



SYNTHESIS OF EXISTING INFORMATION

Volume 1:

*A CHARACTERIZATION OF WATER QUALITY, HYDROLOGIC ALTERATIONS, AND
FISH AND WILDLIFE HABITAT IN THE GREATER CHARLOTTE HARBOR WATERSHED*



Buteo lineatus
Red-shouldered Hawk

- *Peace River & Watershed • Myakka River & Watershed*
- *Coastal Venice/Lemon Bay/Gasparilla Sound/Cape Haze*
- *Charlotte Harbor Proper • Pine Island Sound/Matlacha Pass*
- *Estero Bay & Watershed • Tidal Caloosahatchee River & Watershed*

April 1999



SYNTHESIS OF TECHNICAL INFORMATION

Volume 1:

A CHARACTERIZATION OF WATER QUALITY, HYDROLOGIC ALTERATIONS, AND FISH AND WILDLIFE HABITAT IN THE GREATER CHARLOTTE HARBOR WATERSHED

Written and prepared by

Post, Buckley, Schuh, and Jernigan, Inc.

and

W. Dexter Bender and Associates, Inc.

for the

Charlotte Harbor National Estuary Program

- *Peace River & Watershed • Myakka River & Watershed*
- *Coastal Venice/Lemon Bay/Gasparilla Sound/Cape Haze*
- *Charlotte Harbor Proper • Pine Island Sound/Matlacha Pass*
- *Estero Bay & Watershed • Tidal Caloosahatchee River & Watershed*

April 1999

Cover artwork by Victor McGuire

This document is funded in part by the U.S. Environmental Protection Agency, Region 4 through a cooperative agreement for the Charlotte Harbor National Estuary Program.

Printed on Recycled Paper





Charlotte Harbor National Estuary Program

Policy Committee

Ms. Margaret Highsmith, Co-chair
District Director, South District
Florida Department of Environmental Protection

Mr. Tom Welborn, Co-chair
Branch Chief, Wetlands, Coastal, & Water Quality
U.S. Environmental Protection Agency, Region 4

Honorable Adam Cummings
Commissioner, Charlotte County
Honorable Bill Gorvine
Councilman, City of Punta Gorda
Honorable Ray Judah
Commissioner, Lee County
Honorable Paul Monroe
Councilman, City of Cape Coral
Dr. Molly Krival (Ex-officio member)
Past President,
J.N. "Ding" Darling Wildlife Society

Mr. Medard Koczynski
Director of Growth Management, City of Venice

Mr. Robert Tewis
Natural Resources Manager, City of Fort Myers

Honorable A.C. Cal Adams
Councilman, City of Bartow

Honorable Joseph Fink
Commissioner, City of North Port

Mr. Joe Kowalski
Planner, City of Arcadia

Honorable Steve Brown
Councilman, City of Sanibel

Mr. Gary Oden
County Manager, Hardee County

Honorable Patricia Glass
Commissioner, Manatee County

Honorable Shannon Staub
Commissioner, Sarasota County

Mr. William Hammond
Past Member, Governing Board
South Florida Water Management District

Honorable T. Felton Garner
Commissioner, DeSoto County

Mr. James Beever
Biologist
Florida Game and Fresh Water Fish Commission

Honorable John Albion
Commissioner, Lee County

Mr. Jim Sampson (Ex-officio member)
Director, Environmental Affairs
CF Industries, Inc.

Mr. Douglas Leonard
Executive Director
Central Florida Regional Planning Council

Mr. John Mulholland
Councilman, Town of Fort Myers Beach

Mr. Edward Wotitzky
Peace River Basin Board

Southwest Florida Water Management District

Mr. Steven Seibert
Secretary

Florida Department of Community Affairs

Mr. Mike Perry (Ex-officio member)
Senior Environmental Scientist, SWIM Section
Southwest Florida Water Management District

Mr. Jeff Spence
Director, Polk County Natural Resources
and Drainage Division

Management Committee

Mr. Wesley "Bo" Crum, Chair
Section Chief, Wetlands, Coastal, & Water Quality
U.S. Environmental Protection Agency, Region 4

Technical Advisory Committee

Mr. Mike Perry, Coastal Co-chair
Senior Environmental Scientist, SWIM Section
Southwest Florida Water Management District
Mr. Jim Sampson, Inland Co-chair
Director, Environmental Affairs
CF Industries, Inc.

Citizens' Advisory Committee

Dr. Molly Krival, Chair
Past President
J.N. "Ding" Darling Wildlife Society
Mr. Robert Croft, Vice-chair
Charlotte County

Charlotte Harbor

National Estuary Program

4980 Bayline Drive, 4th Floor
North Fort Myers, FL 33917

Tel. 941/995-1777 Fax 941/656-7724

E-mail: chnep-upton@mindspring.com

ACKNOWLEDGEMENTS

The Charlotte Harbor National Estuary Program would like to thank the following people for the contributions to this document:

Debra Childs
Thomas Fraser
Susan Janicki
Anthony Janicki
Pam Latham

Ralph Montgomery
Ray Pribble
Melissa Reiter
David Wade
Hans Zarbock

Numerous individuals also reviewed the document and provided valuable comments, additional information, and suggestions. Their efforts are greatly appreciated:

Fish and Wildlife Habitat Team

Jess Archer
Chris Becker
Jim Beaver
Margaret Bishop
Anna Bowditch
John Brenneman
Bill Byle
Terry Cain
David W. Ceilley
Joyce Chase
Daniel Clark
Jorge Coppen
Bob Croft
Kelly Dixon
Joy Duperault
Joe Fleming
Barbara Fleshman
Thomas Fraser
Ellen Hawkinson
Glenn Heath
Ed Higby
Lou Hinds
Bob Howard
Charlie Hunsicker
Richard Huxtable
Nat Italiano
Anthony Janicki
Carla Kappmeyer
Wilma Katz
Joe King
Molly Krival
Diane McCommons Beck
Mike Mitchell
Ralph Montgomery
Misty Nabers
Andy Neuhofer
Richard Novak
Warren Olds
Judy Ott
Mike Perry
Laraine Pollock
Bobbi Rodgers
Jim Sampson
Michael Simonik
Fran Stallings
Dave Tomasko
Diana Youmans

Water Quality Team

Chris Becker
Margaret Bishop
John Brenneman
Beth Casey
Joyce Chase
Al Cheatham
LeRoy Crockett
Bob Croft
Kelly Dixon
Ross Franklin
Thomas Fraser
Pat Fricano
Terry Hixon
Bob Howard
Richard Huxtable
Anthony Janicki
Connie Jarvis
Carla Kappmeyer
Wilma Katz
Keith Kibbey
Joe King
Joseph Lee
Lloyd Lueptow
Ralph Montgomery
Kayton Nedza
Judy Ott
Barbara Oxford
Tony Pellicer
Mike Perry
Laraine Pollock
Bill Protheroe
Al Quattrone
Steven Richardson
Bobbi Rodgers
Beverly Sidenstick
James R.E. Smith
Sam Stone
Steve Susick
Dave Tomasko
Bob Vincent
Albert Walton

Hydrologic Alterations Team

Chris Becker
Jim Beaver
Margaret Bishop
Joyce Chase
Al Cheatham
LeRoy Crockett
Bob Croft
Sid Flannery
Joe Fleming
Thomas Fraser
Ellen Hawkinson
Glenn Heath
Bob Howard
Richard Huxtable
Anthony Janicki
Carla Kappmeyer
Diane McCommons Beck
Ralph Montgomery
Tom Myers
Misty Nabers
Andy Neuhofer
Judy Ott
Mike Perry
Laraine Pollock
Bill Protheroe
Steven Richardson
Jacque Rippe
Beverly Sidenstick
Robert Slayton
James R.E. Smith
Sam Stone
Lee Thurner
Dave Tomasko
Mike Walters

Charlotte Harbor National Estuary Program Staff

Patti Armbruster, Administrative Support

Tiffany Lutterman, Director

David Moldal, Environmental
Administrator

Jock Robertson, Technical Writer

Melissa Upton, Public Involvement
Specialist

Table of Contents

List of Tables	ix
List of Figures	xiv
List of Appendices	xxiii
Glossary of Terms	xxiv
1. Introduction	1-1
1.1 Management Conference	1-1
1.2 Synthesis of Existing Information	1-3
2. Myakka River Basin	2-1
2.1 Physical Setting	2-1
2.1.1 Physiography	2-3
2.1.1.1 Topography	2-3
2.1.1.2 Geology	2-3
2.1.1.3 Soils	2-5
2.1.2 Rainfall	2-6
2.1.3 Existing and Future Land Use/Cover	2-8
2.1.3.1 Existing Land Use and Land Cover	2-12
2.1.3.2 Future Land Use	2-15
2.1.4 Surface Water Hydrology and Water Management Practices	2-15
2.1.4.1 Surface Water Hydrology	2-17
Water Use	2-20
Water Discharge and Reuse	2-22
2.1.4.2 Agricultural Management Practices	2-22
Southern Water Use Caution Area	2-25
2.2 Water Quality Conditions	2-29
2.2.1 Data Sources	2-29
2.2.2 Data Analysis	2-31
2.2.2.1 EQL Data	2-31
2.2.2.2 SWFWMD Data	2-33
2.2.2.3 USGS Data	2-38
2.3 Estimation of Pollution Potential	2-41
2.3.1 Load Estimates for the Upper Myakka River Subbasin	2-41
2.3.2 Load Estimates for the Lower Coastal Myakka Subbasin	2-43
2.3.3 Point Source Inventory	2-44
3. Peace River	3-1
3.1 Physical Setting	3-1
3.1.1 Physiography	3-3
3.1.1.1 Topography	3-3

3.1.1.2	Geology	3-3
3.1.1.3	Soils	3-4
3.1.2	Rainfall	3-7
3.1.3	Existing and Future Land Use	3-7
3.1.3.1	Existing Land Use/Cover	3-18
3.1.3.2	Future Land Use	3-23
3.1.4	Surface Water Hydrology and Water Management Practices	3-23
3.1.4.1	Surface Water Hydrology	3-23
3.1.4.2	Urban Management Practices	3-28
	Water Use	3-28
	Water Discharge and Reuse	3-45
3.1.4.3	Agricultural Management Practices	3-46
3.2	Water Quality Conditions	3-50
3.2.1	Data Sources	3-50
3.2.2	Data Analyses	3-51
3.2.2.1	EQL Data	3-53
3.2.2.2	SWFWMD Data	3-66
3.2.2.3	USGS Data	3-70
3.3	Estimation of Pollution Potential	3-70
3.3.1	Load Estimates for the Peace River at Bartow Subbasin	3-79
3.3.2	Load Estimates for the Peace River at Zolfo Springs Subbasin	3-80
3.3.3	Load Estimates for the Payne Creek Subbasin	3-81
3.3.4	Load Estimates for the Charlie Creek Subbasin	3-82
3.3.5	Load Estimates for the Peace River at Arcadia Subbasin	3-83
3.3.6	Load Estimates for the Horse Creek Subbasin	3-84
3.3.7	Load Estimates for the Joshua Creek Subbasin	3-85
3.3.8	Load Estimates for the Shell Creek Subbasin	3-86
3.3.9	Load Estimates for the Lower Peace River Subbasin	3-87
3.3.10	Pollution Source Inventory	3-88
4.	Charlotte Harbor Proper	4-1
4.1	Physical Setting	4-1
4.1.1	Physiography	4-1
4.1.1.1	Topography	4-3
4.1.1.2	Geology	4-3
4.1.1.3	Soils	4-3
4.1.2	Rainfall	4-4
4.1.3	Existing and Future Land Use	4-8
4.1.3.1	Existing Land Use	4-8
4.1.3.2	Future Land Use	4-10
4.1.4	Surface Water Hydrology and Water Management Practices	4-12
4.1.4.1	Surface Water Hydrology	4-12

	4.1.4.2 Urban Management Practices	4-12
	Water Use	4-13
	Water Discharge and Reuse	4-14
	4.1.4.3 Agricultural Management Practices	4-14
4.2	Water Quality Conditions	4-15
4.2.1	Data Sources	4-15
4.2.2	Data Analysis	4-15
	4.2.2.1 EQL Data	4-16
	4.2.2.2 SWFWMD Data	4-20
4.3	Estimation of Pollution Potential	4-23
4.3.1	Loading to the Charlotte Harbor Proper Basin	4-23
4.3.2	Pollution Source Inventory	4-24
5.	Lemon Bay Basin	5-1
5.1	Physical Setting	5-1
5.1.1	Physiography	5-1
	5.1.1.1 Topography	5-1
	5.1.1.2 Geology	5-3
	5.1.1.3 Soils	5-4
5.1.2	Rainfall	5-4
5.1.3	Existing and Future Land Use	5-8
	5.1.3.1 Existing Land Use	5-8
	5.1.3.2 Future Land Use	5-11
5.1.4	Surface Water Hydrology and Water Management Practices	5-12
	5.1.4.1 Urban Management Practices	5-12
	Water Use	5-13
	Water Discharge and Reuse	5-15
	5.1.4.2 Agricultural Management Practices	5-15
5.2	Water Quality Conditions	5-16
5.3	Estimation of Pollution Potential	5-16
5.3.1	Load Estimates for the Lemon Bay Basin	5-17
5.3.2	Pollution Source Inventory	5-18
6.	Pine Island Sound/Matlacha Pass	6-1
6.1	Physical Setting	6-1
6.1.1	Physiography	6-1
	6.1.1.1 Topography	6-1
	6.1.1.2 Geology	6-1
	6.1.1.3 Soils	6-3
6.1.2	Rainfall	6-4
6.1.3	Existing and Future Land Use	6-8

6.1.3.1	Existing Land Use	6-8
6.1.3.2	Future Land Use	6-12
6.1.4	Surface Water Hydrology and Water Management	6-12
6.1.4.1	Urban Management Practices	6-12
	Water Use	6-12
	Water Discharge and Reuse	6-14
6.1.4.2	Agricultural Management Practices	6-14
6.2	Water Quality Conditions	6-15
6.3	Estimation of Pollution Potential	6-15
6.3.1	Load Estimates Pine Island Sound/Matlacha Pass Basin	6-16
6.3.2	Pollution Source Inventory	6-17
7.	Tidal Caloosahatchee River	7-1
7.1	Physical Setting	7-1
7.1.1	Physiography	7-1
	7.1.1.1 Topography	7-3
	7.1.1.2 Geology	7-3
	7.1.1.3 Soils	7-3
7.1.2	Rainfall	7-4
7.1.3	Existing and Future Land Use	7-10
	7.1.3.1 Existing Land Use	7-11
	7.1.3.2 Future Land Use	7-13
7.1.4	Surface Water Hydrology and Water Management Practices	7-13
	7.1.4.1 Urban Management Practices	7-13
	Water Use	7-13
	Water Discharge and Reuse	7-18
	7.1.4.2 Agricultural Management Practices	7-19
7.2	Water Quality Conditions	7-19
7.3	Estimation of Pollution Potential	7-24
	7.3.1 Load Estimates for Telegraph Swamp Subbasin	7-25
	7.3.2 Load Estimates for Orange River Subbasin	7-25
	7.3.3 Load Estimates for Coastal Lower Caloosahatchee Subbasin	7-26
	7.3.4 Pollution Source Inventory	7-27
8.	Estero Bay	8-1
8.1	Physical Setting	8-1
8.1.1	Physiography	8-1
	8.1.1.1 Topography	8-1
	8.1.1.2 Geology	8-3
	8.1.1.3 Soils	8-3
8.1.2	Rainfall	8-5

8.1.3	Existing and Future Land Use	8-5
8.1.3.1	Existing Land Use	8-5
8.1.3.2	Future Land Use	8-11
8.1.4	Surface Water Hydrology and Water Management Practices	8-11
8.1.4.1	Urban Management Practices	8-11
	Water Use	8-12
	Water Discharge and Reuse	8-14
8.1.4.2	Agricultural Management Practices	8-14
8.2	Water Quality Conditions	8-15
8.3	Estimation of Pollution Potential	8-15
8.3.1	Load Estimates for Estero Bay Basin	8-23
8.3.2	Pollution Source Inventory	8-24
9.	Coastal Venice Basin	9-1
9.1	Physical Setting	9-1
9.1.1	Physiography	9-1
9.1.1.1	Topography	9-3
9.1.1.2	Geology	9-3
9.1.1.3	Soils	9-3
9.1.2	Rainfall	9-4
9.1.3	Existing and Future Land Use	9-4
9.1.3.1	Existing Land Use	9-9
9.1.3.2	Future Land Use	9-9
9.1.4	Surface Water Hydrology and Water Management Practices	9-10
9.1.5	Water Management Practices	9-10
9.1.5.1	Urban Management Practices	9-10
	Water Use	9-10
	Water Discharge and Reuse	9-14
9.1.5.2	Agricultural Management Practices	9-15
9.2	Water Quality Conditions	9-16
9.3	Estimation of Pollution Potential	9-16
9.3.1	Load Estimates for Coastal Venice Basin	9-17
9.3.2	Pollution Source Inventory	9-17
10.	Harbor Resources and Habitats	10-1
10.1	Harbor Resources	10-1
10.1.1	Marine and Estuarine Fishes	10-1
	Bay anchovy	10-2
	Redfish (red drum)	10-8
	Spotted Seatrout	10-11
	Snook	10-11

	Striped mullet	10-12
	Sheepshead	10-13
	Sharks	10-15
	Commercial Fisheries	10-19
10.1.2	Marine Mammals and Other Large Vertebrates	10-25
10.1.2.1	Manatees	10-25
	Manatee Distribution Within the Charlotte Harbor NEP	10-28
	Manatee Die-off Events in the Charlotte Harbor NEP	10-29
	General Mortality in the Charlotte Harbor NEP	10-30
10.1.2.2	Bottlenose Dolphin	10-34
10.1.2.3	American Crocodile	10-37
10.1.3	Benthos	10-38
10.1.3.1	Ecological role	10-38
10.3.1.2	Economically Important Species	10-39
	Pink Shrimp	10-39
	Blue Crab	10-40
	American Oyster	10-40
	Hard Clams	10-41
	Southern Bay Scallop	10-44
10.1.4	Birds	10-44
10.1.4.1	Diving and Wading and Birds	10-44
	Eastern Brown Pelican	10-45
	White Ibis	10-48
	Roseate Spoonbill	10-53
10.1.4.2	Raptors	10-53
	Osprey	10-53
	Bald Eagle	10-54
10.2	Critical Harbor Habitats	10-55
10.2.1	Submerged Habitats	10-56
10.2.1.1	Seagrasses	10-56
	Distribution in Lemon Bay	10-58
	Distribution in Charlotte Harbor Proper	10-59
	Distribution in Pine Island Sound/ Matlacha Pass	10-64
	Distribution in Caloosahatchee River	10-64
	Distribution in Estero Bay	10-68
10.2.1.2	Oyster Reef/Hard Bottom	10-68
	Distribution in Lemon Bay	10-68
	Distribution in Charlotte Harbor Proper	10-68
	Distribution in Pine Island Sound/ Matlacha Pass	10-70
	Distribution in the Caloosahatchee River	10-70
	Distribution in Estero Bay	10-70

10.2.1.3	Tidal/Mud Flats	10-70
	Distribution in Lemon Bay	10-71
	Distribution in Charlotte Harbor Proper	10-71
	Distribution in Pine Island Sound/ Matlacha Pass	10-71
	Distribution in the Caloosahatchee River	10-71
	Distribution in Estero Bay	10-71
10.2.1.4	Artificial Reefs	10-72
10.2.2	Emergent Saltwater Wetlands	10-72
10.2.2.1	Mangroves	10-72
	Distribution in Lemon Bay	10-73
	Distribution in Charlotte Harbor Proper	10-73
	Distribution in Pine Island Sound/ Matlacha Pass	10-73
	Distribution in the Caloosahatchee River	10-77
	Distribution in Estero Bay	10-77
10.2.2.2	Saltmarshes	10-77
	Distribution in Lemon Bay	10-80
	Distribution in Charlotte Harbor Proper	10-81
	Distribution in Pine Island Sound/ Matlacha Pass	10-81
	Distribution in the Caloosahatchee River	10-81
	Distribution in Estero Bay	10-81
10.2.3	Shorelines	10-83
	Distribution in Lemon Bay	10-83
	Distribution in Charlotte Harbor Proper	10-83
	Distribution in Pine Island Sound/ Matlacha Pass	10-83
	Distribution in the Caloosahatchee River	10-88
	Distribution in Estero Bay	10-88
10.3	Critical Harbor Habitats	10-88
10.3.1	Aquatic Preserves	10-88
10.3.2	Shoreline Habitats at Risk	10-89
11.	Inland Habitats	11-1
11.1	Critical Inland Habitats	11-2
11.1.1	Wetlands	11-3
	Peace River	11-3
	Myakka River	11-5
	Coastal Harbor Proper	11-5
	Coastal Venice	11-5
	Lemon Bay	11-5
	Pine Island Sound/Matlacha Pass	11-5
	Caloosahatchee River	11-5
	Estero Bay	11-5

11.1.2	Breeding and Feeding Grounds	11-6
	Ibis	11-6
	Egret	11-6
	Roseate Spoonbill	11-12
	Brown Pelican	11-12
	Osprey	11-12
	Eagle	11-12
11.1.3	Riverine	11-23
11.1.4	Listed Species Habitats	11-23
	Florida Panther	11-23
	Scrub Jay	11-28
11.2	Inland Habitats at Risk	11-30
11.2.1	Wetlands	11-31
11.2.2	Uplands	11-31
	Florida Scrub Jay	11-32
	Florida Panther	11-32
11.2.3	Riverine and Lake Systems	11-32
	Upper Peace River	11-33
	Lake Hancock	11-33
12.	Management Options	12-1
13.	Literature Cited	13-1

List of Tables

Table 2-1.	Hydrologic Soil Types in the Myakka River Basin.	2-6
Table 2-2.	Current (1990) land use/cover in the Myakka River Basin.	2-14
Table 2-3.	Future (2010) land use/cover in the Myakka River Basin.	2-15
Table 2-4.	Public water supply facilities in the Myakka River Basin.	2-20
Table 2-5.	Mining operations water use in the Myakka River Basin.	2-21
Table 2-6.	1990 estimated crop acreages, irrigation types, and water use in Manatee County.	2-24
Table 2-7.	1990 estimated crop acreages, irrigation types, and water use in Sarasota County.	2-24
Table 2-8.	Summary of trend tests computed for water quality data from the Lower Myakka River Estuary. ▲ - indicates increasing trend ($p < 0.05$); ▼ - indicates decreasing trend ($p < 0.05$); NS - indicates no significant trend; ID - insufficient data to detect trend.	2-32
Table 2-9.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Upper Myakka River subbasin.	2-42
Table 2-10.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type with the Lower Coastal Myakka River subbasin.	2-43
Table 2-11.	Domestic point sources in the Myakka River Basin by subbasin.	2-46
Table 2-12.	Industrial point sources in the Myakka River Basin by subbasin.	2-47
Table 3-1.	Hydrologic Soil Types in the Peace River Basin: Peace at Bartow, Peace at Zolfo Springs, and Peace at Arcadia Subbasins.	3-4
Table 3-2.	Hydrologic Soil Types in the Peace River Basin: Lower Peace, Payne Creek, and Charlie Creek Subbasins.	3-5
Table 3-3.	Hydrologic Soil Types in the Peace River Basin: Horse Creek, Joshua Creek, and Shell Creek Subbasins.	3-5
Table 3-4.	Current land use (1990)/cover in the Peace River Basin.	3-20
Table 3-5.	Current land use (1990)/cover in the Peace River Basin.	3-21
Table 3-6.	Current land use (1990)/cover in the Peace River Basin.	3-22
Table 3-7.	Future land use (2010)/cover in the Peace River Basin.	3-25
Table 3-8.	Future land use (2010)/cover in the Peace River Basin.	3-25
Table 3-9.	Future land use (2010)/cover in the Peace River Basin.	3-26
Table 3-10.	Public water supply facilities in the Peace River Basin.	3-37
Table 3-11.	Mining operations water use in the Peace River Basin.	3-43
Table 3-12.	Industrial facilities water use in the Peace River Basin.	3-44
Table 3-13.	1990 estimated crop acreages, irrigation types, and water use in Manatee County.	3-46
Table 3-14.	1990 estimated crop acreages, irrigation types, and water use in Sarasota County.	3-46

Table 3-15.	1990 estimated crop acreages, irrigation types, and water use in Charlotte County.	3-47
Table 3-16.	1990 estimated crop acreages, irrigation types, and water use in DeSoto County.	3-48
Table 3-17.	1990 estimated crop acreages, irrigation types, and water use in Hardee County.	3-48
Table 3-18.	1990 estimated crop acreages, irrigation types, and water use in Highlands County.	3-49
Table 3-19.	1990 estimated crop acreages, irrigation types, and water use in Polk County.	3-49
Table 3-20.	Summary of trend tests computed for water quality data from the Peace River Basin. ▲ - indicates increasing trend ($p < 0.05$); ▼ - indicates decreasing trend ($p < 0.05$); NS - indicates no significant trend; ID - insufficient data to detect trend.	3-69
Table 3-21.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Peace River at Bartow subbasin.	3-80
Table 3-22.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Peace River at Zolfo Springs subbasin.	3-81
Table 3-23.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Payne Creek subbasin.	3-82
Table 3-24.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type with the Charlie Creek subbasin.	3-83
Table 3-25.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Peace River at Arcadia subbasin.	3-84
Table 3-26.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Horse Creek subbasin.	3-85
Table 3-27.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Joshua Creek subbasin.	3-86
Table 3-28.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Shell Creek subbasin.	3-87
Table 3-29.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Lower Peace River subbasin.	3-88
Table 3-30.	Domestic point sources in the Peace River Basin.	3-92
Table 3-31.	Industrial point sources in the Peace River Basin.	3-97
Table 4-1.	Hydrologic soil types in the Coastal Harbor Proper Basin.	4-4
Table 4-2.	Current land use/cover in the Charlotte Harbor Proper Basin.	4-10
Table 4-3.	Future land use/cover in the Charlotte Harbor Proper Basin.	4-12
Table 4-4.	1990 estimated crop acreages, irrigation types, and water use in Charlotte County.	4-14
Table 4-5.	1990 estimated crop acreages, irrigation types, and water use in Lee County.	4-15

Table 4-6.	Summary of trend tests computed for water quality data from Charlotte Harbor proper. ▲ - indicates increasing trend ($p < 0.05$); ▼ - indicates decreasing trend ($p < 0.05$); NS - indicates no significant trend; ID - insufficient data to detect trend.	4-20
Table 4-7.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Charlotte Harbor Proper Basin.	4-24
Table 4-8.	Domestic point sources in the Charlotte Harbor Proper Basin	4-25
Table 4-9.	Industrial Point Sources in the Charlotte Harbor Proper Basin.	4-26
Table 5-1.	Hydrologic soil types in the Lemon Bay Basin.	5-5
Table 5-2.	Current (1990) land use/cover in the Lemon Bay Basin.	5-11
Table 5-3.	Future (2010) land use/cover in the Lemon Bay Basin.	5-12
Table 5-4.	Public water supply facilities in the Lemon Bay Basin.	5-13
Table 5-5.	Mining operations water use in the Lemon Bay Basin.	5-14
Table 5-6.	1990 estimated crop acreages, irrigation types, and water use in Sarasota County.	5-15
Table 5-7.	1990 estimated crop acreages, irrigation types, and water use in Charlotte County.	5-15
Table 5-8.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Lemon Bay Basin.	5-17
Table 5-9.	Domestic Point Sources in the Lemon Bay Basin.	5-19
Table 5-10.	Industrial Point Sources in the Lemon Bay Basin.	5-20
Table 6-1.	Hydrologic soil types in the Pine Island/Matlacha Pass Basin.	6-4
Table 6-2.	Current (1990) land use/cover in the Pine Island/Matlacha Pass Basin.	6-11
Table 6-3.	Future (2010) land use/cover in the Pine Island/Matlacha Pass Basin.	6-12
Table 6-4.	Public water supply facilities in the Pine Island Sound/Matlacha Pass Basin.	6-13
Table 6-5.	1990 estimated crop acreages, irrigation types, and water use in Lee County.	6-14
Table 6-6.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Pine Island Sound Basin.	6-16
Table 6-7.	Domestic point sources in the Pine Island Sound Basin.	6-18
Table 6-8.	Industrial point sources in the Pine Island Sound Basin.	6-19
Table 7-1.	Hydrologic soil types in the Tidal Caloosahatchee River Basin.	7-4
Table 7-2.	Current land use (1990) /cover in the Tidal Caloosahatchee River Basin.	7-11
Table 7-3.	Future land use (2010) /cover in the Tidal Caloosahatchee River Basin.	7-12
Table 7-4.	Public water supply facilities in the Tidal Caloosahatchee River Basin.	7-17
Table 7-5.	1990 estimated crop acreages, irrigation types, and water use in Charlotte County.	7-19

Table 7-6.	1990 estimated crop acreages, irrigation types, and water use in Lee County.	7-20
Table 7-7.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Telegraph Swamp Subbasin.	7-25
Table 7-8.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Orange River Subbasin.	7-26
Table 7-9.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Lower Caloosahatchee River Subbasin. ...	7-27
Table 7-10.	Domestic point sources in the Tidal Caloosahatchee River Basin	7-30
Table 7-11.	Industrial point sources in the Tidal Caloosahatchee River Basin	7-32
Table 8-1.	Hydrologic soil types in the Estero Bay Basin.	8-3
Table 8-2.	Current (1990) land use/cover in the Estero Bay Basin.	8-8
Table 8-3.	Future (2010) land use/cover in the Estero Bay Basin.	8-11
Table 8-4.	Public water supply facilities in the Estero Bay Basin.	8-12
Table 8-5.	1990 estimated crop acreages, irrigation types, and water use in Lee County.	8-14
Table 8-6.	1990 estimated crop acreages, irrigation types, and water use in Collier County	8-15
Table 8-7.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Estero Bay Basin.	8-24
Table 8-8.	Domestic Point Sources in the Estero Bay Basin.	8-27
Table 8-9.	Industrial Point Sources in the Estero Bay Basin	8-29
Table 9-1.	Hydrologic soil types in the Coastal Venice Basin.	9-4
Table 9-2.	Current (1990) land use/cover in the Coastal Venice Basin.	9-8
Table 9-3.	Future (2010) land use/cover in the Coastal Venice Basin.	9-9
Table 9-4.	Public water supply facilities in the Coastal Venice Basin.	9-13
Table 9-5.	1990 estimated crop acreages, irrigation types, and water use in Manatee County.	9-14
Table 9-6.	1990 estimated crop acreages, irrigation types, and water use in Sarasota County.	9-15
Table 9-7.	Total nitrogen, total phosphorus, total suspended solids, and hydrologic load by land use type within the Coastal Venice Basin.	9-17
Table 9-8.	Domestic point sources in the Coastal Venice Basin.	9-18
Table 9-9.	Industrial point sources in the Coastal Venice Basin.	9-19
Table 10-1.	Numerically dominant ichthyoplankton species in 1986 and 1987 from the Myakka River, all stages combined. Density statistics are in number of individuals per cubic meter. After Estevez <i>et al.</i> , 1991.	10-2

Table 10-2.	Unique distributions of ichthyoplankton species by river zone in 1986. Downriver: Charlotte Harbor to Myakka Bay stations; Middle River: Tarpon Point to Warm Mineral Springs stations; Upper River: Ramblers' Rest Resort to Snook Haven stations. After Estevez <i>et al.</i> , 1991.	10-3
Table 10-3.	Description of monthly monitoring sampling gears used in 1996. A more detailed description of each gear can be found in the FIMP Procedure Manual.	10-3
Table 10-4.	Species with commercial or recreational importance in the Charlotte Harbor NEP area.	10-4
Table 10-5.	Life stages of sharks inhabiting Tampa Bay/Charlotte Harbor region. Modified from Heuter (1994, Table 38).	10-16
Table 10-6.	Frequencies of apparent causes of manatee deaths for Sarasota (Venice south and Myakka River), Charlotte, and Lee Counties from 1975 through July 1997.	10-31
Table 10-7.	Frequencies of manatee deaths for Sarasota (Venice south and Myakka River), Charlotte, and Lee Counties from 1975 through July 1997 by month.	10-32
Table 10-8.	Frequencies of apparent causes of manatee deaths for Sarasota (Venice south and Myakka River), Charlotte, and Lee Counties from 1975 through July 1997 by month. Data taken from information provided by FDEP.	10-33
Table 10-9.	Frequencies of apparent causes of manatee deaths for Sarasota (Venice south and Myakka River), Charlotte, and Lee Counties from 1975 through July 1997. Data taken from information provided by FDEP.	10-33
Table 10-10.	Summary of bottlenose dolphin abundance estimates from aerial surveys of Charlotte Harbor and Pine Island Sound from 1975 through 1994.	10-35
Table 10-11.	Number of dolphins (% in parentheses) in the catalog of a given year (bold) that were identified in previous or subsequent years. Dolphins identified in only a single survey year were considered "transients".	10-36
Table 10-12.	County distribution of selected colonial waterbirds in 1976-78 and 1986-89 (Rundle, 1991).	10-46
Table 10-13.	Bird colony locations by county within the Charlotte Harbor NEP of wading bird colonies ranked in the top 100 sites in Florida, 1986-189 (Rundle, 1991).	10-47
Table 10-14.	Acreages of mangrove swamps in the Charlotte Harbor NEP area by major basin and subbasin.. . . .	10-73
Table 10-15.	Acreages of saltmarsh in the Charlotte Harbor NEP area by major basin and subbasin.	10-80
Table 11.	Wetland and open water habitat in the Charlotte Harbor NEP area.	11-4

Table 12-1.	Identification of Management Options for Water Quality for the Myakka River Basin.	12-2
Table 12-2.	Identification of Management Options for Hydrologic Alterations for the Myakka River Basin.	12-6
Table 12-3.	Identification of Management Options for Habitat Loss for the Myakka River Basin.	12-8
Table 12-4.	Identification of Management Options for Water Quality for the Peace River Basin.	12-10
Table 12-5.	Identification of Management Options for Hydrologic Alteration for the Peace River Basin.	12-14
Table 12-6.	Identification of Management Options for Habitat Loss for the Peace River Basin.	12-16
Table 12-7.	Identification of Management Options for Water Quality for the Coastal Charlotte Harbor Basin.	12-19
Table 12-8.	Identification of Management Options for Hydrologic Alterations for the Coastal Charlotte Harbor Basin.	12-24
Table 12-9.	Identification of Management Options for Habitat Loss for the Coastal Charlotte Harbor Basin.	12-27
Table 12-10.	Identification of Management Options for Water Quality for the Lemon Bay Basin.	12-30
Table 12-11.	Identification of Management Options for Hydrologic Alteration for the Lemon Bay Basin.	12-35
Table 12-12.	Identification of Management Options for Habitat Loss for the Lemon Bay Basin.	12-37
Table 12-13.	Identification of Management Options for Water Quality for the Pine Island Sound Basin.	12-40
Table 12-14.	Identification of Management Options for Hydrologic Alteration for the Pine Island Sound Basin.	12-45
Table 12-15.	Identification of Management Options for Habitat Loss for the Pine Island Sound Basin.	12-47
Table 12-16.	Identification of Management Options for Water Quality for the Caloosahatchee River Basin.	12-50
Table 12-17.	Identification of Management Options for Hydrologic Alterations for the Caloosahatchee River Basin.	12-55
Table 12-18.	Identification of Management Options for Habitat Loss for the Caloosahatchee River Basin.	12-58
Table 12-19.	Identification of Management Options for Water Quality for the Estero Bay Basin.	12-61
Table 12-20.	Identification of Management Options for Hydrologic Alteration for the Estero Bay Basin.	12-66

Table 12-21.	Identification of Management Options for Habitat Loss for the Estero Bay Basin.	12-69
Table 12-22.	Identification of Management Options for Water Quality for the Coastal Venice Basin.	12-72
Table 12-23.	Identification of Management Options for Hydrologic Alteration for the Coastal Venice Basin.	12-77
Table 12-24.	Identification of Management Options for Habitat Loss for the Coastal Venice Basin.	12-79

List of Figures

Figure 1-1.	Charlotte Harbor NEP Organization	1-2
Figure 1-2.	Charlotte Harbor NEP study area.	1-5
Figure 2-1.	Location of the Myakka River basin in the Charlotte Harbor NEP study area.	2-2
Figure 2-2.	Hydrologic soil groups in the Myakka River basin	2-7
Figure 2-3.	Rain station locations in the Myakka Basin	2-9
Figure 2-4.	Total annual and monthly rainfall plots for the Upper Myakka subbasin.	2-10
Figure 2-5.	Total annual and monthly rainfall plots for the Coastal Myakka subbasin.	2-11
Figure 2-6.	Existing land use map (SWFWMD, 1990; SFWMD, 1988) for the Myakka River Basin.	2-13
Figure 2-7.	Future land use map (SWFRPC, 1990) for the Myakka River Basin.	2-16
Figure 2-8.	USGS monitoring stations in the Myakka River Basin.	2-18
Figure 2-9.	Plots of total annual flow and average monthly flow at station 02298830 in the Myakka River Basin.	2-19
Figure 2-10.	Location of water sampling sites in the Myakka River Basin.	2-30
Figure 2-11.	Time series graphs of water quality constituents measured in the Myakka River Basin (EQL stations).	2-34
Figure 2-12.	Time series graphs of water quality constituents in the Myakka River Basin (EQL)	2-35
Figure 2-13.	Time series graphs of water quality constituents in the Myakka River Basin (SWFWMD stations).	2-36
Figure 2-14.	Time series graphs of water quality constituents in the Myakka River Basin (SWFWMD stations).	2-37
Figure 2-15.	Time series graphs of water quality constituents in the Myakka River Basin (USGS stations).	2-39
Figure 2-16.	Time series graphs of water quality constituents in the Myakka River Basin (USGS stations).	2-40
Figure 2-17.	Location of domestic and industrial point sources in the Myakka River Basin.	2-45
Figure 3-1.	Location of Peace River Basin in the Charlotte Harbor NEP study area.	3-2
Figure 3-2a.	Hydrologic Soil Group designations for the Upper Peace River Basin.	3-6
Figure 3-2b.	Hydrologic Soil Group designations for the Lower Peace River Basin.	3-6
Figure 3-3.	Rainfall monitoring stations in the Peace River Basin.	3-8
Figure 3-4.	Total annual and average monthly precipitation in the Peace River above Bartow subbasin of the Peace River Basin.	3-9
Figure 3-5.	Total annual precipitation and average monthly precipitation for the Peace at Zolfo Springs subbasin.	3-10

Figure 3-6.	Total annual precipitation and average monthly precipitation for the Peace at Arcadia subbasin.	3-11
Figure 3-7.	Total annual precipitation and average monthly precipitation for the Lower Peace subbasin.	3-12
Figure 3-8.	Total annual precipitation and average monthly precipitation for the Payne Creek subbasin.	3-13
Figure 3-9.	Total annual precipitation and average monthly precipitation for the Charlie Creek subbasin.	3-14
Figure 3-10.	Total annual precipitation and average monthly precipitation for the Horse Creek subbasin.	3-15
Figure 3-11.	Total annual precipitation and average monthly precipitation for the Joshua Creek subbasin.	3-16
Figure 3-12.	Total annual precipitation and average monthly precipitation for the Shell Creek subbasin.	3-17
Figure 3-13a.	Existing land use in the upper Peace River Basin.	3-19
Figure 3-13b.	Existing land use in the lower Peace River Basin.	3-19
Figure 3-14a.	Future land use in the Upper Peace River Basin (SWRPC).	3-24
Figure 3-14b.	Future land use in the Lower Peace River Basin (SWRPC).	3-24
Figure 3-15.	USGS water gaging stations in the Peace River Basin.	3-27
Figure 3-16.	Plots of total annual flow and average monthly flow at station 02294650 in the Peace River Basin.	3-29
Figure 3-17.	Plots of total annual flow and average monthly flow at station 02295637 in the Peace River Basin.	3-30
Figure 3-18.	Plots of total annual flow and average monthly flow at station 02296750 in the Peace River Basin.	3-31
Figure 3-19.	Plots of total annual flow and average monthly flow at station 02295420 in the Peace River Basin.	3-32
Figure 3-20.	Plots of total annual flow and average monthly flow at station 02296500 in the Peace River Basin.	3-33
Figure 3-21.	Plots of total annual flow and average monthly flow at station 02297310 in the Peace River Basin.	3-34
Figure 3-22.	Plots of total annual flow and average monthly flow at station 02297100 in the Peace River Basin.	3-35
Figure 3-23.	Plots of total annual flow and average monthly flow at station 02298202 in the Peace River Basin.	3-36
Figure 3-24.	Location of water quality sampling sites in the Peace River Basin (EQL stations).	3-52
Figure 3-25.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-54
Figure 3-26.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-55

Figure 3-27.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-56
Figure 3-28.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-57
Figure 3-29.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-58
Figure 3-30.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-59
Figure 3-31.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-60
Figure 3-32.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-61
Figure 3-33.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-62
Figure 3-34.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-63
Figure 3-35.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-64
Figure 3-36.	Time series graphs of water quality in the lower Peace estuary (EQL stations).	3-65
Figure 3-37.	Time series graphs of water quality in the lower Peace estuary (SWFWMD stations).	3-67
Figure 3-38.	Time series graphs of water quality in the lower Peace estuary (SWFWMD stations).	3-68
Figure 3-39.	Time series graphs of water quality of Horse Creek near Arcadia (USGS Station).	3-71
Figure 3-40.	Time series graphs of water quality of Horse Creek near Arcadia (USGS Station).	3-72
Figure 3-41.	Time series graphs of water quality of Peace River at Arcadia (USGS Station).	3-73
Figure 3-42.	Time series graphs of water quality of Peace River at Arcadia (USGS Station).	3-74
Figure 3-43.	Time series graphs of water quality of Peace River at Zolfo Springs (USGS Station).	3-75
Figure 3-44.	Time series graphs of water quality of Peace River at Zolfo Springs (USGS Station).	3-76
Figure 3-45.	Time series graphs of water quality of Peace River at Bartow (USGS Station).	3-77
Figure 3-46.	Time series graphs of water quality of Peace River at Bartow (USGS Station).	3-78

Figure 3-47.	Location of industrial and domestic point sources of pollution in the Peace River Basin	3-90
Figure 4-1.	Location of Charlotte Harbor Proper Basin in the Charlotte Harbor NEP study area.	4-2
Figure 4-2.	Hydrologic soil groups in the Charlotte Harbor Proper Basin.	4-5
Figure 4-3.	Rain station locations in the Charlotte Harbor Proper Basin.	4-6
Figure 4-4.	Total annual and monthly rainfall plots for the Charlotte Harbor Proper Basin.	4-7
Figure 4-5.	Existing land use map (SWFRPC, 1990) for the Charlotte Harbor Proper Basin.	4-9
Figure 4-6.	Future land use map (SWFRPC, 1990) for the Charlotte Harbor Proper Basin.	4-11
Figure 4-7.	Location of water quality sampling sites in the Charlotte Harbor Proper Basin.	4-17
Figure 4-8.	Time series graphs of water quality constituents measured in the Charlotte Harbor Proper Basin (EQL stations).	4-18
Figure 4-9.	Time series graphs of water quality constituents measured in upper Charlotte Harbor Proper Basin (EQL stations).	4-19
Figure 4-10.	Time series graphs of water quality constituents measured in the Charlotte Harbor Proper Basin (SWFWMD stations).	4-21
Figure 4-11.	Time series graphs of water quality constituents measured in the Charlotte Harbor Proper Basin (SWFWMD stations).	4-22
Figure 4-12.	Location of domestic and industrial point sources in the Charlotte Harbor Proper Basin.	4-27
Figure 5-1.	Location of the Lemon Bay Basin within the Charlotte Harbor NEP study area.	5-2
Figure 5-2.	Hydrologic soil groups in the Lemon Bay Basin.	5-5
Figure 5-3.	Rain station locations in the Lemon Bay Basin.	5-6
Figure 5-4.	Total annual and monthly rainfall plots for the Lemon Bay Basin.	5-7
Figure 5-5.	Existing land use map (SWFRPC, 1990) for the Lemon Bay Basin.	5-9
Figure 5-6.	Future land use map (SWFRPC, 1990) for the Lemon Bay Basin.	5-10
Figure 5-7.	Location of domestic and industrial point sources in the Lemon Bay Basin. .	5-21
Figure 6-1.	Location of the Pine Island/ Matlacha Pass Basin in the Charlotte Harbor NEP study area.	6-2
Figure 6-2.	Hydrologic soil groups in the Pine Island/ Matlacha Pass Basin.	6-5
Figure 6-3.	Rain station locations in the Pine Island/ Matlacha Pass Basin.	6-6

Figure 6-4.	Total annual and monthly rainfall plots for the Pine Island/ Matlacha Pass Basin.	6-7
Figure 6-5.	Existing land use map (SWFRPC, 1990) for the Pine Island/ Matlacha Pass Basin.	6-9
Figure 6-6.	Future land use map (SWFRPC, 1990) for the Pine Island/ Matlacha Pass Basin.	6-10
Figure 6-7.	Location of domestic and industrial point sources in the Pine Island Sound/Matlacha Pass Basin.	6-20
Figure 7-1.	Location of the Tidal Caloosahatchee Basin and associated subbasins within the Charlotte Harbor NEP study area.	7-2
Figure 7-2.	Hydrologic soil groups in the Tidal Caloosahatchee River Basin.	7-5
Figure 7-3.	Rain gage locations in the Tidal Caloosahatchee River Basin.	7-6
Figure 7-4.	Total annual and average monthly rainfall plots for the Telegraph Swamp subbasin.	7-7
Figure 7-5.	Total annual and average monthly rainfall plots for the Orange River subbasin.	7-8
Figure 7-6.	Total annual and average monthly rainfall plots for the Lower Caloosahatchee subbasin.	7-9
Figure 7-7.	Existing land use in the Tidal Caloosahatchee River Basin (SWFWMD, 1988).	7-14
Figure 7-8.	Future land use in the Tidal Caloosahatchee River Basin (SWFRPC, 1990).	7-15
Figure 7-9.	Plots of total annual flow and average monthly flow at S-79 in the Tidal Caloosahatchee River Basin.	7-16
Figure 7-10.	Location of water quality sampling sites in the Tidal Caloosahatchee River Basin.	7-21
Figure 7-11.	Time series graphs of water quality constituents measured in the Tidal Caloosahatchee River Basin (Cape Coral stations).	7-22
Figure 7-12.	Time series graphs of water quality constituents measured in the Tidal Caloosahatchee River Basin (Cape Coral stations).	7-23
Figure 7-13.	Locations of domestic and industrial point sources in the Caloosahatchee River Basin.	7-29
Figure 8-1.	Location of the Estero Bay Basin in the Charlotte Harbor NEP study area. ...	8-2
Figure 8-2.	Hydrologic soil groups in the Estero River Basin.	8-4
Figure 8-3.	Rain station locations in the Estero River Basin.	8-6
Figure 8-4.	Total annual and average monthly rainfall plots for the Estero Bay Basin. ...	8-7
Figure 8-5.	Existing land use map for the Estero Bay Basin (SWFWMD, 1990; SWFWMD, 1988).	8-9

Figure 8-6.	Future land use map for the Estero Bay Basin (SWFRPC, 1990).	8-10
Figure 8-7.	Location of water quality sampling sites in the Estero Bay Basin.	8-16
Figure 8-8.	Time series graphs of water quality constituents measured in northern Estero Bay (Lee County stations).	8-17
Figure 8-9.	Time series graphs of water quality constituents measured in northern Estero Bay (Lee County stations).	8-18
Figure 8-10.	Time series graphs of water quality constituents measured in central Estero Bay (Lee County stations).	8-19
Figure 8-11.	Time series graphs of water quality constituents measured in central Estero Bay (Lee County stations).	8-20
Figure 8-12.	Time series graphs of water quality constituents measured in southern Estero Bay (Lee County stations).	8-21
Figure 8-13.	Time series graphs of water quality constituents measured in southern Estero Bay (Lee County stations).	8-22
Figure 8-14.	Location of domestic and industrial point sources in the Estero Bay Basin.	8-26
Figure 9-1.	Location of the Coastal Venice Basin within the Charlotte Harbor NEP study area.	9-2
Figure 9-2.	Hydrologic soil groups in the Coastal Venice Basin.	9-5
Figure 9-3.	Rain station locations in the Coastal Venice Basin	9-6
Figure 9-4.	Total annual and monthly rainfall plots for the Coastal Venice Basin.	9-7
Figure 9-5.	Existing land use map (SWFWMD, 1990; SFWMD, 1988) for the Coastal Venice Basin.	9-11
Figure 9-6.	Future land use map (SWFRPC, 1990) for the Coastal Venice Basin.	9-12
Figure 9-7.	Location of domestic and industrial point sources in the Coastal Venice Basin.	9-20
Figure 10-1.	Development stages of the bay anchovy (<i>Anchoa mitchilli</i>) collected from the Little Manatee River estuary and Tampa Bay, 4.6, 7.0, 10.5, 16, and 33 mm standard length (after Peebles and Flannery, 1992).	10-6
Figure 10-2.	The distribution of <i>Anchoa mitchilli</i> in the Myakka River by time of year and distance (after Burns <i>et al.</i> , 1987).	10-9
Figure 10-3.	Relative abundance of juvenile common snook, spotted seatrout, and redfish (≤ 33 mm SL) (Charlotte Harbor 1996 Annual Data Summary Report). The box represents the 25th and 75th percentiles. The vertical line extends from the 25th and 97.5th percentiles. The filled circle represents the median value. Different sampling methods were used for some of these data.	10-10
Figure 10-4.	Relative abundance of juvenile sheepshead (≤ 35 mm SL), juvenile pinfish (< 80 mm SL), and juvenile striped mullet (< 35 mm SL)	

(Charlotte Harbor 1996 Annual Data Summary Report). The box represents the 25th and 75th percentiles. The vertical line extends from the 25th and 97th percentiles. The filled circle represents the median value. Different sampling methods were used for some of these data. 10-14

Figure 10-5. Neonate (A), juvenile (B), and adult (C) sharks captured in Charlotte Harbor (modified from Heuter, 1994). 10-18

Figure 10-6. Number of trips and landings of striped mullet from the west coast of Florida. 10-21

Figure 10-7. Number of trips and landings of spotted seatrout from the west coast of Florida. 10-22

Figure 10-8. Number of trips and landings of jack crevalle from the west coast of Florida. 10-23

Figure 10-9. Number of trips and landings of pompano from the west coast of Florida. 10-24

Figure 10-10. Number of trips and landings of pink shrimp from the west coast of Florida. 10-42

Figure 10-11. Number of trips and landings of blue crab from the west coast of Florida. 10-43

Figure 10-12. Habitat distribution for the white ibis in the Caloosahatchee River Basin (FGFWFC, 1994). 10-49

Figure 10-13. Habitat distribution for the white ibis in the Pine Island Sound / Matlacha Pass Basin (FGFWFC, 1994). 10-50

Figure 10-14. Habitat distribution for the white ibis in the Charlotte Harbor Basin (FGFWFC, 1994). 10-51

Figure 10-15. Habitat distribution for the white ibis in the Estero Bay Basin. 10-52

Figure 10-16. Acres of seagrasses in estuarine Charlotte Harbor: 1945 and 1982. 10-59

Figure 10-17. Acres of seagrasses in lagoonal Charlotte Harbor: 1945 and 1982. 10-60

Figure 10-18. Acres of mangroves in Charlotte Harbor: 1945 and 1982. 10-61

Figure 10-19. Acres of saltmarshes in Charlotte Harbor: 1945 and 1982. 10-62

Figure 10-20. Seagrasses (black shaded areas) reported for Lemon Bay in 1994 by the SWFWMD. 10-63

Figure 10-21. Seagrasses (black shaded areas) reported for Charlotte Harbor in 1994 by the SWFWMD. 10-65

Figure 10-22. Seagrasses (black shaded areas) reported for Pine Island Sound and Matlacha Pass from 1980's and 1990's data compiled by the Florida Marine Research Institute. 10-66

Figure 10-23. Seagrasses (black shaded area) reported for Caloosahatchee River from 1980's and 1990's data compiled by FMRI. 10-67

Figure 10-24. Seagrasses (black shaded area) reported for Estero Bay from 1980's and 1990's data compiled by FMRI. 10-69

Figure 10-25. Emergent saltwater wetlands (black shaded areas) reported for Lemon Bay (SWFWMD, 1990).	10-74
Figure 10-26. Emergent saltwater wetlands (black shaded areas) reported for Charlotte Harbor (SWFWMD, 1990).	10-75
Figure 10-27. Emergent saltwater wetlands (black shaded areas) reported for Pine Island Sound and Matlacha Pass region (SWFWMD, 1990).	10-76
Figure 10-28. Emergent saltwater wetlands (black shaded areas) reported for the Caloosahatchee River area (SWFWMD, 1990).	10-78
Figure 10-29. Emergent saltwater wetlands (black shaded areas) reported for Estero Bay (SWFWMD, 1990)..	10-79
Figure 10-30. Altered and at risk shorelines in the Lemon Bay region.	10-82
Figure 10-31. Altered and at risk shorelines in the Charlotte Harbor region.	10-84
Figure 10-32. Altered and at risk shorelines in the Pine Island Sound and Matlacha Pass region.	10-85
Figure 10-33. Altered and at risk shorelines in the Caloosahatchee River region.	10-86
Figure 10-34. Altered and at risk shorelines in the Estero Bay region.	10-87
Figure 10-35. Aquatic Preserves in the Charlotte Harbor NEP study area.	10-90
Figure 10-36. State Buffer Preserves in the Charlotte Harbor NEP study area.	10-91
Figure 11-1. Strategic Habitat Conservation Areas (SHCA) for white ibis and wading bird biodiversity “Hot Spots” for Lemon Bay and the lower Myakka River area (after FGFWC, 1994).	11-7
Figure 11-2. Strategic Habitat Conservation Areas (SHCA) for white ibis and wading bird biodiversity “Hot Spots” for Charlotte Harbor area (after FGFWC, 1994).	11-8
Figure 11-3. Strategic Habitat Conservation Areas (SHCA) for white ibis and wading bird biodiversity “Hot Spots” for Pine Island Sound and Matlacha Pass area (after FGFWC, 1994).	11-9
Figure 11-4. Strategic Habitat Conservation Areas (SHCA) for white ibis and wading bird biodiversity “Hot Spots” for the Caloosahatchee River area (after FGFWC, 1994).	11-10
Figure 11-5. Strategic Habitat Conservation Areas (SHCA) for white ibis and wading bird biodiversity “Hot Spots” for Estero Bay area (after FGFWC, 1994).	11-11
Figure 11-6. Brown pelican habitat in Lemon Bay area (after FGFWC, 1994).	11-13
Figure 11-7. Brown pelican habitat in Charlotte Harbor area (after FGFWC, 1994).	11-14
Figure 11-8. Brown pelican habitat in Pine Island Sound and Matlacha Pass area (after FGFWC, 1994).	11-15
Figure 11-9. Brown pelican habitat in the Caloosahatchee River area (after FGFWC, 1994).	11-16

Figure 11-10. Brown pelican habitat in Estero Bay area (after FGFWC, 1994).	11-17
Figure 11-11. Strategic Habitat Conservation Areas (SHCAs) for the bald eagle in Lemon Bay area (after FGFWC, 1994).	11-18
Figure 11-12. Strategic Habitat Conservation Areas (SHCAs) for the bald eagle in Charlotte Harbor area (after FGFWC, 1994).	11-19
Figure 11-13. Strategic Habitat Conservation Areas (SHCAs) for the bald eagle in Pine Island Sound and Matlacha Pass area (after FGFWC, 1994).	11-20
Figure 11-14. Strategic Habitat Conservation Areas (SHCAs) for the bald eagle in the Caloosahatchee River area (after FGFWC, 1994).	11-21
Figure 11-15. Strategic Habitat Conservation Areas (SHCAs) for the bald eagle in the Estero Bay area (after FGFWC, 1994).	11-22
Figure 11-16. Strategic Habitat Conservation Areas (SHCAs) for the Florida Panther in the Caloosahatchee River area (after FGFWC, 1994).	11-24
Figure 11-17. Strategic Habitat Conservation Areas (SHCAs) for the Florida Panther in the Charlotte Harbor area (after FGFWC, 1994).	11-25
Figure 11-18. Strategic Habitat Conservation Areas (SHCAs) for the Florida Panther in the lower Peace River area (after FGFWC, 1994).	11-18
Figure 11-19. Strategic Habitat Conservation Areas (SHCAs) for the Florida Panther in the Estero Bay area (after FGFWC, 1994).	11-27

List of Appendices

A second volume was prepared to supplement this "Synthesis of Existing Information" document. The specific materials contained within this second volume are presented as a series of independent appendices, each of which addresses a highly technical issue. As such, these materials were included in a separate document due to the limited nature of their audience.

- Appendix A. Total annual and mean monthly rainfall plots for basins within the Charlotte Harbor Study Area.
- Appendix B. Total annual and mean monthly streamflow plots for basins within the Charlotte Harbor Study Area.
- Appendix C. Surface water quality summaries for basins within the Charlotte Harbor Study Area.
- Appendix D. Pollution potential model for basins within the Charlotte Harbor Study Area.
- Appendix E. Land Use data from SWFWMD based on Florida Department of Transportation (FDOT) "Florida Land Use and Cover Classification System" (FLUCCS), Levels II and II for the Charlotte harbor Study Area.

CHARLOTTE HARBOR NATIONAL ESTUARY PROGRAM GLOSSARY OF ABBREVIATIONS

ASR	Aquifer Storage and Recovery
AWT	Advanced Wastewater Treatment
BMP	Best Management Practice
BOD	Biochemical Oxygen Demand
BOR	Basis of Review
CARL	Conservation and Recreation Lands
CCMP	Comprehensive Conservation and Management Plan
CHNEP	Charlotte Harbor National Estuary Program
CUP	Consumptive Use Permit
DO	dissolved oxygen
EQL	Environmental Quality Laboratory
ETB WRAP	Eastern Tampa Bay Water Resources Assessment Project
FDEP	Florida Department of Environmental Protection
FLUCCS	Florida Land Use Code Classification System
FLUMS	Florida Land Use Map System
FMRI	Florida Marine Research Institute
GIS	Geographic Information Systems
HSG	hydrologic soil group
IPM	Integrated Pesticide Management
LWCWSP	Lower West Coast Water Supply Plan
MSL	mean sea level
NOAA	National Oceanographic and Atmospheric Administration
NRCS	National Resource Conservation Service
OP	Ortho-phosphorus
PRMRWSA	Peace River/Manasota Regional Water Supply Authority
FWMD	South Florida Water Management District
SWFRPC	Southwest Florida Regional Planning Council
SWFWMD	Southwest Florida Water Management District
SWIM	Surface Water Improvement and Management
SWUCA	Southern Water Use Caution Area
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
UFAS	Upper Floridan Aquifer System
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WUP	Water Use Permit
WWTP	Wastewater Treatment Plant

UNITS GLOSSARY

cfs	cubic feet per second
cm	centimeter
gpm	gallons per minute
in	inches
$\mu\text{g/l}$	micrograms per liter
mg/l	milligrams per liter
mmhos/cm	millimhos per centimeter
NTU	Nephelometric Turbidity Units
ppt	parts per trillion
Pt-Co units	platinum-cobalt units