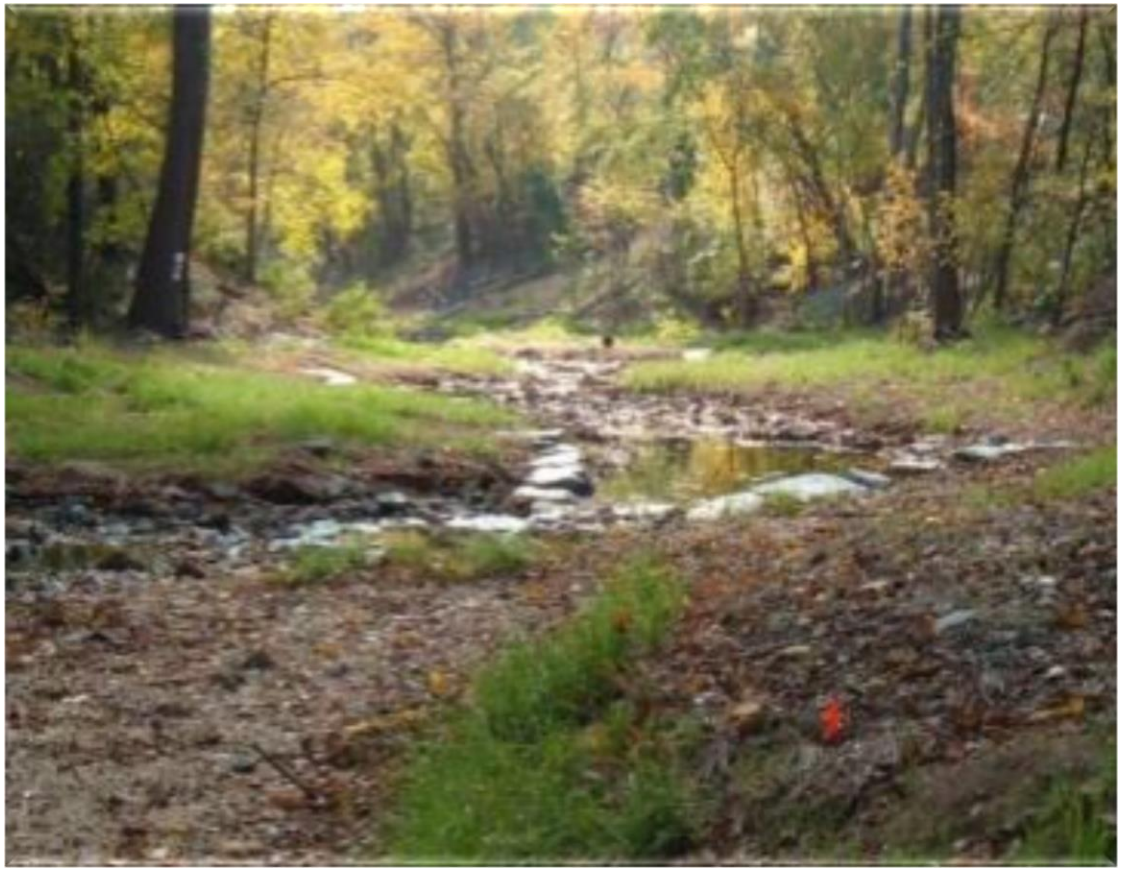


Recommendations for Verifying Individual Stream Restoration Projects

Tom Schueler and David Wood

Chesapeake Stormwater Network

April 16

USWG Meeting

7 Great Categories!

Peoples Choice Voting Begins April 29

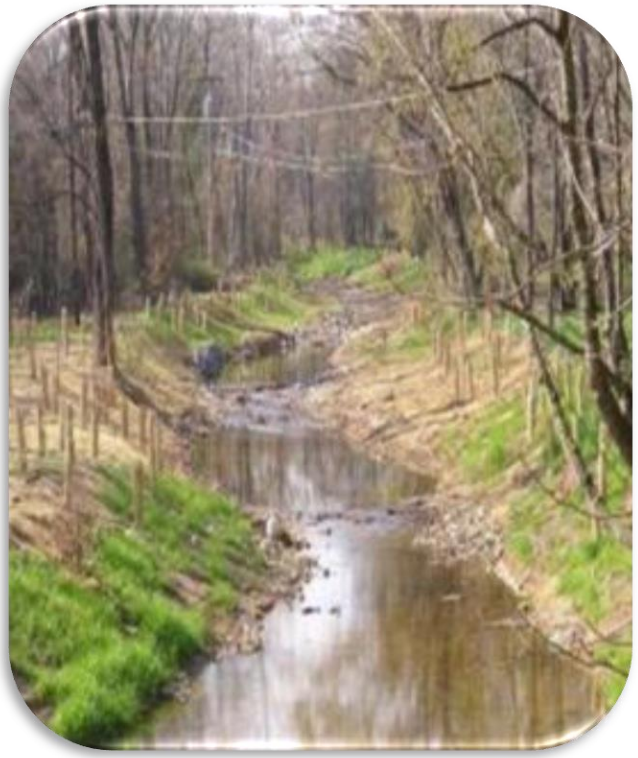
www.chesapeakestormwater.net/the-bubbas/2019-bubbas/

Proposed USWG Actions

- Present Recommended Findings Today
- Get Additional Feedback from Group
- Share it with other 3 Stream Groups
- Comment Period open until May 31
- Produce Final Memo
- Seek USWG Approval at 6/18
- Outreach to States/Stakeholders

A rapidly growing BMP for the urban sector

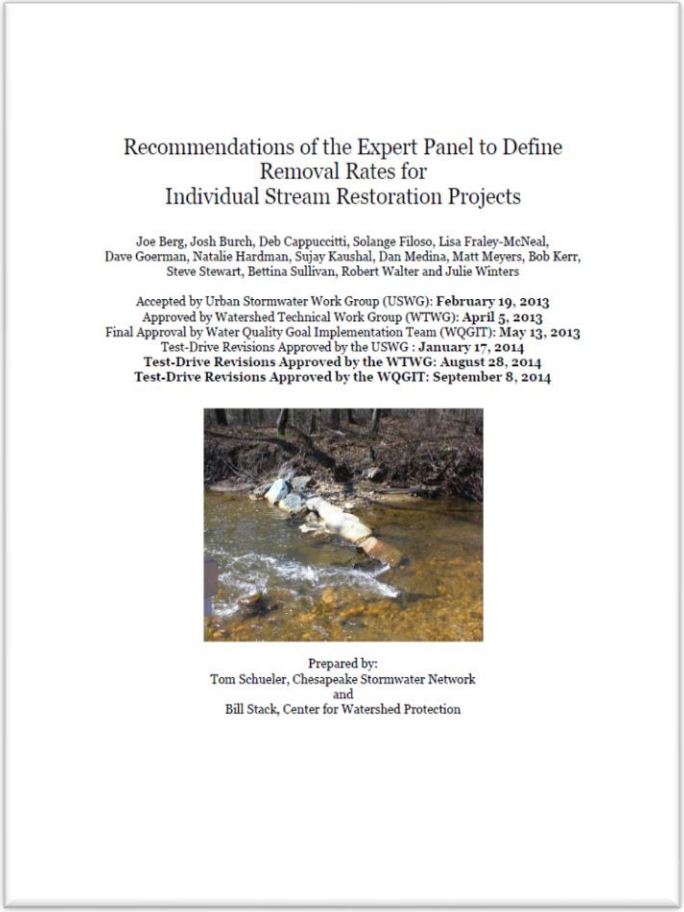
- Considered a cost-effective urban BMP ($/lb removed)
- Hundreds of miles of stream restoration built or in the pipeline
- High use by large MS4s and in MD,VA, PA and DC
- Rapidly evolving market for both the public and private sector
- Regulators and the restoration industry seek better standards of practice
- No pre-existing methods to verify projects after permits expire



Revisiting Stream Restoration: 2018/2019

The USWG formed four groups to revisit the EPR

- Group 1: Verifying Stream Restoration Practices
- Group 2: Crediting Outfall Restoration Practices
- Group 3: Better Standards for Applying Protocol 1 (Prevented Sediment)
- Group 4: Adjusting Protocol 2/3 to Capture Floodplain and Stream Reconnection



Recommendations of the Expert Panel to Define
Removal Rates for
Individual Stream Restoration Projects

Joe Berg, Josh Burch, Deb Cappuccitti, Solange Filoso, Lisa Fraley-McNeal, Dave Goerman, Natalie Hardman, Sujay Kaushal, Dan Medina, Matt Meyers, Bob Kerr, Steve Stewart, Bettina Sullivan, Robert Walter and Julie Winters

Accepted by Urban Stormwater Work Group (USWG): **February 19, 2013**
Approved by Watershed Technical Work Group (WTWG): **April 5, 2013**
Final Approval by Water Quality Goal Implementation Team (WQGIT): **May 13, 2013**
Test-Drive Revisions Approved by the USWG : **January 17, 2014**
Test-Drive Revisions Approved by the WTWG: August 28, 2014
Test-Drive Revisions Approved by the WQGIT: September 8, 2014

Prepared by:
Tom Schueler, Chesapeake Stormwater Network
and
Bill Stack, Center for Watershed Protection

Group 1

Name	Affiliation
Rich Starr	Ecosystem Planning and Restoration
Kathy Hoverman	KCI
Tim Schueler	Hazen and Sawyer
Kip Mumaw	Ecosystem Services
Neely Law	Center for Watershed Protection
Meghan Fellows	Fairfax County, DPWES
Sandra Davis	US Fish and Wildlife Service
Jennifer Rauhofer	Stormwater Management Consulting
Josh Burch	DOEE
Scott Cox	PADEP

Memo Contents

1. Group Charge and Roster
2. Background on Urban BMP Verification
3. Key Adaptations for Stream Restoration Practices
4. Recommended Field Inspection Methods
5. Visual Indicators to Define Functional Performance
6. Thresholds for Defining Management Actions
7. Standards for Post-Construction Project Documentation
8. Sample Databases for Tracking and Verifying Projects
9. Suggested Environmental Assessment Resources
10. References

Technical Appendices

A. Template for Chesapeake Bay Nutrient Removal Credit Verification
B. Fairfax County Stream Restoration Scorecards
C. Example of Project Monitoring/Maintenance Plan

Underlying Approach

- *Focus on the dominant protocol in the project reach*
- *Utilize a two-stage inspection process*
- *Rely on simple indicators along the reach that field techs can understand*
- *Establish numeric thresholds for project failure*
- *Require post-construction documents that show key project areas for verification*
- *Fly drones*

Visual Indicators for Prevented Sediment

Criteria for Loss	Key Visual Indicators
Evidence of bank or bed instability such that the project delivers more sediment downstream than designed, as defined by exposed soils/fresh rootlets	• Severe bank erosion (bare earth exposed or extreme undercutting) • Departure of more than 20% from average post-construction design bank height [1] • Incising bed (bed erosion resulting in the loss of defined pools and riffles and/or presence of active head cut) • Flanking or scour of in-channel structures • Failure or collapse of allowable bank protection practices • Less than 80% ground or canopy cover in the restoration zone [2]

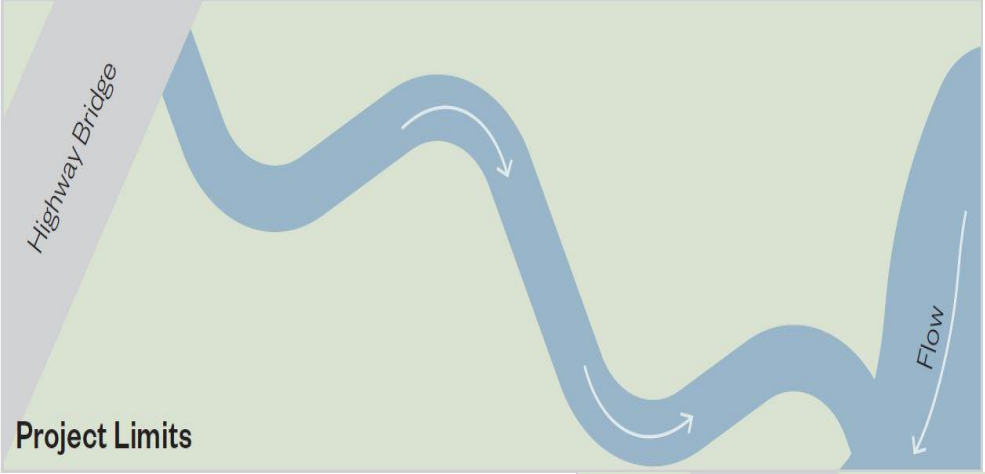
[1] as measured at riffles from the project as-built drawing, preferably from pre-designated control sections established at its most vulnerable locations

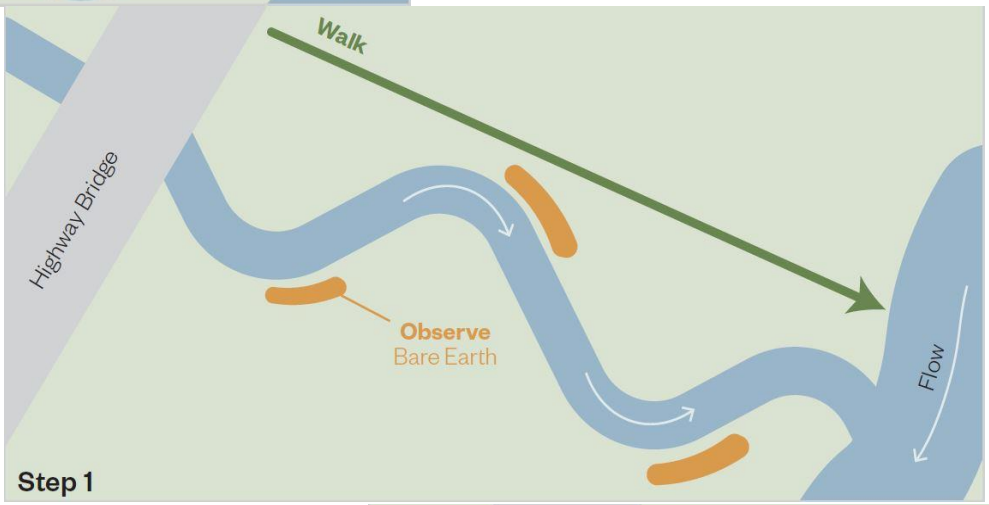
[2] depending on the long-term vegetative community objectives established for the project, may be expressed as a measure of exposed surface soil (>20%) or canopy cover (<80%)

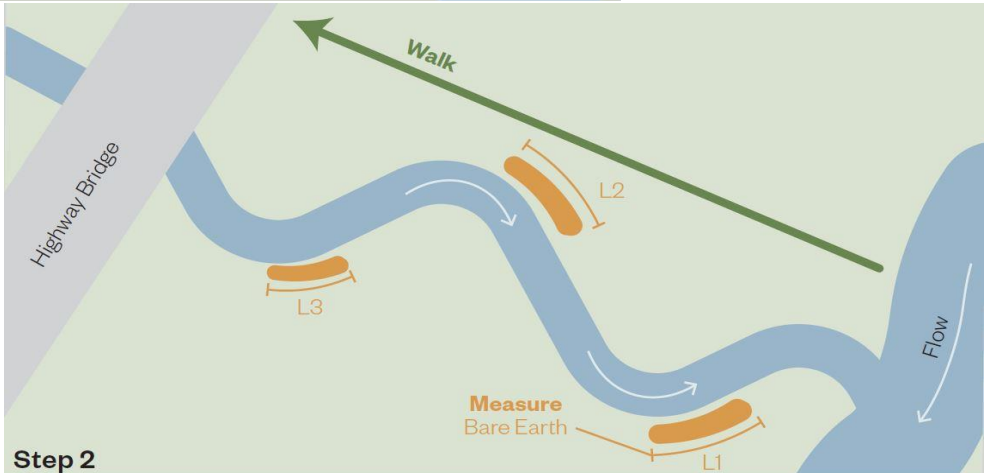
Examples of Visual Indicators for Protocol 1

Clear indicators that indicate severe problems that field technicians can agree on

Fieldwork for Inspecting Projects to Verify Protocol 1







Visual Indicators for Protocol 2 (Denitrification in the Hyporheic Box)

Criteria for Loss	Key Visual Indicators
Evidence that the reach is no longer fully meeting the design assumptions for expanding the hyporheic box (such as when channel incision reduces access to hyporheic zone)	• Departure of more than 20% from average post-construction design bank height [1] • Observable aggradation in streambed (as measured by embeddedness, loss of riffles or bed heterogeneity or excessive deposition, such as lateral and mid-channel bars) • Less than 80% ground or canopy cover [2] found in the project's designed hyporheic zone [3] • Stream de-watering (lack of any observable baseflow in the stream channel)

[1] as measured at riffles from the project as-built drawing, preferably from pre-designated control sections established at its most vulnerable locations

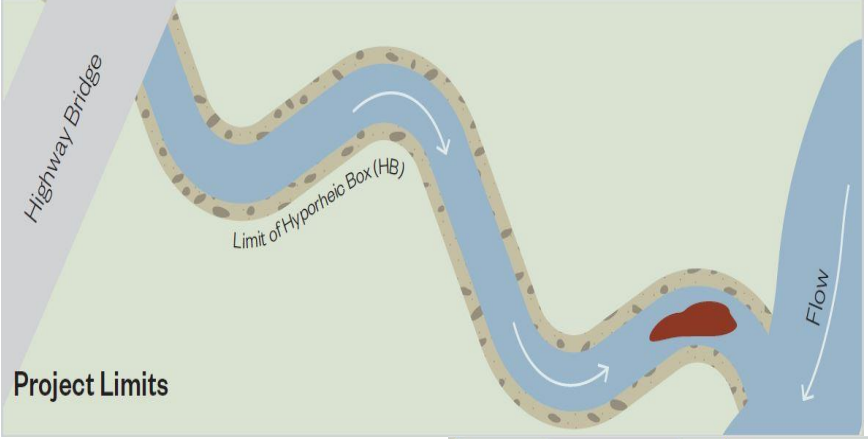
[2] depending on the long-term vegetative community objectives established for the project, may be expressed as a measure of exposed surface soil (>20%) or canopy cover (<80%)

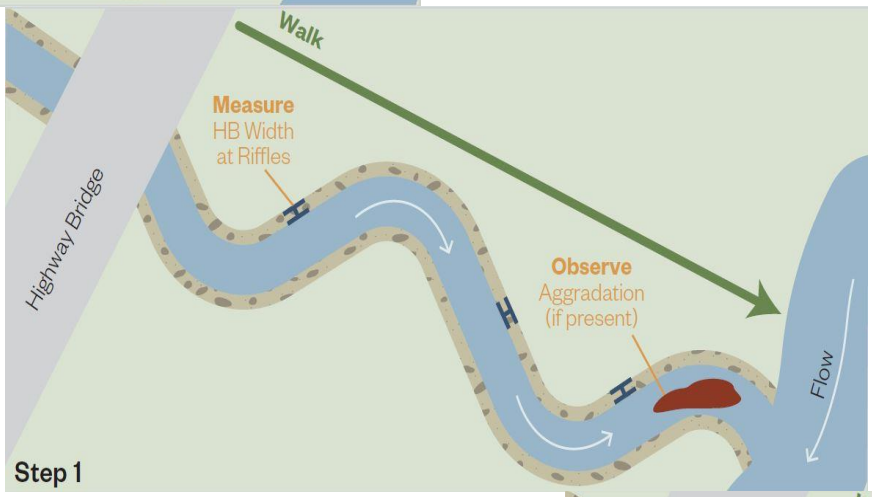
[3] usually a short distance from the edge of the stream to the top of bank (and occasionally extending into the floodplain)

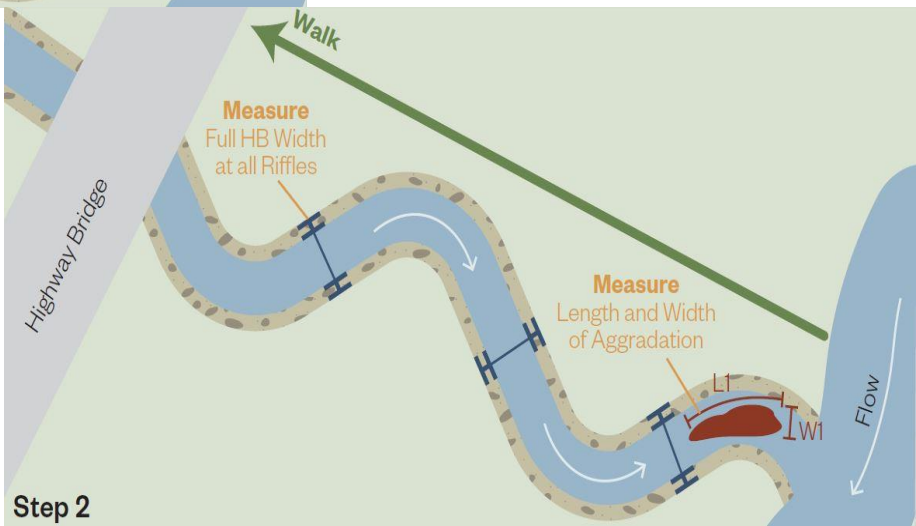
Visual Indicators for the hyporheic box and floodplain

Courtesy of Greg Noe, USGS

Fieldwork for Inspecting Projects to Verify Protocol 2







Visual Indicators for Protocol 3 Floodplain Reconnection

Criteria for Loss	Key Visual Indicators
Channel incision or floodplain sediment deposition increases effective bank height, thereby reducing intended annual stream flow volume diverted to floodplain	• Departure of more than 20% from average post-construction design bank height [1] or presence of active head cuts • Features used to divert flows to or from floodplain are obstructed and no longer work • No evidence of floodplain retention, as signified by a lack of sediment deposition, terraces, wrack-lines or leaf clumps in floodplain • Unable to meet intended wetland or tree canopy cover targets with the project floodplain [2]

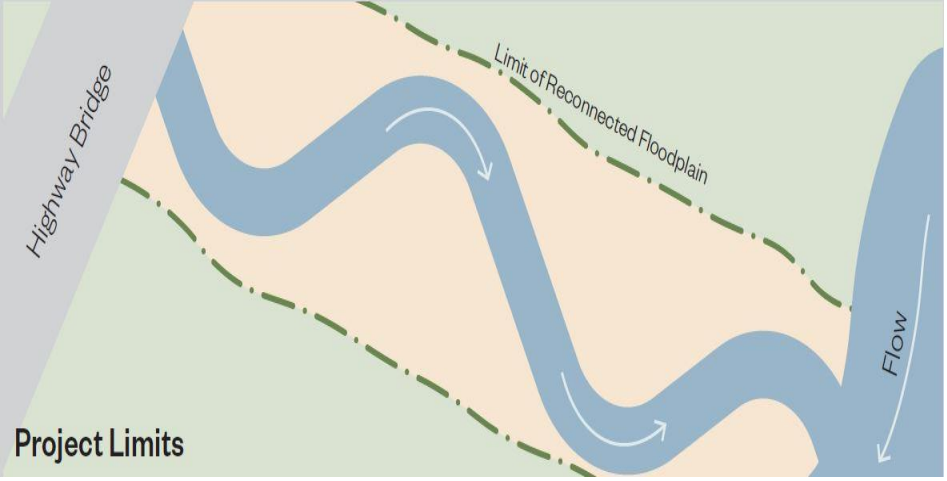
[1] as measured at riffles from the project as-built drawing, preferably from pre-designated control sections established at its most vulnerable locations.

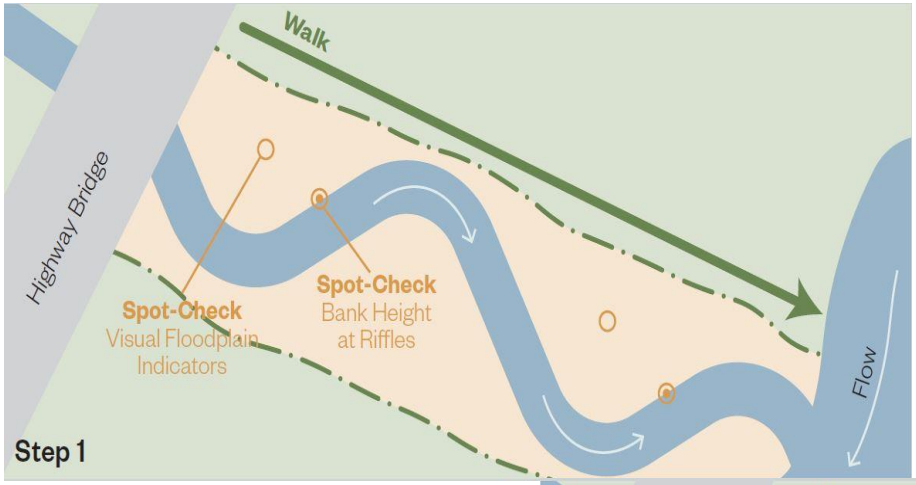
[2] measured from the edge of the stream across the reconnected portion of the floodplain, as shown in the as-built drawing or project monitoring plan. Cover is expressed as the fraction of exposed surface soil in the designed habitat area, and if the designed vegetative community allows for it, tree canopy cover.

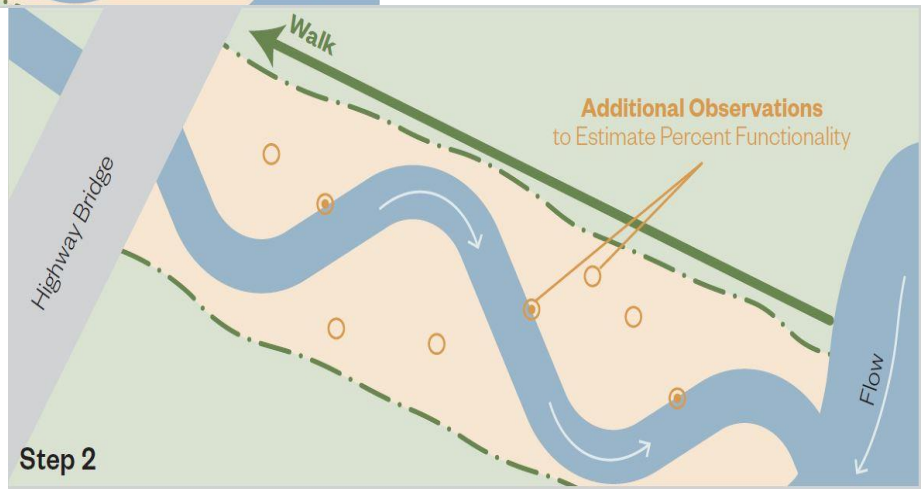
Bank and floodplain connection indicators are critical for Protocol 3

Photo Credit: G. Noe, USGS

Fieldwork for Inspecting Projects to Verify Protocol 3





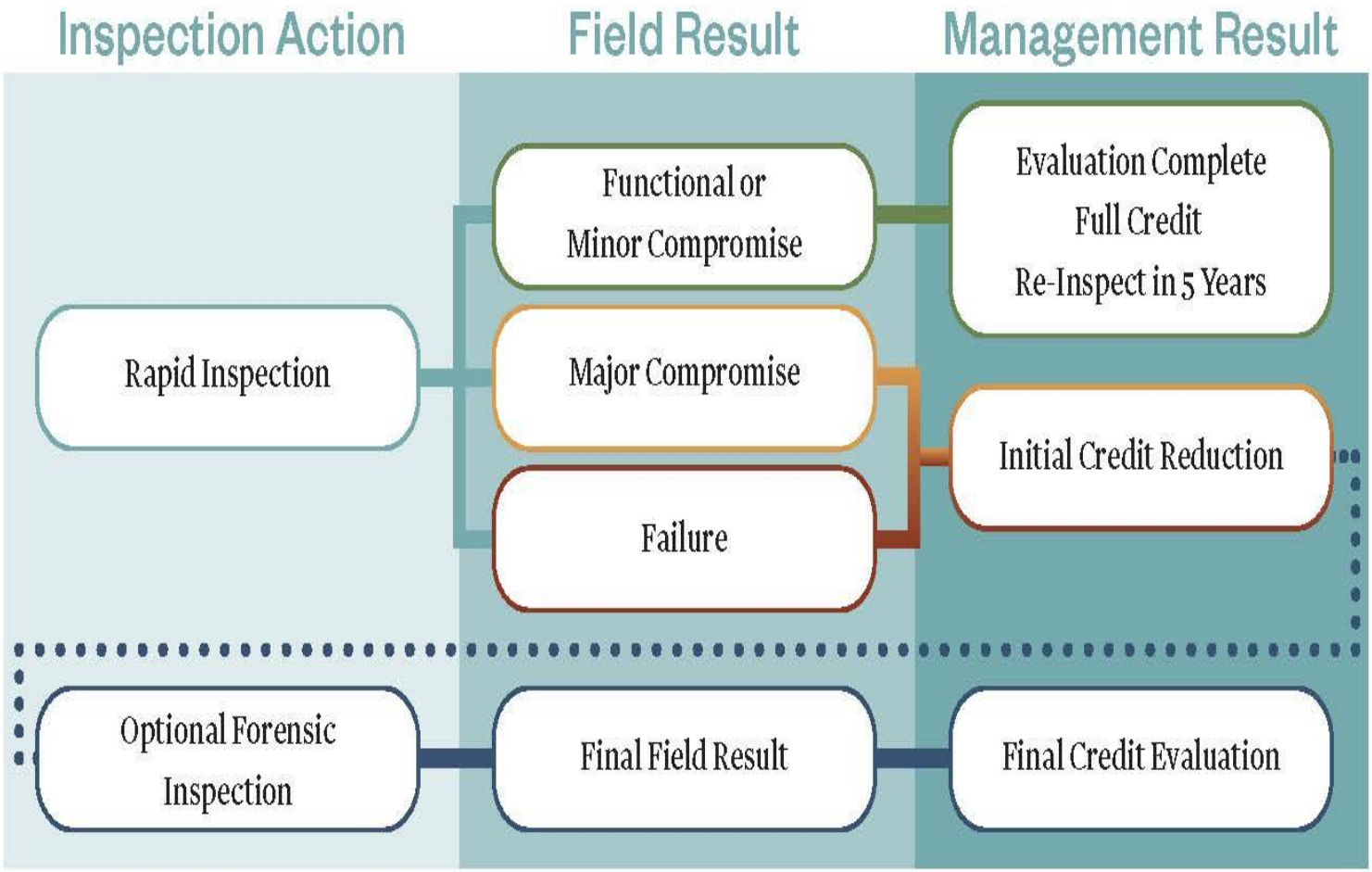


Field data are used to determine whether a project exceeds specific thresholds that define failure and trigger either:

1. Intensive forensic investigations
2. Project maintenance repairs
3. Reduction in pollutant crediting
4. Project abandonment (and full loss of credit).

All stream restoration projects fall into one of three possible categories:

Status	% Failing
Functioning	**0 to 10% of reach**
Showing Major Compromise	**20 to 40% of reach**
Project Failure	**50% or more of reach**

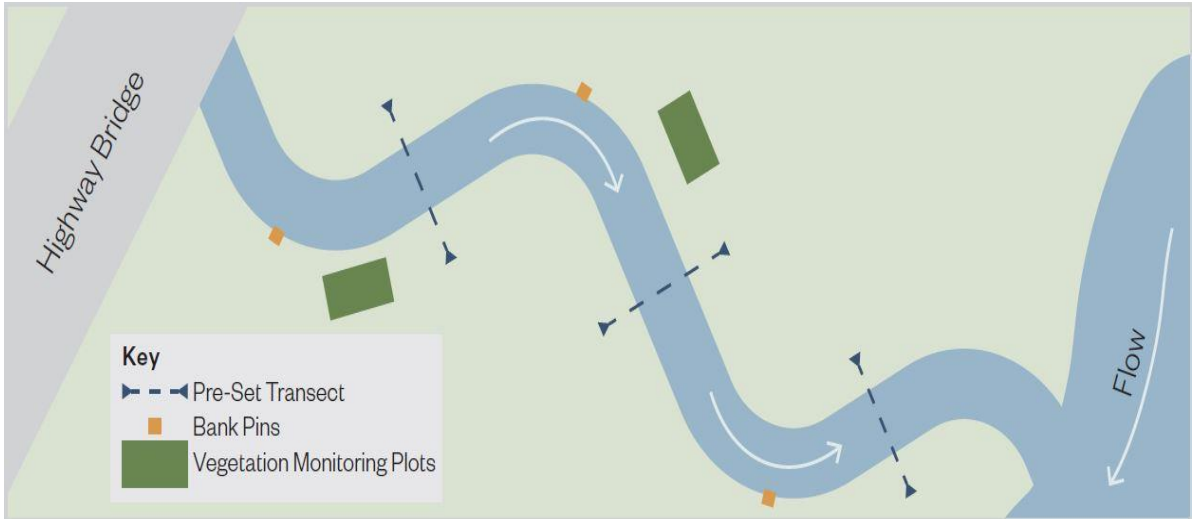

Inspection Action
Field Result
Management Result
Rapid Inspection
Functional or
Minor Compromise
Major Compromise
Failure
Evaluation Complete
Full Credit
Re-Inspect in 5 Years
Initial Credit Reduction
Optional Forensic
Inspection
Final Field Result
Final Credit Evaluation

How Percent Failure is Defined Along a Project Reach for Each Protocol		
Protocol 1	**Protocol 2**	**Protocol 3**
A. Define Restored Banks Over Reach Length[1]	*A*. Define Hyporheic Zone Over Reach Length[2]	*A*. Define Area of Reconnected Floodplain[3]
Example: 1000 ft reach has 2000 LF of restored banks	*Example: 1000 ft reach has 400 LF of reconnected hyporheic zone, both banks would be 800 LF*	*Example: 1000 ft reach has reconnected floodplain on right bank by an additional 10 ft, and additional 20 ft on the left bank = 30,000 ft²*
B. Estimate Total Impaired Reach Length, for all indicators [4]	*B*. Estimate Length of Impaired Hyporheic Zone, for all indicators [5]	*B*. Estimate Length/Area of Diminished Connection [6]
Example: 100 ft of right bank and 50 ft of left bank are compromised, for a total of 150 ft *(150/2000=7.5%)*	*Example: 100 ft of tight bank and 300 ft of left bank are compromised, for a total of 400 ft* *(400/800 = 50%)*	*Example: 300 LF of right bank and floodplain have washed out and are now exposed soil (3000/30,000 =10% of floodplain and 300/2000 = 15% of stream) Total = 25%*
C. Compute Percent Function Loss Over Reach and Compare to Decision Thresholds		
Functioning or showing minor compromise	*Project Failure*	*Showing Major Compromise*

Standards for Post Construction Docs

All post-construction plans should clearly demarcate:

- Locations of any fixed photo stations along the project reach
- Specific control sections should be monumented at reach locations that are most vulnerable to erosion
- Locations and extent of the restored banks and riffles
- Design limits of the hyporheic box and/or reconnected floodplain, if used
- Locations and elevations for bank or floodplain height measurement
- Any other locations for bank pins, random checks of floodplain or hyporheic box, or vegetative cover plots needed to evaluate the project



CBP STREAM FEEDBACK LOOP

Photo Credit: Severn Riverkeeper

- Extensive state and EPA involvement in all four groups
- Expect extensive additional review and comment at USWG phase
- Goal is to compile an updated guidance document for crediting stream restoration projects by end of 2019

Questions and Feedback from Other Members of the Group

Courtesy of Greg Noe, USGS