Colorado River Health Assessment Framework
CoRHAF

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Watershed Scientist

What is CoRHAF?

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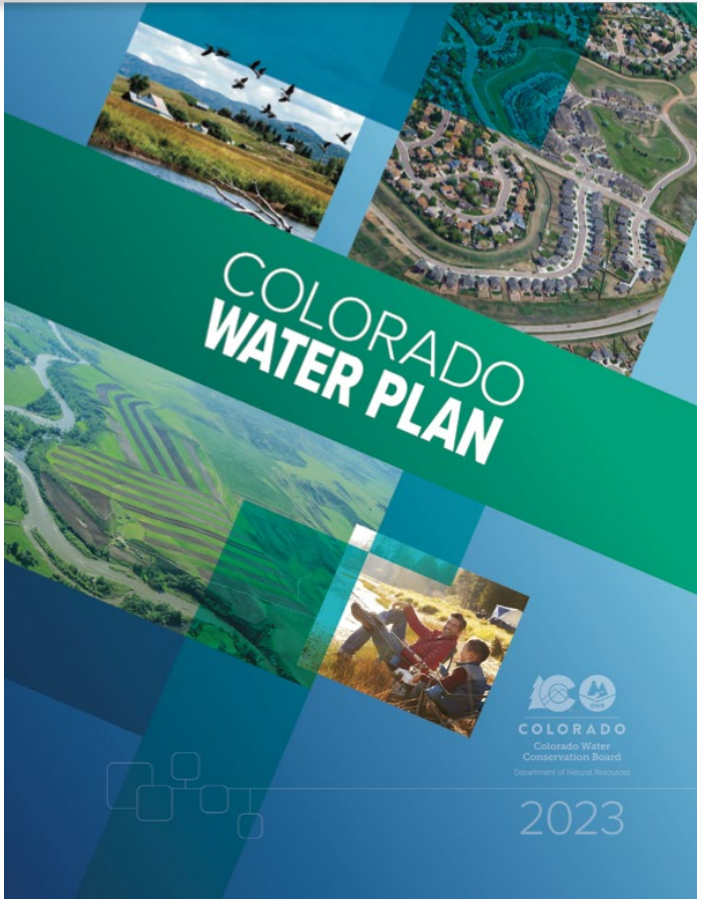
Agency Action 3.1

A comprehensive framework to guide the assessment of stream and river health throughout Colorado

Intended to support those endeavoring to understand the conditions of Colorado's waterways



What is an RHA?

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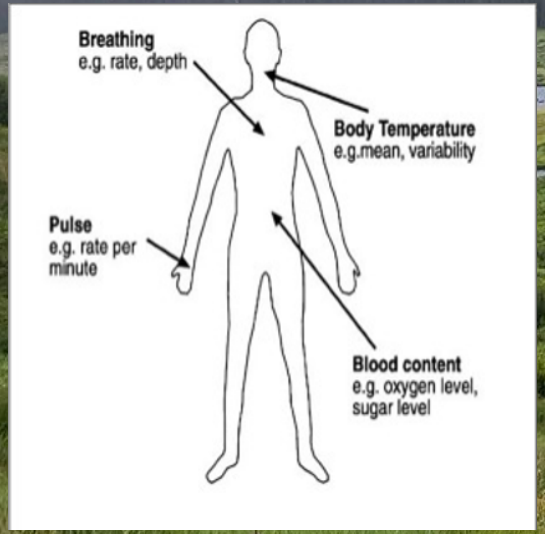
What is "Health"



The ability of an organism or one of its parts to perform its vital functions normally or properly

- Anatomical, physiological, psychological integrity
- Ability to perform valued roles
- Ability to deal with stress

What is an RHA?

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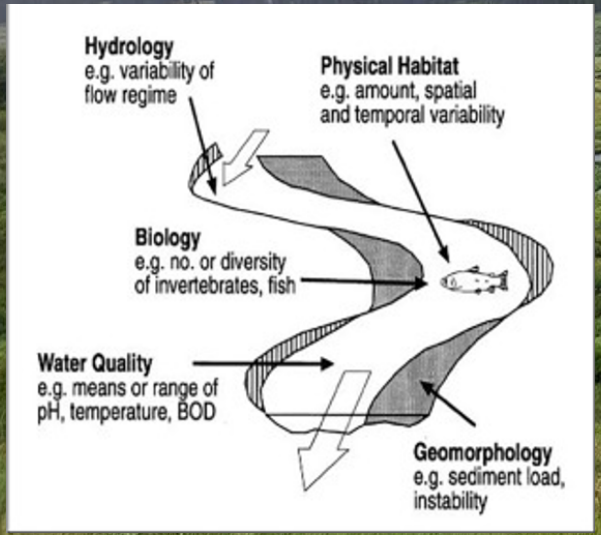
What is “River Health”



The ability of a stream or river to perform its vital functions normally or properly

- Structural, physical, biological integrity
- Ability to perform valued roles
- Ability to deal with stress (resiliency)

What is an RHA?

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Sleeping Elephant, Poudre River Canyon (Ayres Associates, 2023)

Why do CoRHAF?

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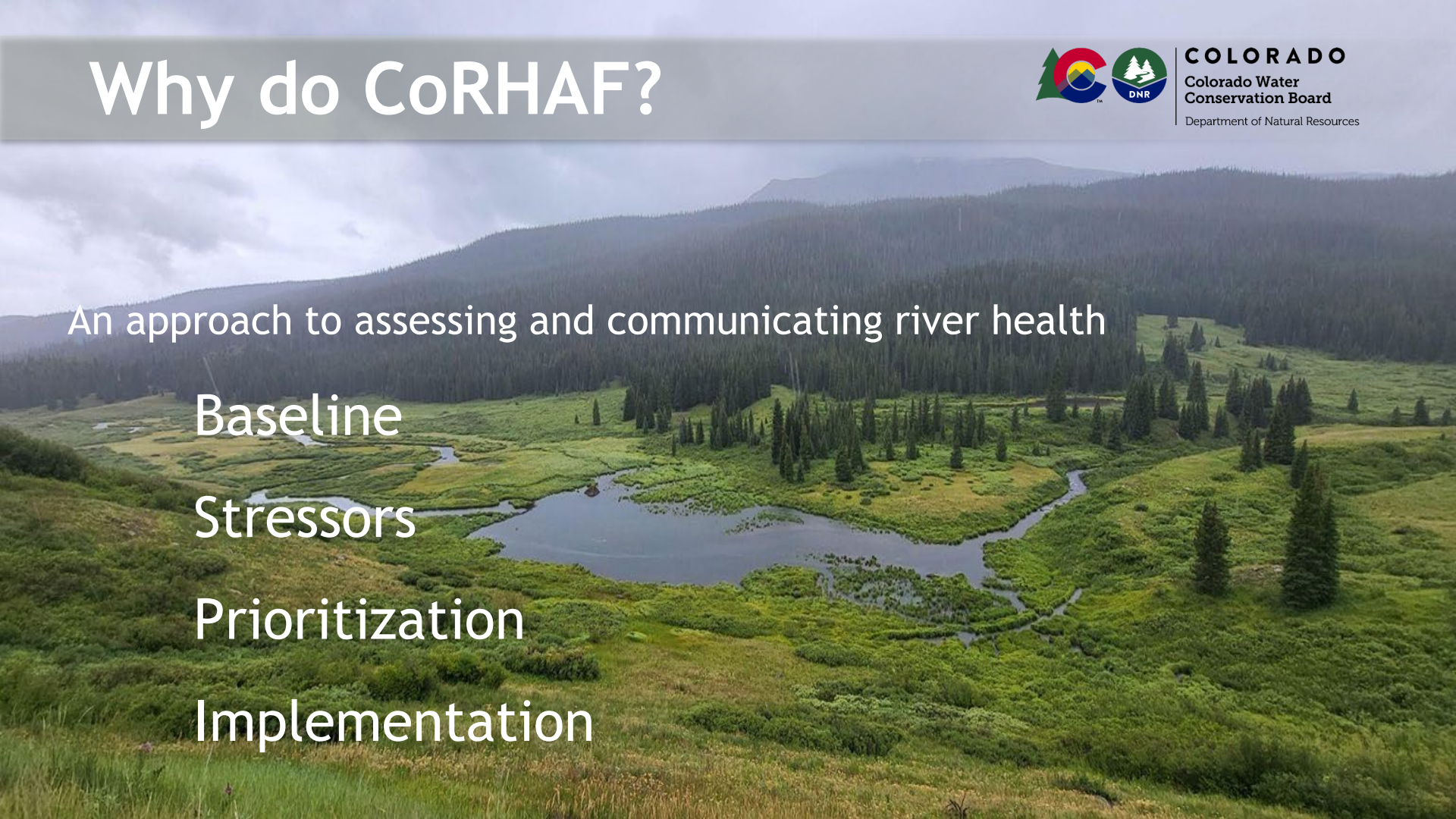

An approach to assessing and communicating river health

- Baseline
- Stressors
- Prioritization
- Implementation

Before you Begin

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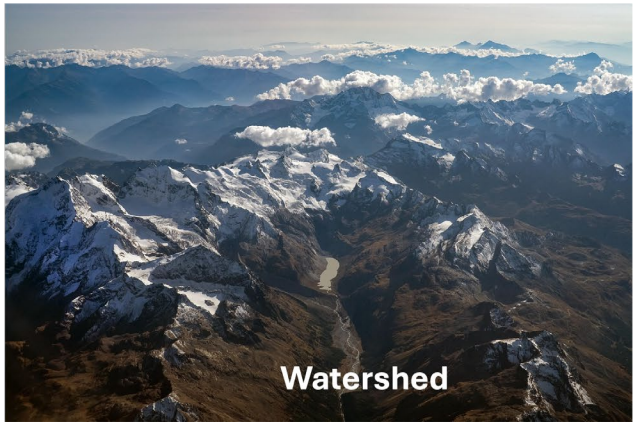
- Engage stakeholders
- Articulate your purpose
- Assembling a technical team
- Scope your assessment



Assessment Intensity

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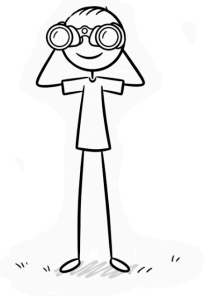
Level 1 – Remote Assessment

Level 2 – Rapid Assessment



Level 3 – Focused Assessment

The Framework

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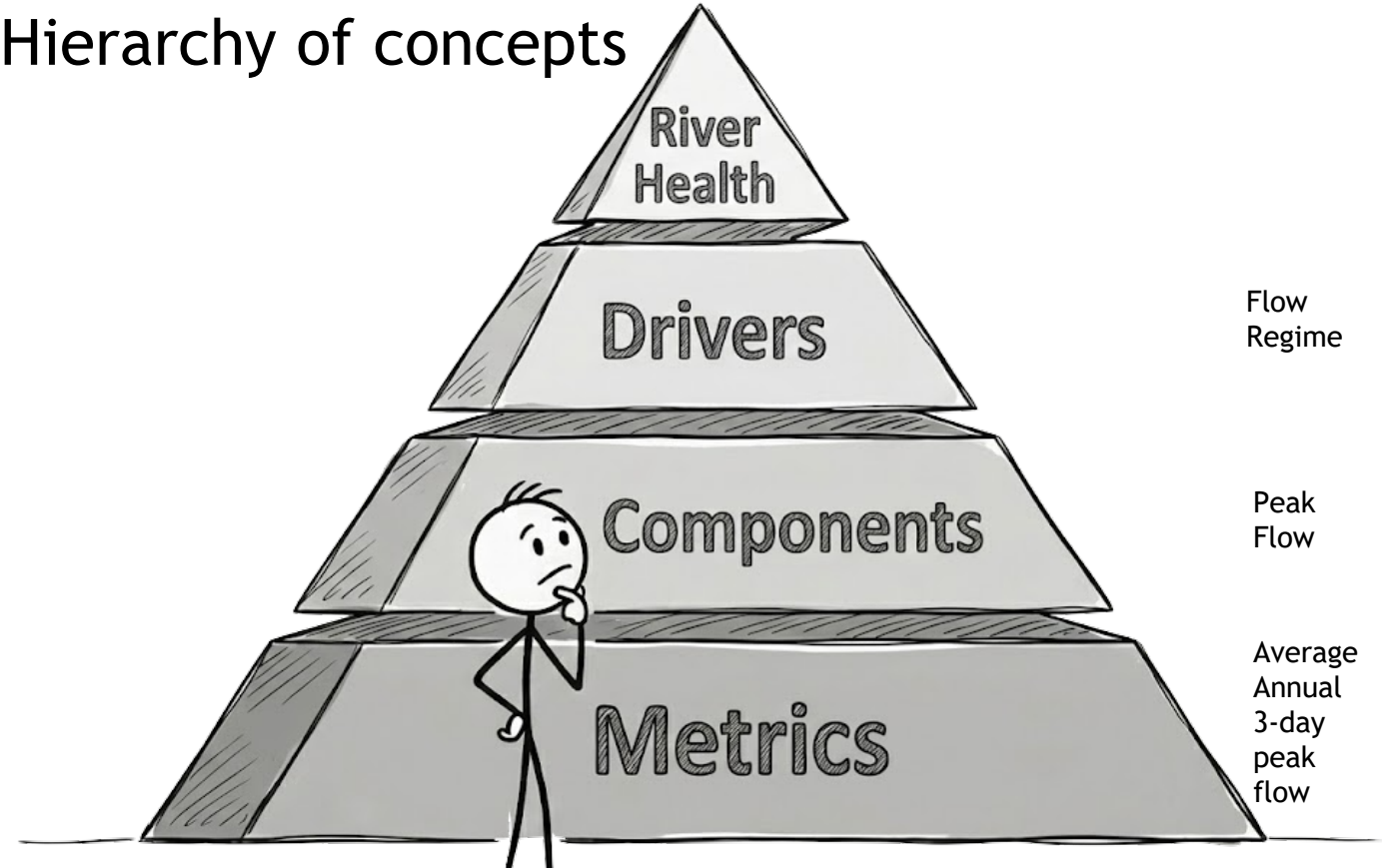
River Health = Hierarchy of concepts



The Framework

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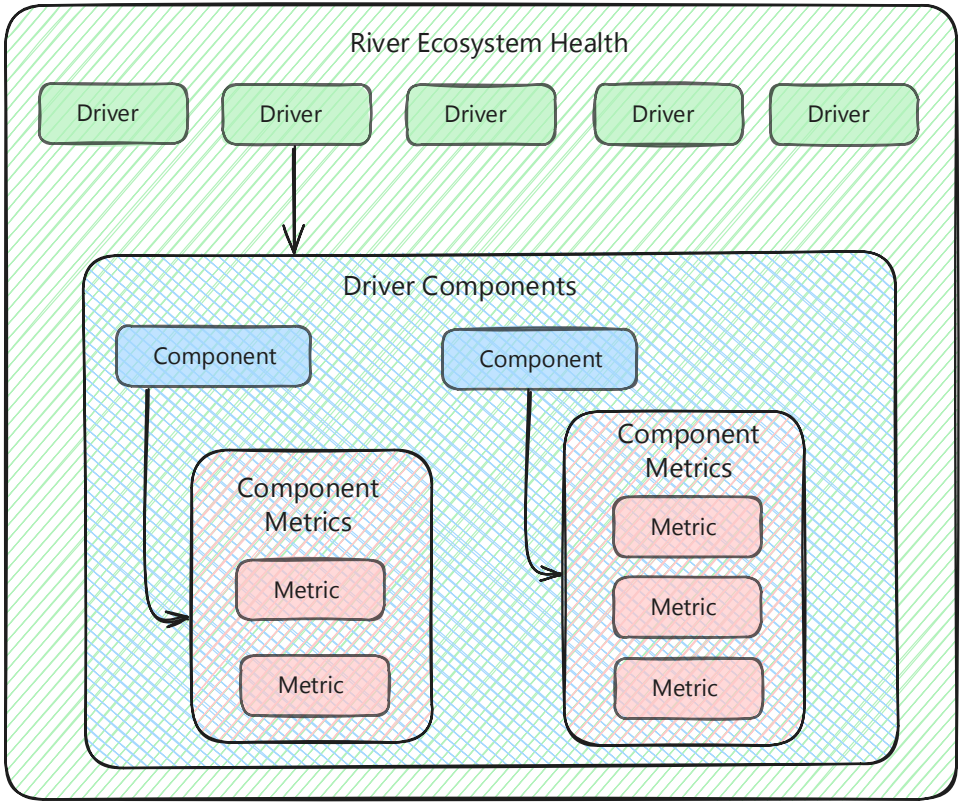

Drivers

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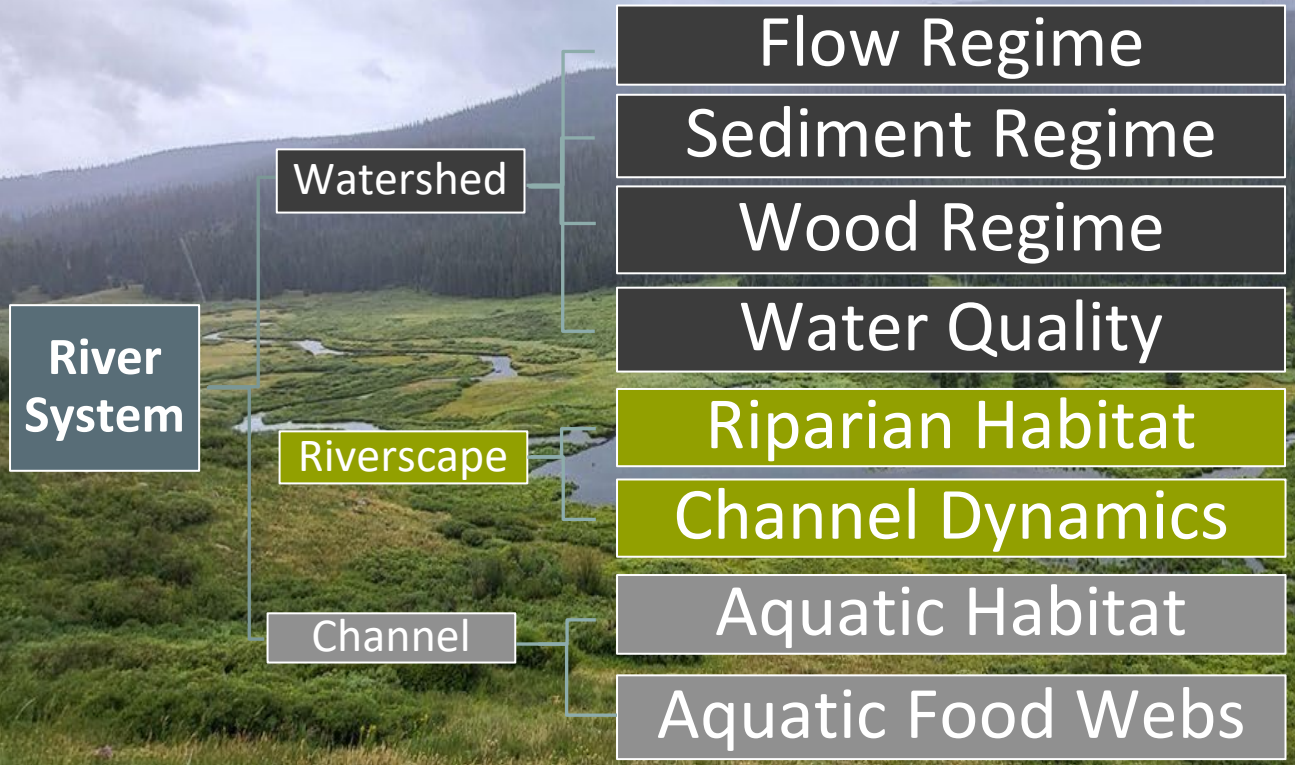

Components

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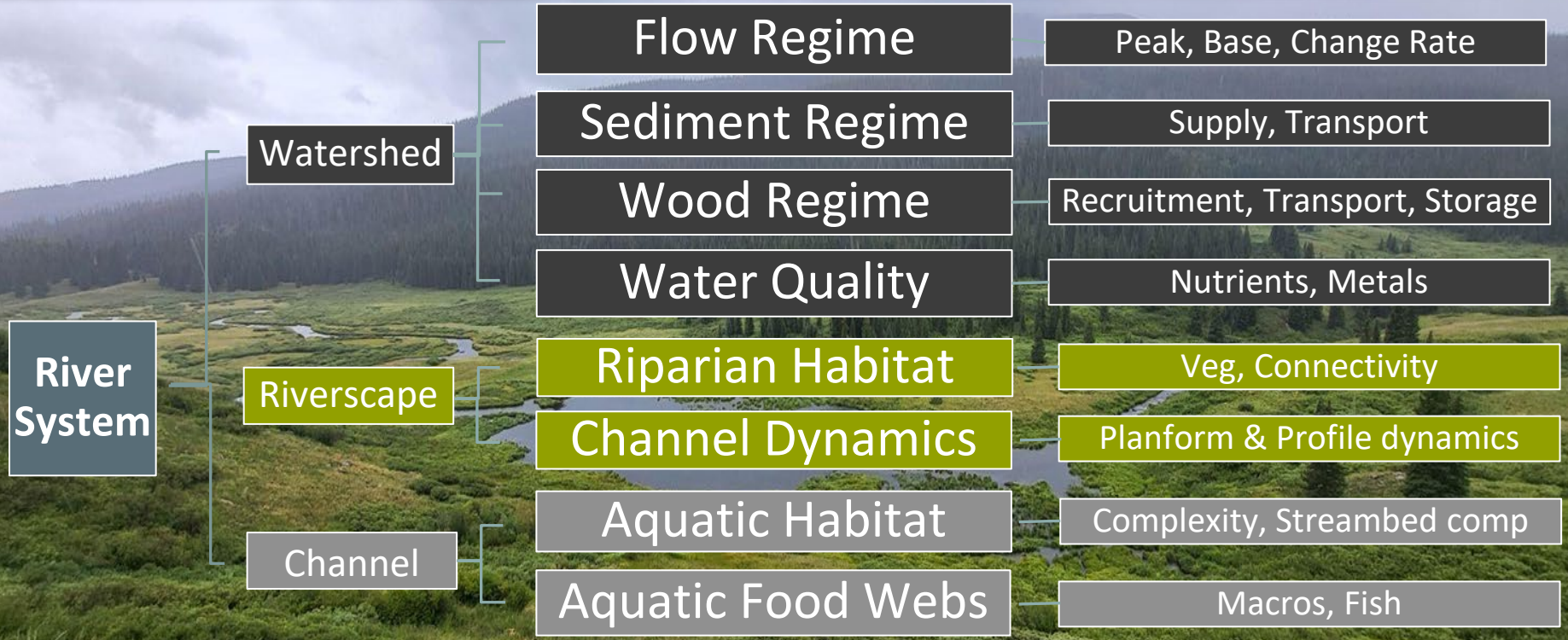

Metrics

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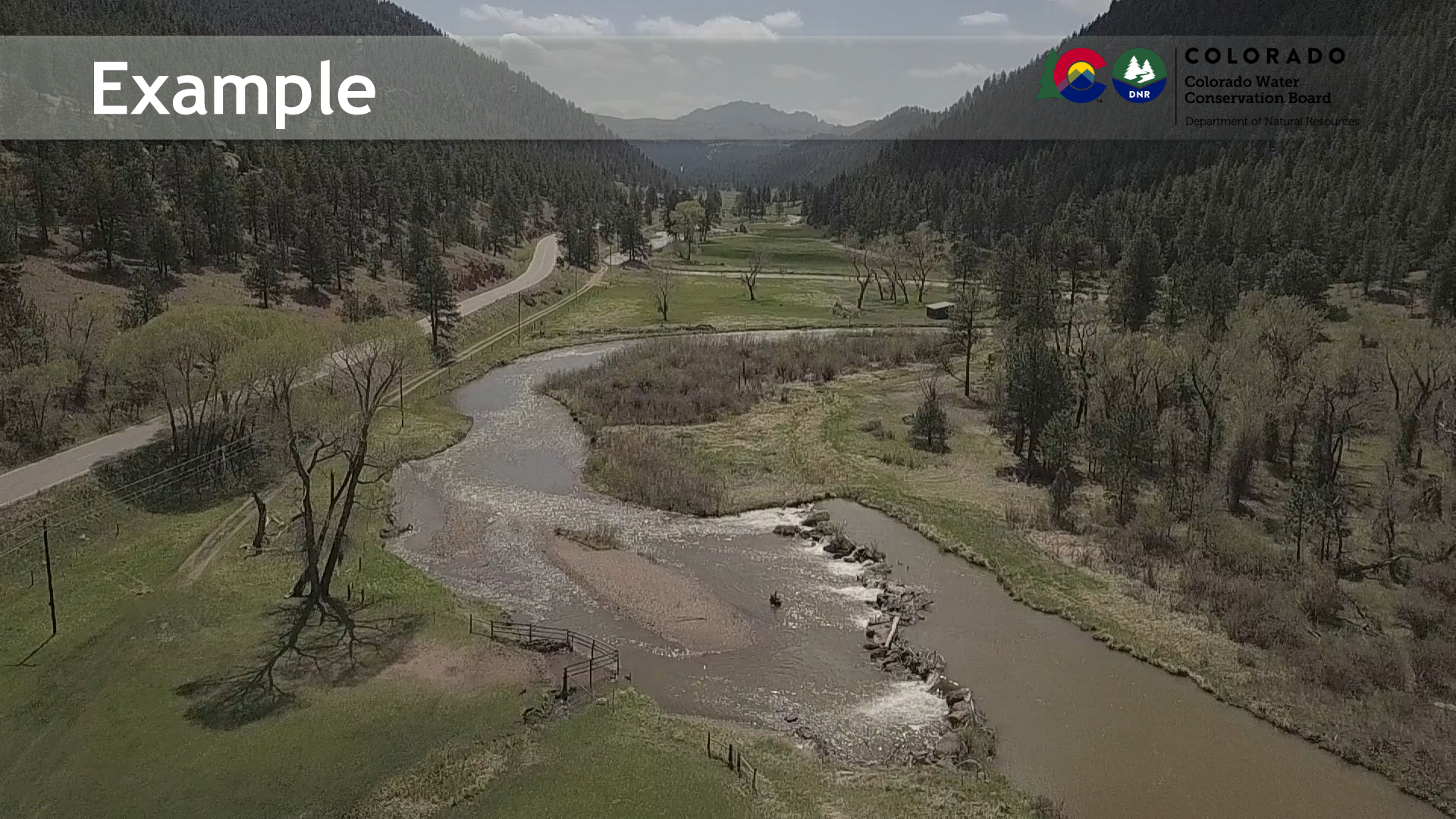
Drivers	Components	Metrics
Flow Regime	Peak Flow	Average annual 3-day max
	Base Flow	Average annual 7-day min
Water Quality	Nutrients	85th percentile nitrate
	Metals	85th percentile dissolved zinc
	Physical Parameters	Min Oct. DO concentration
Riparian Habitat	Riparian Habitat Connectivity	Probability of connectively index
	Riparian Vegetation	Percent woody cover

Example



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Example

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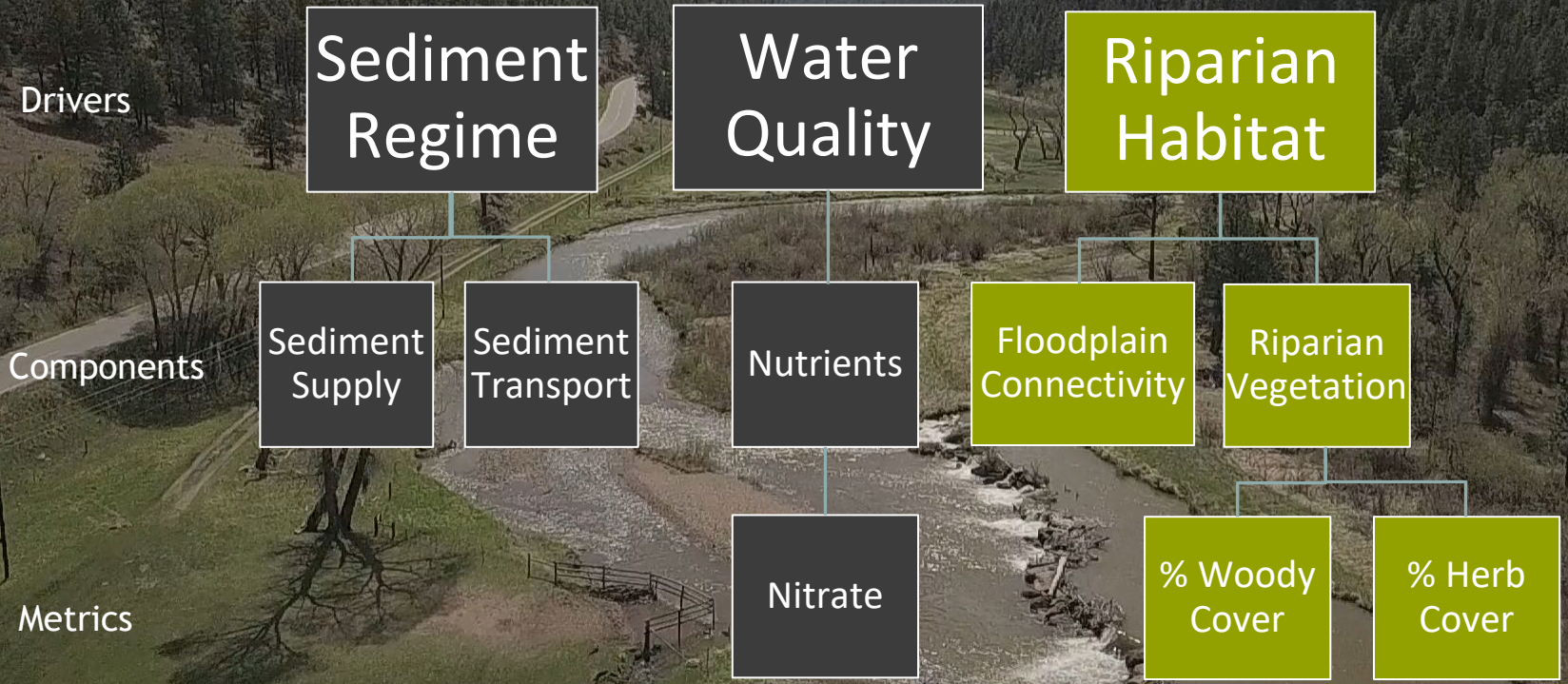

Grading Guidelines

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Component: Sediment Transport

Grade	Qualitative Guidelines
A	The amount of sediment delivered to, and transported through, the reach is at natural levels. Impediments to sediment continuity and transport are trivial if they exist.
B	Impediments to continuity and transport mildly impact sediment movement to the reach from the watershed and through it. Examples include small dams higher on the main stem or major dams on tributaries.
C	There are moderate to substantial impediments to sediment continuity and transport in the watershed, but these impediments either pass a portion of sediment or they are remote enough from the reach that contributions from the contributing area have allowed partial recovery of the sediment regime. Reaches far below major dams are an example.
D	Major and frequent impediments to sediment delivery severely block sediment from the contributing area.
F	Major impediments to sediment delivery trap most or all incoming sediment, supplying the downstream reach with clear-water discharge. Examples include tail waters directly below major dams.

Grading Guidelines

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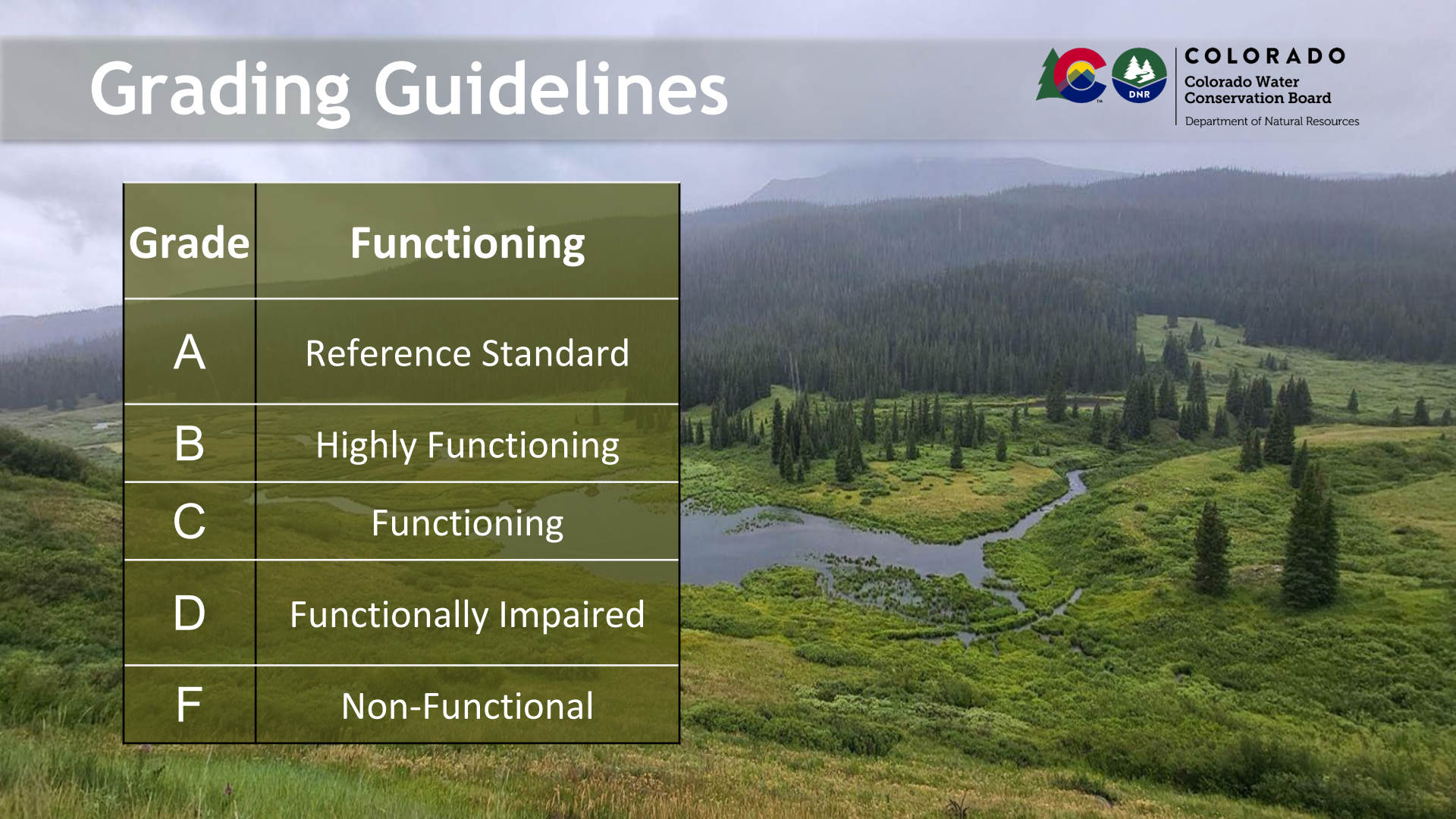
Grade	Functioning
A	Reference Standard
B	Highly Functioning
C	Functioning
D	Functionally Impaired
F	Non-Functional



Grading Guidelines

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Grade	Functioning	Level of Alteration
A	Reference Standard	Negligible
B	Highly Functioning	Mild
C	Functioning	Significant
D	Functionally Impaired	Severe
F	Non-Functional	Profound

Grading Guidelines

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Grade	Functioning	Level of Alteration	Level of Impairment
A	Reference Standard	Negligible	Self-sustaining
B	Highly Functioning	Mild	Mild
C	Functioning	Significant	Substantial
D	Functionally Impaired	Severe	Severe
F	Non-Functional	Profound	Profound

Grading Guidelines

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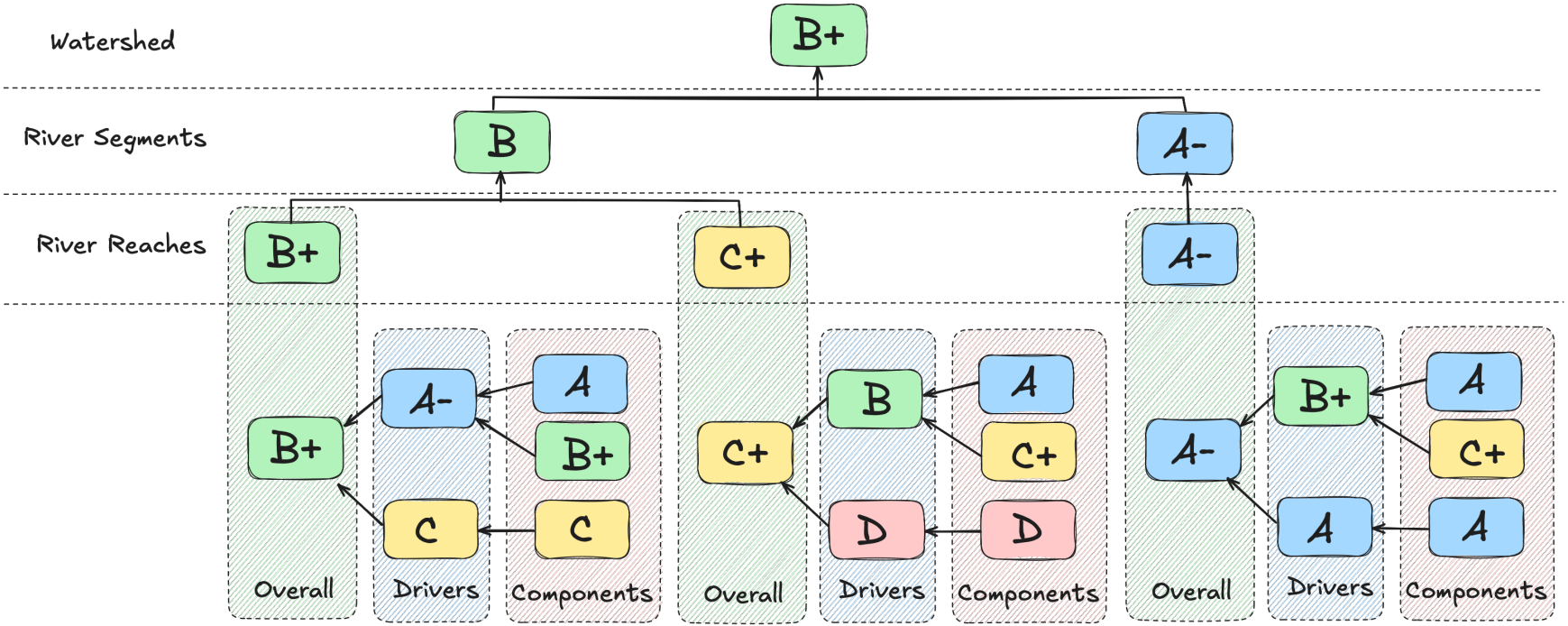

Grading Guidelines

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Resources

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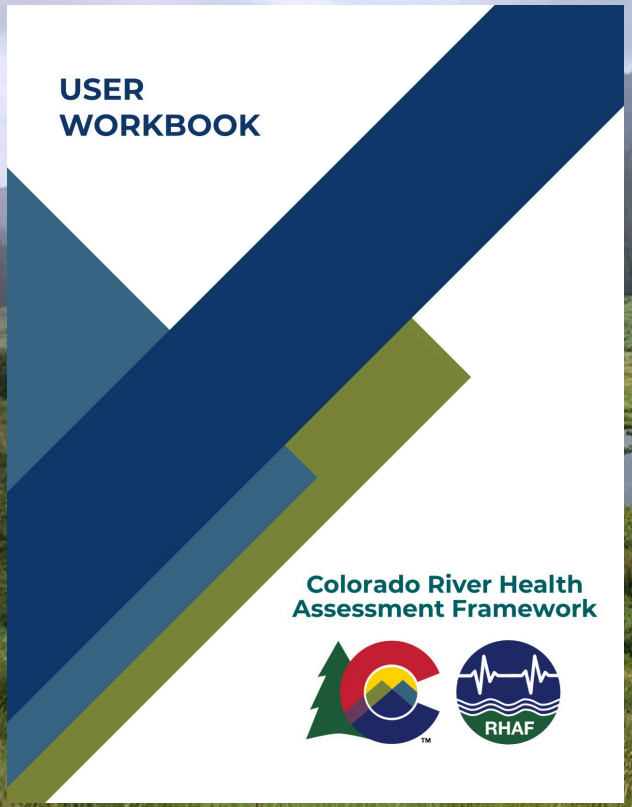

- RHA Planning Workbook
- CoRHAF Template
- Drivers
- Components
- Metrics
- Grading Worksheet
- Example Grading Worksheet

CoRHAF Template

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CoRHAF Template

Position in the RHAF	Tier 1	Tier 2			
Instructions	***Start Here.*** *- In the cells below, indicate which **Drivers** you will include in your RHAF.* *- For those **Drivers** to be assessed, will that be done **holistically** or though break out of **Components**? Holistically assessed **Drivers** will be given grades using Driver grading guidelines. The ready-made CoRHAF **Driver** grading guidelines can be accessed by double clicking the **Driver** name. If you would like to use different guidelines or modify these to your purpose, you are welcome to.* *- In the box below record your answers to the above. For those Drivers which will be assessed holistically, describe the reasons for doing so and describe the approach to assessment (e.g., remote assessment using GIS and Google Earth).* *- You may choose to include additional **Drivers**. If you intend to evaluate those holistically - that is, at the **Driver** level - you will need to create grading guidelines. The CoRHAF website ****link can help you out with that.* *- For those Drivers to be evaluated using **Components**, move to Tier 2 to the right.*	*The cells below contain a generic set of CoRHAF **Components** that has proven useful in a variety of settings.* *- Indicate, with a mark, which **Components** you plan to use.* *- For each selected **Component**, do you intend to evaluate it holistically or break it down into **Metrics**? Record your answer below.* *- Holistically assessed **Components** will be given grades using **Component** grading guidelines. The ready-made CoRHAF **Component** grading guidelines can be accessed by double clicking the **Component** name. If you would like to use different guidelines or modify these to your purpose, you are welcome to.* *- If you select **Components** that are not in the list below you will need to create grading guidelines for the holistically evaluated ones.*	***Components** that will be evaluated holistically require grading guidelines. Below, identify grading guidelines that will need to be drafted or adopted from an existing RHAF. For guidelines adopted from an existing RHAF, list the source for reference.*	*Answer the questions posed about data sources.* *-Based on the responses to this question, you may need to go back and revisit your list of **Components** if you lack information on a **Component** and will not be able to fill that information gap.* *- Note, that newly instituted programs monitoring **Drivers** such as Water Quality or Flow Regime are valuable for future assessments, but they will have too short of a period of record to be of use in a concurrently developed RHA.*	*Metrics tend to be specific to individual rivers or assessments. CoRHAF does not have a generic set of **Metrics** but it does provide example **Metrics** for the **Components** that are commonly broken down.* *- Enter the **Metrics** you plan to use in your RHAF.*

Building Your River Health Assessment Framework	Drivers		Describe how Drivers will be evaluated. Include a rationale	✔	Components	Holistic or Metric Assessment	Do you have Grading Guidelines for the Components that need them? (Check one) YES	NO	Source?	Do you have existing data or information regarding the Component? If so list available data sources. Otherwise, will new data be collected?			Metrics
	Watershed Drivers	Flow Regime			Peak Flow								
					Base Flow								
					Total Volume								
					Rate of Change								
		Sediment Regime			Watershed Supply								
					Local Supply								
					Continuity and Transport								
		Water Quality			Nutrients								
					Physical Parameters								
					Metals								
		Wood Regime			Transport and Storage								
					Recruitment								
	Reach Drivers	Riparian Habitat			Riparian Vegetation								
					Floodplain Connection								
					Riparian Habitat Connectivity								
					Floodplain Morphology								
		Channel Dynamics			Planform Dynamics								
					Profile Dynamics								
	In-Channel Drivers	Aquatic Habitat			Reach Complexity								
					Streambed Composition								
					Aquatic Habitat Connectivity								
		Aquatic Food Web			Macroinvertebrates								
					Fish								

Grading Worksheet

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Wooksheet Example

This is a hypothetical example based on a type of situation that may be encountered in mid-watershed river reaches.

Level of Channel Confinement	Select answer from the dropdown menu to fill out box.	Provide a brief description of the reach/river, along with any other pertainent information.
	Confined	This is a hypothetical example of an assessment of a middle-elevation reach on a free-flowing river in a rural landscape, with substantial forest land in the nearby upper watershed. The reach is naturally confined, but is intermittantly further confined by rail and road grades. There are multiple agricultural diversions stemming from the channel tributaries and municipal diversion of a tributary.

Overall Grade	Overall Score	Driver	Driver Grade	Driver Score	Component	Component Grade	Score	Explanation	Driver Roll up
C	77	Flow Regime	C-	72	Peak Flow	B-	82	Municipal diversion runs all year, agricultural diverson run throughout growing season. No upstream reservoirs so peak flows still remain strong. Main impact is dry season diversions reducing low flows.	Weighted Average (0.45, 0.275, 0.275)
					Base Flow	D	64		
					Total Volume	D	64		
					Rate of Change (not used)				
		Sediment Regime	B-	81	Watershed Supply	B-	80	Unburned watershed, with a mix of rural development and forest land. Bank stablization is common but stream is naturally confined.	Average
					Local Supply	B-	80		
					Continuity and Transport	B-	82		
		Water Quality	D	65	Nutrients	B	87	Generally high water quality, but temperature excedences are common secondary to water use.	Minimum Score
					Physical Parameters	D	65		
					Metals	A-	92		
		Wood Regime	B	83	Transport and Storage	C+	79	Abundant stream side trees, however, numerous bridge crossings occur that catch LWM	Average
					Recruitment	B	87		
		Riparian Habitat	C	75	Riparian Vegetation	C-	71	Naturally confined generally with a narrow riparian fringe. Where openings occur, vegetation and floodplain surface are generally altered, but the banks are generally still forested. Habitat is commonly fragmented, but the barriers are generally still permeable.	Weighted Average (0.35, 0.3, 0.15,0.2)
					Floodplain Connection	B-	80		
					Riparian Habitat Connectivity	C	77		
					Floodplain Morphology	C	74		
		Channel Dynamics	C+	79	Planform Dynamics	C+	79	Naturally confined but commonly narrowed by RR and highway grades. "pushup" diversions	Average
					Profile Dynamics	C+	78		
		Aquatic Habitat	B	83	Reach Complexity	C+	79	Bank armor reduces complexity, along with some homogenization of flows. Streambed is in good condion but some essessive algae, fine sediment, and occassional bed armoring. Flow is unobstructed, but some potential off-channel habitat is isolated by road/rail grades.	Average
					Streambed Composition	B	85		
					Aquatic Habitat Connectivity	B	85		
		Aquatic Food Web	C+	78	Macroinvertebrates	B	85	Macroinvertabrate populations are in very good condtion. The fishery suffers primarily from low flows. Routine stocking supports fishery.	Weighted Average (0.6,0.4)
					Fish	D+	68		

Communicating Results

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THANK YOU

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