Stream Restoration Monitoring:

How do we define and demonstrate project success?

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Overview

1. **Stream restoration projects vary considerably.**
2. **Monitoring plans must be developed to meet *project-specific* needs.**
3. **Successful monitoring protocols will produce adequate data to assess progress and support corrective adaptive management actions.**
4. **Four central elements of an effective stream restoration monitoring plan.**

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Variation in Stream Restoration Projects

- **Type**
- **Size**
- **Cost**
- **Purpose**

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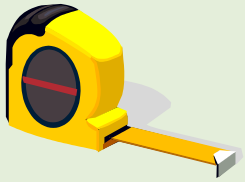
Project Success is Not Generic

- **“Success” needs to be defined**

- **“Success” needs to be measurable**



- **“Success” needs to be manageable**

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Systemic Problems in Reaching Success

National River Restoration Science Synthesis

(Bernhardt et al 2005, 2007)

- **>37,000 projects assessed supplemented with phone interviews with 317 project managers nationwide**
- **For the majority of projects, project phases (goal setting, design, implementation, evaluation) are disconnected**
- **Goals not clearly defined nor linked to measurable success criteria**
- **Data collection not directly related to project goals or not used to evaluate project effectiveness**
- **Likelihood of achieving intended result reduced**

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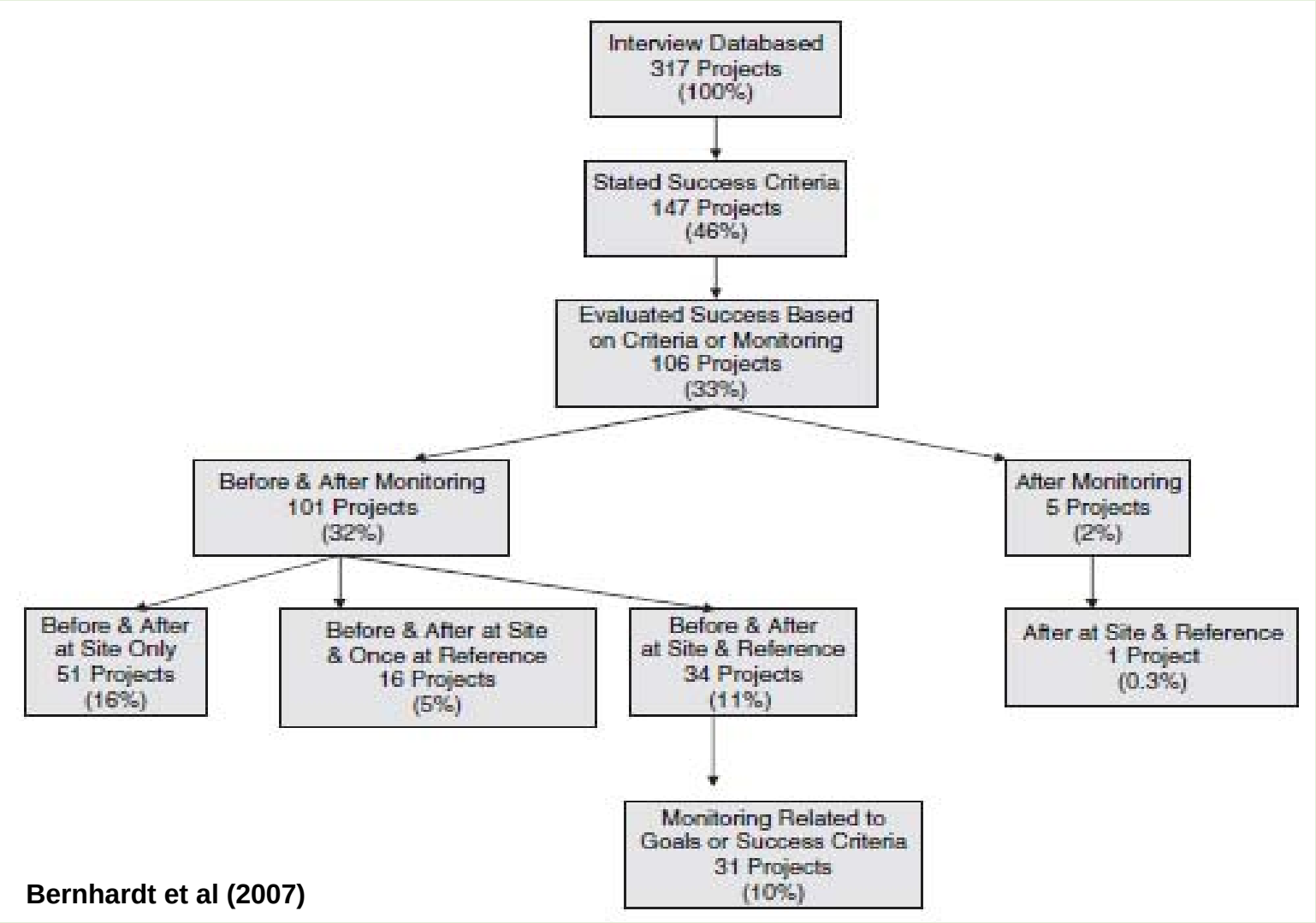
Design and Evaluation in Restoration Projects



Bernhardt et al (2007)

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Repeated Offenses

- **Goals not clearly stated**
- **Success criteria too subjective**
- **Monitoring parameters not linked to success criteria**

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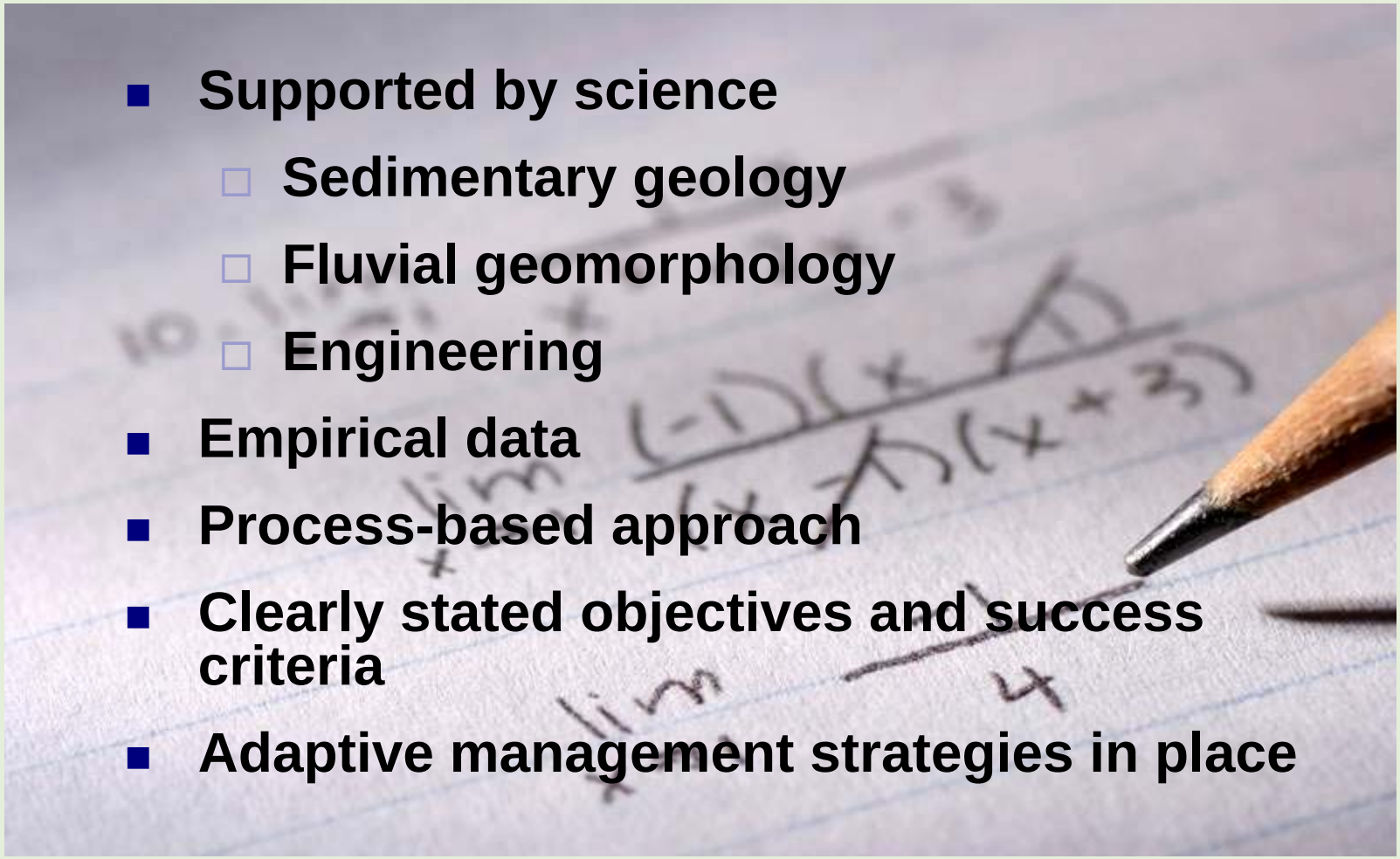
Likelihood of success maximized if:



- **Supported by science**
  - **Sedimentary geology**
  - **Fluvial geomorphology**
  - **Engineering**
- **Empirical data**
- **Process-based approach**
- **Clearly stated objectives and success criteria**
- **Adaptive management strategies in place**

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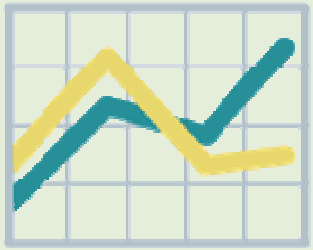
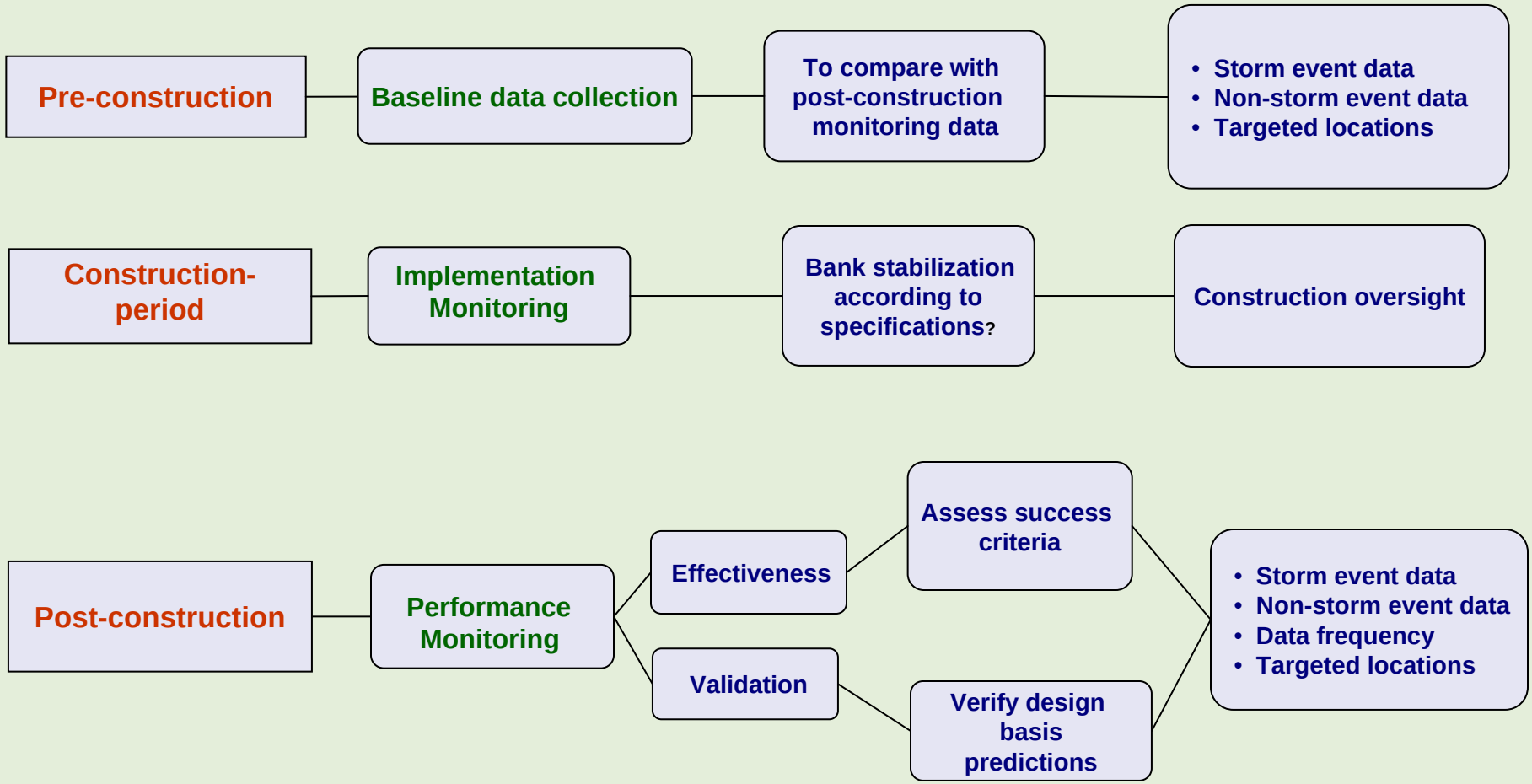
Successful Monitoring Plans

- **Project-specific**
- **Designed to provide adequate data to:**
  - ✓**Assess progress towards meeting stated objectives**



  - ✓**Provide technical basis to support corrective actions if goals not met**

Stream Restoration Monitoring Strategy



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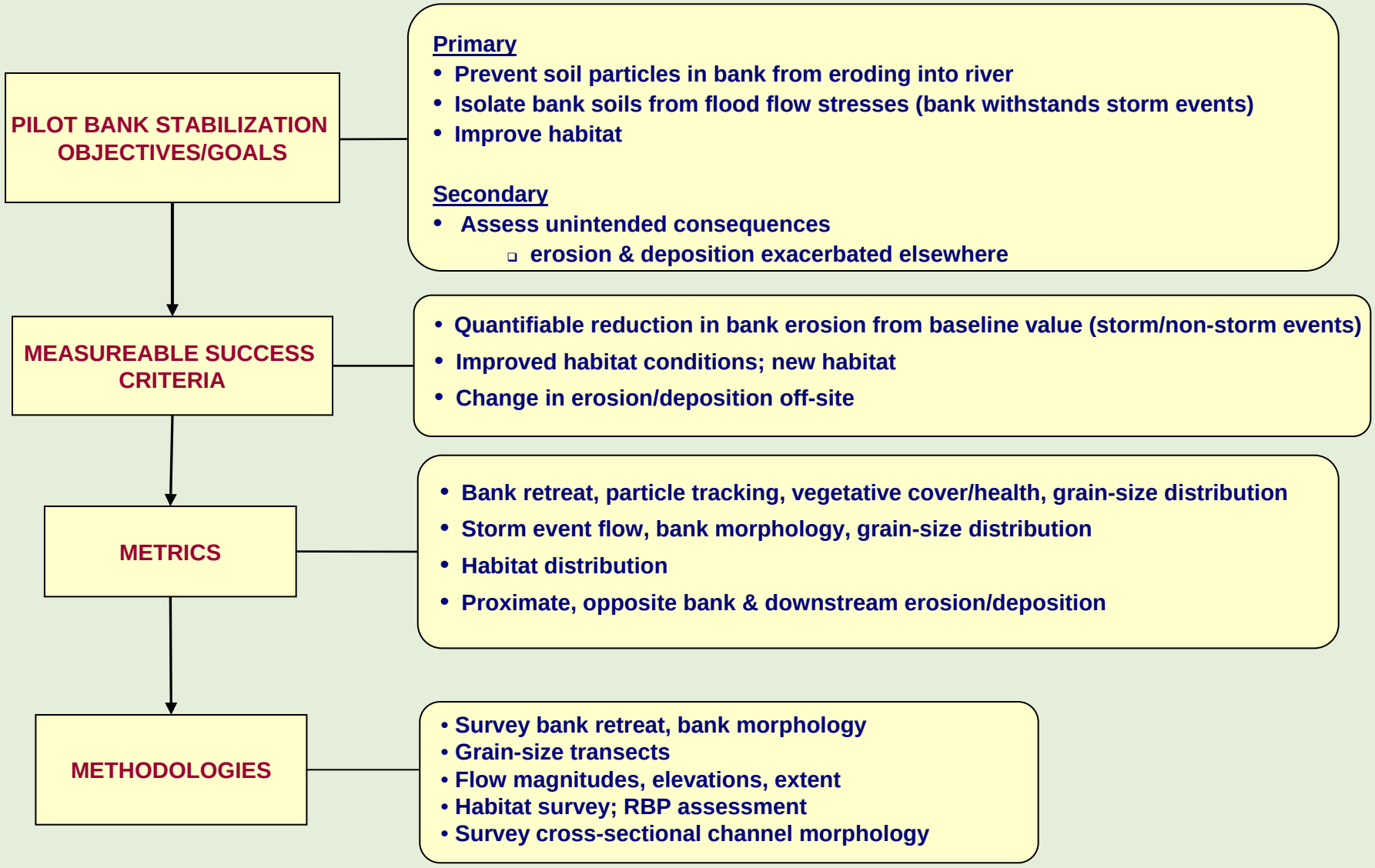
Example of Monitoring Work Plan Development



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Central Elements of an Effective Plan

- **Identify acceptable performance thresholds**
- **Define measureable success criteria that are directly related to project goals and objectives**
- **Establish metrics to quantify success criteria**
- **Provide empirical data applicable to document success and facilitate adaptive management**

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Monitoring Manual: Example Table of Contents

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Example Table of Contents (cont.)

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Examples of Success Criteria and Metrics

OBJECTIVES	SUCCESS CRITERIA	METRIC	SUPPORTING DATA	ANALYSIS
Prevent soil particles in bank from eroding into river	Quantifiable reduction in bank erosion rate	▪ Erosion pin exposure (cm/yr) ▪ Change in channel geometry (+/-)	▪ Grain size distribution ▪ Flow velocity (fps) ▪ Discharge (cfs) ▪ Visual assessment (e.g., slumping, undercutting, rills, gullies, lack of vegetation)	▪ Compare previous erosion rate estimates with post-construction rates ▪ Compare channel geometries at-a-station and downstream ▪ Assess redistribution of sediment grain size
Maintain a stable bank during storm event flow and over bank flow	Bank remains undamaged at less than, or equal to, design flows and over bank flows	▪ Flow velocity (fps) ▪ Discharge (cfs)	▪ Change in channel geometry (+/-) ▪ Grain size distribution ▪ Visual assessment (slumping, undercutting, rills, gullies, lack of vegetation)	▪ Correlate presence or absence of damage with flow velocity and discharge

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Examples of Success Criteria and Metrics (cont.)

OBJECTIVES	SUCCESS CRITERIA	METRIC	SUPPORTING DATA	ANALYSIS
Enhance existing near-bank aquatic and riparian ecosystems	Enhanced habitat diversity	▪ Riparian plant density, survival, % cover, % invasives ▪ % SAV coverage ▪ Large woody debris (P/A)	▪ Channel geometry ▪ Grain size distribution ▪ Flow velocity (fps) ▪ Observed wildlife use ▪ Plant vigor	▪ Compare baseline habitat conditions with post-construction ▪ Correlate habitat distribution with ambient conditions
Determine if off-site changes in river bank erosion and/or sediment deposition have occurred following bank stabilization	No substantial change in off-site river bank erosion and/or sediment deposition	▪ Erosion pin exposure (cm/yr) ▪ Change in channel geometry (+/-)	▪ Grain size distribution ▪ Flow velocity (fps) ▪ Discharge (cfs) ▪ Visual assessment (slumping, undercutting, rills, gullies, lack of vegetation)	▪ Pre- and post-construction weight of evidence: ✓ Compare previous erosion rate estimates with post-construction rates ✓ Compare channel geometries at-a-station and downstream ✓ Assess redistribution of sediment grain size

In Summary

1. Develop a project-specific monitoring plan
2. Relate metrics to clearly stated goals
3. Written manual for field work and data analysis
4. Collect data applicable for adaptive management