Intermediate Marsh WVA

For determining marsh impacts for the St. Tammany Parish (Project), the Intermediate Marsh WVA methodology was selected as the most appropriate evaluation tool. Described below are the assumptions used to determine fresh and intermediate marsh baseline and FWOP and FWP projections for the proposed project area for direct and indirect impacts.

Fresh and intermediate marsh consists of six variables:

1. Percent of wetland area covered by emergent vegetation;
2. Percent of open water area covered by aquatic vegetation;
3. Marsh edge and interspersion;
4. Percent of open water area < 1.5 feet deep, in relation to marsh surface:
5. Mean high salinity during the growing season (March through November): and
6. Aquatic organism access

General Assumptions

The period of analysis expands from 2031 (TY0) to 2082 (TY50), with TY0 representing baseline conditions. In determining future with-project conditions, all project-related direct (construction) impacts were assumed to occur in Target Year 1.

Marsh impacts evaluated included direct permanent impacts to the project features (Figure 1). Note direct temporary (staging) areas were assumed to be permanent impacts because they would be reused for multiple lift. Impacts to Big Branch Marsh National Wildlife Refuge (BBMNWR) were evaluated separately from other impacts. Direct impacts to BBMNWR were evaluated for completeness. However, the Service requires any direct impacts associated with the project that occur on refuge lands to be swapped for the lands that are not impacted. With a land swap for direct impacts, BBMNWR will only have indirect impacts to pine savannah since there were no indirect impacts to marsh as determined by the hydraulics and hydrology (H&H) modeling.

Figure 1: St Tammany Project Features.

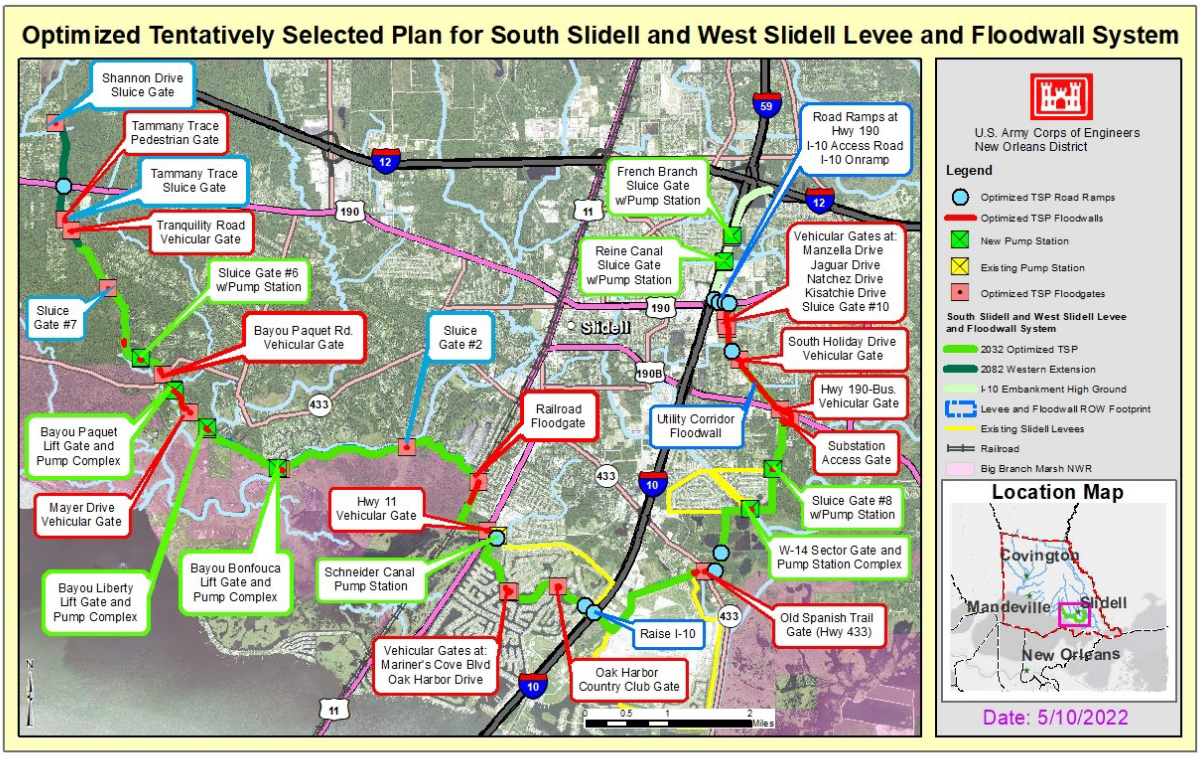

Table 1 and Table 2 list the marsh WVAs developed for all impacts.

Table 1. Table List of Total Direct Impact Wetland Value Assessments.

MARSH PRIVATE Lands			
Impact Area	**Habitat Type Impacted**	**WVA Model**	**Number of models**
Direct Permanent	Marsh	Intermediate	1
BBMNWR Direct Permanent	Marsh	Intermediate	1
Total Number of Model Runs with 3 RSLR			**6**

Temporary impacts are assumed to initially last approximately 5 years, though some areas may be restored earlier. For simplicity we will assume impacts for the full 5 years. The area is assumed to be cleared at the start of construction. After use for construction laydown and staging areas the area would be allowed to re-seeded naturally from surrounding marsh vegetation. After the 5 year use of temporary areas, it is assumed that temporary areas would be reused for future levee lifts. Thus with the expected re-occurring use to temporary areas, the

HET assumed the temporary staging areas would be lost permanently due to use over time and to compression and compaction and because they would not be restored to match pre-existing marsh conditions. All temporary marsh impacts, therefore, were included in the permanent impacts assessment.

Target Years (TYs) for Permanent impacts for FWOP and FWP include TY0, TY1, TY40, and TY50. TY40 represents RSLR impacts for both FWOP and FWP.

Target years are as follows:
FWOP Permanent Direct Impacts TYs – TY0, TY1, TY40, and TY50
FWP Permanent Direct Impacts TYs – TY0, TY1, TY40, and TY50

Land Loss/ Sea level Rise Effects
Land loss rates estimated by the Service were adjusted by the projected effects of the low, intermediate, and high relative sea level rise (RSLR) scenario for these analyses. The land loss rate for the North Shore Marshes was used (-0.46% per year for the period 1985-2016) based on USGS data for the extended project boundary (North shore marshes, total 1 11,383.9 acres). An average accretion rate of 0.75 mm/year was used for this site (0.75 mm/yr from Tchefuncte River, Nyman et al., 2006).

Sea level rise (SLR) estimates were calculated using the USACE's Sea-Level Calculator (SLC). The closest long-term (Aug 1957 to July 2002) gauge to the project area is Gauge 85575: Lake Pontchartrain at Mandeville. The USACE curves are computed using criteria in EC 1165-2-212 for high, intermediate, and low rates. The low, intermediate, and high SLR curve (gauge 85575) was used as appropriate for all SLR estimates.

Based on the USACE's SLC, an estimated subsidence rate of 4.9 mm/yr from the Lake Pontchartrain at Mandeville (gauge 85575) was used for RSLR estimates. The eustatic sea level rise was assumed to be 1.7 mm/yr.

Variable V1 Percent Emergent Marsh

<u>Direct Permanent Impacts:</u>
Persistent emergent vegetation (i.e., emergent marsh) plays an important role in coastal wetlands by providing foraging, resting, and breeding habitat for a variety of fish and wildlife species; and by providing a source of detritus and energy for lower trophic organisms that form the basis of the food chain. An area with no emergent vegetation (i.e., shallow open water) is assumed to have minimal habitat suitability in terms of this variable, and is assigned an SI of 0.1. Optimal vegetative coverage (i.e., percent marsh) is assumed to occur at 60-80 percent (SI=1.0).

Assume all water acres are associated with marsh habitat.

FWOP

Future percent marsh acres were determined using the Marsh Impact Mitigation (MIM) spreadsheet as is the standard procedure. MIM calculates loss of marsh while accounting for RSLR and accretion.

Variable V2 Submerged Aquatic Vegetation

Few standard conventions have been adopted for V2 FWOP and FWP projections. SAV cover is generally assumed to decrease under FWOP conditions as marsh loss continues, areas become deeper, and fetch increases as open water areas become larger.

Direct Permanent Impacts:

FWOP

Marsh site visits were conducted in mid July 2021 just prior to when Submerged Aquatic Vegetation (SAV) coverage would be at its peak density. It can be assumed that maximum coverage is achieved at the end of a growing season (late summer-early fall). A visual estimate of SAV coverage was taken at each transect line. Conditions are expected to remain constant through target years TY0 and TY1. Coverage is expected to decrease by TY40 by half with a continued decrease in coverage by TY50 based on the change in shallow open water to deeper water and increased wave fetch. In addition, sea level rise predications and a slight increase in salinity could result in degradation of SAV.

TY0 and TY1 – 23% SAV
TY40 – 12% SAV
TY50 – 5% SAV RSLR deepening water.

Variable V3 Marsh edge and interspersion

This variable takes into account the relative juxtaposition of marsh and open water for a given marsh**:**water ratio.

Direct Permanent Impacts:

FWOP- Interspersion classes were determined utilizing aerial imagery (see Figures 1-3 for examples) and site data collected during site visits. With minimal land loss expected in this area even with SLR, baseline is a class 1 and reduces to a class 2 in 50 years.

FWOP

TY0 and TY1 is a class 1
TY40 and TY50 is a class 2

FWP

Habitat would be removed for structure footprint

Figure 1. Marsh interspersion on St Tammany Project Big Branch Marsh National Wildlife Refuge land. Blue lines represent levee footprint and orange lines represent staging areas.

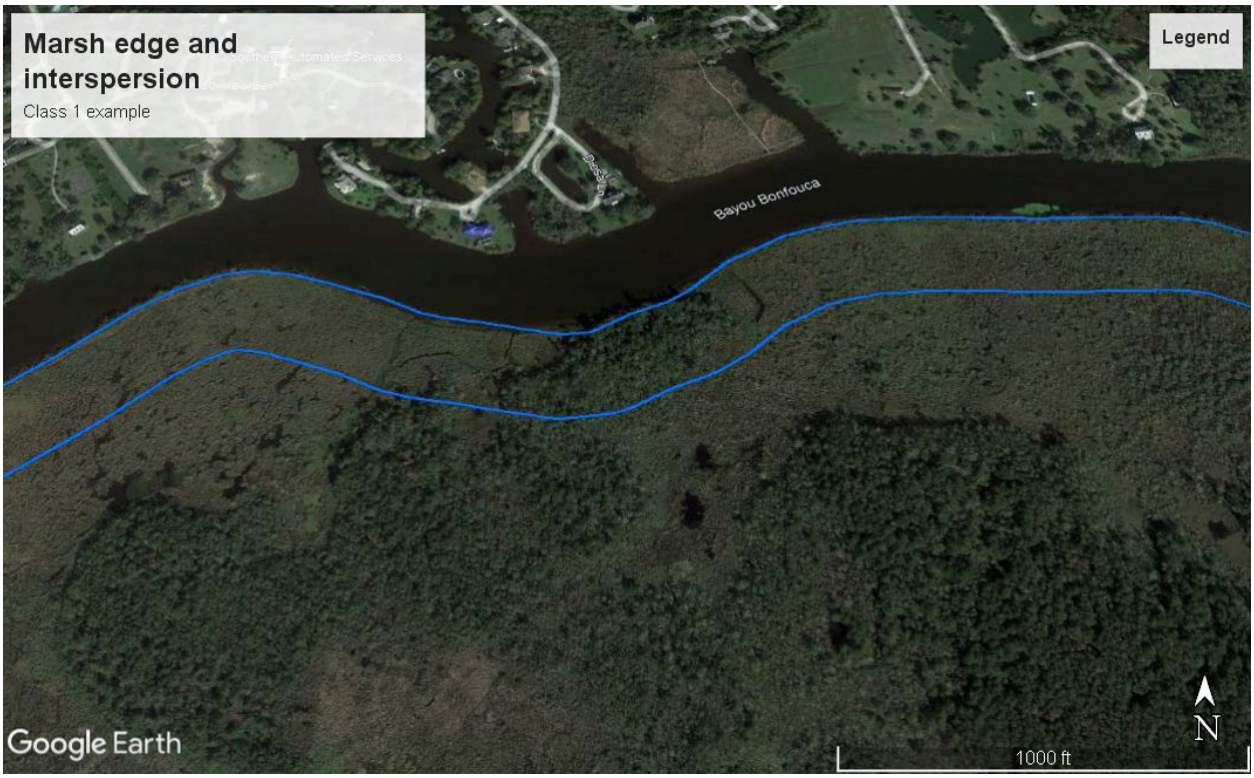

Figure 2. Marsh interspersion on St. Tammany Project Bid Branch Marsh National Wildlife Refuge land. Blue lines represent levee footprint and orange lines represent staging areas.

Figure 3. Marsh Interspersion on St. Tammany Project Private lands. Blue lines represent levee footprint and orange and purple lines represent staging areas.

Variable V4 Percent Open Water ≤ 1.5 ft

<u>Direct Permanent and Temporary Impacts:</u>
FWOP- Marsh site visits were conducted on 15 July 2021. Water depths were measured using a water depth staff gauge and recorded to a tenth of a foot. Water elevations were adjusted to the CRMS0006 hydrostation datum (NAVD88; Geoid 12A). Using the adjusted field data, the percent of open water less than or equal to 1.5 feet was calculated for TY0.

Using the CWPRRA standard procedure for calculating shallow open water projections, TY40 and TY50 bottom elevations were estimated by applying 40 and 50 years of subsidence (-0.8ft at TY40 and -0.6ft at TY50) to all TY0 bottom elevations. Subsidence of 4.9 mm/yr was determined by using the USACE's Sea-Level Calculator, Lake Pontchartrain at Mandeville gauge 85575. The subsidence rate (4.9mm/yr) was converted to the TY40 and TY50 values in ft.

Baseline (TY0) shallow open water was 11% and was applied to both TY0 and TY1. With SLR and marsh loss, the percent was assumed to decrease to 0% by TY40, and remained 0% through TY50.

<u>Direct Permanent Impacts</u>

FWOP
TY0 and TY1 – 11% SOW
TY40 and TY50 – 0% SOW

FWP
Habitat would be removed for structure footprint

Variable V5 Salinity

Existing or Baseline Salinity
The project features are located north of Lake Pontchartrain where the primary influence is freshwater from residing downstream of local rivers and bayous as well as saltier tidal influence coming from Lake Pontchartrain. Lake Pontchartrain salinities are increased through the Rigolets which is an outlet to Lake Borgne and Chandeleur Sound. Previously there were additional openings that were closed to help prevent saltwater intrusion and storm surge. These included the Mississippi River Gulf Outlet (MRGO), closed in 2009; the Inner Harbor Navigation Canal-Lake Borgne Surge Barrier (surge barrier), closed in 2010; and the Seabrook floodgate complex, completed in 2012. Since these closures, average salinities and salinity spikes have been reduced in the Pontchartrain basin and the project area. Salinities seemed to have leveled out by 2014. Therefore baseline salinity estimates were based on nearby Coastwide Reference Monitoring System (CRMS) station salinities from 2014-2021.

The area of impact presently contains fresh and intermediate marsh, which will be permanently impacted by project construction. See Figure 5 for referenced CRMS station locations. The closest CRMS station to the project features is CRMS 3667. This station was compromised by an adjacent CWPPRA marsh creation site that breached its containment dikes and flooded the CRMS gauge with sediment making the station's readings unreliable for recent years. CRMS 0006 was thought to be too greatly influenced by lake Pontchartrain while all the project features were further inland. CRMS 4406 and 4407 were also reviewed but had higher salinities due to the bayou Rigolets connection to Lake Borgne. In all 11 surrounding CRMS stations were evaluated to determine the most appropriate stations for salinity.

CRMS 2854 was used as the main station for determining average growing season salinities and salinity projections. CRMS 2854 has been collecting continuous hourly salinities since September 2007 to the present and is in close proximity to the project area. Salinity data from March 2014 to October 2021 was analyzed to determine the mean salinity during growing season (March to November). The analysis yielded **1.3 ppt**. This data was projected forward to year 2031 to represent the TY0 baseline salinity. See below for an explanation on salinity projections. TY0 salinity, projected forward to 2032, is **1.47ppt**.

Table 2. CRMS 2854 Growing Season Average Salinity from 2014 to 2021.

Growing Season Average Salinity	
Year	**Salinity (ppt)**
2014	**1.8**
2015	**2.4**
2016	**0.9**
2017	**0.8**
2018	**1.1**
2019	**0.7**
2020	**1.2**
2021	**1.2**
Overall Avg	**1.3**

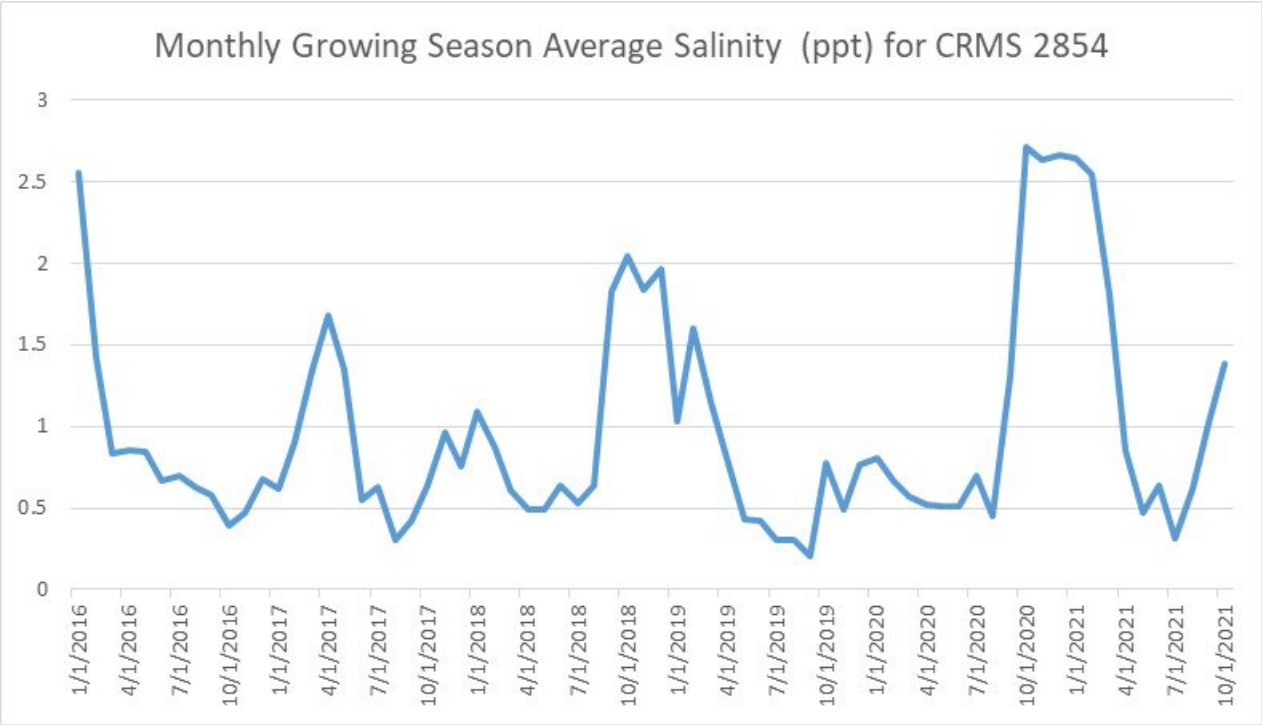

Figure 4. CRMS 2854 Monthly Growing Season Average Salinity (ppt) from 2014 to 2021.

<u>Future Salinity Projections:</u>

In the future, saltwater increases are expected due to continued land loss associated with RSLR. One may get a sense of future salinities by looking at Gulfward salinity monitoring sites as a proxy for future salinities at a more inland site. To project the salinity values the HET used the data from CRMS 0006 as the Gulfward gauge (figure 5).

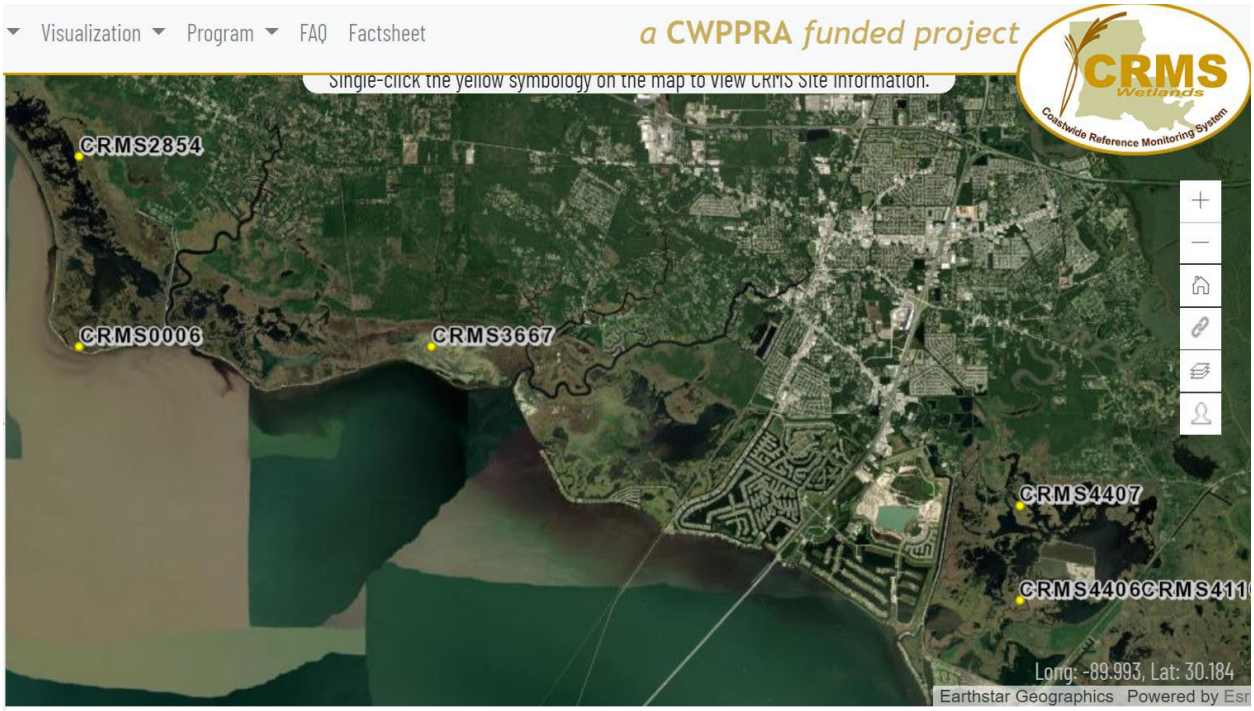

Figure 5. CRMS stations reviewed for St. Tammany Project.

Sea level rise (SLR) estimates were calculated using the USACE's Sea-Level Calculator (SLC). The closest long-term (Aug 1957 to July 2002) gauge to the project area is Gauge 85575: Lake Pontchartrain at Mandevilee. The USACE curves are computed using criteria in EC 1165-2-212 for high, intermediate, and low rates. The intermediate SLR curve (gauge 85575) was used for future salinity projections.

By using the CRMS Gulfward salinity data and the USACE's SLC (gauge 85575) future salinity projections were estimated to increase to **1.68 ppt** by TY50.

<u>Direct Permanent Impacts:</u>
FWOP
TY0 – 1.47 ppt
TY1 –1.48 ppt
TY40 – 1.66 ppt
TY50 – Salinity will increase to 1.68 ppt.

FWP
Habitat would be removed for structure footprint.

Variable V6 Fish Access

<u>Direct Permanent Impacts:</u>
FWOP – The project area are not currently impounded or hydrologically controlled by any structures. It is assumed that aquatic organisms have full access to sites. All FWOP scenarios

were assumed to have an "A" structure rating (open system), and it was assumed that 100% of the wetland would be accessible by all access points.

FWP - Habitat would be removed for project footprint.

Intermediate Marsh WVA Results

See Table 4 for a summary of resulting Annual Average Habitat Unit (AAHUs) and net acres direct and indirect impacts at the end of the period of analysis (year 50) for the three RSLR scenarios for the Intermediate marsh of the St. Tammany Parish Project.

Table 3. St Tammany Parish Project Annual Average Habitat Unit (AAHUs) and Net Marsh acres for the Intermediate Marsh Direct and Indirect Impact areas for the Low, Intermediate, and High Relative Sea Level Rise (RSLR).

LOW RSLR		
FRESH/INTERMEDIATE MARSH	Acres	AAHUS
Private Direct Permanent	-23.9	-21.4
BBMNWR Direct Permanent	-50.8	-40.18
Total	-51	-40
INTERMEDIATE RSLR		
FRESH/INTERMEDIATE MARSH	Acres	AAHUS
Private Direct Permanent	-11.1	-14.4
BBMNWR Direct Permanent	-28.8	-33.13
Total	-40	-48
HIGH RSLR		
FRESH/INTERMEDIATE MARSH	Acres	AAHUS
Private Direct Permanent	0.0	-10.6
BBMNWR Direct Permanent	0.0	-19.77
Total	0	-30