



PERFORMANCE STANDARDS

All required documentation, including monitoring reports, semi-annual ledgers, and as-built surveys shall be submitted to Maryland Department of the Environment (MDE) and the Army Corps of Engineers (Corps). MDE and the Corps will use best professional judgment, visual observation, and monitoring reports to evaluate attainment of performance standards and in determining whether part of or the entire Project is successful or whether corrective actions are warranted. Success will be determined on a plot, well, field, cell, area, or reach basis. Presenting averages or means of plot data across a project site is not satisfactory to demonstrate success. All of the following standards will be used to assess project success and credit releases and must be achieved each monitoring year.

The project shall conform to the following performance standards by the end of the monitoring period, unless otherwise determined by MDE and the Corps.

Performance Standards and success criteria have been put into table format to easily determine if performance standards have been met. Tables 1, 2, and 3 can be found below and should be used to determine if performance standards have been met for each monitoring year.

Wetland Performance Standards

1. Wetland Area(s) – Restoration and Enhancement:

- a. Wetland Vegetation Dominance: Wetland vegetation dominance, defined as a vegetation community where more than 50% of all dominant plant species across all strata are rated obligate (“OBL”), facultative wet (“FACW”), or facultative (“FAC”), using the vegetation sampling procedures as described in the appropriate regional supplement to the Corps of Engineers Wetland Delineation Manual, must be achieved; and
- b. Aerial Cover Vegetative Standards:
 - i. By the end of monitoring year two, a minimum of 60% of the mitigation site shall be vegetated (either by planted or volunteer plants) by native (FAC or wetter) species.
 - ii. By the end of monitoring year three, a minimum of 70% of the mitigation site shall be vegetated (either by planted or volunteer plants) by native (FAC or wetter) species.
 - iii. By the end of monitoring year five and each monitoring year thereafter, a minimum of 85% of the mitigation site shall be vegetated (either by planted or volunteer plants) by native (FAC or wetter) species.
 - iv. Volunteer species should support functions consistent with the project design goals.
- c. Invasive Species: The goal of any Project is to have no invasive species. If invasive species are present at the Project, no more than 10% of relative plant cover¹ over the entire Project site shall be made up by non-native or invasive species by the end of the fifth monitoring year and each year thereafter. No individual colony shall be greater than

¹ “Relative plant cover” is defined as the cover of a particular species as a percentage of total plant cover. Thus, relative cover will always total 100%, even when total absolute cover is quite low.



or equal to 5% of relative plant cover. The 10% and 5% goals will be monitored in each year and areas will be adaptively managed as necessary to meet the 10% and 5% requirements each year and by the fifth year of monitoring. No more than 5% of relative plant cover over the entire Project site shall be made up of Common Reed (*Phragmites australis*²); Mile-a-Minute (*Persicaria perfoliate*); Purple Loosestrife (*Lythrum salicaria*); European Privet (*Ligustrum vulgare*); Porcelain Berry (*Ampelopsis brevipedunculata*); Multiflora Rose (*Rosa multiflora*); and English Ivy (*Hedera helix*). Native status will be based on the Natural Resources Conservation Service Plants Database. Invasive species are identified on the 2010 National Park Service/U.S. Fish and Wildlife Service document Plant Invaders of Mid- Atlantic Natural Areas (<http://www.nps.gov/plants/alien/pubs/midatlantic/>) and the Maryland Invasive Species Council Invasive Species of Concern in Maryland (http://www.mdinvasivesp.org/invasive_species_md.html). Reed Canary Grass (*Phalaris arundinacea*) and Cattail (*Typha spp.*) may also be considered as invasive species by the agencies; and

- d. Wetland Species Richness:
- i. For scrub/shrub wetlands, establish a minimum of three species of native wetland shrubs (FAC or wetter) with no more than 75% of one species, over the entire Project site. Loblolly pine cannot be more than 40%.
 - ii. For forested wetlands, establish a minimum of three species of native wetland trees and two species of native wetland shrubs (FAC or wetter) with no more than 75% of one species, over the entire Project site. Loblolly pine cannot be more than 40%.
- e. Wetland Vegetation Density for Scrub-Shrub and Forested Wetlands: For scrub-shrub or forested wetlands, native wetland (FAC or wetter) plant density of at least 435 living trees/shrubs per acre with a minimum height of 10 in. shall be achieved by the end of the first growing season following planting and maintained each monitoring year thereafter through the end of the monitoring period.
- f. Wetland Vegetation Cover for Forested Wetlands: For forested wetlands, average tree height of tallest five native wetland trees within each sample plot shall be at least three feet in height at year three and at least five feet in height at year five and each monitoring year thereafter. Canopy cover³ of native wetland trees and shrubs must be at least 30% by year 5.
- g. Wetland Hydrology: Wetland hydrology, defined as 14 consecutive days of flooding or ponding, or a water table 12 in. (30 cm) or less below the soil surface, during the growing season at a minimum frequency of 4 years in 7 (50% or higher probability). For the purpose of this determination, the growing season is based on two indicators of biological activity that are readily observable in the field: (1) above-ground growth and development of vascular plants and (2) soil temperature as an indicator of soil microbial activity. These indicators of biological activity shall be used for determinations of growing

² American Common Reed, *Phragmites australis* subsp. *americanus*, is not considered to be an invasive plant.

³ "Canopy cover" is defined as the percentage of ground covered by tree and shrub leaves, when the edges of the leaves are mentally projected down to the ground surface.



season and are more fully described in the appropriate regional supplement to the Corps of Engineers Wetland Delineation Manual.

- h. Wetland Soils: The entire wetland restoration or creation area must meet the Hydric Soil Technical Standard (Technical Note 11) developed by the National Technical Committee for Hydric Soils for saturated conditions and aerobic conditions:
- i. Free water must exist within 10 in. (25 cm) of the ground surface for at least 14 consecutive days; and
 - ii. Anaerobic conditions must exist within 10 in. (25 cm) of the ground surface for at least 14 consecutive days. Anaerobic conditions may be determined by one of the following methods, as detailed in the Hydric Soil Technical Standard:
 - Positive reaction to alpha-alpha dipirydyl, determined as least weekly
 - Reduction of iron determined with IRIS tubes installed for 30 days
 - Measurement of redox potential (Eh) using platinum electrodes, determined at least weekly

2. Buffer Area(s) – Enhancement

Buffer areas that were cleared to provide access for other restoration or enhancement activities must meet the Performance Standards described in Buffer areas below. Enhancement Performance Standards are only required to be met if the buffer is getting mitigation credit.

- a. Aerial Cover Vegetative Standards:
- i. By the end of monitoring year two, a minimum of 60% of the mitigation site shall be vegetated (either by planted or volunteer plants) by native species.
 - ii. By the end of monitoring year three, a minimum of 70% of the mitigation site shall be vegetated (either by planted or volunteer plants) by native species.
 - iii. By the end of monitoring year five and each monitoring year thereafter, a minimum of 85% of the mitigation site shall be vegetated (either by planted or volunteer plants) by native species.
 - iv. Volunteer species should support functions consistent with the project design goals.
- b. Invasive Species: The goal of any Project is to have no invasive species. If invasive species are present at the Project, no more than 10% of relative plant cover⁴ over the entire Project site shall be made up by non-native or invasive species by the end of the fifth monitoring year and each year thereafter. No individual colony shall be greater than or equal to 5% of relative plant cover. The 10% and 5% goals will be monitored in each year and areas will be adaptively managed as necessary to meet the 10% and 5% requirements each year and by the fifth year of monitoring. No more than 5% of relative plant cover over the entire Project site shall be made up of Common Reed (*Phragmites australis*); Mile-a-Minute (*Persicaria perfoliate*); Purple Loosestrife (*Lythrum salicaria*); European Privet (*Ligustrum vulgare*); Porcelain Berry (*Ampelopsis brevipedunculata*); Multiflora Rose (*Rosa multiflora*); and English Ivy (*Hedera helix*). Native status will be

⁴ “Relative plant cover” is defined as the cover of a particular species as a percentage of total plant cover. Thus, relative cover will always total 100%, even when total absolute cover is quite low.



based on the Natural Resources Conservation Service Plants Database. Invasive species are identified on the 2010 National Park Service/U.S. Fish and Wildlife Service document Plant Invaders of Mid- Atlantic Natural Areas (<http://www.nps.gov/plants/alien/pubs/midatlantic/>) and the Maryland Invasive Species Council Invasive Species of Concern in Maryland (http://www.mdinvasivesp.org/invasive_species_md.html). Reed Canary Grass (*Phalaris arundinacea*) and Cattail (*Typha spp.*) may also be considered as invasive species by the agencies.

- c. Vegetation Density for Forested Buffers: For forested buffers, native plant density of at least 435 living trees/shrubs per acre with a minimum height of 10 in. shall be achieved by the end of the first growing season following planting and maintained each monitoring year thereafter through the end of the monitoring period.

Stream Performance Standards

The overall objective for the stream compensation is to ensure that the dimension, pattern, and profile of the stream enhancement and restoration areas: 1) remain within the natural range of variability present in the reference data obtained for the design; 2) remain stable; 3) exhibit appropriate habitat diversity; 4) have healthy viable riparian buffers; and 5) improve biological communities.

1. Stream Restoration Areas

For the linear footage of stream with stream restoration activities, the following Performance Standards will apply:

- a. Dimension: The analysis of representative riffle cross-sections shall indicate that they have not aggraded, degraded, widened, or narrowed to the point where they have become unstable or will cause instability. The following measurements will be used to aid in making this determination each monitoring year:
 - i. The Width/Depth Ratio Stability Rating (measured Width/Depth Ratio divided by the approved as-built Width/Depth Ratio) shall not be greater than 1.3. If the channel is incising, then the Width/Depth Ratio Stability Rating shall not be less than 0.7.
 - ii. The Bank Height Ratio shall not increase or decrease by an amount greater than 0.2 of the approved as-built Bank Height Ratio.
- a. Stream Reach Stability: The analysis of the streambank from the top of the bank to the ordinary high-water mark presence of natural protection to prevent streambank erosion that could jeopardize the stability of the streambank or the stream reach. The following measurements will be used to aid in making this determination each monitoring year:
 - i. The individual Index Values of Bank Erodibility Hazard Index (BEHI) rating for any identified reach shall be equal to or less than the previous year's Index Value. In addition, the Total Score shall be equal to or less than the previous year's Total Score, and shall have a Total Score of "Moderate" by monitoring Year 3, and a Total Score of "Low" by monitoring Year 5, and maintained at "Low" throughout the remainder of the monitoring period.
 - ii. The U.S Forest Service Stream Reach Inventory and Channel Stability Evaluation (Pfankuch, 1975) rating shall be "Good" each monitoring year, beginning with Year



3.

- b. **Pattern:** The analysis of the plan-view survey or field measurements shall indicate that the stream is not migrating to the point where it will cause bank erosion and instability. The following criteria will be used to aid in making this determination each monitoring year:
 - i. The sinuosity of the stream does not increase or decrease by an amount greater than 0.1 of the approved as-built pattern.
 - ii. The thalweg of each channel cross-section does not move by more than 10% of the width of the approved as-built channel width in any given year.
 - iii. The radius of Curvature/Bankfull Width Ratio does not increase or decrease by an amount greater than 0.2 of the as-built condition. For instance, if the as-built ratio is 3.0, the acceptable ratio shall be 2.8 to 3.2 to remain within the range of variability present in the reference data.

- c. **Structures:** The analysis of each instream structure shall indicate that it is performing its intended function, and not adversely affecting the stream. The following measurements will be used to aid in making this determination each monitoring year:
 - i. Absence of significant under cutting, washing around, or erosion of the bank or streambed associated with any instream structure, excluding any minor channel scour within the thalweg immediately downstream of a structure caused by its intended redirection of flow.
 - ii. The invert elevation (controlling elevation) of the header rocks or logs of any vane, j-hook, cross-vane, W-weir, or other structure shall not vary more than 0.2 feet from the approved as-built.

- d. **Materials:** The analysis of the pebble count data shall not show a significant change in streambed materials to the point that indicates a shift in bedload material due to stream instability. The following measurement will be used to aid in making this determination each monitoring year:
 - i. The D50 size particle remains within its approved as-built size class (silt, sand, gravel, cobble, or boulder).

- e. **Profile:** The analysis of the longitudinal profile shall indicate that the bed elevation has neither aggraded nor degraded to the point where it will cause instability. The following criteria will be used to aid in making this determination each monitoring year:
 - i. The analysis of the Longitudinal Profile does not indicate significant alterations in the locations, depths, and slopes of stream features (riffle, run, pool, and glide).

Functional Uplift Goals

The overall project should meet functional uplift goals. These are directly and indirectly related to the wetland and stream performance standards. The corresponding Functional Uplift Goals table has anticipated goals and actual goals for each monitoring year. MDE and the Corps will use best professional judgment, visual observations and monitoring reports to evaluate attainment of wetland and stream functional uplift goals and whether corrective actions are warranted.



- 1. Increase Stream Sinuosity**
 - a. Sinuosity
- 2. Reconnect Stream to Basal Gravel Layer**
 - a. Pebble Counts (D50)
- 3. Reconnect Streams to Floodplain**
 - a. Bank/ height ratio
 - b. Entrenchment ratio
- 4. Reconnect Streams to Floodplain, Increase Flood flow Attenuation**
 - a. Frequency of flooding (modeled with corroborating visual observations)
- 5. Increase Flood flow Attenuation**
 - a. Area of floodplain
- 6. Reconnect Streams to Floodplain, Increase Flood flow Attenuation, Remove Wetland Drains, Improve Habitat**
 - a. Acreage of floodplain wetlands
- 7. Restore Diverted Stream Baseflow**
 - a. Baseflow discharge and physical destruction of pipe
- 8. Increase Upland Riparian Buffer, Improve Upland Habitat**
 - a. Acreage of upland riparian buffer
- 9. Improve In-Stream Habitat**
 - a. Bed diversity
 - b. Riffle habitat area
 - c. Pool habitat area
 - d. LF of stream
 - e. Channel overhead cover area/ LWD frequency
- 10. Invasive Species Controls**
 - a. Decrease in invasive species relative cover
- 11. Improve Aquatic Organism Passage**
 - a. Remove Dam(s)
- 12. Decrease Stream Bank Erosion**
 - a. BEHI score
- 13. Maintain or Improve Fauna Presence**
 - a. Trout (presence, absence, age classes)
 - b. Macroinvertebrates (B-IBI scores, taxa diversity)

Table 1: Eccleston Wetland Performance Standards

Eccleston Wetland Performance Standards											
Parameters	Measurement	Year 2 Monitoring		Year 3 Monitoring		Year 5 Monitoring		Year 7 Monitoring		Year 10 Monitoring	
		Antic.	Actual	Antic.	Actual	Antic.	Actual	Antic.	Actual	Antic.	Actual
Wetland Vegetation Dominance	Regional Supplement vegetation plots, % dominant species FAC or wetter	>50%		>50%		>50%		>50%		>50%	
Wetland Vegetation Aerial Cover	Aerial cover of plants (planted or volunteer) FAC or wetter	60%		70%		85%		85%		85%	
Non-Native/ Invasive Species % Relative Plant Cover	% Relative plant cover over the entire site	<10% Total, <5% Indiv. Colony		<10% Total, <5% Indiv. Colony		<10% Total, <5% Indiv. Colony		<10% Total, <5% Indiv. Colony		<10% Total, <5% Indiv. Colony	
PFO Species Richness	# of species over the whole site, no more than 75% of one species	>3 tree, >2 shrub species		>3 tree, >2 shrub species		>3 tree, >2 shrub species		>3 tree, >2 shrub species		>3 tree, >2 shrub species	
PFO Vegetation Density	living native wetland trees/shrubs per acre >10 inches tall	>435 stems/acre		>435 stems/acre		>435 trees/acre (>10 inches tall)		>435 trees/acre (>10 inches tall)		>435 trees/acre (>10 inches tall)	
PFO Vegetation Cover	Avg. height of tallest five trees and % cover	>2 ft, Canopy cover >30%		>3 ft, Canopy cover >30%		>5 ft, Canopy cover >30%		>5 ft, Canopy cover >30%		>5 ft, Canopy cover >30%	
Wetland Hydrology During Growing Season	Minimum 4 years in 7	14 consecutive days of flooding/ponding/water table <12 inches		14 consecutive days of flooding/ponding/water table <12 inches		14 consecutive days of flooding/ponding/water table <12 inches		14 consecutive days of flooding/ponding/water table <12 inches		14 consecutive days of flooding/ponding/water table <12 inches	
Wetland Soils	Groundwater monitoring	Free water w/in 10 inches >14 consecutive days		Free water w/in 10 inches >14 consecutive days		Free water w/in 10 inches >14 consecutive days		Free water w/in 10 inches >14 consecutive days		Free water w/in 10 inches >14 consecutive days	
	IRIS tubes installed for 30 days show reduction of iron	Anaerobic conditions w/in 10 inches >14 consecutive days		Anaerobic conditions w/in 10 inches >14 consecutive days		Anaerobic conditions w/in 10 inches >14 consecutive days		Anaerobic conditions w/in 10 inches >14 consecutive days		Anaerobic conditions w/in 10 inches >14 consecutive days	

Table 2: Eccleston Stream Performance Standards

Eccleston Stream Performance Standards - Restoration											
Parameters	Measurement	Year 2 Monitoring		Year 3 Monitoring		Year 5 Monitoring		Year 7 Monitoring		Year 10 Monitoring	
		Antic.	Actual	Antic.	Actual	Antic.	Actual	Antic.	Actual	Antic.	Actual
Dimension	Width/depth ratio stability rating (measured w/d divided by as-built w/d)	≥ 0.7, ≤ 1.3		≥ 0.7, ≤ 1.3		≥ 0.7, ≤ 1.3		≥ 0.7, ≤ 1.3		≥ 0.7, ≤ 1.3	
	Bank height ratio	≤ 0.2 ± as-built		≤ 0.2 ± as-built		≤ 0.2 ± as-built		≤ 0.2 ± as-built		≤ 0.2 ± as-built	
Stability	BEHI (Index value for any identified reach)	Not applicable		≤ Previous year's index value		≤ Previous year's index value		≤ Previous year's index value		≤ Previous year's index value	
	BEHI (Total score)	Not applicable		≤ Previous year's total score; Moderate		≤ Previous year's total score; Low		≤ Previous year's total score; Low		≤ Previous year's total score; Low	
	USFS Stream Reach Inventory and Channel Stability Evaluation	Not applicable		Good		Good		Good		Good	
Pattern	Sinuosity	≤ 0.1 ± as-built		≤ 0.1 ± as-built		≤ 0.1 ± as-built		≤ 0.1 ± as-built		≤ 0.1 ± as-built	
	Thalweg movement of each channel cross-section	≤ 10% width of approved as-built channel per year		≤ 10% width of approved as-built channel per year		≤ 10% width of approved as-built channel per year		≤ 10% width of approved as-built channel per year		≤ 10% width of approved as-built channel per year	
	Radius of curvature/bankfull width ratio	≤ 0.2 ± as-built		≤ 0.2 ± as-built		≤ 0.2 ± as-built		≤ 0.2 ± as-built		≤ 0.2 ± as-built	
Structures	"Significant undercutting/erosion of bank or streambed associated with structure "	Absent		Absent		Absent		Absent		Absent	
	Invert elevation of header rocks/logs of structure (eg vane, j-hook)	≤ 0.2 ft ± as-built		≤ 0.2 ft ± as-built		≤ 0.2 ft ± as-built		≤ 0.2 ft ± as-built		≤ 0.2 ft ± as-built	
Materials	D50	Remains within approved as-built size class		Remains within approved as-built size class		Remains within approved as-built size class		Remains within approved as-built size class		Remains within approved as-built size class	
Profile	Significant alterations in locations, depths, and slopes of stream features	Absent		Absent		Absent		Absent		Absent	



Table 3: Eccleston Functional Uplift Goals

Functional Uplift Goals*												
Functional Uplift/Impairment Reduction Goal	Measurement	Baseline	Year 2 Monitoring		Year 3 Monitoring		Year 5 Monitoring		Year 7 Monitoring		Year 10 Monitoring	
			Antic.	Actual.	Antic.	Actual.	Antic.	Actual.	Antic.	Actual.	Antic.	Actual.
Increase stream sinuosity	Sinuosity											
Reconnect streams to basal gravel layer	Pebble Counts (D50)											
Reconnect streams to floodplain	Bank/height ratio											
	Entrenchment ratio											
Reconnect streams to floodplain, increase floodflow attenuation	Frequency of flooding (modeled w/ corroborating observations)											
Increase floodflow attenuation	Area of floodplain											
Reconnect streams to floodplain, increase floodflow attenuation, remove wetland drains, improve habitat	Acreage of floodplain wetlands											
Restore diverted stream baseflow	Baseflow discharge and physical destruction of pipe											
Increase upland riparian buffer, improve upland habitat	Acreage of upland riparian buffer											
Improve in-stream habitat	Bed diversity											
	Riffle habitat area											
	Pool habitat area											
	LF of stream											
	Channel overhead cover area / LWD frequency											
Invasive species control	Decrease in invasive species relative cover											
Improve aquatic organism passage	Remove Dam											
Decrease stream bank erosion	BEHI score											
Maintain or improve fauna presence	Trout (presence, absence, age classes)											
	Macroinvertebrates (B-IBI scores, taxa diversity)											

* Anticipated quantitative goals for each measurement type are TBD.