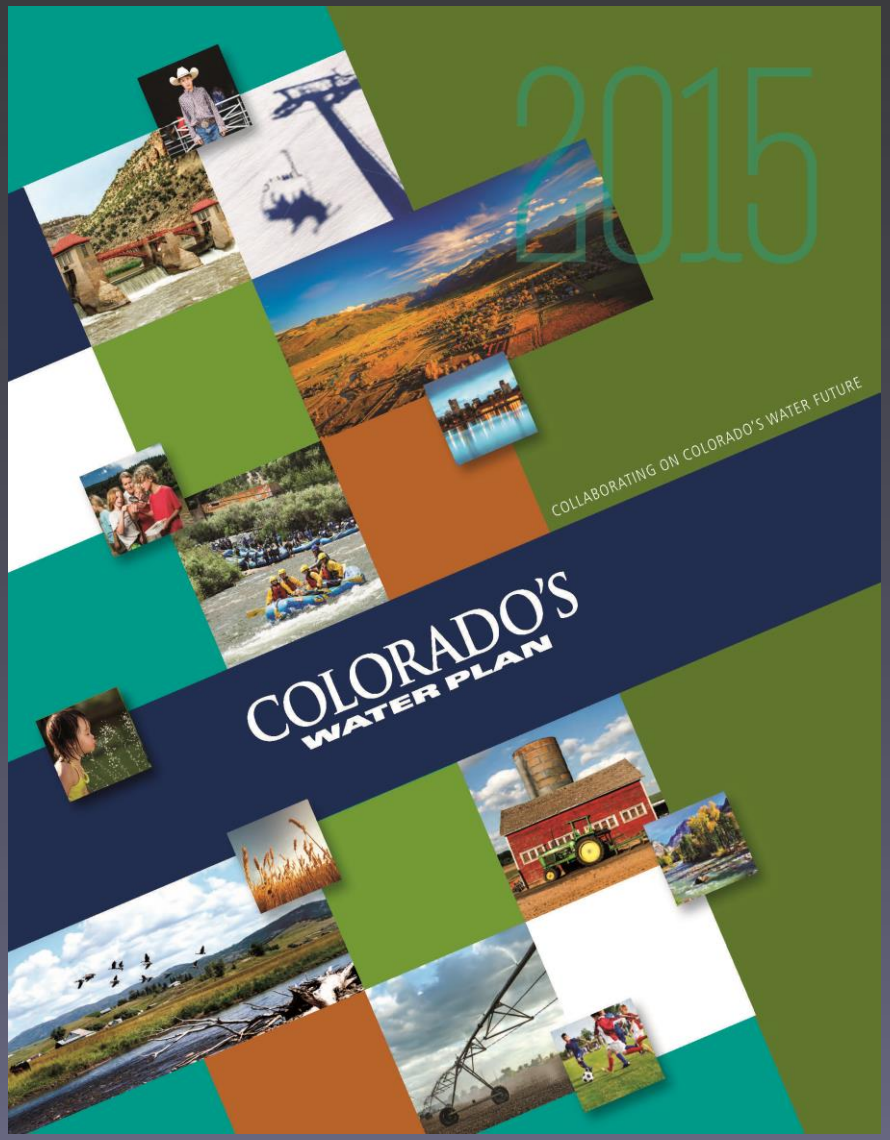
Colorado Stream Health Assessment Framework

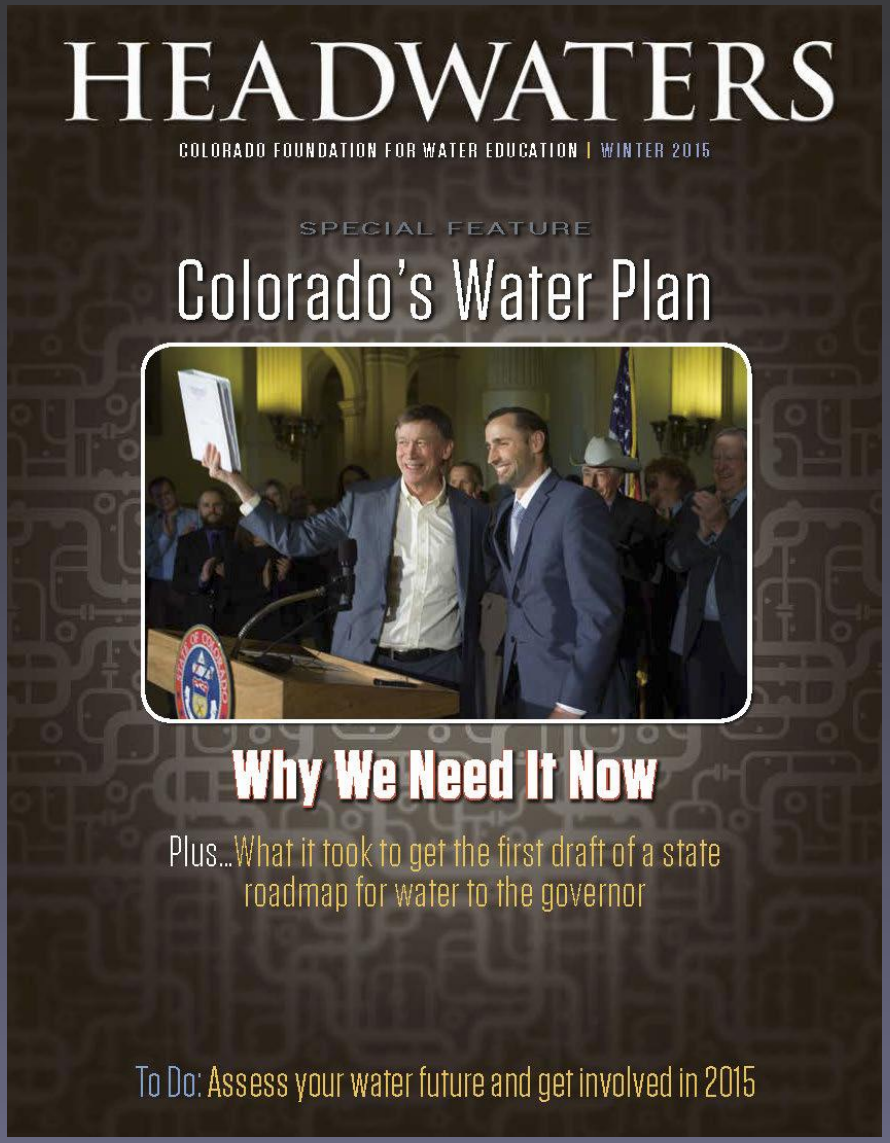


Brad Johnson, Johnson Environmental Consulting
and
Mark Beardsley, EcoMetrics

A holistic health assessment tool for stream management and restoration planning

Colorado Water Plan



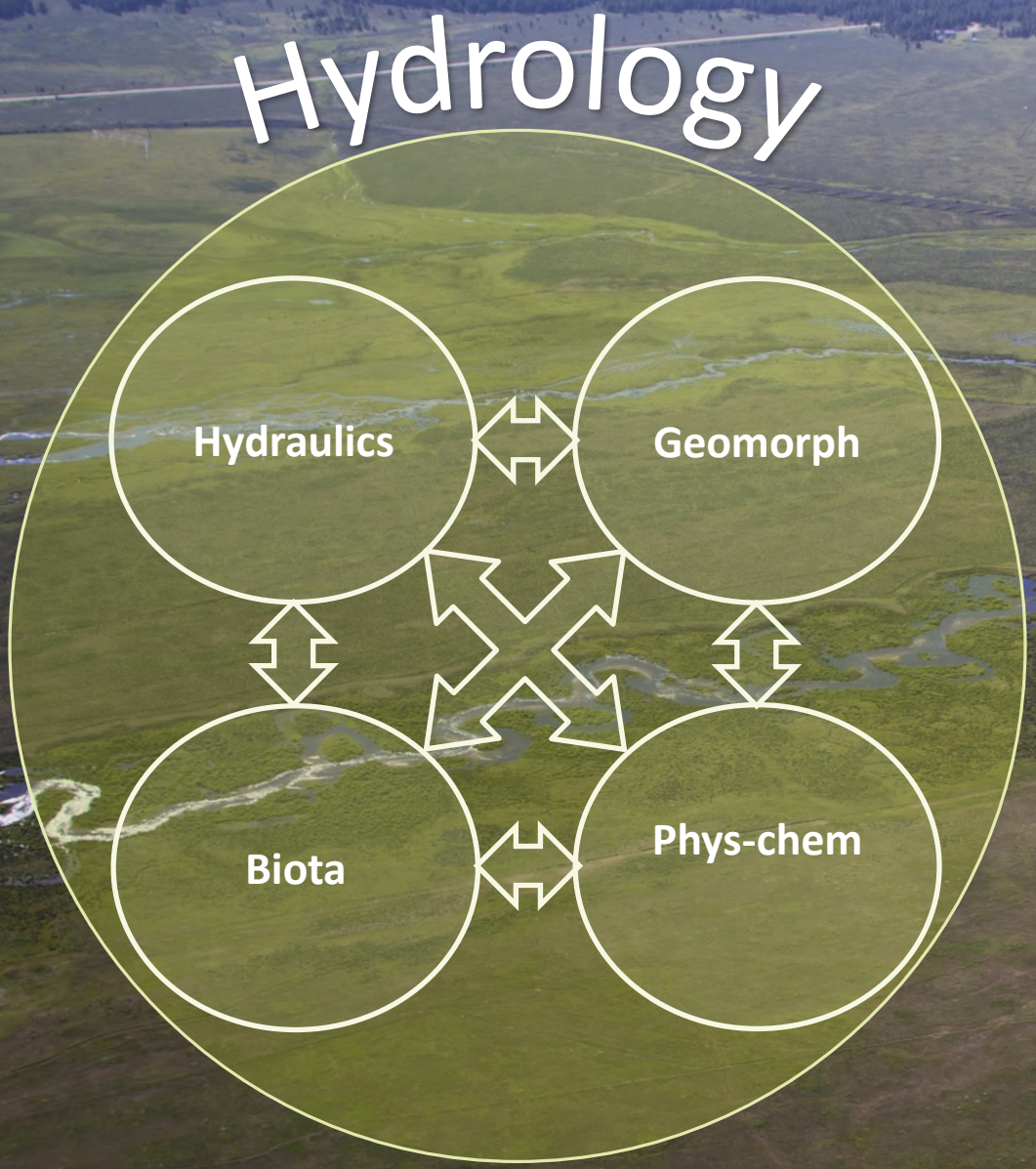


Stream Management Plans

The Colorado Water Plan says that Stream Management Plans should (paraphrased):

- Involve stakeholders
- Assess existing biological, hydrological, and geomorphological conditions;
- Identify flows and other physical conditions needed to support environmental and recreational water uses
- Incorporate environmental and recreational values
- Identify and prioritize alternative management actions to achieve measurable progress toward management objectives

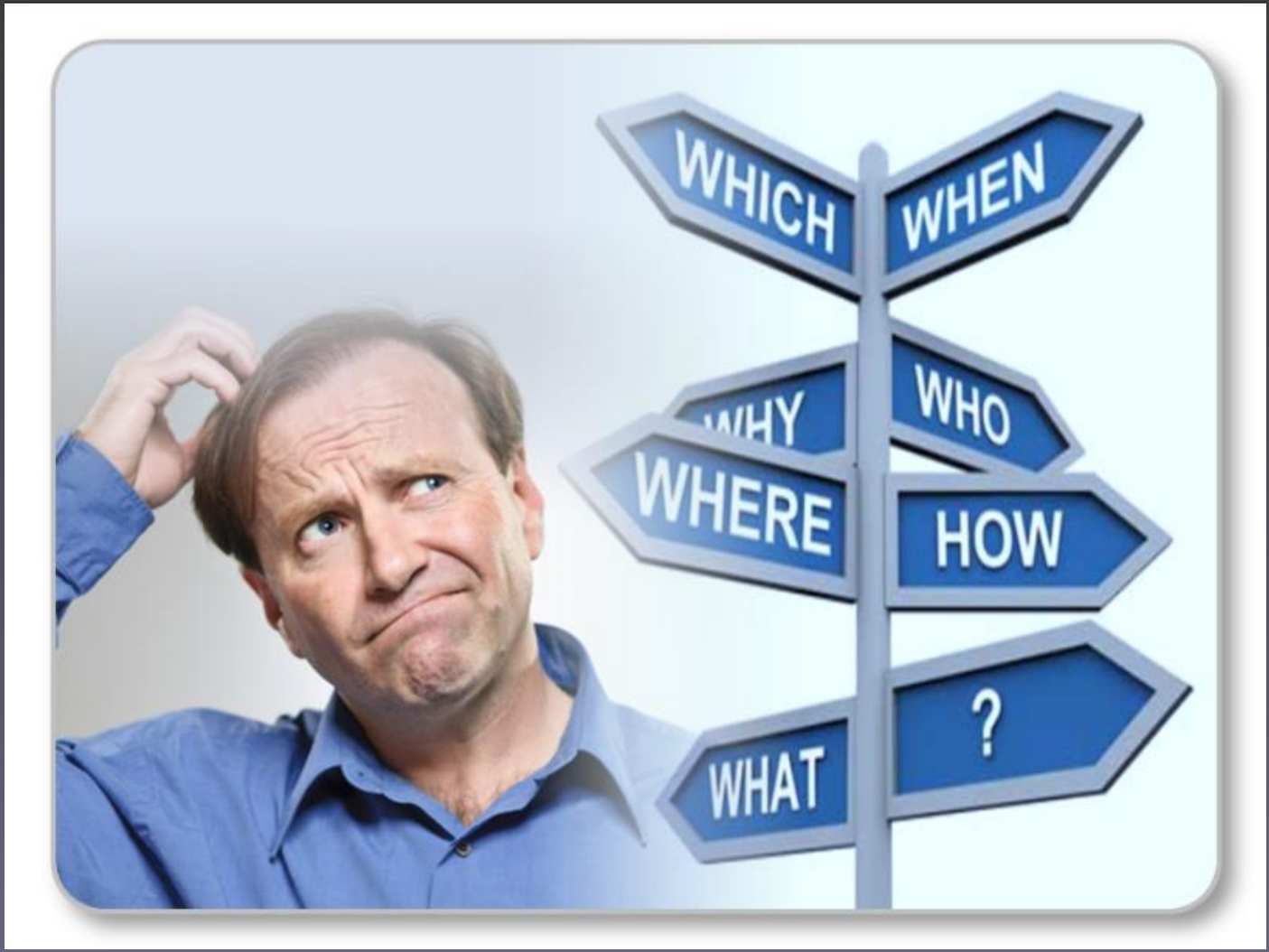
Holistic River Health Assessment



The roll of holistic health assessment:

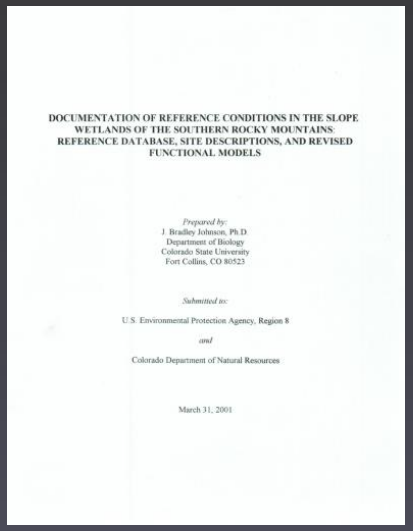
- Describe condition
- Help diagnose causes of impairment
- Assist in prescribing treatments
- Communicate with stakeholders and educate them on issues and solutions
- Set the stage to implement treatments

Where do I get one of those?



Development of Health Assessment Technology

1990's

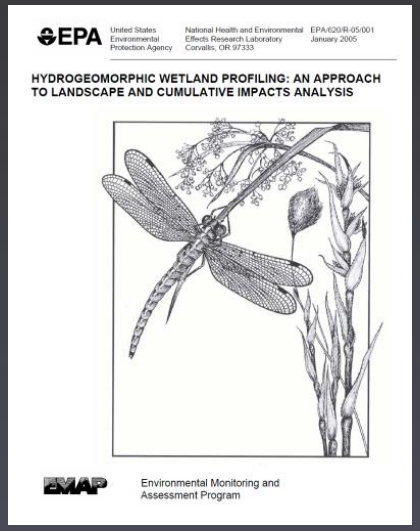

DOCUMENTATION OF REFERENCE CONDITIONS IN THE SLOPE WETLANDS OF THE SOUTHERN ROCKY MOUNTAINS: REFERENCE DATABASE, SITE DESCRIPTIONS, AND REVISED FUNCTIONAL MODELS

Prepared by:
J. Bradley Johnson, Ph.D.
Department of Biology
Colorado State University
Fort Collins, CO 80523

Submitted to:
U.S. Environmental Protection Agency, Region 8
and
Colorado Department of Natural Resources

March 31, 2001

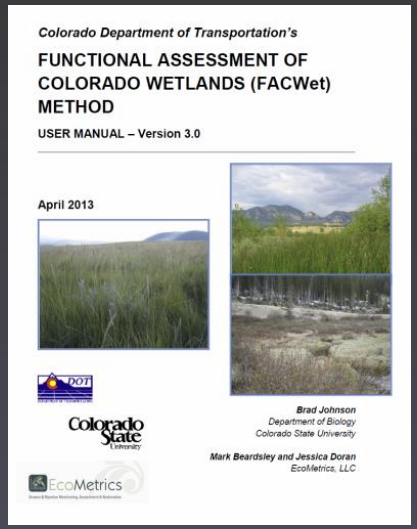
2005


EPA United States Environmental Protection Agency | National Health and Environmental Effects Research Laboratory Corvallis, OR 97333 | EPA/620/R-05/001 January 2005

HYDROGEOMORPHIC WETLAND PROFILING: AN APPROACH TO LANDSCAPE AND CUMULATIVE IMPACTS ANALYSIS

EMAP Environmental Monitoring and Assessment Program

2008


Colorado Department of Transportation's

FUNCTIONAL ASSESSMENT OF COLORADO WETLANDS (FACWet) METHOD

USER MANUAL – Version 3.0

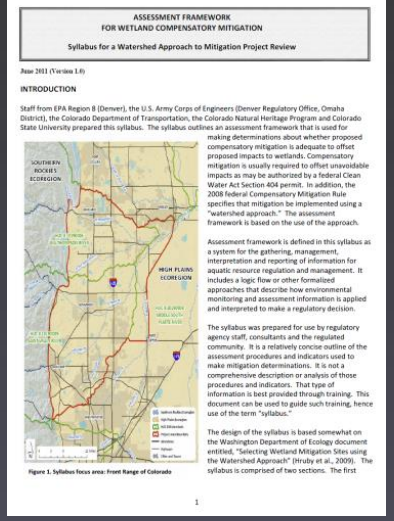
April 2013

Colorado State University

Brad Johnson
Department of Biology
Colorado State University

Mark Beardsley and Jessica Doran
EcoMetrics, LLC

2011


ASSESSMENT FRAMEWORK FOR WETLAND COMPENSATORY MITIGATION

Syllabus for a Watershed Approach to Mitigation Project Review

June 2011 (Version 1.0)

INTRODUCTION

Staff from EPA Region 8 (Denver), the U.S. Army Corps of Engineers (Denver Regulatory Office, Omaha District), the Colorado Department of Transportation, the Colorado Natural Heritage Program and Colorado State University prepared this syllabus. The syllabus outlines an assessment framework that is used for making determinations about whether proposed compensatory mitigation is adequate to offset proposed impacts to wetlands. Compensatory mitigation is usually required to offset unavoidable impacts as may be authorized by a federal Clean Water Act Section 404 permit. In addition, the 2008 federal Compensatory Mitigation Rule specifies that mitigation be implemented using a "watershed approach." The assessment framework is based on the use of the approach.

Assessment framework is defined in this syllabus as a system for the gathering, management, interpretation and reporting of information for aquatic resource regulation and management. It includes a logic flow or other formalized approaches that describe how environmental monitoring and assessment information is applied and interpreted to make a regulatory decision.

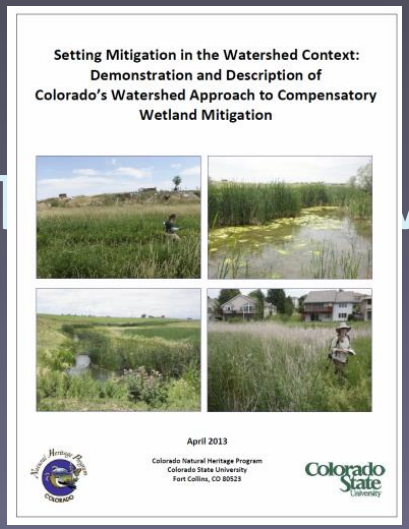
The syllabus was prepared for use by regulatory agency staff, consultants and the regulated community. It is a relatively concise outline of the assessment procedures and indicators used to make mitigation determinations. It is not a comprehensive description or analysis of those procedures and indicators. That type of information is best provided through training. This document can be used to guide such training, hence use of the term "syllabus."

The design of the syllabus is based somewhat on the Washington Department of Ecology document entitled, "Selecting Wetland Mitigation Sites using the Watershed Approach" (Hruby et al., 2009). The syllabus is comprised of two sections. The first

Figure 1. Syllabus focus area: Front Range of Colorado

1

2013

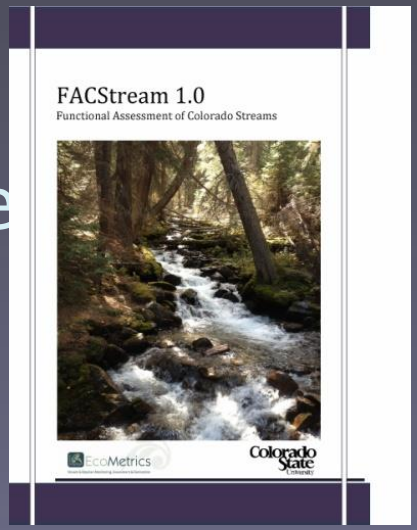

Setting Mitigation in the Watershed Context: Demonstration and Description of Colorado's Watershed Approach to Compensatory Wetland Mitigation

April 2013

Colorado Natural Heritage Program
Colorado State University
Fort Collins, CO 80523

Colorado State University

2015


FACStream 1.0

Functional Assessment of Colorado Streams

EcoMetrics

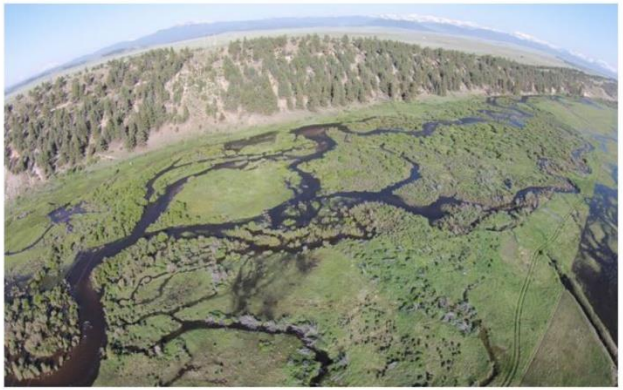
Colorado State University

Application

Park County Wetland and Stream Inventory

Mark Beardsley
EcoMetrics, LLC
10/8/2016

EcoMetrics
Stream & Riparian Monitoring, Assessment & Restoration



Colorado Natural Heritage Program
Providing Comprehensive and Reliable Biological Information For Colorado

Hildebrand Ranch Stream and Wetland Functional Assessment

12/15/2015
Mark Beardsley and Jessica Doran
EcoMetrics

EcoMetrics

Slate River, Peanut Lake Reach

Assessment, Restoration, and Monitoring

To Protect Peanut Lake and Improve River and Wetland Function

Mark Beardsley, M.S.
December 22, 2014

Prepared for: The Crested Butte Land Trust
Primary Author: Mark Beardsley, EcoMetrics
Contributors: Andy Herb, AlpineEco
Jessica Doran, EcoMetrics
David Sutherland, EcoMetrics
Danielle Beamer, CBLT
Hedda Peterson, CBLT

AlpineEco
Crested Butte LAND TRUST
EcoMetrics

Sand Creek

Ecological Assessment and Evaluation of Improvement Options

Mark Beardsley, M.S.
EcoMetrics, LLC
November 12, 2015

EcoMetrics

Submitted to: Sprague Sand Creek Ranch LLC

The Effectiveness of Mechanical Channel Enhancements on Impaired Streams in South Park, Colorado

Using long-term monitoring to evaluate enhancement and restoration

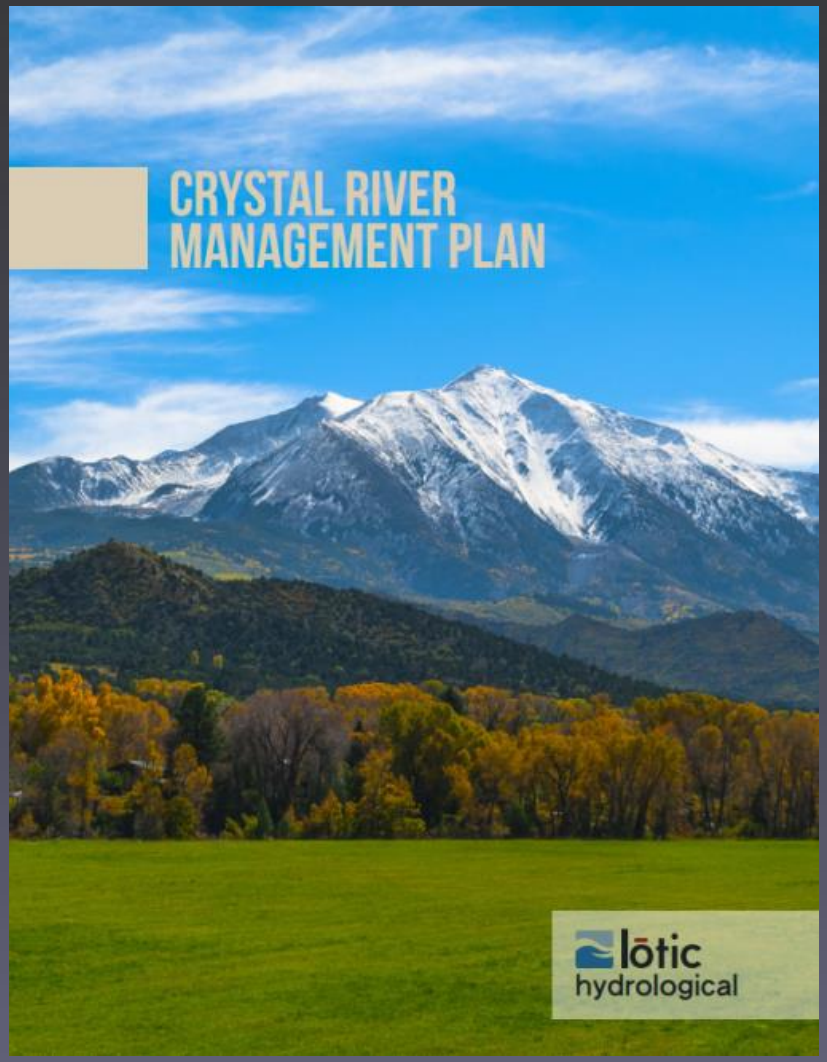
Mark Beardsley
EcoMetrics
January 23, 2017

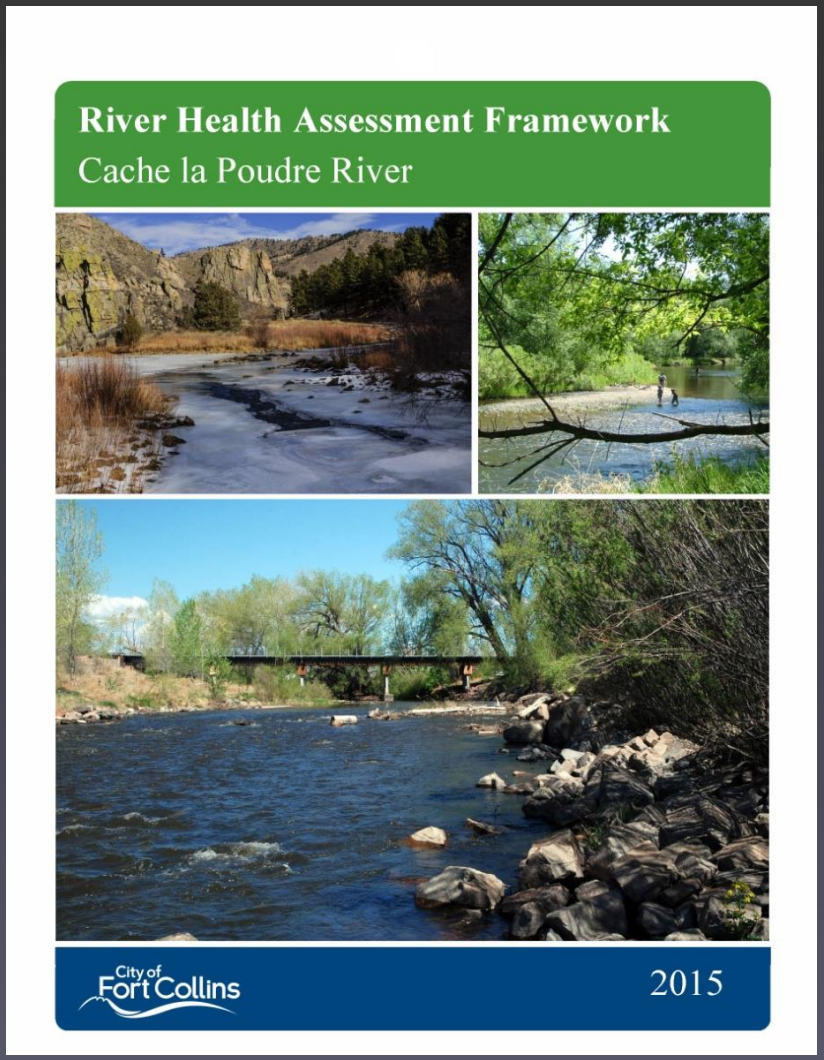
Ralston Creek Assessment Report, 2016

Prepared for Jefferson County
Open Space
By Jessica Doran, David Sutherland and
Mark Beardsley

EcoMetrics
Stream & Riparian Monitoring, Assessment & Restoration

Retool



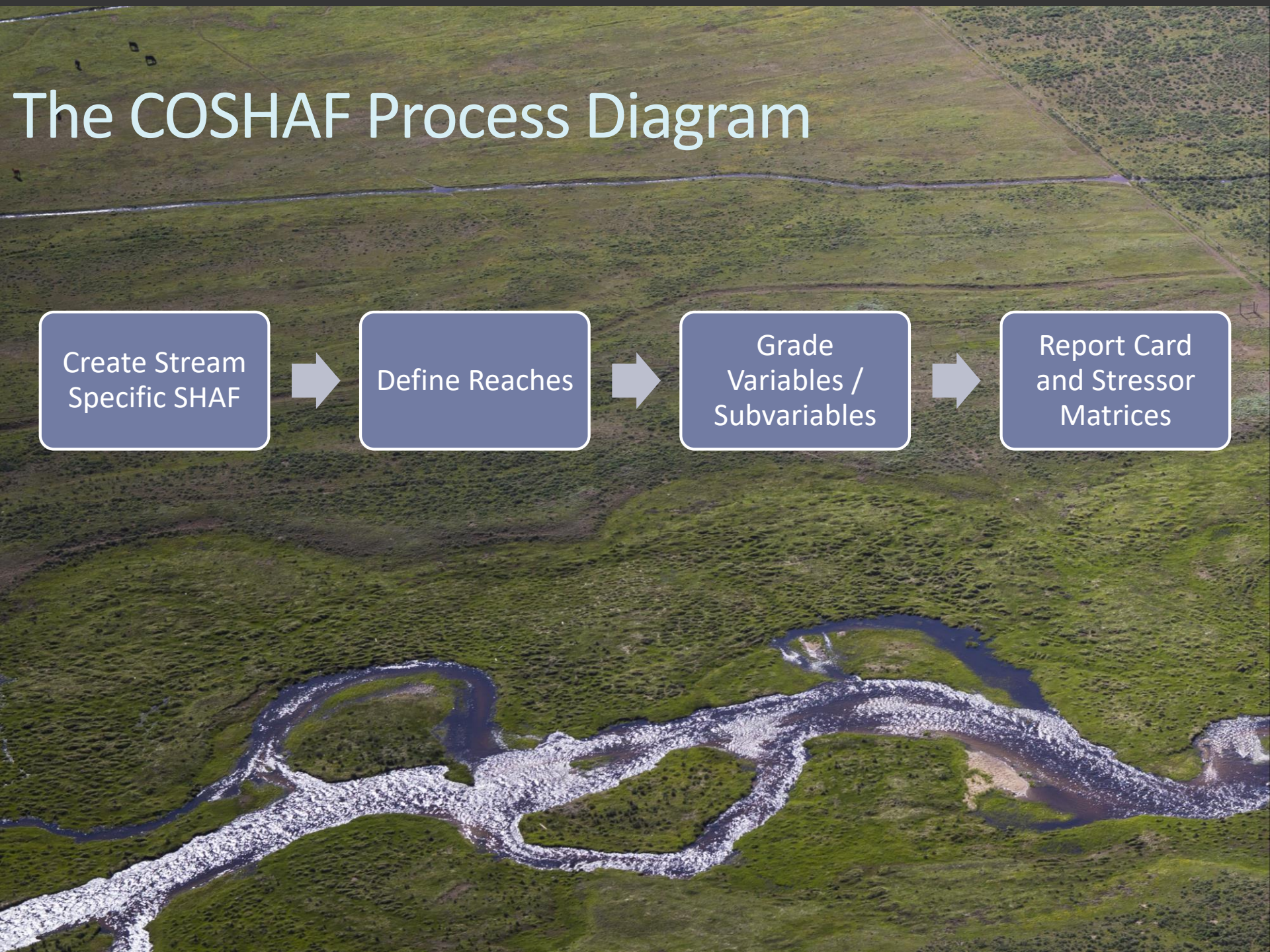


City of Steamboat Springs

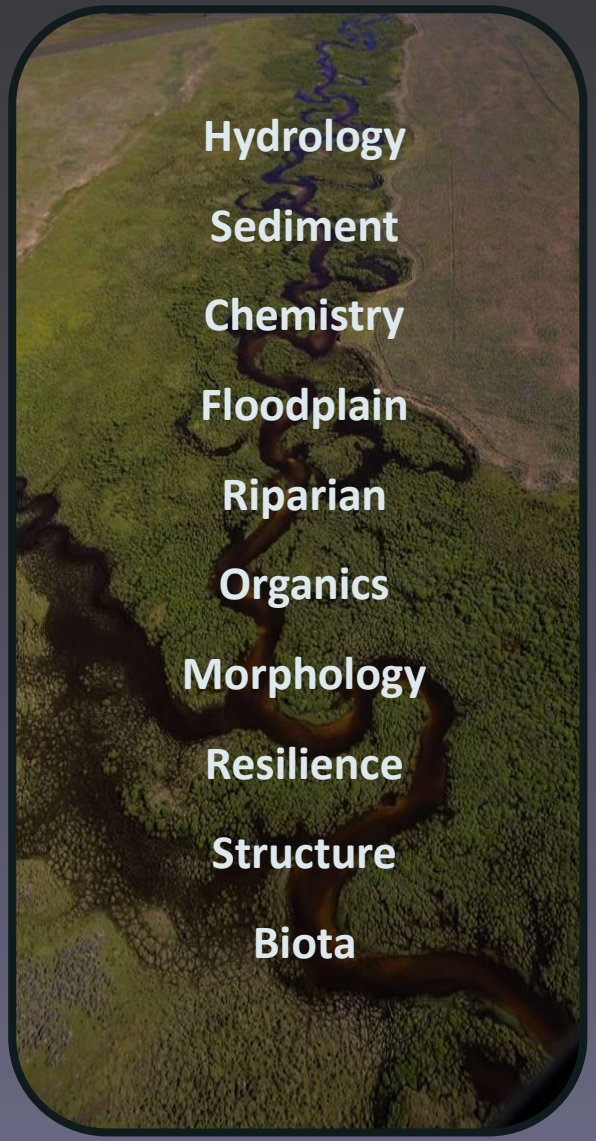
Colorado STREAM HEALTH ASSESSMENT FRAMEWORK

Creating and Implementing a Health Assessment Framework for your Stream

The COSHAF Process Diagram



CO Stream Health Assessment Framework: Introduction

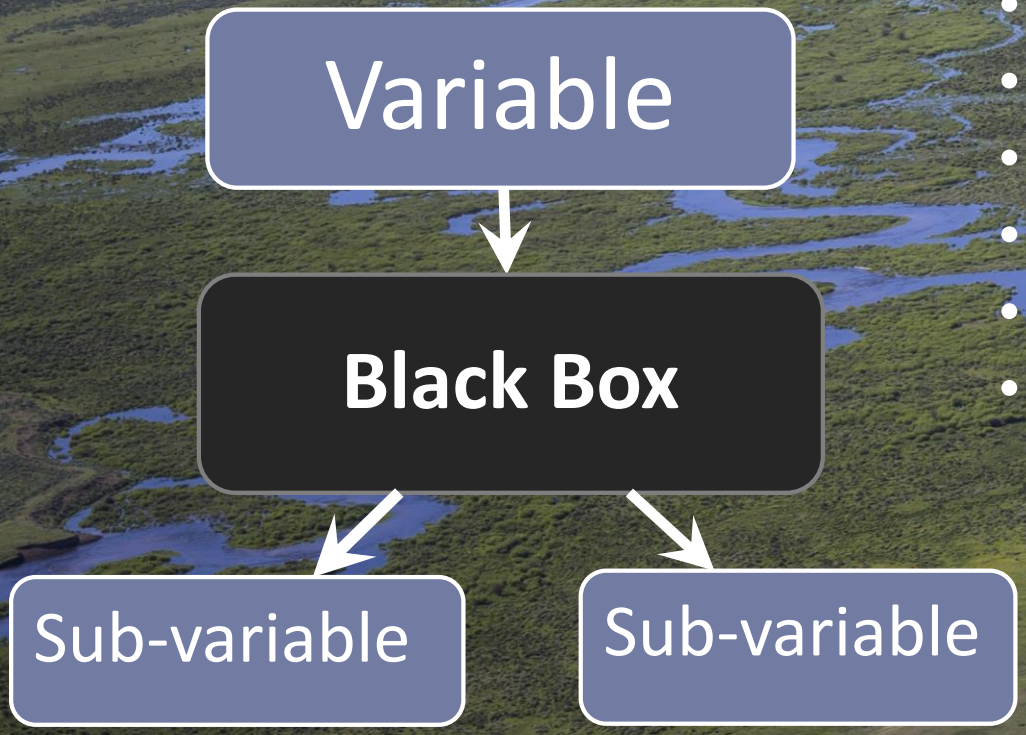


Health Variables

- Hydrology
- Sediment
- Chemistry
- Floodplain Connection
- Riparian Condition
- Organics
- Channel Morphology
- Resilience
- Habitat Structure
- Biota

Grade	Score	Impairment
A	90-100	None
B	80-89	Mild
C	70-79	Significant
D	60-69	Severe
F	50-59	Profound

Customize the COSHAF to your Stream or Watershed



- **ASSESSMENT QUESTIONS**
- **Management goals**
- **Assessment aims & purpose**
- **Data resources**
- **Data gaps**
- **Known issues in watershed**

- Parameters and Methods

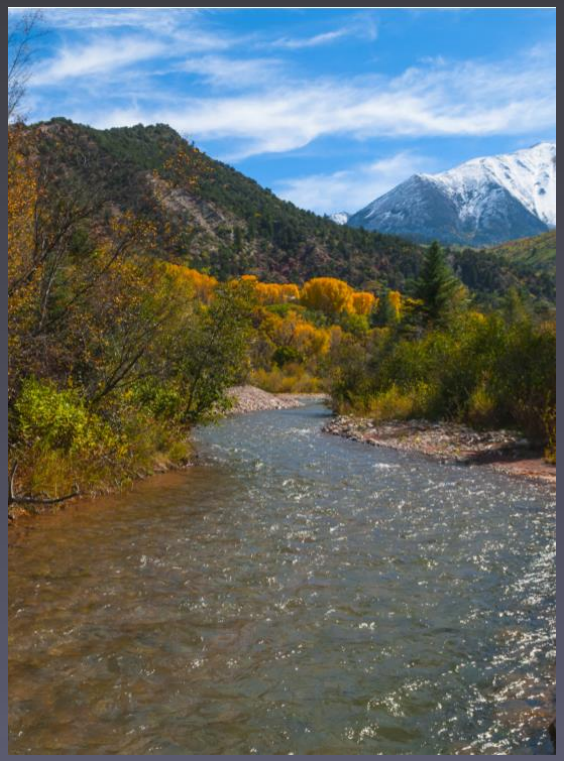
- Parameters and Methods

Potential COSHAF Subvariables

Watershed	Flow regime	Total volume
		Peak flow
		Base flow
		Rate of change
	Sediment regime	Land sources
		Channel sources
		Continuity
	Water quality	Temperature
		Nutrients
		Chemical Condition
	Landscape	Buffer capacity
		Terrestrial connectivity
		Aquatic connectivity
Riparian	Floodplain connectivity	High Frequency
		Medium Frequency
	Riparian Condition	Riparian Condition
	Organic material	Wood
		Detritus
Stream	Morphology	Planform
		Dimension
		Profile
	Stability	Resistance
		Equilibrium
		Resilience
	Physical structure	Macrohabitat
		Microhabitat
	Trophic Structure	Trophic structure

COSHAF Customization – Hydrology Example

FACStream/Crystal



- Total Annual Flow
- Peak Flow
- Base Flow
- Variability

Poudre

- Peak Flow
- Base Flow
- Rate of Change

Yampa

- Total Annual Flow
- Peak Flow
- Base Flow
- Rate of Change

Sub-variable Grading Guidelines

Grade	Impairment
A	None
B	Mild
C	Significant
D	Severe
F	Profound

Base Flows

Grade	Description
A	Base flow magnitude is ample to provide all the functions necessary for a healthy and resilient river ecosystem. There are no dry-ups or other significant stressors and aquatic life is never stressed by altered base flow.
B	Base flow magnitude is less than optimal with minimal effects on stream function. Aquatic life is never critically stressed by altered base flow. Base flows support habitat availability and functional needs of aquatic life. Flows less than 35 CFS occur less than 50 days per year and on less than 50% of days in winter on average. Flows less than 10 CFS occur less than 5 days per year and on less than 10% of days in winter on average. There are no periods of no flow.
C	Base flow alterations are short in duration, or are during times of the season when stream functions are minimally stressed. Base flows support aquatic life needs most of the time, but poor habitat availability and water quality may occur intermittently. Flows less than 35 CFS occur less than 100 days per year and on less than 50% of days in winter on average. Flows less than 10 CFS occur less than 10 days per year and on less than 10% of days in winter on average. There are no periods of no flow.
D	Altered base flow patterns are common and measurably affect stream function. Flows less than 35 CFS occur less than 150 days per year on average. Flows less than 10 CFS occur less than 100 days per year and on less than 60% of days in winter on average. There are less than 20 days per year with no flow on average.
F	Altered base flow patterns have critically reduced stream function, including eliminating native or desired species, violating water quality standards, and/or other irreversible changes. Flows less than 10 CFS occur more than 100 days per year and on less than 60% of days in winter on average. There are 20 or more days per year with no flow on average.

[3] Corresponds to values contained in the Ecological Response Model (ERM).

Grading Sub-variables

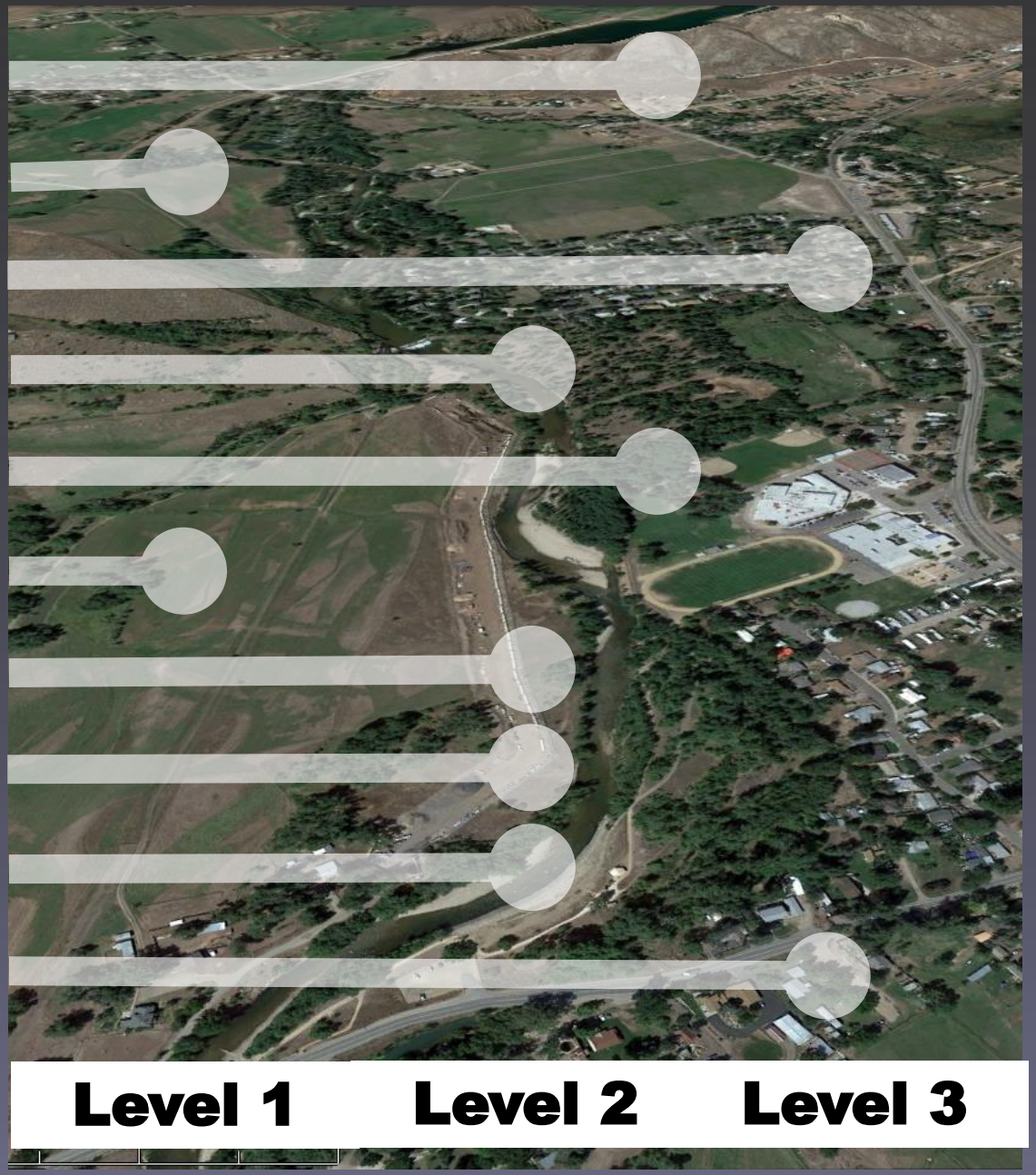
Level 1 Remote

Level 2 Rapid Field

Level 3 Intensive

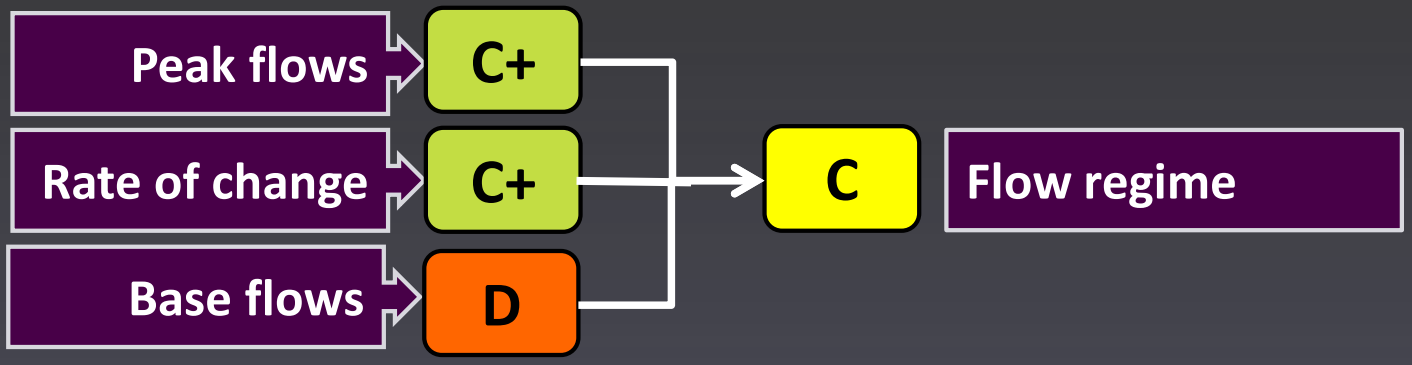
Effort levels may vary

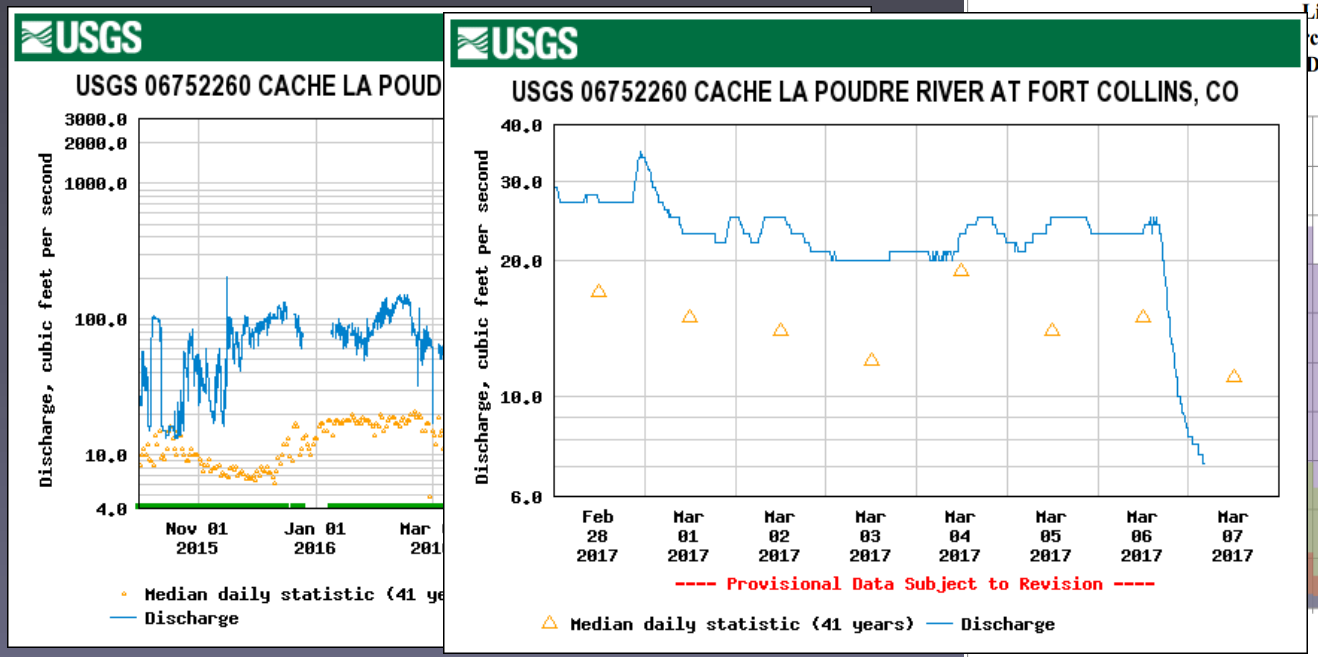
Flow regime	C
Sediment regime	B-
Water chemistry	B
Floodplain conn.	B
Riparian condition	C
Organic material	C
Morphology	C+
Resilience	C
Physical structure	C+
Biota	C

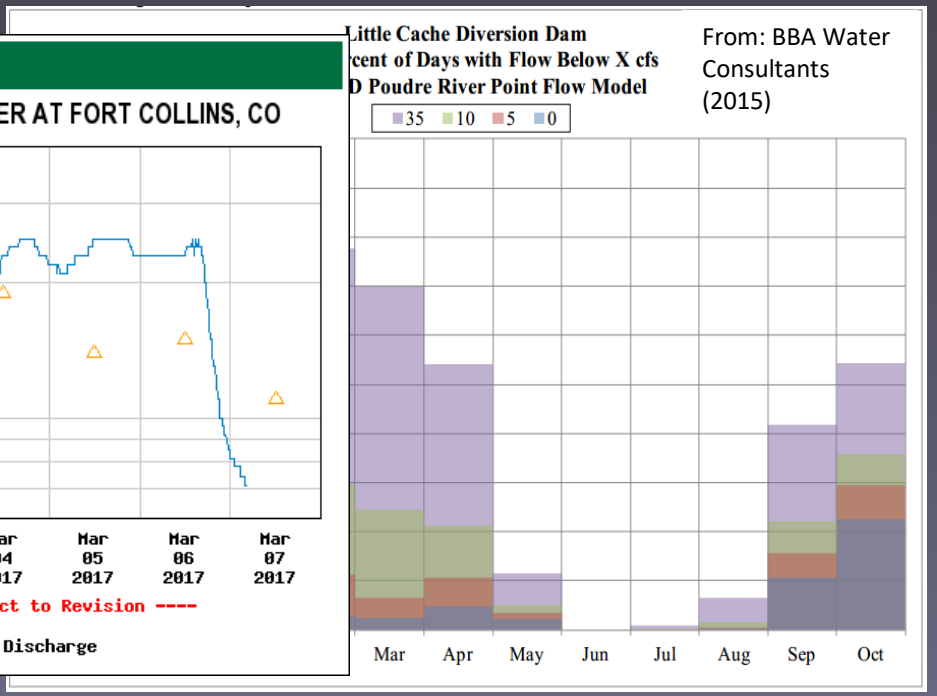


Sub-variable Grading Guidelines & Variable

Grade	Impairment
A	None
B	Mild
C	Significant
D	Severe
F	Profound

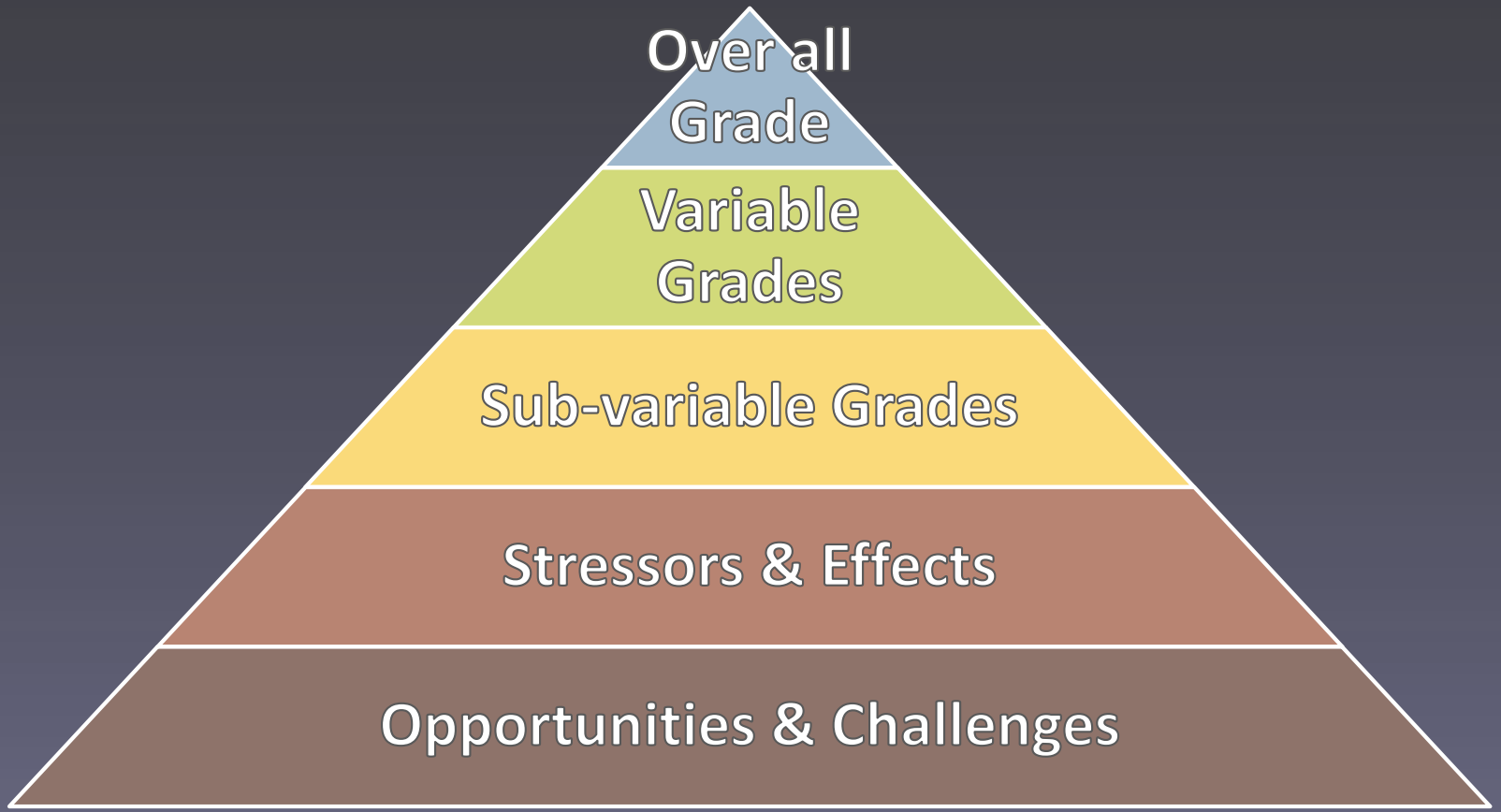






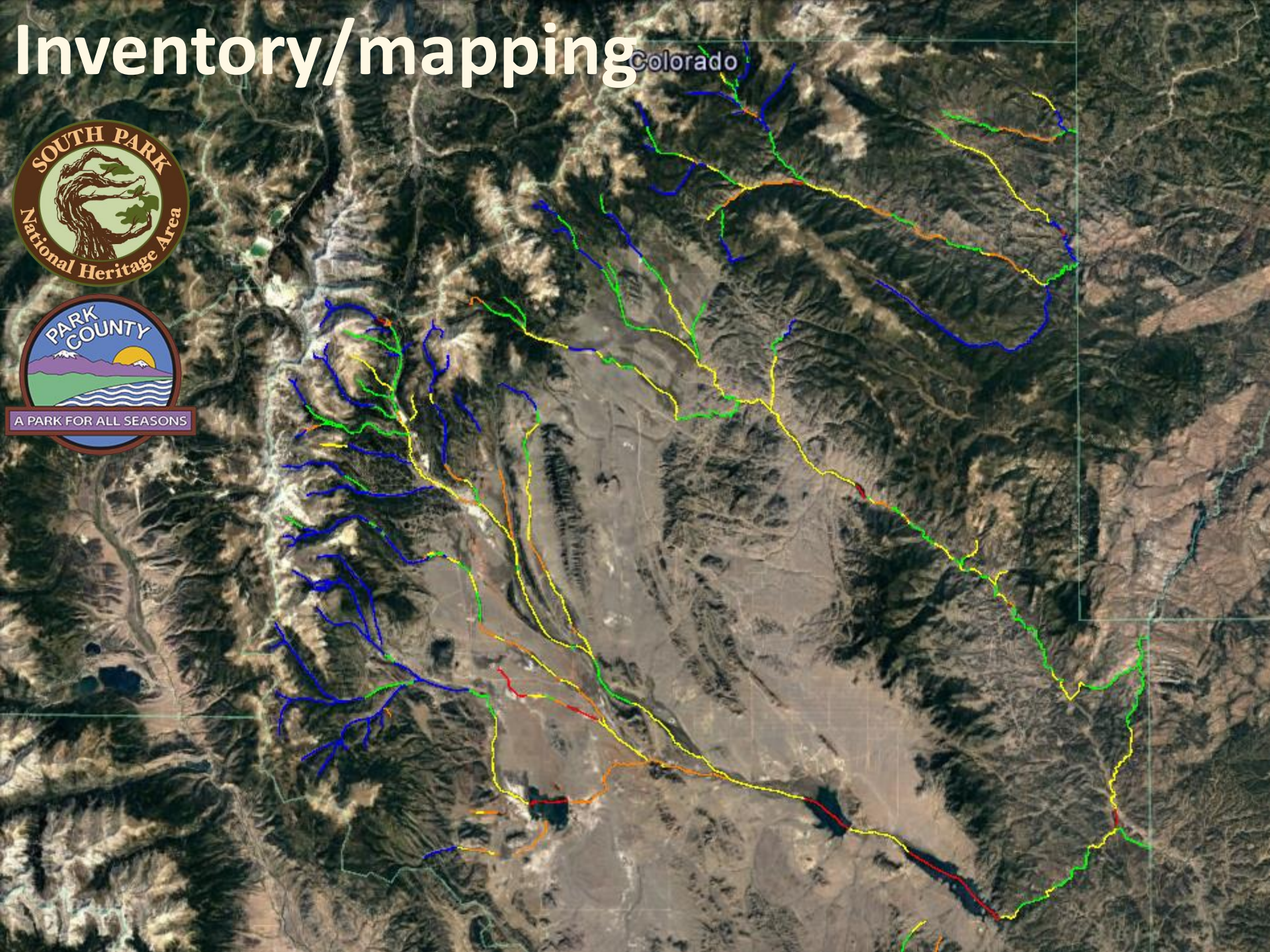
From: BBA Water Consultants (2015)

COSHAF
Is a
Hierarchical Information Framework



Applications and Outputs

Inventory/mapping



Reach Report Card

Flow regime	A
Sediment regime	B
Water chemistry	C-
Floodplain conn.	C+
Riparian condition	B-
Organic material	B-
Morphology	C+
Resilience	C+
Physical structure	B-
Biota	B-
Reach condition	**B-**

Grade	Score	Impairment
A	90-100	None
B	80-89	Mild
C	70-79	Significant
D	60-69	Severe
F	50-59	Profound

Increasing amounts of information

Yampa River Stream Health Report Card: Below Town Segment

Watershed	Flow regime	A	Total volume	A
			Peak flow	A
			Base flow	A-
			Rate of change	A-
	Sediment regime	B	Land sources	B-
			Channel sources	A-
			Continuity	B
	Water quality	C-	Temperature	D
			Nutrients	B
			Chemical Condition	B+
	Landscape	B-	Buffer capacity	C+
			Terrestrial connectivity	B-
			Aquatic connectivity	B
Riparian	Floodplain connectivity	C+	High Frequency	C+
			Medium Frequency	B-
	Riparian Condition	B-	Riparian Condition	B-
	Organic material	B-	Wood	B-
			Detritus	B-
Stream	Morphology	C+	Planform	C+
			Dimension	B-
			Profile	B
	Stability	C+	Resistance	B
			Equilibrium	B
			Resilience	C
	Physical structure	B-	Macrohabitat	B-
			Microhabitat	B
	Trophic Structure	B-	Trophic structure	B-
River Health				B-

Upper Yampa River, Chuck Lewis SWA Segment

River Health Assessment

Causes of Impairment (Estimated Contribution of Stressors)

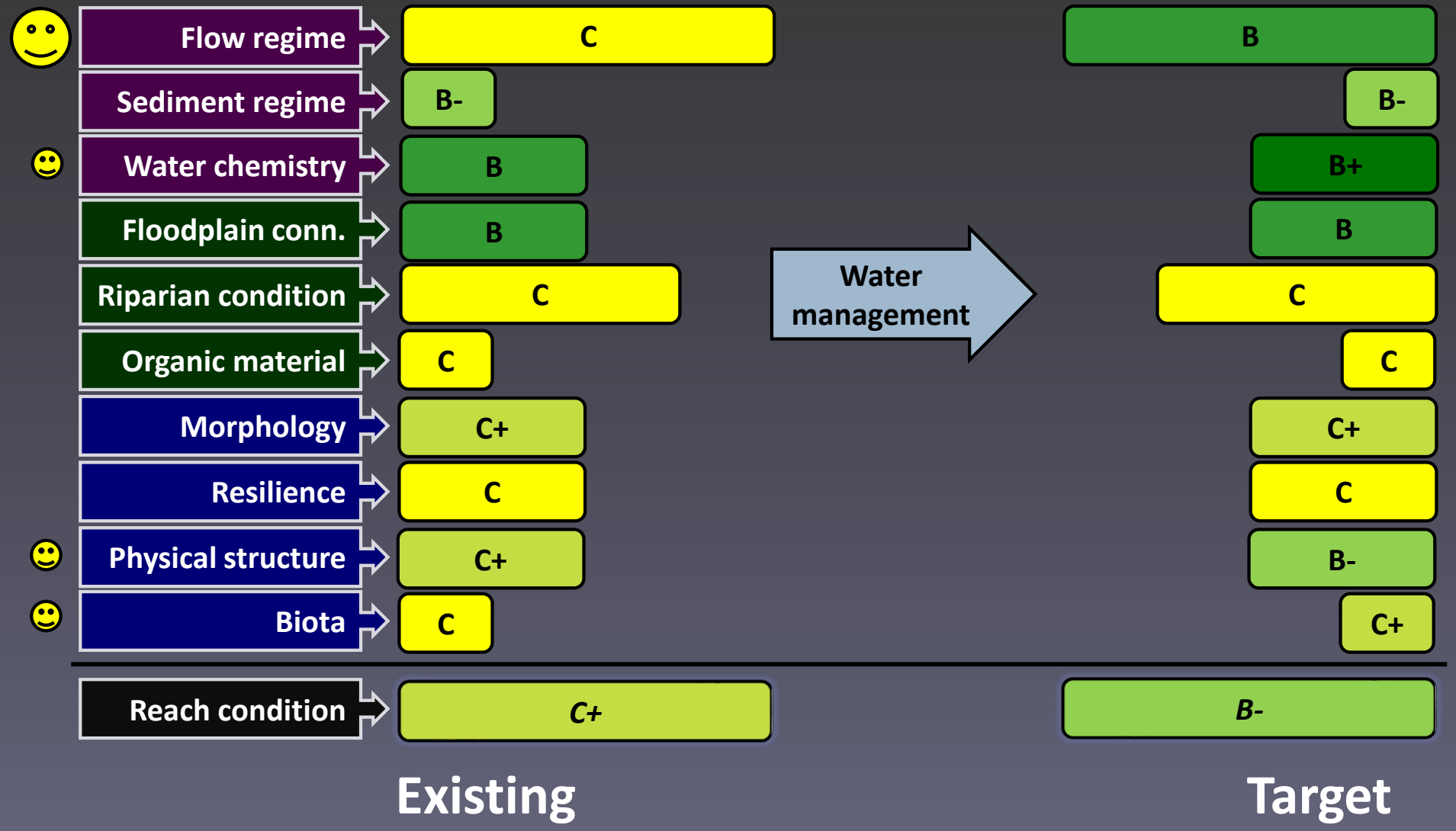
A | B | C | D | F — Reach Condition

None | Low | Moderate | High | Extreme — Stressor Contribution

1.1	1.2	1.3	1.4	1.5
2040 ft	1270	2320 ft	2930 ft	2010 ft

		Water use/management	Large dams/reservoirs (Stagecoach, Catamount)	Watershed land use	Watershed channel erosion	Irrigation runoff/ return flows	Development	Rural/agricultural land use	Aggregate mining	Road/bridge	Levees/ channelization	Bank/channel armor	Channel structures (dams/wiers)	Woody material recruitment/removal	Exotic plant species/weeds	Exotic aquatic species
B+	Flow Regime															
B	Sediment Regime															
C-	Water Quality	*Causes of temperature impairment unknown*														
B	Landscape															
D+	Floodplain															
B-	Riparian Condition															
B-	Organic Material															
C-	Morphology															
C-	Stability															
C	Physical Structure															
C	Trophic Structure															
C	River Health															

Evaluating alternatives



Monitoring

Colorado
EWP
Projects

THANK YOU!

Colorado State University
Colorado Water Conservation Board
Colorado State Land Board
Colorado Department of Transportation
Colorado Parks and Wildlife
City of Fort Collins (RHAF Team)
US Environmental Protection Agency
US Army Corps of Engineers
Colorado Riparian Association
Colorado Natural Heritage Program
Lotic Hydrological
Acclivity Associates
Otak
Jessica Doran & Dave Sutherland (EcoMetrics)

Please visit the EcoMetrics Website to download FACStream materials: http://www.ecometricscolorado.com/functional-assessment.html

Brad Johnson: bjohnson-jec@comcast.net
Mark Beardsley: mark.ecometrics@gmail.com