Mgmt Strat. / Add. Goals	5: Substantial Improvement	4: Moderate to Substantial Improvement	3: Moderate Improvement	2: Slight to Moderate Improvement	1: Slight Improvement	0: No Effect	-1: Slight Worsening	-2: Slight to Moderate Worsening	-3: Moderate Worsening	-4: Moderate to Substantial Worsening	-5: Substantial Worsening
Air Quality	Practice continuously improves the air quality in the surrounding area by either removing pollutants (e.g., ammonia, odors, or particulates) or preventing them from becoming airborne.	Somewhere between 3 and 5 → BPJ	Practice continuously improves the air quality at the site by either removing pollutants or preventing them from becoming airborne.	Somewhere between 1 and 3 → BPJ	Practice slightly improves the air quality at the site during limited periods (e.g., maintenance) by either removing pollutants or preventing them from becoming airborne.	Practice has no impact on Air Quality.	Practice slightly decreases the local air quality at the site during limited periods (e.g., maintenance).	Somewhere between -1 and -3 → BPJ	Practice continuously decreases the local air quality at the site.	Somewhere between -3 and -5 → BPJ	Practice consistently decreases the local air quality in the surrounding area.
Bacteria Loads	Practice results in greater than 90 percent decrease of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or excludes livestock from waterbodies.	Somewhere between 3 and 5 → BPJ	Practice results in between 30–90 percent decrease of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or limits livestock access to waterbodies.	Somewhere between 1 and 3 → BPJ	Practice results in less than 30 percent decrease of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or provides alternative water supply or riparian buffer with no fencing to reduce livestock access to waterbodies.	Practice has no impact on bacteria loads	Practice results in less than 30 percent increase of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or increases livestock access to riparian zone without direct access to waterbodies.	Somewhere between -1 and -3 → BPJ	Practice results in 30–90 percent increase of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or provides additional limited livestock access to waterbodies.	Somewhere between -3 and -5 → BPJ	Practice results in greater than 90 percent increase of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or provides unlimited livestock access to waterbodies.
Biodiversity and Habitat	Practice creates (or restores) a permanent area that allows for a diverse selection of beneficial native plants, which provide food and habitat for pollinators and other species.	Somewhere between 3 and 5 → BPJ	Practice improves the quality of a permanent area of land that allows for a diverse selection of beneficial native plants, which provide food and habitat for pollinators and other species.	Somewhere between 1 and 3 → BPJ	Practice improves the quality of small, isolated areas of land that allows for a diverse selection of beneficial native plants, which provide food and habitat for pollinators and other species. May also apply to areas of habitat improvement that are not necessarily permanent.	Practice has no impact on Biodiversity and Habitat.	Practice degrades low quality areas of viable habitat, thus reducing the overall biodiversity of the area	Somewhere between -1 and -3 → BPJ	Practice permanently degrades an area of viable habitat, thus reducing the overall biodiversity of that area.	Somewhere between -3 and -5 → BPJ	Practice permanently removes areas of viable habitat, thus reducing the overall biodiversity of an area and potentially surrounding areas.

Mgmt Strat. / Add. Goals	5: Substantial Improvement	4: Moderate to Substantial Improvement	3: Moderate Improvement	2: Slight to Moderate Improvement	1: Slight Improvement	0: No Effect	-1: Slight Worsening	-2: Slight to Moderate Worsening	-3: Moderate Worsening	-4: Moderate to Substantial Worsening	-5: Substantial Worsening
Black Duck	Practice directly creates, enhances, or restores wetland habitats or increases or enhances connectivity of breeding, foraging, migrating, and wintering habitats (upland areas; lowland salt marshes; non-tidal marshes; fresh/brackish emergent, forested, or scrub/shrub wetlands; mudflats; SAV; large bodies of open water) for black ducks.	Somewhere between 3 and 5 → BPJ	Practice protects against (e.g., conservation easements, buffers) or reverses shoreline disturbance (e.g., dredging, marina/housing development) adjacent to wetlands, or increases cover or food sources in areas adjacent to wetlands.	Somewhere between 1 and 3 → BPJ	Practice restores, enhances, or preserves native species in or near wetlands or other black duck habitat types, or reduces impacts of climate change (e.g., large storm events, flooding, sea level rise, salinity changes).	Practice has no impact on wetlands	Practice reduces native species in or near wetlands or other black duck habitat types, or increases impacts of climate change (e.g., large storm events, flooding, sea level rise, salinity changes).	Somewhere between -1 and -3 → BPJ	Practice increases shoreline disturbance (e.g., dredging, marina/housing development) adjacent to wetlands, or decreases cover or food sources in areas adjacent to wetlands.	Somewhere between -3 and -5 → BPJ	Practice directly removes wetlands or increases black duck habitat fragmentation.
Blue Crab Abundance	Practice directly improves SAV or other nearshore habitat or water quality conditions in localized area to the benefit of blue crab abundance	Somewhere between 3 and 5 → BPJ	Practice decreases nutrient loads from tributaries	Somewhere between 1 and 3 → BPJ	Practice decreases thermal load from tributaries and/or contributes to optimal water quality contributions from tributaries	Practice has no impact on blue crab abundance	Practice increases thermal load from tributaries and/or contributes to undesirable water quality contributions from tributaries	Somewhere between -1 and -3 → BPJ	Practice increases nutrient loads from tributaries	Somewhere between -3 and -5 → BPJ	Practice directly worsens SAV or other nearshore habitat or water quality conditions in localized area to the detriment of blue crab abundance
Brook Trout	Practice creates riparian shade where there was none previously, removes a high temperature direct discharge source or removes invasive/non-native species that directly impacts native brook trout.	Somewhere between 3 and 5 → BPJ	Practice improves riparian shade conditions, decreases a high temperature direct discharge source or improves access to spawning or seasonally important habitat.	Somewhere between 1 and 3 → BPJ	Practice reduces impervious surface or increases other non-riparian practices to reduce runoff temperature/quantity or improve runoff quality.	Practice has no impact on brook trout.	Practice increases impervious surface or otherwise increases runoff temperature/quantity or degrades runoff quality.	Somewhere between -1 and -3 → BPJ	Practice decreases riparian shade conditions, increases a high temperature direct discharge source or creates a barrier to spawning or seasonally important habitat.	Somewhere between -3 and -5 → BPJ	Practice removes riparian shade, introduces a high temperature direct discharge source or introduces invasive/non-native species that directly impact native brook trout.

Table of Narrative Scoring Guidelines

Mgmt Strat. / Add. Goals	5: Substantial Improvement	4: Moderate to Substantial Improvement	3: Moderate Improvement	2: Slight to Moderate Improvement	1: Slight Improvement	0: No Effect	-1: Slight Worsening	-2: Slight to Moderate Worsening	-3: Moderate Worsening	-4: Moderate to Substantial Worsening	-5: Substantial Worsening
Citizen Stewardship	Practice and required O&M is fully implementable by citizens [Citizens do not include government agencies, non-profit organizations, or professionals (business or individual)] without assistance (technical or financial).	Somewhere between 3 and 5 → BPJ	Practice is fully implementable by citizens [Citizens do not include government agencies, non-profit organizations, or professionals (business or individual)], but O&M requires assistance (technical or financial).	Somewhere between 1 and 3 → BPJ	Practice can be implemented by citizens [Citizens do not include government agencies, non-profit organizations, or professionals (business or individual)] with assistance (technical or financial) from local governments or organizations.	Practice has no impact on citizen stewardship or not applicable to citizen stewardship.					
Climate Adaptation	Practice directly increases the protection of living resources and habitats from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.	Somewhere between 3 and 5 → BPJ	Practice directly increases the protection of public infrastructure and communities from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.	Somewhere between 1 and 3 → BPJ	Practice indirectly increases the protection of living resources, habitats, public infrastructure, or communities from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.	Practice has no impact on climate adaptation.	Practice indirectly decreases the protection of living resources, habitats, public infrastructure, or communities from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.	Somewhere between -1 and -3 → BPJ	Practice directly decreases the protection of public infrastructure and communities from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.	Somewhere between -3 and -5 → BPJ	Practice directly decreases the protection of living resources and habitats from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.
Drinking Water Protection/Security	Practice eliminates toxic contaminants from entering drinking water supplies.	Somewhere between 3 and 5 → BPJ	Practice eliminates traditional pollutants (e.g., nutrients, metals, sediment) from entering drinking water supplies.	Somewhere between 1 and 3 → BPJ	Practice reduces traditional pollutants (e.g., nutrients, metals, sediment) from entering drinking water supplies.	Practice has no impact on Drinking Water Protection/Security.	Practice introduces small amounts of traditional pollutants into drinking water supplies.	Somewhere between -1 and -3 → BPJ	Practice introduces large amounts of traditional pollutants into drinking water supplies.	Somewhere between -3 and -5 → BPJ	Practice introduces toxic contaminants into drinking water supplies.
Economic Development/Job Creation	Practice gives rise to a new business to aid in practice implementation/maintenance or creates full-time permanent staff positions. OR Practice stimulates local economy.	Somewhere between 3 and 5 → BPJ	Practice increases demand for existing businesses that support practice implementation/maintenance OR creates a new part-time permanent staff positions.	Somewhere between 1 and 3 → BPJ	Practice creates temporary jobs for practice installation/implementation or O&M.	Practice has no impact on Economic Development/Job Creation.	Practice removes the need for temporary jobs for practice installation/ implementation or O&M.	Somewhere between -1 and -3 → BPJ	Practice decreases demand for existing businesses that support practice implementation/maintenance OR removes a new part-time permanent staff positions.	Somewhere between -3 and -5 → BPJ	Practice causes closing of a new business or removes a full-time permanent staff positions. OR Practice inhibits local economy.

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Energy Efficiency	Practice creates natural shade from newly planted trees (e.g., tree planting) in a developed area creating shade to reduce energy needed for cooling. OR creates a positive net production of energy over its design lifetime (implementation and post-implementation); energy is captured and used.	Somewhere between 3 and 5 → BPJ	Practice actively enhances natural shade from existing trees in a developed area increasing shade to reduce energy needed for cooling. OR increases productivity (e.g., crop yield) with no net increase in energy consumption versus baseline (i.e., previous surface or no practice) over its design lifetime (implementation and post-implementation). OR Practice eliminates existing need for energy spent on O&M.	Somewhere between 1 and 3 → BPJ	Practice passively protects or preserves natural shade from existing trees in a developed area to prevent increase in energy needed for cooling. OR Practice reduces existing need for energy spent on O&M.	Practice has no impact on energy efficiency.	Practice has potential to harm existing trees in a developed area which increases energy needed for cooling. OR Practice increasing existing need for energy spent on O&M.	Somewhere between -1 and -3 → BPJ	Practice harms trees providing natural shade. OR decreases productivity (e.g., crop yield) with no net increase in energy consumption versus baseline (i.e., previous surface or no practice) over its design lifetime. OR Practice creates need for energy spent on O&M.	Somewhere between -3 and -5 → BPJ	Practice reduces natural shade by removing trees. OR either increases energy consumption or reduces energy efficiency versus baseline over its design lifetime (e.g., pumped dispersals for septic systems).
Fish Habitat	Practice creates riparian shade, wetlands or SAV where there was none previously; removes a high temperature direct discharge source; or removes hardened shoreline.	Somewhere between 3 and 5 → BPJ	Practice improves riparian shade conditions, wetlands or SAV; decreases a high temperature direct discharge source or otherwise directly improves stream water quality (e.g., DO, nutrients, turbidity); or directly prevents sea level rise.	Somewhere between 1 and 3 → BPJ	Practice reduces impervious surface or increases other non-riparian practices to reduce runoff temperature/quantity or improve runoff quality.	Practice has no impact on fish habitat.	Practice increases impervious surface or otherwise increases runoff temperature/quantity or degrades runoff quality.	Somewhere between -1 and -3 → BPJ	Practice decreases riparian shade, wetlands or SAV; increases a high temperature direct discharge source or otherwise directly worsens stream water quality (e.g., DO, nutrients, turbidity); or directly contributes to sea level rise.	Somewhere between -3 and -5 → BPJ	Practice removes riparian shade, wetlands or SAV; introduces a high temperature direct discharge source; or creates a hardened shoreline.
Fish Passage	Practice directly removes barriers, retrofits culverts, or installs passage structures	Somewhere between 3 and 5 → BPJ	Practice improves fish habitat for target fish species (e.g., Alewife, Brook Trout)	Somewhere between 1 and 3 → BPJ	Practice reduces the need for privately owned dams (e.g., reduces flooding probability, increases water supply or use efficiency)	Practice has no impact on fish passage	Practice increases the need for privately owned dams (e.g., increases flooding probability, decreases water supply or use efficiency)	Somewhere between -1 and -3 → BPJ	Practice worsens fish habitat for target fish species (e.g., Alewife, Brook Trout)	Somewhere between -3 and -5 → BPJ	Practice directly creates barriers or hinders fish passage

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Flood Control/Mitigation	Practice prevents runoff to streams. OR improves stormwater drainage or channel condition to prevent flooding.	Somewhere between 3 and 5 → BPJ	Practice increases the floodplain, delays peak flow, and/or reduces flashiness. OR replaces flood prone impervious areas with pervious cover.	Somewhere between 1 and 3 → BPJ	Practice slightly reduces runoff to streams.	Practice has no impact on Flood Control/Mitigation	Practice slightly increases runoff to streams.	Somewhere between -1 and -3 → BPJ	Practice reduces the floodplain, expedites peak flow, and/or increases flashiness. OR replaces flood prone pervious areas with impervious cover.	Somewhere between -3 and -5 → BPJ	Practice diverts all runoff to streams. OR degrades stormwater drainage or channel condition to prevent flooding.
Forage Fish	Practice directly improves fish habitat quality or amount (including through removal of shoreline modifications, protection/establishment of SAV, or directly improving the production of benthic organisms or the distribution and productivity of plankton) or improves access to upriver spawning areas.	Somewhere between 3 and 5 → BPJ	Practice directly improves water quality (e.g., removes or reduces direct discharges, in-stream sources, etc.) or protects shorelines.	Somewhere between 1 and 3 → BPJ	Practice improves water quality through watershed BMPs, reducing impervious surfaces, etc.	Practice has no impact on forage fish.	Practice worsens water quality through watershed land use and development.	Somewhere between -1 and -3 → BPJ	Practice directly worsens water quality (e.g., adds or increases direct discharges, in-stream sources, etc.) or develops shorelines.	Somewhere between -3 and -5 → BPJ	Practice directly worsens fish habitat quality or amount (including shoreline hardening or other modifications, removal of SAV, or directly worsening the production of benthic organisms or the distribution and productivity of plankton), or worsens access to upriver spawning areas.
Groundwater Recharge/Infiltration	Practice maximizes infiltration at a hardened site (e.g., replaces impervious surface area with pervious surface or captures and infiltrates runoff from urban or hardened sites).	Somewhere between 3 and 5 → BPJ	Practice increases infiltration at a hardened site (e.g., replaces impervious surfaces with semi-pervious surfaces).	Somewhere between 1 and 3 → BPJ	Practice reduces runoff and increases infiltration at an unhardened site (e.g., change in tillage that increases infiltration).	Practice has no impact on groundwater recharge/infiltration than without the practice.	Practice increases runoff and decreases infiltration at an unhardened site (e.g., change in tillage that decreases infiltration).	Somewhere between -1 and -3 → BPJ	Practice directly decreases infiltration at a = hardened site (e.g., replaces pervious surfaces with semi-pervious surfaces).	Somewhere between -3 and -5 → BPJ	Practice prevents infiltration at a hardened site (e.g., adds impervious surface area without runoff capture and infiltration) or uses/removes groundwater.
Healthy Watersheds	Practice directly restores or conserves non-urban lands	Somewhere between 3 and 5 → BPJ	Practice protects or improves stream flow regimes or channel stability	Somewhere between 1 and 3 → BPJ	Practice improves water quality or reduces impervious surfaces	Practice has no impact on healthy watersheds	Practice worsens water quality or increases impervious surfaces	Somewhere between -1 and -3 → BPJ	Practice worsens stream flow regimes or channel stability	Somewhere between -3 and -5 → BPJ	Practice directly increases urbanization
Land Use Methods and Metrics Development	Practice creates wetlands or forest areas.	Somewhere between 3 and 5 → BPJ	Practice conserves existing forest, wetlands., or agriculture land or converts crop land to pasture, forage production, perennial grass, etc.	Somewhere between 1 and 3 → BPJ	Practice creates limited area (<0.5 acre) of vegetation or trees.	Practice has no impact on land use methods & metrics development	Practices removes existing vegetation (<0.5 acres) and replaces with impervious surface or turf.	Somewhere between -1 and -3 → BPJ	Practice removes agriculture fields.	Somewhere between -3 and -5 → BPJ	Practice removes wetlands of forested areas.

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Oyster Restoration	Practice directly restores and/or protects native oyster habitat or populations	Somewhere between 3 and 5 → BPJ	Practice improves water quality (e.g., decreases nutrient loads and/or reduces sediment) in targeted oyster restoration tributaries	Somewhere between 1 and 3 → BPJ	Practice reduces runoff that would decrease salinity in targeted oyster restoration tributaries	Practice has no impact on oyster restoration	Practice increases runoff that would decrease salinity in targeted oyster restoration tributaries	Somewhere between -1 and -3 → BPJ	Practice worsens water quality (e.g., increases nutrient loads and/or increases sediment) in targeted oyster restoration tributaries	Somewhere between -3 and -5 → BPJ	Practice directly reduces and/or harms native oyster habitat or populations
Property Values	Practice has potential to significantly improve the property value of the surrounding properties/neighborhood by reducing a threat (e.g. flood reduction) and providing an amenity to the community (e.g. recreational opportunities).	Somewhere between 3 and 5 → BPJ	Practice has potential to slightly improve the property value of the surrounding properties/neighborhood through aesthetic improvement and/or the reduction in a threat. OR practice increases property value through improved soil health/increased crop yields.	Somewhere between 1 and 3 → BPJ	Practice has potential to improve the property value of the land it is situated on.	Practice has no impact on Property Values.	Practice has potential to reduce the property value of the land it is situated on.	Somewhere between -1 and -3 → BPJ	Practice has potential to slightly reduce the property value of the surrounding properties/neighborhood by degrading the aesthetics and/or increasing or causing a threat. OR practice decreases property value through degraded soil health/decreased crop yields.	Somewhere between -3 and -5 → BPJ	Practice has potential to significantly reduce the property value of the surrounding properties/neighborhood by increasing a threat and removing an amenity.
Protected Lands	Practice directly protects/creates highest value wetlands and forestland for maintaining water quality.	Somewhere between 3 and 5 → BPJ	Practice reduces new development pressures, including transportation and energy infrastructure, new housing, and commercial development.	Somewhere between 1 and 3 → BPJ	Practice creates area with native vegetation or removes non-native vegetation.	Practice has no impact on protected lands	Practice removes area of native vegetation or introduces non-native vegetation.	Somewhere between -1 and -3 → BPJ	Practice increases new development pressures, including transportation and energy infrastructure, new housing, and commercial development.	Somewhere between -3 and -5 → BPJ	Practice directly degrades or removes highest value wetlands and forestland that maintained water quality.

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Recreation	Practice creates addition opportunities for recreational use of the water. Practice removes water pollution to waterbodies that have direct-contact recreation (e.g., wading, swimming). Practices eliminate reduce harmful algal blooms.	Somewhere between 3 and 5 → BPJ	Practice creates opportunities for recreational use of the adjacent land or improves the conditions for existing water recreation. Practice reduces water pollution to waterbodies that have direct-contact recreation (e.g., wading, swimming). Practices helps reduce harmful algal blooms.	Somewhere between 1 and 3 → BPJ	Practice enhances a neighborhood by providing opportunities for passive recreation (e.g., wildlife viewing, walking, biking).	Practice has no impact on Recreation.	Practice creates an environment that discourages passive recreational use to surrounding area.	Somewhere between -1 and -3 → BPJ	Practice creates an environment that discourages direct contact recreation in the waterbody.	Somewhere between -3 and -5 → BPJ	Practice removes or prevents all opportunities for recreational use of the water. Practice increases likelihood of algal blooms.
Riparian Forest Buffer	Directly improves the practice, protection, and/or maintenance of riparian forest buffers (35' or wider).	Somewhere between 3 and 5 → BPJ	Facilitates the practice, protection, and/or maintenance of riparian forest buffers.	Somewhere between 1 and 3 → BPJ	Potential to directly improve the restoration, maintenance, or conservation of riparian forest buffers, or their functionality.	Practice has no impact on riparian forest buffers.	Potential to directly impact the restoration, maintenance, or conservation of riparian forest buffers, or their functionality.	Somewhere between -1 and -3 → BPJ	Indirectly impacts the restoration, maintenance, or conservation of riparian forest buffers, or their functionality.	Somewhere between -3 and -5 → BPJ	Practice directly impacts the restoration, maintenance, or conservation of riparian forest buffers, or their functionality.
Stream Health	Practice directly improves within the stream channel and floodplain factors that impact stream health (e.g., in-stream sediment and nutrients, channel alterations/pipes, riparian areas) OR restores natural flow conditions (e.g., improves baseflow)	Somewhere between 3 and 5 → BPJ	Practice directly improves watershed-based factors that reduce the volume and rate of stormwater entering streams (e.g., impervious cover, hydrology, flow alteration).	Somewhere between 1 and 3 → BPJ	Practice improves watershed-based factors that reduce pollutant loads to streams (e.g., nutrients, salt, thermal, toxic).	Practice has no impact on stream health.	Practice worsens watershed-based factors that reduce pollutant loads to streams (e.g., nutrients, salt, thermal, toxic)..	Somewhere between -1 and -3 → BPJ	Practice directly worsens watershed-based factors that reduce the volume and rate of stormwater entering streams (e.g., impervious cover, hydrology, flow alteration).	Somewhere between -3 and -5 → BPJ	Practice directly worsens within the stream channel and floodplain factors that impact stream health (e.g., in-stream sediment and nutrients, channel alterations/pipes, riparian areas) OR removes natural flow conditions (e.g., reduces baseflow)
Submerged Aquatic Vegetation	Practice directly creates SAV acreage.	Somewhere between 3 and 5 → BPJ	Practice directly enhances both the water quality and habitat function of SAV	Somewhere between 1 and 3 → BPJ	Practice directly enhances either the water quality or habitat function of SAV.	Practice has no impact on SAV	Practice directly degrades either the water quality or habitat function of SAV.	Somewhere between -1 and -3 → BPJ	Practice directly degrades both the water quality and habitat function of SAV	Somewhere between -3 and -5 → BPJ	Practice directly reduces SAV acreage.

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Toxic Contaminants Policy and Prevention	Practice has potential to substantially decrease the delivery of toxic contaminants to waterbodies.	Somewhere between 3 and 5 → BPJ	Practice has potential to moderately decrease the delivery of toxic contaminants to waterbodies.	Somewhere between 1 and 3 → BPJ	Practice has potential to slightly decrease the delivery of toxic contaminants to waterbodies.	Practice has no impact on toxic contaminants policy and prevention.	Practice has potential to slightly increase the delivery of toxic contaminants to waterbodies.	Somewhere between -1 and -3 → BPJ	Practice has the potential to moderately increase the delivery of toxic contaminants to waterbodies.	Somewhere between -3 and -5 → BPJ	Practice has the potential to significantly increase the delivery of toxic contaminants to waterbodies.
Tree Canopy	Directly restores or conserves tree canopy, or leads directly to establishment of policies, regulations, ordinances, or program priorities that will result in increased tree canopy.	Somewhere between 3 and 5 → BPJ	Likely to directly or indirectly restore or conserve tree canopy, or leads to establishment of policies, regulations, ordinances, or program priorities that will likely result in increased tree canopy.	Somewhere between 1 and 3 → BPJ	May indirectly result in more tree canopy.	Practice has no impact on tree canopy	May indirectly result in less tree canopy.	Somewhere between -1 and -3 → BPJ	Likely to directly or indirectly impact tree canopy (restoration or conservation), or leads to establishment of policies, regulations, ordinances, or program priorities that will likely result in decreased tree canopy.	Somewhere between -3 and -5 → BPJ	Directly removes trees or hampers restoration or conservation of tree canopy.
Wetlands	Practice directly creates or re-establishes tidal or nontidal wetlands	Somewhere between 3 and 5 → BPJ	Practice directly enhances both the water quality *and* habitat functions of wetlands	Somewhere between 1 and 3 → BPJ	Practice directly prevents degradation through enhancing either the water quality or habitat functions of wetlands OR practice reduces sediment delivery to the wetland	Practice has no impact on wetlands	Practice directly degrades either the water quality or habitat functions of wetlands OR practice increases sedimentation of the wetland	Somewhere between -1 and -3 → BPJ	Practice directly degrades both the water quality *and* habitat functions of wetlands	Somewhere between -3 and -5 → BPJ	Practice directly removes tidal or nontidal wetlands

Air Quality

Air quality is the degree to which the ambient air is pollution-free, assessed by measuring a number of indicators of pollution.

Goal

Protect or enhance local air quality.

Factors Influencing Success

- Available information on air quality impacts of BMPs will affect both the selection and expected air quality effects. Planning for air quality improvements will require reliable information on BMP performance.
- The Chesapeake Bay airshed is significantly larger than its watershed, with air pollution coming from as far away as Cincinnati, Ohio. Impacts of local BMPs can be shrouded by this contribution.
- Many sources of air pollution will not be addressed by nutrient and sediment BMPs, so the potential overall impact of these BMPs on air quality may be severely limited.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Air Quality
5	Substantial Improvement	Practice continuously improves the air quality in the surrounding area by either removing pollutants (e.g., ammonia, odors, or particulates) or preventing them from becoming airborne.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice continuously improves the air quality at the site by either removing pollutants or preventing them from becoming airborne.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice slightly improves the air quality at the site during limited periods (e.g., maintenance) by either removing pollutants or preventing them from becoming airborne.
0	No Effect	Practice has no impact on Air Quality.
-1	Slight Worsening	Practice slightly decreases the local air quality at the site during limited periods (e.g., maintenance).
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice continuously decreases the local air quality at the site.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice consistently decreases the local air quality in the surrounding area.

Bacteria Loads

The load of bacteria that passes a particular point of a river (such as a monitoring station on a watershed outlet) in a specified amount of time (e.g., daily, annually). Mathematically, load is essentially the product of water discharge and the concentration of a substance in the water. Implementation of BMPs to meet TMDL requirements will also reduce bacteria loads to local waterbodies. In some cases, additional BMPs directed at bacteria will be implemented alongside nutrient and sediment practices. Some practices may have unintended consequence of increasing bacteria loads, such as riparian buffers increasing wildlife presence in stream corridors.

Goal

Implement BMPs that will reduce bacteria loads to local waterbodies while at the same time reducing nutrient and sediment loads.

Factors Influencing Success

- Available information on bacteria reductions achievable with BMPs will affect both the selection and expected bacteria load reductions. Planning for bacteria load reductions will require reliable information on BMP performance.
- Unmanaged or unmanageable sources of bacteria such as waterfowl can contribute significant bacteria loads. These sources may be increased in some cases because of BMP implementation.
- Bacteria pathways are complicated by the potential for regeneration of bacteria from “seed” bacteria down-gradient from BMPs. In addition, in-stream sources of bacteria can shroud impacts of land-based BMPs.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Bacteria Loads
5	Substantial Improvement	Practice results in greater than 90 percent decrease of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or excludes livestock from waterbodies.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice results in between 30–90 percent decrease of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or limits livestock access to waterbodies.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice results in less than 30 percent decrease of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or provides alternative water supply or riparian buffer with no fencing to reduce livestock access to waterbodies.
0	No Effect	Practice has no impact on bacteria loads
-1	Slight Worsening	Practice results in less than 30 percent increase of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or increases livestock access to riparian zone without direct access to waterbodies.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice results in 30–90 percent increase of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or provides additional limited livestock access to waterbodies.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice results in greater than 90 percent increase of the bacteria load in BMP effluent, in site runoff, or to a waterbody, or provides unlimited livestock access to waterbodies.

Biodiversity and Habitat

Diversity is the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems. Habitat is the natural home or environment of an animal, plant, or other organism.

Goal

Protect or enhance upland wildlife habitat to enhance or preserve biodiversity. Habitat goals and outcomes for wetlands, black ducks, brook trout, fish passage, SAV, riparian forest, and tree canopy are already addressed under established management strategies.

Factors Influencing Success

- Both the quantity and quality of habitat will need to be adequate to achieve the goal.
- The ability to stitch together sufficient stretches of habitat will affect the overall impact on wildlife. Isolated areas may have significantly less beneficial impact.
- The connectivity of different habitats will affect the overall biodiversity and habitat benefits of practices.
- The presence of non-native plants (e.g., ornamental trees) and animals, as well as expansive areas of turf, will have an adverse effect on biodiversity.
- Crop prices will influence willingness to install and maintain practices that take land out of production. Property values and development pressures will limit opportunities in urban areas and areas adjacent to urban areas.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Biodiversity and Habitat
5	Substantial Improvement	Practice creates (or restores) a permanent area that allows for a diverse selection of beneficial native plants, which provide food and habitat for pollinators and other species.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice improves the quality of a permanent area of land that allows for a diverse selection of beneficial native plants, which provide food and habitat for pollinators and other species.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice improves the quality of small, isolated areas of land that allows for a diverse selection of beneficial native plants, which provide food and habitat for pollinators and other species. May also apply to areas of habitat improvement that are not necessarily permanent.
0	No Effect	Practice has no impact on Biodiversity and Habitat.
-1	Slight Worsening	Practice degrades low quality areas of viable habitat, thus reducing the overall biodiversity of the area
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice permanently degrades an area of viable habitat, thus reducing the overall biodiversity of that area.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice permanently removes areas of viable habitat, thus reducing the overall biodiversity of an area and potentially surrounding areas.

Black Duck

The black duck management strategy refers to the objectives of providing adequate wintering habitat for 100,000 black ducks; estimating breeding habitat management opportunities in areas where breeding has occurred historically and where it is known to occur currently; providing ample foraging habitat for black ducks and connectivity across landscapes; and limiting human development/habitat fragmentation adjacent to important black duck wintering areas.

Goal

By 2025, restore, enhance and preserve wetland habitats that support a wintering population of 100,000 black ducks, a species representative of the health of tidal marshes across the watershed. Refine population targets through 2025 based on best available science. ***Note:*** No BMP will have an impact on refining population targets, so that should be ignored.

Factors Influencing Success

Many factors, with wide-ranging levels of importance and management potential, influence the attainment of the black duck goals. Black ducks use a wide variety of habitat types throughout the Chesapeake Bay watershed. Slightly different habitat characteristics are needed for breeding (nesting and brood-rearing), migrating through, or wintering. Nesting can occur in upland areas or in lowland salt marsh habitats. After hatching, female black ducks typically lead their broods a considerable distance away from the nest and into marsh areas with appropriate cover from predators and weather and with adequate food resources nearby. Duckling survival is greatest when using interior rather than tidal habitats, likely due to increased predator numbers in tidal marshes. During migration, black ducks have greater flexibility than breeding birds with regard to their resource needs. They need adequate cover in the form of emergent, forested, or scrub/shrub wetlands. Their feeding needs can be met by resources found in a variety of wetland types, but whether they are breeding, migrating or wintering, black ducks prefer undisturbed habitat and are rarely found near human developments. Black duck wintering habitat characteristics typically include large bodies of open water, ample food resources, little to no disturbance and cover for protection from severe weather.

A number of factors have affected the black duck population within the watershed. While they are all important, the factors below are listed in rank order from most to least critical.

1. Habitat loss, degradation and fragmentation
2. Food availability - affected by competition and proximity to disturbance (i.e., developed lands)
3. Shoreline disturbance (dredging, marina/housing development)
4. Invasive species
5. Climate impacts
    a. Sea level rise
    b. Flooding (habitat availability)
    c. Salt marsh migration/salinity changes
    d. Large storm events
    e. Migration pattern and/or wintering range shift
6. Habitat loss and fragmentation at other ends of the Atlantic Flyway population’s range

Source: Cornell Lab of Ornithology, https://www.allaboutbirds.org/guide/American_Black_Duck/lifehistory

Habitat: American Black Ducks breed mostly in freshwater wetlands throughout northeastern North America, including beaver ponds, brooks lined by speckled alder, shallow lakes with reeds and sedges, bogs in boreal forests, and wooded swamps. They may also nest in saltmarshes. ***They mostly spend the winter in saltwater wetlands, but also in beaver ponds, flooded timber, agricultural fields, and riverine habitats. They often take refuge from hunting and other disturbances by moving to fresh and brackish impoundments on conservation land.***

Food: American Black Ducks eat mostly plant matter, with insects added during the breeding season. Plant foods include seeds, roots, tubers, stems and leaves of plants growing in moist soil and underwater. In the breeding season adults and ducklings eat a diet high in animal foods, including aquatic insects (larvae of mayflies, caddisflies, dragonflies, flies and midges, and beetles), crustaceans, mollusks, and sometimes fish. They forage individually or with their mates in the nesting season, and either alone or in small groups during the rest of the year. In shallow water they forage like typical "dabbling ducks" by submerging their heads, or tipping up to reach underwater food. In deeper water they may dive more than 12 feet deep for plant tubers and other food items. On migration they eat seeds, foliage, and tubers of aquatic plants, agricultural grains, seeds and fruits of wild terrestrial plants, invertebrates, and sometimes fish and amphibians. ***Wintering birds eat mostly plant parts in freshwater habitats, adding foods such as mussels, zooplankton, and small fish in marine habitats***.

Nest Placement: The female selects a well-concealed site, often on the ground, on wooded or grassy islands, uplands, marshes, cultivated croplands, or cropland borders. She may choose a site in a shrubby area, a brush pile, a hay bale, a patch of grass, or a rock crevice. Nests are sometimes in crotches, hollows, or cavities of large trees.

Key Factors for Wintering

- Habitat loss and fragmentation
- Shoreline disturbance
- Food sources
- Cover

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Black Ducks
5	Substantial Improvement	Practice directly creates, enhances, or restores wetland habitats or increases or enhances connectivity of breeding, foraging, migrating, and wintering habitats (upland areas; lowland salt marshes; non-tidal marshes; fresh/brackish emergent, forested, or scrub/shrub wetlands; mudflats; SAV; large bodies of open water) for black ducks.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice protects against (e.g., conservation easements, buffers) or reverses shoreline disturbance (e.g., dredging, marina/housing development) adjacent to wetlands, or increases cover or food sources in areas adjacent to wetlands.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice restores, enhances, or preserves native species in or near wetlands or other black duck habitat types, or reduces impacts of climate change (e.g., large storm events, flooding, sea level rise, salinity changes).
0	No Effect	Practice has no impact on wetlands
-1	Slight Worsening	Practice reduces native species in or near wetlands or other black duck habitat types, or increases impacts of climate change (e.g., large storm events, flooding, sea level rise, salinity changes).
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice increases shoreline disturbance (e.g., dredging, marina/housing development) adjacent to wetlands, or decreases cover or food sources in areas adjacent to wetlands.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly removes wetlands or increases black duck habitat fragmentation.

Blue Crab Abundance

Goal

Maintain a sustainable blue crab population based on the current 2012 target of 215 million adult females. Refine population targets through 2025 based on best available science.

Factors Influencing Success

The Chesapeake Bay blue crab population and associated fisheries are impacted by a variety of ecosystem factors and natural variability in population dynamics. Many of these factors cannot be controlled or managed by the jurisdictions; instead managers and scientists rely on the best available data to understand the impacts of these factors and make informed management decisions. The following are natural and human factors that influence the partnership's ability to attain this outcome. Harvest and fishery conditions were identified as high priority factors to consider since harvest and effort controls are regulated by the fishery management agencies. Regarding ecosystem factors that can affect blue crab abundance, habitat loss and predation were identified as high priority.

Harvest Impacts and Fishery Conditions Blue crabs continue to support a valuable commercial and recreational fishery in the Bay. The blue crab fishery is complex, with multiple commercial and recreational gear types, various season lengths and regulations in three management jurisdictions. Improving commercial and recreational harvest reporting would provide managers with an improved accounting of harvest and more complete information about the economics of the fishery.

Data Gaps Resource managers make management decisions based on the best available data, and must make assumptions when data are unavailable.

Population Dynamics The blue crab exhibits highly variable population dynamics, in part because of its complex life history during which different life stages occupy different habitats. Once young crabs arrive back in the Bay, many factors continue to influence their survival:

- Salinity
- Temperature
- Overwintering mortality
- Habitat
- Predator and prey abundance
- Hypoxia
- Disease
- Climate Change

Ecosystem Factors

Environmental Variability: Seasonal variations in the physical oceanography of the system, stochastic environmental processes, and blue crab behavior all play key roles in population dynamics. Tides, salinity, and other chemical cues impact larval settlement.

Habitat Loss: Juvenile and molting adult blue crabs obtain refuge from predation by use of key habitats that provide structural complexity or are inaccessible to predators. Loss of submerged aquatic vegetation (SAV) limits primary nurseries in the Chesapeake Bay and potentially affects blue crabs by concentrating recruiting individuals in limited nursery habitats. The unvegetated bottom adjoining salt marshes also provides crucial resources for juvenile blue crabs. The loss of shallow water habitats along natural marshes and forested areas because of shoreline hardening has affected benthic communities and habitats in the nearshore areas. This results in loss of shallow-water refuge and benthic prey provided by marsh edges and other shallow habitats.

Predation and Prey Availability: Predation is a limiting factor on blue crab population size in Chesapeake Bay and affects population dynamics, survival, and reproduction. Eutrophication, habitat alteration and abundance of crab competitor species impact benthic prey abundance and may limit availability to blue crabs.

Hypoxia: Hypoxia responses to low dissolved oxygen (DO) by blue crabs is determined in part by the severity of such events and the crab's tolerance to low oxygen levels. Typically, blue crabs move out of deeper water affected by low DO and into shallow areas during hypoxia or anoxia.

Disease: Known to harbor a variety of pathogens that can be fatal to the crabs, but are not harmful to humans.

Climate Change: Climate change is predicted to have a wide range of effects on the blue crab in Chesapeake Bay, including blue crab mortality, habitat availability, and weather effects on recruitment dynamics. Temperature changes could affect the mortality rates of blue crabs during the winter and change the species assemblage of blue crab predators and prey in the ecosystem. Sea level rise and changes in temperature and salinity may affect the marsh, benthic and SAV habitats that serve as important blue crab nursery and foraging areas, but these impacts may be complex and difficult to predict as the correlation is highly variable and changes along with interactions between abiotic factors. With warming temperatures and changing precipitation, low DO areas are likely to increase in extent and duration, which could reduce foraging resources and limit the available suitable habitat for blue crabs.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Blue Crab Abundance
5	Substantial Improvement	Practice directly improves SAV or other nearshore habitat or water quality conditions in localized area to the benefit of blue crab abundance
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice decreases nutrient loads from tributaries
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice decreases thermal load from tributaries and/or contributes to optimal water quality contributions from tributaries
0	No Effect	Practice has no impact on blue crab abundance
-1	Slight Worsening	Practice increases thermal load from tributaries and/or contributes to undesirable water quality contributions from tributaries
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice increases nutrient loads from tributaries
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly worsens SAV or other nearshore habitat or water quality conditions in localized area to the detriment of blue crab abundance

Brook Trout

Goal

Restore and sustain naturally reproducing Brook Trout populations in Chesapeake Bay headwater streams, with an eight percent increase in occupied habitat by 2025.

Priority Brook Trout Conservation Strategies

- Protect highly functional Wild Brook Trout Only patches from detrimental changes in land use and water use practices.
- Connect habitats that have a high likelihood of sustaining stable wild Brook Trout populations.
- Improve access to Brook Trout spawning and seasonally important habitats (e.g., coldwater refugia, wintering areas).
- Improve Brook Trout habitats that have been impacted by poor land and water use practices.
- Mitigate factors that degrade water quality.
- Enhance or restore natural hydrologic regimes.
- Prevent and mitigate the spread of invasive/exotic species into patches containing wild Brook Trout only.
- Re-introduce wild Brook Trout into catchments within Wild Brook Trout Only patches, where the species has been extirpated or an increase in genetic fitness of the population is needed.

Factors Influencing Success

A variety of activities, both on the land and in the water, will influence the ability to meet the brook trout outcome. Land development, roads, culverts, and unconventional oil and gas drilling all result in three root causes of decreased brook trout occupancy in streams: increased water temperature, increased imperviousness, and increased nutrient/sediment loading.

Downstream Strategies developed a model to predict brook trout within catchments, the relative influence of each predictor variable on brook trout distribution, and a measure of the relationship between the predictor variables and brook trout response. An output of Downstream Strategy's Boosted Regression Trees (BRT) modeling approach is a list of the predictor variables used in the model, ordered and scored by their relative importance (Martin et al. 2012). The relative importance values are based on the number of times a variable is selected for splitting, weighted by the squared improvement to the model as a result of each split, and averaged over all trees. The relative influence score is scaled so that the sum of the scores for all variables is 100, where higher numbers indicate higher influence. Downstream Strategies used ten predictor variables in the Chesapeake Bay Brook Trout BRT Model. The most influential predictor, which accounted for almost 43 percent of the total influence in the model, was predicted mean July water temperature. The three predictor variables that were identified as anthropogenic stressors (network mean imperviousness, network percent agriculture, and network percent mined, non-active) accounted for approximately 34 percent of the total influence.

Thieling (2006) also developed a predictive model for determining Brook Trout population status in the eastern U.S. using classification trees (CART 5.0 Modeling Program), which determined that six core subwatershed and subwatershed water corridor metrics (percentage of forested lands, combined sulfate and nitrate deposition, percentage of mixed forests in the water corridor, percentage of agriculture, road density, and latitude) were useful predictors of Brook Trout distribution and status. One finding from this modeling effort was that 94 percent of the subwatersheds classified as Intact had more than 68 percent of their land base covered by forests. Additionally, when a subwatershed has a combined NO_3 and SO_4 deposition greater than 24 kg/ha, this stressor exerts a negative influence on Brook Trout populations (Thieling 2006); as does having the percentage of agricultural land in the subwatershed in the 12-19% range or higher and a road density value greater than 1.8-2.0 km/km^2.

In addition to compiling data on Brook Trout populations over a 17 state region, Hudy et al. (2005) interviewed regional fisheries managers and asked them to rank perturbations and threats to all subwatersheds that historically supported wild Brook Trout populations. Perturbations and threats were separated into three categories of severity: (1) eliminates Brook Trout life cycle component; (2) reduces Brook Trout populations; and (3) potentially impacts Brook Trout populations. Across the entire study region (eastern U.S), the top five perturbations listed as category 1 or 2 severity for streams were high water temperature, agriculture, riparian condition, the presence of one or more non-native fish species, and urbanization. While their relative influence has not been quantified at a watershed or landscape scale, changes in water quality, modification of hydrologic regime, altered stream flows, and fish passage barriers are other factors affecting the viability of wild Brook Trout populations (EBTJV 2005).

DeWeber and Wagner (2015) used hierarchical logistic regression with Bayesian estimation to predict Brook Trout occurrence probability, which concluded that predicted water temperature had a strong negative effect on Brook Trout occurrence probability at the stream reach scale, and was also negatively associated with the ecological drainage unit (EDU) average probability of Brook Trout occurrence. The effect of soil permeability was positive but decreased as EDU mean soil permeability increased. Brook Trout were less likely to occur in reaches surrounded by agricultural or developed land, and an interaction suggested that agricultural land also resulted in an increased sensitivity to water temperature.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Brook Trout
5	Substantial Improvement	Practice creates riparian shade where there was none previously, removes a high temperature direct discharge source or removes invasive/non-native species that directly impacts native brook trout.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice improves riparian shade conditions, decreases a high temperature direct discharge source or improves access to spawning or seasonally important habitat.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice reduces impervious surface or increases other non-riparian practices to reduce runoff temperature/quantity or improve runoff quality.
0	No Effect	Practice has no impact on brook trout.
-1	Slight Worsening	Practice increases impervious surface or otherwise increases runoff temperature/quantity or degrades runoff quality.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice decreases riparian shade conditions, increases a high temperature direct discharge source or creates a barrier to spawning or seasonally important habitat.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice removes riparian shade, introduces a high temperature direct discharge source or introduces invasive/non-native species that directly impact native brook trout.

Citizen Stewardship

Goal

Increase the number and the diversity of local citizen stewards and local governments that actively support and carry out the conservation and restoration activities that achieve healthy local streams, rivers and a vibrant Chesapeake Bay.

For the purposes of this strategy, the following definition of diversity is being used: "Expanding the diversity of the workforce and participants in restoration and conservation activities means to include a wide range of people of all races, income levels, faiths, gender, age, sexual orientation and disabilities, along with other diverse groups. For this effort to be successful it will require us to honor the culture, history and social concerns of local populations and communities."

Factors Influencing Success

There are a wide variety of factors that influence the ability to make progress on this Outcome. In order to focus this management strategy, the factors influencing progress have been organized into two major categories. *Capacity Factors* include the limitations, barriers and gaps that prevent the development and ability to scale up highly effective citizen stewardship programs. *External Factors* include many of the pre-existing public opinions, perceptions, politics, and market forces that define the challenges and opportunities to effectively increasing the number and diversity of citizen stewards. These categories are very much related in that many programs lack the capacity to effectively address or overcome the external factors that prevent the scaled up adoption of stewardship behaviors and actions. The Bay Program may be well positioned to address many of the *capacity factors* identified below enabling partner agencies and organizations to better address external factors and implement high impact citizen stewardship programs.

Capacity Factors

1. Many existing programs not designed for maximum impact
2. Lack of financial and regulatory incentives for effective stewardship programs
3. Need additional capacity to recruit and train volunteers and leaders
4. Lack ability to measure impact and track progress of stewardship programs
5. Lack of strategic coordination of the many programs implemented at the local level
6. Need region-wide stewardship programs to help build a more robust and diverse movement for clean water

External Factors

1. Public opinion, perception and attitude about Bay clean up varies and poses both challenges and opportunities
2. Lack of social norms that encourage adoption of helpful individual actions and behaviors
3. Need to increase use of existing and expand access to water resources for all citizens
4. Existing markets are the major drivers of consumer choices and often create disincentives for stewardship actions

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Citizen Stewardship
5	Substantial Improvement	Practice and required O&M is fully implementable by citizens[1] without assistance (technical or financial).
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice is fully implementable by citizens[1], but O&M requires assistance (technical or financial).
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice can be implemented by citizens[1] with assistance (technical or financial) from local governments or organizations.
0	No Effect	Practice has no impact on citizen stewardship or not applicable to citizen stewardship.

[1] Citizens do not include government agencies, non-profit organizations, or professionals (business or individual).

Climate Adaptation

Goal

Increase the resiliency of the Chesapeake Bay watershed, including its living resources, habitats, public infrastructure and communities, to withstand adverse impacts from changing environmental and climate conditions.

Monitoring and Assessment Outcome Continually monitor and assess the trends and likely impacts of changing climatic and sea level conditions on the Chesapeake Bay ecosystem, including the effectiveness of restoration and protection policies, programs and projects.
Adaptation Outcome Continually pursue, design, and construct restoration and protection projects to enhance the resiliency of Bay and aquatic ecosystems from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.

Factors Influencing Success

The following are natural and human factors that influence the Partnership's ability to attain the Climate Resiliency Outcomes:

1. Science Factors
    - Scientific Capabilities
    - Variability of Watershed
    - Complexity of the Monitoring Program
    - Non-climate Related and Multiple Stressors
2. Institutional Capacity, Regulatory Constraints and Stakeholder Response
    - Engaging Stakeholders and Incorporating Change
    - Lack of Capacity
    - Adapting to Change and Lack of Guidance
    - Lack of Collaboration

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Climate Adaptation
5	Substantial Improvement	Practice directly increases the protection of living resources and habitats from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice directly increases the protection of public infrastructure and communities from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice indirectly increases the protection of living resources, habitats, public infrastructure, or communities from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.
0	No Effect	Practice has no impact on climate adaptation.
-1	Slight Worsening	Practice indirectly decreases the protection of living resources, habitats, public infrastructure, or communities from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice directly decreases the protection of public infrastructure and communities from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly decreases the protection of living resources and habitats from the impacts of coastal erosion, coastal flooding, more intense and more frequent storms and sea level rise.

Drinking Water Protection/Security

Drinking water protection involves a range of steps including delineation and assessment of source waters; assessment of potential contaminant sources; implementation of management measures to prevent, reduce, or eliminate risks to the drinking water supply; and plans to address emergencies.

Goal

Implement BMPs that protect designated drinking water supply sources, both surface and groundwater sources, in areas with state approved source water protection plans.

Factors Influencing Success

- Location of BMPs relative to the drinking water supply and drainage area will impact the selection and effects of the BMPs.
- The degree to which drinking water protection resonates among landowners will impact their willingness to install and maintain protective practices.
- Geological conditions and land uses in the drinking water supply watershed will have a large impact on the potential for BMPs to achieve local goals source protection.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Drinking Water Protection/Security
5	Substantial Improvement	Practice eliminates toxic contaminants from entering drinking water supplies.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice eliminates traditional pollutants (e.g., nutrients, metals, sediment) from entering drinking water supplies.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice reduces traditional pollutants (e.g., nutrients, metals, sediment) from entering drinking water supplies.
0	No Effect	Practice has no impact on Drinking Water Protection/Security.
-1	Slight Worsening	Practice introduces small amounts of traditional pollutants into drinking water supplies.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice introduces large amounts of traditional pollutants into drinking water supplies.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice introduces toxic contaminants into drinking water supplies.

Economic Development/Job Creation

Economic development refers to efforts that seek to improve the economic well-being and quality of life for a community by creating and/or retaining jobs and supporting or growing incomes and the tax base. Economic development includes activities that stabilize local economies, create long-term employment, contribute to the health of the natural environment, build on local resources and capacity, and increase community control and ownership. A job is a paid position of regular employment or a task or piece of work, especially one that is paid.

Goal

Generate new jobs and stimulate local economy through practice implementation, operation and maintenance, or other means.

Factors Influencing Success

- Adequate training to support job growth may not be available.
- BMP prioritization and selection at the site level will have an impact on capital and maintenance costs, as well as indirect costs due to any associated changes that may be required at the site to accommodate implementation of the BMPs. For example, changes in farm management to adapt to implementation of a new animal waste management system could result in changes in job opportunities. The extent and frequency of street sweeping will also have an impact on overall costs and job opportunities.
- The current availability of local businesses, labor and supplies will impact the degree of success. High unemployment rates may result in abundant, low-cost labor, whereas low unemployment rates may restrict available labor. The mechanisms through which BMPs are paid for, implemented, and maintained may also have a direct impact on costs and job opportunities.
- The type of BMPs to be implemented will depend on land uses and the current level of BMP implementation at the sites. The degree of automation versus manual labor required both before and after the BMPs are implemented will affect job opportunities.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Economic Development/Job Creation
5	Substantial Improvement	Practice gives rise to a new business to aid in practice implementation/maintenance or creates full-time permanent staff positions. OR Practice stimulates local economy.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice increases demand for existing businesses that support practice implementation/maintenance OR creates a new part-time permanent staff positions.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice creates temporary jobs for practice installation/implementation or O&M.
0	No Effect	Practice has no impact on Economic Development/Job Creation.
-1	Slight Worsening	Practice removes the need for temporary jobs for practice installation/ implementation or O&M.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice decreases demand for existing businesses that support practice implementation/maintenance OR removes a new part-time permanent staff positions.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice causes closing of a new business or removes a full-time permanent staff positions. OR Practice inhibits local economy.

Energy Efficiency

Energy efficiency is the act of providing the same service while reducing energy consumption through altered processes or conditions. Part of these processes could include the act of generating energy or reducing the cooling needs in urban heat islands.

Goal

Reduce energy consumption or generate energy. Implementation of BMPs will have a neutral or net positive impact on energy efficiency in areas where they are implemented.

Factors Influencing Success

- Many BMPs require maintenance. BMP maintenance requires site visits and thus energy consumption. For example, grass swales require mowing and certain septic technologies require electric pumps to operate. Other practices could remove the need for mowing or other energy consumption.
- Certain practices can help mitigate the *heat island* effect in urban areas. For example, impervious cover reduction can reduce the amount of asphalt that absorbs the sun’s energy.
- Urban tree canopy can create shade, and thus reduce the amount of energy needed to cool buildings during the summer months.
- The number and type of passes required for tillage, nutrient management, and pesticide management operations will affect energy consumption. For example, deep tillage is more energy intensive than disking operations. Equipment choices for harvesting also affect energy consumption.
- Commercial and organic fertilizers have different energy footprints, an important factor in determining the overall energy efficiency of alternative combinations of nutrient sources. Methane generation at animal operations may also improve overall farm energy efficiency.
- The type and use patterns of irrigation systems (e.g., center pivot vs. furrow) can affect energy consumption. The design and management of bird houses can have significant impacts on energy consumption (e.g., ventilation). Manure and litter hauling strategies and distances can also affect energy consumption on a larger geographic scale.
- The availability of shade trees and structures can affect agriculture animal health and the need to consume energy for cooling mechanisms or herd management.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Energy Efficiency
5	Substantial Improvement	Practice creates natural shade from newly planted trees (e.g., tree planting) in a developed area creating shade to reduce energy needed for cooling. OR creates a positive net production of energy over its design lifetime (implementation and post-implementation); energy is captured and used.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice actively enhances natural shade from existing trees in a developed area increasing shade to reduce energy needed for cooling. OR increases productivity (e.g., crop yield) with no net increase in energy consumption versus baseline (i.e., previous surface or no practice) over its design lifetime (implementation and post-implementation). OR Practice eliminates existing need for energy spent on O&M.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice passively protects or preserves natural shade from existing trees in a developed area to prevent increase in energy needed for cooling. OR Practice reduces existing need for energy spent on O&M.
0	No Effect	Practice has no impact on energy efficiency.
-1	Slight Worsening	Practice has potential to harm existing trees in a developed area which increases energy needed for cooling. OR Practice increasing existing need for energy spent on O&M.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice harms trees providing natural shade. OR decreases productivity (e.g., crop yield) with no net increase in energy consumption versus baseline (i.e., previous surface or no practice) over its design lifetime. OR Practice creates need for energy spent on O&M.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice reduces natural shade by removing trees. OR either increases energy consumption or reduces energy efficiency versus baseline over its design lifetime (e.g., pumped dispersals for septic systems).

Fish Habitat

Goal

Protect, restore and enhance finfish, shellfish and other living resources, their habitats and ecological relationships to sustain all fisheries and provide for a balanced ecosystem in the watershed and Bay.

Fish Habitat Outcome Continually improve effectiveness of fish habitat conservation and restoration efforts by identifying and characterizing critical spawning, nursery and forage areas within the Bay and tributaries for important fish and shellfish, and use existing and new tools to integrate information and conduct assessments to inform restoration and conservation efforts.

Factors Influencing Success

The following table outlines the natural and human factors that influence the partnership's ability to attain this outcome. It also highlights potential approaches for addressing the factors influencing success, which are further outlined in the Management Approach section of [the management strategy] document. For the purposes of this strategy and table, fish habitat is categorized as either tidal saltwater or tidal- or non-tidal freshwater with associated subcategories for each. The highest priority factors for each category are marked with an asterisk* (prioritization may be further refined in implementing this strategy). The species listed are based on workgroup session and will correspond with the Forage Fish Management Strategy, STAC Forage Workshop report and with jurisdictional priority species.

Tidal Saltwater

Habitat Classification	Species of Interest	Factors Influencing (* indicates factors with the most votes from the workgroup sessions). Prioritization may be further refined in implementing this strategy.	Approaches
Sub-tidal (<10m)	• Bay Anchovy • Atlantic Sturgeon • Blue Crab • Oyster • Spot • Croaker • Summer Flounder • Striped Bass • Forage species (general)	• Water Quality • Land use change/urbanization* • Bottom type and loss of habitat structure * • Shoreline hardening • Declines in SAV • Climate change • Fishing activities (dredging, etc.)	1. Comprehensive spatial management for competing bottom uses. 2. Proactively identify high quality productivity areas. 3. Integration and synthesis of habitat information. 4. Determine quantity of available habitat and thresholds for species.
Nearshore and Intertidal	• Juvenile sciaenids • Horseshoe Crab • Mummichog • Juvenile crabs • Grass Shrimp • Bay Anchovy	• Land use change/urbanization* • Shoreline hardening* • Climate change (sea level rise)* • Water quality • Declines in SAV and wetlands	1. Proactively identify high quality productivity areas (benthos, water column habitat). 2. Show differences between hardened and natural shorelines. 3. Maximize value of living shorelines (BMPs).

Freshwater

Habitat Classification	Species of Interest	Factors Influencing (* indicates factors with the most votes for each section)	Approaches
Non-tidal—**Cold and Upstream waters**	• Brook Trout • Trout (general)	• Increasing water temperature and reduced water quality due to land use change/ urbanization* (Impervious surface, loss of forest cover) • Climate change (temperature, freshwater flow) • Gas and mineral extraction; acid mine drainage • Watershed acidification	1. Cold water stream not a top priority for this group, but this team would identify overlaps with interests of groups such as the Eastern Brook Trout Joint Venture. 2. Identify other priority cold water streams that benefit trout species in addition to brook trout.
Non-tidal—**Warm**	• Freshwater Mussels • Black basses • American Shad • American Eel • River Herring	• Land use change/urbanization (impervious surface)* • Water quality • Declines of SAV* • Barriers to fish migration • Watershed fragmentation • Climate change • Gas and mineral extraction	1. Identify high priority areas for conservation/protection (use Maryland Biological Stream Survey and Index of Biological Integrity). a. Link to Pennsylvania Conservation Regulations b. Link to State Wildlife Action Plans. 2. Promote activities to restore affected areas. a. Link to Water Quality GIT (BMPs) 3. Outreach to public and decision-makers.
Tidal	• Striped Bass • Atlantic Sturgeon • Largemouth Bass • American Shad • River herring • American Eel • White Perch • Yellow Perch	• Land use change/urbanization* • Water quality • Loss of wetlands* • Loss of SAV* • sea level rise and saltwater intrusion)* • Predatory invasive species • Barriers to fish migration	1. Identify areas with restoration potential. 2. Identify and map critical spawning and nursery areas for conservation. 3. Develop criteria for healthy habitats. 4. Develop protection policies/regulations.

Based on the above discussion, the top factors influencing success for scoring purposes are:

- Loss of forest
- Increasing water temperature
- Increasing impervious surface
- Decreasing water quality
- Declines or loss of SAV
- Loss of wetlands
- Bottom type and loss of habitat structure
- Shoreline hardening
- Sea level rise and saltwater intrusion

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Fish Habitat
5	Substantial Improvement	Practice creates riparian shade, wetlands or SAV where there was none previously; removes a high temperature direct discharge source; or removes hardened shoreline.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice improves riparian shade conditions, wetlands or SAV; decreases a high temperature direct discharge source or otherwise directly improves stream water quality (e.g., DO, nutrients, turbidity); or directly prevents sea level rise.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice reduces impervious surface or increases other non-riparian practices to reduce runoff temperature/quantity or improve runoff quality.
0	No Effect	Practice has no impact on fish habitat.
-1	Slight Worsening	Practice increases impervious surface or otherwise increases runoff temperature/quantity or degrades runoff quality.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice decreases riparian shade, wetlands or SAV; increases a high temperature direct discharge source or otherwise directly worsens stream water quality (e.g., DO, nutrients, turbidity); or directly contributes to sea level rise.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice removes riparian shade, wetlands or SAV; introduces a high temperature direct discharge source; or creates a hardened shoreline.

Fish Passage

Goal

By 2025, restore historical fish migratory routes by opening 1,000 additional stream miles, with restoration success indicated by the presence of Alewife, Blueback Herring, American Shad, Hickory Shad, American Eel and/or Brook Trout. Restore connectivity to creek, stream and river habitats for migratory fish through dam removal and fish passage projects.

The Fish Passage Workgroup will implement priority projects to remove barriers, retrofit culverts, install passage structures and monitor for presence of target species. More specifically, the fish passage objectives include:

1. During the period 2011-2025, restore historical fish migratory routes by opening 1,000 additional stream miles, with restoration success indicated by the presence of Alewife, Blueback Herring, American Shad, Hickory Shad, American Eel and/or Brook Trout.
2. Document return of fish to opened stream reaches by establishing the presence or absence of target species at a select number of projects within the Chesapeake Bay watershed.
3. Use the Fish Passage Tool for high priority dam removal and fish passage projects.

Factors Influencing Success

Many factors with wide-ranging levels of importance and management potential influence the ability to re-open fish passage miles within the watershed. A thorough understanding of these factors is essential for project success.

1. Community/Landowner Willingness, Legislation to Incentivize or Mandate Barrier Removal
2. Funding
3. Understanding the Ancillary Benefits of Dam Removal (Policy Makers, Dam Owners and Local Government)
4. Target Species Populations in Decline Region-wide (unmanageable)
5. Selecting Most Cost-Effective Projects for Implementation

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Fish Passage
5	Substantial Improvement	Practice directly removes barriers, retrofits culverts, or installs passage structures
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice improves fish habitat for target fish species (e.g., Alewife, Brook Trout)
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice reduces the need for privately owned dams (e.g., reduces flooding probability, increases water supply or use efficiency)
0	No Effect	Practice has no impact on fish passage
-1	Slight Worsening	Practice increases the need for privately owned dams (e.g., increases flooding probability, decreases water supply or use efficiency)
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice worsens fish habitat for target fish species (e.g., Alewife, Brook Trout)
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly creates barriers or hinders fish passage

Flood Control/Mitigation

Flood control refers to all methods used to reduce or prevent the detrimental effects of floodwaters. Flood mitigation involves the management and control of flood water movement, such as redirecting flood runoff through the use of floodwalls and flood gates, rather than trying to prevent floods altogether.

Goal

Improve flood control and mitigation to protect properties while also maintaining natural cycles to the extent needed to protect water quality and biological communities.

Factors Influencing Success

- Location and types of BMP opportunities will have an impact on success. For example, upland BMPs may have a greater impact in an urban setting than in an agricultural setting due to differing runoff coefficients and pathways.
- Soils, topography, and land cover will impact both the selection and performance of BMPs on the landscape scale. The type and coverage of BMPs (e.g., farm system vs. stand-alone urban practices) will affect the potential for BMPs to have an impact on flood control and mitigation.
- Practice design standards and specifications, if not updated to accommodate climate change, will also affect the potential for BMPs to be effective.
- The municipality has a Hazard Mitigation Plan that includes specific flood control/mitigation practices, such as green infrastructure or living shorelines. Additional elements of the Plan could include policy or building staff capacity. Specific actions could include: Drainage system maintenance, floodplain protection, watershed management, riparian buffers, wetland preservation/restoration, slope stabilization, channel modification, storm sewers.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Flood Control/Mitigation
5	Substantial Improvement	Practice prevents runoff to streams. OR improves stormwater drainage or channel condition to prevent flooding.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice increases the floodplain, delays peak flow, and/or reduces flashiness. OR replaces flood prone impervious areas with pervious cover.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice slightly reduces runoff to streams.
0	No Effect	Practice has no impact on Flood Control/Mitigation
-1	Slight Worsening	Practice slightly increases runoff to streams.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice reduces the floodplain, expedites peak flow, and/or increases flashiness. OR replaces flood prone pervious areas with impervious cover.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice diverts all runoff to streams. OR degrades stormwater drainage or channel condition to prevent flooding.

Forage Fish

Goal

Continually improve the Partnership's capacity to understand the role of forage fish populations in the Chesapeake Bay. By 2016, develop a strategy for assessing the forage fish base available as food for predatory species in the Chesapeake Bay. While the stated goal for forage fish is development of an assessment strategy, the focus for this project is on forage fish abundance.

Factors Influencing Success

Forage species are diverse and live in many different habitats in the Chesapeake Bay. Most are short-lived and experience large swings in abundance annually, seasonally, and spatially. They are subject to environmental variability and other factors that control their populations and reproductive success. Resource managers need to understand the factors that control forage abundance to manage responsibly. The following are factors that influence forage species abundance and that influence the partnership's ability to attain the outcome of assessing the forage base.

Factors Affecting Forage Abundance (in priority order based on a survey of this strategy drafting team)

- Habitat (amount and quality)
- Predation
- Water quality
- Land use and watershed development
- Fishing and catch removals
- Climate change
- Food for forage species

Eutrophication leads to hypoxia which limits the production of benthic organisms and fish, and alters the distribution and productivity of plankton. Excessive algal growth has strong negative impacts on SAV, which serves as an important habitat.

Specific factors identified by the Forage Action Team that affect forage abundance include hardening of shorelines and other shoreline modifications, dams that limit access to upriver spawning areas of anadromous fishes (e.g., shad and herring), water quality (as linked to land use and watershed development), shoreline and upland development, poor agricultural practices, increases in impervious surfaces, contaminated runoff, climate change, and foods for forage species that are affected by various physical and biological factors.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Forage Fish
5	Substantial Improvement	Practice directly improves fish habitat quality or amount (including through removal of shoreline modifications, protection/establishment of SAV, or directly improving the production of benthic organisms or the distribution and productivity of plankton) or improves access to upriver spawning areas.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice directly improves water quality (e.g., removes or reduces direct discharges, in-stream sources, etc.) or protects shorelines.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice improves water quality through watershed BMPs, reducing impervious surfaces, etc.
0	No Effect	Practice has no impact on forage fish.
-1	Slight Worsening	Practice worsens water quality through watershed land use and development.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice directly worsens water quality (e.g., adds or increases direct discharges, in-stream sources, etc.) or develops shorelines.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly worsens fish habitat quality or amount (including shoreline hardening or other modifications, removal of SAV, or directly worsening the production of benthic organisms or the distribution and productivity of plankton), or worsens access to upriver spawning areas.

Riparian Forest Buffer

Goal

Continually increase the capacity of forest buffers to provide water quality and habitat benefits throughout the watershed. Restore 900 miles per year of riparian forest buffer and conserve existing buffers until at least 70 percent of riparian areas throughout the watershed are forested.

Agricultural forest buffers receive the most attention since they prevent more N, P and sediment from entering the waterways than urban forest buffers or any type of grass buffer. There are good agricultural forest buffer planting cost-share programs in place. These programs need to be maximized. Complementary programs that encourage forest buffers also need to be implemented.

Most factors affecting the RFB Management Strategy relate to difficulties in delivering existing programs. Some factors are more technical, or relate to the need for strengthened management/leadership. Other factors exist because of the many demands on riparian land, rendering it unfit for riparian forest establishment. Watershed-wide restoration, conservation, and maintenance/stewardship services are consistently needed in order to increase the amount of riparian forest buffers in the watershed. Strong leadership and funding helps to facilitate this.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Score	Score Narrative for Riparian Forest Buffer
5 Substantial Improvement	Directly improves the practice, protection, and/or maintenance of riparian forest buffers (35' or wider).
4 Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3 Moderate Improvement	Facilitates the practice, protection, and/or maintenance of riparian forest buffers.
2 Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1 Slight Improvement	Potential to directly improve the restoration, maintenance, or conservation of riparian forest buffers, or their functionality.
0 No Effect	Practice has no impact on riparian forest buffers.
-1 Slight Worsening	Potential to directly impact the restoration, maintenance, or conservation of riparian forest buffers, or their functionality.
- 2 Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
- 3 Moderate Worsening	Indirectly impacts the restoration, maintenance, or conservation of riparian forest buffers, or their functionality.
- 4 Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
- 5 Substantial Worsening	Practice directly impacts the restoration, maintenance, or conservation of riparian forest buffers, or their functionality.

Groundwater Recharge/Infiltration

Groundwater recharge or deep drainage or deep percolation is a hydrologic process where water moves downward from surface water to groundwater. Recharge is the primary method through which water enters an aquifer. Infiltration is the process by which water on the ground surface enters the soil.

Goal

Maintain groundwater recharge rates at levels sufficient to sustain aquifer water levels. Implementation of BMPs will have a neutral or net positive impact on groundwater recharge rates where they are implemented.

Factors Influencing Success

- Geological conditions (e.g., soils) will have a large impact on current recharge rates and the potential for BMPs to achieve local goals for infiltration/recharge.
- Pumping rates for various uses of groundwater (e.g., drinking water, irrigation) have the potential to overwhelm any impact due to BMP implementation. Droughts can cause major changes in aquifer levels. Urbanization can drive up water demand for groundwater use.
- The presence of irrigation systems will impact options on farmland.
- Availability of land for recharge areas will impact BMP options in urban settings.
- Climate change could have an effect through reduced precipitation to an area and other factors.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Groundwater Recharge/Infiltration
5	Substantial Improvement	Practice maximizes infiltration at a hardened site (e.g., replaces impervious surface area with pervious surface or captures and infiltrates runoff from urban or hardened sites).
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice increases infiltration at a hardened site (e.g., replaces impervious surfaces with semi-pervious surfaces).
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice reduces runoff and increases infiltration at an unhardened site (e.g., change in tillage that increases infiltration).
0	No Effect	Practice has no impact on groundwater recharge/infiltration than without the practice.
-1	Slight Worsening	Practice increases runoff and decreases infiltration at an unhardened site (e.g., change in tillage that decreases infiltration).
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice directly decreases infiltration at a = hardened site (e.g., replaces pervious surfaces with semi-pervious surfaces).
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice prevents infiltration at a hardened site (e.g., adds impervious surface area without runoff capture and infiltration) or uses/removes groundwater.

Healthy Watersheds

Goal

100 percent of state-identified currently healthy waters and watersheds remain healthy.

Activities that protect healthy waters and watersheds–including land conservation, local ordinances, anti-degradation policies, and other measures–often cost less and can be more effective at maintaining health than restoration.

Factors Influencing Success

- Human and natural factors
- Federal, State and Local Regulatory Framework

In assessing the range of factors influencing our ability to meet this goal, land use change---specifically the amount, type, and way in which land use change occurs---is the single biggest factor impacting healthy watersheds.

Land use change---specifically the amount, type, and way in which land use change occurs---is the single biggest factor impacting healthy watersheds. Increasing urban development (i.e., impervious area), including transportation infrastructure is the most significant influence on watershed health through changing land use and other habitat modifications. Factors include air quality and air deposition, climate change, invasive species, changing stream flow regimes, and channel stability.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Healthy Watersheds
5	Substantial Improvement	Practice directly restores or conserves non-urban lands
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice protects or improves stream flow regimes or channel stability
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice improves water quality or reduces impervious surfaces
0	No Effect	Practice has no impact on healthy watersheds
-1	Slight Worsening	Practice worsens water quality or increases impervious surfaces
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice worsens stream flow regimes or channel stability
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly increases urbanization

Land Use Methods & Metrics Development

Goal

Conserve landscapes treasured by citizens in order to maintain water quality and habitat; sustain working forests, farms and maritime communities; and conserve lands of cultural, indigenous and community value.

Outcome

Continually improve the knowledge of land conversion and the associated impacts throughout the watershed. By 2016, develop a Chesapeake Bay watershed-wide methodology and local level metrics for characterizing the rate of farmland, forest and wetland conversion, measuring the extent and rate of change in impervious surface coverage and quantifying the potential impacts of land conversion to water quality, healthy watersheds and communities. Launch a public awareness campaign to share this information with citizens, local governments, elected officials and stakeholders.

While the stated goal is landscape conservation, the outcome is focused on methods and metrics development. Scoring for this project pertains to the outcome, not the overall goal.

Factors Influencing Success

The following are natural and human factors that influence the Bay Program's ability to attain this outcome:

- The Bay Program Management Board has interpreted the Outcome language as calling for the development of separate metrics for forest, farm, and wetland conversion in addition to measuring the rate of impervious surface change.
- High-resolution land cover and elevation data availability and costs.
- Sustainability of long-term monitoring.
- Methodology for assessing landscape change with high-resolution data with sufficient precision to inform county-level decisions.
- Methodology to quantify impacts to communities and the environment.
- Agreement on the temporal and spatial scale at which to assess change.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Land Use Methods & Metrics Development
5	Substantial Improvement	Practice creates wetlands or forest areas.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice conserves existing forest, wetlands., or agriculture land or converts crop land to pasture, forage production, perennial grass, etc.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice creates limited area (<0.5 acre) of vegetation or trees.
0	No Effect	Practice has no impact on land use methods & metrics development
-1	Slight Worsening	Practices removes existing vegetation (<0.5 acres) and replaces with impervious surface or turf.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice removes agriculture fields.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice removes wetlands of forested areas.

Oyster Restoration

Goal

Continually increase finfish and shellfish habitat and water quality benefits from restored oyster populations. Restore native oyster habitat and populations in 10 tributaries by 2025 and ensure their protection.

As of 2014, six tributaries have been selected for oyster restoration: Harris Creek, the Little Choptank and Tred Avon Rivers in Maryland, and the Lynnhaven, Lafayette and Piankatank Rivers in Virginia.

Factors Influencing Success

The following are natural and human factors that influence the partnership's ability to attain this *outcome. The top priority factors are listed in order based on a survey of the drafting team of this* management strategy.

1. Low Population
   Research and modelling efforts have found that the current oyster population is at less than 1% of historic levels. The main causes for the reduced oyster stocks have been historical overfishing, habitat loss (including poor water quality), and diseases (MSX and Dermo). At their current level of abundance in the Bay, oysters are not creating enough offspring to support full population recovery.
2. Resource Availability
   a. Funding
   b. Shell/substrate - The amount of natural shell available for restoration is very limited due to high demand among restoration efforts, fishery enhancement, and aquaculture. Alternatives to local shell, including fossil shell, stone, crushed concrete and fabricated reef structures (e.g.: reef balls; oyster castles), have been used with varying degrees of success.
   c. Hatchery spat (young oysters) supply.
3. Water Quality
   Poor water quality (e.g. low dissolved oxygen levels, pollution, sedimentation, eutrophication, sewage contaminants, salinity changes from massive freshwater inputs, etc.) can prevent natural recruitment and increase natural mortality among adult oysters. These negative effects can threaten the long-term success of oyster restoration projects if water quality is not improved.
4. Enforcement
   Enforcement of sanctuaries and harvest regulations is challenging and illegal harvest of oysters (poaching) has long been problematic in the Chesapeake. Illegal removal of oysters threatens the success of restoration efforts in sanctuaries.
5. Spat set variability
   Spat set varies tremendously interannually and spatially within the Chesapeake Bay, with higher spat levels in higher salinity waters and low to no spat set in lower salinity waters. Some areas may require intensive seeding and re-seeding with hatchery-produced oysters to rebuild stocks, particularly in lower-salinity waters.

Specific factors identified that potentially relate to best management practices include poor water quality and salinity levels.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Oyster Restoration
5	Substantial Improvement	Practice directly restores and/or protects native oyster habitat or populations
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice improves water quality (e.g., decreases nutrient loads and/or reduces sediment) in targeted oyster restoration tributaries
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice reduces runoff that would decrease salinity in targeted oyster restoration tributaries
0	No Effect	Practice has no impact on oyster restoration
-1	Slight Worsening	Practice increases runoff that would decrease salinity in targeted oyster restoration tributaries
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice worsens water quality (e.g., increases nutrient loads and/or increases sediment) in targeted oyster restoration tributaries
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly reduces and/or harms native oyster habitat or populations

Property Values

Property value is an estimate of what a home or a piece of land is actually worth.

Goal

Preserve or enhance property values through enhanced water quality and related benefits associated with BMP implementation.

Factors Influencing Success

- The incremental impact of BMPs on property values might not be measurable. Properties adjacent to those receiving BMPs might have a greater impact on property value than the BMPs.
- Site conditions may limit the set of BMPs available, thereby impacting the potential for selecting BMPs that will reduce nutrient and sediment loads while also protecting property values. For example, land availability can limit the choices for runoff retention in urban settings (e.g., a wet pond or wetland could not be installed in an ultra-urban setting.) BMPs that require significant operations/maintenance costs could negatively affect property values.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Property Values
5	Substantial Improvement	Practice has potential to significantly improve the property value of the surrounding properties/neighborhood by reducing a threat (e.g. flood reduction) and providing an amenity to the community (e.g. recreational opportunities).
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice has potential to slightly improve the property value of the surrounding properties/neighborhood through aesthetic improvement and/or the reduction in a threat. OR practice increases property value through improved soil health/increased crop yields.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice has potential to improve the property value of the land it is situated on.
0	No Effect	Practice has no impact on Property Values.
-1	Slight Worsening	Practice has potential to reduce the property value of the land it is situated on.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice has potential to slightly reduce the property value of the surrounding properties/neighborhood by degrading the aesthetics and/or increasing or causing a threat. OR practice decreases property value through degraded soil health/decreased crop yields.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice has potential to significantly reduce the property value of the surrounding properties/neighborhood by increasing a threat and removing an amenity.

Protected Lands

Goal

By 2025, protect an additional two million acres of lands throughout the watershed—currently identified as high-conservation priorities at the federal, state or local level—including 225,000 acres of wetlands and 695,000 acres of forest land of highest value for maintaining water quality.

Factors Influencing Success

The following are natural and human factors that influence the abilities of the Partnership and its participants to attain this outcome:

1. Changes in Land Use
2. Public Support for Conservation
3. Funding and Incentives for Conservation
4. Ownership Patterns and Fragmentation
   As the watershed's resident population grows and shifts toward urban areas, land values increase near commercial centers. As competition for economically viable use of the land intensifies, the incentives and pressures to develop compete with the values that support conservation. It takes greater communication, consensus-building and cooperation to protect contiguous parcels in the Eastern U.S.
5. Managing Protected Areas
   As land is protected, managers and funders must address strategies for supporting long-term management. Funding for maintenance of existing public lands is often limited. Privately-held easements also require monitoring, which can become more complicated as the land transfers to second generation landowners.
6. Climate Change
   Climate change and climate-induced disasters impact land conservation by changing the viability of shoreline and low elevation parcels for protection as well as development. Shifting temperature and precipitation regimes impact upland areas by shifting native species patterns and increasing invasive species. Land protection is complicated by a changing climate. It is also one of many tools that can offset the impacts of climate change. In particular, undeveloped shoreline mitigates rising tides and can allow the surrounding ecosystem to adapt to changes in the coastline.

Specific factors identified include changes in land use (e.g., urbanization), new energy infrastructure (e.g., pipelines), and accessibility of protected lands for recreation (increases public awareness).

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Protected Lands
5	Substantial Improvement	Practice directly protects/creates highest value wetlands and forestland for maintaining water quality.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice reduces new development pressures, including transportation and energy infrastructure, new housing, and commercial development.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice creates area with native vegetation or removes non-native vegetation.
0	No Effect	Practice has no impact on protected lands
-1	Slight Worsening	Practice removes area of native vegetation or introduces non-native vegetation.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice increases new development pressures, including transportation and energy infrastructure, new housing, and commercial development.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly degrades or removes highest value wetlands and forestland that maintained water quality.

Recreation

Recreation can take many forms including swimming, wading, fishing, boating. picnics, wildlife viewing, hiking, birdwatching.

Goal

Increase recreational value of land and waters within the watershed.

Factors Influencing Success

- BMP's ability to reduce nutrients that might cause algal blooms and reduce sediment deposition that in turn affects benthic organisms and the fish that consume them.
- Accessibility for disabled, aging, and lower-income residents is also important, and BMPs on public properties can have an impact on this factor (e.g., wetland treatment systems in urban areas could provide birding opportunities).
- Partnerships, volunteerism, and public outreach can also be essential to the maintenance and preservation of recreational opportunities, but BMPs might have no impact on these factors.
- Land acquisition is often important to enhance park facilities and services; BMPs involving land use change or retirement (e.g., forest buffers) may be helpful in this regard when implemented on lands adjacent to parklands.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Recreation
5	Substantial Improvement	Practice creates addition opportunities for recreational use of the water. Practice removes water pollution to waterbodies that have direct-contact recreation (e.g., wading, swimming). Practices eliminate reduce harmful algal blooms.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice creates opportunities for recreational use of the adjacent land or improves the conditions for existing water recreation. Practice reduces water pollution to waterbodies that have direct-contact recreation (e.g., wading, swimming). Practices helps reduce harmful algal blooms.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice enhances a neighborhood by providing opportunities for passive recreation (e.g., wildlife viewing, walking, biking).
0	No Effect	Practice has no impact on Recreation.
-1	Slight Worsening	Practice creates an environment that discourages passive recreational use to surrounding area.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice creates an environment that discourages direct contact recreation in the waterbody.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice removes or prevents all opportunities for recreational use of the water. Practice increases likelihood of algal blooms.

Stream Health

Goal

Continually improve stream health and function throughout the watershed. Improve health and function of 10 percent of stream miles above the 2008 baseline for the Chesapeake Bay watershed.

Factors Influencing Success

To fully achieve this outcome it is critical to address priority stressors to restore stream functions and improve local stream health, as well as the Bay. A stressor in the context of this strategy is any factor limiting to aquatic life or stream processes that occurs as a direct or indirect impact of current or past human actions.

1. Ecological stressors & factors are the physical, chemical and biological factors that impair or limit stream health recovery. They may also be watershed-based factors that limit stream function(s) or negatively affect downstream waters. Further, these factors affect stream health at two scales - local and downstream waters to the Bay. Ecological stressors and factors influencing the Outcome include:
2. Within the stream channel and floodplain factors:
   - Excessive sediment and nutrients in-stream from unstable stream banks and legacy sediments in the floodplain
   - Limited nutrient and organic processing-instream
   - Alteration in channel form and function resulting in instability and disequilibrium affecting diversity and quality of habitat
   - Concentrated flows and reduction in baseflows
   - Piped and channelize streams
   - Removal/Loss of forested riparian areas and the benefits provided by shading
3. Watershed-based factors:
   - Impervious cover and increases in stormwater runoff
   - Significant changes in watershed hydrology (time of concentration) related to overland flow impacted by road drainage, ag land drainage, driveways, stormwater collection systems, etc.
   - Flow alteration and flashy hydrology
   - Excessive nutrient loading to streams from excess untreated runoff (agricultural and urban) from the upland areas in the watershed and groundwater
   - Implementation of stormwater management controls (e.g. BMPs)
   - Leaky wastewater infrastructure
   - Toxicity of effluent from resource extraction activities (i.e., acid mine drainage, fracking)
   - Road de-icing practices (salt)
   - Thermal impacts
   - Invasive species
   - Endocrine disrupting chemicals
4. Policy and Administrative factors limit the implementation potential of an action. Stressors degrading streams that originate from watershed land use and or from leaky public and private wastewater infrastructure are often very challenging to address because of the scale of the problem, cost of remediation, difficulty of acquiring space for remediation projects, and other challenges. Many of these stressors are poorly dealt with via existing laws and policies. In regards to stream restoration, key among these factors are related to the permit approval process,

that despite approval of many projects throughout the Chesapeake Bay, there are projects that encounter delays during the permit review process hindering, significantly in some cases, their implementation. Uncovering factors that are common to both the practitioner and regulator need to be overcome to address this barrier to implementation. The current assessment of jurisdictions to meet their 2017 and 2025 WIP targets heightens the need to address these factors to implement projects that meet the sediment and nutrient loads reductions necessary to improve stream health. Factors that influence the outcome include:

- Review and approval of stream restoration projects for WIP implementation
- Lack of common watershed, stressor and stream assessment and restoration guidelines
- Integration of water quality and living resource goals during WIP stream restoration
- MS4 permits focus on water quality
- Adequate financial resources to support local implementation efforts
- Adequate extension infrastructure to communicate newest research and technical guidance to jurisdictions
- In very urban area, the availability of land to retrofit and implement upland BMPs

5. Scientific Knowledge & Application of Research are factors related to our current understanding of streams and their response to management interventions and the ability to effectively translate the most up-to-date scientific understanding to address Bay Agreement outcomes and regulatory guidance. Factors that influence the outcome include:

- Stressor identification and prioritization procedures
- Functional metrics that correlate with priority stressors identified for measurement
- Robust stream restoration monitoring to evaluate the potential functional lift or improvement in stream functions from BMP implementation
- Possible lag times that affect the ability to evaluate the effect of upland BMP on stream health
- Research needed to guide the selection of achievable reference conditions/design approaches based on watershed and stream functions to include an urban reference continuum
- Insufficient data to develop Bay-wide fish-based indicator to complement macro-invertebrate indicator (Chessie BIBI)
- Lengthy timeframe for adjusting BMP credit or recognizing new BMPs
- Limitations of the applicability of the Chessie BIBI (and other similar ecological data) to streams where restoration work is being conducted on an annual basis.
- Identify nutrient hotspot in stream valley where erodible geologic materials and soils contain excess nutrients
- Additional research to refine nutrient credits for stream restoration projects as supported by the Expert Panel recommendations on Individual Stream Restoration Projects to include for example bioavailability of nutrients.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Stream Health
5	Substantial Improvement	Practice directly improves within the stream channel and floodplain factors that impact stream health (e.g., in-stream sediment and nutrients, channel alterations/pipes, riparian areas) OR restores natural flow conditions (e.g., improves baseflow)
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice directly improves watershed-based factors that reduce the volume and rate of stormwater entering streams (e.g., impervious cover, hydrology, flow alteration).
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice improves watershed-based factors that reduce pollutant loads to streams (e.g., nutrients, salt, thermal, toxic).
0	No Effect	Practice has no impact on stream health.
-1	Slight Worsening	Practice worsens watershed-based factors that reduce pollutant loads to streams (e.g., nutrients, salt, thermal, toxic)..
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice directly worsens watershed-based factors that reduce the volume and rate of stormwater entering streams (e.g., impervious cover, hydrology, flow alteration).
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly worsens within the stream channel and floodplain factors that impact stream health (e.g., in-stream sediment and nutrients, channel alterations/pipes, riparian areas) OR removes natural flow conditions (e.g., reduces baseflow)

Submerged Aquatic Vegetation

Goal

Sustain and increase the habitat benefits of SAV (underwater grasses) in the Chesapeake Bay. Achieve and sustain the ultimate outcome of 185,000 acres of SAV Bay-wide necessary for a restored Bay. Progress toward this ultimate outcome will be measured against a target of 90,000 acres by 2017 and 130,000 acres by 2025.

Factors Influencing Success

Many factors, with wide-ranging levels of importance and management potential, influence the attainment of SAV goals. A thorough understanding of these factors is essential to restoration success.

1. High-quality habitat conditions are vital to the success of SAV restoration and abundance goals. Good quality habitat conditions for SAV are defined by shallow water (2 meters or less) with sufficient water quality and salinity for the species being targeted for restoration. Most important, water clarity is necessary for productive SAV habitat. Water clarity varies primarily as a function of precipitation. Additionally, bottom disturbance by rays and herbivory by waterfowl serve to limit success of active restoration efforts. While these factors are difficult to control directly, the workgroup is able to target restoration projects to areas in the Bay with suitable habitat conditions. The SAV maps provide information on Bay salinity, depth, and sediment input, which plays an important role in water clarity.

   The Bay is considered at high-risk for sea level rise and increased Bay water temperatures from climate change, which will influence SAV habitat conditions. Climate change and sea level have little management potential; however, the workgroup is able to advocate management approaches to alleviate some of the climate stressors (i.e. minimize shoreline hardening/modification to allow inland migration of SAV as water levels increase). Also, heat-tolerant SAV species can be used in planting and transplanting efforts if it is anticipated that climate change and sea level rise will be an important factor for a restoration project.
2. Human Impacts
   Physical interruption of SAV through anthropogenic activities, including dredging, propeller scarring, fishing and aquaculture practices, as well as the introduction of invasive species can cause direct physical disturbance to SAV. Additionally, the indirect effect of localized water quality degradation, such as shoreline alteration, or sedimentation from changes in land use or in water activities like clam dredging, also influences the health of SAV beds. Human activities can be managed through education, outreach, and regulation.
3. Restoration Science
   SAV planting and seeding efforts in the Bay have seen limited success to date because of the over-riding water quality and physical habitat stressors that active SAV restoration efforts cannot correct. In addition to degraded water clarity, bottom disturbance and herbivory can also limit success of active planting and seeding efforts. Even in ideal habitat conditions with limited human impacts, the availability of source seeds, plants, and propagules (from laboratories, nurseries, and wild collection), as well as the survival rate of the targeted SAV species, influences the success of restoration projects.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for SAV
5	Substantial Improvement	Practice directly creates SAV acreage.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice directly enhances both water quality *and* habitat function of SAV.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice directly enhances either the water quality or habitat function of SAV..
0	No Effect	Practice has no impact on SAV
-1	Slight Worsening	Practice directly degrades either the water quality or habitat function of SAV.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice directly degrades both the water quality *and* habitat function of SAV.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly reduces SAV acreage..

Toxic Contaminants Policy and Prevention

Goal

Continually improve practices and controls that reduce and prevent the effects of toxic contaminants below levels that harm aquatic systems and humans. Build on existing programs to reduce the amount and effects of PCBs in the Bay and watershed. Use research findings to evaluate the implementation of additional policies, programs and practices for other contaminants that need to be further reduced or eliminated.

Factors Influencing Success

The following are natural and human factors that influence the Partnership's ability to attain this outcome:

- Broad geographic extent and distribution of toxics
- Toxics can be separated into 3 broad categories—metals, hydrophobic organics, hydrophilic organics—that can behave differently to BMPs and other restoration practices
- Use of herbicides and pesticides in agricultural and lawn maintenance
- Political will to modify regulatory programs and/or create voluntary programs
- High cost of remedies: in-stream sediment remediation; waste water source trackdown studies; electrical equipment replacements; stormwater controls; contaminated site remediation
- Variety of sources and pathways for toxics entering the environment that necessitate a wide-range of very different management responses (e.g., primary sources such as faulty electrical equipment and herbicide/pesticide application, secondary sources such as wastewater treatment by-products, and pathways such as stormwater runoff)
- Knowledge gaps on relative sizes of sources

Resulting Scoring Narrative

While the Toxic Contaminants Policy and Prevention Outcome places an emphasis on PCBs, the outcome also seeks to improve practices and controls that reduce and prevent the effects of other classes of toxic contaminants. In scoring each category of best management practices (BMPs), the predominant class of contaminant of concern was identified for each source sector (e.g., pesticides for agriculture) and a score was developed based upon the BMP's potential impact upon that contaminant class (e.g., pesticides). These classes are listed below with the identified sectors. Where monitoring data or modeled data were available, they were used in developing the scores. However, the complexity of factors often require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Toxic Contaminants Policy and Prevention
5	Substantial Improvement	Practice has potential to substantially decrease the delivery of toxic contaminants to waterbodies.
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice has potential to moderately decrease the delivery of toxic contaminants to waterbodies.
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ

1	Slight Improvement	Practice has potential to slightly decrease the delivery of toxic contaminants to waterbodies.
0	No Effect	Practice has no impact on toxic contaminants policy and prevention.
-1	Slight Worsening	Practice has potential to slightly increase the delivery of toxic contaminants to waterbodies.
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice has the potential to moderately increase the delivery of toxic contaminants to waterbodies.
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice has the potential to significantly increase the delivery of toxic contaminants to waterbodies.

Toxic Contaminant Classes

Contaminant Group	Sector	Extent, Severity, and Sources
Polychlorinated biphenyls (PCBs)	Urban	PCBs have widespread extent and severity. The severity was based on risk to human health through consumption of contaminated fish with impairments identified in all of the watershed jurisdictions. Some primary sources are contaminated soils, leaks from transformers, and atmospheric deposition.
Mercury		Mercury had both widespread extent and severity. The severity was based on risk to human health through consumption of contaminated fish. The primary source is air emissions from coal-fired power plants.
Polycyclic aromatic hydrocarbons (PAHs)	Urban	Widespread extent throughout the Bay watershed. The severity was localized based on impairments for risk to aquatic organisms in a limited number of areas in the watershed. The primary sources are contaminated soils, road sealants, atmospheric deposition, and combustion.
Pesticides	Ag, Urban, Forestry?	Widespread extent of selected herbicides (primarily atrazine, simazine, metolachlor, and their degradation products) and localized extent for some chlorinated insecticides (aldrin, chlordane, dieldrin, DDT/DDE, heptachlor epoxide, mirex). The chlorinated insecticides have localized severity based on risk to aquatic organisms. For many pesticides that had widespread occurrence, water-quality standards were not available to determine impairments. Research shows sub-lethal effects for some compounds at environmentally relevant concentrations. Primary sources are applications on agricultural and urban lands and legacy residue in soils.
Petroleum hydrocarbons	Urban	Localized extent and severity (to aquatic organisms) in a limited number of areas in the watershed.
Dioxins and Furans		Localized extent and severity (to aquatic organisms) in a limited number of areas in the watershed. The primary sources are spills, contaminated soils, and atmospheric deposition.
Metals and Metalloids	Urban	Localized extent and severity (to aquatic organisms) of some metals (aluminum, chromium, iron, lead, manganese, zinc) in a limited number of areas in the watershed. The primary sources are spills, industrial processes, and atmospheric deposition.
Pharmaceuticals, Household and Personal Care Products, Flame Retardants, Biogenic Hormones	Urban, Septics	Information was not adequate to determine extent or severity. However, their use in the watershed suggests widespread extent is possible. Severity was not accessed but research shows sub-lethal effects to selected aquatic organisms for some compounds at environmentally relevant concentrations. Range of sources from wastewater treatment and septic tanks to animal feeding operations. Biogenic hormones assessment was focused on naturally occurring compounds from human or animals.

Tree Canopy

Goal:

Continually increase urban tree canopy capacity to provide air quality, water quality and habitat benefits throughout the watershed. Expand urban tree canopy by 2,400 acres by 2025.

In this Management Strategy, we use a broad definition of "urban" tree canopy that includes all sizes of communities. It is important to note that this goal is intended to reflect a *net gain* in acreage of tree canopy, after accounting for canopy losses due to various factors such as development, storms, pests/diseases, and natural mortality. Meeting the goal requires protecting as much of our existing tree canopy as possible and planting enough to both mitigate losses and expand the tree canopy cover by 2,400 acres.

Factors Influencing Success

There are a variety of social and environmental factors that influence the ability to meet Urban Tree Canopy goals. The equation in Figure 1 illustrates the basic components of achieving an urban tree canopy goal, demonstrating that success is not just a matter of how many trees are planted, but how new and existing trees grow and survive over time as a function of the protection and maintenance that is provided, as well as the canopy losses that occur through removals and mortality. Each element of this equation is influenced by various social and environmental factors, summarized in Figure 1 and Table 1.

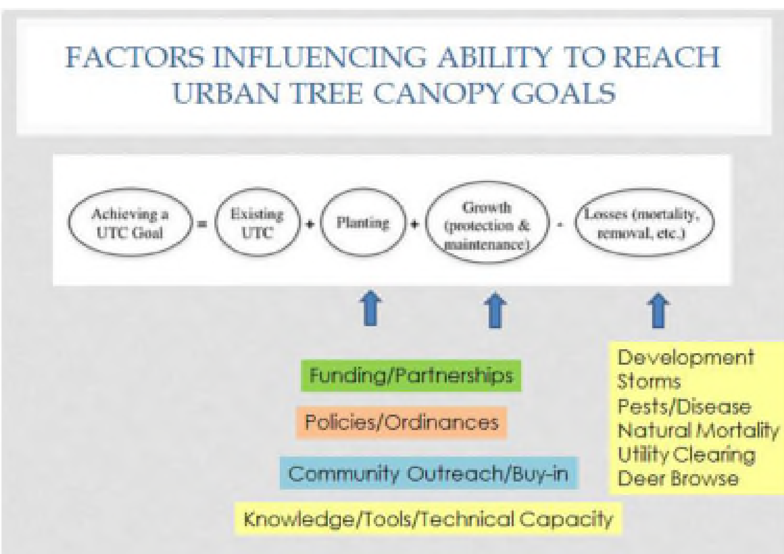

Figure 1. The Basic Components of Achieving an Urban Tree Canopy Goal

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Score	Score Narrative for Tree Canopy
5 Substantial Improvement	Directly restores or conserves tree canopy, or leads directly to establishment of policies, regulations, ordinances, or program priorities that will result in increased tree canopy.
4 Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3 Moderate Improvement	Likely to directly or indirectly restore or conserve tree canopy, or leads to establishment of policies, regulations, ordinances, or program priorities that will likely result in increased tree canopy.
2 Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1 Slight Improvement	May indirectly result in more tree canopy.
0 No Effect	Practice has no impact on tree canopy
-1 Slight Worsening	May indirectly result in less tree canopy.
- 2 Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
- 3 Moderate Worsening	Likely to directly or indirectly impact tree canopy (restoration or conservation), or leads to establishment of policies, regulations, ordinances, or program priorities that will likely result in decreased tree canopy.
- 4 Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
- 5 Substantial Worsening	Directly removes trees or hampers restoration or conservation of tree canopy.

Wetlands

Goal

Continually increase the capacity of wetlands to provide water quality and habitat benefits throughout the watershed. Create or reestablish 85,000 acres of tidal and nontidal wetlands and enhance the function of an additional 150,000 acres of degraded wetlands by 2025. These activities may occur in any land use (including urban) but primarily occur in agricultural or natural landscapes.

Factors Influencing Success

There are many social, political, and programmatic factors that influence the rate and success of implementing wetland restoration projects. Understanding the following factors will help conservation and agency partners to formulate key policy, technical, and socioeconomic solutions and to target restoration efforts where they provide the greatest benefit:

1. Funding must be dedicated for wetland restoration and enhancement implementation, and technical staff to manage these projects, if the Wetlands Outcome is to be met.
2. Landowner Willingness/Marketing and Outreach - Increasing and incentivizing landowner willingness is essential to the success of wetland restoration and enhancement.
3. Inaccurate and Incomplete Reporting - The Wetland Workgroup is not confident that all wetland restoration projects are being reported to the Chesapeake Bay Program and that some of the reported information may be inaccurately categorized.
4. Understanding of Importance of Restoration among Decision-Makers - Conflicting state priorities can impede restoration efforts. Wetland restoration needs to be elevated as a consistent priority to meet multiple environmental and societal problems such as water quality, reduced wildlife habitat, flood resiliency, and climate change. Decision-makers should emphasize the ecosystem services provided by these wetlands and the need to protect and restore wetlands to increase these services.
5. Technical Understanding among Restoration Practitioners - Funding does not always exist for technical training or for sufficient technical staff to deliver wetland restoration projects.
6. Climate Change – Changing weather patterns and storm intensity result in increased overland flow that must be absorbed by wetlands. One of the more significant impacts from climate change is wetlands loss due to sea level rise. Sea level rise threatens to inundate many coastal wetlands. Tidal wetland losses will be greater if no migration corridor exists due to development or other barriers.

Resulting Scoring Narrative

The complexity of factors require best professional judgement (BPJ) to discern the differences between some scores. For instance, multiple different combinations of practice effects could lead to judgments that a 4 is warranted instead of a 3 or 5.

Value	Score	Score Narrative for Wetlands
5	Substantial Improvement	Practice directly creates or re-establishes tidal or nontidal wetlands
4	Moderate to Substantial Improvement	Somewhere between 3 and 5 → BPJ
3	Moderate Improvement	Practice directly enhances both the water quality *and* habitat functions of wetlands
2	Slight to Moderate Improvement	Somewhere between 1 and 3 → BPJ
1	Slight Improvement	Practice directly prevents degradation through enhancing either the water quality or habitat functions of wetlands OR practice reduces sediment delivery to the wetland
0	No Effect	Practice has no impact on wetlands
-1	Slight Worsening	Practice directly degrades either the water quality or habitat functions of wetlands OR practice increases sedimentation of the wetland
-2	Slight to Moderate Worsening	Somewhere between -1 and -3 → BPJ
-3	Moderate Worsening	Practice directly degrades both the water quality *and* habitat functions of wetlands
-4	Moderate to Substantial Worsening	Somewhere between -3 and -5 → BPJ
-5	Substantial Worsening	Practice directly removes tidal or nontidal wetlands