Riverine Herbaceous/Shrub HGM Interim
(FCI formulas)

Temporary Storage & Detention of Storage Water:

$$[\{V_{dur} \times V_{freq}\}^{1/2} \times \{V_{topo} + \{V_{herb} + V_{mid}/2\}/2]^{1/2}$$

Maintain Plant and Animal Community:

$$\{V_{mid} + V_{herb} + V_{connect}\}/3$$

Removal & Sequestrian of Elements & Compounds:

$$[[V_{wood} + V_{freq} + V_{dur} + [\{V_{topo} + V_{herb} + V_{mid}\}/3] + [\{V_{detritus} + V_{redox} + V_{sorpt}\}/3]]/5$$

V_{dur}

V_{freq}

V_{topo}

V_{wood}

V_{mid}

V_{herb}

$V_{connect}$

$V_{detritus}$

V_{redox}

V_{sorpt}

* The Riverine model is designed to be used to produce an assessment of the potential function of wetlands that share a surface hydrologic connection (at least periodically during anticipated high flows) with a riverine system {i.e. it is limited to wetlands located in the floodplain and/or floodway}. This model is to be used for a rapid non-controversial estimate of the potential impacts to herbaceous riparian wetlands and to see if the proposed mitigation will adequately address the wetland functions that are being impacted.

Riverine Herbaceous/Shrub HGM Interim

The techniques used to determine which functional capacity index (FCI) will be used for each variable rare typically based on standard techniques described in detail in the 1987 Corps Wetland Delineation Manual, the NRCS 3rd Edition to the National Food Security Act Manual (NFSAM) and/or the "A Regional Guidebook for Application of Hydrogeomorphic Assessments to Riverine Low Gradient Wetlands (Ainslie et al. 1997). These sources will hereafter be referred to as the 87 WDM, NFSAM, and the Kentucky Riverine Guidebook, respectively.

Documentation should be made for each variable as to which method, indicator, plot size was used for each variable.   The number of sample plots is related to the variability of the site. Significantly different timber age classes or species types should be sampled separately. One of two sample plots might be sufficiently in a small uniform site, whereas, numerous sample plots would be required for a large diverse site. The following is a general definition and guidance on the methodology for each variable.

V_{dur}: **Duration of Flooding:** Indicators as described in the Wetland Hydrology Section of the 87 WDM (paragraphs 46-49) will be utilized to estimate duration of flooding. NOTE: unlike the criteria for hydrology for wetland delineation, growing season is not a factor in the variable. Those indicators associated with saturation should not be used.

V_{freq}: **Frequency of Flooding:** Indicators as described in the Wetland Hydrology Section of the 87 WDM (paragraphs 46-49) will be utilized to estimate frequency of flooding. Utilization of the county soil survey is a particularly good tool. NOTE: unlike the criteria for hydrology for wetland delineation, growing season is not a factor in the variable.

V_{topo}: **Topography:** To determine percent for these criteria, visual estimate will be conducted. Those areas with significant topographic features will be shown on a reference map, briefly described (i.e ridge/slough, mounds, undulations, channels/burn, etc.) and measured to determine acreage. Percent of site containing topographic features can then be determined.

V_{wood}: **Woody vegetation:** Percentage of the WAA that is covered by woody vegetation will be determined by the use of recent aerial photography. Field verification is needed to ensure land use changes have not occurred. Size and density of woody vegetation impedes water flow. For example; a few large trees in a pasture would NOT constitute "covered with woody vegetations" nor would 1 year old seedlings. It should also be noted that an area clear cut with stumps, sprouts and shrubs removed would NOT constituted "woody vegetation" and the functions should be assessed using a herbaceous model.

V_{mid}: **Midstory (Shrubs/saplings/woody vines):** The midstory layer is the layer of botanical specie located between the herbaceous and forest/tree canopy. This would included shrubs, saplings, smaller trees, small trees, and large woody vines. A measure is taken at each plot and/or a visual estimate is performed at each sample location(s).

V_{herb}: : **Herbeceous layer:** Herbaceous layers are made at each data location/plot as is described it in the 87 WDM. It is recommended that 2-5 sub plots be taken at each location to account for vegetative variability.

$V_{detritus}$: **Detritus:** This variable is a measure of the percentage of areas with detritus at the soil surface. Plowed areas or areas "washed" by high velocity flood water should not be considered as areas having detritus. Determination of an A (with organic) or O horizon should be determined for the entire site by on site field information.   For this variable, the A (with organic) must have a Munsell value of 4 or less. Refer to the Kentucky Riverine Model for additional details regarding this variable.

V_{redox}: **Redoximorphic process:** This variable is an indicator of periodic aerobic and anaerobic process within the top 10-12 inches of the soil surface. Redox features should be document for each sample plot/location and any other soil investigation conducted on the site. At least 50% of the must meet this criteria to be a 1 in the sub index.

V_{sorpt}: **Sorptive Soil Properties:** This variable is a general indicator of the potential that the soil has in regards to it's absorptive properties. This information can be obtained by the use of the county soil survey in conjunction with the field data.

$V_{connect}$: **Connectivity to other habitat types:** This variable concentration on the geo-location of the WAA in relationship to other habitat type within 600 feet from the perimeter of the WAA.

Variables for HGM (Interim) Herbaceous/Shrub Riverine

V_{dur}: The % of the WAA that is flooded and/or ponded due to the hydrology (i.e. flooding overbank flow) of the nearby waterway

Criteria	Variable Sub index
In an average year at 80% of the WAA either floods and/or ponds for at least 14 consecutive days	1.00
In an average year at 80% of the WAA either floods and/or ponds for at least 7 consecutive days	0.75
In an average year at 50-79% of the WAA either floods and/or ponds for at least 7 consecutive days	0.50
In an average year at 25-50% of the WAA either floods and/or ponds for at lease 7 consecutive days	0.25
In an average year all or portions of the WAA either floods and/or ponds for at least 1-7 consecutive days	0.10
The area is NOT subject to flooding	0.00

V_{freq}: The frequency that the WAA is flooded and/or ponded by nearby waterway .

Criteria	Variable Sub index
Floods or pond annually 5 out of 5 years (floodway)	1.00
Floods or ponds 3 or 4 out of 5 years (elevation data reveals in floodway and mapped w/n 100 yr floodplain)	0.75
Floods or ponds 2 out of 5 years (100- year floodplain)	0.50
Floods or ponds less than 2 out of 5 years (100-500 yr floodplain grey w/out elevations)	0.25
The area is not subject to flooding or ponding (500 yr floodplain)	0.00

V_{topo}: The roughness associated with the WAA

Criteria	Variable Sub Index
Greater than 30% of the WAA is represented by dips, hummocks, channel sloughs and/or other topographic features	1.00
15 - 30% of the WAA is represented by dips, hummocks, channel sloughs and/or other topographic features	0.70
Less than 15% of the WAA is represented by dips, hummocks, channel sloughs and/or other topographic features	0.40
Smooth, flat, or very gentle undulating with little or no topographic features	0.10

V_{wood}: Percentage of the WAA that is covered by woody vegetation

Criteria	Variable Sun Index
Greater than 90% of the WAA is covered with woody vegetation	1.00
67 to 90 % of the WAA is covered with woody vegetation	0.75
34 to 66% of the WAA is covered with woody vegetation	0.50
11 to 33% of the WAA is covered with woody vegetation	0.25
0-10% if the WAA is covered with woody vegetation	0.10

V_{mid}: The average/mean coverage of the midstory (shrub/sapling) layer in the WAA

Criteria	Variable Sub Index
Midstory coverage of the WAA is more than 75%	1.00
Midstory coverage of the WAA is between 50-75 %	0.75
Midstory coverage of the WAA is between 25-50%	0.50
Midstory coverage of the WAA is between 1-25%	0.25
Midstory coverage of the WAA is equal to or less than1%	0.10

V_{herb}: The average/mean coverage of the WAA by the herbaceous layer

Criteria	Variable Sub Index
Herbaceous cover in the WAA averages greater than 75%	1.00
Herbaceous cover in the WAA averages between 50-75%	0.75
Herbaceous cover in the WAA averages between 25-50%	0.50
Herbaceous cover in the WAA average is between 1-25%	0.25
Herbaceous cover in the WAA is equal to or less than 1% (barren soil or all shrub)	0.10

$V_{connect}$: the number of habitat types within a 600' of the parameter of the WAA
(Habitat to be counted has to be at a minimum 5% of the size of the WAA)

Habitat Types:

Forested	Shrub/Sapling
Herbaceous/Prairie/Abandoned Ag field	Active Agricultural Field
Open water	Wetland
Mudflat	Lawn

Criteria:	Variable Sub Index
Wetland plus four habitats and/or surrounded by forested	1.00
Wetland plus two or more habitat type (other than forested) OR three or more habitat types	0.75
Wetland plus one other habitat types or two other habitat types	0.50
One other habitat types other than urban habitat	0.25
Surround by urban (homes, lawn, concrete, etc.)	0.10

$V_{detritus}$: The amount of the detritus on the WAA
(A horizon has to have a value of 4 or less)

Criteria	Variable Sub Index
Greater than 85% of the area possesses an O or A horizon	1.00
From 11-84% of the area possesses an O or A horizon	0.50
Less than 10% of the area possesses an O or A horizon	0.30
Site is plowed	0.10

V_{redox}: The amount of the WAA that exhibits redox features an indication of the chemical exchange

Criteria	Variable Sub Index
Redox concentrations represent at least 20% of the pedon within the top 4 inches of the soil surface, or feature masked due to parent material but conditions are conducive to redoximorphic processes. (many mottles)	1.0
Redox features less than 20%	0.1

V_{sorpt}: The absorptive properties of the soils in the WAA

Criteria	Variable Sub Index
The WAA is dominated by montmorillonitic clayey soils (clay, clay loams, silty clay loams) or soils with high organic (2/1, 2/2, or 3/1)	1.00
WAA is dominated by loamy (silt loams, very fine sandy loams, loam) or non-montmorillonitic clays	0.50
The WAA is dominated by sandy soils (sands, loamy fine sands, loamy sands)	0.10

Riverine Herb/Shrub HGM (Interim) Worksheet

WAA #

Variable	Subindex
V_{dur}	
V_{freq}	
V_{topo}	
V_{wood}	
V_{mid}	
V_{herb}	
$V_{detritus}$	
V_{redox}	
V_{sorpt}	
$V_{connect}$	

WAA #

Variable	Subindex
V_{dur}	
V_{freq}	
V_{topo}	
V_{wood}	
V_{mid}	
V_{herb}	
$V_{detritus}$	
V_{redox}	
V_{sorpt}	
$V_{connect}$	

WAA #

Variable	Subindex
V_{dur}	
V_{freq}	
V_{topo}	
V_{wood}	
V_{mid}	
V_{herb}	
$V_{detritus}$	
V_{redox}	
V_{sorpt}	
$V_{connect}$	

Riverine Herb/Shrub (Interim HGM) Worksheet
Functional Capacity Index (FCI)

Temporary Storage & Dentention of Storage Water:

$$[\{V_{dur} \times V_{freq}\}1/2 \times \{V_{topo} + \{V_{herb} + V_{mid/2}\}\}/2]1/2$$

$[\{\underline{\hspace{1cm}} \times \underline{\hspace{1cm}}\} \frac{1}{2} \times \{\underline{\hspace{1cm}} + \{\underline{\hspace{1cm}} + \underline{\hspace{1cm}}/2\}/2]1/2 = FCI$

$[\{\underline{\hspace{1cm}} \times \underline{\hspace{1cm}}\} \frac{1}{2} \times \{\underline{\hspace{1cm}} + \{\underline{\hspace{1cm}} + \underline{\hspace{1cm}}/2\}/2]1/2 = FCI$

Maintain Plant and Animal Communities:

$$\{V_{mid} + V_{herb} + V_{connect}\}/3$$

$\{\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}}\}/3 = FCI$

$\{\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}}\}/3 = FCI$

Removal & Sequestrian of Elements & Compounds:

$$[[V_{wood} + V_{freq} + V_{dur} + [\{V_{topo} + V_{herb} + V_{mid}\}/3] + [\{V_{detritus} + V_{redox} + V_{sorpt}\}/3]]/5$$

$[[\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}} +[\{\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}}\}/3] + [\{\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}}\}/3]]/5 = FCI$

$[[\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}} +[\{\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}}\}/3] + [\{\underline{\hspace{1cm}} + \underline{\hspace{1cm}} + \underline{\hspace{1cm}}\}/3]]/5 = FCI$

Functional Capacity Units (FCU); FCI x wetland acres per WAA…

WAA #	Pre-project FCUs	Post Project FCUs
Temp Storage of Water		
Maintain Plant & Animal		
Removal of Elements		

Riverine Herb/Shrub (Interim) HGM Worksheet
Functional Capacity Index (FCI)

Mitigation

Temporary Storage & Dentention of Storage Water:

$[\{V_{dur} \ X \ V_{freq}\}1/2 \ X \ \{V_{topo} + \{V_{herb} + V_{mid/2}\ \}/2] \ ½$

Pre: $[\{\_\_\_ \ x \ \_\_\_\} \ ½ \ x \ \{\_\_\_ + \{ \ \_\_\_\_ + \_\_\_/2\}\}/2]1/2 = FCI$

Post: $[\{\_\_\_ \ x \ \_\_\_\} \ ½ \ x \ \{\_\_\_ + \{ \ \_\_\_\_ + \_\_\_\_/2\}\}/2]1/2 = FCI$

Maintain Plant and Animal Communities:

$\{V_{mid} + V_{herb} + V_{connect}\}/3$

Pre: $\{\_\_\_\_ + \_\_\_\_ + \_\_\_\_\}/3 = FCI$

Post: $\{\_\_\_\_ + \_\_\_\_ + \_\_\_\_\}/3 = FCI$

Removal & Sequestrian of Elements & Compounds:

$[[V_{wood} + V_{freq} + V_{dur} + [\{V_{topo} + V_{herb} + V_{mid}\ \}/3] +[\{V_{detritus} + V_{redox} + V_{sorpt}\ \}/3]]/5$

Pre:
$[[\_\_\_\_ + \_\_\_\_ + \_\_\_\_ +[\{\_\_\_\_ + \_\_\_\_ + \_\_\_\_\}/3] + [\{\_\_\_ + \_\_\_\_ + \_\_\_\_\}/3]]/5 = FCI$

Post:
$[[\_\_\_\_ + \_\_\_\_ + \_\_\_\_ +[\{\_\_\_\_ + \_\_\_\_ + \_\_\_\_\}/3] + [\{\_\_\_ + \_\_\_\_ + \_\_\_\_\}/3]]/5 = FCI$

Mitigation
Functional Capacity Units (FCU); FCI x wetland acres per WAA…

WAA #	Pre-project	Post 1 yr	Post 5 yr	Post 10 yr
Temporary Storage				
Maintain Plant & Animal				
Sequestrian of Elements				

Riverine Herb/Shrub (Interim) HGM Worksheet
Functional Capacity Unit (FCU)
Impact(s) sheet

Potential Functional Capacity impacts
{i.e. WAA 1 FCU biota loss (bl) + WAA 2 bl + WAA 3 bl + WAA 4 bl = net FCU loss}

Temporary Storage & Detention of Storage Water:

Maintain Plant & Animal Communities:

Removal & Sequestrian of Elements & Compounds:

* **Net FCU loss is calculated by deducting the post project FCU from the pre-project FCU per function capacity. Different functional capacity index should NEVER be summarized.**