Stream Restoration Project Inspection and Verification

Tom Schueler

Chesapeake Stormwater Network

Chesapeake Water Environment Association

June 14, 2018

Thanks to Tim, Kathy, Kip, Joe and others for their initial feedback, but all errors, omissions or over-simplifications are Tom Schueler's fault

Need for BMP Verification

Chesapeake Bay Program
A Watershed Partnership

Need to ensure that the practices we are claiming for pollutant reduction credit in the Bay (1) actually exist (2) are working as intended, and (3) are maintained properly over their design life

Credit Duration Depends on BMP Type

Stream Restoration	5 yrs
Stormwater Retrofits	10 yrs
New LID Practices	10 yrs
Individual Nutrient Discharges	10 yrs
Homeowner BMPs	5 yrs
UNM Plans	3 yrs
Street Cleaning	1 yr

Verification of Stream Restoration Credit *

- Duration for the removal credits is 5 years
- Can be renewed based on a field performance inspection
- Duration of the credit is shorter than other urban BMPs, as these projects are:
    - subject to catastrophic damage from extreme flood events
    - have requirements for 3 to 5 years of post-construction monitoring to satisfy permit conditions
- If a project does not pass inspection, there is 1 year to take corrective action prior to loss of credit

* Based on original 2013 expert panel report

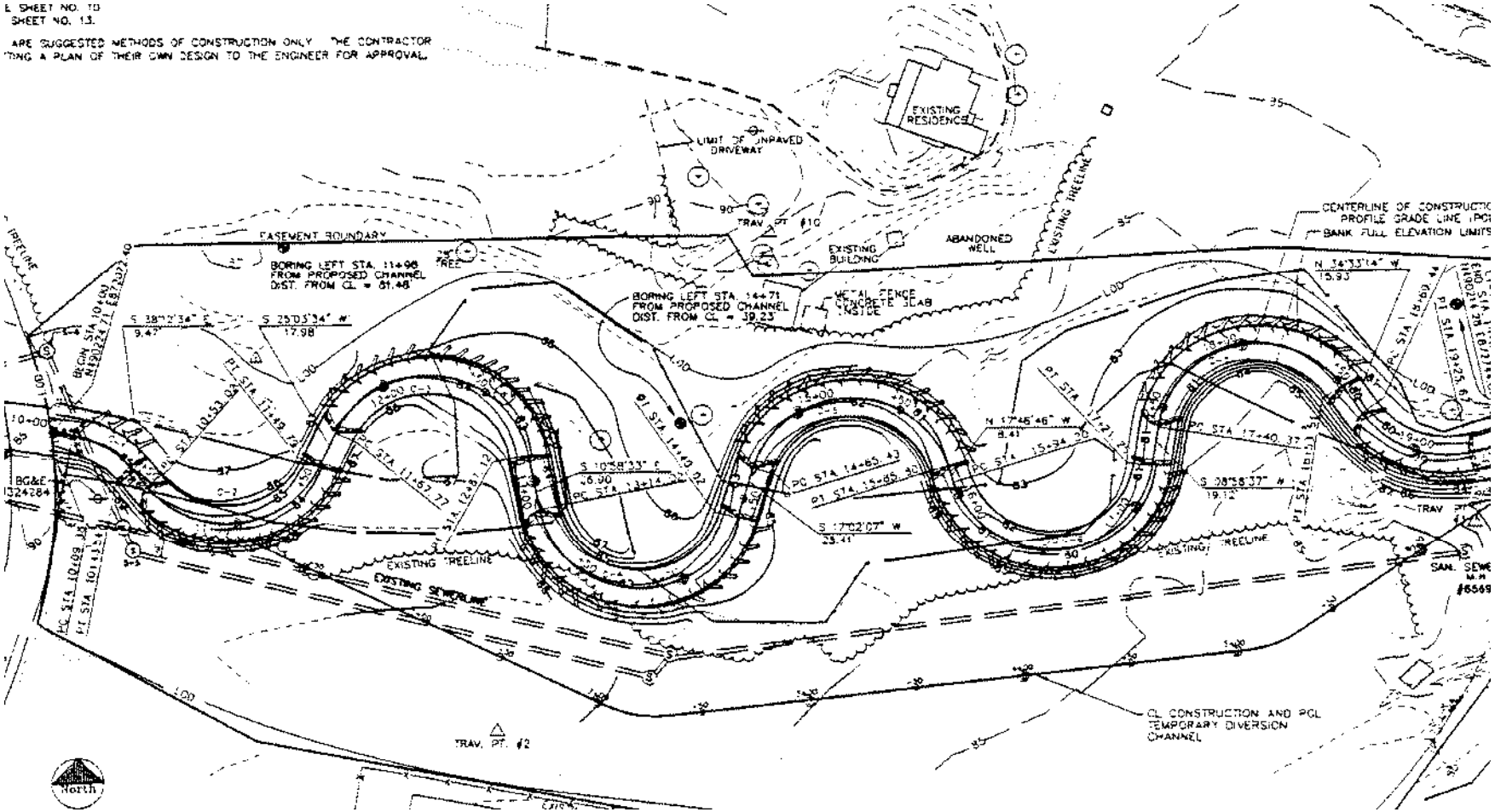
Challenges

- Post construction monitoring is typically required for 3-5 years to satisfy permits – mostly for channel stability.
- To ensure projects are operating as designed, field inspections are needed to renew the credit 5 years after the permit expires
- No specific guidance exists on how to inspect and verify projects going forward

Objectives for SR Verification Guidance

- Craft a technically sound field method to assess pollutant reduction function of restoration projects over time
- Account for inherent differences in restoration design strategies and the three crediting protocols
- Establish an industry standard for project as-builts and supporting materials
- Provide numeric triggers for management actions for projects (e.g., confirm/reduce/eliminate credits)
- Enable a crew to inspect a 1000 ft project reach in 2-4 hours or less
- Provide useful data to inform design of future projects
- Impose reasonable and predictable costs for project sponsors in the long run

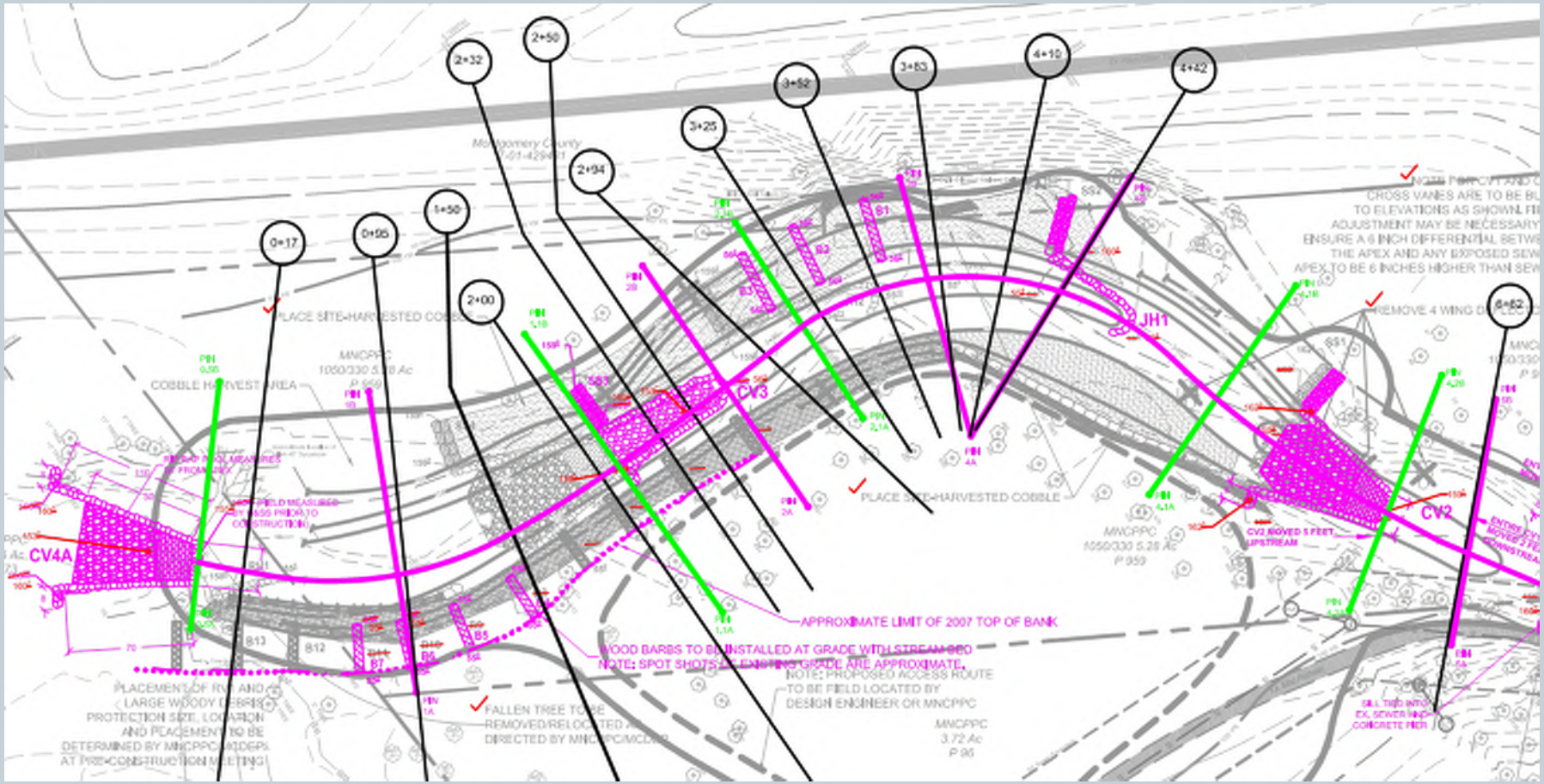
Is there a standard for project as-builts that could better support future verification efforts?



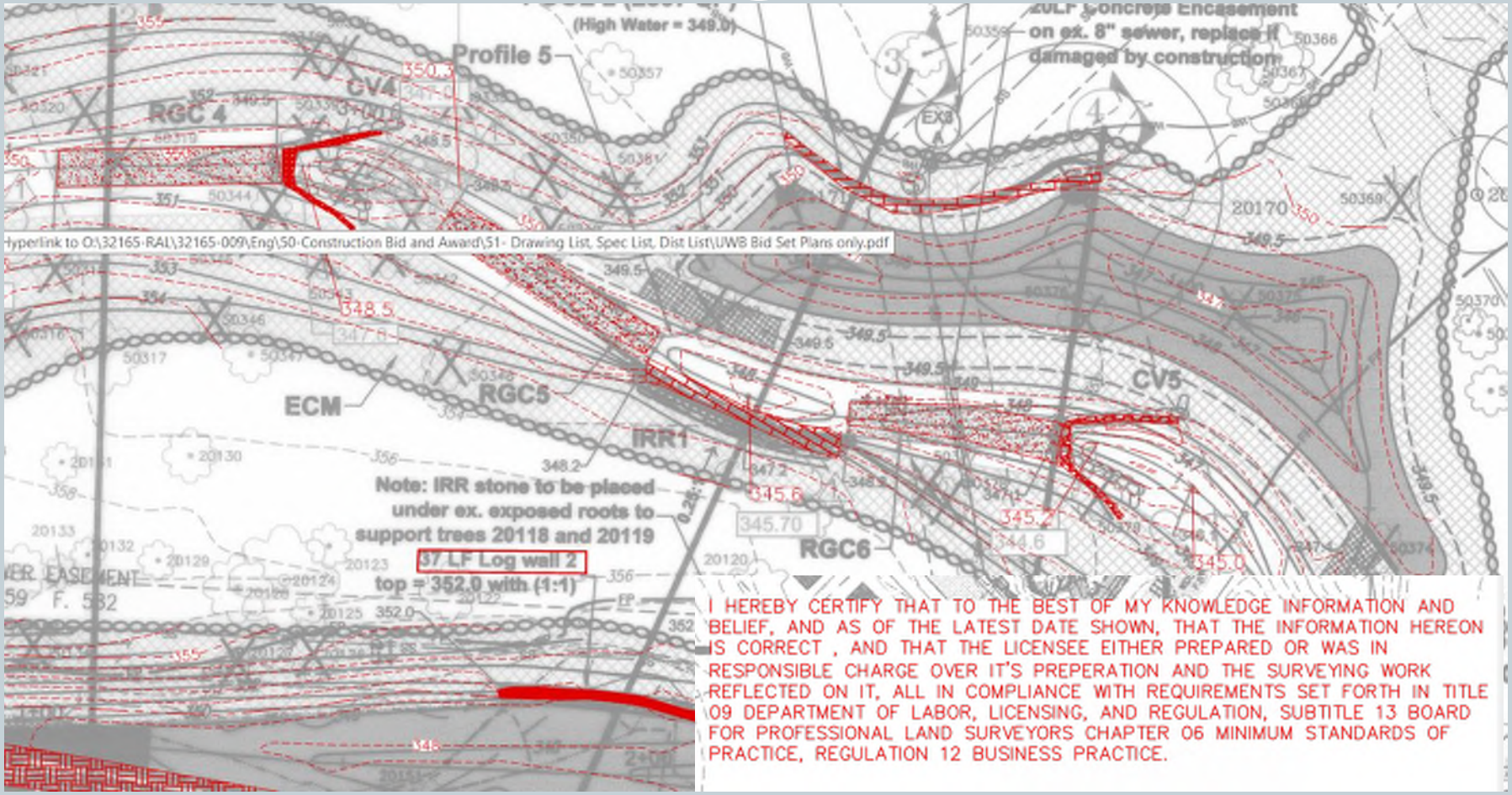
Stream as-built plans fall into 3 categories

- No as-built: projects without any sort of "as-built" or other construction documentation rely on original design drawings.
- "Red line" Copy of design plans w/ info pertaining to installation of actual work documented by the contractor, engineer, third party or some combination thereof.
- Professionally surveyed as-built: Surveyor does a topographic survey for the completed project, tied to the original design datum

Redline


0+17
0+95
1+50
2+00
2+34
2+94
3+25
3+52
3+83
4+10
4+42
CV4A
CV3
CV2
JH1
PLACE SITE-HARVESTED COBBLE
APPROXIMATE LIMIT OF 2007 TOP OF BANK
NOTE: PROPOSED ACCESS ROUTE TO BE FIELD LOCATED BY DESIGN ENGINEER OR MNCPPC
FALLEN TREE TO BE REMOVED/RELOCATED AS DIRECTED BY MNCPPC/MCDEP
PLACEMENT OF RVT AND LARGE WOODY DEBRIS PROTECTION SIZE, LOCATION AND PLACEMENT TO BE DETERMINED BY MNCPPC/MCDEP AT PRE-CONSTRUCTION MEETING
CV2 MOVED 5 FEET UPSTREAM
REMOVE 4 WING DEFLECTORS
CROSS VANES ARE TO BE BU
TO ELEVATIONS AS SHOWN FI
ADJUSTMENT MAY BE NECESSARY
ENSURE A 6 INCH DIFFERENTIAL BETWE
THE APEX AND ANY EXPOSED SEW
APEX TO BE 6 INCHES HIGHER THAN SEW
MNCPPC
1050/330 5.28 Ac
P 959
MNCPPC
3.72 Ac
P 95

As-built


(High Water = 349.0)
Profile 5
CV4
RGC 4
Hyperlink to O:\32165-RAL\32165-009\Eng\50-Construction Bid and Award\51- Drawing List, Spec List, Dist List\UWB Bid Set Plans only.pdf
ECM
RGC5
IRR1
Note: IRR stone to be placed under ex. exposed roots to support trees 20118 and 20119
37 LF Log wall 2
top = 352.0 with (1:1)
RGC6
CV5
20170
I HEREBY CERTIFY THAT TO THE BEST OF MY KNOWLEDGE INFORMATION AND BELIEF, AND AS OF THE LATEST DATE SHOWN, THAT THE INFORMATION HEREON IS CORRECT , AND THAT THE LICENSEE EITHER PREPARED OR WAS IN RESPONSIBLE CHARGE OVER IT'S PREPERATION AND THE SURVEYING WORK REFLECTED ON IT, ALL IN COMPLIANCE WITH REQUIREMENTS SET FORTH IN TITLE 09 DEPARTMENT OF LABOR, LICENSING, AND REGULATION, SUBTITLE 13 BOARD FOR PROFESSIONAL LAND SURVEYORS CHAPTER 06 MINIMUM STANDARDS OF PRACTICE, REGULATION 12 BUSINESS PRACTICE.

As-Built Preparation Staff Level

As-built Level	Surveyor (S)	Engineer (E)	Technician (T)
No as-built	NA	NA	NA
Redline	NA	optional	optional
Topographic survey	required	Usually required	optional

SPECIALISTS, SUCH AS RLA's, Geologists, etc are considered as E's for this table

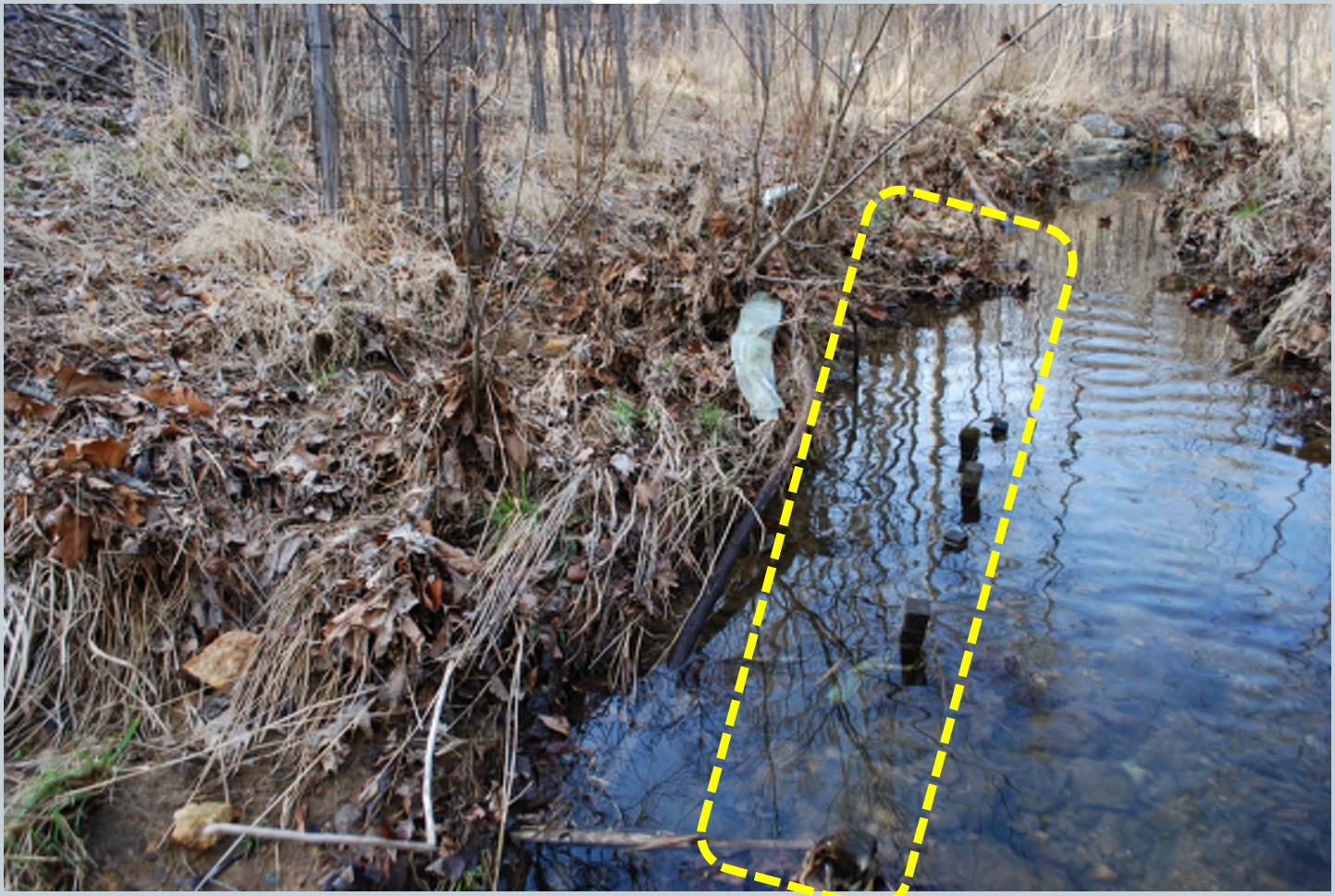
Defining Water Quality Function Loss for Protocol 1 (Prevented Sediment)

Criteria for Function Loss	**Key Visual Indicators**
Evidence of bank or bed instability such that the project delivers more sediment downstream than designed	• Migration of incision through the project reach • Vertical bank instability • Lateral bank instability • Flanking of individual structures • Downstream scour of in-channel structures
Feedback: Keep the list short…Focus on known cross-sections and/or pre-established photo stations to reduce observation bias… Some optional indicators may include riparian plant community, stream substrate composition and stream channel form diversity	

Minor headcut migration

Structure Flanking

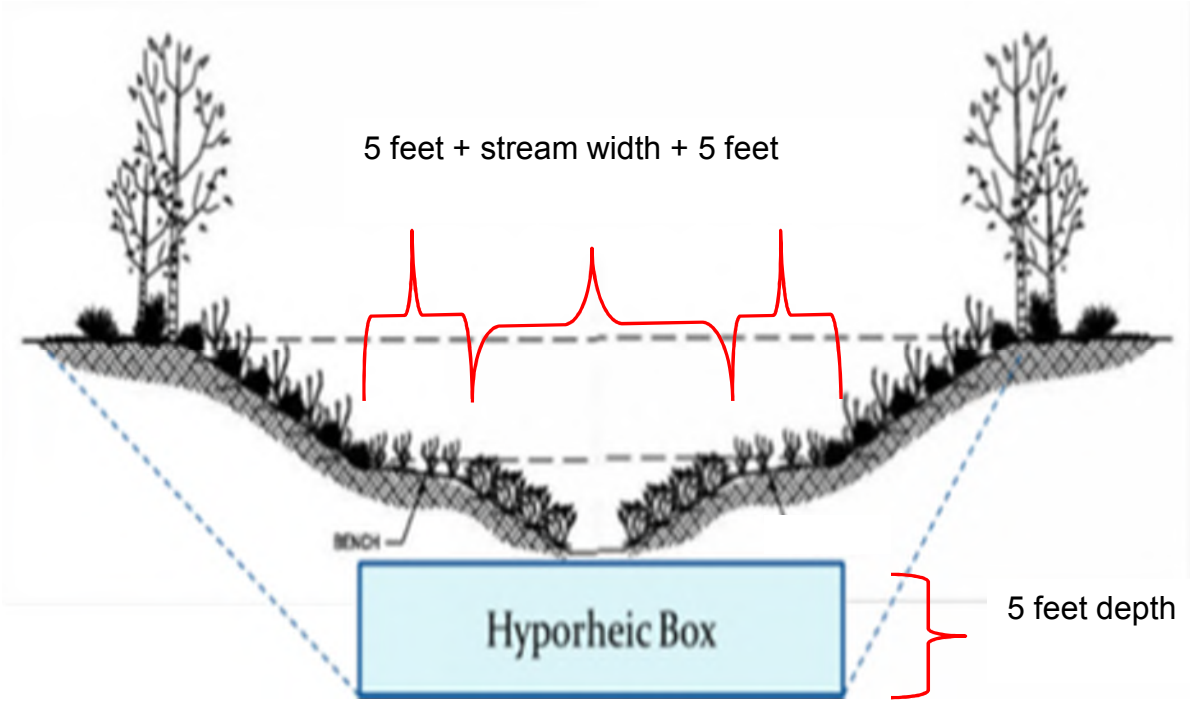
Minor Erosion and Lateral Migration



Major Migration

Defining Water Quality Function Loss for Protocol 2 Hyporheic Box

Criteria for Function Loss	**Key Visual Indicators**
Evidence that the reach is no longer fully meeting design assumptions for expanding the hyporheic box.	• Incision or obstructions preventsghts to sharply depart from increase ratios above 1 • Lack of carbon source evident in the streambed • Bed sedimentation, embeddedness, loss of riffles
Feedback: This is the hardest protocol to define a "visual indicator" since the box is below the floodplain and stream and cannot be seen w/o digging a well	


5 feet + stream width + 5 feet
BENCH
Hyporheic Box
5 feet depth

Protocol 3:
Credit for Floodplain Reconnection

Annual mass nutrient reduction credit for projects that reconnect stream channels to their floodplain over a wide range of storm events

Photos courtesy of Jeff Hartranft, PADEP

Defining Water Quality Function Loss for Protocol 3 Floodplain Reconnection

Criteria for Function Loss	**Key Visual Indicators**
Channel incision or floodplain sediment deposition increases effective bank height, thereby reducing intended annual stream flow volume diverted to floodplain	• Evidence of stream/floodplain disconnection • No evidence of floodplain sediment deposition • Increased bank heights due to channel incision • Upland plant species dominate wetland areas
Feedback So Far: More work needed for this protocol**.**	

Possible Standard Resources to Use for Project Inspections

Parts of some off-the shelf stream assessment resources could be very helpful:

- Rapid Stream Restoration Monitoring Protocol (USFWS, 2014)
- Stream Corridor Assessment (SCA)
- Elements of Rapid Bioassessment Protocol (RBP)
- Stream Visual Assessment Protocol
- Others?

Verifying Streamside Plant Community?

- How useful is it to track the success of the original planting plans ?
- How do we account for factors like invasive species, beaver colonization and water table changes ?
- While we can set numeric targets for the success of the original project planting plan, should we bother ?
- The long term trajectory of the plant community is often hard to predict or control

Special Workshop held on tweaking the stream restoration protocols to provide more reliable pollutant removal and greater uplift on 6/4

Three short term action teams formed to address Protocol 1, Protocols 2&3 and new outfall stabilization approach

Draft proposal on stream restoration verification memo released soon for comment

CSN Maintenance Resources www.chesapeakestormwater.net

- Bioretention Illustrated: A Visual Guide for Constructing, Inspecting, Maintaining and Verifying the Bioretention Practice
- The Pond Protocol
- Archived Visual Indicators Webcasts:
  - Inspecting, Maintaining and Verifying LID Practices
  - Visual Indicators for Infiltration, Surface Sand Filters and Permeable Pavement
  - Visual Indicators for Grass Channels and Filter Strips