Grand-White Lake Land Bridge Protection Project
(PME-18)

(To Prevent the Coalescence of Grand/White Lakes)

Candidate Project for the Ninth Priority Project List
of the
Coastal Wetlands Planning, Protection and Restoration Act

Candidate Project Information Sheet
for
Wetland Value Assessment

Proposed by

U. S. Fish and Wildlife Service
La. Department of Natural Resources
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Vermilion Parish

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Candidate Project Wetland Value Assessment Information Sheet

Project Area

The land bridge is located between Grand and White Lakes in Vermilion and Cameron Parishes. Although the land bridge is contained within both parishes, the project components are wholly within Cameron Parish. The project is located in the western area of the land bridge and includes that area between the northern portion of Collicon Lake and the eastern portion of Grand Lake. The project area consists of 451 acres (29 %) of fresh marsh, a small amount (< 1%) of bottomland shrub/scrub, and 1,079 acres (71%) of water for a total area of 1,530 acres (1998/90 National Wetlands Research Center, National Biological Survey Habitat Type map data).

Land Bridge Issues and Problems

Collicon Lake (3,000 ac) is in imminent danger of breaching (< 500 ft) into the eastern portion of Grand Lake. The 13,281 acre Grand-White Lake Land Bridge area consists of 67% fresh marsh (8,935 acres) and 33% water (4,346 acres). There have been little landscape changes in this area since 1956 with the exception of an increase in open water. The Grand-White Lake Land Bridge has experienced shoreline erosion caused by wind driven waves and high water levels along the SE shoreline of Grand Lake (15 mi NW fetch), the SW portion of White Lake (15 mi SE fetch) and the W shoreline of Collicon Lake (2 mi SE fetch). The Grand Lake eastern shoreline is less than 500 ft from breaching into Collicon Lake. Should this breach occur, the size of Grand Lake will increase by over 4,800 acres and the size of the land bridge will be reduced by 2 miles (11,000 ft). About 40% of the land bridge would be lost to the open waters of Grand Lake if this breach occurs. If this breach should occur, the 17 mile Grand Lake NW fetch will come to bear on the fragile eastern and northern shorelines of Collicon Lake. The small strip of marsh separating Collicon and Round Lakes would also be lost and the entire 1,530 ac project area will become part of Grand Lake. Shoreline erosion would accelerate in the marsh between the former Collicon Lake and Alligator Lake and Lake le Bleu which will also be in jeopardy of being converted to the open waters of Grand Lake.

Historic Land Bridge Loss Rates

Table 1 shows historic Land Bridge land loss rates (Dunbar et al. 1992). Table 2 predicts that

the whole Coast 2050 land bridge planning unit will loose 14% of its land in the next 50 years (from 1990 to 2050) at a rate of 0.23%/yr.

Table 1: Land Bridge Mapping Unit Land Loss Rates (% per yr)

Year	**1932-56**	**1956-74**	**1974-83**	**1983-90**
Land Bridge Mapping Unit	0.26 %/yr (560 ac)	0.66 %/yr (990 ac)	0.26 %/yr (175 ac)	0.24%/yr (120 ac)

Table 2 Future Land Bridge Loss Projections to 2050

Year	**1990 ac**	**2050 ac**	**% change**
Land Bridge Mapping Unit	7,090 ac of marsh	6,065 ac	- 14 % (0.23 %/yr) (- 1,025 ac)

Table 3 Salinity/Habitat Trends

	1949 Habitat		1968/74		1990	
Habitat	Fresh Marsh	Open Water	Fresh Marsh	Open Water	Fresh Marsh	Open Water
Land Bridge Mapping Unit	63%	37%	56%	44%	53%	47%

Table 4: Grand White Lake Land Bridge Project (PME-18) Marsh Widths and Shoreline Loss Rates

Transect	1956 (ft)	1978 (ft)	1988/ 90 (ft)	*1994 (ft)	1999 (projected)	56/78 loss (ft/yr)	56/90 loss (ft/yr)	56/94 loss (ft/yr)	78/90 loss (ft/yr)	78/94 loss (ft/yr)	90/94 loss (ft/yr)	Average Among Years
1	2551	2609?	1719	1905?	1771	+2.6 ?	-24.5	-17?	-74.2	-44?	+46.5?	
2	1900	1807	1309	1503?	1368	-4.2	-17.4	-10.4?	-41.5	-19?	+48.5?	
3	2306	2217	1976	1554	1419	-4.1	-9.7	-19.8	-20	-41.4	-105.5	-33.42
4	2847	2029	1695	1592	1457	-37.2	-33.9	-33	-27.8	-27.3	-25.8	-30.83
5	2118	1507	1384	1252	1117	-27.8	-21.6	-22.8	-10.3	-15.9	-33	-21.9
6	1974	1026	1082?	640	505	-43	-26.2	-35.1	+4.7?	-24	-110.5	-39.02
7	2382	1145	1274?	970	835	-56.3	-32.6	-37.2	+10.8?	-10.9	-76	-33.7
8	1574	850	731	710	575	-32.9	-24.8	-22.7	-9.9	-8.8	-5.3	-17.4
9	1405	926	573	547	412	-21.8	-24.5	-22.6	-29.4	-23.7	-6.5	-21.42
10	2328	1804	1305	928	793	-23.8	30.1	-36.8	-41.6	-54.7	-94.3	-36.85
Avg. All Sta's	**2334 ft**	**1790 ft**	**1305 ft**	***1160 ft**	**1025**	**-24.8 ft/yr**	**-24.5 ft/yr**	**-25.7 ft/yr**	**-23.9 ft/yr**	**-26.9 ft/yr**	**-36.2 ft/yr**	**-29.3 ft/yr**
[1]Sta 4-10						**-34.6**	**-27.7**	**-30**	**-14.8**	**-23.6**	**-50.2**	

Note: The two 1994 shoreline width outliers (transects 1 and 2) should be noted. Averages for 1994 were calculated with two outliers omitted. [1] Average for Transects 4 to 10 between Grand and Collicon Lakes only. 1999 shoreline widths were calculated by applying the 78/94 loss rate of -26.9 ft/y to the 1994 widths and projected to 5 years.

Table 5: Average Shoreline Erosion Rates for Southeastern Grand and Western Collicon Lakes

Time Periods	Transects 4 to 10 (ft/yr)	All Transects (ft/yr)
1956/78	-34.6	-24.8
1956/1990	-27.7	-24.5
1978/1990	-14.8	-23.9
1956/1994	-30	-25.7
1978/1994	-23.6	-26.9 (recommended rate)
1990/1994	-50.2	-36.2
Unweighted Average	-30.2	-27

Project Features

1. Hard Shoreline Stabilization -

Install 11,000 ft (2.1 mi) of hard shoreline stabilization at the SE shore of Grand Lake from a point approximately 1,000 ft (0.2 mi) north of the Old Intracoastal Waterway (GIWW) to a point even with the Round Lake northern shoreline. The hard shoreline protection will be either segmented rock breakwaters or "X-shaped-A-JACKS-like" concrete material. The project will be incrementalized into two subprojects; Increment 1 equals the rock breakwaters and Increment 2 consists of the "A-JACKS-like" concrete material. Both increments will have the terrace component described below.

2. Linear Terraces -

Install two 9,240 ft rows of linear terraces along the NW shore of Collicon Lake. Construct about 74 - 200 ft long X 10 ft wide at the top (82 ft wide at base) terraces with 50 ft gaps between terraces (total of 74 gaps). 37 terraces and gaps will be constructed in each of two rows parallel to the shoreline. The total terrace length will be 13,860 ft (6,930 ft in each of 2 rows) plus 4,620 ft (2,310 ft in each row) of gaps. The first row will be located approximately 50 ft from the shoreline in about 2.5 ft of water; the second row will be approximately 200 ft lakeward of the first row in about 3.5 ft of water. Thus the area covered by the terraces and gaps in the rows and between terraces will be approximately 64 acres in the NW portion of Collicon Lake. The terrace tops will be vegetated with Seashore paspalum (*Paspalum vaginatum*) in two rows of gallon

containers on 5 ft centers. The terrace slide slopes will be vegetated with Bullwhip (*Scirpus californicus*) in four offset rows of gallon containers on 10 ft centers. Two rows will be in the water and two will be above the water line.

3. Maintenance -

At year 2, 25% of the rock (or "A-JACKS-like" material) and vegetation will be replaced. At year 10, 50% of the terraces (if necessary) will be replaced and revegetated. At year 15, an additional 10% of the rock (or A-JACKS) will be replaced.

The soils (firm bottoms) and water depths (1 - 4 ft deep to > 500 ft from shore) are favorable for terraces or dedicated dredging in Collicon Lake as well as for hard shoreline stabilization along the eastern shoreline of Grand Lake.

A field test of the 2-foot long A-Jacks was performed along the eastern shoreline of Grand Lake on September 30, 1999. The A-Jacks were stacked two high with only 4 inches of subsidence noted in the bottom unit.

Wetland Value Assessment Variables

VI Emergent Vegetation

Existing Conditions

The 1,530 acre project area consists of 451 acres (29%) of fresh marsh and shrub/scrub (< 1%) and 1,079 acres (71%) of open water. Most of the open water is over 2 ft deep and located within the northern half of Collicon Lake. The marsh is dominated by Bulltongue (*Sagittaria lancifolia*) (71%), with traces of rattle box (*Sesbania drummondii*), Chinese Tallow (*Sabium sebiferum*), elephant ear (*Colocasia esculenta*), Louisiana iris (*Iris giganticerulea*), hibiscus (*Hibiscus lasiocarpus*), and swamp lily (*Hymenocallis occidentalis*).

Marsh Type - Fresh Marsh
Project Area - 451 ac fresh marsh and shrub/scrub; 1,079 water; 1,530 ac total area.

We recommend using the 1978/1994 shoreline erosion rate of -26.9 ft/yr which takes into account data from all 10 transects. Rationale for this choice is below.

Table 6: Shoreline Erosion Rate Rationale

1.	The most recent rate (90/94; -36.2 ft/yr) contains some high rates and has two outliers (transects 1 and 2).
2.	It is recommended that we use the next most recent rate (78/94; -26.9 ft/yr).
3.	The next latest rate (78/90; -23.9 ft/yr) contains the transect 1 outlier from 1978 and 1990 has outliers 6 and 7.
4.	Recalculating the 78/90 rate removing the outliers, the rate becomes -25.8 ft/yr.
5.	The 78/94 rate is -26.9; if outliers 1 and 2 are removed, the rate also becomes -25.8 ft/yr.
6.	The rate of -26.2 ft/yr could be used; it is the weighted average of the 56/90 transects 1-3 (-17.2 ft/yr) and the 56/94 transect 4-10 (-30 ft/yr).
7.	The 56/94 rate is -25.7 ft/yr. If the outliers (1, 2) are removed, the rate becomes -28.8 ft/yr.
8.	Use -30 ft/yr (56/94 for 4-10) for the area covered by transects 4-10 (70 % of the shoreline) and -17.2 ft/yr (56/90 for 1-3) for the area covered by transects 1-3 (30% of the shoreline).

V1 Emergent Vegetation (Cont.)

1a. Future Without Project

Assumptions: Assume a breakthrough of Grand Lake into Collicon Lake at TY 15 (see Table 7 below) for the area between transects 4 and 10. This will cause much of the marsh between Grand and Collicon Lakes to be lost by TY 15 and will begin to increase the shoreline erosion rates on the northern and eastern portions of Collicon Lake. As the shoreline erodes at transect areas 6 and 9, it will apply increased erosive pressure on transect areas 3, 4, 5, 7, 8 and 10 by increasing erosion on the northern and southern sides of these "islands." The initial breaks can easily occur earlier than at TY 15. If the 56/94 shoreline erosion rate (-28.8 ft/yr) is used, breakthroughs would occur 1 to 2 years earlier than indicated below. Table 7 shows an estimate of projected years to breakthrough at various transects between the narrow marsh area between Grand and Collicon Lakes.

Table 7: Projected Grand Lake Breakthrough into Collicon Lake

Transect	**1999 Marsh Width**	**Marsh Remaining in 20 years (-26.9 ft./yr)**	**Year of Breakthrough**	**Breakthrough Target Year**
1	1771	1233	2065	66
2	1368	830	2050	51
3	1419	881	2052	53
4	1457	919	2053	54
5	1117	579	2041	42
6	**505**	**-33**	**2018**	**19**
7	835	297 (probably 0)	2030 (or sooner)	31
8	575	37 (probably 0)	2020 (or sooner)	21
9	**412**	**-126**	**2014**	**15**
10	793	255 (probably 0)	2028 (or sooner)	29
Average	1025 ft			

1a. Future Without Project

The project shorelines have been separated into four areas:

(A) the Grand-Collicon Lake shoreline (**-26.9 ft/yr**) (1978/94 average rate) (note this includes the western Round Lake shore),

(B) the northern and eastern portion of Collicon Lake (**- 9 ft/yr** before TY 15 and -18 ft/yr after breakthrough), and

(C) the south, east and northern Round Lake shoreline (**-5.7 ft/yr** before TY 17 and -11.4 ft/yr after breakthroughs of Collicon and Round Lake).

Area Shoreline Erosion Rates:

A. Grand-Collicon Lake rate = -26.9 ft/yr (= 78/94 rate, see Table 6 above)
B. Northern and Eastern Collicon Lake rates = - 9 ft/yr before TY 15 (= 1/3 of -26.9 ft/yr), and -18 ft/yr after breakthrough at TY 15 (2 X -9 ft/yr = - 18 ft/yr)
C. Round Lake rate = -5.7 ft/yr before breakthrough (= 33.3% of the Grand Lake shoreline rate at Round Lake = 33.3% of -17.1 ft/yr = -5.7 ft/yr); -11.4 ft/yr (2 X -5.7 ft/yr) after TY 15, the anticipated date of Collicon Lake breakthrough into Round Lake.

Marsh = 451 acres (29%)
Water = 1079 ac (71%)
Total = 1530 ac

TY 0 (Baseline)

Marsh = 451 ac (29%)

TY 1

Area A (E. Grand L. = W. Round L.) -26.9 ft X 11,000 ft =	-6.8 ac
Area B (Collicon N and E). -9 ft/yr X 11,550 ft =	-2.4 ac
Area C (Round N, S, & E). -5.7 ft/yr X 8,580 ft =	-1.12 ac
SubTotal	-10.32 ac

451 - 10.3 = 441/1530 = 29% marsh

TY 2 to TY 15

(Breakthrough Between Grand and Collicon Lakes and

Collicon and Round occurs at TY 15)

Area A (E Grand & W Round L). -26.9 ft X 11,000 ft X 14 yrs =	-95.1 ac
Area A breakthrough at TY 15 (Grand L.). Loss of all 30 remaining acres (6,000 ft X 220 ft = 30 ac), 220 ft is the projected width of a 6,000 ft length of the land bridge at TY 15	-30 ac
Area B (Collicon N & E). -9 ft/yr X 11,550 ft X 14 yrs =	-33.4 ac
Area C (Round N, S, & E). -5.7 ft/yr X 8,580 ft X 14 yrs =	-15.7 ac
SubTotal	-174 ac

441 - 174 = 267/1530 = 17% marsh

TY 16-TY 20

Area A (Grand L. at Round L.) 5,000 ft X 26.9 ft/yr X 5 yrs =	-15.4 ac
Area B (Collicon N & E). - 18 ft/yr X 11,550 ft X 5 =	-23.9 ac
Area C (Round N, S, & E). - 11.4 ft/yr X 8,580 X 5ft =	-11.2 ac
SubTotal	-51 ac

267 - 51 = 216/1530 = 14 % marsh

1b. Future with Project (Rock Segmented Breakwaters and Terraces)

Assumption: The rock segmented breakwaters will stop shoreline erosion and accrete some marsh along the eastern shoreline of Grand Lake and the terraces will stop shoreline erosion and accrete marsh along the western and northern shorelines of Collicon Lake. Minor erosion would continue on the eastern Collicon Lake and Round Lake shorelines.

Note: The planting effort includes 2 rows of seashore paspalum at the terrace tops and four rows of bullwhip on each terrace side. Therefore 100% of the exposed earthen terraced area will be viable marsh vegetation at TY 1.

FWP (Breakwaters Increment) TY 1

Area A (Grand L.). -0 ft X 11,000 ft =	- 0 ac
Area B (Collicon L. N) 0 ft X 3,300 ft =	- 0 ac
Area B1 (eastern Collicon L.) -9 ft/yr X 8,250 ft =	-1.7 ac

FWP (Breakwaters Increment) TY 1 (Cont.)

Area B2 (total revegetation of the terraced area)

2 rows 6,930 ft long X 40 ft top and sides (10 ft at top + 15 ft each side) 2 X 6,930 X 40 =	+12.7 ac
Terrace erosion (2 ft/ yr X 9,240 ft = 0.4 ac/yr)	-0.4 ac
Area C (entire Round L. shore). -5.7 ft/yr X 11,880 ft =	-1.6 ac
SubTotal	+9 ac

451 + 9 = 460/1530 = 30% marsh

FWP (Breakwaters Increment) TY 2-10

Assumption: By TY 10 marsh has accreted the 50 ft between the breakwaters and the Grand Lake eastern shore and between the 1st row of terraces and the western Collicon Lake shore.

Area A (Grand L. accretion). + 50 ft X 11,000 ft =	+ 12.6 ac
Area B (Collicon L. N) 0 ft X 3,300 ft =	- 0 ac
Area B1 (eastern Collicon L.) -9 ft/yr X 8,250 ft X 9 =	-15.3 ac
Area B3 (northern and western Collicon L. accretion; terraced area) 50 ft X 9,240 ft =	+10.6 ac
Terrace erosion (rate = 2 ft/yr) 2 ft X 9,240 ft X 9 =	-3.8 ac
Area D1 (between terraces) 25 ft X 6,930 =	+4 ac
Area D2 (from outer terrace shoreward to the borrow pit) 25ft X 6,930 =	+4 ac
Area C (entire Round L. shore). -5.7 ft/yr X 11,880 ft X 9=	-14.4 ac
SubTotal	-2.3 ac

460 - 2 = 458/1530 = 30% marsh at TY 10

FWP (Breakwaters Increment) TY 11-20

Area A (Grand L.). + 50 ft X 11,000 ft =	- 0 ac
Area B (Collicon L. N) 0 ft X 3,300 ft =	- 0 ac
Area B1 (eastern Collicon L.) -9 ft/yr X 8,250 ft X 10 =	-17 ac
Area B2 (northern and western Collicon L. accretion) 50 ft X 9,240 ft (terraced area) =	+0 ac
Area D (revegetation of 50 ft of the terraced area not including the 68 ft borrow area) 50ft X 6,930 =	+8 ac
Terrace erosion, 2 ft X 9,240 X 10 yrs	-4.2 ac
Area C (entire Round L. shore). -5.7 ft/yr X 11,880 ft X 10=	-15.5 ac
SubTotal	-29 ac

458 - 29 = 429/1530 = 28% marsh at TY 20

1c. Future with Project ("A-JACKS-like" Material and Terraces)

Assumption: The "A-JACKS-like" material will slow erosion by 85% along the eastern shoreline of Grand Lake. Therefore the Grand Lake erosion rate will be reduced 85% from - 26.9 ft/yr to -4 ft/yr. Assume that no Grand Lake emergent marsh accretion occurs between the A-JACKS and the shoreline. The terraces will stop shoreline erosion and accrete marsh along the western and northern shorelines of Collicon Lake. Minor erosion would continue on the eastern Collicon Lake shoreline and along the terraces as with the "breakwater" increment above.

FWP (A-JACKS Increment) TY 1

Area A (Grand L.). -4 ft X 11,000 ft =	- 1 ac
Area B (Collicon L. N) 0 ft X 3,300 ft =	- 0 ac
Area B1 (eastern Collicon L.) -9 ft/yr X 8,250 ft =	-1.7 ac
Area B2 (total revegetation of the terraced area) 2 rows 6,930 ft long X 40 ft top and sides (10 ft at top + 15 ft each side) 2 X 6,930 X 40 =	+12.7 ac
Terrace erosion (2 ft/ yr X 9,240 ft = 0.4 ac/yr)	-0.4 ac
Area C (entire Round L. shore). -5.7 ft/yr X 11,880 ft =	-1.6 ac
SubTotal	+8 ac

451 + 8 = 459/1530 = 30% marsh

FWP (A-JACKS Increment) TY 2-10

Assumption: By TY 10 no marsh has accreted between the A-Jacks and the Grand Lake eastern shore, but 50 ft has accreted between the 1st row of terraces and the northern and western Collicon Lake shore.

Area A (Grand L.). -4 ft X 11,000 ft X 9 yrs =	- 9 ac
Area B (Collicon L. N) 0 ft X 3,300 ft =	- 0 ac
Area B1 (eastern Collicon L.) -9 ft/yr X 8,250 ft X 9 =	-15.3 ac
Area B3 (northern and western Collicon L. accretion; terraced area) 50 ft X 9,240 ft =	+10.6 ac
Terrace erosion (rate = 2 ft/yr) 2 ft X 9,240 ft X 9 =	-3.8 ac
Area D1 (between terraces) 25 ft X 6,930 =	+4 ac
Area D2 (from outer terrace to borrow pit) 25ft X 6,930 =	+4 ac
Area C (entire Round L. shore). -5.7 ft/yr X 11,880 ft X 9=	-14.4 ac
SubTotal	-24 ac

459 - 24 = 435/1530 = 28% marsh at TY 10

FWP (A-JACKS Increment) TY 11-20

Area A (Grand L.). -4 ft X 11,000 ft X 10 yrs =	-10 ac
Area B (Collicon L. N) 0 ft X 3,300 ft =	- 0 ac
Area B1 (eastern Collicon L.) -9 ft/yr X 8,250 ft X 10 =	-17 ac
Area D (revegetation of 50 ft of the terraced area)	
50ft X 6,930 =	+8 ac
Terrace erosion, 2 ft X 9,240 X 10 yrs	-4.2 ac
Area C (entire Round L. shore). -5.7 ft/yr X 11,880 ft X 10=	-15.5 ac
SubTotal	-39 ac

435 - 39 = 396/1530 = 26% marsh at TY 20

V2 Aquatic Vegetation

Existing conditions

During March 11 and June 29, 1999 field trips, less than 5% coverage of submerged aquatics were observed along a band 50 ft in width along the Grand and Collicon Lake shorelines. Very few aquatics were observed in Collicon Lake just east of the SE Grand Lake shoreline during the July 9, 1999 helicopter flight. Round Lake, north of Collicon Lake had about 10% SAV's. The eastern land bridge lakes, closer to White Lake, had more aquatics. Grand Lac L'Huit consisted of > 50% aquatics. Turtle Lake, lying on the Old GIWW, had approximately 30 to 40% aquatics, mostly in the northern half. Other lakes in the land bridge, similar in size to Turtle Lake, had SAV coverage of about 10 %.

It is estimated that 2% of the open water in the Grand-Collicon Lake portion of the project area and 10% of Round Lake is covered in SAV's.

Grand Lake 50 ft X 11,000 = 13 ac @ 5% SAV's =	0.65 ac
Collicon Lake shore, 50 ft X 20,790 ft = 24 ac @ 5% SAV's =	1.2 ac
(W. & No. Collicon L. shore, 50 ft X 12,540 ft = 14 ac X 5% = 0.7 ac	
E. Collicon L. shore, 8,250 ft X 50 ft = 9 ac X 5% = 0.45 ac)	
Mid Collicon Lake = 709 ac @ 0% SAV's =	0.0 ac
Round Lake, 333 ac @ 10% SAV's =	33.3 ac
Total Acreage SAV's	35 ac

Total acreage of SAV's = 35 ac; 35/1079 ac water = 3.3% SAV's

Therefore, the baseline SAV coverage for the project equals 3.3%.

V2 Future Without Project SAV's

The Grand-Collicon Lake areas will remain at nominal (0.2%) SAV's (1.8 ac SAV/746 ac water) until the projected breakthrough of Grand Lake into Collicon Lake occurs at TY 15. At this time, the SAV's in the Grand L. eastern shore and the western Collicon Lake shore will be reduced to 0%. This will reduce the SAV's within the Grand-Collicon Lake portion of the project area to virtually 0%. This will remove approximately 2 acres of SAV's from the 35 which will reduce the total project area SAV's to 3%.

TY 1 to TY 14 FWOP SAV's

Grand Lake 50 ft X 11,000 = 13 ac @ 5% SAV's =	0.65 ac
W. & No. Collicon L. shore, 50 ft X 12,540 ft = 14 ac X 5% =	0.7 ac
E. Collicon L. shore, 8,250 ft X 50 ft = 9 ac X 5% =	0.45 ac
Mid Collicon Lake = 709 ac @ 0% SAV's =	0.0 ac
10% of the 333 acre Round Lake area is in SAV's (33.3 ac)	33.3 ac
Total Project Area SAV's	35 ac

Total project SAV's = 35 ac (35/1079 ac = 3.3% SAV's) = 3.3%

3 % SAV's for the Project Area TY 1 - 14

TY 15 FWOP SAV's (Breakthrough occurs between Grand and Collicon Lakes)

Loss of 1.3 ac of SAV's at E. Grand and W. Collicon shorelines.	0 ac	
E. Collicon Lake SAV's remain =	0.5 ac	
Round Lake SAV's = 10% (0.1 X 333 ac = 33.3 ac)		33.3 ac
Total project SAV's =	34 ac	

SAV's at TY 15(34/1263) = 3%

TY 16-20 FWOP SAV's

TY 20 water = 1,079 ac + 235 ac (marsh converted to water) = 1,314 ac water

1. E. Grand - W. Collicon Lake SAV's =	0 ac
2. E Collicon L. SAV's = 0.3% (1 ac/957 ac water = 0.1%)	0 ac
3. Round Lake SAV's = 5% (0.05 X 333 ac = 17 ac)	17 ac
Total SAV's =	17 ac

4. Total Project SAV's = 1.3% (17 ac/1,314 ac = 1.3 %)

V2 Future With Project SAV's

TY 1 FWP SAV's (Breakwater Increment)

Grand-Collicon Lake region	2 ac
10% of the 333 acre Round Lake area is in SAV's (33.3 ac).	33.3 ac
Total SAV's	35 ac

Total project SAV's = 35 ac (35/1,070 ac = 3.3% SAV's) = 3.3%

= 3.3% SAV's for TY 1 FWP-Breakwaters Project Area

TY 1 FWP SAV's (A-JACKS Increment)

Grand-Collicon Lake region	2 ac
10% of the 333 acre Round Lake area is in SAV's (33.3 ac).	33.3 ac
Total SAV's	35 ac

Total project SAV's = 35 ac (35/1,071 ac = 3.3% SAV's) = 3.3%

= 3.3% SAV's for TY 1 FWP-A-JACKS Project Area

TY 10 FWP SAV's (Breakwater Increment)

Grand-Collicon Lake

Emergent vegetation accretion of the shallow water shorelines of eastern Grand Lake and western and northern Collicon Lake due to the project removes the ability for SAV's to grow in these areas due to lack of available shallow water.

Grand Lake 50 ft X 11,000 = 13 ac @ 5% SAV's =	0 ac
W. & No. Collicon L. shore, 50 ft X 12,540 ft = 14 ac X 5% =	0 ac
E. Collicon L. shore, 8,250 ft X 50 ft = 9 ac X 5% =	0.45 ac
Mid Collicon Lake = 709 ac @ 0% SAV's =	0.0 ac
68 ft of terraced area available (150 ft - 82 ft (borrow area) = 68 ft) will revegetate with SAV's; Terrace area = 9,240 ft X 68 ft = 14.4 ac	
Round Lake, 333 ac @ 10% SAV's =	33.3 ac
Total Acreage SAV's	48.15 ac

Total acreage of TY 10 (breakwater) SAV's = 48. ac; 48/1,068 ac water (4.5%) = 5% SAV's

Total Project area FWP (breakwater) SAV's at TY 10 = 5%

TY 10 FWP SAV's (A-JACKS Increment)

Emergent vegetation accretion of the shallow water shorelines of eastern Grand Lake is not proposed to occur under the A-JACKS increment, thereby leaving area for 0.7 acres of SAV's to develop. However, emergent vegetation accretion along western and northern Collicon Lake will occur which removes the ability for SAV's to grow in these areas.

Grand Lake 50 ft X 11,000 = 13 ac @ 50% SAV's =	6.5 ac
W. & No. Collicon L. shore, 14 ac accretion X 5% =	0 ac
E. Collicon L. shore, 8,250 ft X 50 ft = 9 ac X 5% =	0.45 ac
Mid Collicon Lake = 709 ac @ 0% SAV's =	0.0 ac
68 ft of terraced area available (150 ft - 82 ft (borrow area) =	
68 ft) will revegetate with SAV's; Terrace area = 9,240 ft X 68 ft =	14.4 ac
Round Lake, 333 ac @ 10% SAV's =	33.3 ac
Total Acreage SAV's	54.7 ac

Total acreage of TY 10 (A-JACKS) SAV's = 55 ac; 55/1,095 ac water (5%) = 5% SAV's

Total Project area FWP (A-JACKS) SAV's at TY 10 = 5%

TY 11 to TY 20 FWP SAV's (Breakwater Increment)

FWP caused accretion eliminates shallow water for SAV's along the eastern Grand Lake and western and northern Collicon Lakes.

Grand L. shore =	0 ac
E. Collicon L. shore, 8,250 ft X 50 ft = 9 ac X 5% =	0.45 ac
Mid Collicon Lake = 709 ac @ 0% SAV's =	0.0 ac
100% of the remaining unvegetated terraced area (18 ft X	
9,240 ft = 4 ac) will revegetate with SAV's	4 ac
Round Lake, 333 ac @ 10% SAV's =	33.3 ac
Total Acreage SAV's	37.75 ac

Total acreage of TY 20 (breakwater) SAV's = 38 ac; 38/1,097 ac water (3.44%) = 3% SAV's

Total Project area SAV's from TY 15 to TY 20 (Breakwater) = 3%

TY 11 to TY 20 FWP SAV's (A-JACKS Increment)

FWP caused accretion eliminates shallow water for SAV's along the western and northern Collicon Lakes, but not the eastern Grand Lake shore.

Grand Lake 50 ft X 11,000 = 13 ac @ 50% SAV's =	6.5 ac
E. Collicon L. shore, 8,250 ft X 50 ft = 9 ac X 5% =	0.45 ac
Mid Collicon Lake = 709 ac @ 0% SAV's =	0.0 ac
100% of the remaining unvegetated terrace area (18 ft X 9,240 ft = 4 ac) will revegetate with SAV's	4 ac
Round Lake, 333 ac @ 10% SAV's =	33.3 ac
Total Acreage SAV's	44 ac

Total acreage of TY 20 (A-JACKS) SAV's = 44 ac; 44/1,134 ac water (3.9%) = 4% SAV's

Total Project area SAV's from TY 15 to TY 20 (A-JACKS) = 4%

V3 Interspersion

Existing Conditions, Future Without Project, and Future With Project (with both the Breakwater and A-Jacks Increments).

100% Type 4

V4 Water Depth

Existing Conditions

Grand L. = 11,000 ft X 50 ft (< 1.5 ft deep) =	12.6 ac
Collicon L west = 7,260 ft X 50 ft =	8.3 ac
Collicon L. north and east = 11,550 ft X 50 ft =	13.3 ac
Round L. = 11,880 ft X 50 =	13.6 ac
Total Acres of shallow water =	48 ac

Total water area = 1,079 ac
Baseline % shallow water = 48 ac/1079 ac = 4 %

V4 Water Depth Future Without Conditions

TY 1 = 4 % (same as existing)

TY 15

By TY 15, the narrow land bridge between Grand and Collicon Lakes will be breaking up with an equal amount of deep and shallow water created. The deep water will be offset by shallow water created by the deterioration of the marshes in this area. Therefore, TY 15 = 4% shallow water.

TY 15 = 4 % shallow water

TY 20 =

Loose half of the original 48 acres of shallow water due to deepening of Round Lake and the shore of Collicon L. = 24 ac = 1.8 % (24 ac/1,314 ac = 1.8%). By TY 20, 235 ac of marsh will be lost to open water (1,079 + 235 = 1,314 ac).

TY 20 = 2 % shallow water

V4 Future With Project (Breakwater and A-JACKS Increments)

TY 1 (Breakwater)

Baseline shallow water =	48 ac
Shallow water created by terraces; (10 ft/side X 2 sides/terrace X 6,930 ft X 2 rows of terraces) =	6.4 ac
Total TY 1	54.4 ac

TY 1 (Breakwater Increment) = 5 % (54.4 ac shallow water; 54.4/1,070 ac = 5 %)

TY 1 (A-JACKS)

Baseline shallow water =	48 ac
Shallow water created by terraces; (10 ft/side X 2 sides/terrace X 6,930 ft X 2 rows f terraces) =	6.4 ac
Total TY 1	54.4 ac

TY 1 (A-Jacks Increment) = 5 % (54.4 ac shallow water; 54.4/1,071 ac = 5 %)

TY 10 (**Breakwater Increment)**

Shallow water between the shore and the breakwaters in Grand L. and the terraces in western

and northern Collicon Lakes will accrete to emergent vegetation due the project thereby converting this shallow water area from water to marsh. 25 ft of the open water within the terraced area (200 ft) will become shallow water by TY 5. Terrace area = 9,240 ft X 25 ft = ± 5.3 acres in shallow water by TY 10.

TY 10 FWP Shallow Water (Breakwaters) Calculations

Grand L. =	0 (all 12.6 ac of shallow water between breakwaters and shore accreted by TY 10)
Collicon L. west =	0 (all 8.3 ac of shallow water accreted bet. shore and 1st terrace)
Collicon L. north =	0 (all 3.8 ac of shallow water accreted bet. shore and 1st terrace)
Collicon L. east =	9 ac (8,250 ft X 50 ft)
Round L. =	13.6 ac
Terraced area =	5.3 ac (9,240 ft X 25 ft)
Terrace eroded area=	0.42 ac (- 2ft/yr X 9,240 ft = 0.42)
Total	32.12 ac

Total FWP (Breakwaters) Shallow Water (TY 10) = 32 ac = 3% (32/1,068 ac = 3%)

TY 10 FWP Shallow Water (A-JACKS Increment)

Accretion along Grand Lake is not claimed to occur with the A-Jacks increment, therefore the shallow water area will be available at TY 10.

TY 10 FWP Shallow Water (A-Jacks) Calculations

Grand L. =	21.6 ac (original 12.6 ac + 9 ac eroded; 11,000 X - 4 ft/yr X 9 yrs)
Collicon L. east =	9 ac
Round L. =	13.6 ac
Terraced area =	5.3 ac (9,240 ft X 25 ft)
Terrace eroded area =	3.8 ac (- 2ft/yr X 9,240 ft X 9 yrs = 3.8 ac)
Total	53.3 ac

Total FWP (A-Jacks Increment) Shallow Water (TY 10) = 53.3 ac

TY 10 (A-JACKS) Shallow water = 5 % (53.3/1,095 ac = 4.87%)

TY 11 to TY 20 FWP Water Depth (Breakwater Increment)

TY 20 FWP Shallow Water (Breakwaters) Calculations

Grand L. =	0 (all 12.6 ac of shallow water accreted by TY 10)

Collicon L. west =	0 (all 8.3 ac shallow water accreted)
Collicon L. north =	0 (all 3.8 ac shallow water accreted)
Collicon L. east =	9 ac (8,250 ft X 50 ft)
Round L. =	13.6 ac
Terraced area =	5.3 ac (9,240 ft X 25 ft)
Terrace eroded area =	4.2 ac (- 2ft/yr X 9,240 ft X 10 yrs = 4.2 ac)
Total	32.1 ac

The 31.7 ac of shallow water from TY 10 remains. No additional shallow water is accreted due the project except for that caused by an additional year of modest terrace erosion.

Total shallow water by TY 20 FWP = 32 ac, 32/1,097 = 2.9%

TY 20 FWP (Breakwaters) shallow water = 3%

TY 11 to TY 20 FWP Water Depth (A-Jacks Increment)

TY 20 FWP Shallow Water (A-Jacks) Calculations

Grand L. =	32.6 ac (original 12.6 ac + 20 ac eroded; 11,000 X - 4 ft/yr X 20 yrs = 20 ac)
Collicon L. west =	0 (all 8.3 ac shallow water accreted)
Collicon L. north =	0 (all 3.8 ac shallow water accreted)
Collicon L. east =	9 ac (8,250 ft X 50 ft)
Terraced area =	5.3 ac (9,240 ft X 25 ft)
Terrace eroded area =	4.2 ac (- 2ft/yr X 9,240 ft X 10 yrs = 4.2 ac)
Round L. =	13.6 ac
Total	64.7 ac

The 64.7 ac of shallow water from TY 10 remains. Additional shallow water is created through Grand Lake erosion (- 4 ft/yr) and terrace erosion (- 2 ft/yr). The amount of water available has increased by 39 ac (from 1,095 ac to 1,134 ac) due to erosion of marsh to water.

Total shallow water by TY 20 FWP (A-Jacks) = 65 ac, 65/1,134 = 5.7%

TY 20 FWP (A-JACKS) shallow water = 6%

V5 Salinity

Existing Conditions, FWOP and FWP

The area is presently a fresh marsh and the salinities rarely go above 1 ppt within the project

area.

V6 Aquatic Organism Access

Existing access value = 0.1

(Due to the presence of the Catfish, Schooner Bayou and Leland Bowman gates/locks. The project will not cause a reduction in the access of fisheries organisms present in Grand Lake to project marshes.)

FWOP = 0.1

(Due to the presence of the Catfish, Schooner Bayou structures)

FWP = 0.1

(Project components such as segmented breakwaters, A-JACKS and terraces with gaps will continue to allow fisheries organisms access to the project marshes, but the access value remains at the FWOP level of 0.1).

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Fresh/Intermediate Marsh

Project: Grand/White Lakes Landbridge Protection
Option A - Rock Breakwaters
Condition: Future Without Project

Project Area:
Fresh..... 1,530
Intermediate..

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 15 Value	TY 15 SI			
V1	% Emergent	29	0.36	29	0.36	17	0.25			
V2	% Aquatic	3	0.13	3	0.13	3	0.13			
V3	Interspersion	%		%		%				
	Class 1		0.20		0.20		0.20	0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	100		100		100		0.2	0.2	0.2
	Class 5									
V4	%OW <= 1.5ft	4	0.15	4	0.15	4	0.15			
V5	Salinity (ppt)									
	fresh	1	1.00	1	1.00	1	1.00	1.00	1.00	1.00
	intermediate									
V6	Access Value									
	fresh	0.10	0.37	0.10	0.37	0.10	0.37	0.37	0.37	0.37
	intermediate									
	Emergent Marsh HSI =		**0.42**	**EM HSI =**	**0.42**	**EM HSI =**	**0.34**			
	Open Water HSI =		**0.23**	**OW HSI =**	**0.23**	**OW HSI =**	**0.23**			

Project: Grand/White Lakes Landbridge Protection
FWOP

Variable		TY 20 Value	TY 20 SI	Value	SI	Value	SI			
V1	% Emergent	14	0.23							
V2	% Aquatic	1	0.11							
V3	Interspersion	%		%		%				
	Class 1		0.20					0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	100						0.2	0	0
	Class 5									
V4	%OW <= 1.5ft	2	0.12							
V5	Salinity (ppt)									
	fresh	1	1.00					1.00		
	intermediate									
V6	Access Value									
	fresh	0.10	0.37					0.37		
	intermediate									
	EM HSI =		**0.32**	**EM HSI =**		**EM HSI =**				
	OW HSI =		**0.21**	**OW HSI =**		**OW HSI =**				

Project: Grand/White Lakes Landbridge Protection

FWOP

Variable										
		Value	SI	Value	SI	Value	SI			
V1	% Emergent									
V2	% Aquatic									
V3	Interspersion	%		%		%				
	Class 1							0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4							0	0	0
	Class 5									
V4	%OW <= 1.5ft									
V5	Salinity (ppt)									
	fresh									
	intermediate									
V6	Access Value									
	fresh									
	intermediate									
		EM HSI =		EM HSI =		EM HSI =				
		OW HSI =		OW HSI =		OW HSI =				

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Fresh/Intermediate Marsh

Project: Grand/White Lakes Landbridge Protection
Option A - Rock Breakwaters
Condition: Future With Project

Project Area:
Fresh..... 1,530
Intermediate..

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 10 Value	TY 10 SI			
V1	% Emergent	29	0.36	30	0.37	30	0.37			
V2	% Aquatic	3	0.13	3	0.13	5	0.15			
V3	Interspersion	%		%		%				
	Class 1		0.20		0.20		0.20	0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	100		100		100		0.2	0.2	0.2
	Class 5									
V4	%OW <= 1.5ft	4	0.15	5	0.16	3	0.13			
V5	Salinity (ppt)									
	fresh	1	1.00	1	1.00	1	1.00	1.00	1.00	1.00
	intermediate									
V6	Access Value									
	fresh	0.10	0.37	0.10	0.37	0.10	0.37	0.37	0.37	0.37
	intermediate									
	Emergent Marsh HSI =		**0.42**	**EM HSI =**	**0.42**	**EM HSI =**	**0.42**			
	Open Water HSI =		**0.23**	**OW HSI =**	**0.23**	**OW HSI =**	**0.24**			

Project: Grand/White Lakes Landbridge Protection
FWP

Variable		TY 20 Value	TY 20 SI	Value	SI	Value	SI			
V1	% Emergent	28	0.35							
V2	% Aquatic	3	0.13							
V3	Interspersion	%		%		%				
	Class 1		0.20					0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	100						0.2	0	0
	Class 5									
V4	%OW <= 1.5ft	3	0.13							
V5	Salinity (ppt)									
	fresh	1	1.00					1.00		
	intermediate									
V6	Access Value									
	fresh	0.10	0.37					0.37		
	intermediate									
	EM HSI =		**0.41**	**EM HSI =**		**EM HSI =**				
	OW HSI =		**0.23**	**OW HSI =**		**OW HSI =**				

Project: Grand/White Lakes Landbridge Protection

FWP

Variable							
		Value	SI	Value	SI	Value	SI
V1	% Emergent						
V2	% Aquatic						
V3	Interspersion	%		%		%	
	Class 1						
	Class 2						
	Class 3						
	Class 4						
	Class 5						
V4	%OW <= 1.5ft						
V5	Salinity (ppt)						
	fresh						
	intermediate						
V6	Access Value						
	fresh						
	intermediate						
		EM HSI =		EM HSI =		EM HSI =	
		OW HSI =		OW HSI =		OW HSI =	

0	0	0
0	0	0
0	0	0
0	0	0

AAHU CALCULATION - EMERGENT MARSH

Project: Grand/White Lakes Landbridge Protection
Option A - Rock Breakwaters

Future Without Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	451	0.42	187.28	
1	441	0.42	183.13	185.21
15	267	0.34	91.58	1893.61
20	216	0.32	70.02	403.19
			AAHUs =	**124.10**

Future With Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	451	0.42	187.28	
1	460	0.42	193.71	190.49
10	458	0.42	192.87	1739.61
20	429	0.41	175.63	1841.93
			AAHUs	**188.60**

NET CHANGE IN AAHUs DUE TO PROJECT		
A. Future With Project Emergent Marsh AAHUs	=	188.60
B. Future Without Project Emergent Marsh AAHUs	=	124.10
Net Change (FWP - FWOP) =		**64.50**

AAHU CALCULATION - OPEN WATER

Project: Grand/White Lakes Landbridge Protection
Option A - Rock Breakwaters

Future Without Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	1079	0.23	246.75	
1	1089	0.23	249.03	247.89
15	1263	0.23	288.82	3764.99
20	1314	0.21	279.93	1422.55
			AAHUs =	271.77

Future With Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	1079	0.23	246.75	
1	1070	0.23	245.58	246.16
10	1072	0.24	258.71	2269.27
20	1101	0.23	250.86	2548.50
			AAHUs	253.20

NET CHANGE IN AAHUs DUE TO PROJECT		
A. Future With Project Open Water AAHUs	=	253.20
B. Future Without Project Open Water AAHUs	=	271.77
Net Change (FWP - FWOP) =		**-18.57**

TOTAL BENEFITS IN AAHUs DUE TO PROJECT		
A. Emergent Marsh Habitat Net AAHUs	=	64.50
B. Open Water Habitat Net AAHUs	=	-18.57
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1		**37.70**

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Fresh/Intermediate Marsh

Project: Grand/White Lakes Landbridge Protection
Option B - A-Jacks
Condition: Future Without Project

Project Area:
Fresh..... 1,530
Intermediate..

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 15 Value	TY 15 SI			
V1	% Emergent	29	0.36	29	0.36	17	0.25			
V2	% Aquatic	3	0.13	3	0.13	3	0.13			
V3	Interspersion	%		%		%				
	Class 1		0.20		0.20		0.20	0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	100		100		100		0.2	0.2	0.2
	Class 5									
V4	%OW <= 1.5ft	4	0.15	4	0.15	4	0.15			
V5	Salinity (ppt)									
	fresh	1	1.00	1	1.00	1	1.00	1.00	1.00	1.00
	intermediate									
V6	Access Value									
	fresh	0.10	0.37	0.10	0.37	0.10	0.37	0.37	0.37	0.37
	intermediate									
	Emergent Marsh HSI =		**0.42**	**EM HSI =**	**0.42**	**EM HSI =**	**0.34**			
	Open Water HSI =		**0.23**	**OW HSI =**	**0.23**	**OW HSI =**	**0.23**			

Project: Grand/White Lakes Landbridge Protection
FWOP

Variable		TY 20 Value	TY 20 SI							
V1	% Emergent	14	0.23							
V2	% Aquatic	1	0.11							
V3	Interspersion	%		%		%				
	Class 1		0.20					0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	100						0.2	0	0
	Class 5									
V4	%OW <= 1.5ft	2	0.12							
V5	Salinity (ppt)									
	fresh	1	1.00					1.00		
	intermediate									
V6	Access Value									
	fresh	0.10	0.37					0.37		
	intermediate									
	EM HSI =		**0.32**	**EM HSI =**		**EM HSI =**				
	OW HSI =		**0.21**	**OW HSI =**		**OW HSI =**				

Project: Grand/White Lakes Landbridge Protection

FWOP

Variable							
		Value	SI	Value	SI	Value	SI
V1	% Emergent						
V2	% Aquatic						
V3	Interspersion	%		%		%	
	Class 1						
	Class 2						
	Class 3						
	Class 4						
	Class 5						
V4	%OW <= 1.5ft						
V5	Salinity (ppt)						
	fresh						
	intermediate						
V6	Access Value						
	fresh						
	intermediate						
		EM HSI =		EM HSI =		EM HSI =	
		OW HSI =		OW HSI =		OW HSI =	

0	0	0
0	0	0
0	0	0
0	0	0

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Fresh/Intermediate Marsh

Project: Grand/White Lakes Landbridge Protection
Option B - A-Jacks
Condition: Future With Project

Project Area:
Fresh..... 1,530
Intermediate..

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 10 Value	TY 10 SI			
V1	% Emergent	29	0.36	30	0.37	28	0.35			
V2	% Aquatic	3	0.13	3	0.13	5	0.15			
V3	Interspersion	%		%		%				
	Class 1		0.20		0.20		0.20	0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	100		100		100		0.2	0.2	0.2
	Class 5									
V4	%OW <= 1.5ft	4	0.15	5	0.16	5	0.16			
V5	Salinity (ppt)									
	fresh	1	1.00	1	1.00	1	1.00	1.00	1.00	1.00
	intermediate									
V6	Access Value									
	fresh	0.10	0.37	0.10	0.37	0.10	0.37	0.37	0.37	0.37
	intermediate									
	Emergent Marsh HSI =		**0.42**	**EM HSI =**	**0.42**	**EM HSI =**	**0.41**			
	Open Water HSI =		**0.23**	**OW HSI =**	**0.23**	**OW HSI =**	**0.24**			

Project: Grand/White Lakes Landbridge Protection
FWP

Variable		TY 20 Value	TY 20 SI	Value	SI	Value	SI			
V1	% Emergent	26	0.33							
V2	% Aquatic	4	0.14							
V3	Interspersion	%		%		%				
	Class 1		0.20					0	0	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	100						0.2	0	0
	Class 5									
V4	%OW <= 1.5ft	6	0.17							
V5	Salinity (ppt)									
	fresh	1	1.00					1.00		
	intermediate									
V6	Access Value									
	fresh	0.10	0.37					0.37		
	intermediate									
	EM HSI =		**0.40**	**EM HSI =**		**EM HSI =**				
	OW HSI =		**0.24**	**OW HSI =**		**OW HSI =**				

Project: Grand/White Lakes Landbridge Protection

FWP

Variable							
		Value	SI	Value	SI	Value	SI
V1	% Emergent						
V2	% Aquatic						
V3	Interspersion	%		%		%	
	Class 1						
	Class 2						
	Class 3						
	Class 4						
	Class 5						
V4	%OW <= 1.5ft						
V5	Salinity (ppt)						
	fresh						
	intermediate						
V6	Access Value						
	fresh						
	intermediate						
		EM HSI =		EM HSI =		EM HSI =	
		OW HSI =		OW HSI =		OW HSI =	

0	0	0
0	0	0
0	0	0
0	0	0

AAHU CALCULATION - EMERGENT MARSH

Project: Grand/White Lakes Landbridge Protection
Option B - A-Jacks

Future Without Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	451	0.42	187.28	
1	441	0.42	183.13	185.21
15	267	0.34	91.58	1893.61
20	216	0.32	70.02	403.19
			AAHUs =	**124.10**

Future With Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	451	0.42	187.28	
1	459	0.42	193.29	190.28
10	435	0.41	178.09	1670.78
20	396	0.40	157.44	1676.88
			AAHUs	**176.90**

NET CHANGE IN AAHUs DUE TO PROJECT		
A. Future With Project Emergent Marsh AAHUs	=	176.90
B. Future Without Project Emergent Marsh AAHUs	=	124.10
Net Change (FWP - FWOP) =		**52.80**

AAHU CALCULATION - OPEN WATER

Project: Grand/White Lakes Landbridge Protection
Option B - A-Jacks

Future Without Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	1079	0.23	246.75	
1	1089	0.23	249.03	247.89
15	1263	0.23	288.82	3764.99
20	1314	0.21	279.93	1422.55
			AAHUs =	271.77

Future With Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	1079	0.23	246.75	
1	1071	0.23	245.81	246.28
10	1095	0.24	266.09	2303.04
20	1134	0.24	268.92	2675.43
			AAHUs	261.24

NET CHANGE IN AAHUs DUE TO PROJECT		
A. Future With Project Open Water AAHUs	=	261.24
B. Future Without Project Open Water AAHUs	=	271.77
Net Change (FWP - FWOP) =		**-10.53**

TOTAL BENEFITS IN AAHUs DUE TO PROJECT		
A. Emergent Marsh Habitat Net AAHUs	=	52.80
B. Open Water Habitat Net AAHUs	=	-10.53
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1		**32.37**