

Rhode Island Wetland Functional Assessment Protocol

Landforms

Functional assessments will be used for analyzing functions and values of wetland effects such as with mitigation, restoration and enhancement planning.

Separate functional assessments apply to different landforms as listed below. Refer to the descriptions of the landforms to determine which model applies. If it is determined that your situation does not fit one of the landforms then contact the State Wildlife Biologist for further guidance and the possibility to use the "Other Wetland " functional assessment. For each functional assessment there is a corresponding Measurement Condition Index that assists you in rating each variable.

[Intermittent Stream \(Appendix A\)](#)
[Wooded Riverine \(Appendix B\)](#)

[Slope Wetlands \(Appendix C\)](#)
[Other Wetlands \(Appendix D\)](#)

Intermittent Stream

Wetlands that occur within low gradient, fine substrate riverine ecosystems that have intermittent or seasonal flow regimes within defined channels. These generally include the lower segments of first order streams and second order streams with the characteristic flow regime. These ecosystems typically convey surface water within a defined channel. In normal precipitation years, their flow regime is seasonal and typically occurs in the spring and summer. Surface flow will cease, usually in late summer or early fall. During years of above-normal precipitation, they may exhibit year-round flow. Conversely, these stream systems may be dry for extended periods during years of drought.

Functions being evaluated: Flood Attenuation, Wildlife Habitat

Variables used:

Hydrology Alterations

Sediment Deposition

Native Plant Composition

Buffer Continuity and Width

Topography of Floodplain

Floodplain Land Use

Wooded Riverine

Wetlands that occur within larger riverine ecosystems that have perennial flow regimes within defined channels. These include second order streams with the characteristic flow regime and points lower within the watershed. These ecosystems typically convey surface water within a defined channel with periodic out-of-bank flow during high rainfall events. Large wetlands within the floodplain may have similarities to other wetland classes (i.e. old "oxbows" may have playa wetland characteristics).

Functions being evaluated: Flood Attenuation, Wildlife Habitat

Variables used:

Hydrology Alterations	Topography of Floodplain
Sediment Deposition	Floodplain Land Use
Native Plant Composition	Vegetation Strata
Buffer Continuity and Width	

Slope Wetlands

Wetlands that are normally found where there is a surface discharge of groundwater on sloping land. Typically occurs at the upper end of small drainage courses or sidehill seeps along breaks associated with larger streams. A restrictive soil layer that has slow permeability restricts downward movement of water causing water to move laterally and discharge at the surface. Slope wetlands are typically not capable of depressional storage because of a lack of closed contours but may contain small basins which hold water for brief periods (less than 7 days) during precipitation events. Principal water sources are groundwater return flow and inter-flow from surrounding uplands, as well as precipitation. Climate ranges from semi-arid to subhumid. The slope wetland class has been defined by Brinson, et. al. (1993). After testing and revising the model, the reference domain for its application may be expanded.

Functions being evaluated: Water Quality, Wildlife Habitat

Variables used:

Hydrology Alterations	Buffer Continuity and Width
Sediment Deposition	Vegetation Density
Native Plant Composition	Source Area of Flow

Other Wetlands

If it is determined that your situation does not fit one of the other landforms then contact the State Wildlife Biologist for further guidance and the possibility to use the "Other Wetlands " functional assessment. (i.e. red maple dominated forested wetlands, wet meadows)

Intermittent Stream Functional Assessment

Date: _____	County: _____
Planner: _____	Location: _____
Landowner: _____	
Site Conditions: _____	

Proposed Action	Proposed Conditions (if any)

For each variable, use the coinciding measurement condition index sheet to arrive at a rating from 0-1.0 that most closely resembles the present or planned condition. **Then, take that number and multiply it by the weight factor and enter that value in the score column.**

Variables (Use Measurement Condition Index worksheet to answer this section. Answers will auto-fill from there)		Pre-Project	Post-Project	Project With Conditions
use for calculating Vhalt	Hs Stream Hydrology			
	Hw Wetland Hydrology			
Vhalt*	Hydrology Alterations			
Vsed	Sediment Deposition			
Vnplant	Native Plant Composition			
Vbuff	Buffer Continuity and Width			
Vtopo	Topography of Floodplain			
Vfuse	Floodplain Land Use			

*Vhalt = the square root of (Hs x Hw)

Flood Attenuation = $[4(Vhalt) + (Vsed + Vtopo)/2 + (Vbuff + Vfuse)/2]$ then divide by 6

Final Rating			

Wildlife Habitat = $[3(Vhalt) + Vnplant + (Vbuff + Vfuse)/2 + (Vsed + Vtopo)/2]$ then divide by 6

Final Rating			

Minimal Effect threshold is 0.10 (There must be less than a 0.10 decrease for BOTH Flood Attenuation and Wildlife Habitat from Pre-Project conditions)

Notes:

	Post-Project	With Conditions
Minimal Effect decision:	No Minimal Effect granted	No Minimal Effect granted

<i>Intermittent Stream Functional Assessment Measurement Condition Index</i>			
Hs: Stream Hydrology			
Definition: The presence of man-made, surface and/or subsurface alterations that are on the floodplain within or immediately adjacent to the stream segment/linear wetland. These alterations primarily impact the hydrology of the stream segment/linear wetland. Surface alterations may include channelization, dams, diversions, or dikes. Subsurface alterations may include tile drainage or ditches greater than two feet in depth. Flood plain alterations within 1/4 mile (1,320 feet) parallel to or upstream are considered significant to hydrology and must be considered.			
Assessment area: Stream reach and adjacent floodplain including alterations 1/4 mile above and below stream reach being assessed.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Flood plain has not been physically manipulated. No surface alterations (such as constructed channels, dams, dikes, diversions, dugouts, or fill) or subsurface alterations (such as tile drainage) present.		
0.75	A water impoundment structure is situated downstream from the stream segment/linear wetland such that wetland hydrology has been enhanced or degraded beyond what it would normally be. No structures are present parallel to or upstream that would affect hydrology or hydrology impacted $\leq 25\%$.		
0.5	One or more surface alterations (constructed channels, dams, dikes, diversions, dugouts, or fill) are present at a distance greater than 1/4 mile (1,320 feet) parallel to or upstream from the stream/linear wetland. Such alteration(s) partially divert (>25 - 50%) or retard the flow of surface water, particularly water from high flow events, away from the wetland. No subsurface alterations are present.		
0.25	One or more surface alterations (constructed channels, dams, dikes, diversions, dugouts, or fill) are present at a distance greater than 1/8 mile (660 feet) up to 1/4 mile (1,320 feet) parallel to or upstream from the stream/linear wetland. Such alteration(s) partially divert (>50 - 75%) or retard the flow of surface water, particularly water from high flow events, away from the wetland. No subsurface alterations are present.		
0.01	One or more surface alterations (constructed channels, dams, dikes, diversions, dugouts, or fill) are present within 1/8 mile (660 feet) parallel to or upstream from the stream/linear wetland. Such alteration(s) are designed to divert or retard >75% of the surface water flow, particularly water from high flow events, away from the wetland, AND/OR A subsurface drainage feature (such as drain tile) is adjacent and parallel to the wetland.		
0	Flood plain hydrology has been altered such that all surface and/or subsurface flow to the wetland has been eliminated. (Alterations include channelization and lining, or complete diversion or drainage of surface and/or subsurface water sources.)		

<i>Intermittent Stream Functional Assessment Measurement Condition Index</i>			
Hw: Wetland Hydrology			
Definition: The presence of man-made, surface and/or subsurface alterations that are within or adjacent to wetlands located on the floodplain but not within the flowing channel. These alterations primarily impact the hydrology of the wetland. Surface alterations may include shallow ditches, fill, or dams/dikes. Subsurface alterations may include tile drainage or ditches greater than two feet in depth.			
Assessment area: Wetlands located within adjacent floodplain. If there are no wetlands present in the assessment area then give this variable the same Condition Index Rating as Stream Hydrology.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Wetland has not been physically manipulated. No surface alterations (such as drainage ditches, dams, dikes, dugouts, or fill) or subsurface alterations (such as tile drainage) present.		
0.75	A surface alteration is present within the wetland as follows: (1) a drainage ditch with a bottom elevation at or above the hydric boundary; (2) a dam, dike, dugout, or any fill material affecting 25% or less of the wetland area, AND No subsurface alterations are present within the wetland.		
0.5	A surface alteration is present within the wetland as follows: (1) a drainage ditch with a bottom elevation at or below the hydric boundary but above the bottom of the wetland; (2) a dam, dike, dugout, or any fill material affecting 26% to 50% of the wetland area, AND No subsurface alterations are present within the wetland.		
0.25	A surface alteration (such as a dam, dike, dugout, or fill) is present within the wetland, and impacts from 51 to 75% of the wetland area.		
0.01	A surface alteration is present within the wetland as follows: (1) a drainage ditch with a bottom elevation at or below the bottom of the wetland, (2) a dam, dike, dugout, or any fill material affecting 76% to 99% of the wetland area; (3) a constructed channel in lieu of the natural watercourse, vegetated, AND/OR Subsurface alterations (such as drain tile) into and through wetland, with some saturation remaining as evidenced by the presence of remnant hydrophytes.		
0	Cultural alterations to the wetland are present such that all wetland hydrology has been eliminated. Alterations include channelization and lining, or complete diversion or drainage of surface and/or subsurface water sources.		

<i>Intermittent Stream Functional Assessment Measurement Condition Index</i>			
Used: Sediment Deposition			
Definition: The presence or absence of culturally accelerated (excessive) sedimentation within the channel (where applicable) and the floodplain wetland. Direct filling in the wetland does not count as sediment and is addressed under Hydrology Alterations. If fill is present, only evaluation that portion of the wetland that is intact. Assess possible sediment deposition near the edge of the wetland and toe of the adjacent slopes.			
Assessment area: Stream reach and adjacent floodplain wetlands.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	No visual evidence of culturally accelerated sedimentation within the wetland or stream channel. (Note: Wetlands within well-connected floodplains may receive significant amounts of "natural" sedimentation during specific flood event.)		
0.75	Evidence of sedimentation within less than half of the wetland area in the form of small rills, sediment fans or bars, or thin silt deposits on detritus.		
0.5	Evidence of sedimentation throughout most (50 to 75%) of the wetland, as evidenced by the presence of rills, sediment fans or bars, partial burial of detritus, or accumulations along plant stems. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. Tillage may be into or through buffer and into the outer edge of the wetland.		
0.25	Significant evidence of sedimentation throughout most (> 75%) of the wetland, as evidenced by the presence of rills, sediment fans or bars, partial to nearly complete burial of detritus, or burial of plant crowns and partial burial of stems. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. A buffer is typically absent. Tillage may occur throughout most (> 50%) of the wetland in most years.		
0.1	Significant evidence of sedimentation throughout the wetland, as evidenced by the presence of rills, sediment fans or bars, and nearly complete burial of detritus and plants. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. Conventional tillage is common, and ephemeral or perennial gullies may be present on uplands. Best management practices lacking to control erosion.		
0	Pronounced rise in bottom elevation of wetland due to sedimentation, resulting in the loss of wetland vegetation and/or hydrology. Wetland has been completely silted full.		

Intermittent Stream Functional Assessment Measurement Condition Index

Vnplant: Native Plant Composition	
Definition: The percentage of <u>appropriate</u> native wetland species (OBL, FACW, FAC) present in the stream reach and/or wetland, as indicated by the top five dominant species present on site, or by a more extensive species survey.	
Assessment area: Stream and adjacent floodplain wetlands	
Condition Index Rating	Pre-project
Condition Index Rating	Post-project
Condition Index Rating	Project w/ conditions
1.0	Native wetland species comprise 76 to 100 percent of the total vegetation present in the wetland.
0.75	Native wetland species comprise 51 to 75 percent of the total vegetation present in the wetland.
0.5	Native wetland species comprise 26 to 50 percent of the total vegetation present in the wetland.
0.25	Native wetland species comprise 11 to 25 percent of the total vegetation present in the wetland.
0.1	Native wetland species comprise 1 to 10 percent of the total vegetation present in the wetland; OR A single dominant plant species (native or non-native) comprise a monotypic invasive stand within the wetland (i.e. reed canarygrass, cattails, etc.).
0	Wetland is unvegetated. OR Wetland is completely dominated by non-wetland plants.

Vnbuff: Buffer Continuity and Width								
Definition: The two components for this variable include continuity and width of permanently vegetated buffer adjacent to the wetland. Buffer continuity and width are interrelated as shown by the table below. Continuity is the estimated percentage of the wetland perimeter which is bordered by permanent vegetated buffer. <u>When buffer width is >100 ft use 100 ft for the width at that point.</u> Width is the average of multiple points surrounding the wetland and should be estimated based only on those areas where a buffer of permanent vegetation is present. The starting point is at the normal high water mark or the top of the bank measured perpendicular outward. Aerial photos and field investigations can be used. The point on the table at which these figures intersect is the summary rating to use for these two components. Correlate the summary rating to the 0 to 1.0 index rating.								
Assessment area: Stream reach and immediately adjacent floodplain wetlands								
Condition Index Rating	Pre-project							
Condition Index Rating	Post-project							
Condition Index Rating	Project w/ conditions							
Summary Rating for Buffer Continuity and Width								
Width(ft)	Cont(%)	100	80-99	60-79	40-59	20-39	5-20	<5
	100	100	90	70	50	30	15	0
	75-99	80	75	60	40	25	10	0
	50-74	60	50	50	30	20	10	0
	25-49	40	30	30	20	15	5	0
	10-24	20	20	15	10	10	5	0
	5-9	10	10	10	5	5	1	0
	<5	0	0	0	0	0	0	0
1.0	Summary Rating of 80 - 100							
0.75	Summary Rating of 60 - 79							
0.5	Summary Rating of 40 - 59							
0.25	Summary Rating of 20 - 39							
0.1	Summary Rating of 1 - 19							
0	Summary rating is 0 OR No buffer of permanent vegetation is present.							

<i>Intermittent Stream Functional Assessment</i> Measurement Condition Index			
V_{topo}: Topography of Floodplain			
Definition: The topographic roughness of the floodplain, excluding the effects vegetation and other biotic factors have on that surface. Components are important in terms of velocity reduction of surface water flow and surface water storage.			
Assessment area: Area inundated by periodic out of bank flood events.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Natural conditions occur in the flood plain area as evidenced by irregular, uneven surfaces (undulating conditions from meander scars, sediment bars, or hummocks). No evidence of any manipulations that would result in a smooth surface (such as cut/fill activities, cultivation, etc.).		
0.75	Evidence of manipulations or activities in the flood plain area that have had a smoothing effect on the surface (such as cut and/or fill activities, cultivation, etc.), AND 1 to 25% of the flood plain area is affected; OR Excessive "hoof action" (trampling) by livestock has occurred throughout the flood plain, such that naturally-occurring features have been obscured.		
0.5	Evidence of manipulations or activities in the flood plain area that have had a smoothing effect on the surface (such as cut and/or fill activities, cultivation, etc.), AND 26 to 50% of the flood plain area is affected.		
0.25	Evidence of manipulations or activities in the flood plain area that have had a smoothing effect on the surface (such as cut and/or fill activities, cultivation, etc.), AND 51 to 75% of the flood plain area is affected.		
0.1	Evidence of manipulations or activities in the flood plain area that have had a smoothing effect on the surface (such as cut and/or fill activities, cultivation, etc.), AND 76 to 95% of the flood plain area is affected.		
0	Greater than 95% of the flood plain has been manipulated such that the surface is smooth and regular (as from fill and leveling for pavement, channel lining, etc.)		

<i>Intermittent Stream Functional Assessment Measurement Condition Index</i>			
Vfuse: Floodplain Land Use			
Definition: Rate the land use and condition of the majority of the topographic floodplain. Aerial photography and visual observations should be used to determine the dominant land use within the floodplain. Select the condition index rating that most closely matches the dominant land use type.			
Assessment area: Area inundated by periodic out of bank flood events.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Well managed, permanently vegetated native plant communities. Management allows for adequate plant recovery time between grazing periods.		
0.75	Permanent vegetation under a system of management such as: Native species under season-long grazing with moderate use; OR Idle non-native grassland; OR Permanent native or non-native hayland.		
0.5	Permanent native or non-native pasture which has been historically over-grazed, with some (<50%) bare ground and low plant vigor; OR No-till small grain; OR Minimum till small grain in a grass/legume rotation.		
0.25	Permanent native or non-native pasture which has been severely over-grazed, with significant (>50%) bare ground, low plant vigor, and evidence of soil erosion; OR No-till or minimum till row crop, continuous minimum till small grain.		
0.1	Conventional tillage small grain or row crop; OR Inputs/overflow from cultural activities (such as from industry and urbanization).		
0	Urban, semi-pervious, or impervious surface resulting in maximum overland flow and a high rate of delivery to the wetland.		

Wooded Riverine Functional Assessment

Date: _____	County: _____
Planner: _____	Location: _____
Landowner: _____	
Site Conditions: _____	

Proposed Action	Proposed Conditions (if any)

For each variable, use the coinciding measurement condition index sheet to arrive at a rating from 0-1.0 that most closely resembles the present or planned condition. **Then, take that number and multiply it by the weight factor and enter that value in the score column.**

Variables (Use Measurement Condition Index worksheet to answer this section. Answers will auto-fill from there)		Pre-Project	Post-Project	Project With Conditions
use for calculating Vhalt	Hr	River Hydrology		
	Hw	Wetland Hydrology		
Vhalt*	Hydrology Alterations			
Vsed	Sediment Deposition			
Vnplant	Native Plant Composition			
Vbuff	Buffer Continuity and Width			
Vtopo	Topography of Floodplain			
Vfuse	Floodplain Land Use			
Vstrata	Vegetative Strata			

*Vhalt = the square root of (Hr x Hw)

Flood Attenuation = $[4(Vhalt) + (Vsed + Vtopo)/2 + (Vbuff + Vfuse + Vstrat)/3]$ then divide by 6

Final Rating			

Wildlife Habitat = $[3(Vhalt) + Vnplant + (Vbuff + Vfuse + Vstrat)/3 + (Vsed + Vtopo)/2]$ then divide by 6

Final Rating			

Minimal Effect threshold is 0.10 (There must be less than a 0.10 decrease for BOTH Flood Attenuation and Wildlife Habitat from Pre-Project conditions)

Notes:

	Post-Project	With Conditions		
	Minimal Effect decision:	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">No Minimal Effect granted</td> <td style="width: 50%; text-align: center;">No Minimal Effect granted</td> </tr> </table>	No Minimal Effect granted	No Minimal Effect granted
No Minimal Effect granted	No Minimal Effect granted			

Wooded Riverine Functional Assessment Measurement Condition Index			
Hr: River Hydrology			
Definition: The presence of man-made, surface and/or subsurface alterations that are on the floodplain within or immediately adjacent to the river segment/linear wetland. These alterations primarily impact the hydrology of the river segment/linear wetland. Surface alterations may include channelization, armored banks, dams/dikes, levees, and severely degraded channels. Subsurface alterations are not common but may include large tile drainage systems. Flood plain alterations within 1/4 mile (1,320 feet) parallel to or upstream are considered significant to hydrology and must be considered.			
Assessment area: Stream reach and adjacent floodplain including alterations 1/4 mile above and below stream reach being assessed.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Flood plain has not been physically manipulated. No surface alterations (such as constructed channels, armored banks, dams, dikes, levees, diversions, dugouts, fill, or degraded channels) or subsurface alterations (such as tile drainage) present. Out of bank flow frequency averages at least once every 2 years to connect river to floodplain.		
0.75	A water impoundment structure is situated downstream from the stream segment/linear wetland such that wetland hydrology has been enhanced or degraded beyond what it would normally be. No structures are present parallel to or upstream that would affect hydrology or hydrology impacted $\leq 25\%$. Any bank armor material is installed using bio-engineering techniques and is confined to a specific point on the river bank.		
0.5	One or more surface alterations (see list in 1.0 rating above) are present at a distance greater than 1/4 mile (1,320 feet) parallel to or upstream from the stream/linear wetland. Such alteration(s) partially divert ($>25 - 50\%$) or retard the flow of surface water, particularly water from high flow events, away from the wetland. No subsurface alterations are present. Out of bank flow frequency occurs once every 3 to 10 years on average.		
0.25	One or more surface alterations (see list in 1.0 rating above) are present at a distance greater than 1/8 mile (660 feet) up to 1/4 mile (1,320 feet) parallel to or upstream from the stream/linear wetland. Such alteration(s) partially divert ($>50 - 75\%$) or retard the flow of surface water, particularly water from high flow events, away from the wetland. No subsurface alterations are present. Bank armor (if present) consists primarily of rock or metal and is confined to a specific point on the river bank. Out of bank flow frequency occurs once every 11 to 25 years on average.		
0.01	One or more surface alterations (see list in 1.0 rating above) are present within 1/8 mile (660 feet) parallel to or upstream from the stream/linear wetland. Such alteration(s) are designed to divert or retard $>75\%$ of the surface water flow, particularly water from high flow events, away from the wetland. Bank armor (if present) consists primarily of rock or metal and used across a majority of the reach within the assessment area. Out of bank flow frequency occurs once every 26 or more years. AND/OR A subsurface drainage feature is used to contain the flow of the river for a distance greater than 100 feet.		
0	Flood plain hydrology has been altered such that all surface and/or subsurface flow to the wetland has been eliminated. (Alterations include channelization and lining, or complete diversion or drainage of surface and/or subsurface water sources.)		

Wooded Riverine Functional Assessment Measurement Condition Index			
Hw: Wetland Hydrology			
Definition: The presence of man-made, surface and/or subsurface alterations that are within or adjacent to wetlands located on the floodplain but not within the flowing channel. These alterations primarily impact the hydrology of the wetland. Surface alterations may include shallow ditches, fill, or dams/dikes. Subsurface alterations may include tile drainage or ditches greater than two feet in depth.			
Assessment area: Wetlands located within adjacent floodplain. If there are no wetlands present in the assessment area then give this variable the same Condition Index Rating as River Hydrology.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Wetland has not been physically manipulated. No surface alterations (such as drainage ditches, dams, dikes, dugouts, or fill) or subsurface alterations (such as tile drainage) present.		
0.75	A surface alteration is present within the wetland as follows: (1) a drainage ditch with a bottom elevation at or above the hydric boundary; (2) a dam, dike, dugout, or any fill material affecting 25% or less of the wetland area, AND No subsurface alterations are present within the wetland.		
0.5	A surface alteration is present within the wetland as follows: (1) a drainage ditch with a bottom elevation at or below the hydric boundary but above the bottom of the wetland; (2) a dam, dike, dugout, or any fill material affecting 26% to 50% of the wetland area, AND No subsurface alterations are present within the wetland.		
0.25	A surface alteration (such as a dam, dike, dugout, or fill) is present within the wetland, and impacts from 51 to 75% of the wetland area.		
0.01	A surface alteration is present within the wetland as follows: (1) a drainage ditch with a bottom elevation at or below the bottom of the wetland, (2) a dam, dike, dugout, or any fill material affecting 76% to 99% of the wetland area; (3) a constructed channel in lieu of the natural watercourse, vegetated, AND/OR Subsurface alterations (such as drain tile) into and through wetland, with some saturation remaining as evidenced by the presence of remnant hydrophytes.		
0	Cultural alterations to the wetland are present such that all wetland hydrology has been eliminated. Alterations include channelization and lining, or complete diversion or drainage of surface and/or subsurface water sources.		

Wooded Riverine Functional Assessment Measurement Condition Index			
Used: Sediment Deposition			
Definition: The presence or absence of culturally accelerated (excessive) sedimentation within the channel (where applicable) and the floodplain wetland. Direct filling in the wetland does not count as sediment and is addressed under Hydrology Alterations. If fill is present, only evaluation that portion of the wetland that is intact. Assess possible sediment deposition near the edge of the wetland and toe of the adjacent slopes.			
Assessment area: River reach and adjacent floodplain wetlands.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	No visual evidence of culturally accelerated sedimentation within the wetland or stream channel. (Note: Wetlands within well-connected floodplains may receive significant amounts of "natural" sedimentation during specific flood event.)		
0.75	Evidence of sedimentation within less than half of the wetland area in the form of small rills, sediment fans or bars, or thin silt deposits on detritus.		
0.5	Evidence of sedimentation throughout most (50 to 75%) of the wetland, as evidenced by the presence of rills, sediment fans or bars, partial burial of detritus, or accumulations along plant stems. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. Tillage may be into or through buffer and into the outer edge of the wetland.		
0.25	Significant evidence of sedimentation throughout most (> 75%) of the wetland, as evidenced by the presence of rills, sediment fans or bars, partial to nearly complete burial of detritus, or burial of plant crowns and partial burial of stems. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. A buffer is typically absent. Tillage may occur throughout most (> 50%) of the wetland in most years.		
0.1	Significant evidence of sedimentation throughout the wetland, as evidenced by the presence of rills, sediment fans or bars, and nearly complete burial of detritus and plants. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. Conventional tillage is common, and ephemeral or perennial gullies may be present on uplands. Best management practices lacking to control erosion.		
0	Pronounced rise in bottom elevation of wetland due to sedimentation, resulting in the loss of wetland vegetation and/or hydrology. Wetland has been completely silted full.		

Wooded Riverine Functional Assessment Measurement Condition Index

Vnplant: Native Plant Composition			
Definition: The percentage of <u>appropriate</u> native wetland species (OBL, FACW, FAC) present in the river reach and/or wetland, as indicated by the top five dominant species present on the site, or by a more extensive species survey.			
Assessment area: River reach and adjacent floodplain wetlands			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Native wetland species comprise 76 to 100 percent of the total vegetation present in the wetland.		
0.75	Native wetland species comprise 51 to 75 percent of the total vegetation present in the wetland.		
0.5	Native wetland species comprise 26 to 50 percent of the total vegetation present in the wetland.		
0.25	Native wetland species comprise 11 to 25 percent of the total vegetation present in the wetland.		
0.1	Native wetland species comprise 1 to 10 percent of the total vegetation present in the wetland; OR A single dominant plant species (native or non-native) comprise a monotypic invasive stand within the wetland (i.e. reed canarygrass, cattails, etc.).		
0	Wetland is unvegetated. OR Wetland is completely dominated by non-wetland plants.		

Vnbuff: Buffer Continuity and Width								
Definition: The two components for this variable include continuity and width of permanently vegetated buffer adjacent to the wetland. Buffer continuity and width are interrelated as shown by the table below. Continuity is the estimated percentage of the wetland perimeter which is bordered by permanent vegetated buffer. <u>When buffer width is >100 ft use 100 ft for the width at that point.</u> Width is the average of multiple points surrounding the wetland and should be estimated based only on those areas where a buffer of permanent vegetation is present. The starting point is at the normal high water mark or the top of the bank measured perpendicular outward. Aerial photos and field investigations can be used. The point on the table at which these figures intersect is the summary rating to use for these two components. Correlate the summary rating to the 0 to 1.0 index rating.								
Assessment area: River reach and immediately adjacent floodplain wetlands								
Condition Index Rating	Pre-project	Post-project	Project w/ conditions					
Summary Rating for Buffer Continuity and Width								
	Cont(%)	100	80-99	60-79	40-59	20-39	5-20	<5
Width(ft)	≥100	100	90	70	50	30	15	0
	75-99	80	75	60	40	25	10	0
	50-74	60	50	50	30	20	10	0
	25-49	40	30	30	20	15	5	0
	10-24	20	20	15	10	10	5	0
	5-9	10	10	10	5	5	1	0
	<5	0	0	0	0	0	0	0
1.0	Summary Rating of 80 - 100							
0.75	Summary Rating of 60 - 79							
0.5	Summary Rating of 40 - 59							
0.25	Summary Rating of 20 - 39							
0.1	Summary Rating of 1 - 19							
0	Summary rating is 0 OR No buffer of permanent vegetation is present.							

Wooded Riverine Functional Assessment Measurement Condition Index			
V_{topo}: Topography of Floodplain			
Definition: The topographic roughness of the flood plain, excluding the effects vegetation and other biotic factors have on that surface. Components are important in terms of velocity reduction of surface water flow and surface water storage.			
Assessment area: Area inundated by periodic out of bank flood events.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Natural conditions occur in the flood plain area as evidenced by irregular, uneven surfaces (undulating conditions from meander scars, sediment bars, or hummocks). No evidence of any manipulations that would result in a smooth surface (such as cut/fill activities, cultivation, etc.).		
0.75	Evidence of manipulations or activities in the flood plain area that have had a smoothing effect on the surface (such as cut and/or fill activities, cultivation, etc.), AND 1 to 25% of the flood plain area is affected; OR Excessive “hoof action” (trampling) by livestock has occurred throughout the flood plain, such that naturally-occurring features have been obscured.		
0.5	Evidence of manipulations or activities in the flood plain area that have had a smoothing effect on the surface (such as cut and/or fill activities, cultivation, etc.), AND 26 to 50% of the flood plain area is affected.		
0.25	Evidence of manipulations or activities in the flood plain area that have had a smoothing effect on the surface (such as cut and/or fill activities, cultivation, etc.), AND 51 to 75% of the flood plain area is affected.		
0.1	Evidence of manipulations or activities in the flood plain area that have had a smoothing effect on the surface (such as cut and/or fill activities, cultivation, etc.), AND 76 to 95% of the flood plain area is affected.		
0	Greater than 95% of the flood plain has been manipulated such that the surface is smooth and regular (as from fill and leveling for pavement, channel lining, etc.)		

Wooded Riverine Functional Assessment Measurement Condition Index			
Vfuse: Floodplain Land Use			
Definition: Rate the land use and condition of the majority of the topographic floodplain (excluding the river segment; adjacent wetlands; and associated buffers for each). Aerial photography and visual observations should be used to determine the dominant land use within the floodplain. Select the condition index rating that most closely matches the dominant land use type.			
Assessment area: Area inundated by periodic out of bank flood events.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Well managed, permanently vegetated native plant communities. Management allows for adequate plant recovery time between grazing periods.		
0.75	Permanent vegetation under a system of management such as: Native species under season-long grazing with moderate use; OR Idle non-native grassland; OR Permanent native or non-native hayland.		
0.5	Permanent native or non-native pasture which has been historically over-grazed, with some (<50%) bare ground and low plant vigor; OR No-till small grain; OR Minimum till small grain in a grass/legume rotation.		
0.25	Permanent native or non-native pasture which has been severely over-grazed, with significant (>50%) bare ground, low plant vigor, and evidence of soil erosion; OR No-till or minimum till row crop, continuous minimum till small grain.		
0.1	Conventional tillage small grain or row crop; OR Inputs/overflow from cultural activities (such as from industry and urbanization).		
0	Urban, semi-pervious, or impervious surface resulting in maximum overland flow and a high rate of delivery to the wetland.		

Wooded Riverine Functional Assessment Measurement Condition Index

Vstrat: Vegetative Strata

Definition: The rating is based on the number of vegetative strata present that are appropriate for the site and the percentage of the assessment area (buffer and topographic floodplain) occupied by those strata. If different conditions exist on different parts of the assessment area, assess the dominant cover type within the buffer zone.

Assessment area: Area inundated by periodic out of bank flood events.

Strata

Rivers and adjacent wetlands may contain from one to three vegetative strata, depending upon river hydrology, position/location of the wetland within the hydrologic unit, and geographical region of the state. These strata, for purposes of simplicity, are defined as follows:

1. Herbaceous layer -- the layer consisting of grasses, sedges, forbs, etc.
2. Shrub layer -- the layer consisting of shrubs such as chokecherry, rough-leaved dogwood, false indigo, etc.
3. Tree layer -- the layer consisting of mature trees such as willows, cottonwoods, etc.

Vegetative stratification and composition within riverine ecosystems is more complex than this variable will address. The following guidelines can be used to determine the number of strata that should be present under natural conditions in a given floodplain at a given position in the hydrologic unit. Comparison to a reference standard site in the surrounding proximity is the preferred approach. The attached map showing riparian buffer vegetation recommendations also provides general information on the suitability of trees to different regions of the state.

<u>Stream Order</u>	<u>No. Strata</u>	<u>Vegetative Type</u>
1st Order and Upper 20% of 2nd	1	Herb
Mid 20% to 50% of 2nd Order	2	Herb/Shrub
Lower 50% of 2nd Order and beyond	3	Herb/Shrub/Tree

Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	All appropriate strata are present on 50% or more of the floodplain within the assessment area.		
0.75	All appropriate strata are present only within the buffer zone for the river edge and adjacent wetlands. OR One appropriate strata is missing but 50% or more of the floodplain contains permanent vegetation.		
0.5	One appropriate strata is missing and only the buffer zone contains permanent vegetation. OR More than one appropriate strata is missing but 50% or more of the floodplain contains permanent vegetation.		
0.25	More than one appropriate strata is missing and only the buffer zone contains permanent vegetation.		
0.1	Permanent vegetation is present in small portions of the floodplain (substantially less than 50%). OR Only small portions of the buffer zone contains permanent vegetation and/or buffers do not meet minimum required widths (filter strip - 20 feet; riparian forest buffer - 35 feet).		
0	Any permanent vegetation that is present consists of less than 1% of the assessment area.		

Slope Wetlands Functional Assessment

Date: _____	County: _____
Planner: _____	Location: _____
Landowner: _____	
Site Conditions: _____	

Proposed Action	Proposed Conditions (if any)

For each variable, use the coinciding measurement condition index sheet to arrive at a rating from 0-1.0 that most closely resembles the present or planned condition. **Then, take that number and multiply it by the weight factor and enter that value in the score column.**

Variables (Use Measurement Condition Index worksheet to answer this section. Answers will auto-fill from there)		Pre-Project	Post-Project	Project With Conditions
Vhalt	Hydrology Alterations			
Vsed	Sedimentation Deposition			
Vnplant	Native Plant Composition			
Vbuff	Buffer Continuity and Width			
Vdens	Vegetation Density			
Vsour	Source Area of Flow			

Water Quality = $[3(Vhalt) + Vdens + Vbuff + (Vsed + Vsour)/2]$ then divide by 6

Final Rating			

Wildlife Habitat = $[3(Vhalt) + Vdens + Vnplant + Vbuff]$ then divide by 6

Final Rating			

Minimal Effect threshold is 0.10 (There must be less than a 0.10 decrease for BOTH Flood Attenuation and Wildlife Habitat from Pre-Project conditions)

Notes:

		Post-Project	With Conditions
Minimal Effect decision:	No Minimal Effect granted	No Minimal Effect granted	No Minimal Effect granted

Slope Wetlands Functional Assessment Measurement Condition Index

Vhalt: Hydrology Alterations			
Definition: The presence of a constructed surface or subsurface drainage feature or fill within the wetland.			
Surface: The depth of the surface drain and/or depth of fill within the wetland impacts wetland ground water surface elevation and movement of surface water through the wetland.			
OR			
Subsurface: The impact of the subsurface drain on the wetland is determined by its relative elevation and distance from the wetland (lateral effects). Subsurface drains outside of the influence of the wetland but within the watershed are considered under the Source Area of Flow variable			
Assessment area: Wetland and area of lateral effects			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	No surface drains or fill present. OR No subsurface drain present. -OR- If there is a nearby subsurface drainage feature (outside of the wetland), the distance to such feature is equal to or greater than that identified as the lateral effect in the approved county lateral effect table for the soil type.		
0.75	Fill exists within the wetland but affects less than 10 percent of the wetland. -OR- A dugout or dam exists within the wetland but affects less than 10 percent of the wetland area. -OR- A shallow grassed waterway exists and follows the natural meandering flow path. OR The distance to a nearby subsurface drainage feature is less than the lateral effect distance identified, with an estimated corresponding impact to the wetland size and/or width of less than or equal to 25 percent. -OR- Development of the assessment area for livestock water (spring development) is planned.		
0.5	A narrow surface drain or gully exists within the wetland, but is less than 1 foot in depth. -OR- Fill exists within the wetland and affects more than 10 percent, but less than 50 percent, of the wetland. OR The distance to a nearby subsurface drainage feature is less than the lateral effect distance identified, with an estimated corresponding impact to the wetland size and/or width of greater than 25 to less than or equal to 50 percent.		
0.25	A surface drain or gully exists within the wetland, and is between 1 and 2 feet in depth. -OR- The natural meandering flow path has been straightened, and out of bank flow will occur for a 10 year, 24 hour storm. -OR- Fill or an excavation (pit) exists within the wetland and affects 50 percent or more of the wetland area. OR The distance to a nearby subsurface drainage feature is less than the lateral effect distance identified, with an estimated corresponding impact to the wetland size and/or width of greater than 50 to less than or equal to 75 percent.		
0.01	A surface drain exists within the wetland that is greater than 2 feet in depth. -OR- The natural meandering flow path has been straightened, and out of bank flow will NOT occur for a 10 year, 24 hour storm. OR Subsurface drainage feature is located within the wetland or close enough to impact the wetland size and/or width greater than 75 percent. Saturated conditions have been severely impacted but still occur seasonally.		
0	Armored or lined channel, saturated conditions completely non-existent, or wetland completely filled. -OR- Saturated conditions non-existent (completely drained). OR Fill exists within the wetland and affects 90 percent or more of the wetland area.		

<i>Slope Wetlands Functional Assessment</i> Measurement Condition Index			
Used: Sediment Deposition			
Definition: The presence or absence of culturally accelerated (excessive) sedimentation within the wetland. Direct filling in the wetland does not count as sediment and is addressed under Hydrology Alterations. If fill is present, only evaluation that portion of the wetland that is intact.			
Assessment area: Wetland and toe of the adjacent slopes.			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	No visual evidence of culturally accelerated sedimentation within the wetland.		
0.75	Evidence of sedimentation within less than half of the wetland area in the form of small rills, sediment fans or bars, or thin silt deposits on detritus, AND/OR Sediment thickness is < 3 inches.		
0.5	Evidence of sedimentation throughout most (50 to 75%) of the wetland, as evidenced by the presence of rills, sediment fans or bars, partial burial of detritus, or accumulations along plant stems, AND/OR Sediment thickness is 3 to < 6 inches. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. Tillage has been into or through buffer and into the outer edge of the wetland.		
0.25	Significant evidence of sedimentation throughout most (> 75%) of the wetland, as evidenced by the presence of rills, sediment fans or bars, partial to nearly complete burial of detritus, or burial of plant crowns and partial burial of stems, AND/OR Sediment thickness is 6 to < 9 inches. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. A buffer is typically absent. Tillage has occurred throughout most (> 50%) of the wetland in most years		
0.1	Significant evidence of sedimentation throughout the wetland, as evidenced by the presence of rills, sediment fans or bars, and nearly complete burial of detritus and plants, AND/OR Sediment thickness is 9 to 12 inches. Indicator: Dominant land use adjacent to the wetland, or within the watershed area, is cropland. Conventional tillage is common, and ephemeral or perennial gullies may be present on uplands. Best management practices lacking to control erosion.		
0	Pronounced rise in bottom elevation of wetland due to sedimentation, resulting in the loss of wetland vegetation and/or hydrology. Typical thickness of sediment is > 12 inches; OR Wetland has been completely filled (such as in or around urban areas).		

Slope Wetlands Functional Assessment Measurement Condition Index

Vnplant: Native Plant Composition			
<p>Definition: The percentage of <u>appropriate</u> native wetland species (OBL, FACW, FAC) present in the river reach and/or wetland, as indicated by the top five dominant species present on the site, or by a more extensive species survey.</p> <p>Assessment area: Wetland</p>			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Native wetland species comprise 76 to 100 percent of the total vegetation present in the wetland.		
0.75	Native wetland species comprise 51 to 75 percent of the total vegetation present in the wetland.		
0.5	Native wetland species comprise 26 to 50 percent of the total vegetation present in the wetland.		
0.25	Native wetland species comprise 11 to 25 percent of the total vegetation present in the wetland.		
0.1	Native wetland species comprise 1 to 10 percent of the total vegetation present in the wetland; OR A single dominant plant species (native or non-native) comprise a monotypic invasive stand within the wetland (i.e. reed canarygrass, cattails, etc.).		
0	Wetland is unvegetated. OR Wetland is completely dominated by non-wetland plants.		

Vnbuff: Buffer Continuity and Width								
<p>Definition: The two components for this variable include continuity and width of permanently vegetated buffer adjacent to the wetland. Buffer continuity and width are interrelated as shown by the table below. Continuity is the estimated percentage of the wetland perimeter which is bordered by permanent vegetated buffer. <u>When buffer width is >100 ft use 100 ft for the width at that point.</u> Width is the average of multiple points surrounding the wetland and should be estimated based only on those areas where a buffer of permanent vegetation is present. The starting point is at the normal high water mark or the top of the bank measured perpendicular outward. Aerial photos and field investigations can be used. The point on the table at which these figures intersect is the summary rating to use for these two components. Correlate the summary rating to the 0 to 1.0 index rating.</p> <p>Assessment area: Buffer zone adjacent to wetland</p>								
Condition Index Rating	Pre-project	Post-project	Project w/ conditions					
Summary Rating for Buffer Continuity and Width								
	Cont(%)	100	80-99	60-79	40-59	20-39	5-20	<5
Width (ft)	≥100	100	90	70	50	30	15	0
	75-99	80	75	60	40	25	10	0
	50-74	60	50	50	30	20	10	0
	25-49	40	30	30	20	15	5	0
	10-24	20	20	15	10	10	5	0
	5-9	10	10	10	5	5	1	0
	<5	0	0	0	0	0	0	0
1.0	Summary Rating of 80 - 100							
0.75	Summary Rating of 60 - 79							
0.5	Summary Rating of 40 - 59							
0.25	Summary Rating of 20 - 39							
0.1	Summary Rating of 1 - 19							
0	Summary rating is 0 OR No buffer of permanent vegetation is present.							

Slope Wetlands Functional Assessment Measurement Condition Index

Vdens: Vegetation Density			
Definition: The abundance of actively growing plants throughout the wetland - (not including annually planted agricultural crops). If different conditions exist on different parts of the wetland, estimate a value with consideration for the amount of area at each condition index.			
Assessment area: Wetland			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	Canopy cover is >80 to 125 percent. -AND- Wetland is intact (either undisturbed or has not been tilled or otherwise disturbed for 20 years or more).		
0.75	Canopy cover is >60 to 80 percent, or >125 percent, -AND- Wetland is intact (either undisturbed or has not been tilled or otherwise disturbed for 20 years or more).		
0.5	Canopy cover is >40 to 60 percent. -OR- Wetland is tilled infrequently (20% or less of all years).		
0.25	Canopy cover is >20 to 40 percent. -OR- Wetland is tilled occasionally (>20% to <60% of all years). Hydrophytic vegetation normally returns to the site during wet periods when tillage is impossible		
0.1	Canopy cover is 1 to 20 percent. -OR- Wetland is tilled most years (60% or more of all years). Growing hydrophytic vegetation may return to the site during wet periods when tillage is impossible		
0	Plants absent, no canopy cover (site is more disturbed than described above).		

Vsour: Source Area of Flow			
Definition: The physical alterations that exist within the area surrounding the wetland that defines the watershed source area.			
Assessment area: Watershed			
Condition Index Rating	Pre-project	Post-project	Project w/ conditions
1.0	No surface or subsurface alterations within the wetland watershed source area. (This includes surface alterations such as dams, terraces, and roads; subsurface alterations such as tile drains and ditches; and additional inputs such as irrigation and terrace outlets.)		
0.75	Surface alterations occur within the watershed source area which impact overland flow into wetland (such as terraces or road right-of-ways with culverts allowing passage of water). Less than 20 percent of watershed area is impacted. AND No subsurface alterations or additions (identified in 5 above) are present. -OR- Center pivot irrigation is used within the wetland watershed source area.		
0.5	Surface alterations occur within the watershed source area which impact overland flow into wetland (such as terraces or road right-of-ways which partially divert the flow of water to the wetland). Greater than 20 up to to 50 percent of watershed area is impacted. AND No subsurface alterations or additions (identified in 5 above) are present.		
0.25	The dominant surface and subsurface flow path of water in the watershed source area has been altered to affect the flow of water to the wetland (such as by tiling, terraces, or surface irrigation return). Greater than 50 to 95 percent of the watershed area is impacted. AND The alteration(s) does not change the wetland subclass.		
0.1	The dominant surface and subsurface flow path of water in the watershed source area has been altered to affect the flow of water to the wetland (such as by tiling, terraces, or surface irrigation return). Greater than 50 to 95 percent of the watershed area is impacted. AND The alteration(s) changes the wetland subclass.		
0	Upland watershed source area extremely altered such that 95% or more of all water flow to wetland has been eliminated (such as from urbanization).		

<i>Other Wetlands Functional Assessment</i>	
Date: _____	County: _____
Planner: _____	Location: _____
Landowner: _____	
Site Conditions: _____	
Proposed Action	Proposed Conditions (if any)

FUNCTIONAL ASSESSMENT WORKSHEET			
FUNCTION	EXISTING FUNCTIONAL LEVEL ²	FUNCTIONAL EFFECTS ¹	
		Alteration as described above	Alteration with conditions described above
HYDROLOGICAL FUNCTIONS			
1. Surface water storage			
(a) Up to 7 days			
(b) More than 7 days			
2. Velocity reduction			
3. Ground water recharge			
4. Ground water discharge			
INORGANIC AND ORGANIC CYCLING FUNCTIONS			
1. Mineral recycling Process			
2. Remove dissolved elements and compounds			
3. Particulate retention (sediment and organic material)			
4. Export of Organic Carbon			
5. Organic carbon storage (soils w/ 8" or more OM only)			
PLANT AND ANIMAL FUNCTIONS			
1. Maintain typical plant species of the native community			
2. Maintain typical layers of the natural plant community			
3. Maintain typical accumulation of decomposing plant and animal matter			
4. Maintain typical abundance of animals (vertebrates and invertebrates)			
5. Maintain habitat quality, interspersions, travel corridors, etc.			

FUNCTION	EXISTING FUNCTIONAL LEVEL ²	FUNCTIONAL EFFECTS ¹	
		Alteration as described above	Alteration with conditions described above
Number of Functions Existing			
Number of Existing Functions Reduced or Eliminated			
Percent of Existing Functions Reduced or Eliminated			

¹ (0) - No Effect; (-) - Reduced; (+) - Improved; (E) - Eliminated. Consider direct and indirect impacts

² (NA) - not applicable; (E) - exceptional; (H) - high; (M) - medium; (L) – low

Minimal effect decision (check "√" the appropriate description and decision):	
<input type="checkbox"/>	A. One or more existing, identified functions are rated exceptional and that function will be reduced or eliminated. The effect is NOT MINIMAL and does not qualify for a minimal effect exemption. MITIGATION WILL BE VERY DIFFICULT TO ACHIEVE.
<input type="checkbox"/>	B. One or more existing, identified functions that are rated medium or high will be eliminated by the proposed action. The effect is NOT MINIMAL and does not qualify for a minimal effect exemption. Mitigation <u>may</u> be possible.
<input type="checkbox"/>	C. No exceptional functions will be reduced or eliminated. No medium or high functions will be eliminated. Greater than 25% of the total number of existing functions will be reduced (or eliminated if a low function). The effect is NOT MINIMAL and does not qualify for a minimal effect exemption. Mitigation <u>may</u> be possible.
<input type="checkbox"/>	D. No exceptional functions will be reduced or eliminated. No medium or high functions will be eliminated. Less than 25% of the total number of existing functions will be reduced (or eliminated if a low function) then the effect is MINIMAL . Proceed with Step 7.
<input type="checkbox"/>	E. All existing, identified functions are rated low. The effect is MINIMAL . (This situation will be very rare) Proceed with Step 7.

Notes: