Little Lake Shoreline Protection/Dedicated Dredging near Round Lake

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

Proposed by

National Marine Fisheries Service

and

Louisiana Department of Natural Resources

Wetland Value Assessment

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Project Information Sheet Format for Wetland Value Assessment

Project Name: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake

Sponsoring Agency: National Marine Fisheries Service
EnvWG contact - Rachel Sweeney 225/389-0508
EngWG contact - Rachel Sweeney 225/389-0508

Project Area: 1374 acres
- Area A: 1074 acres
- Area B: 94 acres (boundary determined by anticipated extent of area to be lost due to shoreline erosion)
- Area C: 206 acres (boundary determined by anticipated extent of area to be lost due to shoreline erosion)

Problem:
Shoreline erosion and wetland loss in the Little Lake mapping unit resulted in the loss of approximately 53% of the 1932 acreage by 1990. The high wetland loss rate in this area is generally caused by shoreline erosion, subsidence, and channel construction which results in altered hydrology. It is projected that an additional 14,000 acres will be lost in this mapping unit by 2050 (Coast 2050, Appendix D).

Goals:

Marsh Creation:
Create 488 acres of intertidal elevation suitable for the establishment of vegetated wetlands at TY1
Create 143 acres of vegetated emergent marsh at TY3
Create 466 acres of vegetated, emergent marsh at TY5
Reduce FWOP loss rate of 1.785%/yr by 50%

Marsh Nourishment:
Maintain 508 acres of marsh at TY5
Maintain 444 acres of marsh at TY20
Reduce FWOP loss rate of 1.785%/yr by 50%

Prevent shoreline erosion

Project Features:
<u>Shoreline Protection</u>
Installation of 20,620 feet of shoreline protection(geotextile encapsulated lightweight aggregate core capped with rock) in open water, generally along the -2 contour, with a crest elevation approximately 2 feet above mean water. The shoreline protection will include offset gaps with a 10-foot base width every 1,000 feet to provide adequate drainage and marine organism access. Material

generated by access/floatation dredging (± 404,000 cy) may be used beneficially; however, no credit is included in this WVA for such acreage.

Marsh Creation and Nourishment

In Area A, material will be dredged from Little Lake to create and nourish marsh. For marsh creation, dredged material will be placed to intertidal elevations in approximately 90% of the 2001 open water acres to create approximately 488 acres of intertidal elevation. Approximately 10% of the existing interior open water will not be filled to maintain selected features such as tidal creeks and ponds. Additionally, six-12 inches of dredged material will be placed over 532 acres of existing marsh for marsh nourishment. Retention dikes will be constructed as required to provide containment along the perimeter of the project area where existing marsh, spoil banks, etc., will not adequately contain the material. Internal low-level training dikes may also be used to direct the flow of dredged material. All dikes will be gapped prior to demobilization by the dredging contractor. Due to the large size of the marsh creation area, only limited vegetative plantings (± 50 acres) will be used in areas determined to lack vegetative source material. No credit is incorporated into the WVA for these plantings.

Monitoring Information:

Shoreline Protection

- *Freshwater Bayou (ME-04)* was completed in 1995. Erosion occurred at all six reference area sites, averaging 6.54 ft/yr over a 14.5 month period. Along the project area shoreline, progradation of the vegetated edge occurred at 15 of the 27 sites, erosion occurred at 8 sites, and no change was observed at 4 sites. Overall the shoreline prograded at an average rate of 2.34 ft/yr.
- *Cameron Prairie Refuge (ME-09)* shoreline data indicates the spoil bank erosion rate was -3.76 ft/yr between March 1995 and May 1997 in the reference area which is located directly east of the project area. The shoreline in the project area prograded at a rate of _4.61 ft/yr. Change in shoreline position in the project area ranged from +23 ft to +2 ft. as compared to reference area shoreline change from -19 ft. to -3 ft.
- *Boston Canal (TV-09*) rock breakwaters have completely halted shoreline erosion behind the structures and have accumulated sediments. Analysis of 11 elevation profile from 1994 overlaid with the 1995 profiles indicate that approximately 1.5 to 4.5 ft of sediment were deposited between the breakwater and the existing shoreline. Greater gains were documented adjacent to the bayward breakwaters.
- To date, *Turtle Cove (PO-10)* has achieved protecting the shoreline and appears to have promoted deposition behind the gabion. The shoreline has prograded +3.36 ft/yr behind the gabion, and sediment elevation increased 0.26 ft/yr. Land area increased 5.78 ac.
- *Fresh water Bayou Bank Protect (T/V-11)*- no specific conclusion on breakwater performance can be made at this time due to the absence of post construction data. Partial structure failure has resulted making maintenance necessary.
- *Bayou Segnette Wetlands (BA-16)*- no statically based conclusions on project effects on shoreline erosion. Reported many severely eroded portions existed where the rock berm was bordered only by open water.

- *Baie De Chactas (BA-05c)*- averaged -7 ft/yr pre-project between 1951 to 1990 (north shore Lake Salvador). Post construction of an oyster shell berm indicated subsequent breaching and reinitiation of shoreline recession. In 1995, the presence of the shell berm could no longer be detected. Salinity measurements averaged 0.2 ppt.
- *Lake Salvador Phase II (BA-15)* - creation of emergent elevations behind the continuous rock breakwater were successful based on as-built inspection immediately post construction and annually since construction. The created elevations were colonized soon after placement (during construction), with lesser vegetation present where large quantities of shell were present in the dredged sediment. Target elevations were too high and not strictly enough enforced during construction resulting in the creation of some uplands and shrub/scrub wetlands.

Marsh Creation

- 1 year post-construction
  - *Queen Bess (BA-05b)*- showed 28% coverage after 8 months post construction with some plantings conducted.
  - *BBWW (BA-19)* showed 0% cover
  - *Atchafalaya Sediment Delivery* showed 49% cover
  - *Lake Chapeau* showed 0% cover
- 2 years post-construction
  - *BBWW (BA-19)* showed 0% cover

- 3 years *Bayou LaBranche (P0-17)* 51% emergent marsh (82% land)
- Hydroperiod data at LaBranche showed greater flooding duration inside vs the reference area likely due to the containment dikes and unauthorized maintenance of closures were breaches had formed.

Historical and present vegetative community

Project area marshes have been historically classified as both intermediate (1949) and fresh (1956). Between the 1950's and 1970's, project area marshes had shifted to higher salinity communities, and were classified as intermediate to brackish. More recent habitat analyses classify Area A as intermediate, and Areas B and C as brackish. We do note that at each year of habitat classification, project area marshes are on or near the line of demarcation between habitat types. Observations from the July 12, 2001 interagency site visit suggest that all three areas are similarly dominated by *Spartina patens* with consistent, but less dominant occurrences of *Distichlis spicata* and *Juncus roemerianus*. Based on field observation it appears that Areas A, B, and C are essentially the same habitat types.

Based on historical salinity data, and anticipated effects of the Davis Pond Freshawater Diversion porject, the intermediate model will be used to conduct the WVA.

Soil types in the project area

Project area soils are Lafitte-Clovelly.

Land loss data

Marsh acreage and land loss rates - Area A

Marsh Acreage

The data and analyses provided by the COE and USGS regarding marsh acreage and land loss rates reveals several inconsistencies. The pertinent results of the COE and USGS analyses are summarized in Tables 1 and 2. (Note that the "marsh acreage" data in Table 1 has been transformed into "% marsh" to ease comparison between the two data sources because the COE's analysis was performed for a 1040 acre project area while USGS's analysis was conducted for a project area of 1,073 acres; the raw data and analyses are attached in Appendix A).

Table 1 – Comparison of COE and USGS estimates of "marsh acreage." Note that information has been transformed into percent marsh to ease comparison due to slightly different project boundaries used in each analysis. Original data included in Appendix A.

		"1950's"	1956	1974	1978	1983	1988/ 1990	1990	1993
% of area classified as marsh or land	COE	99%		90%		90%		87%	
	USGS		97%		86%		48%		60%

Regarding marsh acreage in Area A, both COE and USGS data summarized in Table 1 indicate consistent estimates for marsh acreage from the 1950s to mid 1970s. However, major discrepancies are evident in comparing the two data sets for the 1980s and 1990s, with Corps data consistently indicating much higher marsh acreage than those estimated by the USGS analyses. Inspection of both 1995 aerial infrared photographs and the 1998 DOQQs indicates that Area A contains significantly less marsh than the COE's 1990 estimate of 87% marsh. In order to determine the relative accuracy of the 1988/90 and 1993 estimates provided by USGS, the GIS images for the 1988/90 habitat classification and 1993 land/water analysis were copied onto transparencies, and overlaid on the 1995 photography as well as the 1998 DOQQs. Both the 1988/90 habitat analysis and the 1993 land/water analysis appear relatively consistent with the 1995 and 1998 images of Area A. Inspection of the 88/90 analysis does indicate that some areas classified as open water in 1988/90 remain as marsh on the 1995 and 1998 images. Experience in interpreting the 1988/90 imagery and resultant analyses have led to a common understanding that in many cases, the 1988 imagery produces an artificially high estimate of water areas and consequently, a skewed estimate of marsh acres. Comparison of the 1993 land/water analysis to the 1995 and 1998 images shows a good correlation. Noting that various marsh classes are the only "land" classes in Area A (except for .07% of the area which was classified as Shrub/Scrub), we propose to use the "land" acreage value of 644 acres from USGS's 1993 land to water analyses as the basis for determining the 2001 acreage of marsh in Area A.

Land Loss Rates

The discrepancies between the COE and USGS data sets also result in significant differences in the land loss rates for Area A. Land loss rates calculated from the two data sets are summarized below in Table 2.

Table 2 – Comparison of land loss rates calculated from COE and USGS data

Period	1930's - 1950's	1950's - 1974	1956 - 1978	1974 - 1983	1978 - 1988/90	1983 - 1990	1978 - 1993
COE	0%/yr	0.38%/yr		0.01%/yr		0.28%/yr	
USGS			0.58%/yr		3.86%/yr		2.01%/yr

Based on our comparison of the 1978 analysis against the 1974 aerial photographs which indicate an excellent agreement between images and our analyses of the relative accuracy of the 1993 land to water analysis, we propose to use a land loss rate of 2.01%/yr (as derived from the 1978 and 1993 data) for Area A. This rate was determined based on two years which we believe the data sources and resultant analyses are most accurate. As a comparison, the estimated land loss rates for the Little Lake mapping unit, derived from the Coast 2050, Appendix D, are summarized in Table 3. Although the proposed loss rate of 2.01%/year is slightly higher than the overall rates for the entire Little Lake mapping unit, the land loss maps clearly indicate that some of the loss in this mapping unit in concentrated in the vicinity of the project area.

Table 3 - Land loss rates calculated for the Little Lake Mapping Unit; derived from Coast 2050, Appendix D.

Period	1932-1956	1956 - 1974	1974 - 1983	1983 - 1990
Loss Rate	0.39 %/year	1.29 %/year	1.78 %/year	1.85 %/year

Shoreline Erosion

Shoreline erosion rates were calculated by Del Bristch for Areas A, B, and C, independently. The positions of the 1932 and 1988 shorelines were measured at 21 transects, and annual rates were derived for each transect. Note that areas of extremely high localized erosion were not included in the analysis, and that the high and low values were not used when calculating the "average" rate (see Appendix B for Del's analysis and resulting erosion rates). We proposed to use the following shoreline erosion rates:

Area A: 20'/yr
Area B: 40'/yr
Area C: 40'/yr

AREA A

V1 - Emergent Marsh

Assumptions: - 1993 USGS land acreage (644 acres) brought forward to 2001 by 1) applying 20'/year shoreline erosion over the 7541 feet of shoreline and prorating resulting acreage (3.46 acres) by 60% to adjust for land to water ratio (2.07 acres marsh lost annually due to erosion) and 2) applying land loss rate of 2.01%/year to the remaining acreage. (Appendix C).

TY0

2001 emergent marsh: 532 ac (50%)

2001 open water: 542 ac (50%)

2001 total: 1074 ac

FWOP

Assumptions: - Continued shoreline erosion of 20'/yr.

- Increased FWOP 2.01%/yr loss rate by 10% due to increasing fragmentation of existing marsh and continued deterioration of the shoreline. Decreased FWOP loss rate by 15% and 5% for the effects of Davis Pond and Bayou L'Ours Ridge, respectively. Resulting FWOP loss rate: 2.01%/yr * 1.1% * 0.85% * 0.95% = 1.785%/yr (Appendix D).

TY1 emergent marsh: 521 acres (49%)
open water: 553 acres (52%)

TY20 emergent marsh: 336 acres (31%)
open water: 737 (69%)

FWP

Table 4 – Summary of V1 assumptions and calculations used in FWP scenario (full calculations in Appendix E)

Project Area	1074		FWOP Loss Rate 1.785
TY0 Marsh Acres: 532		Created Acres (90% of TY0 water acres): 488	
TY0 Water Acres: 542		Nourished Acres (100% TY0 marsh acres): 532	
	FWP Land Loss Rates (%/yr)		
Created acres: 50% reduction in FWOP	0.895	Nourished acres: 50% reduction in FWOP	0.895

	TY1 acres	
Marsh Creation	10% of the created marsh credited at TY 1	**49**
Marsh Nourishment	100% existing marsh nourished, 50% credit at TY1	**266**
Total Marsh		**315**
Project Area	Project area= 1074-((75% of 488 acres)+(50% of 532 acres))	**369**

TY3 acres		
Marsh Creation	30% created acreage - 3 yrs loss at .895%/year	**143**
Marsh Nourishment	100% nourished acres less 3 years loss at 1.34%/year	**518**
Total Marsh		**661**
Project Area	Project area= 1074-(70% of 488 acres)	**732**

TY5 acres		
Marsh Creation	100% created acreage - 5 yrs loss at .895%/year	**466**
Marsh Nourishment	100% nourished acres less 3 years loss at 1.34%/year	**508**
Total Marsh		**974**

TY1

Assumptions: - Shoreline erosion is prevented.
- 90% of the existing open water area is filled to marsh elevation. Without the installation of vegetative plantings, 10% of the created acreage is credited at TY1.
- 100% of the existing marsh acreage is nourished with 6 - 12 inches of dredged material. 50% of the nourished acreage is credited at TY1.

emergent marsh: 315 acres (85%)

Creation: [(0.9*542 acres)*.10 for credit in TY1 = 49 acres] and
Nourishment: [532 acres * .5 for credit in TY1= 266 acres]

open water: 54 acres (15%)

TY3

Assumptions: - 30% credit for created acreage
- 100% credit for nourished marsh acreage.
- FWOP loss rate reduced by 50% for all created and nourished acreage (to 0.89%/yr). Three years of loss instantaneously applied to both created and nourished acres.

emergent marsh: 661acres (90%)

Creation: [488 acres*0.3 for credit in TY3 - (3 yrs*(542*0.895%/yr)) = 133 acres] and
Nourishment: [532 acres - 3*(532*0.895%/yr) = 518 acres]

open water: 71 acres (10%)

TY5

Assumptions: 100% credit for all created and nourished marsh acreage. Five years of loss instantaneously applied to both created and nourished acres.

emergent marsh: 974 acres (91%)

Creation: [488 acres - (5 yrs*(542*0.895%/yr)) = 466 acres] and
Nourishment: [532 acres - 5*(532*0.895%/yr) = 508 acres]

open water: 100 acres (9%)

TY20 emergent marsh: 851 acres (79%)
open water: 223 acres (21%)

V2 - Submerged Aquatic Vegetation
FWOP
TY1 - TY20: 10%

FWP
TY1 10%
TY3 15%
TY5 15%
TY20 15%

V3 - Interspersion
FWOP
TY0 20% Class 1; 40% Class 3 and 40% Class 4
TY1 20% Class 1; 40% Class 3 and 40% Class 4
TY20 20% Class 2 and 80% Class 4

FWP
TY1 100% Class 1
TY3 100% Class 1
TY5 100% Class 1
TY20 70% Class 1 and 30% Class 2

V4 - Shallow Open Water Habitat
FWOP Survey data collected August 2001 indicates that the majority of the open water in the project area is less than 2.5 feet deep, and that approximately 55% is less than 1.5 feet at average water stages. It is assumed that FWOP, the ratio of deep to shallow open water will not change significantly, although the total amount of open water will increase.
TY0 55%
TY1 55%
TY20 55%

FWP The majority of shallow open water will be filled for marsh creation.
TY1 90%
TY3 90%
TY5 85%
TY20 80%

V5 - Salinity
FWOP and FWP; all TYs: 4 ppt

V6 - Fish Access

FWOP and FWP; all TYs: 1

AREA B

V1 - Emergent Marsh

Assumptions: -Assume 40'/year shoreline erosion over the 4,100 feet of shoreline for 20 years; 78% land to water ratio; and 200-foot offset for shoreline protection. Note, no land loss rate applied for FWP or FWOP scenarios.

(40'/yr)*(20 yrs)*(4,100 feet)=75 acres
(75 acres)*(0.78 land:water) =59 acres marsh and 16 acres water
(200' offset)*(4,100 feet) - 19 acres water

TY0
2001 emergent marsh: 59 acres (63%)
2001 open water: 35 acres (37%) [16 acres + 19 acres]
2001 total: 94 acres

FWOP
Assumption: Continued shoreline erosion of 40'/yr. Annual loss = (40')*(4,100')*(.78) = 3 acres

TY1 emergent marsh: 56 acres (60%) [59 acres - 3 acres]
open water: 38 acres (40%)

TY20 emergent marsh: 0 acre (0%) [56 acres-(19 yrs*3 acres/yr)]
open water: 94 acres (100%)

FWP
Assumption: Shoreline erosion is prevented
TY1 emergent marsh: 59 acres (63%)
open water: 35 acres (37%)

TY20 emergent marsh: 59 acres (63%)
open water: 35 acres (37%)

V2 - Submerged Aquatic Vegetation
FWOP and FWP; all TYs: 0%

V3 - Interspersion
FWOP
TY0 80% Class 2, 20% Class 4
TY1 80% Class 2, 20% Class 4
TY20 100% Class 5

FWP
TY1 80% Class 2, 20% Class 4

TY20 80% Class 2; 20% Class 4

V4 - Shallow Open Water Habitat
FWOP
TY0 50%
TY1 50%
TY20 0%

FWP
TY1 50%
TY20 50%

V5 - Salinity
FWOP and FWP; all TYs: 4 ppt

V6 - Fish Access
FWOP and FWP; all TYs: 1

AREA C

V1 - Emergent Marsh
Assumptions: Assume 40'/year shoreline erosion over the 8,978 feet of shoreline for 20 years; 84% land to water ratio; and 200-foot offset for shoreline protection. Note, no land loss rate applied for FWP or FWOP scenarios.

(40'/yr)*(20 yrs)*(8,978 feet)=165 acres
(165 acres)*(0.84 land:water) =139 acres marsh and 26 acres water
(200' offset)*(8,978 feet) = 41 acres water

TY0
2001 emergent marsh: 139 acres (68%)
2001 open water: 67 acres (32%) [26 acres+41 acres]
2001 total: 206 acres

FWOP
Assumption: Continued shoreline erosion of 40'/yr. Annual loss (40')*(8,978')*(.85) = 7 acres

TY1 emergent marsh: 132 acres (64%) [139 acres - 7 acres/yr]
open water: 74 acres (36%)

TY20 emergent marsh: 0 acre (0%) [132 acres- (19 yrs*7 acres/yr)]
open water: 206 acres (100%)

FWP
Assumption: Shoreline erosion is prevented
TY1 emergent marsh: 139 acres (68%)

open water: 67 acres (32%)

TY20 emergent marsh: 139 acres (68%)
open water: 67 acres (32%)

V2 - Submerged Aquatic Vegetation
FWOP and FWP; all TYs: 0%

V3 - Interspersion
FWOP
TY0 75% Class 1 and 25% Class 4
TY1 70% Class 1 and 30% Class 4
TY20 100% Class 5

FWP
TY1 75% Class 1 and 25% Class 4
TY20 75% Class 1 and 25% Class 4

V4 - Shallow Open Water Habitat
FWOP
TY0 5%
TY1 4%
TY20 0%

FWP
TY1 5%
TY20 5%

V5 - Salinity
FWOP and FWP; all TYs: 4 ppt

V6 - Fish Access
FWOP and FWP; all TYs: 1

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Fresh/Intermediate Marsh

Project: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area A
Condition: Future Without Project

Project Area:
Fresh.....
Intermediate. 1,074

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 20 Value	TY 20 SI			
V1	% Emergent	50	0.55	49	0.54	31	0.38			
V2	% Aquatic	10	0.19	10	0.19	10	0.19			
V3	Interspersion	%		%		%				
	Class 1	20	0.44	20	0.44		0.28	1	1	0
	Class 2					20		0	0	0.6
	Class 3	40		40				0.4	0.4	0
	Class 4	40		40		80		0.2	0.2	0.2
	Class 5									
V4	%OW <= 1.5ft	55	0.72	55	0.72	55	0.72			
V5	Salinity (ppt)									
	fresh		1.00		1.00		1.00			
	intermediate	4		4		4		1.00	1.00	1.00
V6	Access Value									
	fresh		1.00		1.00		1.00			
	intermediate	1.00		1.00		1.00		1.00	1.00	1.00
	Emergent Marsh HSI =		**0.63**	**EM HSI =**		**0.63**	**EM HSI =**		**0.49**	
	Open Water HSI =		**0.38**	**OW HSI =**		**0.38**	**OW HSI =**		**0.37**	

Project: Little Lake Shoreline Protection/Dedicated Dredging near 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 =**				

Project: Little Lake Shoreline Protection/Dedicated Dredging near 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: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area A

Condition: Future With Project

Project Area:
Fresh.....
Intermediate. 1,074

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 3 Value	TY 3 SI			
V1	% Emergent	50	0.55	85	0.87	90	0.91			
V2	% Aquatic	10	0.19	10	0.19	15	0.24			
V3	Interspersion	%		%		%				
	Class 1	20	0.44	100	1.00	100	1.00	1	1	1
	Class 2							0	0	0
	Class 3	40						0.4	0	0
	Class 4	40						0.2	0	0
	Class 5									
V4	%OW <= 1.5ft	55	0.72	90	1.00	90	1.00			
V5	Salinity (ppt)									
	fresh		1.00		1.00		1.00			
	intermediate	4		4		4		1.00	1.00	1.00
V6	Access Value									
	fresh		1.00		1.00		1.00			
	intermediate	1.00		1.00		1.00		1.00	1.00	1.00
	Emergent Marsh HSI =		**0.63**		**EM HSI = 0.91**		**EM HSI = 0.94**			
	Open Water HSI =		**0.38**		**OW HSI = 0.45**		**OW HSI = 0.48**			

Project: Little Lake Shoreline Protection/Dedicated Dredging near FWP

Variable		TY 5 Value	TY 5 SI	TY 20 Value	TY 20 SI	Value	SI			
V1	% Emergent	91	0.92	79	0.81					
V2	% Aquatic	15	0.24	15	0.24					
V3	Interspersion	%		%		%				
	Class 1	100	1.00	70	0.88			1	1	0
	Class 2			30				0	0.6	0
	Class 3							0	0	0
	Class 4							0	0	0
	Class 5									
V4	%OW <= 1.5ft	85	1.00	80	1.00					
V5	Salinity (ppt)									
	fresh		1.00		1.00					
	intermediate	4		4				1.00	1.00	
V6	Access Value									
	fresh		1.00		1.00					
	intermediate	1.00		1.00				1.00	1.00	
	EM HSI =		**0.95**		**EM HSI = 0.86**		**EM HSI =**			
	OW HSI =		**0.48**		**OW HSI = 0.48**		**OW HSI =**			

Project: Little Lake Shoreline Protection/Dedicated Dredging near 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: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area A

Future Without Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	532	0.63	336.54	
1	521	0.63	326.22	331.37
20	336	0.49	164.22	4578.65
			AAHUs =	245.50

Future With Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	532	0.63	336.54	
1	315	0.91	287.11	321.91
3	661	0.94	622.14	905.82
5	976	0.95	924.40	1545.92
20	853	0.86	735.35	12422.02
			AAHUs	759.78

NET CHANGE IN AAHUs DUE TO PROJECT		
A. Future With Project Emergent Marsh AAHUs	=	759.78
B. Future Without Project Emergent Marsh AAHUs	=	245.50
Net Change (FWP - FWOP)	=	**514.28**

AAHU CALCULATION - OPEN WATER

Project: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area A

Future Without Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	542	0.38	207.99	
1	553	0.38	212.21	210.10
20	738	0.37	274.45	4630.21
			AAHUs =	**242.02**

Future With Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	542	0.38	207.99	
1	54	0.45	24.09	121.10
3	71	0.48	34.42	58.28
5	98	0.48	47.50	81.92
20	221	0.48	105.16	1147.74
			AAHUs	**70.45**

NET CHANGE IN AAHUs DUE TO PROJECT		
A. Future With Project Open Water AAHUs	=	70.45
B. Future Without Project Open Water AAHUs	=	242.02
Net Change (FWP - FWOP) =		**-171.56**

TOTAL BENEFITS IN AAHUs DUE TO PROJECT		
A. Emergent Marsh Habitat Net AAHUs	=	514.28
B. Open Water Habitat Net AAHUs	=	-171.56
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1		**293.04**

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Fresh/Intermediate Marsh

Project: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area B
Condition: Future Without Project

Project Area:
Fresh.....
Intermediate. 93

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 20 Value	TY 20 SI			
V1	% Emergent	61	0.65	56	0.60	0	0.10			
V2	% Aquatic	0	0.10	0	0.10	0	0.10			
V3	Interspersion	%		%		%				
	Class 1		0.52		0.52		0.10	0	0	0
	Class 2	80		80				0.6	0.6	0
	Class 3							0	0	0
	Class 4	20		20				0.2	0.2	0
	Class 5					100				
V4	%OW <= 1.5ft	50	0.66	50	0.66	0	0.10			
V5	Salinity (ppt)									
	fresh		1.00		1.00		1.00			
	intermediate	4		4		4		1.00	1.00	1.00
V6	Access Value									
	fresh		1.00		1.00		1.00			
	intermediate	1.00		1.00		1.00		1.00	1.00	1.00
	Emergent Marsh HSI =		**0.71**	**EM HSI =**	**0.68**	**EM HSI =**	**0.24**			
	Open Water HSI =		**0.30**	**OW HSI =**	**0.30**	**OW HSI =**	**0.23**			

Project: Little Lake Shoreline Protection/Dedicated Dredging near
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 =**				

Project: Little Lake Shoreline Protection/Dedicated Dredging near 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: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area B

Project Area:
Fresh.....
Intermediate. 93

Condition: Future With Project

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 20 Value	TY 20 SI			
V1	% Emergent	61	0.65	61	0.65	61	0.65			
V2	% Aquatic	0	0.10	0	0.10	0	0.10			
V3	Interspersion	%		%		%				
	Class 1		0.52		0.52		0.52	0	0	0
	Class 2	80		80		80		0.6	0.6	0.6
	Class 3							0	0	0
	Class 4	20		20		20		0.2	0.2	0.2
	Class 5									
V4	%OW <= 1.5ft	50	0.66	50	0.66	50	0.66			
V5	Salinity (ppt)									
	fresh		1.00		1.00		1.00			
	intermediate	4		4		4		1.00	1.00	1.00
V6	Access Value									
	fresh		1.00		1.00		1.00			
	intermediate	1.00		1.00		1.00		1.00	1.00	1.00
	Emergent Marsh HSI =		**0.71**	**EM HSI =**	**0.71**	**EM HSI =**	**0.71**			
	Open Water HSI =		**0.30**	**OW HSI =**	**0.30**	**OW HSI =**	**0.30**			

Project: Little Lake Shoreline Protection/Dedicated Dredging near FWP

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 =**				

Project: Little Lake Shoreline Protection/Dedicated Dredging near FWP

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 =			

AAHU CALCULATION - EMERGENT MARSH

Project: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area B

Future Without Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	57	0.71	40.55	
1	53	0.68	36.03	38.27
20	0	0.24	0.00	267.88
			AAHUs =	15.31

Future With Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	57	0.71	40.55	
1	57	0.71	40.55	40.55
20	57	0.71	40.55	770.42
			AAHUs	40.55

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project Emergent Marsh AAHUs =	40.55
B. Future Without Project Emergent Marsh AAHUs =	15.31
Net Change (FWP - FWOP) =	**25.24**

AAHU CALCULATION - OPEN WATER

Project: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area B

Future Without Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	36	0.30	10.80	
1	40	0.30	12.00	11.40
20	93	0.23	21.13	326.94
			AAHUs =	16.92

Future With Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	36	0.30	10.80	
1	36	0.30	10.80	10.80
20	36	0.30	10.80	205.18
			AAHUs	10.80

NET CHANGE IN AAHUs DUE TO PROJECT	
A. Future With Project Open Water AAHUs =	10.80
B. Future Without Project Open Water AAHUs =	16.92
Net Change (FWP - FWOP) =	**-6.12**

TOTAL BENEFITS IN AAHUs DUE TO PROJECT	
A. Emergent Marsh Habitat Net AAHUs =	25.24
B. Open Water Habitat Net AAHUs =	-6.12
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1	**15.13**

WETLAND VALUE ASSESSMENT COMMUNITY MODEL
Fresh/Intermediate Marsh

Project: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area C
Condition: Future Without Project

Project Area:
Fresh.....
Intermediate. 206

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 20 Value	TY 20 SI			
V1	% Emergent	67	0.70	64	0.68	0	0.10			
V2	% Aquatic	0	0.10	0	0.10	0	0.10			
V3	Interspersion	%		%		%				
	Class 1	75	0.80	70	0.76		0.10	1	1	0
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	25		30				0.2	0.2	0
	Class 5					100				
V4	%OW <= 1.5ft	5	0.16	4	0.15	0	0.10			
V5	Salinity (ppt)									
	fresh		1.00		1.00		1.00			
	intermediate	4		4		4		1.00	1.00	1.00
V6	Access Value									
	fresh		1.00		1.00		1.00			
	intermediate	1.00		1.00		1.00		1.00	1.00	1.00
	Emergent Marsh HSI =		**0.78**	**EM HSI =**	**0.76**	**EM HSI =**	**0.24**			
	Open Water HSI =		**0.28**	**OW HSI =**	**0.28**	**OW HSI =**	**0.23**			

Project: Little Lake Shoreline Protection/Dedicated Dredging near
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 =**				

Project: Little Lake Shoreline Protection/Dedicated Dredging near 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: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area C
Condition: Future With Project

Project Area:
Fresh.....
Intermediate. 206

Variable		TY 0 Value	TY 0 SI	TY 1 Value	TY 1 SI	TY 20 Value	TY 20 SI			
V1	% Emergent	67	0.70	67	0.70	67	0.70			
V2	% Aquatic	0	0.10	0	0.10	0	0.10			
V3	Interspersion	%		%		%				
	Class 1	75	0.80	75	0.80	75	0.80	1	1	1
	Class 2							0	0	0
	Class 3							0	0	0
	Class 4	25		25		25		0.2	0.2	0.2
	Class 5									
V4	%OW <= 1.5ft	5	0.16	5	0.16	5	0.16			
V5	Salinity (ppt)									
	fresh		1.00		1.00		1.00			
	intermediate	4		4		4		1.00	1.00	1.00
V6	Access Value									
	fresh		1.00		1.00		1.00			
	intermediate	1.00		1.00		1.00		1.00	1.00	1.00
	Emergent Marsh HSI =		**0.78**	**EM HSI =**	**0.78**	**EM HSI =**	**0.78**			
	Open Water HSI =		**0.28**	**OW HSI =**	**0.28**	**OW HSI =**	**0.28**			

Project: Little Lake Shoreline Protection/Dedicated Dredging near FWP

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 =**				

Project: Little Lake Shoreline Protection/Dedicated Dredging near 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: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area C

Future Without Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	139	0.78	108.40	
1	131	0.76	99.14	103.74
20	0	0.24	0.00	725.94
			AAHUs =	41.48

Future With Project			Total	Cummulative
TY	Marsh Acres	x HSI	HUs	HUs
0	139	0.78	108.40	
1	139	0.78	108.40	108.40
20	139	0.78	108.40	2059.59
			AAHUs	108.40

NET CHANGE IN AAHUs DUE TO PROJECT		
A. Future With Project Emergent Marsh AAHUs	=	108.40
B. Future Without Project Emergent Marsh AAHUs	=	41.48
Net Change (FWP - FWOP) =		**66.92**

AAHU CALCULATION - OPEN WATER

Project: Little Lake Shoreline Protection/Dedicated Dredging near Round Lake - Area C

Future Without Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	67	0.28	18.98	
1	75	0.28	20.96	19.97
20	206	0.23	46.80	665.38
			AAHUs =	34.27

Future With Project			Total	Cummulative
TY	Water Acres	x HSI	HUs	HUs
0	67	0.28	18.98	
1	67	0.28	18.98	18.98
20	67	0.28	18.98	360.54
			AAHUs	18.98

NET CHANGE IN AAHUs DUE TO PROJECT		
A. Future With Project Open Water AAHUs	=	18.98
B. Future Without Project Open Water AAHUs	=	34.27
Net Change (FWP - FWOP) =		**-15.29**

TOTAL BENEFITS IN AAHUs DUE TO PROJECT		
A. Emergent Marsh Habitat Net AAHUs	=	66.92
B. Open Water Habitat Net AAHUs	=	-15.29
Net Benefits=(2.1xEMAAHUs+OWAAHUs)/3.1		**40.40**