Coast 2050 Region 2

NAOMI FRESHWATER DIVERSION (BA-03)

PROGRESS REPORT No. 2
for the period
November 17, 1992 to March 18, 1996

Project Status

The following data collection and analysis activities have been conducted since the previous progress report:

Discrete hydrologic data were collected for 16 stations on October 18, November 15, and December 13, 1995, and January 18, 1996. The standing data set was updated with these data and used to statistically evaluate any effects to the area caused by siphon operations. Data from February and March 1996 were not collected in time for the statistical analyses and will be included in the next report.

Project Description

The Naomi project area contains approximately 13,000 acres of intermediate and brackish marsh and is located within the parishes of Plaquemines and Jefferson. The area is bound to the north by Bayou de Fleur and a mineral access canal, to the west by the Pen and a mineral access canal off of Bayou de Fleur, to the south by Bayou Dupont, and to the east by a storm protection levee (figure 1). The freshwater diversion structure is located at river mile 64 AHP (above head of passes) at Naomi, Louisiana, and consists of eight 72-in. diameter siphon tubes with a combined maximum discharge of 2144 cfs. The siphon empties into a revetted discharge pond with one 30-ft-wide by 3,300-ft-long outfall channel (Brown & Root, Inc. 1992). All operational changes in siphon flow are performed by Plaquemines Parish government (PPG) (table 1). These changes are influenced by an operations scheme (table 2) developed in 1992 by Brown and Root, Inc., based on an environmental model and subsequently revised by PPG and the Louisiana Department of Natural Resources, Coastal Restoration Division (LDNR/CRD). This revision calls for the siphon to be operated at 8 pipes in January and February, 2 pipes in March and April, and 8 pipes from May through December.

The project area, as is true with the Barataria basin, suffers from a lack of fresh water and sediment because of the building of the flood control levee along the Mississippi River. The main project objective is to protect the project area from continued degradation by introducing fresh water into the area through the west bank of the Mississippi River. The river water will also bring sediment and nutrients into the project area to improve growing conditions for fresh and intermediate marsh plant species.

Specific measurable goals were established to evaluate project effectiveness; increase marsh to open-water ratios, reduce and stabilize mean salinity, and increase relative abundance of fresh and intermediate marsh plant species.

Monitoring Design

Health-related water quality (fecal coliform) and discrete hydrologic variables are monitored biweekly and are available from November 17, 1992, to present. Hydrologic variables include salinity and water temperature (surface and bottom) at 16 stations and water level at 7 staff gauges surveyed to the National Geodetic Vertical Datum (NGVD). Plant species composition and percent cover is measured at 6 stations annually (figure 1). An initial vegetation delineation of the project area, using the 6 vegetation stations, was performed in June 1992 by Allan Ensminger of Wetlands and Wildlife Management Co. under contract with the LDNR/CRD. The vegetation sites are to be visited once a year and compared to the initial preoperational data. Infrared aerial photography (1:12,000) is used to calculate marsh to open-water ratios and for vegetation delineations. Change in marsh to open-water ratios from preoperation (1992) to 5-yr postoperation will be evaluated in 1997. Aerial photographs are also used to delineate the extent of the turbidity plume caused by the siphon. The extent of the turbidity plume has been evaluated monthly since October 1995 by looking at water transparency with an 8-in. Secchi disc. Daily siphon discharge in cubic feet per second (cfs) is formulated from the head differential between the river and the marsh staff gauges and the number of pipes operating. Any missing values for daily gauge or operational status are interpolated from known values. Water velocity will be measured monthly during siphon operation beginning March 1996; locations are currently being established.

All discrete biological monitoring is performed biweekly by PPG with LDNR/CRD accompanying PPG on every other trip. On the monthly joint monitoring trips, PPG obtains fecal coliform samples and LDNR/CRD records all hydrologic variables. PPG independently monitors the project on a monthly basis two weeks after the joint monitoring trip. During those trips, PPG obtains fecal coliform samples and records all hydrologic variables. LDNR/CRD performs all vegetative monitoring.

The primary method of analyses for hydrologic variables will be to determine pre- to postoperation differences in mean values as evaluated by an analysis of variance (ANOVA, $P \leq 0.05$). In addition, regression analyses will be performed to evaluate if relationships exist between siphon flow and hydrologic variables. Several time periods exist when the siphons were not functioning after the initial opening on February 3, 1993. Hydrologic data from these time periods were treated as preoperational.

Results/Discussion

Infrared aerial photographs (1:12,000) from February 1993 were used to delineate the extent of the turbidity plume caused by siphon flow (Plaquemines Parish Government 1993). The plume covered the entire northern half of the project area from station 15 to the Brady Canal. This plume was confirmed to cover the same extent in February 1996 through visual inspection of water color. The Mississippi River water is a distinct light brown color that is easily distinguishable from the clearer marsh water. During both time periods, the siphon was operating at all 8 pipes. In 1993, average flow for February was estimated at 1584.2 cfs; average flow for February 1996 has not yet been calculated. The Brady Canal may serve as a conduit for the loss of a portion of the fresh water and sediment from the project area to the Pen. This will be addressed in the outfall management plan, which seeks to reduce some of the apparent channelized flow that occurs via the Brady Canal.

There was an overall decrease in mean project area salinity immediately following the opening of the structure on February 3, 1993. A gradual increase in overall salinity usually begins in the fall of each year (figure 2) when periods of low river stage cause the structure to loose prime and stop flowing. Low river stage reduces the head differential between the siphon intake on the river and the outfall area in the marsh, which in turn reduces flow through the structure. The reduced flow cannot flush the air from the structure that is entering via faulty butterfly stop valves. The usual fall salinity increase did not occur in 1993 because the atypically high river stages, caused by the extreme flooding in the Midwestern United States, kept head differential high. A regression analysis indicates that a significant (P=0.0001) inverse relationship exists between siphon flow and mean project area salinity.

Mean salinity in the project area, across all stations, has been significantly (P=0.0001) reduced as a result of siphon operation. Mean preoperation salinity was 0.99 ppt (±0.04 SE), while mean salinity during structure operation was 0.42 ppt (±0.02 SE). Individual station mean salinity has been reduced in varying degrees as a result of siphon flow (figure 3). The largest overall reduction in mean salinities occurred in the southernmost stations in the vicinity of Bayou Dupont and the Chenier Traverse Bayou (stations 5, 6, & 7). Both waterways are conduits of saltwater into the project area and preoperational salinities were highest here. Since salinities at those stations closest to the siphon were low prior to siphon operation, the fresh water has had a reduced effect on the mean salinities of those stations. The preoperation 0.5 ppt isohaline line, which ran diagonally through stations 1 and 14, has been shifted south of stations 4, 11, and 12 postoperation. The 1.0 ppt isohaline line has been shifted from north of stations 8 and 10 to south of all stations in the project area except station 10. With the exception of station 10, which is somewhat isolated hydrologically from the fresh water introduced into the area, mean salinities at all stations have been reduced by at least 50%. Station 10 also has a connection, via a mineral access canal, to Bayou Dupont farther down-estuary than stations 5, 6, and 7 that may transport a greater volume of salt water into the area.

Mean water level has increased from 1.46-ft NGVD preoperation to 1.67-ft NGVD postoperation. However, this apparent increase can be attributed to the increased water level at station 14, which is located in the outfall pond and thus directly influenced by siphon flow. Mean water level at station 14 has increased from 1.08-ft NGVD to 2.50-ft NGVD as a result of siphon operation. If station 14 is removed from the calculation of project area mean water level, then preoperation water level is 1.52 and postoperation level is 1.57 ft NGVD. This slight change in mean water level is not significant (P=0.4944).

The original 6 vegetation stations were revisited in July 1995 by LDNR/CRD. Both the 1992 and 1995 vegetation studies indicated that the dominant intermediate marsh (stations 1-4) species was bulltongue *(Sagittaria lancifolia)* (table 3). Ensminger, however, observed a larger amount of three-cornered grass *(Scirpus americanus,* [formerly *S. olneyi*]) in 1992 than did LDNR/CRD in 1995. Both Ensminger in 1992 and LDNR/CRD in 1995 observed that the southern brackish marsh area was overwhelmingly dominated by marshay cordgrass *(Spartina patens)*. There was no indication in 1995 that the intermediate-to-brackish marsh boundary had shifted from that established previously by Chabreck and Linscombe in 1988 or Ensminger in 1992. The flow of the siphon to date has been highly variable, including a 9-mo period of no flow. As a result, it may as yet be too early to speculate on the effects that the diversion is having on the vegetation.

References

Chabreck, R. H., and J. Linscombe 1988. Vegetative type map of the Louisiana coastal marshes. New Orleans: Louisiana Department of Wildlife and Fisheries. Scale 1:62,500.

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Ensminger, A. B. 1992. Vegetative delineations for the Naomi freshwater diversion outfall area project No. BA-03. Unpublished final report prepared for the Louisiana Department of Natural Resources/Coastal Restoration Division. Belle Chasse, La.: Wetlands and Wildlife Management Co. 29 pp.

Plaquemines Parish Government 1993. Naomi (LaReussite) Freshwater Diversion Siphon 1993 Annual Monitoring Report. Pointe a la Hache, La.: Plaquemines Parish Government. 37 pp.

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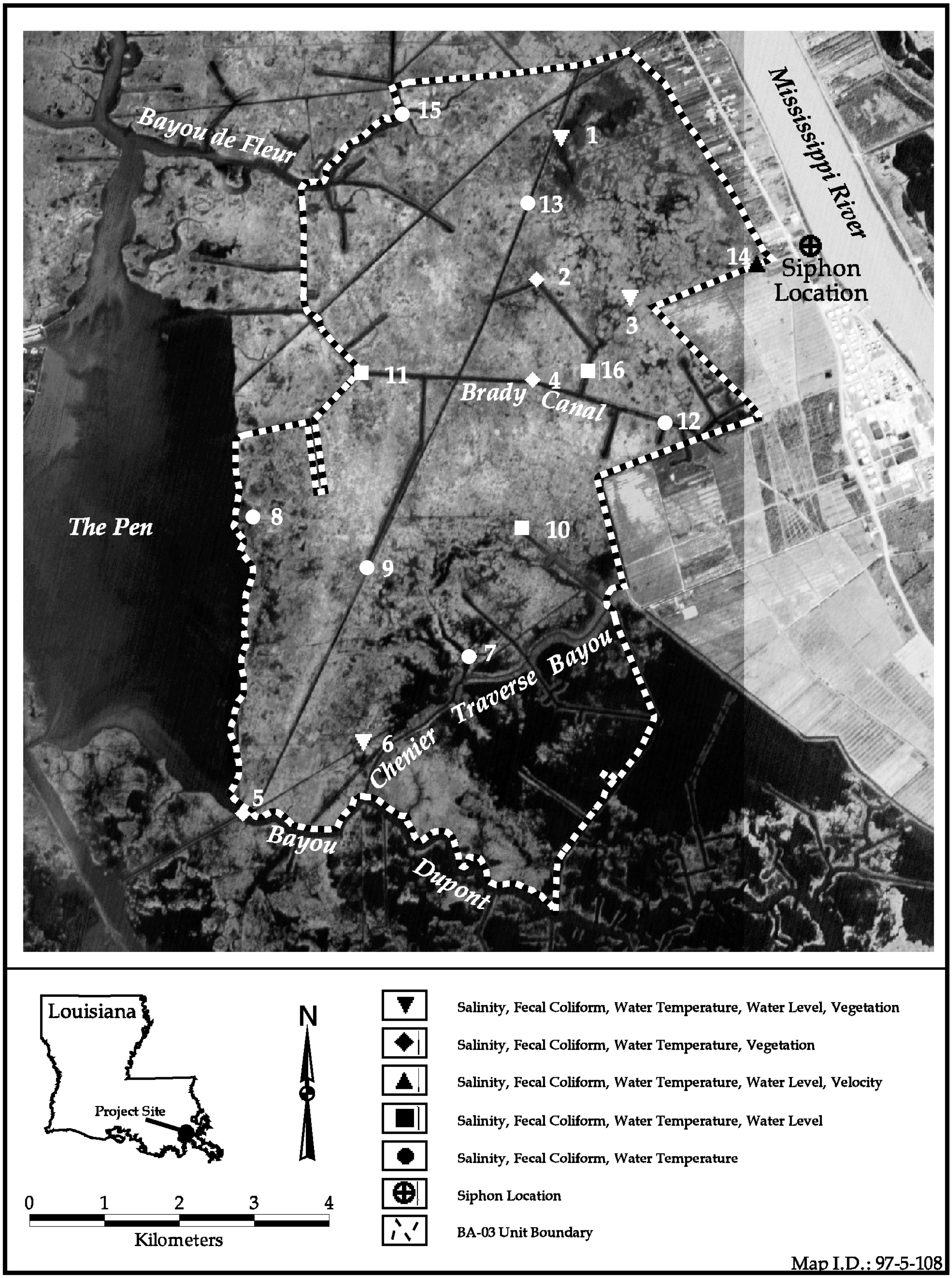

Figure 1. Location of Naomi project area illustrating hydrologic, health-related water quality and vegetation sampling stations.

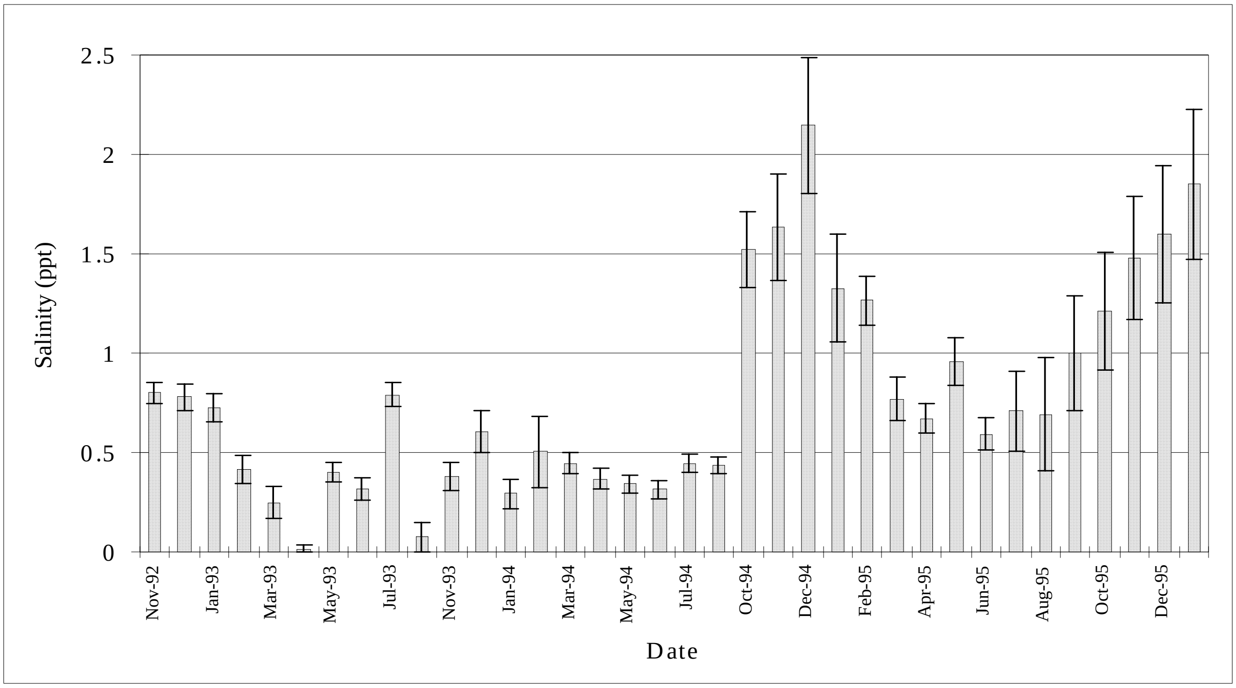

Figure 2. Monthly mean salinity for all stations collectively at the Naomi freshwater diversion project area (error bars represent + 1 SE).

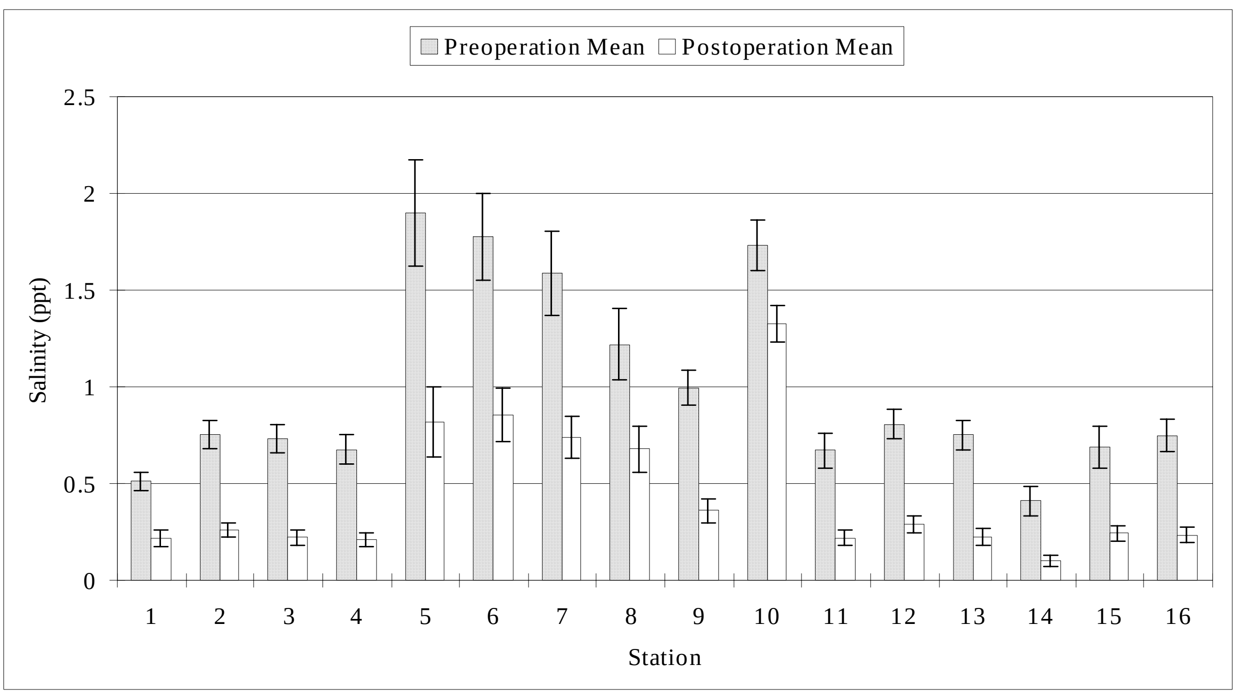

Figure 3. Comparison of pre- nad postoperation mean salinity bt station at the Naomi freshwater diversion project area (error bars represent + 1 SE).

Table 1. Operations of the Naomi freshwater diversion siphon.

Date	Operation
3-Feb-93	Naomi opened for the first time - all 8 pipes
1-Apr-93	Down to 2 pipes
9-Apr-93	Closed because of oil spill
19-Apr-93	Up to 2 pipes
29-Apr-93	Up to 6 pipes
14-Jul-93	Up to 8 pipes
10-Aug-93	Down to 2 pipes
20-Sep-93	Up to 8 pipes
1-Dec-93	Found by PPG to be shut down
7-Dec-93	Up to 3 pipes
23-Feb-94	Up to 8 pipes
30-Aug-94	Found by PPG to be nonoperational because of low river stage and faulty valves; primed 8 pipes
7-Sep-94	Found by PPG to be nonoperational due to low river stage and faulty valves
6-Jul-95	Up to 8 pipes
10-Jul-95	Found by PPG to be operating at 5 pipes
12-Jul-95	Up to 8 pipes
3-Aug-95	Closed because of hurricane threat
10-Aug-95	Up to 8 pipes
6-Sep-95	Found by PPG to be operating at 7 pipes
11-Sep-95	Found by PPG to be nonoperational; primed 8 pipes
25-Sep-95	Found by PPG to be operating at 7 pipes
1-Oct-95	Closed because of low river stage
8-Feb-96	Up to 8 pipes

Table 2. Operations scheme for the Naomi freshwater diversion siphon (from Brown and Root, Inc. 1992).

Month	Duration Period	Number of Pipes	Flow (cfs)
January	First half of month	8	1493
	Second half of month	3	561
February	First half of month	7	1470
	Second half of month	2	420
March	First half of month	6	1482
	Second half of month	2	494
April	First half of month	2	540
	Second half of month	2	540
May	First half of month	4	1028
	Second half of month	2	514
June	First half of month	4	880
	Second half of month	2	440
July	First half of month	6	1056
	Second half of month	3	528
August	First half of month	8	1071
	Second half of month	4	536
September	First half of month	8	1039
	Second half of month	4	520
October	First half of month	8	1039
	Second half of month	4	520
November	First half of month	8	1039
	Second half of month	4	520
December	First half of month	6	1002
	Second half of month	3	501

Table 3. Vegetation percent cover estimates by station for the Naomi freshwater diversion project area.

	Station / Year	1	2	3	4	5	6		Station / Year	1	2	3	4	5	6
% Open Water	**1992**				10			**% Open Water**	**1992**				10		
	1995	50	30	30	0	0	30		**1995**	50	30	30	0	0	30
Salinity	**1992**	1.5	2.0	2.0	2.0	4.0	4.0	**Salinity**	**1992**	1.5	2.0	2.0	2.0	4.0	4.0
	1995	0.2	0.2	0.2	0.2	3.1	3.3		**1995**	0.2	0.2	0.2	0.2	3.1	3.3
Alternanthera philoxeroides	**1992**			T				*Ludwigia spp.*	**1992**						
	1995	5 und	30 und						**1995**	T					
Acnida cuspidata	**1992**		<5		5	T		*Lythrum lineare*	**1992**						
	1995								**1995**						T
Aster tenuifolius	**1992**							*Mikania scavdens*	**1992**						
	1995						T		**1995**				T		
Baccharis halimifolia	**1992**							*Myriophyllum spicatum*	**1992**					P aq	P aq
	1995					<5	T		**1995**						
Bacopa monnieri	**1992**			T				*Myrica cerifera*	**1992**				T		
	1995		30 und	T			T		**1995**						
Cabomba caroliniana	**1992**							*Najas quadalupensis*	**1992**	P aq					
	1995	P aq							**1995**						
Carex spp.	**1992**				5	T		*Paspalum cf. distichum*	**1992**						
	1995								**1995**	10 und					
Ceratophyllum demersum	**1992**	P aq					P aq	*Pluchea camphorata*	**1992**				10	T	
	1995								**1995**		<5	T			
Cuscata indecora	**1992**							*Pluchea foetida*	**1992**		<5				
	1995					T			**1995**						
Cyperus odoratus	**1992**							*Polygonum spp.*	**1992**		<5				
	1995		T	T	T				**1995**	<5	<5	T	5	<5	T
Daubentonia drummundii	**1992**							*Ruppia maritima*	**1992**						
	1995		T			T			**1995**	P aq					
Distichlis spicata	**1992**							*Sagittaria lancifolia*	**1992**	75	10	80	20	T	
	1995						<5		**1995**	80	60	85	75		
Echinochloa walteri	**1992**			T	5	T		*Salvinia rotundifolia*	**1992**						
	1995				T		T		**1995**	P aq					
Eichhornia crassipes	**1992**	P aq						*Sapium sebiferum*	**1992**						
	1995	P aq		P aq					**1995**			T			
Eleocharis cellulosa	**1992**							*Scirpus americanus*	**1992**		85	10	20	10	
	1995						<5		**1995**		10	T	<5	<5	<5
Eleocharis parvula	**1992**			T	5	T		*Scirpus californicus*	**1992**	10					
	1995								**1995**	T					
Eleocharis spp.	**1992**							*Sesbania spp.*	**1992**						
	1995	85 und	T						**1995**						T
Hydrocotyle umbellata	**1992**			T				*Spartina alterniflora*	**1992**		T	T			
	1995		20 und	T					**1995**						
Ipomoea sagittata	**1992**			T				*Spartina patens*	**1992**			T	20	90	95
	1995					<5	<5		**1995**		20		20	90	90
Kosteletskya virginica	**1992**							*Sphenoclea zeylandica*	**1992**						
	1995		T	T		T			**1995**				T		
Lemna minor	**1992**	P aq						*Typha spp.*	**1992**	15		10			
	1995	P aq		P aq					**1995**	20		10			
Lippia lanceolata	**1992**							*Vigna luteola*	**1992**		<5		5	T	
	1995	T	T				T		**1995**	T	<5			<5	<5

T = trace, Paq = present aquatic vegetation, #und = percent cover as understory vegetation, and <5 = less than 5%.