ECOLOGICAL LIFT EXPECTATIONS AND SITE SELECTION: AN APPROACH TO ESTIMATING ECOLOGICAL LIFT (AND MITIGATION CREDITS) IN MARYLAND

The National Stream Restoration Conference

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Stream Functions Pyramid

A Guide for Assessing & Restoring Stream Functions » OVERVIEW

5 **BIOLOGY** » *Biodiversity and the life histories of aquatic and riparian life*

4 **PHYSIOCHEMICAL** » *Temperature and oxygen regulation; processing of organic matter and nutrients*

3 **GEOMORPHOLOGY** » *Transport of wood and sediment to create diverse bed forms and dynamic equilibrium*

2 **HYDRAULIC** » *Transport of water in the channel, on the floodplain, and through sediments*

1 **HYDROLOGY** » *Transport of water from the watershed to the channel*

FIGURE 1

wharman@stream-mechanics.com

StreamMechanics

Topics

- Maryland Stream Mitigation Framework (MSMF) Background
- MSMF Components
  - Impacts
  - Stream Channel Mitigation
  - Mitigation Crediting of Stream Buffers
  - Emphasis on Site Selection and Site Protection
- Draft Site Evaluation Process for Stream and Wetland Mitigation in Baltimore District

Maryland Stream Mitigation Framework Objectives

1) Achieve “no net loss” of stream functions in Maryland.
2) Provide a consistent framework for stream mitigation AND impact assessment
3) Provide procedural stability for mitigation providers, permit applicants, and regulators.
4) Reward strategic site selection and mitigation plans, considering both broadscale factors using a watershed approach and finescale factors of a proposed site.
5) Apply data consultants typically collect for stream design and wetland delineations on a mitigation or impact site.

Acknowledgements for The Maryland Stream Mitigation Framework V.1

Team members (past and present):

Nick Ozburn (USACE/Lead), Matt Hynson (USACE), Denise Clearwater (MDE), Randah Kamel (MDE), Alex Sicard (MDE), Mark Secrist (USFWS), Jack Dinne (USACE), Aaron Blair (EPA), Carrie Traver (EPA), Megan Fitzgerald (EPA), Christine Mazzarella (EPA).

Contributions and feedback on MSMF V.1 and Beta Tool:

Maryland IRT, Maryland Environmental Service, Ecosystem Restoration and Banking Association, Maryland Water Resources Registry Team, Maryland DNR, USACE-Regulatory, The Maryland Wetland Assessment Team, USACE-Institute for Water Resources, USEPA-HQ, Maryland State Highways Administration, Rich Starr (USFWS/EPR), Cidney Jones (EPR), and numerous consultants who gave feedback on the MSMF Beta tool.

Unit of Measurement (Functional Foot)

What is a Functional Foot?

- Quantity of stream habitat adjusted by conditional and functional quality.
- Functional Foot Benchmark for MSMF:
  - 1 linear foot of stream
  - Quality rating of 100%
  - 1 sq mi DA
  - *This equals 1 functional foot

- Adjustments for incentives and waterbody size are implemented in calculator

- Applicable for Impacts and Mitigation
- Applicable to Stream Restoration, Stream Preservation, and Fish Passage crediting

MSMF V.1. Components and Tools

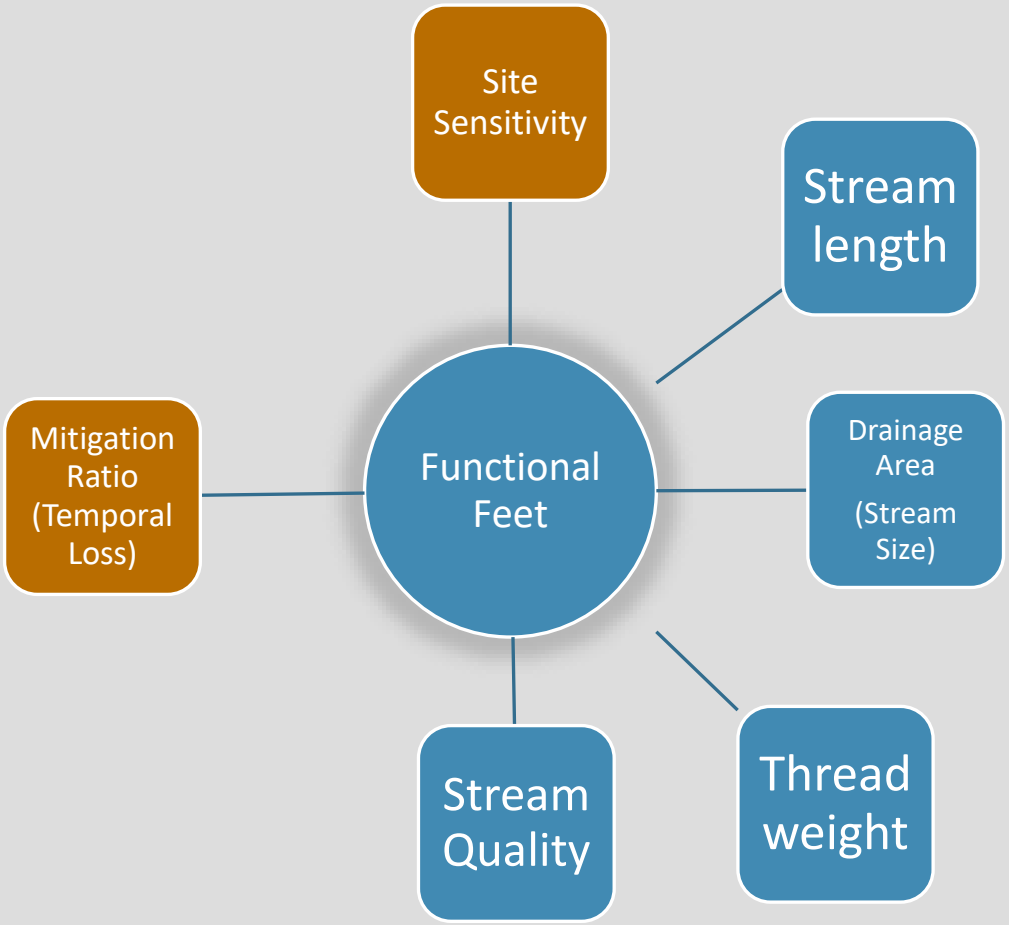
Components

- SOP
- Stream Impact and Mitigation Calculators
- MSMF V.1. Manual
- Functions Based Stream Assessment (and instructions)
- EPA Rapid Bioassessment Habitat Forms (and instructions)
- Stream Buffer Quality Assessment (and instructions)
- Site Evaluation Form for Stream and Wetland Mitigation

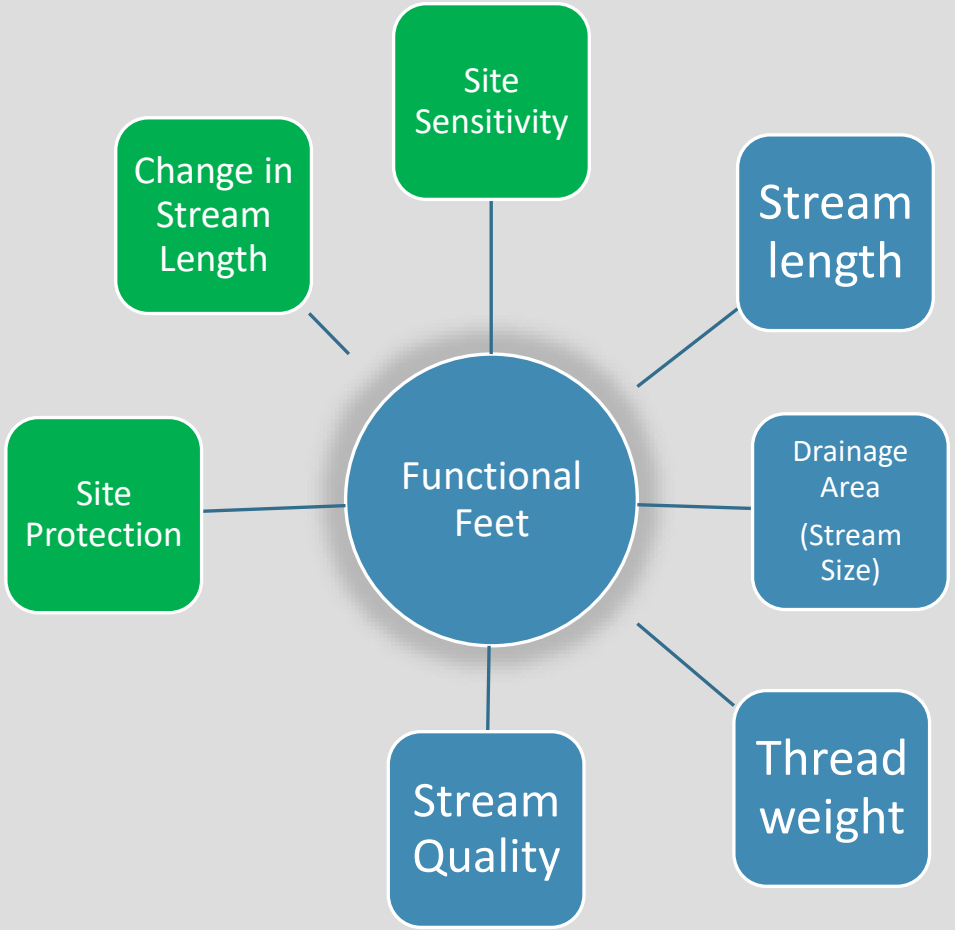
Tools

- Watershed Resources Registry:
  MSMF Site Sensitivity Mapper for Impacts
- Watershed Resources Registry:
  MSMF Site Sensitivity Mapper for Mitigation
- USGS Stream Stats

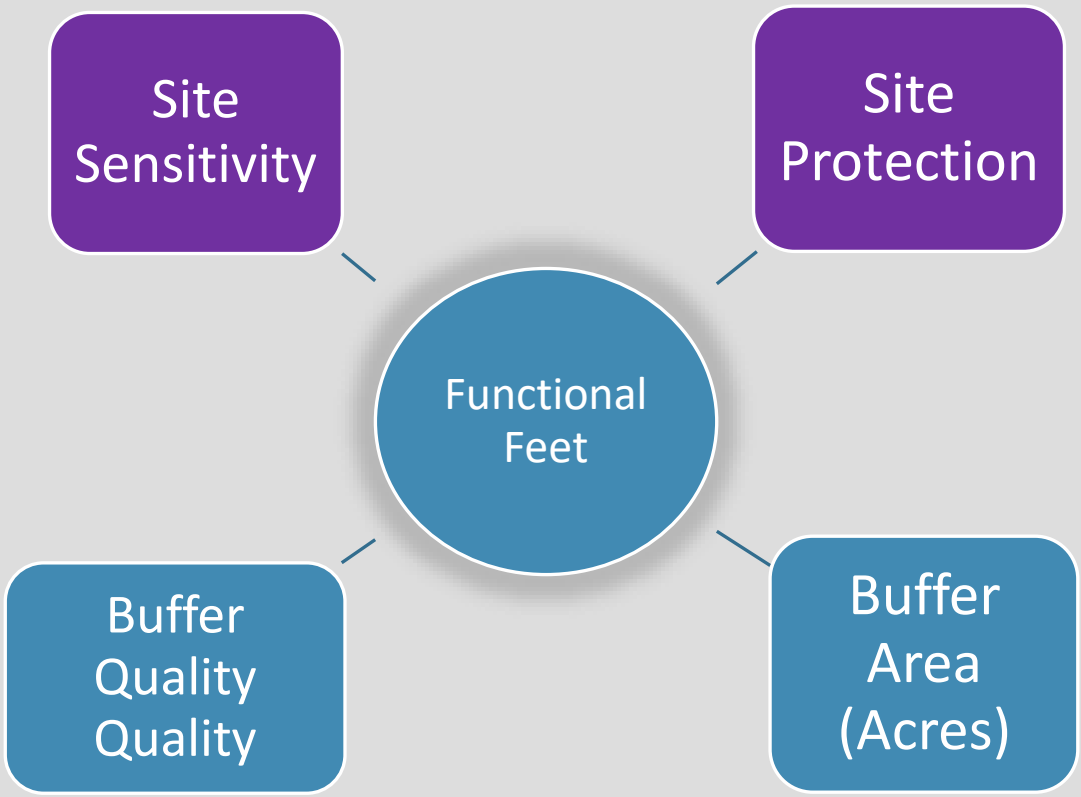
Stream IMPACT Calculation (Functional Feet)



Stream MITIGATION Calculation for Stream Channels (Functional Feet)



Stream MITIGATION Calculation for Stream Buffers (Functional Feet)



STREAM MITIGATION QUANTIFICATION

Two Calculation Tabs

For Channels

-12 Data Entry Columns

-7 Factor into Calculation/5 Categorical

For Buffers

-7 Data Entry Columns

-5 Factor into Calculation/2 Categorical

Additional Columns are Calculations

STREAM MITIGATION CALCULATOR for Stream Channels

BACKGROUND INFORMATION

Corps Project ID #:	NAB-2022-55555	Corps PM:	George Burns
Project Name:	Mingo Fork Mitigation Bank	Date:	15-Nov-22
Lat/Long:	39.6598, -76.8859	Sponsor:	Penguin Investments
County:	Baltimore County	Collaborators:	Acme Engineering (Bob, Jim, Marcy)

STREAM GAIN TOTAL (Functional Feet)

1206

											Raw Change in Reach Value (Functional Feet)	Adjustments				
Reach Name	Physiographic Region	Evaluation	Activity	Resource Type	Length (Feet)	Stream Quality	Channel Thread	Drainage Area (sqmi)	Raw Reach Value (Functional Feet)	Raw Change in Value (Functional Feet)		Change in Reach Length Adjustment	Site Sensitivity	Site Protection	Stream Gains (Functional Feet)	Remarks
Reach 1 Downstream Restoration	Piedmont	Existing	Preliminary Resource Evaluation	Perennial Headwater	1000	35%	Primary	1	350	450		No Change	2	Easement	604	Restoration of degraded reach
							100%	1.00				0	20%	0.08		
	Piedmont	Proposed	Restoration/ Enhancement	Perennial Headwater	1000	80%	Primary	1	800			0.5	90	64		
							1	1.00				0				
Reach 2 Upstream Preservation	Piedmont	Existing	Preliminary Resource Evaluation	Perennial Headwater	1000	80%	Primary	1	800	0		No Change	2	Easement	160	Preservation of HQ reach
							100%	1.00				0	20%	0.08		
	Piedmont	Proposed	Preservation	Perennial Headwater	1000	80%	Primary	1	800			0.5	16	64		
							1	1.00				0				
Trib 1 Restoration	Piedmont	Existing	Preliminary Resource Evaluation	Intermittent	1000	35%	Primary	0.4	245	315		No Change	2	Easement	442	Restoration of tributary
							100%	0.70				0	20%	0.08		
	Piedmont	Proposed	Restoration/ Enhancement	Intermittent	1000	80%	Primary	0.4	560			0.5	63	64		
							1	0.70				0				

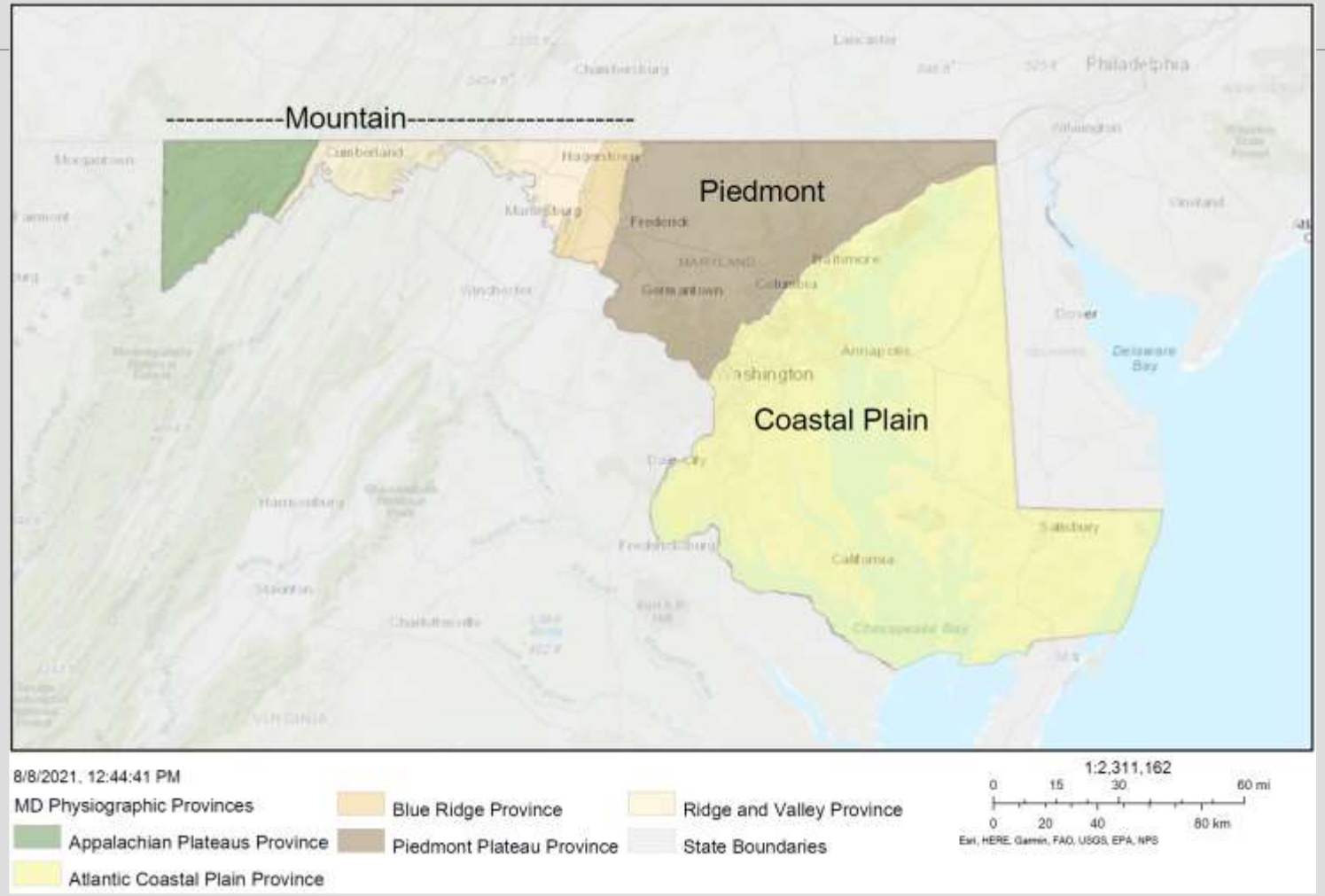
Stream Mitigation Calculation for Stream Channels

Raw Change in Reach Value
1-Identifying the stream reaches

- Stream reaches are identified as a length of stream with roughly the same stream quality score, without a major change in drainage area.
- The Stream reach applies only to an area receiving the same treatment.
- *For example: If a stream reach of consistent quality and size (drainage area) will be subject to two different types of impacts (Temporary construction and fill). It would be split into two different reaches.*
- *Noticeable changes in Entrenchment and Incision are good places to break up reaches*

Raw Change in Reach Value

2) Physiographic Regions of Maryland (simplified)



Raw change in Reach Value
3-Evaluation

- Evaluation: Preset in calculator
- Existing on top row
- Proposed on bottom row.

Raw change in Reach Value
4-Activity

- Activity: Select from dropdown
  - Restoration/Enhancement: For all “restoration type activities”
  - Preservation: For preservation of high quality streams without work performed

**Buffer enhancement work covered in Stream Buffer Calculation Tab (Separate workbook)*

Raw change in Reach Value
5-Resource Type

- Resource Type:
  - Ephemeral
  - Intermittent
  - Perennial Headwater
  - Perennial Wadeable

- CATEGORICAL, Does NOT factor into Credits.

Raw Change in Reach Value
6-Stream length

- Physical stream length along centerline of stream channel measured in feet.

Raw Change in Reach Value
7) Stream Quality Assessment

Stream Assessments:

- Function Based Rapid Stream Assessment with numeric Scoring (USFWS 2015)
- For Ephemerals: “EPA RBP Habitat Forms for Ephemeral/Intermittent Streams”
- *Take Score out of Total Possible to yield Stream Quality Value for Functional Foot Calculation*
  - (Example: Score 120/200 possible = 60%)
- Compare Existing vs. Proposed Conditions
- Revised Stream Assessment Coming in 2023

Raw Change in Reach Value
8) Stream Channel Thread

Thread Weight Adjustment:

- Solves challenge of multi-thread channels and oxbows
- Channels must be perennial and at least 1 ft wide
- For Multi-thread systems but NOT Braided channels
- Limit of three credited channels (including oxbows)
  - Primary (100%)
  - Second (20%)
  - Third (10%)

Raw Change in Reach Value
9) Drainage Area adjustment (stream size)

- DA is directly Related to Bankfull Width
- Bankfull is directly related to OHWM
- Roundabout way at including stream area without measuring it (intentional)
- Increases Capped at DA=10 sqmi (Work on larger waters may occur, no increase in credit)

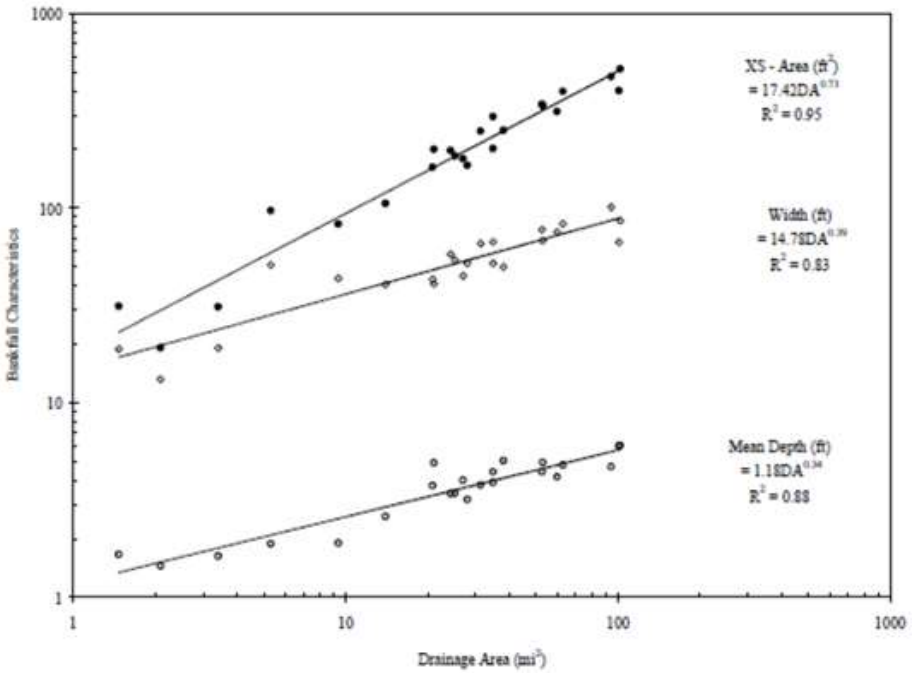
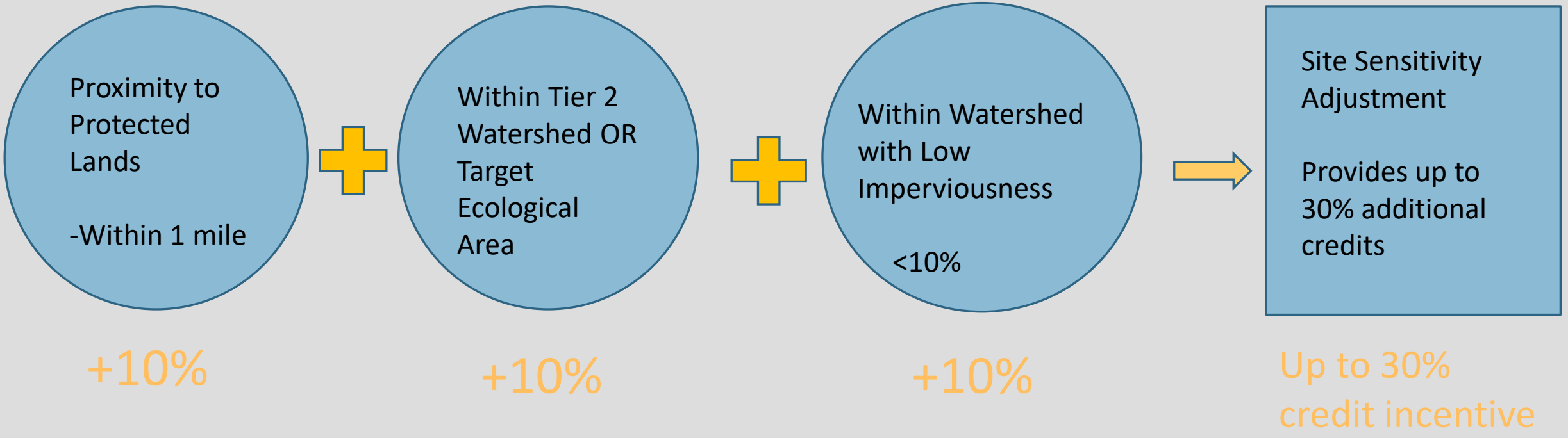


Figure 17. Bankfull channel dimensions as a function of drainage area for Maryland Piedmont survey sites (n = 23).

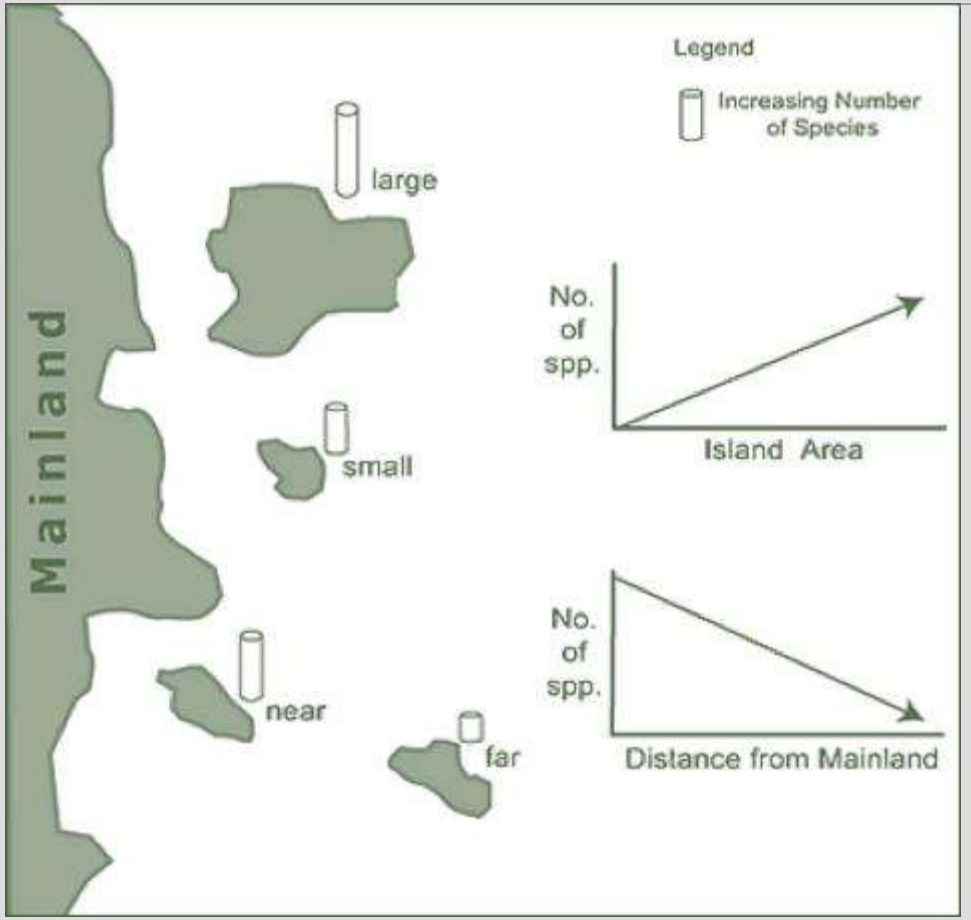
Figure from USFWS 2002
(MD Piedmont bankfull regional curves)

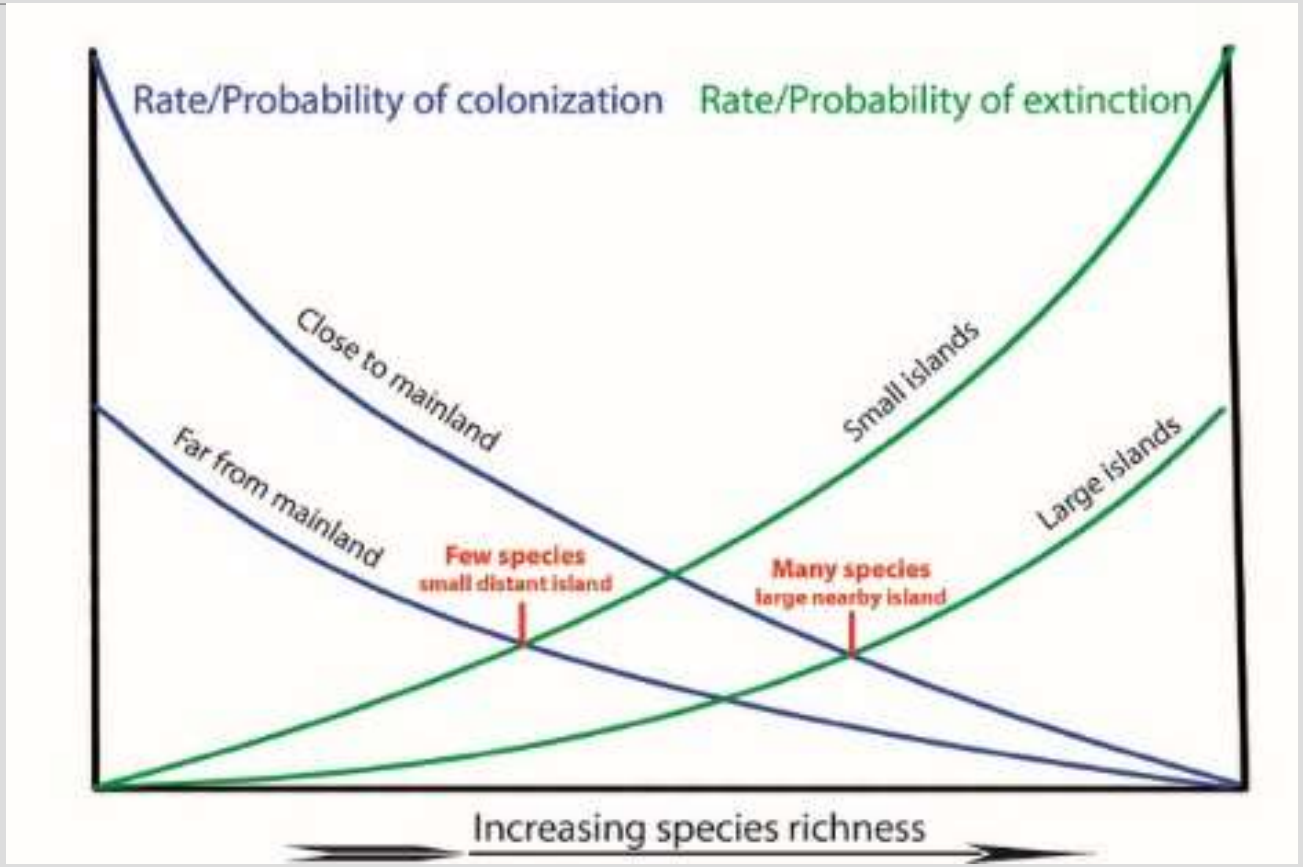
Stream Mitigation Adjustments

10-Stream Sensitivity Adjustment (Prioritization)



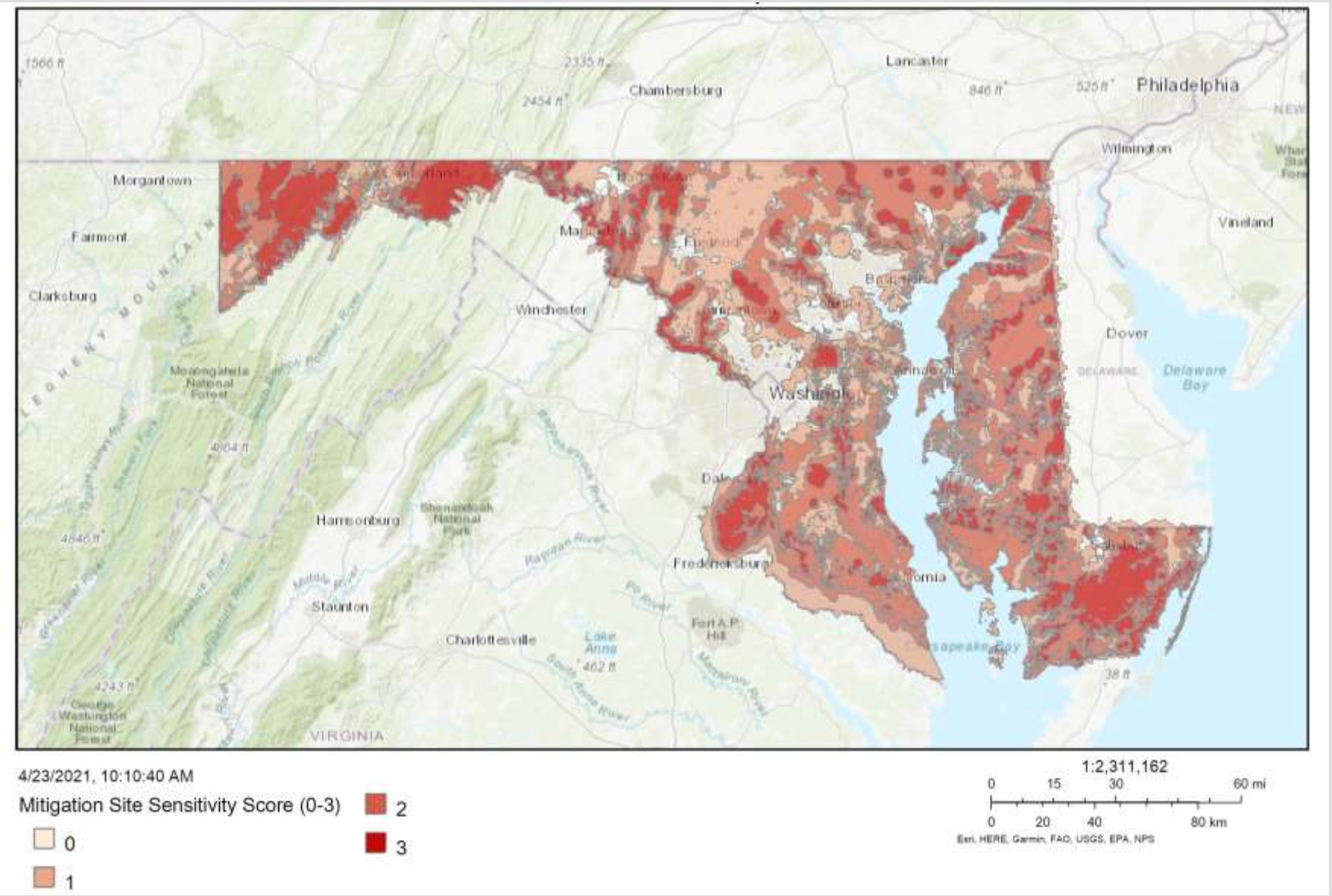
Theory of Island Biogeography and Mitigation (or Impact) Site Selection





From MacArthur and Wilson, 1967.

Stream Mitigation Site Sensitivity Score



Geographic prioritization based on Maryland Watershed Resources Registry layer:

-MSMF Site Sensitivity for Mitigation

Site Sensitivity/Site Selection Crediting Process

1) Applicant examines WRR Score for: MSMF Site Sensitivity for Stream Mitigation

2) Applicant provides “Site Evaluation Form for Stream and Wetland Mitigation”

3) Reviewers/Resource Agencies weigh in on what appropriate value should be based on 1&2 above.

Note: We are looking at a variety of factors and determining the site sensitivity value (0-30%) awarded based on site prioritization (WRR) and on ground site conditions. At discretion of reviewers/resource agencies.

Stream Mitigation Adjustments
11)Change in Reach Length

- Purpose:
  - In prior MSMF Calculations, disproportional credit awarded for channel length gains and lost for channel length losses (fixing tortuously meandering channels)
  - *Ex. Restoration of 1,000 ft channel to 1,200 ft. 1,000 ft of the restoration has quality change from 30% (Existing) to 75% (Proposed). The Remaining 200 ft had a quality range from 0%-75%. This dramatically effects crediting. A 50% adjustment is added to any reach length gains/losses to make these more comparable.*
  - Change based on Public comments and past use of older MSMF Tools.

Stream Mitigation Adjustments
12) Site Protection

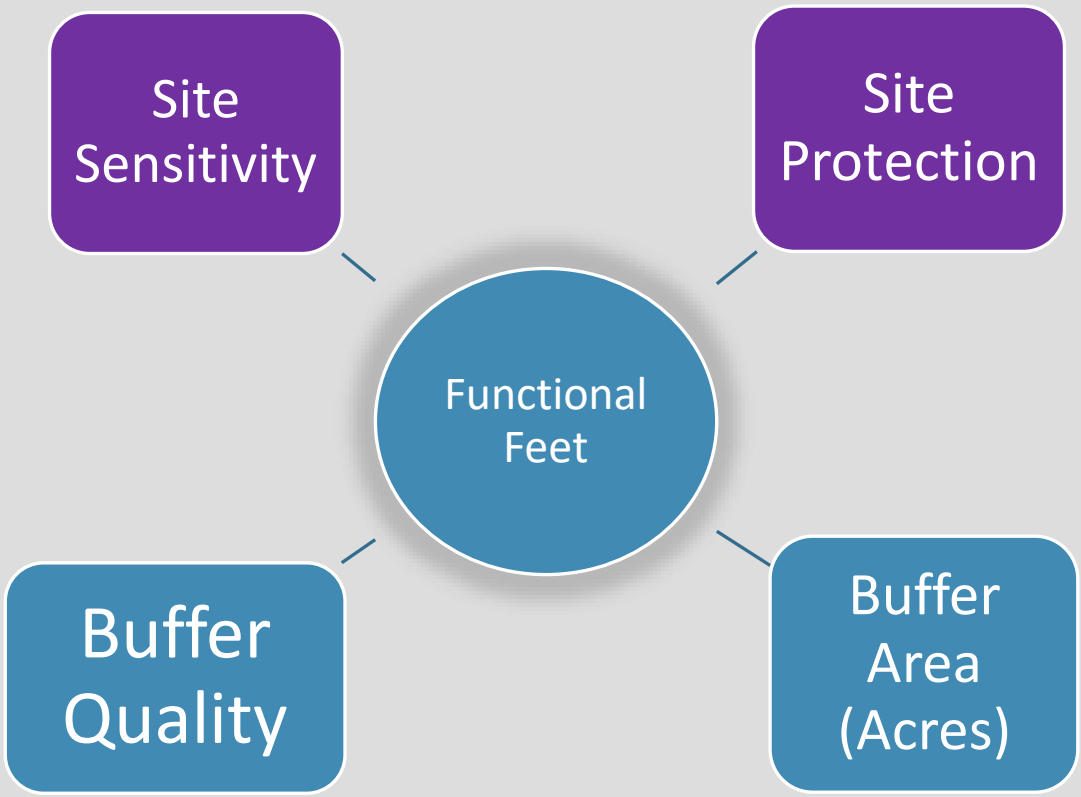
Options and Adjustments

- Existing Protection (+0%)
  - Where land is already protected (some public lands, etc.)
- Improved Protection (+3%)
  - Where land is already partially protected, and instrument improves protection
- Deed Restriction (+5%)
- Easement (+8%)
- Accredited Easement (+10%)


IS YOUR CUP
HALF FULL OR
HALF EMPTY?
OUT
OF
ORDER

Stream Mitigation Calculation for Stream Buffers

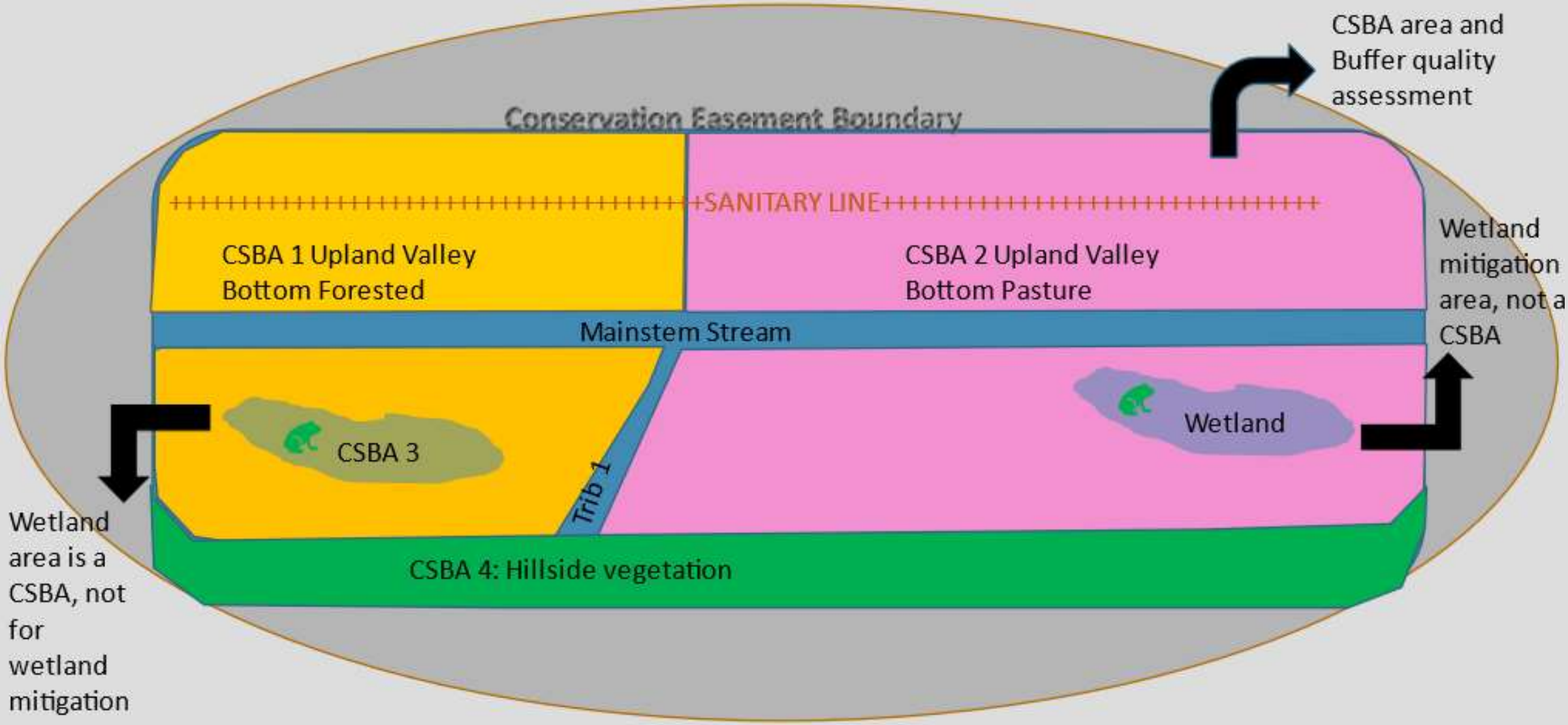
Stream Mitigation Calculation for Stream Buffers (Functional Feet)



Raw Change in Buffer Value
Credited Stream Buffer Area (CSBA)Name

- Identify Different CSBA for each Distinct Vegetation type on the site
- Must be within boundaries of site protection instrument
- At a minimum separate CSBA for:
  - Valley Bottom Uplands
  - Valley Bottom Wetlands
  - Hillside
  - If present within boundaries of site protection instrument

Identifying Credited Stream Buffer Areas



STREAM MITIGATION CALCULATOR for Stream Buffers

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County:	Baltimore County	Collaborators:	Acme Engineering (Bob, Jim, Marcy)

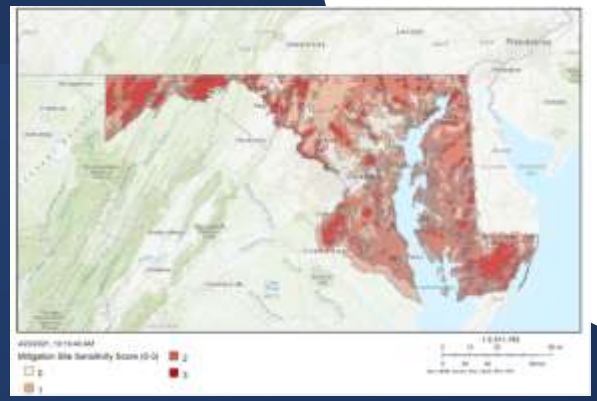
Total Stream Gains (Functional Feet)

304

Credited Stream Buffer Area Name (CBSA)	Activity	Evaluation	Buffer Area (Acres)	Buffer Quality	Quality Acres	Raw Buffer Value (Functional Feet)	Raw Change in Buffer Value (Functional Feet)	Adjustments: Site Sensitivity	Adjustments: Site Protection	Stream Gains (Functional Feet)	REMARKS
CSBA 1: Valley Floor Pasture Uplands	Preliminary Resource Eval	Existing Buffer	10.00	20%	2.00	100	225	3	Accredited Easement	325	Planting forest and pollinator plants in former pasture area after grading.
	Restoration/ Enhancement	Proposed Buffer	10.00	65%	6.50	325		30%	10%		
								68	33		
CSBA 2: Hillside	Preliminary Resource Eval	Existing Buffer	10.00	85%	8.50	383	0	2	Easement	105	Hillside riparian zone, existing high quality to be preserved.
	Preservation	Proposed Buffer	10.00	85%	8.50	383		20%	8%		
								8	31		
CSBA 3: Mature Forested Valley bottom (existing)	Preliminary Resource Eval	Existing Buffer	10.00	85%	8.50	425	-125	2	Easement	-126	Mature Forest to young forest after grading.
	Restoration/ Enhancement	Proposed Buffer	10.00	60%	6.00	300		20%	8%		
								-25	24		

Draft Site Evaluation Form For Stream and Wetland Mitigation

Maryland Stream Mitigation Framework Version 1



Maryland Stream Framework: Process Steps by Scale

Step 1. Broad Landscape Scale

- Is the site strategically located within the Ecological Landscape?
- Desktop Analysis

Step 2. Site Scale

- Is the site suitable for stream mitigation?
- Desktop Analysis/Field Evaluation

Step 3. Reach Scale

- What is the quality of each stream reach and each buffer area? How will it change after work is performed?
- Field Evaluation(s)

STEP 1: BROAD LANDSCAPE SCALE

1. Broad Landscape Scale

- Is the site strategically located within the Ecological Landscape?

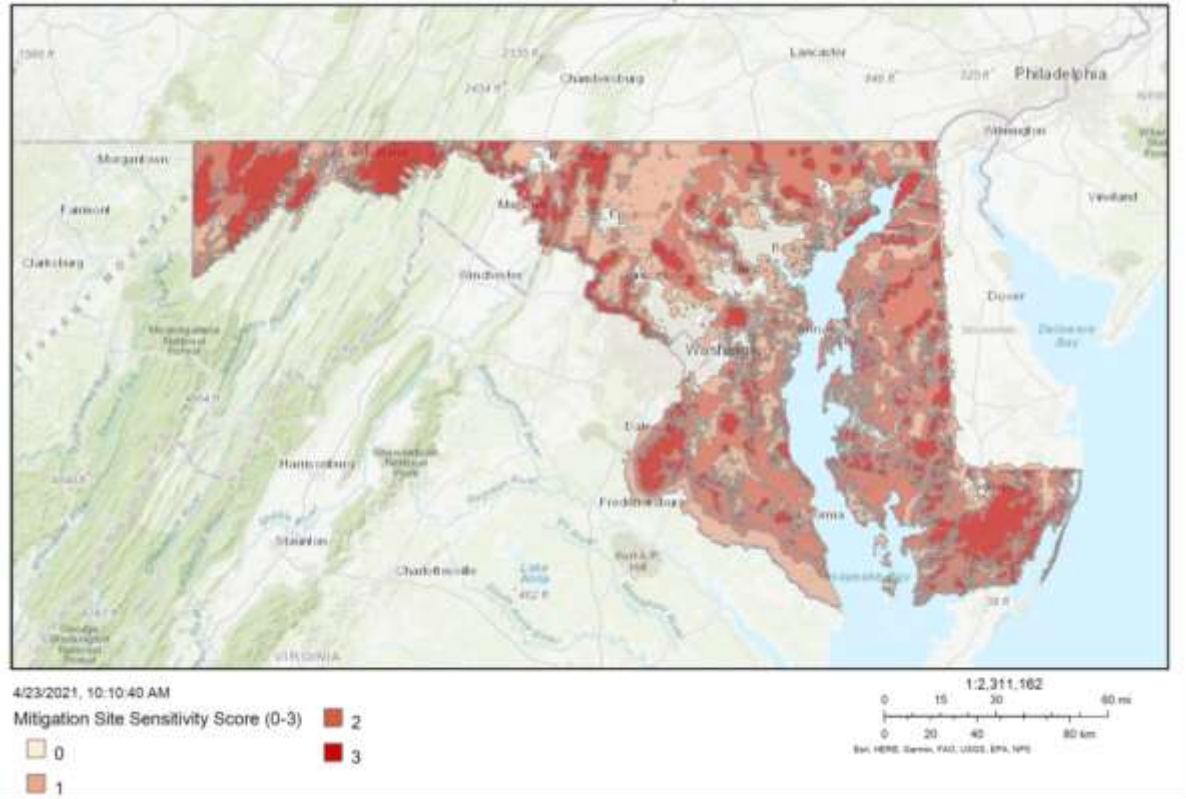
Desktop Analysis

Watershed Resources Registry: Site Sensitivity Data

DNR data (optional)

Captured in MSMF Mitigation Calculation: Site Sensitivity

Other Considerations: Aquatic Connectivity



STEP 2: SITE SCALE

2. Site Scale

- Is the site suitable for stream mitigation?
- For restoration, seeking physically damaged sites with healthy water quality, secure property, and few constraints.

Desktop Analysis/Field Evaluation

Site Evaluation Form for Stream Mitigation

1) Water Quality (303d listed? High Conductivity?)
   -If yes, water quality evaluation required

2) Design Constraints:
   -Valley Confinement
   -Utility Constraints throughout site
   -Existing Communities (potential losses)

3) Real property considerations: Clear Title, Site protection method
   -Pass/Fail, If Pass captured in Mitigation Calculator “Site Protection”

STEP 3: REACH SCALE

3. Reach Scale

- What is the quality of each stream reach and each buffer area?
- How will quality change after work is performed?

Field Evaluation

Stream Quality:
-Stream Quality Assessment (FBRSA) or (RBP)

Buffer Quality:
-Stream Buffer Quality Assessment

Captured in Mitigation Calculator “Stream Quality” and “Buffer Quality” tabs respectively

Stream length and buffer area also determined at this scale/phase

Post-Construction Monitoring

Suggested Sequence for Stream Mitigation: Bank Proposals

For Maryland Stream Mitigation Framework Version 1

The **Prospectus Phase** includes **Steps 1-6**
The Prospectus Phase primarily covers the Broad Landscale Scale and the Site Scale items with some Reach Scale considerations.

1

Step 1: Mitigation Site Search
Tools:
-Maryland WRR: MSMF Stream Sensitivity Layers for Mitigation
-MSMF V.1. Manual

2

Step 2: Site Evaluation
Use "Site Evaluation for Stream Mitigation" form to screen for water quality, site constraints, aquatic connectivity, and property/title considerations (screening only).

Option to provide Draft Prospectus for review during this time

3

Step 3: Verify Water Quality **If Required**
If required after completing Step 2 "Site Evaluation for Stream Mitigation," provide detailed water quality report.

4

Step 4: Identification of Stream Reaches and Buffer Areas
Provide photographs and high-level summary of existing vs proposed quality. Provide USGS Stream Stats output for any stream assessments and resource mapping.

5

Step 5: Prospectus Submittal
-Prospectus provided to IRT including information from steps 1-4.
-See Templates

The **Draft Mitigation Banking Instrument Phase** includes **Steps 7-11**
During the Draft MBI Phase, detailed preliminary Reach Scale tasks are completed. Unresolved Site Scale items also must be completed at this Phase.

6

Step 6: Prospectus Review
-Agency and public review of Prospectus
-Corps provides Initial Eval letter to Sponsor within 90 days of receipt of complete Prospectus

7

Step 7: Stream and Buffer Assessments
-Stream and wetland teams (Bank Sponsor) assess stream reaches and stream buffer areas and delineate wetlands.
-Tools: FBRSA, RBP forms, Stream Buffer Quality Assessment, Wet. Del. Manual and Regional Supplement, MSMF V.1. Manual, MSMF V.1.

8

Step 8: Preliminary Biological Monitoring
-MBSS Protocol for Macroinvertebrates
-MBSS Protocol for Fishes or Herps
-Option for alternative species monitoring (Avian, bats, audio sampling, etc)

9

Step 9: Detailed Stream and Buffer Design
-Topo Survey
-Stream and Buffer Design
-Hydraulic Modeling

10

Step 10: Draft MBI Submittal
-Sponsor provides all required Items from Steps 1-9
-See MBI checklist
-Include Completed MSMF V.1. Stream Mitigation Calculation Tab for Stream Channels and/or Tab for Stream Buffers
-See MSMF V.1., MSMF V.1. Manual

The **Final MBI Phase** includes **Steps 12-15**
It includes revisions to the Draft MBI, site design, and credit calculations based on agency comments.

11

Step 11: Draft MBI Review
-Agencies Review MBI
-Corps provide status to sponsor within 90 days of complete Draft MBI receipt by the IRT.

12

Step 12: Design and MBI Revisions
-Revision to site plan and Draft MBI based on agency comments
Revision to MSMF V.1. Stream Mitigation Calculations
-See "Final MBI Checklist" and "Final MBI template"

13

Step 13: Final MBI Submittal
-See MBI Checklist and MBI template

14

Step 14:Final MBI Review
-Agency Review of Final MBI
-Corps provides approval or comment letter within 45 days
-Site protection instrument recorded upon approval.

The **Performance Phase** includes **Steps 16-18**
During the Monitoring Phase, post-construction stream/buffer assessments are completed in addition to biological monitoring. Stream Crediting is recalculated in the MSMF Stream Mitigation Tab and site repairs may be needed.

Step 15: Project Construction Phase
-Construction initiated after required permits are received.

15

Step 16: As-built Report Submittal
-Sponsor provides As-built Report to Corps/MDE within 90 days of construction completion.
-Credit release pending

16

Step 17: Post-Construction Monitoring and Reporting
-10 years of monitoring (select years)
-Assess stream and buffer quality and monitor biology
-Tools: FBRSA, RBP, Stream Buffer Quality Assessment, MBSS Protocols, MSMF V.1.
-MSMF V.1. Credit Re-evaluation based on monitoring
-See Final MBI Monitoring Plan

17

18

Step 18: Release From Monitoring/Bank Closure

Step 19: Long-term Management/Bank Closure
-Long-term Steward enforces site protection, monitors site, notifies Corps/MDE and sponsor of potential problems and threats to the site.
-The sponsor remains responsible for interim monitoring until bank closure.

19