Coastal Protection and Restoration Authority of Louisiana
Office of Coastal Protection and Restoration

2008 Operations, Maintenance, and Monitoring Report

for

NAOMI OUTFALL MANAGEMENT

State Project Number BA-03c
Priority Project Lists 5

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Jefferson & Plaquemine Parishes

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2008 Operations, Maintenance, and Monitoring Report
For
Naomi Outfall Management (BA-03c)

Table of Contents

Preface

The 2008 OM&M Report format is a streamlined approach which combines the Operations and Maintenance annual project inspection information with the monitoring data and analyses on a project-specific basis. The report format for 2008 includes monitoring data collected through December 2007, and annual Maintenance Inspections through June 2007. Monitoring data collected in 2008 and maintenance inspections conducted between July 2007 and June 2008 will be presented in the 2009 OM&M Report.

I. Introduction

In 1992, the state-funded Naomi- Siphon Diversion (BA-03) project was built to re-introduce (or divert) freshwater from the Mississippi River into the adjacent marshes through a set of eight siphons (Figure 1). The freshwater re-introduction was intended to restore some of the ecological functions supported by periodic over-bank flooding that occurred prior to the placement of the flood-control levee system. In order to manage freshwater from the diversion and to protect the area marshes from shoreline erosion and saltwater intrusion, the CWPPRA-funded Naomi Outfall Management Project (BA-03c) and the Barataria Bay Waterway East Bank Protection Project (BA-26) were completed in 2002. Monitoring of the state-funded BA-03 project was expanded in 1997 to include both the BA-03c and BA-26 project areas because they were adjacent to one another. Thus, for monitoring purposes, all three projects are combined into one project and will be referred to in this report as the Naomi Outfall Management project. All references to "project area" will refer to the unified area of all three projects. Although the three projects are combined for monitoring purposes, the BA-26 inspection reports along with the description of its features and maintenance budgets will remain separate.

The Naomi Outfall Management project area lies within the Barataria Basin in Jefferson and Plaquemines Parishes, Louisiana. The area is bordered by the Barataria Bay Waterway (BBW) and the town of Lafitte on the west and the Mississippi River back protection levee and the community of Naomi on the east (Figure 2). The area extends to the south of the Pen and includes the Dupre Cut portion of the Barataria Bay Waterway. The project comprises an area of approximately 26,956 ac (10,782 ha) of brackish and intermediate marsh.

The objective of the Naomi Outfall Management project is to protect the project area from continued degradation by managing freshwater introduced from the Mississippi River. In doing so the project also seeks to increase the benefit of sediment and nutrients introduced into the project area. The specific goal of the project is to manage the diverted freshwater from the Naomi siphon in the project area via the installation of two water control structures designed to reduce freshwater loss and saltwater intrusion.

Figure 1. Siphons constructed in 1992 as part of the Naomi-Siphon Diversion (BA-03) project and funded by the state of Louisiana. Mississippi River water is siphoned from the river intakes, discharged into a ponding area, and distributed through a single channel into the surrounding marshes.

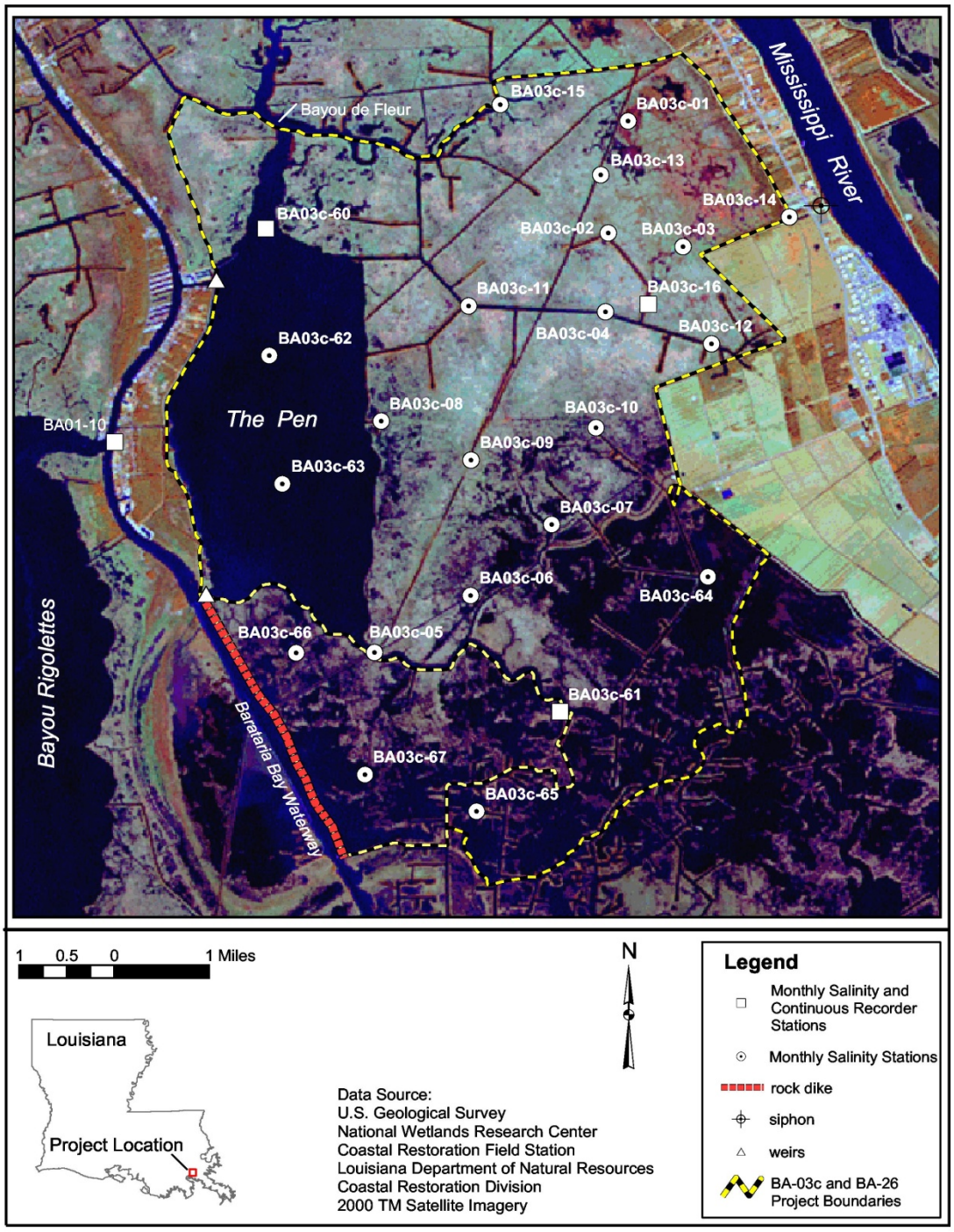

Figure 2. The Naomi-Siphon Diversion (BA-03), Naomi Outfall Management (BA-03c) and Barataria Bay Waterway East (BA-26) project boundary, stations, and water control structures. Staff gauges are located at stations 1, 3, 6, 10, 11, 14, 16, 60, and 61.

Project construction began on June 3, 2002, and was completed on August 17, 2002. Project life is estimated to be 20 years. Project inspections occur on an annual basis.

The principal project features include two fixed-crested weirs with boat bays (Figure 2):

1. One stone weir at **Goose Bayou Canal:**
    a. Total length of weir = 458 ft
    b. Bottom width of boat bay = 30 ft
    c. Boat bay bottom elevation= -5 ft North American Vertical Datum (NAVD 88)
    d. Weir crest = +1 ft. (NAVD 88)
    e. Rock placed directly on geotextile
    f. Rock rip rap = 3,967 tons
    g. Geotextile = 2,851 yards
    h. Rock conforms to Rock Type 1 of Material Specification 523 with a graduation of:

Percent Lighter Than	Rock Unit Weight
100	700 lbs
50-100	300 lbs
15-50	150 lbs
0-15	45 lbs

    i. Four (4) - 4-piling clusters with navigation aid lights and warning signs
    j. Six (6) single pilings with warning signs
    k. Thirty-two buoys and associated stainless steel cable

2. One stone weir at **Bayou Dupont Canal**
    a. Total length of weir = 302 ft
    b. Bottom width of boat bay = 30 ft
    c. Boat bay bottom elevation = -5 ft (NAVD 88)
    d. Weir crest +1 ft. (NAVD 88)
    e. Rock placed directly on geotextile
    f. Rock rip rap = 8,505 tons
    g. Geotextile = 3,374 yards
    h. Rock conforms to Rock Type 1 of Material Specification 523 with a graduation of:

Percent Lighter Than	Rock Unit Weight
100	700 lbs
50 -100	300 lbs
15-50	150 lbs
0-15	45 lbs

i. Four (4) 4-pile clusters with day mark navigation signs and three (3) of the piling clusters with navigation aid lights.
j. Three (3) single pilings with warning signs (reduced from five (5) in 2006 repair project)
k. Twenty-two warning buoys with stainless steel cable
l. Two (2) marker buoys with warning markings and internal radar reflectors (added during 2006 repair project in place of two (2) single pilings with warning signs).

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Naomi Outfall Management Project (BA-03c) is to evaluate the constructed project features for deficiencies, and to prepare a report detailing the condition of project features and recommended corrective actions. Should it be determined that corrective actions are needed, LDNR shall provide a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs (LDNR OM&M Plan 2002). The annual inspection report also contains a summary of maintenance projects and an estimated projected budget for the upcoming three (3) years for operation, maintenance and rehabilitation. The three (3) year projected operation and maintenance budget is shown in Appendix B.

An annual inspection of the Naomi Outfall Management Project (BA-03c) was held on March 27, 2007 by Barry Richard of LDNR and Michael Trusclair of NRCS. There was a light southeast wind, and the tide gauge located approximately 0.8 miles north of C&M Marina on the east bank of the Barataria Bay Waterway was reading +0.5-ft NAVD-88. Photographs of that inspection are included in Appendix A of this report.

On June 20, 2006, a contract was awarded to place two warning buoys in places where warning signs were damaged and to replace 5 navigation lights. This project was completed on October 4, 2006.

b. Inspection Results

BAYOU DUPONT CANAL WEIR

Rock Rip-rap

There were no notable changes in the rock rip-rap during this inspection.

Pilings

The two pilings on either side of the boat bay, which were found to be damaged during the previous annual inspection, have been replaced with regulatory marker buoys. Two piling clusters supporting navigation lights appeared to have been damaged. One cluster was leaning significantly and the other displayed physical signs of damage.

Warning Signs and Day Board Navigation Signs

All signs are in good condition.

Navigation Aid Lights

There was no damage to any navigation lights.

Regulatory Marker Buoys

One of the buoys has apparently floated away since the last inspection. The other buoy remains washed up on the rocks.

GOOSE BAYOU CANAL WEIR

Rock Rip-rap

There were no notable changes in the rock rip-rap during this inspection.

Pilings

All pilings appeared to be in good condition (see Appendix A, Photograph 3).

Warning Signs and Day Board Navigation Signs

All signs appeared to be in satisfactory condition with no indication of significant damage.

Navigation Aid Lights

The navigation lights, which were noted as damaged in last year's inspection report, have been replaced.

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

Bayou Dupont repair needs are listed in the previous section.

ii. Programmatic/ Routine Repairs

A contract has been awarded to Automatic Power for regular maintenance of the lights.

III. Operation Activity

a. Operation Plan

Siphon Operation

There are no active operations for the BA03c outfall project structures. However, the BA-03 siphons play an integral role in the monitoring aspect of BA03c given that siphon discharge increases the amount of freshwater introduced into the project area.

The operation plan called for the structure to have all eight pipes operating at just over 1,000 ft^3s^{-1} for all months except March and April when only two pipes are to be in operation (LDNR 1992). Daily siphon discharge from 1993-2007 was calculated from the head differential between the river, the immediate outfall area, and the number of siphons in operation. However, siphons were inoperable from August 30, 2005 through December 30, 2006 as a result of damage due to hurricane Katrina. Water elevation data were obtained from the Mississippi River gauge readings at Alliance LA, and the immediate outfall area staff gauge (BA03c-14). Operation data were obtained from Plaquemines Parish Government (PPG), which contain both the date and number of siphons in operation. It should be noted that PPG is responsible for all operations of the Naomi Siphon.

b. Actual Operations

Siphon Discharge

The siphons are capable of a maximum discharge of 2,144 ft^3s^{-1} with the optimum river stage and uninterrupted operation. However, from 1993 through 2007 the structure was only in operation 74% of the time. Discharge averaged 748 ft^3s^{-1} when fully operational (i.e. all eight pipes), and 501 ft^3s^{-1} over the entire period, including times of no flow (Figure 3). In addition, siphon flow varied each year due to limited operations, seasonal low river stages, and droughts. When the Mississippi River gauge in Alliance, LA dropped below 1.5 feet NAVD88 the siphons began to lose prime and were rendered inoperable. Additional obstacles to operation were: marine fisheries, tropical storms, oil spills, maintenance problems, and staffing limitations within PPG.

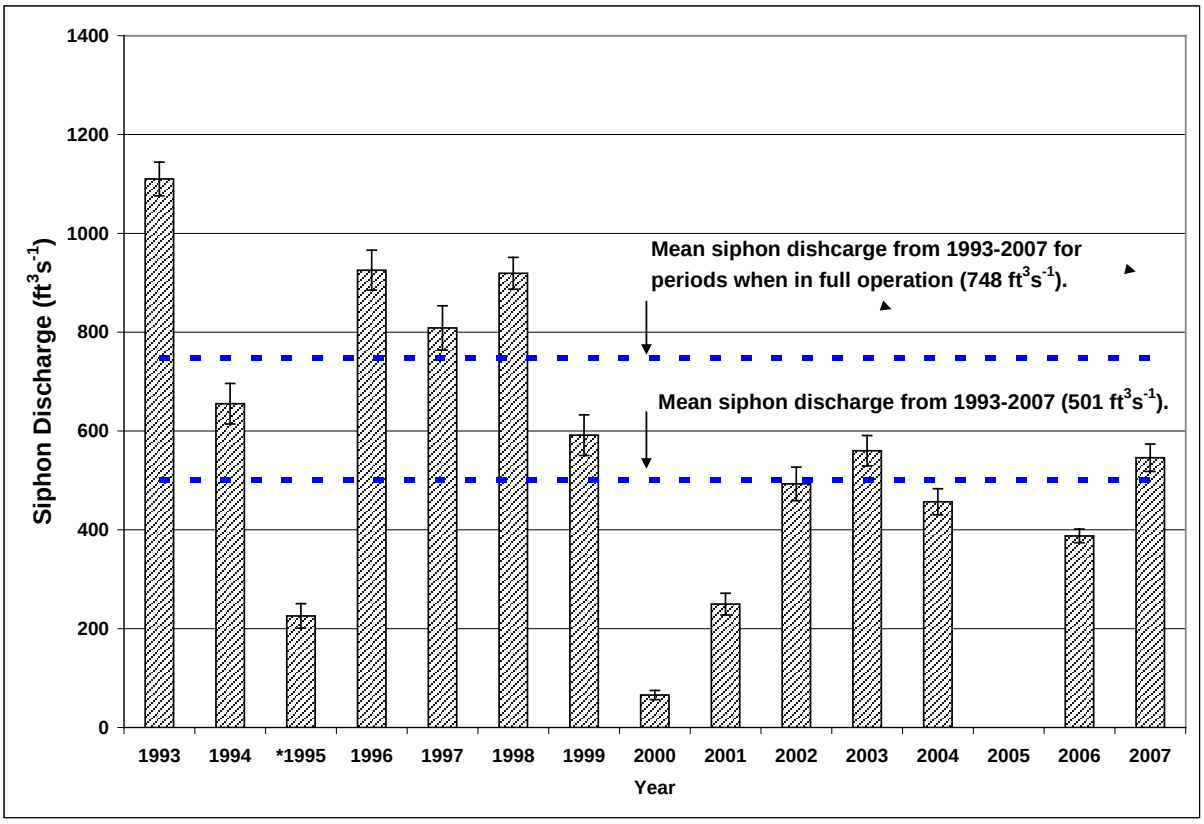

Figure 3. Yearly mean (±SE) siphon discharge for the Naomi Outfall Management (BA-03c) project from 1993 to 2007. Dotted lines represent mean discharge through 2007 when siphons were in full operation. Daily siphon discharge was estimated from the Mississippi River gauge at Alliance LA, the immediate staff gauge in the outfall area, and the number of siphons in operation. *Siphons were limited in operation during 1995 (operations), 2000 (drought), and 2005 (Hurricane Katrina).

IV. Monitoring Activity

a. Monitoring Goals

The objective of the project was to protect the project area from continued degradation by managing the diverted freshwater from the Naomi siphon in the project area. This was achieved with the installation of two water control structures designed to reduce freshwater loss and saltwater intrusion.

The following goals will contribute to the evaluation of the above objectives:

1. Reduce the mean salinity in the project area.
2. Improve the growing conditions and increase the relative abundance of fresh-to-intermediate marsh species.
3. Reduce the rate of conversion of marsh to open water in project area.

b. Monitoring Elements

Salinity

Salinity data were collected hourly at three continuous recorder stations from June 1999 to December 2007 (see Figure 2). Discrete salinity was monitored monthly at 16 stations from 1992 to 1999 and at 24 stations from 1999 to 2007. Data were used to characterize the spatial and temporal variation in salinity throughout the project area. Salinity data will continue to be collected through 2012.

Water elevation

Water level data were collected hourly at the three continuous recorder stations from 1999 to 2007. Discrete water level measurements were recorded monthly at seven staff gauge stations from 1992 to 2000 and at nine gauges from 2000 – 2007 (see Figure 2). Data were used to characterize the spatial and temporal variation in water level throughout the project area. Water level data collection will continue through 2012.

Vegetation

Species composition and relative abundance of emergent vegetation were quantified using modified Braun-Blanquet methods described in Steyer et al. (1995). Twenty-one stations were visually monitored in 1992 (pre-construction) and in 1995 (post-construction). Forty plots ($4m^2$) were surveyed in years 1997, 2000, 2003, 2006 and will continue to be surveyed in 2009, and 2012.

Habitat Mapping

In order to document vegetated and non-vegetated areas, color-infrared aerial photography (1:12,000 scale with ground controls) was obtained following procedures outlined in Steyer et al. (1995). Photography was obtained in 1993 (pre-construction) and 2000 (post-construction), and will be collected in 2008 and 2017.

c. Preliminary Monitoring Results and Discussion

Salinity

Mean daily salinity measured at the three continuous recorders was lower during periods when all siphons were in either major or minor operation (vs. no-flow), indicating that the siphons are capable of reducing salinity in the project area (Figure 4). However, salinity during these periods was influenced by factors other than siphon operation, particularly normal seasonal variability within the Barataria Basin (Swenson and Swarzenski 1995; Wiseman et. al. 1990). For example, salinity is generally lowest throughout the Barataria Basin during the spring which corresponds to the period of highest flow for the Mississippi River. During a drought from September 1999 to December 2000, mean yearly salinity levels in the project area increased greatly, while siphon operation decreased substantially due to low river stage. This occurred again in 2005 following Hurricane Katrina (Figure 5). Since siphon operation is a function of river stage, the ability to control salinity during drought or normal low river stages (e.g. late summer and fall) was limited. Pre-construction salinity levels were higher than post-construction levels at all continuous recorders. Therefore, the percent change were compared at each continuous monitoring station within the project to the reference salinity measured at station BA01-10, a Barataria Bay Waterway station, figure 2, located outside the project. The percent change between pre and post data for stations 16, 60, 61 and 10 among stations were 46%, 48%, 44% and 46% indicating little difference for pre and post salinity levels among the stations inside and outside the project area (Figure 6).

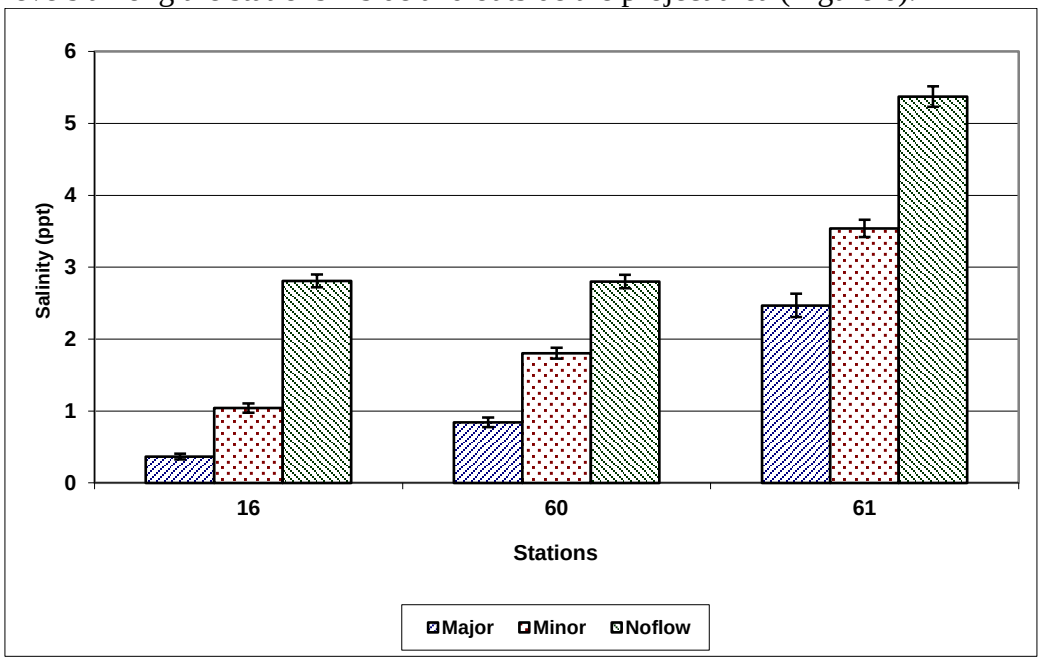

Figure 4. **Naomi Outfall Management (BA-03c) Project** mean (±SE) salinity for the period 1999 to 2007 for 3 operational categories at YSI continuous recorder stations (major discharge >1,072 ft^3s^{-1}; minor discharge >0, <1,072 ft^3s^{-1}; no flow = 0 ft^3s^1).

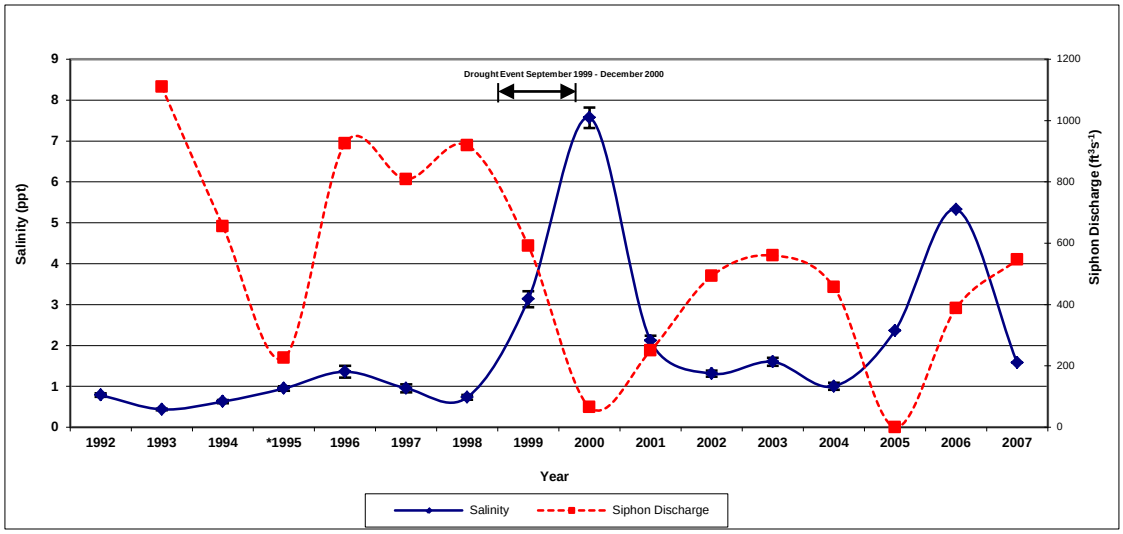

Figure 5. Naomi Outfall Management (BA-03c) Project yearly mean (±SE) salinity and siphon discharge. Salinity was measured at 16 discrete monthly hydrologic stations for the period 1992 to 2003 and at 24 stations from 1999 to 2007. *Siphons were not operational for 9 months during 1995.

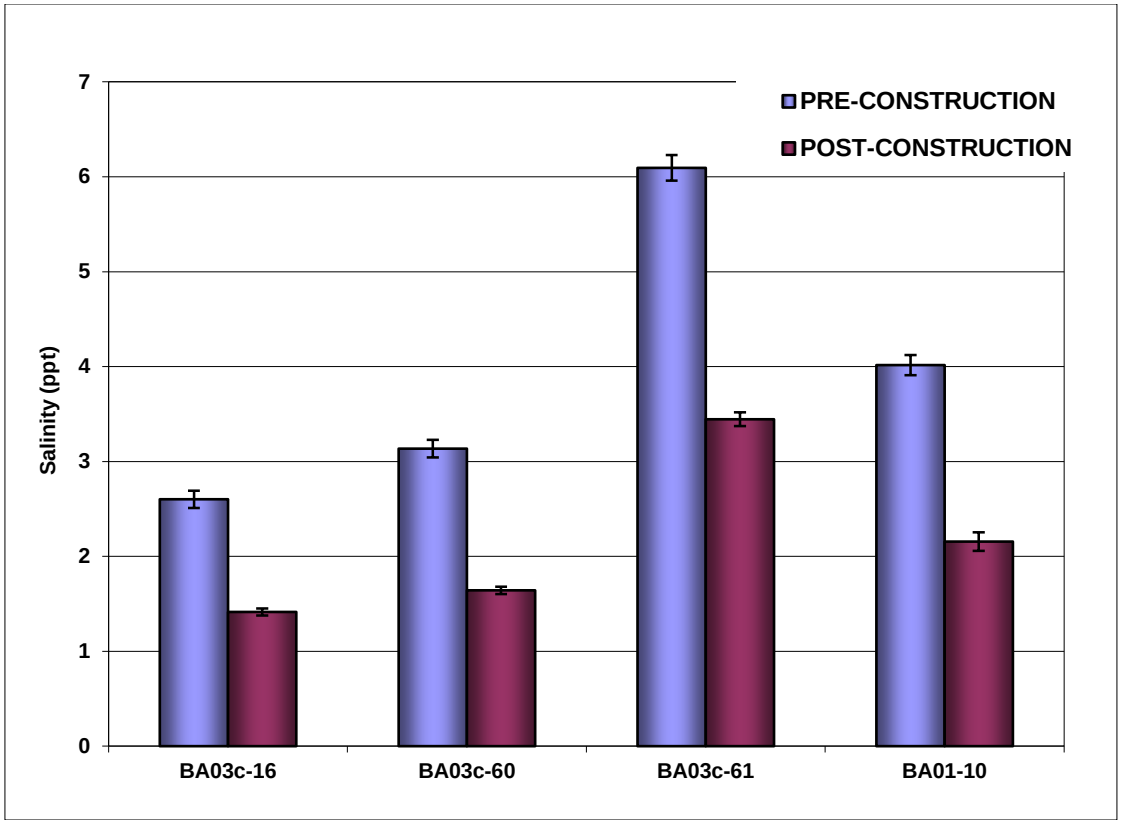

Figure 6. Naomi Outfall Management (BA-03c) Project mean daily salinity during pre-construction (05/01/1999 to 08/15/2002) and post-construction (08/15/2002 to 12/31/2007) for project and reference (BA01-10) stations.

Water Elevation

Water level from monthly staff gauge readings collected during siphon operations was significantly higher (P<.0001) at the monitoring station nearest the outfall structure (station 14) than the remaining stations. The mean water level at station 14 (during major flow conditions (>1,072 ft^3s^{-1}) was 23.2 inches above the mean water level measured during no-flow conditions. Nonetheless, data from the remainder of the stations indicated water surface elevations dissipated quickly with distance from the discharge area, and few differences in water level were noted among flow categories for other stations outside of the immediate outfall area.

Hourly water levels indicated that water levels changed very little between the pre- and post-construction periods. The difference between mean pre-construction and post-construction water levels at station 60 and 61, the stations farthest from the diversion, was $\leq$ 1 inch, while that of stations BA01-10 (the reference station) and 16, the stations closest to the diversion, was 2.3 and 3.3 inches (Figure 7).

Figure 7. Naomi Outfall Management (BA-03c) Project mean monthly water levels during pre-construction (05/01/1999 to 08/15/2002) and post-construction (08/15/2002 to 12/31/2007) within the project and reference areas.

Vegetation

Early vegetation surveys conducted in years 1992 and 1995 indicated that the northeast portion of the project area was comprised of fresh to intermediate marsh with *Sagittaria lancifolia* (bulltongue) as the dominant species. The southern portion of the project area was comprised of brackish marsh with *Spartina patens* (marshay cordgrass) as the dominant species. Vegetation surveys later conducted during 1997, 2000, 2003 and 2006 cannot be directly compared with the beginning 1992 and 1995 surveys due to different methodologies, times of year, and sampling sites used in the latter years. During the 1997, 2000, 2003 and 2006 surveys, *S. patens* had the highest percent cover and frequency of occurrence over the entire project area (Table 1, figures 8 and 9) and to a greater extent in the southern part of the project area than the north. Frequency of *S. patens* in the southern area was 100% for all stations during all four surveys, whereas it averaged 48% in the northern area. Frequency of other species was greater in the northern area. Species richness was 26% greater at the northern stations than at the southern stations due to the closer proximity to the less saline environment near the siphon. Overall, species richness increased each year in both the northern stations and southern stations indicating a recovery of the vegetation community from the 2000 drought.

Habitat Mapping

The 1991 pre-construction photography, which was flown on November 05, 1991, covers only the original Naomi-Siphon Diversion (BA-03) project area (figure 10). The 2000 post-construction photography, which was flown on November 23, 2000, includes the original BA-03 project area, as well as the BA-03c and BA-26 project areas (figure 11). The pre- and post construction landwater analysis cannot be directly compared due to differences in scale between the two years (1:12,000 in 1991 vs. 1:24, 000 in 2000).

Table 1. The frequency at which each species occurred and the total number of species in the Naomi Outfall Management Project (BA-03c) during the 1997, 2000, 2003, and 2006 surveys.

Scientific Name	Common Name	Occurrence (%)			
		1997	2000	2003	2006
Alternanthera philoxeroides	Aligatorweed	10.0	15.0	10.0	12.5
Amaranthus australis	Southern amaranth	2.5	.	15.0	10.0
Ammannia latifolia	Pink redstem	2.5	2.5	10.0	5.0
Andropogon glomeratus	Bushy bluestem	17.5	7.5	.	.
Baccharis halimifolia	Eastern baccharis	17.5	10.0	5.0	5.0
Bacopa monnieri	Coastal waterhyssop	10.0	17.5	22.5	22.5
Cuscuta indecora	Bigseed dodder	.	.	2.5	5.0
Cyperus sp.	Flatsedge	12.5	15.0	.	10.0
Cyperus compressus	Poorland flatsedge	.	.	15.0	.
Cyperus odoratus	Fragrant flatsedge	12.5	10.0	20.0	7.5
Distichlis spicata	Seashore saltgrass	2.5	25.0	10.0	5.0
Echinochloa crus-galli	Barnyardgrass	2.5	.	.	.
Echinochloa walteri	Coast cockspur	.	2.5	10.0	10.0
Eichhornia crassipes	Water hyacinth	2.5	.	.	.
Eleocharis sp.	Spikerush	27.5	.	5.0	.
Eleocharis cellulosa	Gulf Coast spikerush	40.0	27.5	45.0	42.5
Eleocharis parvula	Dwarf spikesedge	2.5	2.5	20.0	.
Fuirena squarrosa	Dwarf spikesedge	.	.	2.5	.
Galium tinctorium	Spikerush	.	.	7.5	.
Hibiscus moscheutos	Crimsoneyed rosemallow	17.5	.	.	.
Hydrocotyle sp.	Hydrocotyle	35.0	10.0	32.5	7.5
Ipomoea sagittata	Saltmarsh morninglory	30.0	37.5	42.5	40.0
Iva frutescens	Bigleaf sumpweed	2.5	10.0	5.0	15.0
Juncus effusus	Common rush	5.0	.	.	.
Juncus roemerianus	Needlegrass rush	2.5	2.5	2.5	2.5
Kosteletzkya virginica	Virginia saltmarsh mallow	.	2.5	2.5	20.0
Lemna minor	Common duckweed	.	5.0	.	.
Ludwigia microcarpa	Smallfruit primrose-willow	20.0	.	.	.
Lythrum lineare	Wand lythrum	.	.	37.5	25.0
Mikania scandens	Climbing hempvine	7.5	.	.	10.0
Panicum dichotomiflorum	Fall panicgrass	.	.	.	2.5
Panicum hemitomon	Maidencane	.	.	.	12.5
Panicum repens	Torpedograss	.	2.5	7.5	.
Paspalum distichum	Knotgrass	.	.	2.5	.
Phyla nodiflora	Turkey tangle fogfruit	45.0	25.0	40.0	20.0
Pluchea camphorata	Camphor pluchea	17.5	5.0	20.0	15.0
Pluchea foetida	Stinking camphorweed	2.5	.	.	.
Polygonum hydropiperoides	Swamp smartweed		.	.	2.5
Polygonum pensylvanicum	Pennsylvania smartweed	37.5			
Polygonum punctatum	Dotted smartweed	22.0	5.0	57.5	2.5
Sacciolepis striata	American cupscale	5.0	17.5	.	.
Sagittaria lancifolia	Bulltongue	45.0	47.5	50.0	45.0
Sagittaria platyphylla	Delta arrowhead	5.0	.	.	.
Salvinia minima	Water spangles	2.5	2.5	.	.
Schoenoplectus americanus	Olney bulrush	.	.	5.0	12.5
Schoenoplectus pungens	Common threesquare	35.0	25.0	.	2.5
Schoenoplectus robustus	Sturdy bulrush	.	.	37.5	12.5
Setaria magna	Giant bristlegrass	2.5	.	2.5	5.0
Setaria parviflora	Knotroot bristlegrass	22.5	2.5	5.0	2.5
Solidago sempervirens	Seaside goldenrod	17.5	15.0	5.0	10.0
Spartina alterniflora	Smooth cordgrass	2.5	10.0	7.5	5.0
Spartina patens	Marshay cordgrass	65.0	75.0	70.0	75.0
Sphenoclea zeylanica Gaertn.	Chickenspike	2.5	.	.	.
Sporobolus sp.	Dropseed	7.5	.	.	.
Symphyotrichum subulatum	Coastal Waterhyssop	27.5	.	20.0	15.0
Symphyotrichum tenuifolium	Perennial saltmarsh aster	35.0	40.0	.	17.5
Thelypteris palustris	Eastern marsh fern	10.0	2.5	7.5	10.0
Typha latifolia	Broadleaf cattail	.	2.5	2.5	5.0
Vigna luteola	Hairypod cowpea	45.0	.	40.0	12.5
Zizaniopsis miliacea	Giant cutgrass	.	.	2.5	.
Number of species		43	32	39	38

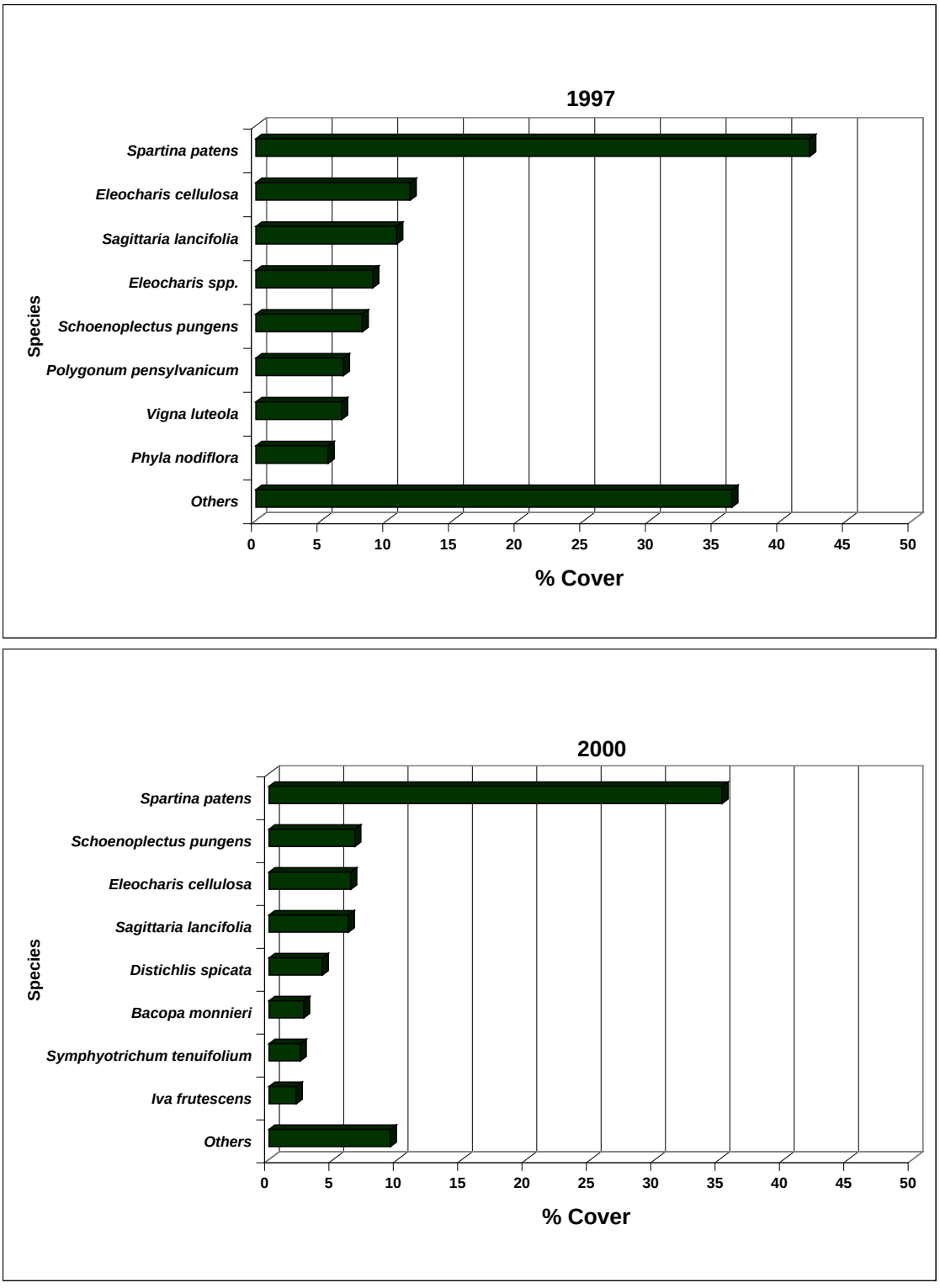

Figure 8. Mean percent cover of dominant vegetative species across all 4m^2 plots during the 1997 and 2000 (pre-outfall structure construction) vegetation surveys in the Naomi Outfall Management (BA-03c) project area.

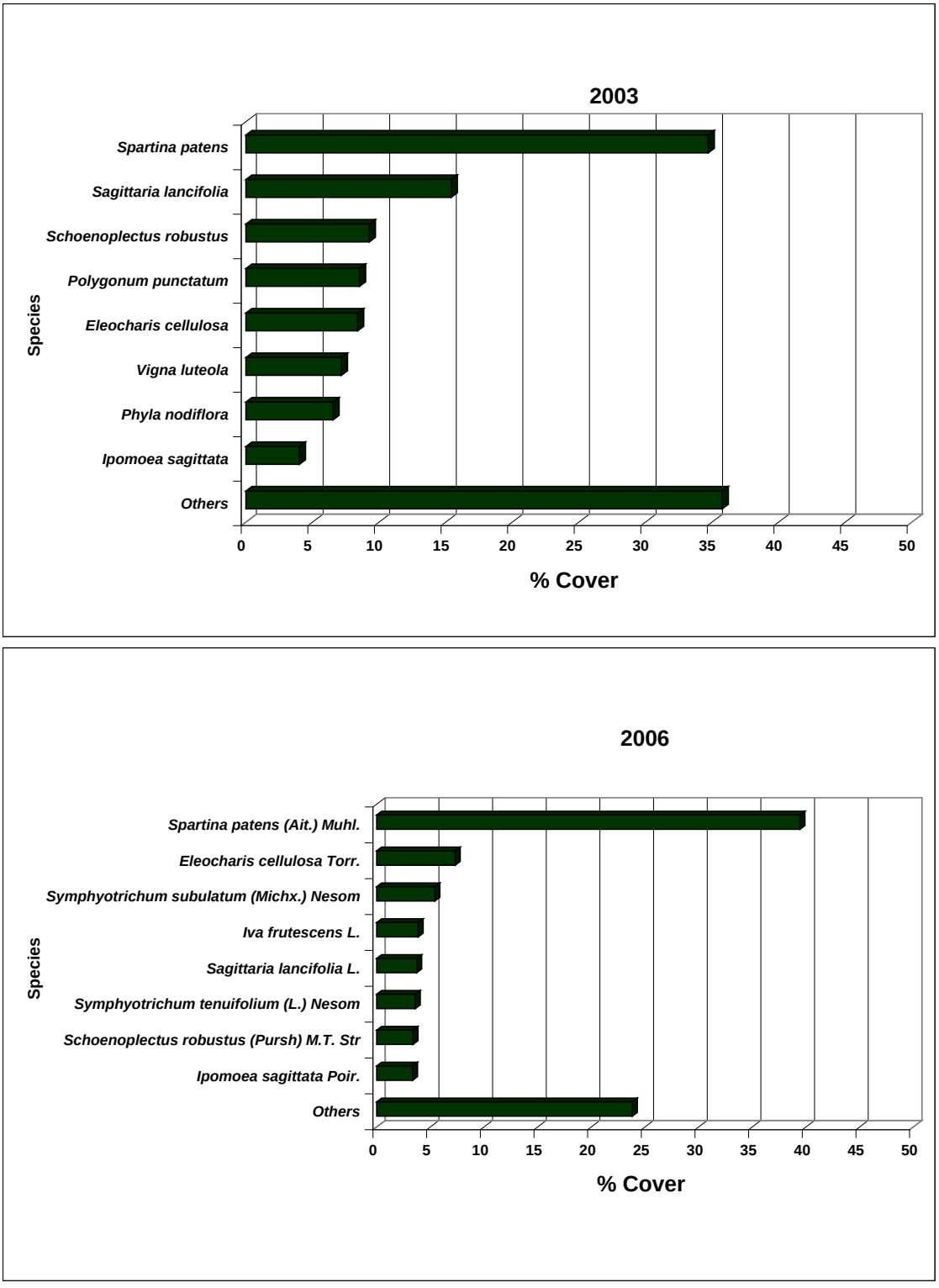

Figure 9. Mean percent cover of dominant vegetative species across all $4m^2$ plots during the 2003 and 2006 (post-outfall structure construction) vegetation surveys in the Naomi Outfall Management (BA-03c) project area.

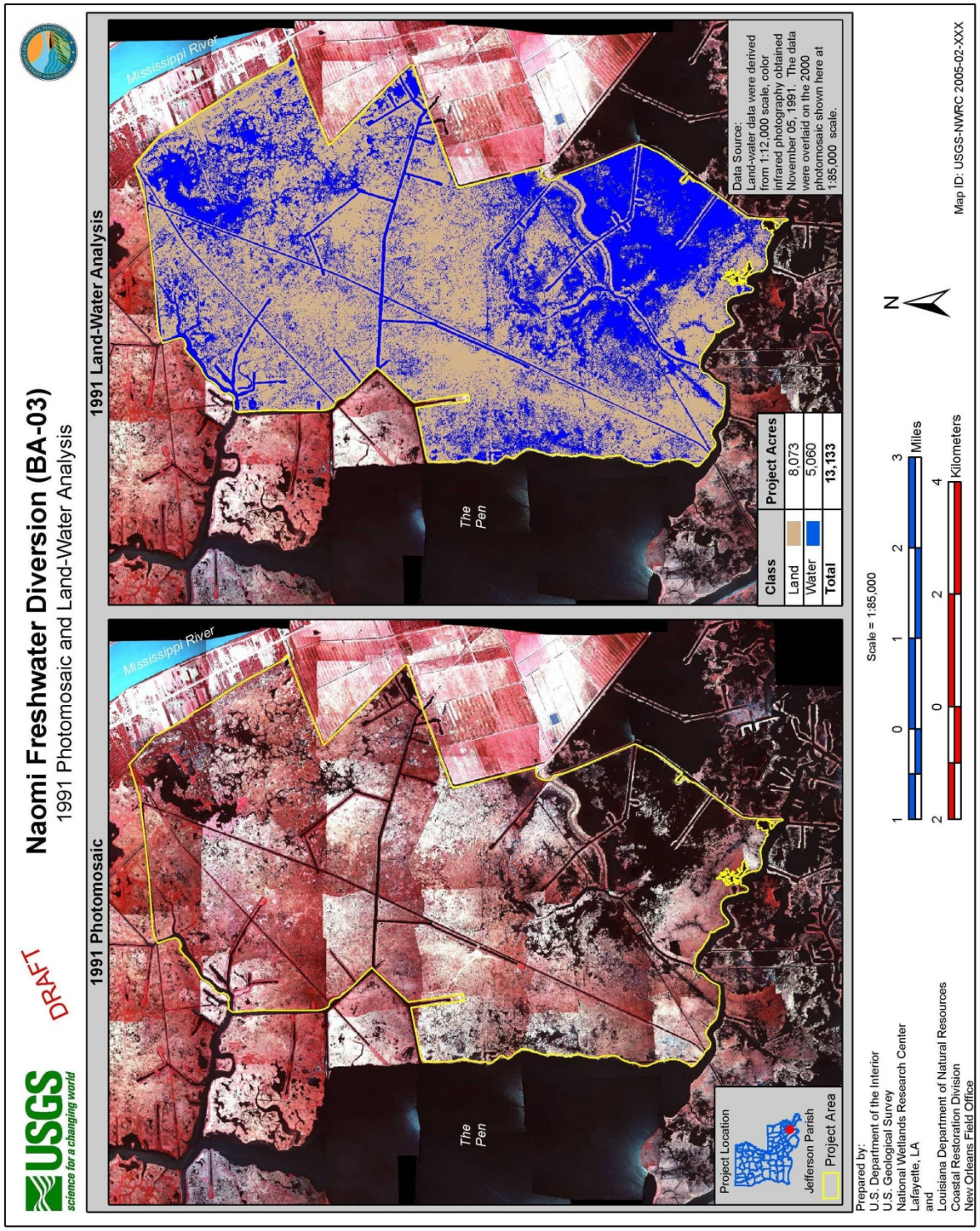

Figure 10. Pre-construction (1991) aerial photography and land-water analysis of the Naomi-Siphon Diversion (BA-03) project area.

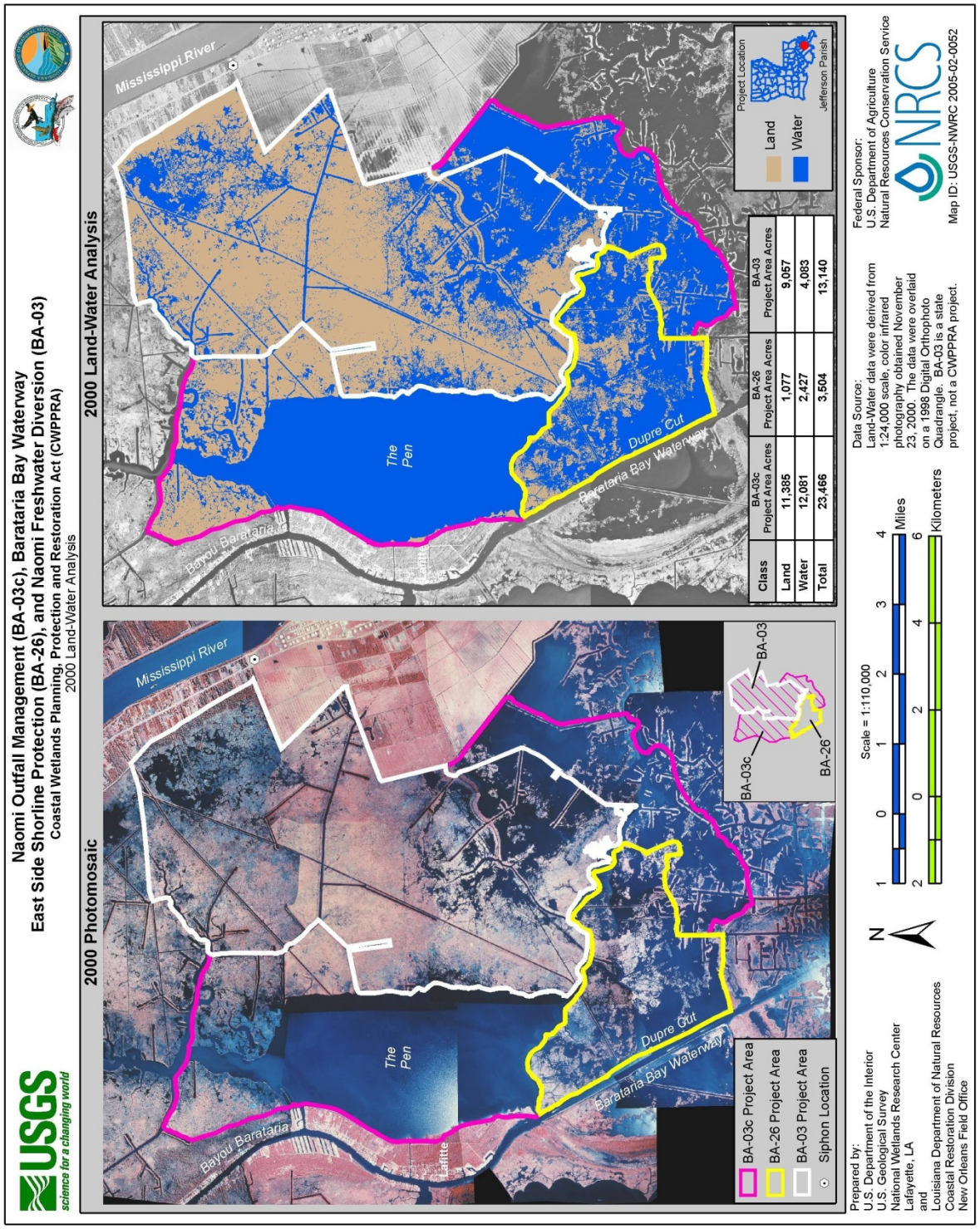

Figure 11. Post-construction (2000) aerial photography and land-water analysis of the BA-03, BA-03c and BA-26 project areas.

V. Conclusions

a. Project Effectiveness

Freshwater introduced by the siphons as a part of the state/PPG funded Naomi- Siphon Diversion (BA-03) project reduced salinity in the project area when the siphons were operated. However, the full potential benefit of the siphon was not realized because of various operation limitations. Some evidence was found to suggest that the outfall management structures associated with the Naomi Outfall Management (BA-03c) project had an effect on reducing the mean project salinity. Salinity was usually lower in the project area at the northern continuous recorder stations 16 and 60 than at the reference site, station BA01-10 (figure 12). These structures were designed to: 1) retain freshwater from the diversion and direct it south and 2) cut off inflow of saltwater from the Barataria Bay Waterway.

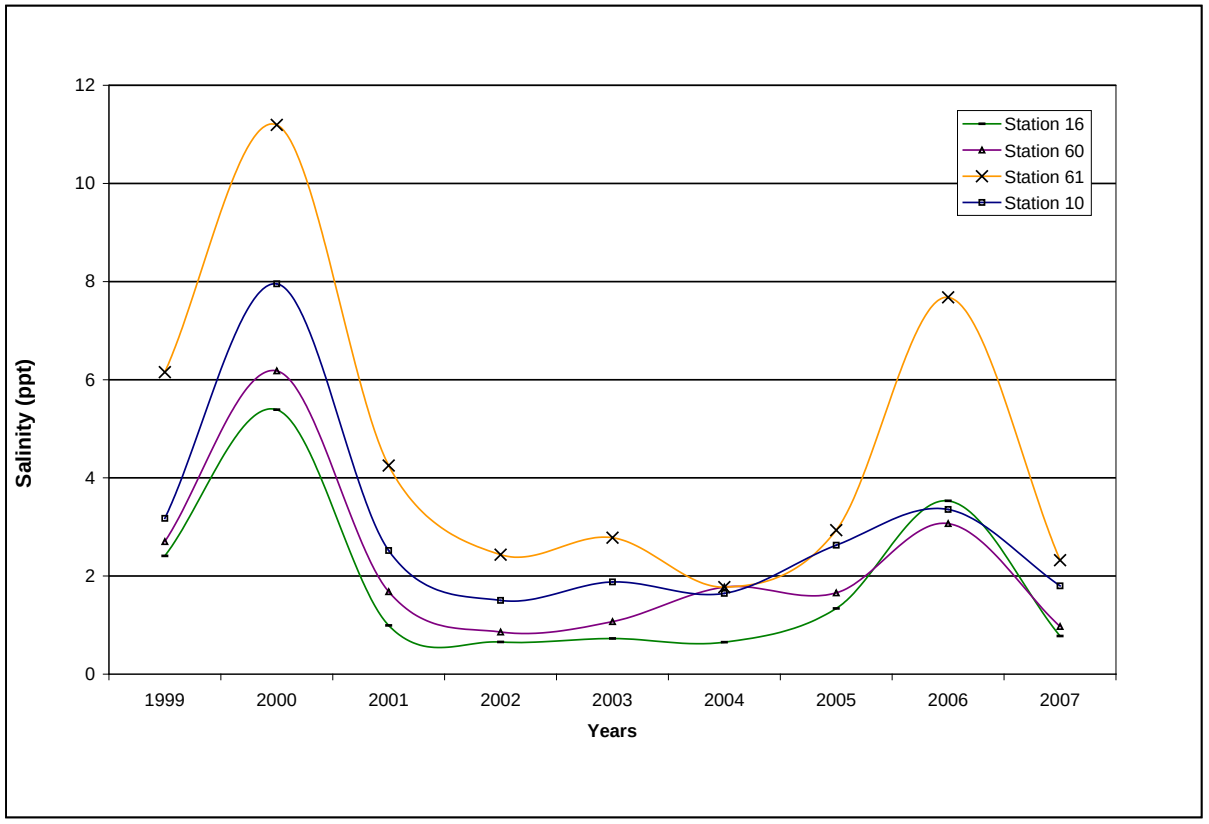

Figure 12. Yearly mean salinity within the BA-03c Naomi Outfall Management project. Salinity was measured hourly at three hydrologic stations within the project and at one hydrologic station outside the project (BA-10 reference) from 1999 to 2007.

Changes in salinity appeared to have an effect on the vegetation community in the post-construction period. From 1992 to 1999, prior to the construction of the outfall management structures, the number of freshwater species increased within the project area which was likely a result of the diversion. However, the vegetation community was affected by the drought in 2000, with some stations reverting from fresher to more saline species (Evers and Sasser 2002). Since the construction of the outfall management structures and continuation of the freshwater flow from the siphons, vegetation reverted back towards a fresher and more diverse community especially in the southern project area. One of the goals of this project was to increase the relative abundance of intermediate to fresh marsh plant species. That goal is being met in the project as a whole.

b. Recommended Improvements

The following recommendations pertain to the Naomi-Siphon Diversion (BA-03) operation; to improve and increase discharge and make operations more efficient. These recommendations will be discussed with the Plaquemines Parish Government (PPG), as PPG owns, operates, and maintains the siphon. There are no budgeted funds available in the CWPPRA-approved BA-03c O&M budget for siphon operation.

One problem which is currently being repaired is the piling damage at the Bayou Dupont Canal Weir. There have been at least three occasions where one of the two warning pilings has been hit by water vessels. To remedy this problem, we recommend placing buoys in the same location as the pilings. These buoys will be monitored closely to make sure they perform as planned. It may be necessary to look into installing the buoys in areas of high traffic for future projects instead of installing only pilings with signs.

c. Lessons Learned

From 1993 through 2007 the structure was only in operation 74% of the time and discharge averaged 748 ft^3s^{-1} when fully operational (i.e. all eight pipes). However, the siphons are capable of a maximum discharge of 2,144 ft^3s^{-1} with the optimum river stage and uninterrupted operation. It is apparent that the siphons at Naomi would benefit from the same improvements as those now being implemented for the West Pointe a la Hache siphon diversion. Siphon improvements would increase the amount and duration of freshwater flow to the project area by increasing the duration of operation and discharge volume of all siphon pipes each year, thereby increasing the net annual delivery of freshwater & sediment to the project area.

VI. Literature Cited

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Appendix A
Inspection Photographs

Photo #1 – The Bayou Dupont Canal Weir, approaching the structure from the Barataria Waterway, looking toward the Pen.

Photo #2 - The Bayou Dupont Canal Weir. Note the leaning piling cluster with the navigation light.

Photo #3 – The Goose Bayou Canal Weir. Looking East toward the Pen.

Appendix B
Three Year Budget Projection

Naomi Outfall Management / BA-03c / PPL 5
Three-Year Operations & Maintenance Budgets 07/01/2008 - 06/30/2011
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Project Manager	O & M Manager	Federal Sponsor	Prepared By
Barry Richard	*Barry Richard*	*NRCS*	*Barry Richard*

	2008/2009	2009/2010	2010/2011
Maintenance Inspection	$3,174.00	$3,257.00	$3,342.00
General Maintenance	$3,000.00	$3,000.00	$3,000.00
Structure Operation	$0.00	$0.00	$0.00
Administration	$0.00	$0.00	$0.00
Maintenance/Rehabilitation			

08/09 Description:

E&D	$0.00
Construction	$0.00
Construction Oversight	$0.00
Sub Total - Maint. And Rehab.	$ -

09/10 Description

E&D		$789.50
Construction		$7,114.00
Construction Oversight		$426.84
	Sub Total - Maint. And Rehab.	$ 8,330.34

10/11 Description:

E&D			$0.00
Construction			$0.00
Construction Oversight			$0.00
		Sub Total - Maint. And Rehab.	$ -

	2008/2009	2009/2010	2010/2011
Total O&M Budgets	**$ 6,174.00**	**$ 14,587.34**	**$ 6,342.00**

O &M Budget (3 yr Total)	**$ 27,103.34**
Unexpended O & M Budget	**$ 353,162.37**
Remaining O & M Budget (Projected)	**$ 326,059.03**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 2008/2009

Naomi Outfall Management / BA-03c / PPL 5

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$3,174.00	**$3,174.00**
General Structure Maintenance	LUMP	1	$3,000.00	**$3,000.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**
ADMINISTRATION				
LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSER Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument		EACH	0	$0.00	$0.00
Staff Gauge / Recorders		EACH	0	$0.00	$0.00
Marsh Elevation / Topography		LUMP	0	$0.00	$0.00
TBM Installation		EACH	0	$0.00	$0.00
OTHER					$0.00
				TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings		EACH	0	$0.00	$0.00
OTHER					$0.00
				TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:	Relocate bouy anchors and minor repairs				
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navagation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,174.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 2009/2010

Naomi Outfall Management / BA-03c / PPL 5

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$3,257.00	**$3,257.00**
General Structure Maintenance	LUMP	1	$3,000.00	**$3,000.00**
Engineering and Design	LUMP	1	$789.50	**$789.50**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$426.84	**$426.84**
ADMINISTRATION				
LDNR / CRD Admin.	LUMP	0	$2,000.00	$0.00
FEDERAL SPONSER Admin.	LUMP	0	$2,000.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:				
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:					
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navagation Aid		EACH	1	$1,351.00	$1,351.00
Signage		EACH	1	$5,763.00	$5,763.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$7,114.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: $14,587.34

OPERATION AND MAINTENANCE BUDGET WORKSHEET 2010/2011

Naomi Outfall Management / BA-03c / PPL 5

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$3,342.00	**$3,342.00**
General Structure Maintenance	LUMP	1	$3,000.00	**$3,000.00**
Engineering and Design	LUMP	0	$0.00	**$0.00**
Operations Contract	LUMP	0	$0.00	**$0.00**
Construction Oversight	LUMP	0	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	0	$0.00	$0.00
FEDERAL SPONSER Admin.	LUMP	0	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
	LUMP	0	$0.00	$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:					
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navigation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,342.00**

Appendix C
Field Inspection Form

FIELD INSPECTION CHECK SHEET

Project No. / Name: Naomi Outfall Management

Date of Inspection: 3/27/2008 Time: 9:30

Structure No. **Bayou Dupont Canal**

Inspector(s): Richard, Trusclair

Structure Description: Stone Weir

Water Level: Inside: N/A Outside: Approx. 0.5 ft

Type of Inspection: Annual

Weather Conditions: Clear skies, Light Wind

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Rock Riprap	Good	None	N/A	#1	
Creosote Piling	Fair	None	None	#1, 2	Some damage to pile clusters
Warning Signs and Day Board Navigation Signs	Fair	None	None	#1, 2	
Navigation Aid Lights	Fair	None	None	#1, 2	
Warning Buoys	Poor	See observations	None	#1	One missing and one up on rocks.
Vandalism	N/A	N/A	N/A		

FIELD INSPECTION CHECK SHEET

Project No. / Name: Naomi Outfall Management

Date of Inspection: 3/27/2008 Time: 9:30

Structure No. **Goose Bayou Canal**

Inspector(s): Richard, Trusclair

Structure Description: Stone Weir

Water Level: Inside: N/A Outside: Approx. 0.5 ft

Type of Inspection: Annual

Weather Conditions: Clear skies, Light Wind

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Rock Riprap	Good	None	N/A		
Creosote Piling	Good	None	None	#3	
Warning Signs and Day Board Navigation Signs	Good	None	None	#3	
Navigation Aid Lights	Good	None	None	#3	
Warning Buoys	Good	None	None	#3	
Vandalism	N/A	N/A	N/A		