High Definition Stream Survey Methods for MS4 Compliance

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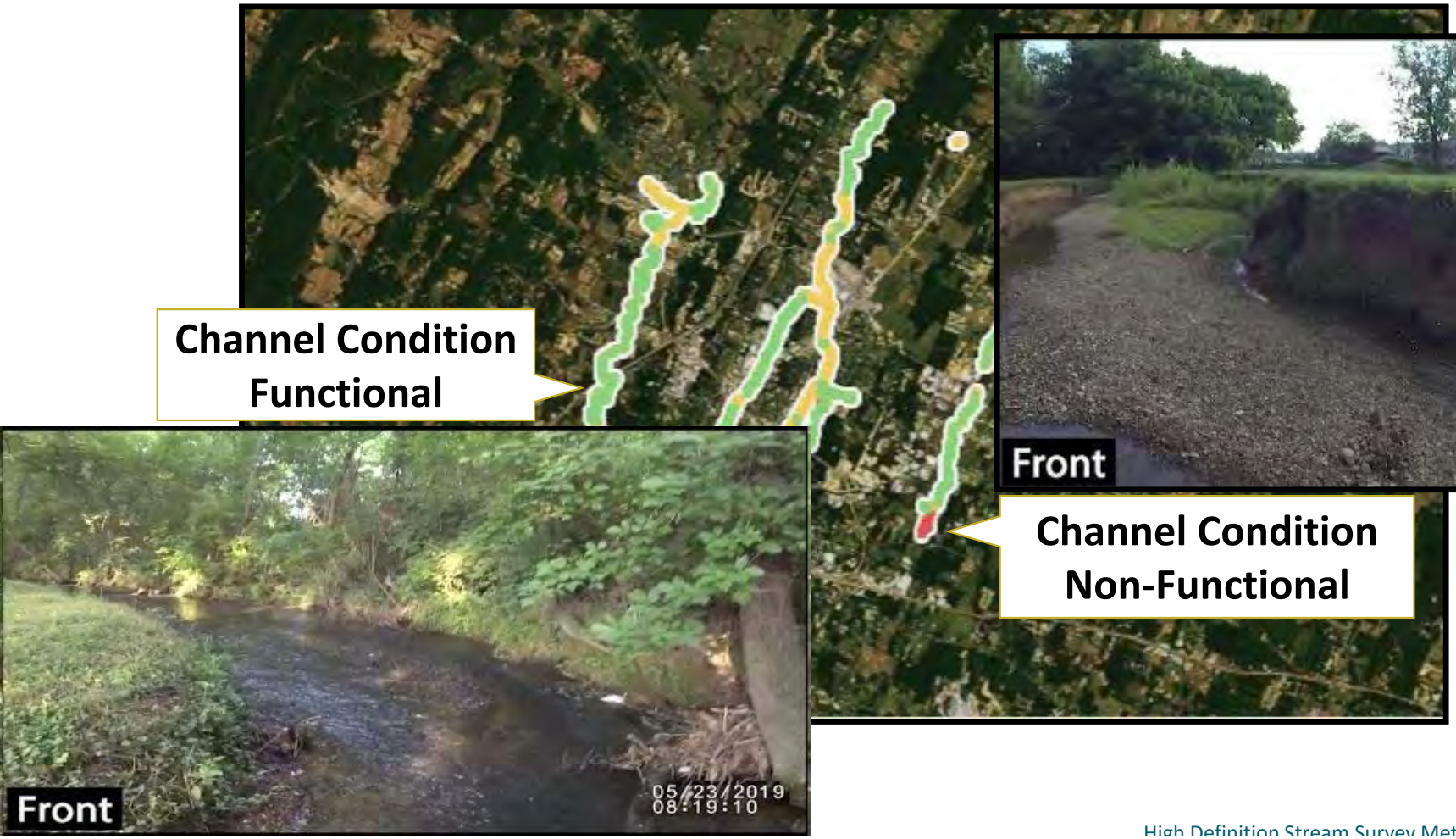
Everyone wants clean water in their community


Construction Site Runoff Control
Minimum Control Measure
Photo by U.S. EPA
Illicit Discharge Detection and Elimination
Minimum Control Measure
Photo by U.S. EPA
Where?
What type?
Post-Construction Runoff Control
Minimum Control Measure
Photo by U.S. EPA

Successful plans depend on quality data



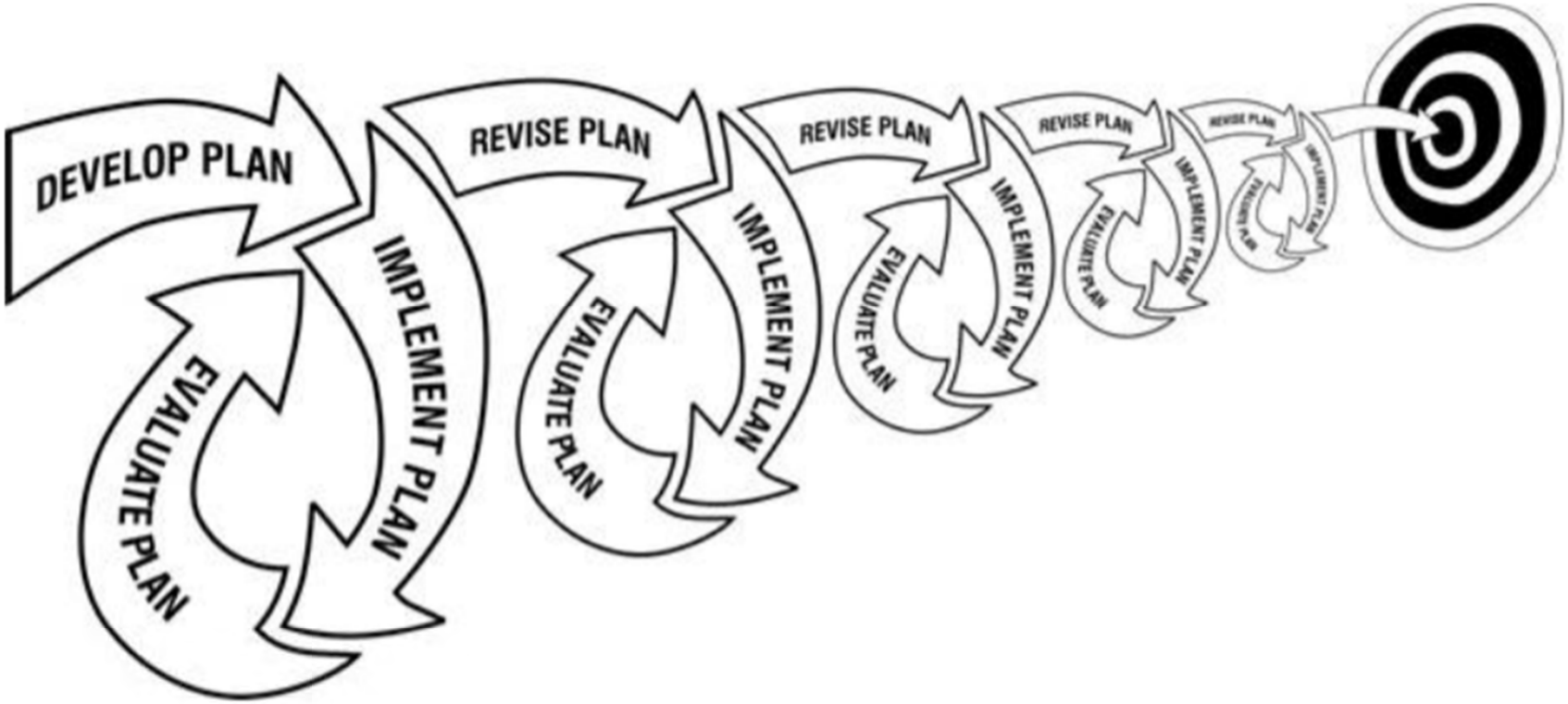


Figure 1. The iterative process of stormwater management (Develop, implement, evaluate, repeat).

EPA 833-F-07-010 Evaluating the Effectiveness of Municipal Stormwater Programs

High Definition Stream Survey

HDSS links GPS, Video, Sonar, Water Quality and other sensors to allow Rapid and Accurate Data Collection.

Quality Data Collection

Side video
- Left and Right Streambank
- Riparian
- Infrastructure

Front video
- Habitat type
- Canopy cover

Down video
- Substrate type
- Embeddedness

Side scan sonar
- Depth
- Side scan imagery

Water quality sensor
- DO, pH, Temp, etc

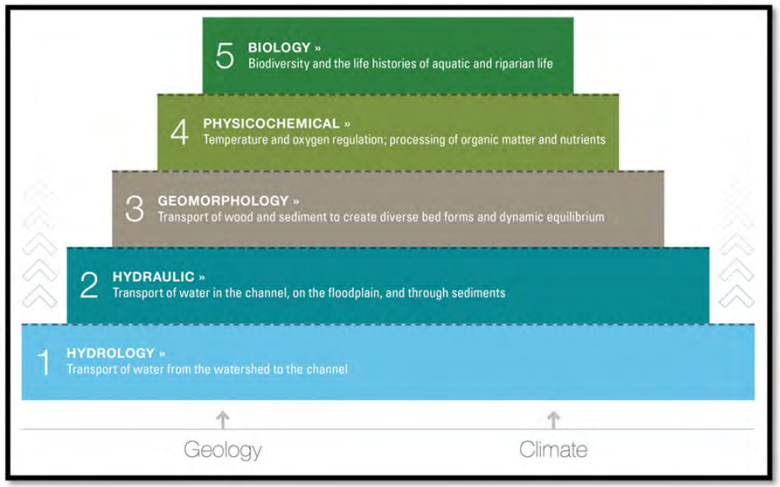
Water Grab Samples

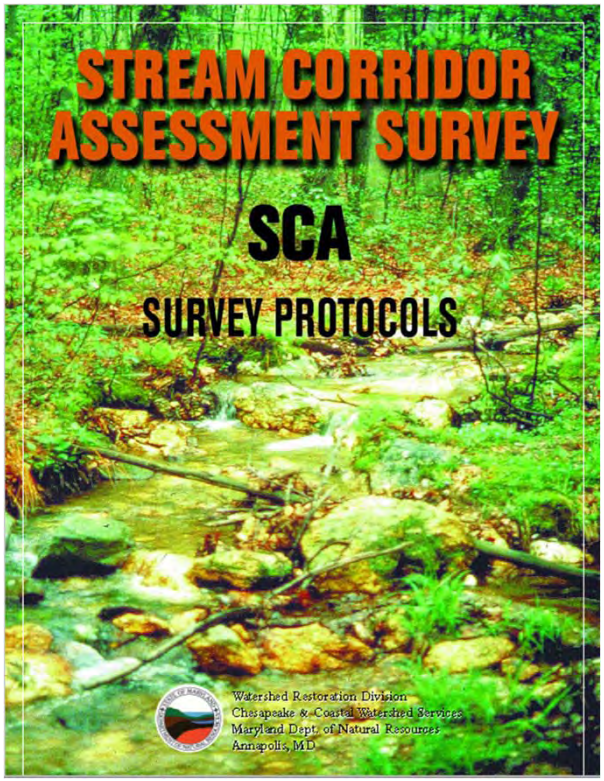
GPS
- Time
- Location
- Elevations

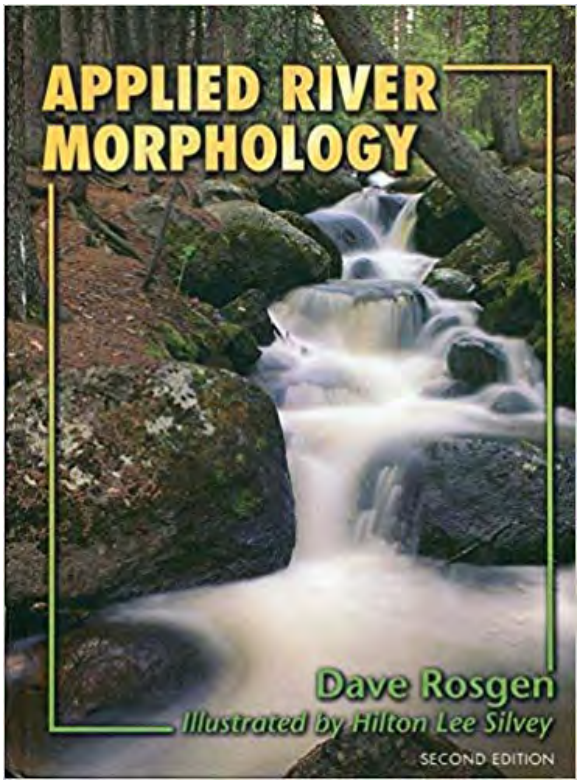

High Definition Stream Survey
TruttaSolutions.com
Map
Front
N35° 13' 45.8"
W84° 50' 43.1"
05/20/2019
13:06:58PM
South Mouse Creek - Track 101
N035.229463 Head: 023.73°
W084.845288 COG: 043.62°
Sonar
Speed: 3.0 kts
Depth: 1.11ft
Side-Scan
Left
Right

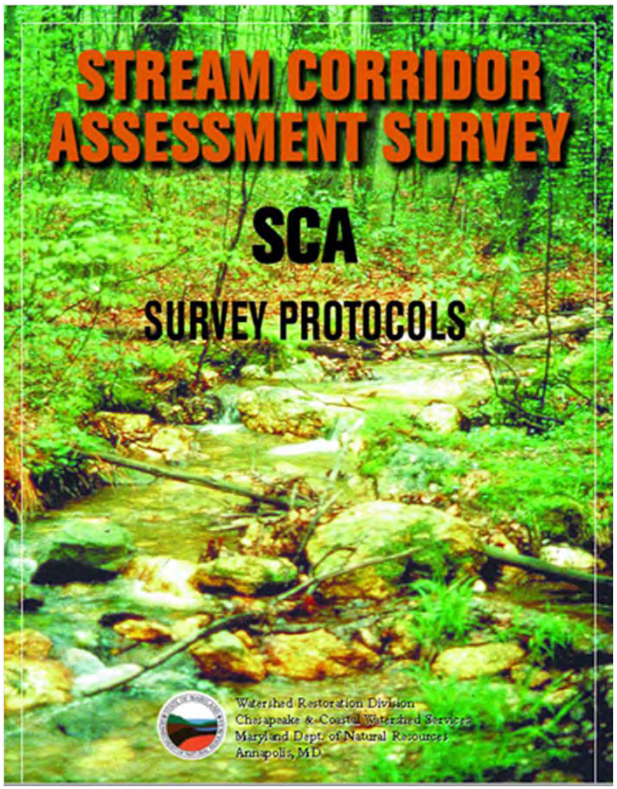
Versatile Data Collection

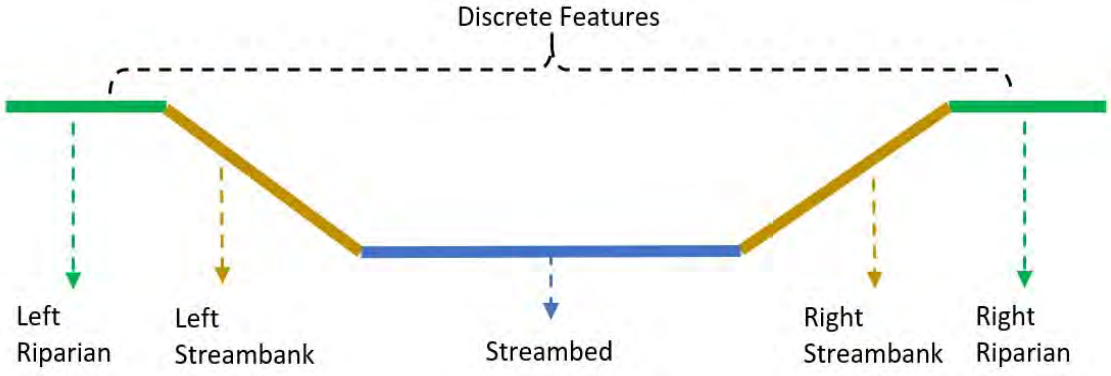
Flexible Data Classification











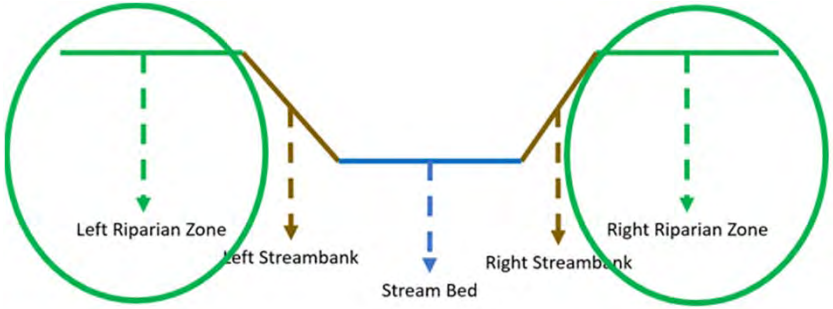
- Riparian
- Streambank
- Streambed
- Discrete features

Two Types of Data

- Continuous Variables
  - Condition and modification type of:
    - Streambed
    - Streambanks
    - Riparian zone

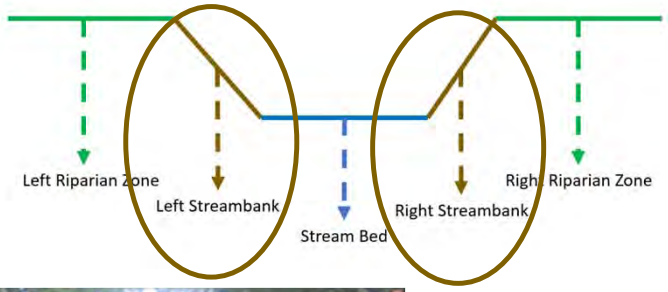
- Point Variables (Discrete Features)
  - Condition, type, and location of:
    - Outfall
    - Road crossing
    - Pipe
    - Other

Riparian Condition Scoring



Functional ← → Non-functional

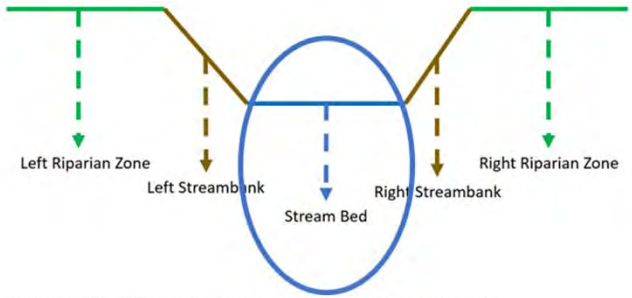
Streambank Condition Scoring



Functional ← → Impaired

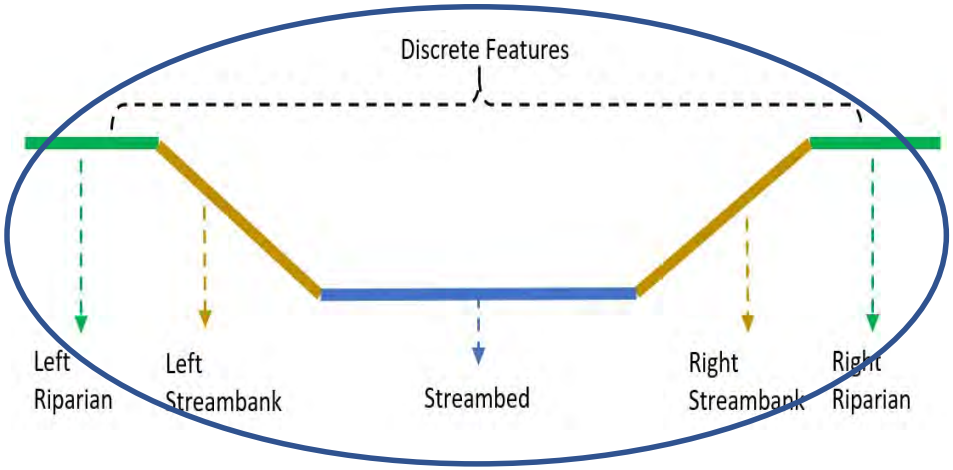
Non-Functional

Streambed Condition Scoring



Functional ← → Non-functional

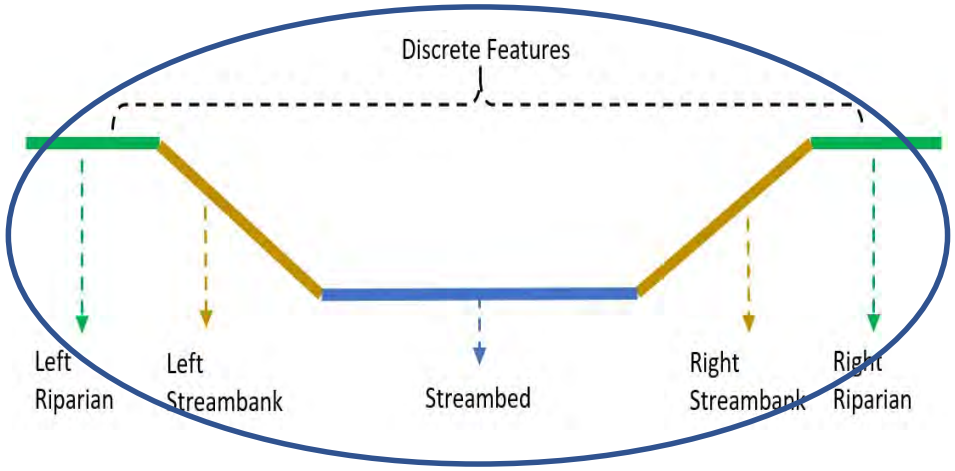
Discrete Feature Scoring - Outfalls

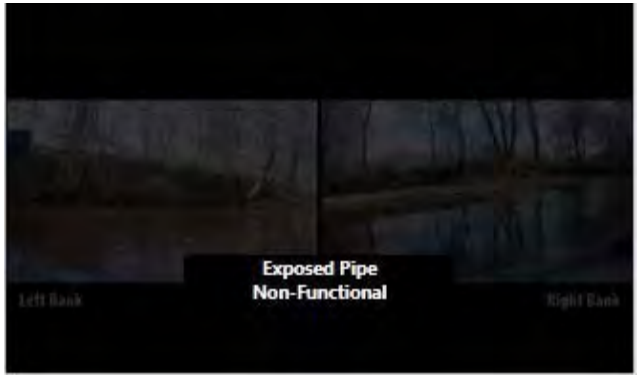


Clean Outfall ⟵ ⟶ **Illicit Discharge**

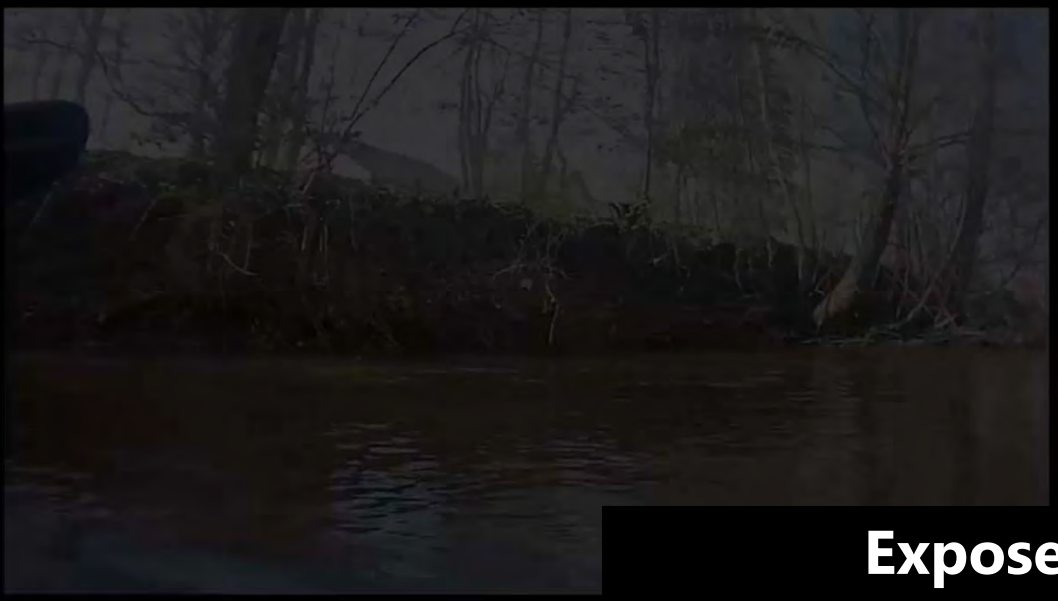
High Definition Stream Survey Methods for a MS4 Stormwater Permit

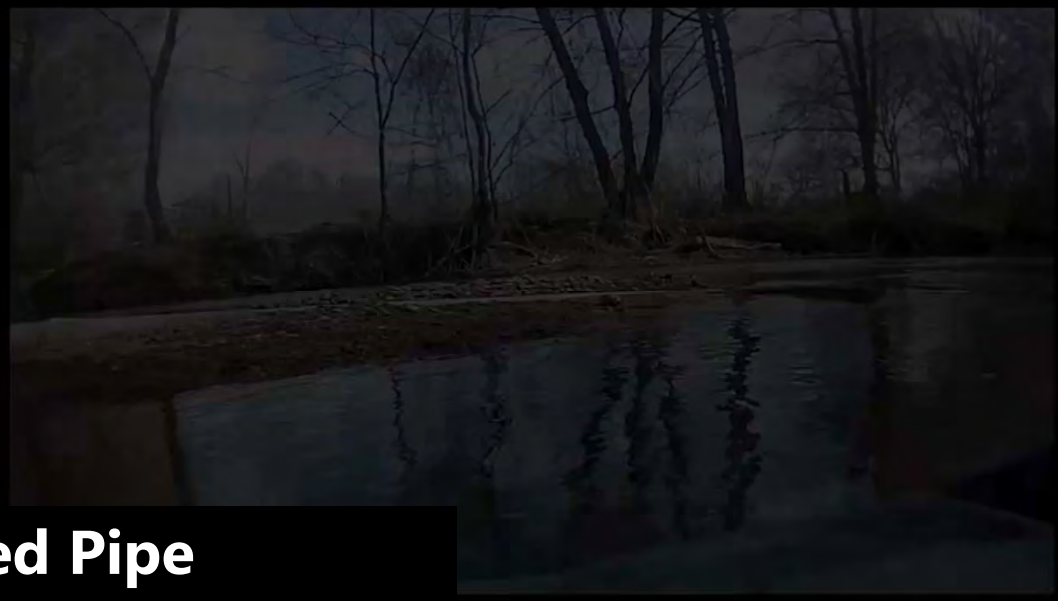
- Exposed Pipes





Minor ← → **Severe**





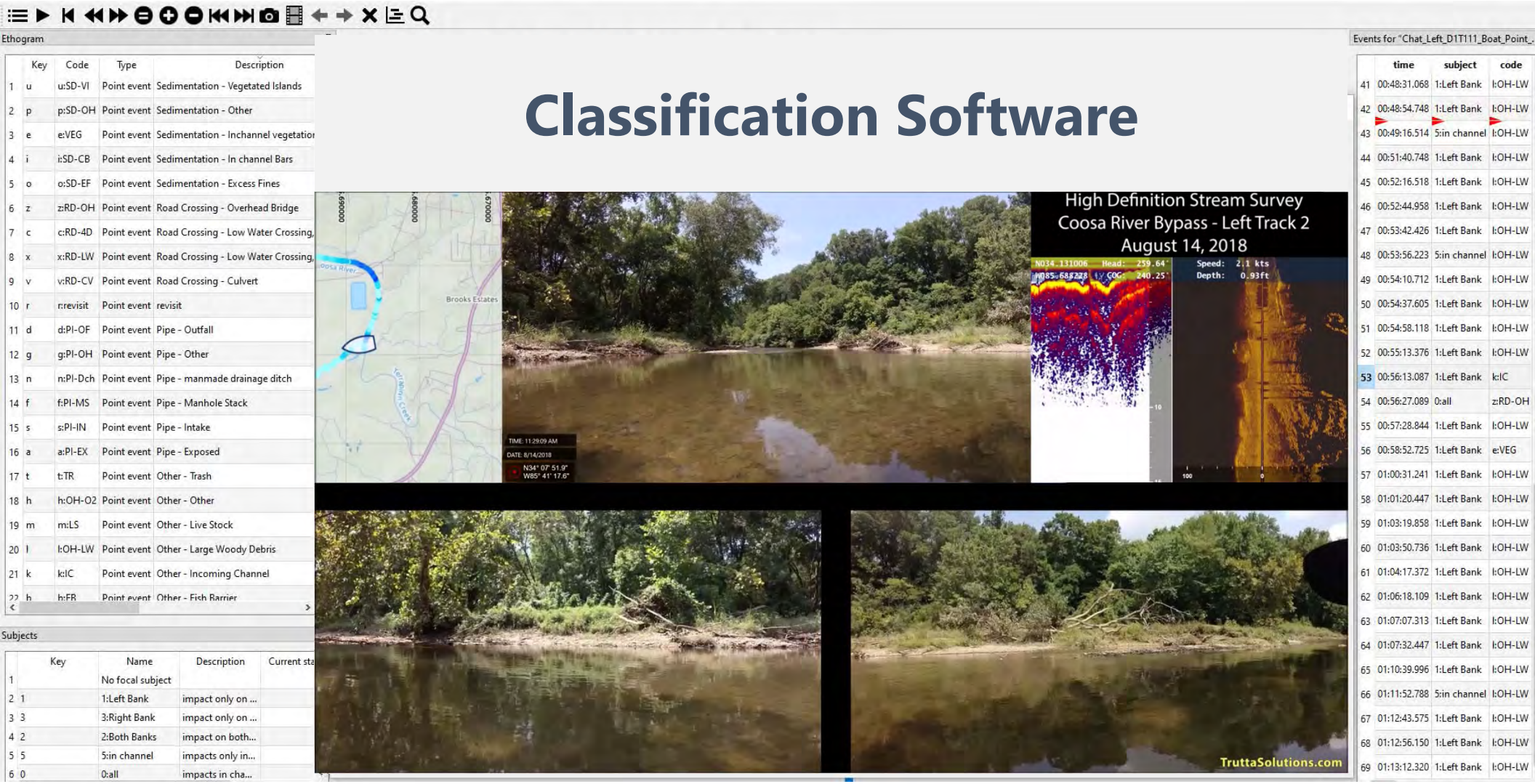
Exposed Pipe
Non-Functional

Left Bank

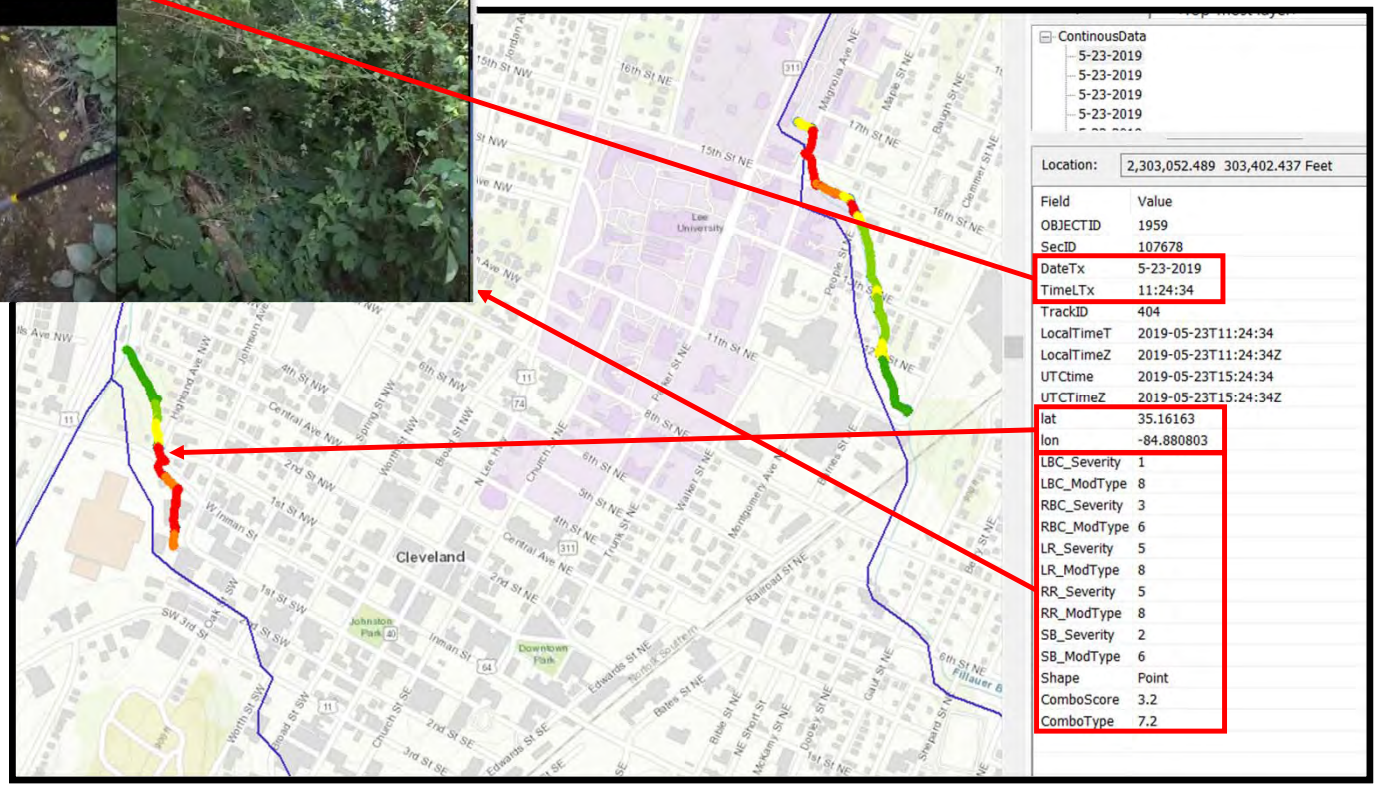
Right Bank


Front
Front
Front

Classification Software

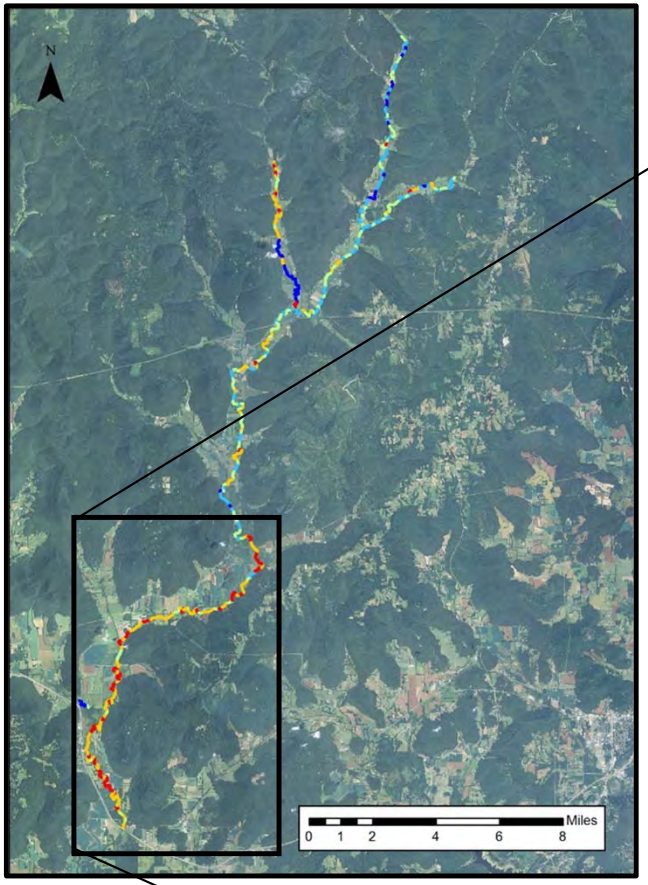


Identify and Highlight



Reviewable, Repeatable, QA/QC

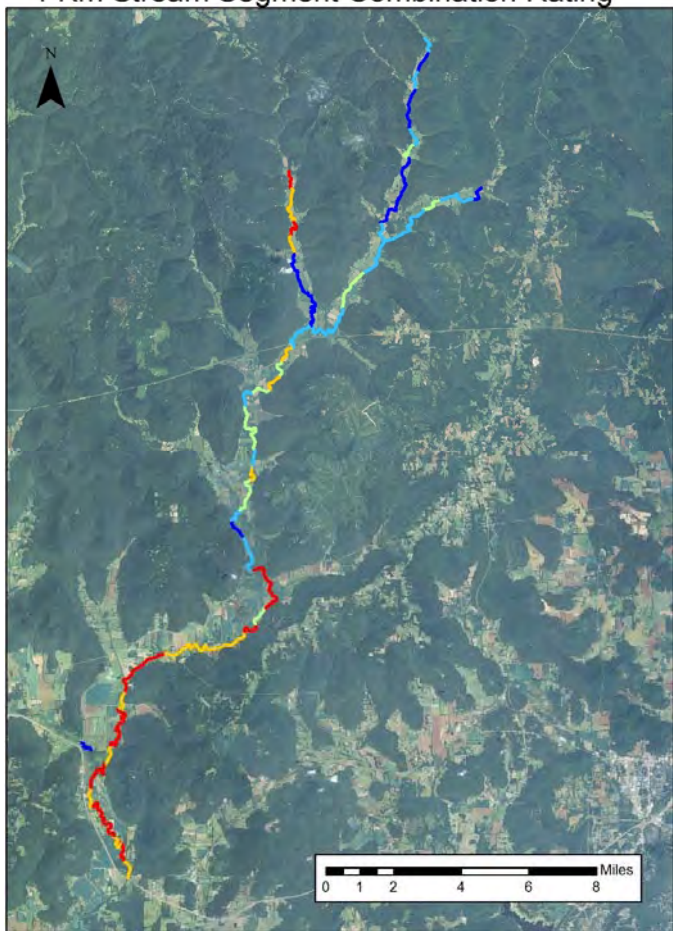
Analysis Made Easy



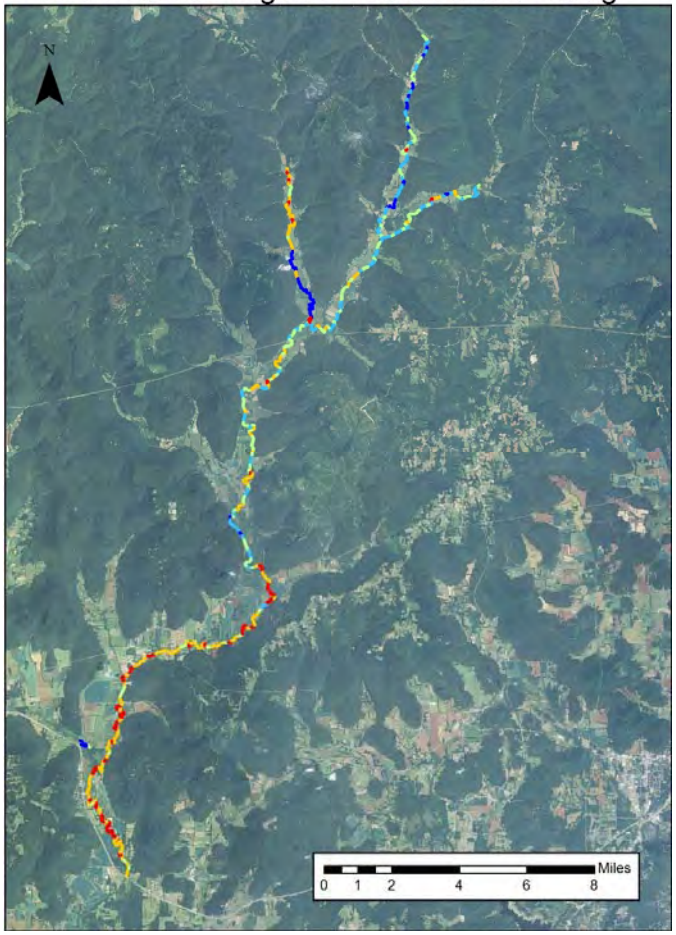
-Paint Rock River Survey- 53 Continuous miles
-61,382 continuous data points in 3 days,

Stream Segment Combination Rating

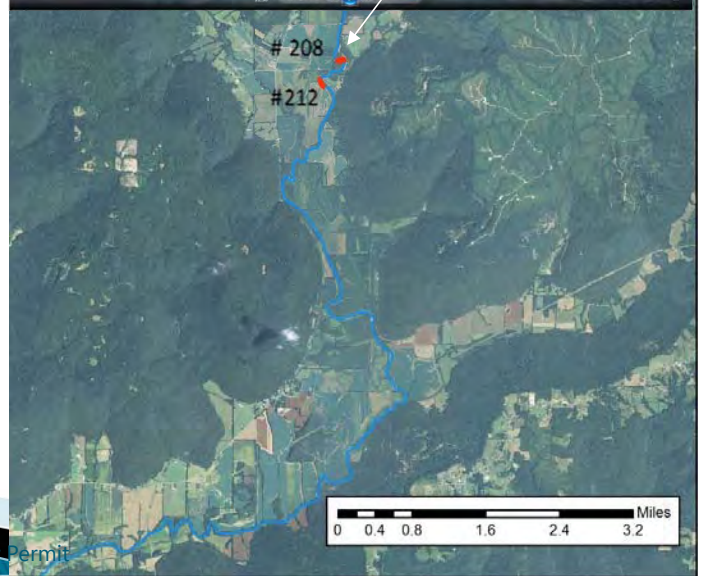
1 Km Stream Segment Combination Rating

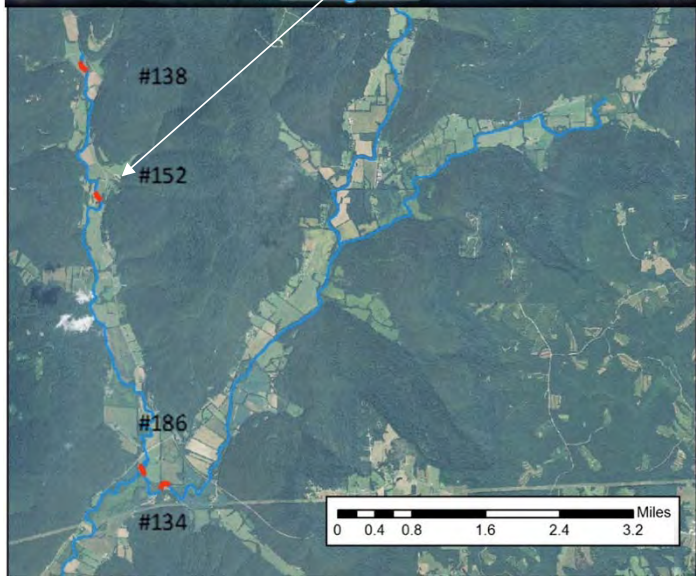


200 m Stream Segment Combination Rating

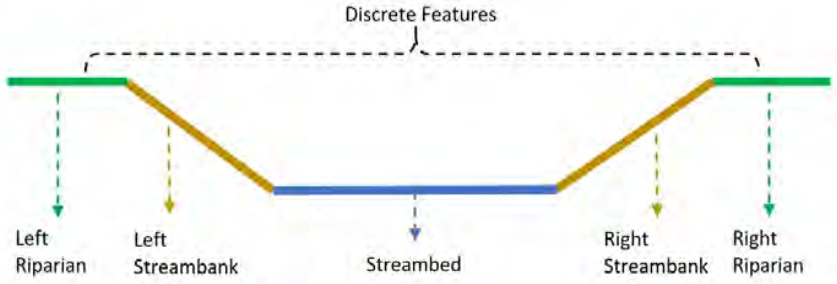


HDSS Enables BMP Cost Estimates: Permitting, Access, Construction





$$Rehabilitation\ score = \frac{(BMP\ Cost + Access\ Cost + Permit\ \&\ Ownership)}{\div Derived\ Funtional\ Uplift}$$

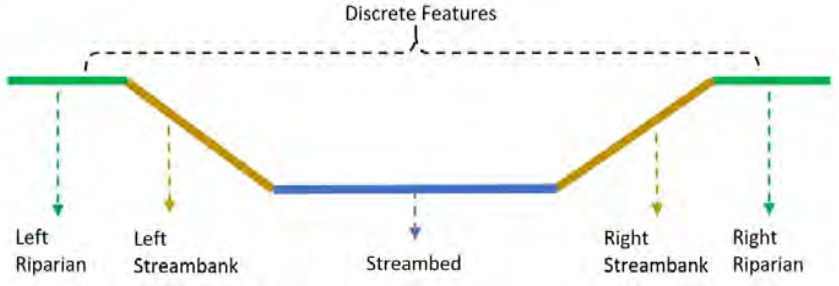


Cost of BMP

Example:

Streambank Planting:
Relative Cost: $$
Potential Uplift: 2 units

Streambank Grading, Stabilization and Planting:
Relative Cost: $$$$
Potential Uplift: 4 units



Cost of Access

Calculate from GIS: (To Stream Centerline at each meter)

- Distance from Nearest Roads
- Topography Change from Road
- Ground Cover from Road
- Wetland % from Road

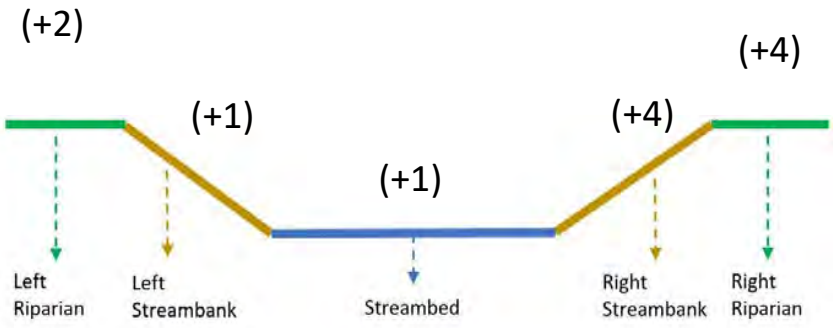
Combine and Determine a Relative Cost of Access Score

Cost of Permit/Ownership

Calculate from GIS: (To Stream Centerline at each meter)

- T & E impact:
  - # of Threatened species
  - # of Endangered species
- BMP Permits
  - Stream Channel Alteration Permit, etc.
- Ownership
  - # of owners on Left Bank within 100m up and downstream
  - # of owners on Right Bank within 100m up and downstream
- Combine and Determine a Relative Cost of Access Score for each Stream Corridor Component

Summarize Maximum Uplift



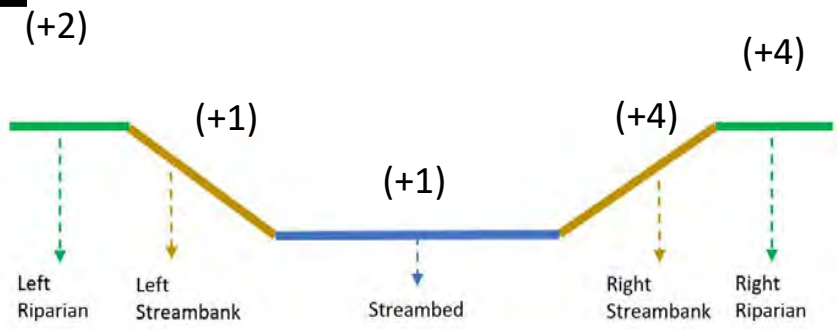
Cost/Unit Uplift

Summarize:

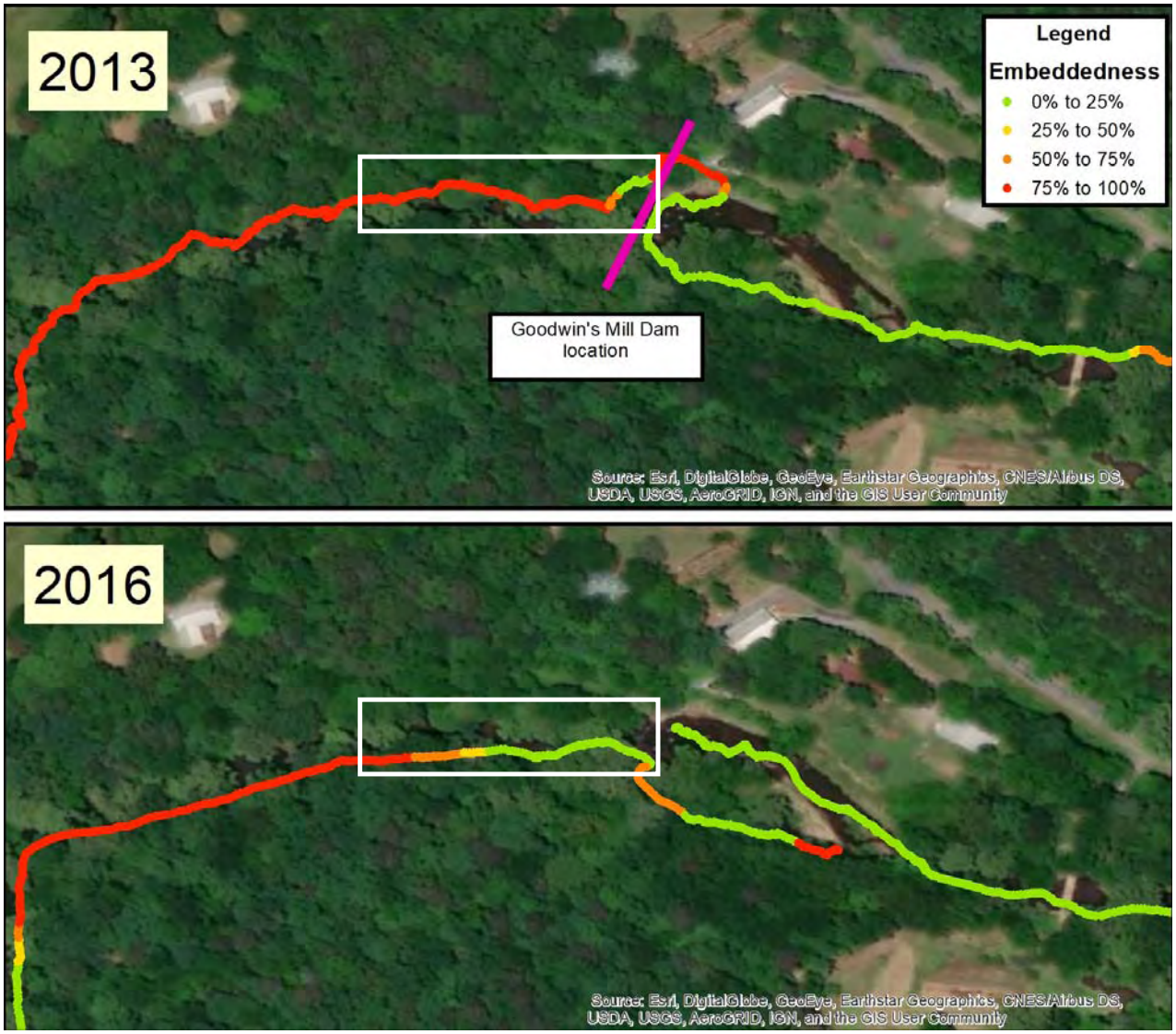
Cost/Unit Uplift = BMP Total Cost / Uplift

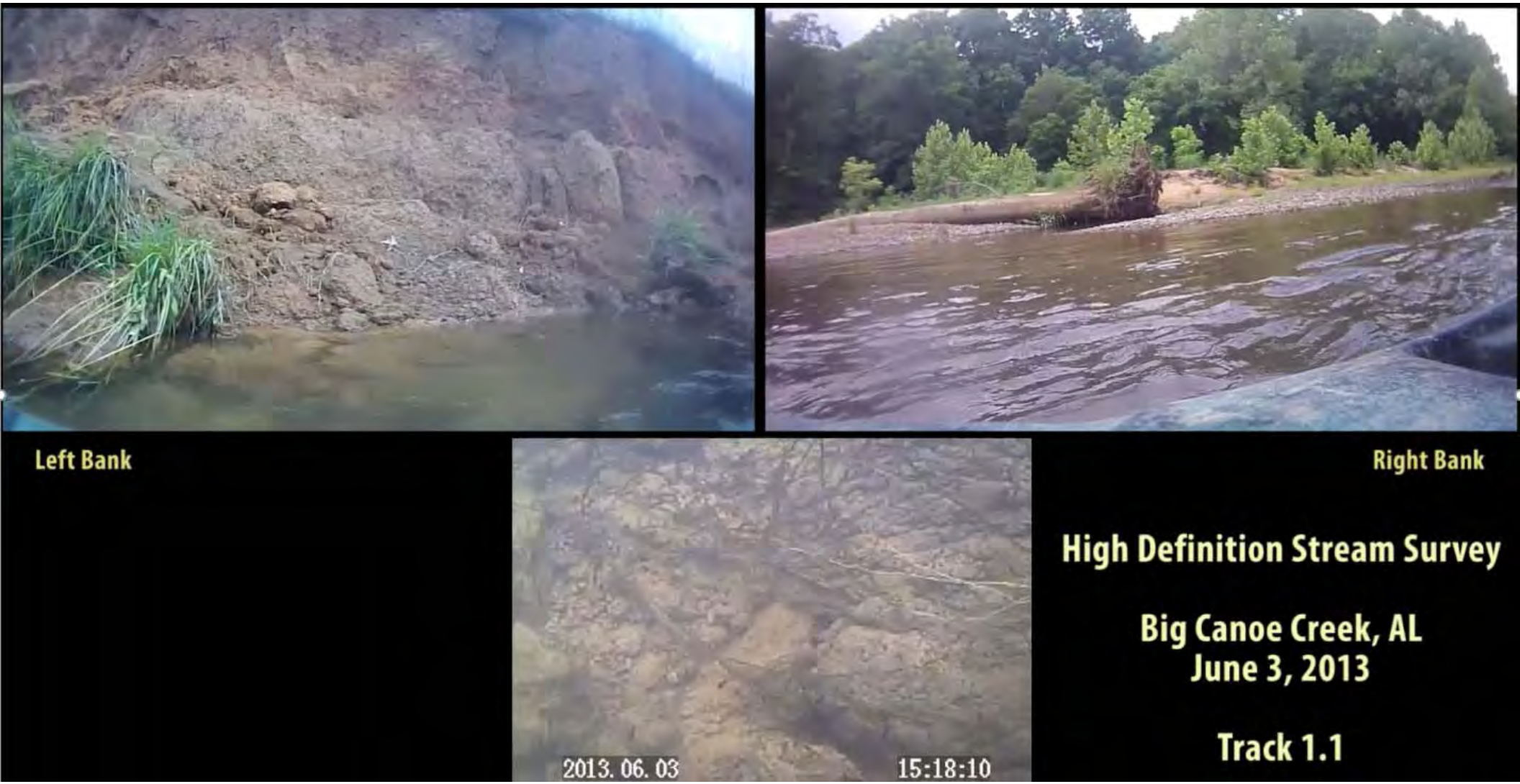
Select actions with the lowest cost per unit uplift.

- Map will show where
- BMP will tell what to do
- Cost will give relative amount
- Cost/Uplift will make sure it is best bag for buck.



Evaluation


2013
Legend
Embeddedness
0% to 25%
25% to 50%
50% to 75%
75% to 100%
Goodwin's Mill Dam location
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
2016
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community


Left Bank
Right Bank
2013. 06. 03
15:18:10
High Definition Stream Survey
Big Canoe Creek, AL
June 3, 2013
Track 1.1


2016. 04. 27
10:29:45
Front
HDSS
Big Canoe Creek, AL
March 27, 2016
Track 1.1
Left Bank
Right Bank

Sediment Contribution from Failing Streambanks

- ≈ 6m difference in stream centerline between 2013 and 2016
- ≈ 200m failing bank length
- ≈ 1.2m (4ft) high stream bank

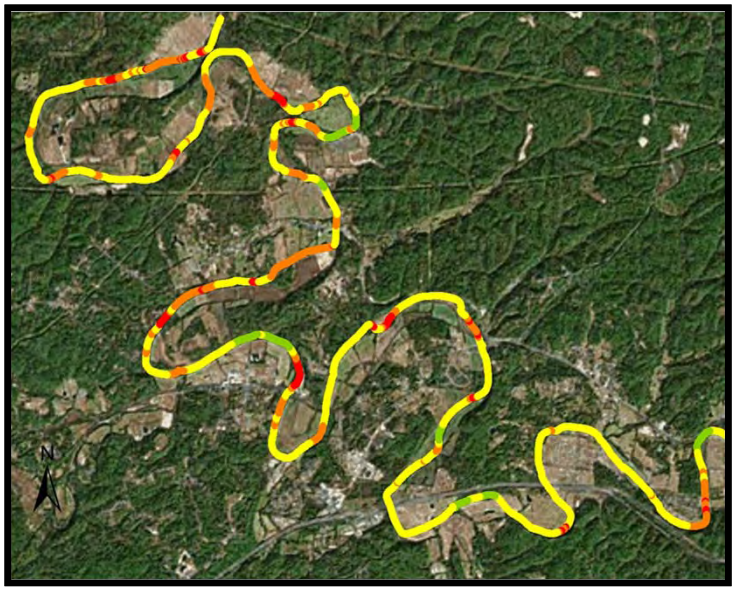
$$6m * 200m * 1.2m = 1440m^3$$

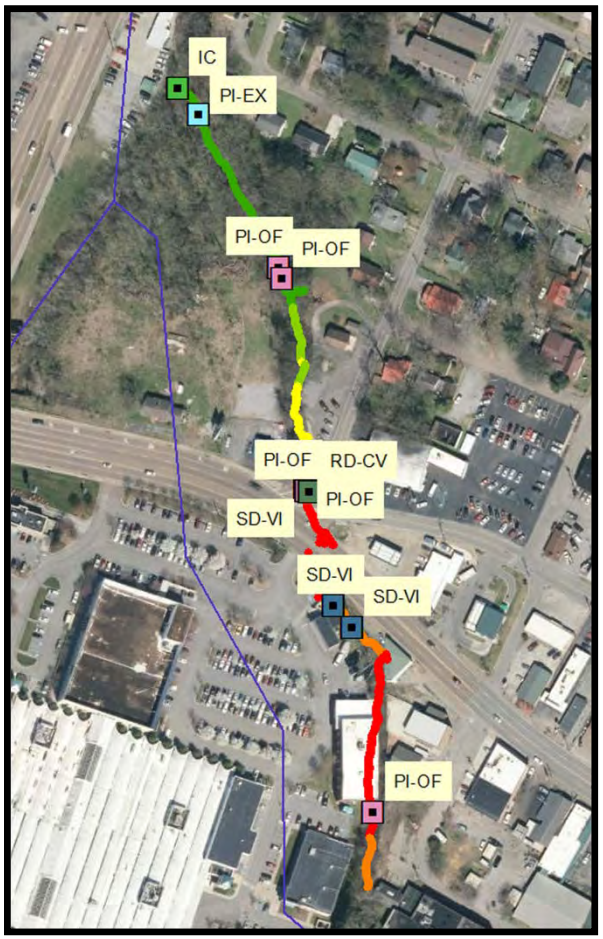
or

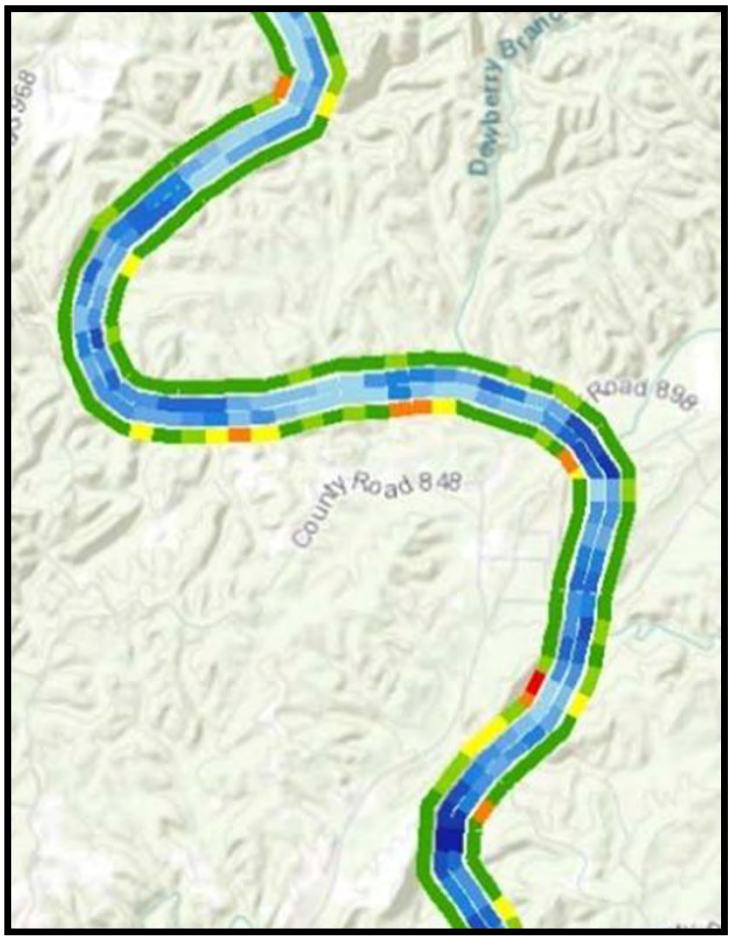
$480m^3$ /yr sediment input

Effective Communication

Easy to Understand Outputs







EPA guidance encourages partnerships

Power

Utilities

Transportation

Conservation

Flood Prevention

NPDES

Fisheries

Recreation

T&E

Hydropower

Stormwater MS4

Transportation

Wildlife

Environmental & Non-Profits

Water Quality
- Longitudinal Profile
- Tributary input
- Sediment TMDLs
- Point & Non-Point Source Impacts

Water Quantity
- Channel Profiles
- Channel Capacity
- Flood Risk Models
- Drought impacts
- Instream Flow

Habitat
- Riffle, Run, Pool Delineation
- Substrate Types
- Embeddedness
- Instream Cover
- Riparian Condition

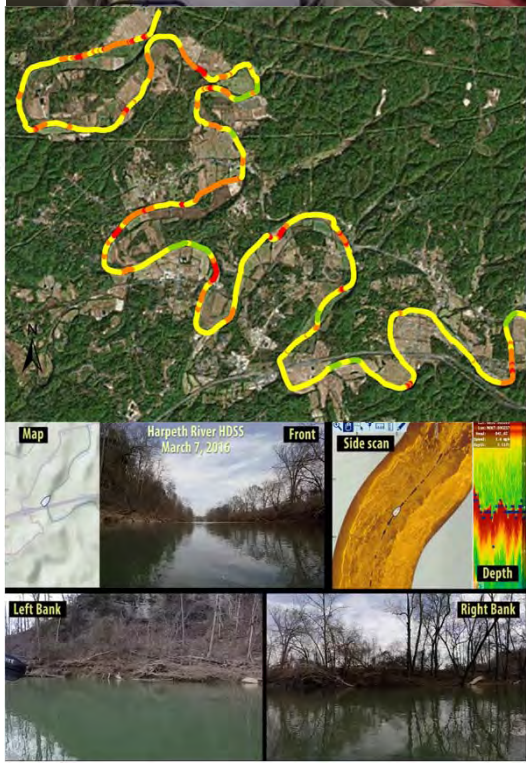
HDSS
Cross-sectional Transects and Longitudinal Surveys

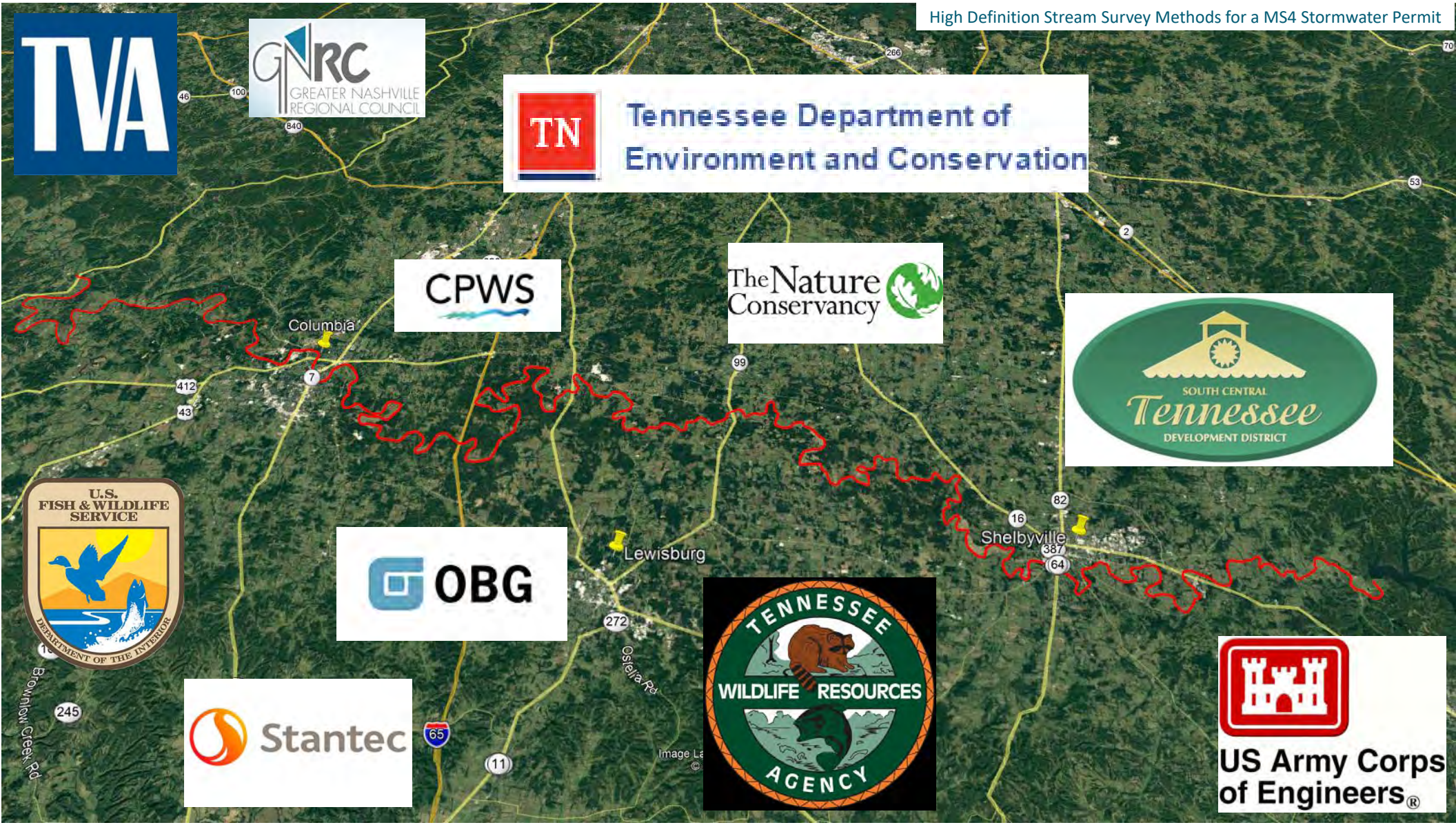
Infrastructure
Location, Extent & Condition of:
- Bridges
- Intakes & Outfalls
- Bank Stabilization
- Dams, etc.

Outreach
- Virtual Stream Tours
- Integrates with Aerial Imagery
- StreamView Dashboards show data and stream conditions

Stream Corridor Assessment
- Current Conditions Archive
- Restoration Prioritization
- Mitigation Potential

Integrated Planning Framework
HDSS supports integrated planning by providing high-quality, multi-attribute, geo-referenced data of the entire stream channel




TVA
GNRC
GREATER NASHVILLE REGIONAL COUNCIL
TN
Tennessee Department of Environment and Conservation
CPWS
The Nature Conservancy
SOUTH CENTRAL
Tennessee
DEVELOPMENT DISTRICT
U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR
OBG
Stantec
TENNESSEE WILDLIFE RESOURCES AGENCY
US Army Corps of Engineers®
Columbia
Lewisburg
Shelbyville
Brownlow Creek Rd
Oselia Rd
Image La
©
46
100
840
266
70
53
2
99
412
43
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82
16
387
64
272
245
65
11

MORE DATA, HIGHER QUALITY, LOWER COST

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