Interim Hydrogeomorphic Function Analysis

As part of the permitting process, InControl Technologies conducted an Interim Hydrogeomorphic Function Assessment for wetland habitats within a 75-acre tract. This work is documented in a report included in **Appendix A**. At present, the USACE Galveston District requires the use of their interim hydrogeomorphic model (iHGM) to calculate the functional value of jurisdictional wetlands. Within this framework, major classes of wetland functions (i.e., biological, chemical, physical) are described as indices that can be multiplied by the acreages that will be impacted to determine functional losses by fill, conversion, or temporary impairment by construction activities. Under the 2008 Mitigation Rule, these impacts must be compensated for through equivalent mitigation credits.

h February 2020, a wetland delineation was completed for the wetlands within the property to determine the extent of wetlands within the property. On-site iHGM functional assessment data were collected on February 13, 2020 through February 14, 2020 to determine the sub-index values for the Herbaceous/Shrub and Forested iHGM models.

InControl Technologies delineation identified 1.88 acres of PEM wetlands and 9.55 acres of PFO wetlands within the proposed location of the project (**Figure 4**) that would be considered jurisdictional wetlands. Wetland F is believed to be non-jurisdictional and was not included in the functional assessment. Based on field data, wetlands with similar functional values were selectively grouped into the minimum number of Wetland Assessment Areas (WAAs) for each vegetation class using the iHGM analyses (**Figure 7**).

The mitigation credits required to offset the identified wetlands include 7.097 FCUs for Physical (TSSW), 6.858 FCUs for biological (MPAC) and 7.492 FCUs for Chemical (RSEC).

		•	TSSW (physical)		MPAC (biological)		RSEC (chemical)	
WAAID Type	туре	Acreage	FCI	FCU	FCI	FCU	FCI	FCU
WAA1	PEM		0.791	0.791	0.64	0.638	0.81	0.807
WAA2	PEM	5.64	0.742	4.183	0.71	4.019	0.79	4.437
WAA3	PEM	1.71	0.689	1.179	0.61	1.043	0.77	1.311
WAA4	PEM	1.06	0.597	0.633	0.62	0.654	0.56	0.594
WAAS	PEM	.82	0.381	0.313	0.62	0.506	0.42	0.344
	Total	11.58		7.097		6.858		7.492

Table 5. Existing Riverine Forested/Herbaceous Wetland FCI & FCU Values

The findings presented in the iHGM report are restricted to and are based upon our professional opinions. These values are subject to alterations in project plans, verification of the wetland delineation, and verification of the iHGM. Only the USACE and the U.S. Environmental Protection Agency have final legal authority to determine the location, extent, and functional value of waters of the U.S. We believe that the information contained in the iHGM report accurately represent conditions at the site and the findings would be consistent with those of the USACE.

Wetland Functional Assessment

The USACE Galveston District requires the use of their interim hydrogeomorphic model (iHGM) to calculate the functional value of jurisdictional wetlands. Within this framework, major classes of wetland functions (i.e., biological, chemical, physical) are described as indices which are multiplied by the acreages that will be impacted to determine functional losses by fill, conversion, or temporary impairment by construction activities. Under the 2008 Mitigation Rule, these impacts must be compensated for through equivalent mitigation credits.

iHGM Model

The iHGM uses multiple variables to evaluate three ecological functions which describe, and measure forested and herbaceous/shrub riverine wetlands in the U.S. Army Corps of Engineers (USACE) Galveston District. These three functional capacity indices (FCI) are used to quantify potential impacts for each wetland assessment area (WAA) associated with a project. For this project, InControl Technologies applied the Riverine Herbaceous-Shrub functional assessment (USACE 2010a). The FCI quantify temporary storage of surface water (TSSW), maintenance of plant and animal communities (MPAC), and removal and sequestration of elements and compounds (RSEC) for each wetland to determine physical, biological, and chemical functions, respectively.

The Riverine Herbaceous-Shrub iHGM functional assessment uses ten (10) variables to evaluate nonforested (herbaceous or scrub-shrub) riverine wetlands. The three indices are expressed by the following function:

$$TSSW = \sqrt{\sqrt{(Vdur * Vfreq)} * (CVtopo \frac{+Viie.b}{3} \frac{Vmid}{3})]}$$
$$MPAC = \frac{Wmid + Vhe, b + Vconnect J}{3}$$
$$RSEC = \frac{Vwood + Vrreq + Vdur + \frac{(Viopo + Viierb + Vwood)}{3} + \frac{(Vdetritus + V13 \cdot edox + Vso, -pt)]}{S}$$

The variables for the herbaceous scrub-shrub iHGM include:

- Vdur: Duration of flooding and ponding in an average year
- Vfreq: Frequency of flooding and ponding
- Vtopo: Percent containing topographic features
- Vherb: Percent of herbaceous cover
- Vmid: Percent of relative cover between the herbaceous and tree strata
- Vwood: Percent covered by woody vegetation
- Vdetritus: Percent of area with detritus at the soil surface
- Vredox: Abundance of redox features within the top 12 inches of soil

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- Vsorpt: Absorptive properties of the soil
- Vconnect: Number of habitat types found within 600 feet

The Riverine Forested iHGM model includes the variables found in the Riverine Herbaceous/Shrub iHGM functional assessment with five additional variables that account for the ecological effects of the tree stratum and associated detritus, forest indices are expressed with the following function:

$$TSSW = \sqrt{\left[\sqrt{(Vdur * Vfreq)} * \frac{(Viopo + V,wd + Vwood)}{3}\right]}$$

$$MPAC = \frac{\left[Vtree + Vcwd + Vnch + \frac{(Vbasal + Vdensity)}{2} + \frac{(Vmid + Viierb)}{2} + Vconnect\right]}{6}$$

$$RSEC = \frac{\left[Vtree + Vcwd + Vnch + \frac{(Vbasal + Vdensity)}{2} + \frac{(Vdensity)}{2} + \frac{(Vdensity$$

The additional variables for the Forested iHGM include:

- Vcwd: Duration of flooding and ponding in an average year
- Vtree: Frequency of flooding and ponding
- Vrich: Percent containing topographic features
- Vbasal: Percent of herbaceous cover
- Vdensity: Percent of relative cover between the herbaceous and tree strata

Therefore, a wetland scoring closer to 1 for each variable will generate a higher FCI score for each ecological function {TSSW, MPAC, and RSEC) than one in which variable values are near 0. Once an FCI has been calculated for each wetland, the corresponding functional capacity units (FCU) can be determined based on the product of the total acreage of a wetland and its corresponding FCI values.

Wetland Functional Assessment Results

InControl Technologies delineation identified 1.88 acres of PEM wetlands and 9.55 acres of PFO wetlands within the proposed location of the project (Figure 6) that would be considered jurisdictional wetlands. Wetland F is believed to be non-jurisdictional and was not included in the functional assessment. Based on field data, wetlands with similar functional values were selectively grouped into the minimum number of Wetland Assessment Areas (WAAs) for each vegetation class using the iHGM analyses. **Table 3** shows the sub-index values assigned for each WAA within the project area. The following paragraphs provide general descriptions of the values used to calculate the iHGM values.

 <u>Duration of flooding (Vdur)</u> is estimated using hydrology indicators listed in the Corps of Engineers Wetlands Delineation Manual (Manual; USACE 1987) and the Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Atlantic and Gulf Coastal Region, Version 2.0 (Regional Supplement; USACE 2010b). The portion of the property containing wetlands is

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within the 100-year flood plain and the wetlands are situated in local depressions. Based on field observations, the duration of inundation events in all WAAs occur for at least seven consecutive days, resulting in sub-index values of 0.75 for all wetlands except for WAA 5which scored 5.0.

- **Frequency of flooding (Vfreg)** uses indicators listed in the Manual (USACE 1987), the Regional Supplement (USACE 2010b), and FEMA floodplain maps. The project areas lying within the 500-year floodplain and the geography of the wetlands are such that much of these areas are inundated by frequent periodic flooding. Based on field observation, InControl Technologies believes that all WAAs flood or pond semi-annually; with WAA1, WAA2 and WAA4 flooding more frequently and scoring 0.75 due to their lower landscape position than WAA3 and WAA5 which scored a 0.5 respectively.
- <u>Topography (Vtopo)</u> relies on visual estimates conducted in the field to determine what percent of the WAA is composed of heterogeneous topographic features (e.g., dips, hummocks, channel sloughs). Some topographic features observed within the project area include depressions and hummocks; however, the wetlands generally lacked significant microtopographic features.
- <u>Woody vegetation (Vwood)</u> was assessed visual observations. Woody vegetation obviously dominated the PFO wetlands (WAA1, WAA2 and WAA3), with cover greater than 67% in each. Therefore, their scores were 1.0. PEM wetlands within the property contained low densities of woody shrubs and trees resulting in scores of 0.1, indicating that woody vegetation cover in these wetlands were less than 33 percent.
- <u>Midstory (Vmid)</u> describes the shrub and sapling vegetation layer found between ground level and an upper forest canopy. The midstory stratum covers ranged widely across the wetlands, with subindex values ranging from 0.1 to 0.5.
- <u>Herbaceous (Vherb)</u> describes the average herbaceous vegetation cover in each WAA. The most common sub-index value was 1.0 within the PEM WAAs, while the PFO WAAs scored at 0.3.
- <u>Connectivity to other habitat types (Vconnect)</u> was assessed using aerial imagery extending 600 feet from the project area. The project area included two or more habitat types (other than forested} throughout. Therefore, a sub-index score of 1.0 to 0.75 was assigned.
- <u>Detritus (Vdetritus)</u> refers to the presence of either an O or A horizon associated with the WAAs. Frequent flooding within the project area saturates soils, decreasing the rate at which organic carbon is naturally utilized thereby allowing for the accumulation of organic matter. Sub-index value of 1.0 was assigned to all WAAs within the project area.
- <u>Redoximorphic process (Vredox)</u> is based on extent to which pedons within the WAA that exhibit redoximorphic features as an indication of alternating oxidizing and reducing conditions. Periodic flooding within saturated soils, causing vacillation between anaerobic and aerobic conditions which allows the reduction and translocation of iron and manganese within the upper portions of the soil. Soils within all wetlands contained redoximorphic concentrations that represent less than 20

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percent of the upper portion of the pedon, warranting a sub-index score of 0.1.

Sorptive soil properties (Vsorpt) are determined using the Natural Resources Conservation Service (NRCS) Soil Survey (U.S. Department of Agriculture [USDA] 2016) and data recorded in the field. According to the USDA Soil Survey, Brazoria Clay, rarely flooded (Ma) and Lake Charles Clay, 0 to 1 percent slopes (Le & La) are present in the project area. Field surveys confirmed that sandy clay soils (sub-index score of 1.0) dominated all WAAs.

The following results are exclusively for the Riverine Forested iHGM model.

- <u>Coarse woody debris (Vcwd)</u> is measured by a point-intercept method involving a tally of woody debris greater than 3 inches in diameter along a 100-foot-long transect in forested WAAs. Due to land use of the property, this could not be directly measured; therefore, this sub-index score was estimated from adjacent forested wetland areas. Based on this, we estimate that coarse woody debris is three to seven pieces within all forested WAAs which correspond to a score of 0.5.
- The percentage of trees that are mast producers (Vtree) was assessed via summation of the percent cover of mast producing species (e.g., oak, hickory, cypress, maple, and elm) in the WAA. Due to land use of the property, this could not be directly measured; therefore, this sub-index score was estimated from residual materials (stumps and stems left on the ground) and those identified in adjacent forested wetland areas. Forested wetlands in WAA1 andWAA3 was a significant coverage of Chinese tallow; however, WAA2 was dominated by a far more diverse assemblage. Therefore, these wetlands were assigned sub-index values of 0.5, 0.3 and 0.8 respectively.
- <u>Tree richness (Vrich)</u> is a measure of the diversity of species within the WAAs. Common tree species found within PFO WAAs include Chinese tallow and cedar elm and water oak and green Ash. Therefore, these wetlands warrant sub index score 0.6 respectively.
- <u>Tree basal area (Vbasal)</u> is the mean basal area per acre of trees in the WAA. The calculated basal area within WAA1, WAA2 and WAA3 is approximately 144, 61 and 146 square feet per acre, corresponding to sub-index scores of 1.0.
- <u>Tree density (Vdensity)</u> is based on the number of trees per acre that are at least 3 inches in diameter at breast height. Tree density ranged from between 250 and 300 trees per acre, resulting in a sub-index score of 1.0 for both associated WAAs.

These categories are summarized in separate Functional Assessment Variables Scores table included in **Attachment D**. The tables in **Attachment D** summarize the scores for each of the each of the variables detailed above. **Table 4** below summarizes the FCI and FCU scores with totals beneath of the functional credit units that will need to be mitigated with credits from an appropriate mitigation bank.

The mitigation credits required to offset the identified wetlands include 7.097 FCUs for Physical (TSSW), 6.858 FCUs for biological (MPAC) and 7.492 FCUs for Chemical (RSEC).

Table 4. Existing Riverine Forested/Herbaceous wetiand FCI & FCO values								
	Turne		TSSW (p	hysical)	MPAC (I	oiological)	RSEC (chemical)
WAAID	туре	Acreage	FCI	FCU	FCI	FCU	FCI	FCU
WAA1	PEM	1	0.791	0.791	0.64	0.638	0.81	0.807
WAA2	PEM	5.64	0.742	4.183	0.71	4.019	0.79	4.437
WAA3	PEM	1.71	0.689	1.179	0.61	1.043	0.77	1.311
WAA4	PEM	1.06	0.597	0.633	0.62	0.654	0.56	0.594
WAAS	PEM	.82	0.381	0.313	0.62	0.506	0.42	0.344
	Total	11.58		7.097		6.858		7.492

Table 4. Existin9 Riverine Forested/Herbaceous Wetland FCI & FCU Values



Riverine Forested HGM (Interim) Assessment Pre-Impacts

 Applicant:
 MC-SBSenna
 WAA ID:
 WAA1
 WAA Acreage:
 1.000

 V_{du}.: Percent of the WAA that is flooded and/or ponded due to the hydrology (i.e. flooding overbank flow) of the nearby waterway.
 Decision:
 h an average year, at least 80% of the WAA either floods and/or ponds for at least 7 consecutive days.

Subindex: 0.750

0.500

1.000

0.300

1.000

Subindex:

Subindex:

Comments:

Nearly half the indviduals were triadica sebifera.

 V_{1,Q_1} : Frequency that the WAA is flooded and/or ponded by the nearby waterway.

Decision:

Floods or ponds 2 out of 5 years (100-year floodplain).

Comments:

 $V_{10_{n}0}$. Roughness associated with the WAA.

Decision:

Greater than 30% of the WAA is represented by dips, hummocks, channel sloughs, and/or other topographic features.

Comments:

V_{cwd}: Coarse Woody Debris within the WAA.

Decision:

Less than 3 pieces of CWD greater than 3" diameter along 100' transect.

!Subindex:

Comments:

 $V_w \omega_d$: Percentage of the WAA that is covered by woody vegetation.

Decision:

67-90% of the WAA is covered with woody vegetation.

Subindex:

Comments:

 V_1 . The percentage of the trees in the WAA that are mast producers.

Decision:

Less than 20% of the stand is oak, hickory, cypress, maple, and/or elm.

!Subindex: 0.300

Comments:

	Interim HGM fo	r MC-68 Sienna: I	Forested WAAs		
Applicant:	M <u>C68Senna</u>	WAA ID:	WAA1	WAA Acreage:	1.000
V,ich: The diversity o	of the species within the WAA. (To be c	onsidered the species	must comprise at least	t 5% of the stand.)	
Decision:					
	Fo	our tree species preser	nt.		
÷				ISubindex:	0.600
Comments:					
V _{basai} : The average/	mean basal area of the trees in the WA	A per acre.			
Decision:					
	The average basal area of t	he WAA is greater tha	n 100 square feet per	acre.	
				!Subindex:	1.000
Comments:					
V _{dens} uy: The average	e density of the WAA stand. (Tree is wo	odv with over 3' Diam	eter at Breast Height []	DBH)).	
Decision:			5 t		
	The WAA averages	a tree density of 100-	-250 trees per acre.		
				Subindex:	0.600
Comments:					
V i The average/n	nean coverage of the midstory (shruh/s	anling) laver in the WA	ΔΔ		
Decision:	Teah coverage of the midstory (shirub/s		v		
	Midstory cove	erage of the WAA is lea	ss than 10%.		
				Subindex:	0.250
Comments:				Toubindox.	0.200
	fill body and				
V _{herb} : The average/I Decision:	mean coverage of the herbaceous layer	in the WAA.			
	Herbaceous cove	r in the WAA averages	s between 5-30%		
				Subindey:	1 000
Comments:				Subindex.	1.000
		has to have a MA			
v _{detritus} : The amoun Decision:	il of detritus on the WAA (The A-horizon	nas to have a Munse	n value of 4 or less).		
	Greater than 85%	of the area nossesses	an O or A horizon		
			2. 0 0. / (Honzon.	Rubindow	1 000
Comments:				ISUDINGEX:	1.000

Applicant:	MC-SBSenna	WAA ID:	WAA1	WAA Acreage:	1.000
Vedox: The amount of the WA	A that exhibits redox features as a	n indication	of the chemical exchange.		
Decision:		il marcate	of the onomous exertaing.		
	Redox fea	atures less	than 20%		
				1	0.400
Commente:				ISubindex:	0.100
Comments.					
V The absorptive proper	ies of the soils in the WAA				
Decision:					
The $W/\Delta \Delta$ is dominated b	u montmorillonitic clavev soils (clav	clay loams	silty clay loams) or soils with	h high organic (211-212	or 3/1)
	y MONUNO IIIO IIIO Gayey sons (Gay,	, clay loans	s, Silly clay idanis, or sons will		01 3/1).
Commonto:				ISubindex:	1.000
Comments:					
Number of babitat to	within 600 fact of the perimeter	- of the W/A	٨		
Vconnecl: NUMBER OF Nabilal IN	pes within 600 reet of the perimeter	the size of	Α. μο 1//ΔΔ		
			ne waa		
Habitat Types:	Forested		Shrub/Sapling]
	Herbaceous/Prairie/Abandoned	Ag Field	Active Ag Field]
	Open Water		Welland		4
Decision:	Mudilat		Lawn		<u> </u>
	Mattand alug four babi	t-to and/or			
	vvetiana pius tour napit	tats and/or	surrounded by torested.	L	
				Subindex:	1.000
Comments:					
Functional Capacity Indices	(FCI) and Units (FCU=FCI*WAA	Acreage)		Pre-FCI	Pre-FCU
Temporary Storage & Detent	ion of Storage Water	" O F		0.70	0 7010
[(vdur•vireq) 0	.5 • ((viopo + vowa + vwood) / 5)]	0.5		0.79	0.7910
Maintain Plant & Animal Com	nmunity				
(Vtree + Vcwd + V	/rich + [(Vbasal + Vdensity) / 2) + [(Vmid + Vhe	rb) / 2) + Vconnect) / 6	0.64	0.6400
Removal & Sequestrian of El	ements & Compounds dur + I(1/topo + 1/oud + 1/u/cod) / 21 + I(1/topo + 1/topo +	Vdetritue + V	$redox \pm (const) / 31) / 5$	0.94	0.0100
(vwood + vired + vi	uu + [(viopo + vowa + vwooa) / 3] + [(vueunus + V	redox +vsolb() / 31) / 5	0.81	0.8100

) .

Applicant:	M <u>C-68Şenna</u>	WAA ID:	WAA2	WAA Acreage	e: <u>5.640</u>	
V _{dur} : Percent of t	the WAA that is flooded and/or ponded d	lue to the hydrology (i.e. f	looding overbank fl	ow) of the nearby waterw	/ay.	
Decision:						
In an average year, at least 80% of the WAA either floods and/or ponds for at least 7 consecutive days.						
				I Subindex:	0.750	
Comments:						

 V_{μ} ; Frequency that the WAA is flooded and/or ponded by the nearby waterway.

Decision:

Floods or ponds 3 or 4 out of 5 years (elevation data reveals in floodway and mapped within the 100-year floodplain).

		Subindex:	0.750
Comments:			

 $V_{10_{p}0}$. Roughness associated with the WAA.

Decision:

15-30% of the WAA is represented by dips, hummocks, channel sloughs, and/or other topographic features.

Comments:

V _{cwd} : Coarse Woody Debris v	within the WAA.		
Decision:			
	From 3-7 pieces of CWD greater than 3" diameter along 100' trans	ect.	
		Subindex:	0.500
Comments:			
2			

$V_w \omega_d$: Percentage of the WAA that is covered by woody vegetation.	-15	
Decision:		
67-90% of the WAA is covered with woody vegetation.	T	
	Subindex:	1.000
Comments:		

 V_{t} ...: The percentage of the trees in the WAA that are mast producers.

of the stand is oak, hickory, cypress, maple, and/or elm. Black willow, cottonwood, tallow, and sycamore do not represent more than 10% of

Subindex: 0.800

Subindex:

0.700

Comments:

Decision:

Applicant:	MC68Senna	WAA ID:	WAA2	WAA Acreage:	5.640
V, _i c _h : The diversity of	of the species within the WAA. (To be	e considered the species	s must comprise at lea	st 5% of the stand.)	
Decision:					
		Three tree species prese	ent.		
				ISubindex:	0.600
Comments:					
V · The average	mean basal area of the trees in the l				
Decision:					
	The average basal area	of the WAA is between	60-80 square feet per	acre.	
				Subindex:	1 000
Comments:				loubilideAl	
V _{density} : The average	e density of the WAA stand. (Tree is	woody with over 3" Dian	neter at Breast Height	[DBH)).	
Decision.	7		050 (
	The VVAA average	ges a tree density of 100	-250 trees per acre.		
Comments:				!Subindex:	1.000
Commenta.					
V _{m;d} : The average/n	nean coverage of the midstory (shru	o/sapling) layer in the W	AA.		
Decision:					
	Midstory c	overage of the WAA is le	ess than 10%.		
				ISubindex:	0.250
Comments:					
V _{back} . The average/r	mean coverage of the herbaceous la	ver in the WAA			
Decision:		,			
	Herbaceous co	ver in the WAA averages	s between 31-50%.		
				!Subindex:	0.500
Comments:					
V _{detritus} : The amoun	t of detritus on the WAA (The A-horiz	zon has to have a Munse	ell value of 4 or less).		
	Greater than 85	% of the area nossesses	en OorAborizon		
Three thes species present. Isubindex: 0.60 Comments:					
Comments:				!Subindex:	1.000

"Contraction

)

)

Applicant:	MC-@Senna WAA ID:	WAA2	WAA Acreage	5.64
/,edox: The amount of the W/	AA that exhibits redox features as an indicatio	n of the chemical exchange.		
Decision:		-		
	Redox features less	s than 20%		
		S (11d11 2070.		
			Subindex:	0.10
Comments:				
. The absorptive proper	ties of the soils in the WAA.			
,0,1: 110 0000 parts prope.				
				044
The WAA is dominated b	y montmorillonitic clayey soils (clay, clay ioan	ns, silty clay loams) or sous	with high organic (211, 212,	, or 311).
			ISubindex:	1.00
Comments:				
/connect: Number of habitat t	ypes within 600 feet of the perimeter of the W	/AA.		
Habitat to be cou	nted has to be at a minimum 5% of the size of	f the WAA		
				-
Habitat Types:	Forested	Shrub/Sapling		Ţ
	Herbaceous/Prairie/Abandoned Ag Field	Active Ag Field		4
	Open Water	Wetland		4
	Mudflat	Lawn		
Decision:				
	Wetland plus four habitats and/o	r surrounded by forested.		
			Subindev	1.00
Comments:			:Subindex.	1.00
John Henris.				
unctional Capacity Indice	s (FCI) and Units (FCU=FCI*WAA Acreage)		Pre-FCI	Pre-F
Femporary Storage & Deten	tion of Storage Water			
[(Vdur • Vfreg) A ().5 • ((Vtopo + Vcwd + Vwood) / 3)] ∧ 0.5		0.74	4.18
L\ 1/			1 4.1.1	
Aaintain Plant & Animal Cor	nmunity			
(Vtree + Vcwd + V	/rich + [(Vbasal + Vdensity) / 2] + [(Vmid + Vh	erb) / 2] + Vconnect) / 6	0.71	4.01
		, , , , , , , ,		
Removal & Sequestrian of E	lements & Compounds			
	(dur I [A /topo I) (and I) (upod) / 21 I [A /detritus I	$\sqrt{redox} + \sqrt{cornt} / 31 / 5$	0.70	Ϊ 1 12

Riverine Forested HGM (Interim) Assessment Pre-Impacts

WAA ID: _____ WAA3 Applicant: _____ M<u>C-68Sienna</u> WAA Acreage: 1.710 V_{du}.: Percent of the WAA that is flooded and/or ponded due to the hydrology (i.e. flooding overbank flow) of the nearby waterway. Decision: In an average year, at/east 80% of the WAA either floods and/or ponds for at/east 7 consecutive days. ISubindex: 0.750 Comments:

Vira: Percent of the WAA that is flooded and/or ponded due to the hydrology (i.e. flooding overbank flow) of the nearby waterway. Decision:

Floods or ponds 2 out of 5 years (100-year floodplain).

Subindex:

0.500

0.400

0.500

0.750

Comments:

V₁₀₀₀: Roughness associated with the WAA.

Decision:

Less than 15% of the WAA is represented by dips, hummocks, channel sloughs, and/or other topographic features.

Comments:

V_{cwd}: Coarse Woody Debris within the WAA. Decision:

From 3-7 pieces of CWD greater than 3" diameter along 100' transect.

Comments:

Vw cod: Percentage of the WAA that is covered by woody vegetation.

Decision:

0-10% of the WAA is covered with woody vegetation.

Subindex:

Comments:

v,,...: The percentage of the trees in the WAA that are mast producers.

🖞 of the stand is oak, hickory, cypress, maple, and/or elm. Black willow, cottonwood, tallow, and sycamore do not represent more than 5% c

ISubindex: 0.500

Comments:

Decision:

ISubindex:

!Subindex:

Applicant:	MC-68Senna	waa id:	WAA3	WAAAcreage:	1.710
$V_{,i}$ c_h : The diversity of th	ne species within the WAA. (To be cor	isidered the species	must comprise at leas	st 5% of the stand.)	
Decision:	Thro	a trac anaciae proc			
	, inte	e liee species prese		cubindov	0.600
Comments:				Isubilitiex.	0.000
V _{basa1} : The average/me	an basal area of the trees in the WAA	per acre.			
Decision:	The overege basel area of th	o 14/4 A io avector the	n 100 anuara faat nar		
	The average basal area of the	• WAA IS greater tha	an 100 square feet per		4.000
Comments:				Subindex:	1.000
V _{densit} v: The average de	ensity of the WAA stand. (Tree is woo	dy with over 3' Dian	neter at Breast Height	[DBH]).	
Decision:					
	The WAA averages a	a tree density of 100	-250 trees per acre.		
Commonts:				ISubindex:	0.600
Comments.					
	n any arage of the midster (abruh lage	oling) lover in the \A(A A		
Decision:	in coverage of the midstory (sinub/sap	ning) layer in the vo			
	The site i	is open land (non-foi	rested).		
				subindex:	0.500
Comments:					
V _{herb} : The average/mea	an coverage of the herbaceous layer i	n the WAA.			
Decision.	Herbaceous cover i	in the WAA average	s between 5-30%		
				!Subindex:	0.500
Comments:					0.000
V _{de} tritu: The amount of	detritus on the WAA (The A-horizon I	nas to have a Munse	ell value of 4 or less).		
Decision:	Graatar than 950/ at	fthe area nonconcer	an Oord barizon		
	Greater than 85% 01	uie area possesses	an Uur A norizon.	Kuba daya	1.004
				:Subindex:	1.000

Comments:

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- Alleria

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Applicant:	M <u>C-68Sienna</u>	WAA ID:	WAA3	WAAAcreage	:
Ved x: The amount of the W	AA that exhibits red ox features	as an indication of	the chemical exchange		
Decision:			the chemical exchange.		
Redox concentrations rej	present at least 20% of the ped material, but conditions	on within the top 4 s are conducive to r	inches of the soil surface edoximorphic processes	e, or feature masked due s.	to parent
				Subindex:	0.100
Comments:					
V · · The absorptive prope	rtios of the soils in the M/AA				
v _{sorot} . The absorptive prope					
The WAA is dominated b	y montmori/Jonitic clayey soils	(clay, clay loams, s	ilty clay loams) or soils w	with high organic (211, 212	, or 3/1).
				Subindex:	1.000
Number of bobiets	human within COO fact of the man				
Vconnect: NUMber of nabitat	types within 600 feet of the peri	Imeter of the VVAA.	14/4 4		
Habitat to be cou	nted has to be at a minimum 5	% of the size of the	WAA		
Habitat Types	Forested	Sh	muh/Sanling		ר
Tablat Types.	Herbaceous/Prairie/Abando	oned Ag Field Ag	tive Aa Field		i i
	Open Water	W	etland		i i
	Mudflat	La	wn		1
Decision:	-	unne (athematican feur		h - h itat f maa	
Well	and plus two or more habital ty	pes (other than lore	sted) OR three of more	nabilal lypes.	
_				ISubindex:	0.750
Comments:					
Functional Canacity Indice	e (FCI) and Unite (FCII=FCI*)			Pre-FCI	Pre-FCU
Temporary Storage & Deten	tion of Storage Water	MAA Acicuge)			
[(Vdur • Vfreq) //	0.5 • ((Vtopo + Vcwd + Vwood)	/ 3)] 🗚 0.5		I 0.69	Į 1.1790
Maintain Plant & Animal Co	mmunity				
(Vtree + Vcwd +	Vrich + [(Vbasal + Vdensity) / 2] + [(Vmid + Vherb)	/ 2] + Vconnect) / 6	0.61	I 1.0430
Removal & Sequestrian of E	Elements & Compounds				
(Vwood + Vfreq + \	/dur + [(Vtopo + Vcwd + Vwood) / 3	3] + [(Vdetritus + Vrede	ox +Vsorpt) / 31) / 5	I 0.77	I 1.3110

Riverine Forested HGM (Interim) Assessment Pre-Impacts

Applicant: ------'-M_C_-_6_8_S_ie_n_n_a_____

WAA ID:

WAA4

WAA Acreage: 1.060

0.750

0.750

0.400

0.000

0.100

Subindex:

!Subindex:

!Subindex:

Subindex:

V_{du},: Percent of the WAA that is flooded and/or ponded due to the hydrology (i.e. flooding overbank flow) of the nearby waterway. Decision:

h an average year, at least 80% of the WAA either floods and/or ponds for at least 7 consecutive days.

Comments:

 $V_{1.0}$ Frequency that the W M is flooded and/or ponded by the nearby waterway.

Decision:

Floods or ponds 3 or 4 out of 5 years (elevation data reveals in floodway and mapped within the 100-year floodplain).

Comments:

 $V_{10}p_{0}$. Roughness associated with the WM.

Decision:

15-30% of the WAA is represented by dips, hummocks, channel sloughs, and/or other topographic features.

Comments:

V_{cwd}: Coarse Woody Debris within the W.M. Decision:

Area is open land (pasture or cropland)

Comments:

 $V_w \alpha_d$: Percentage of the W M that is covered by woody vegetation.

Decision:

0-10% of/he WAA is covered with woody vegetation.

!Subindex:

Comments:

 V_1 ree: The percentage of the trees in the W M that are mast producers. Decision:

The area is open land (non-forested).

!Subindex: 0.000

Comments:

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Applicant:	MC-@Senna	WAA ID:	WAA4	WAAAcreage: _	
V,;c _h : The diversity of the	e species within the WAA. (To be	considered the species	must comprise at leas	it 5% of the stand.)	
Decision:					
	0	ne-two tree species pres	sent.		
				!Subindex:	0.000
Comments:					
√ _{basai} : The average/mea	an basal area of the trees in the V	VAA per acre.			
Decision:					
	The average basal area	of/he WAA is between 6	60-80 square feet per a	acre.	
				!Subindex:	0.000
Comments:					
V _{densit} v: The average de	ensity of the WAA stand. (Tree is	woody with over 3" Diarr	neter at Breast Height [DBH]).	
Decision:	_				
	The s	site is open land (non-for	rested).		
C				!Subindex:	0.000
Comments.					
V _{m;d} : The average/mear	n coverage of the midstory (shrub	/sapling) layer in the WA	4A.		
Decision:	7	" I diam for	2 B		
	ine s	ite is open land (non-ton	rested).		
Comments:				Subindex:	0.100
Commente.					
V _{herb} : The average/mea	an coverage of the herbaceous lay	/er in the WAA.			
Decision:	Harbassaus	the MAA everage			
		/er in the waa averages	S Detween 5-30%.		
Comments:				!Subindex:	1.000
V _{detritus} : The amount of Decision	detritus on the WAA (The A-horiz	on has to have a Munse	I value of 4 or less).		
Decision.					
	Greater than 85%	4 of the area possesses	an Oor A horizon		
	Greater than 85%	% of the area possesses	an OorA horizon.		1 000

Contraction of the local division of the loc

-month

pplicant:	M <u>C-68Se</u>	nna	waa id:	WAA4	WAA Acreage:	1,060
V,ed₀x: The amount	of the WAA that exhi	bits redox features as	an indication o	f the chemical exchange	9.	
Decision:						
		Redox f	features less tha	an 20%.		
					subindex:	0.100
comments:						
50 ^m . The absorpti	ve properties of the s	oils in the WM.				
ecision:						
The WAA is do	minated by montmoril	llonitic clayey soils (cla	ay, clay loams, s	silty clay loams) or soils	with high organic (211, 212,	or 311).
					subindex:	1.000
omments:						
· Number o	f habitat types within	600 feet of the perime	ter of the W/AA			
Habitat	to be counted has to i	be at a minimum 5% c	of the size of the	W/AA		
nabitat						
Habitat -	Types: Forested	J	s	hrub/Sapling		ר
	Herbace	ous/Prairie/Abandone	ed Ag Field A	ctive Ag Field		ĺ
	Open W	ater	V	/elland		1
	Mudflat		La	awn		1
ecision:						
		Wetland plus four hal	bitats and/or su	rrounded by forested.		
					ISubindex:	0.750
omments:					ioubindex.	0.750
unctional Capaci	ty Indices (FCI) and	Units (FCU=FCI*WAA	A Acreage)		Pre-FCI	Pre-FC
emporary Storage	& Detention of Stora	ge Water	M 0F			
[(vdur•	Vfreq) A 0.5 • ((Vtopo	+ Vcwa + Vwooa) / 3)	JI A U.5		0.60	0.633
laintain Plant & Ar	nimal Community					
Wtree +	Vcwd + Vrich + I(Vh:	asal + Vdensity) / 2) +	[(Vmid + Vherh)	/ 2] + Vconnect) / 6	0.62	0 654
(1.001					1 0.02	1 0.004
emoval & Seques	trian of Elements & C	Compounds				
(Vwood -	+Vfreq +Vdur + [(Vtopo	+ Vowd + Vwood) / 3] +	[(Vdetritus + Vrec	lox +Vsorpt) / 3]) / 5	0.56	0.594

Riverine Forested HGM (Interim) Assessment Pre-Impacts

Applicant: _____

WAA ID: _____

WAA5

WAA Acreage: 0.820

Vdu: Percent of the WAA that is flooded and/or ponded due to the hydrology (i.e. flooding overbank flow) of the nearby waterway. Decision:

In an average year, at least 50-79% of the WAA either floods and/or ponds for at least 7 consecutive days.

ISubindex: 0.500

0.500

0.400

0,000

0.100

ISubindex:

subindex:

Comments:

V_{1.0} Frequency that the WAA is flooded and/or ponded by the nearby waterway. Decision:

68-;acreMC____

Floods or ponds 2 out of 5 years (100-year floodplain).

Comments:

 $V_{10_{D}0}$. Roughness associated with the WAA.

Decision:

Less than 15% of the WAA is represented by dips, hummocks, channel sloughs, and/or other topographic features.

Comments:

V_{cwd}: Coarse Woody Debris within the WAA. Decision:

Area is open land (pasture or cropland)

!Subindex:

Comments:

 $V_{\!\scriptscriptstyle W} \varpi_{\!\scriptscriptstyle d}$: Percentage of the WAA that is covered by woody vegetation.

Decision:

0-10% of the WAA is covered with woody vegetation.

ISubindex:

Comments:

Decision:

_)

V, •: The percentage of the trees in the WAA that are mast producers.

The area is open land (non-forested).

Subindex: 0.100

Comments:

	Interim	HGM	for	MC-68	Sienna:	Forested	WAAs
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Applicant:	68 <u>-асеМ</u> С	WAA ID:	WAA5	WAA Acreage:	0.820
V,ich: The diversity of	f the species within the WAA. (To b	e considered the species	s must comprise at least	t 5% of the stand.)	
Decision:	The	area is open land (pop-fr	prested)		
				ISubindex:	0.000
Comments:					0.000
V _{basa} ,: The average/n Decision	nean basal area of the trees in the	WAA per acre.			
	The	site is open land (non-fo	rested).		
Commonto				!Subindex:	0.000
Comments:					
V _{denslt} v: The average	density of the WAA stand. (Tree is	woody with over 3" Diar	neter at Breast Height [I	DBH]).	
Decision:			<i>(</i>))		
	Ine	site is open land (non-fo	rested).	e diades.	0.000
Comments:				sudindex:	0.000
Vmld The average/m	ean coverage of the midstory (shru	b/sapling) layer in the W	AA.		
Decision:	The	site is onen land (non-fo	rested)		
				Subindex:	0 100
Comments:					0.100
		,	•		
V _{herb} : The average/m	nean coverage of the herbaceous la	ayer in the WAA.			
Decision:	Herbaceous c	over in the W/AA average	s between 5-30%		
			3 between 5-50%.	ISubindex:	1 000
Comments:					1.000
			- H		
Decision:	of detritus on the WAA (The A-nori	zon has to have a muns	ell value of 4 or less).		
	Greater than 85	% of/he area possesses	s an O or A horizon.		
				ISubindex:	1.000
Comments:					

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	68 <u>-aαe</u> ⊒M <u>C</u> WAA ID:	WAAS	WAA Acreage:	0.820
/,edox: The amount of the V	VAA that exhibits redox features as an indication	on of the chemical exchar	nge.	
Decision:				
	Redox features les	s than 20%.		
			Subindex:	0.100
Comments:				
/,on1 The absorptive prop	erties of the soils in the WAA.			
Decision:				
The WAA is dominated	by montmoril/onitic clayey soils (clay, clay loan	ns, silty clay loams) or so	oils with high organic (211, 212,	or 311).
			ISubindex:	1.000
Comments:				
Number of habitat	times within 600 fact of the perimeter of the M	/ ^ ^		
vconnect: Number of habitat Habitat to be co	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o	IAA. f the WAA		
<u>vconnect:</u> Number of habita Habitat to be co Habitat Types:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested	/AA. f the WAA IShrub/Sapling	x x	
v <u>connect:</u> Number of habita Habitat to be co Habitat Types:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field	/AA. f <i>the WAA</i> Shrub/Sapling Active Ag Field	X	
v _{connect:} Number of habita Habitat to be co Habitat Types:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water	/AA. f <i>the WAA</i> Shrub/Sapling Active Ag Field Wetland	x x	
v _{connect:} Number of habita Habitat to be co Habitat Types:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat	/AA. <i>f the WAA</i> Shrub/Sapling Active Ag Field Wetland Lawn	x x	
vconnect: Number of habita Habitat to be cc Habitat Types: Decision:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat	/AA. <i>fthe WAA</i> Shrub/Sapling Active Ag Field Wetland Lawn	x x	
v _{connect:} Number of habita Habitat to be cc Habitat Types: Decision:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water [Mudflat] Wetland plus one other habitat type	/AA. <i>f the WAA</i> Shrub/Sapling Active Ag Field Wetland Lawn <i>c or two other habitat type</i>	x x	
v _{connect:} Number of habita Habitat to be co Habitat Types: Decision:	t types within 600 feet of the perimeter of the W winted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat Wetland plus one other habitat type	/AA. <i>f the WAA</i> Shrub/Sapling Active Ag Field Wetland Lawn <i>t</i> Lawn <i>t</i> Lawn	x x s. ISubindex:	0.500
Vconnect: Number of habita Habitat to be co Habitat Types: Decision: Comments:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat Wetland plus one other habitat type	/AA. f the WAA Shrub/Sapling Active Ag Field Wetland Lawn to or two other habitat type	x x	0.500
v _{connect:} Number of habita Habitat to be cc Habitat Types: Decision: Comments:	t types within 600 feet of the perimeter of the W sunted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat Wetland plus one other habitat type	/AA. <i>f the WAA</i> Shrub/Sapling Active Ag Field [Wetland [Lawn <i>t Lawn</i> <i>t Lawn</i>	x x	0.500
v _{connect:} Number of habita Habitat to be co Habitat Types: Decision: Comments:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat Wetland plus one other habitat type	/AA. <i>f the WAA</i> Shrub/Sapling Active Ag Field Wetland Lawn <i>c or two other habitat type</i>	x x	0.500
Vconnect: Number of habita Habitat to be co Habitat Types: Decision: Comments:	t types within 600 feet of the perimeter of the W winted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat Wetland plus one other habitat type	/AA. <i>f the WAA</i> Shrub/Sapling Active Ag Field Wetland Lawn <i>t Lawn</i>	x x s. ISubindex:	0.500
Vconnect: Number of habita Habitat to be co Habitat Types: Decision: Comments:	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat Wetland plus one other habitat type :es (FCI) and Units (FCU=FCI*WAA Acreage)	/AA. <i>f the WAA</i> Active Ag Field Wetland Lawn <i>c or two other habitat type</i>	x x es. ISubindex: Pre-FCI	0.500 Pre-FC
Vconnect: Number of habita Habitat to be co Habitat Types: Decision: Comments: Functional Capacity Indio Femporary Storage & Dete	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat Wetland plus one other habitat type wetland plus one other habitat type type (FCI) and Units (FCU=FCI*WAA Acreage) ntion of Storage Water	AA. fthe WAA Shrub/Sapling Active Ag Field Wetland Lawn e or two other habitat type	x x es. ISubindex: Pre-FCI	0.500 Pre-FC
Vconnect: Number of habita Habitat to be co Habitat Types: Decision: Comments: Functional Capacity India Femporary Storage & Dete [(Vdur • Vfreq) A	t types within 600 feet of the perimeter of the W unted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat <i>Wetland plus one other habitat type</i> <i>Wetland plus one other habitat type</i> 	AA. fthe WAA Shrub/Sapling Active Ag Field Wetland Lawn to or two other habitat type	x x es. ISubindex: Pre-FCI	0.500 Pre-FC
Viconnect: Number of habita Habitat to be co Habitat Types: Decision: Comments: Functional Capacity Indio Femporary Storage & Dete [(Vdur • Vfreq) & Maintain Plant & Animal Co	t types within 600 feet of the perimeter of the W winted has to be at a minimum 5% of the size o Forested Herbaceous/Prairie/Abandoned Ag Field Open Water Mudflat Wetland plus one other habitat type Wetland plus one other habitat type stion of Storage Water .0.5 • ((Vtopo + Vcwd + Vwood) / 3)] ^ 0.5	/AA. <i>f the WAA</i> Shrub/Sapling Active Ag Field Wetland Lawn <i>c or two other habitat type</i>	x x 	0.50 Pre-F(0.313

Removal & Sequestrian of Elements & Compounds (Vwood + Vfreq + Vdur + [(Vtopo + Vowd + Vwood) / 3] + [(Vdetritus + Vredox +Vsorpt) / 3]) / 5

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0.42 | 0.3444

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Table 4 Functional Assessment Variable Scores	

	Wetland			Vdur	Vtreq	Vt,po	Vcwd	Vwood	Vtree	Vrich	Vbasal	Vdensity	Vmid	Vherl>	Vconnect	Vdetritus	Vredox	Vsorpt
WAAID	ID{s}	T:tJ e	Acreage															-
WAAI	Wet A	PFO	1.00	0.75	0.S	1	0.3	0.75	0.3	0.6	1.0	1.0	0.25	1	1.0	1.0	0.1	1.0
WAA2	WetA	PFO	5.64	.075	0.75	0.7	0.5	0.75	0.8	0.8	1.0	1.0	0.25	0.5	1.0	1.0	0.1	1.0
WAA3	WetC&D	PFO	1.71	0.75	0.5	0.4	0.5	0.75	0.5	0.6	1.0	1.0	0.5	0.5	0.75	1.0	0.1	1.0
WAA4	WetB	PEM	1.06	0.75	0.5	0.4		0.1					0.1	1	0.75	1.0	0.1	1.0
WAAS	WetE	PEM	0.82	0.5	0.4	0.1		0					0.1	1.0	0.75	1.0	0.1	1.0

v