

**Regional Waterway Management System
For Manatee County:
Bishop Harbor, Tidal Braden River, and
Lower Reaches of the Upper Manatee River**



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by

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Abbreviations

DGPS	Differential Global Positioning Systems
DOQQ	Digital Orthophoto Quarter Quadrangles
ESRI	Environmental Systems Research Institute, Inc.
FDEP	Florida Department of Environmental Protection
FMRI	Florida Marine Research Institute
FSG	Florida Sea Grant
GIS	Geographic Information System
MLLW	Mean Lower Low Water
MOA	Memorandum of Agreement
NOAA	National Oceanic and Atmospheric Administration
PID	Parcel Identification Number
SWFWMD	Southwest Florida Water Management District
USGS	U.S. Geological Survey
WCIND	West Coast Inland Navigation District

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Executive Summary

The Regional Waterway Management System for Manatee County is a collaborative effort by the Manatee County Community Services Department, the West Coast Inland Navigation District, and the University of Florida Sea Grant College Program. This report addresses, the tidal Braden River, extending from State Road 64 to the Ward Lake Dam; the Manatee River, from the I-75 bridge to the Lake Manatee Dam; and Bishop Harbor. A principal waterway management issue of the region is balancing the growth of its boating population with conservation and management of its estuarine and riverine resources. The project devises and uses methods that allow for the simultaneous use and protection of coastal waters, while still maintaining the economic vitality of coastal communities. This approach evaluates the human ecosystem (boat user) and waterway system (environment) jointly, concurrently, and spatially; and is consistent with municipal, county, Florida Department of Environmental Protection (FDEP), and WCIND goals of facilitating safe boating and reducing boating impacts on natural resources. The project's design criteria are: (a) fit channel maintenance to boat draft needs; (b) minimize impacts on bay habitats; (c) prioritize and evaluate management alternatives on a regional scale; and (d) identify information products, for boaters and shore residents, which encourage environmental awareness by users of neighborhood waterways and boat access channels.

Information for the project area is presented in tables and maps for approximately 30 miles of navigable waterways, 543 boats, 941 moorings, 354 shore facilities, and 239 boating-related signs. The report is based on regional (1:24,000) and large-scale (1:2400) mapping of water depth, boat and facility characteristics, signage, and habitat (sea grass, mangrove).

The waterway management needs of the area are uniquely defined by the geography of boat source areas ("trafficsheds"¹); there are waterways with many boats, and areas with few boats. The relations of (1) concentrations of boats to access channel length and (2) boat draft to controlling channel depth determine the degree of boat accessibility and channel restrictions. An understanding of these relations is fundamental to developing and implementing rational waterway management policy.

The report provides a planning tool and decision options to stabilize channel conditions in order to avoid further deterioration of bay resources. A detailed, comparative analysis of water depth and boat draft relations provides a comprehensive overview of channel conditions and the geographic distribution and severity of waterway restrictions for the Braden and Manatee Rivers. There were no boats in Bishop Harbor and, therefore, it was not included in the analysis. The analysis delineates and quantifies, at a 0.5 ft resolution, levels of boat accessibility to the open bay, and the location and extent of channel depth restrictions. Two planning options are illustrated: (1) normal low tide conditions (2) and below normal (winter Cold Front) conditions. Data for a third option are presented: (3) adjusting waterway maintenance standards to the variable draft capability of restricted boats.

Estimated dredging requirements are provided for trafficsheds that contain waterway restrictions. The 20-foot wide improvement footprint used in the study conforms with the WCIND “surgical” approach to maintenance dredging adopted for regional waterway management in southwest Florida in order to minimize environmental impacts to bay resources.

The results for the Braden and Manatee Rivers indicate that the greatest problems of boat access and channel restrictions occur at a relatively few main channel locations. Nine locations present access-problems to 10 or more boats at MLLW. The maximum number of boats that are impeded at these locations ranges from 14 to 107. The relatively high volume of boat traffic traversing some of these channel locations makes them strong candidates for maintenance dredging. The County should use the information contained in report to determine if spot dredging is warranted at some or all of these locations.

As development pressures increase in the area, so will boat traffic. The County should insure that adequate markings are in place on both rivers to promote safe and environmentally responsible navigation. For example, the channel markings on the SR-64 and SR-70 bridges across the Braden River should be upgraded and lights should be installed. Better markings are suggested for the lower portion of the Manatee River near the I-75 bridge as well as shoal areas on both rivers.

The waterway inventory information in the project’s GIS database has value and application beyond the bay water planning and management results presented in this report. This information should be reformatted and provided to shorefront residents and boaters in trafficsheds targeted for waterway improvements, as Waterway Maps, showing channel center-line depths, boat facilities, and natural resource conditions. (The WCIND and FSG have produced similar maps of anchorages.) This information can sensitize users to the environmental conditions of the waterways and provide a basis for instilling stewardship and responsible boating practices.

Manatee County should consider implementing these recommendations under a Memorandum of Agreement (MOA) for Regional Waterway Systems Management, similar to one executed in 1997 by the Florida Department of Environmental Protection, the West Coast Inland Navigation District, and the Florida Sea Grant College Program (Appendix A). This MOA is designed to offer local governments and waterfront community organizations a mechanism to effect regional waterway improvements within an ecosystem, place-based management approach. The MOA provides an avenue for pursuing region-wide permit review and project applications. The 1997 MOA led to the recently added State of Florida administrative code, “Chapter 62-341.490 Noticed General Permits for Dredging by the West Coast Inland Navigation District (WCIND).”

Manatee County and the WCIND have an investment in this Regional Waterway Management System. This system should be maintained and enhanced in order to

respond to the county's growing needs for rapid assessment and comprehensive geographic analysis of its bay water resources.

The Regional Waterway Management System can be strengthened by linkage to the county's upland databases, which will facilitate response to more complex issues that transcend land-water boundaries. For example, sediment sources could be identified and their relative contribution to waterway shoaling quantified. This would allow for a more equitable distribution of maintenance dredging costs among those charged with waterway maintenance and those who contribute to shoaling.

The Regional Waterway Management System database should be updated periodically with countywide boat information. Florida Sea Grant is developing a plan based on revising the annual Vehicle/Vessel Registration Form. This plan, to incorporate information on boat type, draft, and location onto the form, will offer a systematic updating method that should be pursued through the County Tax Collector's Office and the Division of Motor Vehicles.

The bathymetric surveys should be updated, as needed, to identify shoaling conditions of the waterways. The WCIND has collaborated, through Florida Sea Grant, with the National Oceanic and Atmospheric Administration (NOAA) Marine Chart Division and the Coastal Services Center on two projects of significance: 1) an effort to redesign coastal charts for recreational waterway users, and 2) the enhancement and standardization of bathymetric field collection methods used by the WCIND. The WCIND and Manatee County should explore existing and future opportunities to partner with this federal charting agency and thereby share survey information on a periodic basis.

The appropriate County department should be provided with the GIS equipment, software, and training to carry out waterway inventory and analysis, in order to respond to routine customer requests for information and technical services. The Florida Cooperative Extension Service and State University System should continue to provide institutional and professional support.

A measure of the success of the regional waterway management program is whether technical results are translated into meaningful benefits for local communities. A program that includes a strong boater education component will best address the diverse management needs of Manatee County. The Manatee County Marine Agent is an appropriate resource for the dissemination of Project results at the local, community level. The Marine Agent can work with interested waterfront communities to help maintain their waterways, providing assistance in the form of project data, technical support, workshops, and field site inspections. Networking the community with permitting agencies and contractors, in order to develop community-based strategies to restore and maintain waterway resources, will increase the effectiveness of the Marine Agent. Boaters can play an active, critical role in determining whether to boat in a given area, what type of boating should occur, and what level of intervention is necessary.

¹The term trafficshed is used to define an area that contains a concentration of boats that use a common channel, exclusive to the trafficshed, to gain access to deep, open water. For the purpose of this report, deep, open water—defined as a function of vessel draft—begins at that location in the transit of a vessel, from its berth, beyond which the vessel is no longer restricted because of environmental or depth limitations. In the project area, the main channel of the Manatee River, downstream of the I-75 Bridge, is considered “deep, open water.”

1. Introduction

Manatee County faces a daunting planning dilemma: how to balance the growth of its boating population with conservation and management of its estuarine and riverine resources. This application of the Regional Waterway Management System focuses on: 1) the tidal portion of the Braden River, extending from State Road 64 to the Ward Lake Dam, 2) the Manatee River, extending from the I-75 bridge upstream to the Lake Manatee Dam, and 3) Bishop Harbor. This project is a collaborative effort, by the Manatee County Community Services Department, the West Coast Inland Navigation District, and the University of Florida Sea Grant College Program, to apply the latest science and technology to the region's waterway management issues.

The waters and adjoining shore ecosystems of Bishop Harbor and the Braden and Manatee Rivers are attractive, unique, varied, and vulnerable to pressures from boating and from expanding commercial and residential developments that fringe the shoreline. The region is a focal point for boating enthusiasts; increased boat traffic and upland development create problems that are manifested in user conflicts, declining water quality, and stressed habitat conditions, such as boat wake that washes away soil and sand supporting mangrove roots or boat contaminants that accumulate due to low tidal exchange.

The pressures brought to bear on the region offer a glimpse of the challenges that are faced along the entirety of coastal Manatee County. The quandary that confronts private citizen users, planners, and elected officials is how to sustain and protect this coastal and riverine ecosystem without isolating people from nature. The Florida Sea Grant approach is to devise and use methods that allow for the simultaneous use and protection of coastal waters, while maintaining the economic vitality of coastal communities. This approach is embodied in the report, which evaluates the human ecosystem (boat user) and waterway system (environment) jointly, concurrently, and spatially.

The report focuses on the technical aspects of waterway management and provides a planning tool and decision options to stabilize channel conditions in order to avoid further deterioration of bay resources. A detailed, comparative analysis of water depth and boat draft relations provides a comprehensive overview of channel conditions and the geographic distribution and severity of waterway restrictions for the Braden and Manatee Rivers. There were no boats in Bishop Harbor and, therefore, it was not included in the analysis. Two planning options are illustrated: (1) normal low tide conditions and (2) below normal (winter Cold Front) conditions. Data for a third option is presented: (3) adjusting waterway maintenance standards to the variable draft capability of restricted boats. The scientific approach presented in the report ensures a rational and objective method of waterway management.

In situations where dredging is selected as an appropriate management option, the prescribed dredge depth and width will depend on a number of factors,

including regulatory and historical precedents, potential environmental impacts, draft characteristics of the present boat population, and cost. Designated controlling depths that have been established via permitting from the Florida Department of Environmental Protection (FDEP) may set practical limits to upstream dredge projects. A central tenet of the Florida Sea Grant approach is that maintained, signed channels discourage resource depletion by encouraging boaters to stay within the channels and away from environmentally sensitive shoal areas. This approach also promotes safe navigation.

Cost, including spoil disposal, is another factor that influences the depth-to-dredge decision. Some restricted waterways are secondary access channels for which there is a clear public need to fully subsidize the maintenance of the waterway. Other waterways are residential canal systems where the maintenance cost should be borne by local citizen users. The Geographic Information System developed for the project provides the necessary information to identify where public/private partnerships may be required to cost-share local waterway restoration or improvement.

Estimated dredging requirements are provided for “trafficsheds”¹ that contain waterway restrictions. The 20-foot wide improvement footprint used in the study conforms with the WCIND “surgical” approach to maintenance dredging adopted for regional waterway management in southwest Florida in order to minimize environmental impacts to bay resources.

2. Background

The Regional Waterway Management System provides the scientific base and information necessary to meet the waterway management needs of waterfront neighborhoods along the tidal Braden River, the Manatee River, and Bishop Harbor. The area includes approximately 30 miles of navigable waterways, 543 boats, 941 moorings, 354 shore facilities, and 239 boating-related signs. Information is presented on boats, channels, and potential dredging required to provide boats with waterway access from berths to secondary channels and, ultimately, to deep, open water²—the point at which a vessel is no longer restricted to a channel.

The report is based on regional (1:24,000) and large-scale (1:2400) mapping of water depth, boat and facility characteristics, signage, and habitat. A detailed analysis delineates and quantifies, at 0.5-foot resolution, levels of boat accessibility to open waters and the location and extent of channel depth restrictions.

The methodology and objectives of the Manatee County Project stem from a pilot study (Antonini and Box, 1996) conducted by Florida Sea Grant (FSG) and the West Coast Inland Navigation District (WCIND). The pilot study, designed for southwest Florida waterways, was a test application of a management system that is consistent with municipal, county, Florida Department of Environmental Protection (FDEP), and WCIND goals of facilitating safe boating and reducing boating impacts on natural resources. The design criteria are: (a) fit channel maintenance to boat draft

needs; (b) minimize impacts on bay habitats; (c) prioritize and evaluate management alternatives on a regional scale; and (d) identify information products, for boaters and shore residents, which encourage environmental awareness by users of neighborhood waterways and boat access channels.

The pilot study (Antonini and Box 1996), which includes southern Manatee and northern Sarasota counties, extends from the Cortez bridge south to Siesta Key bridge. The pilot included 53 miles of waterways, canals and boat channels; with 5000+ boats, 2300+ shore facilities, and 900+ signs. This study indicated that, whereas 95 percent of the boats must use channels to access the bay, only 11 percent (532) have restricted access. The analysis, furthermore, indicated that a large number of restricted boats (64 percent) are situated in a limited number of waterways (7). A maintenance dredging policy designed to provide the 532 “access-problem” boats with unlimited access, under normal tidal conditions, would require servicing 10 percent (28,680 ft) of the access channels. Under such a policy, 70 percent of the required dredging would deepen channels by 1 foot.

Results from the pilot study prompted the Manatee County Board of Commissioners to reexamine its position on the maintenance dredging issue, and to authorize the evaluation of the remaining waterways in northern Manatee County. The north Manatee County study (Swett, Antonini, and Schulte 1999) extended from the Cortez bridge north to the Hillsborough county line, and included Palma Sola Bay, Bimini Bay, Anna Maria Sound, Snead Island Cutoff, Terra Ceia Bay, and the Manatee River downstream of the I-75 bridge.

The north Manatee County study included approximately 153 miles of navigable waterways, 4478 boats, 7663 moorings, 2965 shore facilities, and 1148 boating-related signs. This study showed that 21 percent (519) of all boats have restricted access to deep, open waters at mean lower low water (MLLW). The greatest problems of boat access and channel restrictions occur in a relatively few trafficsheds. For example, three trafficsheds account for 42 percent of boat access problems and 15 percent of channel restrictions. Several secondary channels were identified that are used heavily by boaters and that serve numerous trafficsheds. The high volume of boat traffic traversing these arteries makes them strong candidates for improvement.

The combined results of the two previous Manatee County studies, a similar project conducted in Miguel Bay (Antonini, Fann, and Swett 2001), and the current work, provide the County with a rationale and method for implementing a county-wide Regional Waterway Management System containing the following elements: (a) documentation of existing depths; (b) establishment of maintenance dredging requirements according to user draft specifications; (c) placement of signs to conform with boat density and traffic patterns; (d) management of boat traffic based on detailed knowledge of boat distributions and travel routes; (e) siting of habitat restoration to protect waterways; (f) regional scale permitting to accommodate water-dependent uses

and to minimize environmental impacts; and (g) educating the public, using waterway maps and guide materials, to instill stewardship and best boating practices.

A Memorandum of Agreement (MOA), signed by the FDEP, FSG, and the WCIND (September 26, 1997), provides the required, state-approved framework for a Regional Waterway Management System that is needed to implement the study results (Appendix A).

3. Information Base

Florida Sea Grant conducted three separate types of on-the-water surveys in order to obtain: (1) tide-corrected depths of waterway access channels (February—April 2002); (2) the location and characteristics of boats, moorings, and related facilities (March—April 2002); and (3) the location and characteristics of signs (March—April 2002). Shoreline, generalized land use/land cover characteristics, and mangrove and sea grass information was obtained from the South Florida Water Management District (SFWMD). One-meter resolution, 1994-95 U.S. Geological Survey digital orthophoto quarter quadrangles (DOQQ) in JPEG format were obtained from the Florida Resources and Environmental Analysis Center (www.labins.org).

This report presents boat, channel, signage, and habitat information for the project area (Figure 1). Boat and channel characteristics are reported for individual trafficsheds.

The following presents a general overview of key site conditions.

- a. **Trafficsheds.** The study identifies two trafficsheds; the Braden River trafficshed, between SR-64 and Ward Lake Dam; and the Manatee River trafficshed, between I-75 and Lake Manatee Dam.
- b. **Boats.** There are 543 boats³ berthed along the Braden and Manatee Rivers or stored on salt-water accessible parcels (Table 1). Boat types are reported as recreational fishing, open utility (bass, skiff, john, pontoon), speed, power cabin, sail, row (kayak, canoe), personal water craft, and other (houseboat or market fish). The characteristics collected for each boat include: facility, mooring type, length, age, make and model, draft (including draft adjustment capability), and the date the boat was surveyed.
- c. **Facilities.** There are approximately 354 boating facilities in the region.⁴ Facilities are reported as residential (single-family, multi-family), marina, anchorage, government, and business (Table 2).
- d. **Moorings.** The region includes 941 moorings (543 occupied with a boat and 397 empty).⁵ Mooring types are reported as anchorage, beached or blocked, davits, float, hoist, marine railway, ramp, seawall, trailer, and wet slip.
- e. **Derelict Vessels:** Derelict vessels (3) were mapped separately when encountered during the boat/mooring survey. Attributes recorded included

whether each vessel was aground or afloat, condition (good or poor), type (when ascertainable).

- f. **Signage.** There are 239 boating-related signs in the region: business (4), government facility (4), hazard warning (2), navigation guide (116), other (5), private ownership (49), resource protection (4), and speed regulation (55). All signs in the water and along the waterfront, visible to the boater, are included in this inventory. Signage information includes site (bridge, dock, land, water), type (e.g. buoy, piling, structure, etc.), message, status (non-permitted, permitted), and condition (damaged, ok).
- g. **Site.** Site characteristics include the general distribution of biological features within the water body; namely mangrove areas and sea grass beds (Figure 2). Mangroves are found in Bishop Harbor and along the shoreline of the Braden and Manatee Rivers. Mapped sea grass beds were obtained from the state SWIM program, which does not map sea grass beds upstream of the limit shown in Figure 2.

4. Field Surveys

- a. **Depths.** Boat channels were identified by interpretation of aerials and by field reconnaissance methods. Permitted and non-permitted channel markers were used for orientation wherever present. To identify the deepest part of each channel, soundings were first collected along 45-degree transects that covered each water body, followed by a series of shore parallel survey lines (Figure 3). Personnel from the Manatee County Environmental Management Department and local boaters provided information about existing channel conditions for specific locations. When the depth survey was completed, county field staff examined maps of the surveyed boat channels to verify their location and the logical consistency of depth measurements.

Depths were recorded for all channel centerlines and approaches to boating facilities. A Trimble DSM212H 12-channel Differential Global Positioning System (DGPS) receiver with integrated dual-channel Minimum Shift Keying (MSK) differential beacon receiver was used to obtain the geographic position of each depth feature. Thinning the raw data to a 5-foot average spacing yielded a final data set of 87,908 depth points for the entire study area.

All depths are referenced to the navigation datum, mean lower low water (MLLW). Temporary tide gauges were installed at four locations during the periods of data collection: SR-70 Bridge, SR-64 Bridge, Colony Cove, and Fort Hamer (Figure 4). Additional tide observations on the Manatee River were obtained from a USGS water level recorder installed at Rye Wilderness Park. Soundings in Bishop Harbor were corrected based on Port Manatee tide observations by the Tampa Bay Physical Oceanographic Real-Time System

(<http://ompl.marine.usf.edu/PORTS/>) The University of Florida Department of Coastal and Oceanographic Engineering provided computer programs with which to correct depths to MLLW.

- b. **Boats, Facilities, and Signs.** The positions and attributes of boat and waterway features were surveyed using a Trimble Pro XR DGPS with a beacon receiver and a TSC1 data logger. An Advantage range finder (Laser Atlanta Optics, Inc.) determined the offset from the observer's location to the position of the surveyed feature. Information about the feature and its location also were plotted on 1:2400-scale section aerials.
- c. **Data Editing.** A series of integrity checks was carried out on depth measurements, tide records, and all boat, facility and signage features. The logical consistency of attribute values and the accuracy of feature positions were ascertained. Discrepancies were verified in the field and corrected.

5. Printed Data Products

Printed data products provided to the County consist of thematic information portrayed at both trafficshed (1:2400) and regional (1:24,000) scales. The trafficshed-scale thematic information is contained in three 31-page atlases, and the regional scale information in one atlas. All atlases contain an index of page numbers that overlies an aerial photo mosaic of the study region.

a. Trafficshed-Scale Atlases

1. Bathymetry – 87,908 soundings for channel center-lines and adjacent shoals. Depths are corrected to MLLW and presented at 0.5-ft resolution.
2. Channel Depths, Boat Drafts, and Signage – 87,908 soundings, presented in 6 depth categories (≤ 1 , 1.5 or 2.0, 2.5 or 3.0, 3.5 or 4.0, 4.5 or 5.0, > 5.0 ft); boat draft (543 vessels) presented in 6 draft categories (same ft units as depths); Signs (225) presented in 8 categories: speed regulation, hazard warning, resource protection, navigation guide, private ownership, government, business, and other.
3. Analysis - Channel Restrictions, defined as the difference between a channel segment depth and the maximum draft of vessels located up-channel, portrayed in 1 non-restriction and 6 restriction classes (0.0 ft, 0.5 ft, 1.0 ft, 1.5 ft, 2.0 ft, ≥ 2.5 ft); and Boat Restrictions (543 boats, excluding derelict vessels), defined as the difference between boat draft and the controlling center-line depth, portrayed in 6 restriction classes (same ft units as Channel Restrictions).

b. Regional Scale Atlases

1. Bathymetry – 87,908 soundings that pertain to channel center-lines and adjacent shoals. Depths are corrected to MLLW and presented at 0.5-ft resolution as color-coded symbols in 4 generalized depth ranges (≤ 2 ft, > 2 ft and ≤ 4 ft, >4 ft and ≤ 6 ft, > 6 ft).

2. Boats - 543 boats presented as color-coded symbols in 4 generalized draft categories (≤ 1 ft, > 1 and ≤ 2 ft, > 2 ft and ≤ 3 ft, > 3 ft).
3. Facilities - the distribution of wet and dry slips per facility. A facility is defined as the land use to which a slip is associated, and includes the following categories: anchorage, business, government, marina, residence (single family or multi-family), or other. A color-coded symbol, graduated in size, indicates the number of slips per facility.
4. Signs - 239 signs presented as color-coded symbols in 8 classes: speed regulation, hazard warning, resource protection, navigation aid, private ownership, government, business, and other.
5. Sea Grass and Mangroves - the map shows the approximate location of sea grass beds and mangroves in the study area. Sea grass, mangroves, and land cover were extracted from databases obtained from the SWFWMD and the FMRI. Sea grass distribution was mapped from January 1999 1:24,000-scale, natural-color aerial photography, and mangrove and land cover information are from a 1999, 1:24,000 scale, GIS coverage.

6. Geographic Information System (GIS) Data Files, Metadata, and Software Application

The present contract between FSG and Manatee County, which is funded through the WCIND, includes delivery of GIS data files and corresponding metadata. The GIS database for Bishop Harbor and the Braden and Manatee Rivers includes nine files: boats, boating access channels, channel depths, derelict vessels, hazards, moorings, signage, trafficheds, and the Map Atlas index. They have been provided to the County on CD-ROM in ARC/INFO export format and as ArcView 3.X shape files. The metadata have been provided consistent with federal standards for reporting GIS data descriptions.⁶

During implementation of the South Sarasota County Regional Waterway Management System (Antonini et al., 1998), the WCIND commissioned the development of a customized ArcView (ESRI, Inc.) application to produce print copies of one or more atlas pages. This application was modified to include atlas pages for the project area and has been delivered to Manatee County and to the WCIND. The application re-creates the printed atlases, which include the following layers, themes, and attributes, at the pre-defined 1:2400 (1in = 200 ft) scale:

- (a) A background black-and-white image that consists of U.S. Geological Survey (USGS) digital orthophoto quarter quadrangles. The orthophotos have a spatial resolution of 1-meter and were derived from 1994-1995 color infrared photography.
- (b) Water depth (0.5 ft increments adjusted to MLLW datum).
- (c) Boat draft, presented as color-coded symbols in six draft classes: ≤ 1 ft, 1.5 or 2.0 ft, 2.5 or 3.0 ft, 3.5 or 4.0 ft, 4.5 or 5.0 ft, and > 5.0 ft.
- (d) Channel center-line depth, accurate to 0.5 ft and corrected to mean lower low

water (MLLW), presented as color-coded symbols in six classes: ≤ 1 ft, 1.5 or 2.0 ft, 2.5 or 3.0 ft, 3.5 or 4.0 ft, 4.5 or 5.0 ft, and > 5.0 ft.

- (e) Signage (speed regulation, hazard warning, resource protection, navigation guide, private ownership, government, business, and other).
- (f) Channel restrictions portrayed in seven classes: no restriction, 0.0 ft, 0.5 ft, 1.0 ft, 1.5 ft, 2.0 ft, and ≥ 2.5 ft.
- (g) Boat accessibility portrayed in seven restriction depth classes: no restriction, 0.0 ft, 0.5 ft, 1.0 ft, 1.5 ft, 2.0 ft, and ≥ 2.5 ft.

Upon starting the application, the user is presented with a view (page) showing an index of the study region that includes general land use/land cover and a variation of the USGS quarter quadrangle grid. Each individual index tile represents 1/16th of a quarter quadrangle and is labeled with a corresponding atlas page number. The user is able to select and print pages at the pre-defined 1:2400 scale. This application requires ArcView 3.X, running under Windows 95, 98, NT, 2000, or XP, on an appropriate computer, and plotting hardware. Further details are contained in the user notes found on the application CD-ROM.

7. Institutional Framework for Regional Waterway Systems Management

The WCIND met with the FDEP Deputy Secretaries in September 1997 and discussed the state's adoption of the waterway management methodology described in this report. The FDEP, at that meeting, signed a Memorandum of Agreement (MOA), wherein the agency states that it will work as a partner with FSG and the WCIND in implementing a regional waterway management system in WCIND waters (Appendix A). Since Manatee County has taken the initiative by sponsoring these waterway evaluations, the county is well positioned to implement the study's results by proposing to the FDEP an ecosystems-type approach to waterway management, including needed maintenance dredging, habitat restoration, and boat traffic management.

8. Results for the Braden and Manatee Rivers

a. Boats

There are 543 small-craft-type vessels (excluding 3 derelict vessels) situated on-the-water or on adjacent salt-water accessible upland parcels on the Braden and Manatee Rivers (Table 2). There were no boats, moorings, or facilities located in Bishop Harbor. The majority (27 percent) consists of open utility vessels, followed by kayak/row/canoe (25 percent), recreational fishing (23 percent), speed (12 percent), and power cabin (4.6 percent). There are relatively few sail boats (2.6 percent) at adjacent waterfront locations.

b. Trafficsheds

The term trafficshed is used to define the location of concentrations of boats

that use a common channel to gain access to open water. This term is a segmentation unit for the purposes of waterway management. Segmentation into trafficsheds permits data generalization and reduction for GIS analysis and subsequent management recommendations. The project area was divided into two trafficsheds: the Braden River trafficshed with 273 (50.3 percent) vessels and the Manatee River trafficshed with 270 (49.7 percent).

c. Accessibility

Boat accessibility refers to the difference between a boat's draft and the MLLW depth of the shallowest downstream channel segment that the boat must traverse to gain access to a secondary channel and, ultimately, deep water—the point at which a vessel is no longer restricted to a channel. Four levels of restrictions are denoted:

- (a) Somewhat restricted (0.0 ft or 0.5 ft deeper).
- (b) Restricted (1.0 ft or 1.5 ft deeper).
- (c) Severely restricted (2.0 ft or 2.5 ft deeper).
- (d) Blocked (3.0 ft or deeper).

Fifty-seven percent of all boats (307 of 543) experience some degree of restriction. Of the restricted boats, 70 percent (215) are *somewhat restricted* and only experience problems within 0.5 ft of MLLW; 26 percent (81) are *restricted* by 1.0—1.5 ft; 3.3 percent (10) are *severely restricted* by 2.0 - 2.5 ft; and 1 boat (0.3 percent) is *blocked* by shoals \geq 3.0 feet. A summary of the analytical results is presented in Table 3. Figure 5 shows a sample of the mapped results, which appear in the analysis atlases described on page 6.

The boats in the study area may be grouped into three draft categories: shallow (0.5 to 1.5 ft), medium (2.0 to 3.5 ft), and deeper draft (4.0 ft and greater). Seventy-one percent (386) of all boats have shallow drafts, 29 percent (156) have medium drafts, and 1 boat has a deeper draft (Table 4). Of all restricted boats, 49.8 percent have shallow drafts and 49.8 percent have medium drafts. Of particular note is the fact that 72 percent (141) of Braden River boats have shallow drafts compared to only 11 percent (12) of Manatee River boats. In comparison, 88 percent (97) of Manatee River boats have medium drafts compared to 28 percent (56) of Braden River boats.

Some boats—those propelled by outboards or inboards with out-drives—are capable of varying their draft by partially raising or lowering the outboard unit of the propulsion system. The accessibility analysis for these boats included two options: (a) normal running conditions, with the lower unit fully extended; and (b) shallow water running, with the lower unit partially raised, for temporary shoal operation. Eighty-six percent (263) of the restricted boats have the ability to raise their lower units (Table 5). These are concentrated at the lower end of the restriction levels, meaning that raising the lower unit by 0.5—1.0 ft would effectively eliminate, or substantially reduce, the restriction problem. The majority (81 percent) of the restricted boats with "variable draft"

capability are in the 1.0 ft (27), 1.5 ft (97), 2.0 ft (87), and 2.5 ft (37) draft categories (Table 6).

d. Spatial Distribution of Restricted Access Boats

Nearly equal numbers of vessels are found on the Braden (273) and Manatee Rivers (270), however, nearly two-thirds (197) of all restricted boats (307) are located on the Braden River (Table 3). The remaining 110 restricted vessels are located on the Manatee River. Seventy-five percent (83) of restricted boats on the Manatee River and 67 percent (132) of those on the Braden River only experience problems within 0.5 foot of MLLW. Another 23 percent (25) of Manatee River restricted vessels and 28 percent (56) of those on the Braden River are restricted by 1.0—1.5 ft. Eighty-two percent (9) of vessels restricted by ≥ 2.0 ft are found on the Braden River, while only two such vessels are located on the Manatee River.

The tidal portion of the Braden River has east and west channel branches that are significant in terms of boat traffic (Figure 6). The west branch is 3.3 miles long and starts approximately at the mid-point, while the east branch is 5.9 miles long and starts just below Lake Ward. The west branch joins the east branch about 1500 feet upstream from the SR-64 bridge. The east branch is the primary channel used by Braden River boaters, but the west branch serves as the main access channel for the 81 vessels berthed along the western shore. The main Manatee River channel, along which boats were surveyed, is 9.6 miles long.

Ninety-three percent (75) of west branch vessels are restricted to some degree at MLLW: 41 percent (31) within 0.5 foot of MLLW, 49 percent (37) by 1.0—1.5 ft, and 9 percent (7) by 2.0 ft. Of the 31 west branch vessels that are *somewhat restricted*, sixteen are kayaks or canoes and three are personal water craft. Sixty-three percent (114) of the 180 vessels that use the east branch are restricted at MLLW: 54 percent (98) are restricted by 0.5 foot or less and 9 percent (16) are restricted by 1.0—1.5 ft (Table 7).

Seventy percent (77) of the 110 restricted vessels on the Manatee River are found on the north shore, along the Highway 301 corridor, between Dolphin Marina and Colony Cove. Seventy-one percent (55) of these vessels only experience problems within 0.5 foot of MLLW, twenty-six percent (20) by 1.0—1.5 ft, and two vessels by 2.0 feet.

Thirty of the remaining 33 restricted vessels on the Manatee River are found between the I-75 bridge and the Gamble Creek confluence. The remaining 3 restricted vessels are found on the upper Manatee River, above the confluence. Eighty-five percent (28) of these vessels experience problems only within 0.5 foot of MLLW.

e. Channel Restrictions

Over 30 statute miles of waterways were surveyed on the Braden and Manatee Rivers and in Bishop Harbor. Soundings selected from the 87,908 in the data set

were used to construct channel depth segments for travel routes. Travel routes were analyzed to determine the location and extent of restrictions (shoals) that impede boat traffic.

To determine the degree to which a channel might impede upstream boat traffic, the MLLW depth of each channel segment was compared to the deepest draft boat located upstream. The summary of channel restrictions presented in Tables 8a and 8b were determined on the basis of the deepest draft boat located upstream from each channel segment. A sample of the mapped results, which appear in the trafficshed-scale atlases described on page 6, is shown in Figure 5.

Boat traffic is restricted on approximately 25 percent (7.7 mi.) of the principal travel route waterways. However, 65 percent (5.0 mi.) of the restricted channel length only impedes vessel transit by less than or equal to 0.5 feet at MLLW. The remaining 35 percent of restricted channel length consists of 2.4 mi. that restricts by 1.0 or 1.5 ft, 0.24 mi. that restricts by 2.0 to 2.5 ft, and 88 feet of channel that restricts one boat by 3 ft or greater at MLLW (Table 8a).

The total channel length of the Manatee River (15 mi.) is nearly equal to that of the Braden (15.4 mi) River. However, 61 percent (4.7 mi.) of restricted channels are found on the Braden River, compared to 39 percent (3.1 mi.) on the Manatee River (Table 8a). Seventy-five percent (2.3 mi.) of Manatee River restricted channels cause access problems within 0.5 foot of MLLW, compared to 59 percent (2.8 mi.) on the Braden River. Seventy-two percent (1.9 mi) of all restricted channels that cause access problems \geq 1.0 foot are found on the Braden River.

Fifty-four percent (2.5 mi.) of Braden River channel restrictions are located on the east and west branches (Table 8b). Between the two branches, the west contains only 36 percent (3.3 mi.) of the total branch channel length (9.2 mi.), but 59 percent (1.5 mi.) of the channel restrictions. Sixty percent (1.5 mi.) of channel restrictions on both branches cause access problems only within 0.5 foot of MLLW, 37 percent (0.9 mi.) are access problems between 1.0—1.5 ft, and 398 feet of west branch channel restrict boats by 2.0 ft at MLLW.

Specific channel segments can be identified according to the number of boats that they restrict at MLLW. Figure 7 identifies nine locations on the three main river channels that present access problems for 10 or more boats at MLLW. Table 9 lists, for each of the nine locations, the channel length and numbers of restricted boats at specific restriction levels. The location with the greatest total length of 'access-problem' channels is number 7, which is located on the west branch of the Braden River. At location 7 there is 259 ft of channel that restrict 73 boats by 2.0 ft, 319 ft of channel that restrict 53 boats by 1.5 ft, 1289 ft that restrict 31 boats, and 1252 ft that restrict 12-16 boats. The channel segment that restricts the greatest number of vessels at MLLW is located at location 6 on the east branch of the Braden River. There is total restricted

channel length of 612 ft at this location: 112 ft of channel that restricts 107 boats by 1.5 ft and 500 ft of channel that restricts 39 boats by 1.0 ft.

There are four secondary channel locations that bear mentioning. These locations serve relatively small areas or neighborhoods and restrict 10 or more boats at MLLW (Figure 8).

1) The channel that leads from the I-75 bridge to Colony Cove contains 1786 feet of restricted channel length. Portions of the restricted length impede up to 58 boats at MLLW.

2) The entrance to Waterlefe contains 51 ft of restricted channel. (There is an additional 251 feet of channel that restricts 9 boats at MLLW.) Portions of the restricted length impede up to 13 boats at MLLW.

3) The channel that leads into the community of Sugarhouse Creek from the Braden River west branch contains 1136 ft of restricted channel. Portions of the restricted length impede up to 24 boats at MLLW.

4) The channel that leads into the Braden River (west branch) community at the northern terminus of East 45th Street contains 169 ft of restricted channel. Portions of the restricted length impede up to 16 boats at MLLW.

f. Projected Dredging Requirements

Dredging estimates are based on a 20-foot wide improvement footprint, which conforms with the WCIND "surgical" approach to maintenance dredging adopted for regional waterway management in southwest Florida in order to minimize environmental impacts to bay resources. This improvement footprint, along with the 5 ft margin setbacks for channel markers, is consistent with the WCIND standard of 30 ft wide navigation channels.

Tables 10a and 10b present an analysis for all Manatee and Braden River channels. Estimates of required dredging were calculated using two scenarios:

- i) Normal (MLLW = 0 ft datum) Depth Clearance (Table 9); and
- ii) Additional Depth Clearance, which requires a 1 ft clearance between lowest point of boat and channel bottom (Table 10).⁷ Dredging amounts are in cubic yards and assume a base channel width⁸ of 20 ft.

Under Scenario (i) Normal Clearance, the amount of dredge required for a 100-ft channel segment restricted by 1.5 ft, is equal to the restriction amount, multiplied by a 20-ft base channel width, divided by 27 (27 ft³ per yd³), or approximately 111 cubic yards.

$$[100 \text{ ft} \times 1.5 \text{ ft} \times 20 \text{ ft}] / 27 \text{ ft}^3 \text{ per yd}^3$$

Given the above assumptions, the depth of dredge equals the restriction level

of the channel, e.g., a 0.0 ft channel restriction level requires no dredging, whereas a channel with a 2.5 restriction level would require a 2.5 ft depth cut.

Under Scenario (ii) Additional Depth Clearance, the same obstruction would require approximately 185 cubic yards:

$$[100 \text{ ft} \times (1.5 \text{ ft} + 1.0 \text{ ft}) \times 20 \text{ ft}] / 27 \text{ ft}^3 \text{ per yd}^3$$

In this case, restricted channel segments would be dredged to the restriction level plus an additional foot, e.g., a somewhat restricted segment (0.5 ft restriction) would be dredged to $0.5 + 1.0 = 1.5$ ft.

Table 11 lists projected dredge requirements for the nine main channel locations that present access problems for 10 or more boats at MLLW. Estimated dredge volumes are listed for successively greater restriction levels—0.5 ft to 2.0 ft—and are cumulative. For example, at location 2 on the Manatee River an estimated 10 cubic yards of material would need to be removed to free 14 boats at MLLW. An additional 120 cubic yards, for a total of 130 cubic yards, would need to be removed to free 30 vessels. total dredge volume listed is the estimated amount of material that would need to be removed to free the maximum number of restricted boats. For example, at location number 6 on the east branch of the Braden River, an estimated 2157 cubic yards of material would need to be removed to allow unrestricted passage for 107 boats at MLLW. Information presented at this level of detail allows the County to determine if and where spot dredging would be more effective.

g. Signage

The study region contains 239 boating-related signs: 4 are for businesses, 4 belong to government facilities, 2 are hazard warnings, 116 are navigation-type, 49 are categorized as private ownership, 4 are for resource protection, 55 post speed regulations, and 5 are classified as other. The most common type of sign is “piling” (77 percent) followed by those on structures (21 percent). There are 150 signs on the Manatee River, 78 on the Braden River, and 11 leading into and within Bishop Harbor. Tables 12a and 12b detail this information.

9. Conclusions and Recommendations

The waterway management needs of Manatee County are uniquely defined by the geography of boat source areas (trafficsheds) and the main and secondary channels that service the trafficsheds. The relations of boat draft to controlling channel depth determine the degree of boat accessibility and channel restrictions. An understanding of these relations is fundamental to developing and implementing rational waterway management policy. The results of this study argue in favor of prioritizing channel improvements based on greatest need; they also highlight conditions within Manatee

County waters that should guide region-wide bay water use policies. A rational waterway planning policy must address both user needs and environmental limitations.

a. Short-term

- 1) The results for the Braden and Manatee Rivers indicate that the greatest problems of boat access and channel restrictions occur at a relatively few main channel locations. Nine locations present access-problems to 10 or more boats at MLLW (Figure 7). The maximum number of boats that are impeded at these locations ranges from 14 to 107. The relatively high volume of boat traffic traversing some of these channel locations makes them strong candidates for maintenance dredging. The County should use the information contained in Table 11 to determine if spot dredging is warranted at some or all of these locations.
- 2) Signage—as development pressures increase in the area, so will boat traffic. The County should insure that adequate markings are in place on both rivers to promote safe and environmentally responsible navigation. For example, the channel markings on the SR-64 and SR-70 bridges across the Braden River should be upgraded and lights should be installed. Better markings are suggested for the lower portion of the Manatee River near the I-75 bridge as well as shoal areas on both rivers.
- 3) The waterway inventory information in the project’s GIS database has value and application beyond the bay water planning and management results presented in this report. This information should be reformatted and provided to shorefront residents and boaters in trafficsheds targeted for waterway improvements, as Waterway Maps, showing channel center-line depths, boat facilities, and natural resource conditions. (The WCIND and FSG have produced similar maps of anchorages.) This information can sensitize users to the environmental conditions of the waterways and provide a basis for instilling stewardship and responsible boating practices.
- 4) Manatee County should consider implementing these recommendations under a Memorandum of Agreement (MOA) for Regional Waterway Systems Management, similar to one executed in 1997 by the Florida Department of Environmental Protection, the West Coast Inland Navigation District, and the Florida Sea Grant College Program (Appendix A). This MOA is designed to offer local governments and waterfront community organizations a mechanism to effect regional waterway improvements within an ecosystem, place-based management approach. The MOA provides an avenue for pursuing region-wide permit review and project applications. The 1997 MOA led to the recently added State of Florida administrative code, “Chapter 62-341.490 Noticed General Permits for Dredging by the West Coast Inland Navigation District (WCIND).”

b. Long-term

- 5) Manatee County and the WCIND have an investment in this Regional Waterway Management System. This system should be maintained and enhanced in order to respond to the county's growing needs for rapid assessment and comprehensive geographic analysis of its bay water resources.
- 6) The Regional Waterway Management System can be strengthened by linkage to the county's upland databases, which will facilitate response to more complex issues that transcend land-water boundaries. For example, sediment sources could be identified and their relative contribution to waterway shoaling quantified. This would allow for a more equitable distribution of maintenance dredging costs among those charged with waterway maintenance and those who contribute to shoaling.
- 7) The Regional Waterway Management System database should be updated periodically with countywide boat information. Florida Sea Grant is developing a plan based on revising the annual Vehicle/Vessel Registration Form. This plan, to incorporate information on boat type, draft, and location onto the form, will offer a systematic updating method that should be pursued through the County Tax Collector's Office and the Division of Motor Vehicles.
- 8) The bathymetric surveys should be updated, as needed, to identify shoaling conditions of the waterways. The WCIND has collaborated, through Florida Sea Grant, with the National Oceanic and Atmospheric Administration (NOAA) Marine Chart Division and the Coastal Services Center on two projects of significance: 1) an effort to redesign coastal charts for recreational waterway users, and 2) the enhancement and standardization of bathymetric field collection methods used by the WCIND. The WCIND and Manatee County should explore existing and future opportunities to partner with this federal charting agency and thereby share survey information on a periodic basis.
- 9) The appropriate County department should be provided with the GIS equipment, software, and training to carry out waterway inventory and analysis, in order to respond to routine customer requests for information and technical services. The Florida Cooperative Extension Service and State University System should continue to provide institutional and professional support.
- 10) A measure of the success of the regional waterway management program is whether technical results are translated into meaningful benefits for local communities. A program that includes a strong boater education component will best address the diverse management needs of Manatee County. The Manatee County Marine Agent is an appropriate resource for the dissemination of Project results at the local, community level. The Marine Agent can work with interested waterfront communities to help maintain their waterways, providing assistance in

the form of project data, technical support, workshops, and field site inspections. Networking the community with permitting agencies and contractors, in order to develop community-based strategies to restore and maintain waterway resources, will increase the effectiveness of the Marine Agent. Boaters can play an active, critical role in determining whether to boat in a given area, what type of boating should occur, and what level of intervention is necessary.

Endnotes

¹The term trafficshed is used to define an area that contains a concentration of boats that use a common channel, exclusive to the trafficshed, to gain access to deep, open water.

²For the purpose of this report, deep, open water—defined as a function of vessel draft—begins at that location in the transit of a vessel, from its berth, beyond which the vessel is no longer restricted to a channel because of environmental or depth limitations. In the project area, the main channel of the Manatee River, downstream of the I-75 Bridge, is considered “deep, open water.”

³This total excludes 3 derelict vessels. Derelict condition is included in the Derelicts database.

⁴The facility count was based on a cross-tabulation of the facility type, the parcel identification number (PIN)—a unique numerical identifier in the property ownership spatial database of Manatee County assigned to each boat and mooring, and the parcel owner name. Facility counts should be regarded as estimates. In some instances, boats and moorings were designated as belonging to a single-family residence; however, there was no corresponding subdivision into single-family residences within the county property ownership spatial data base. An example of this is a mobile home park. In order to generate facility counts, for those instances where parcels did not contain PINs, unique identifiers were generated and assigned to these boats and moorings based on the judgment of the project staff. This was accomplished by the project’s analyst deciding to which parcel a boat or mooring belonged. The adjacency to the parcel of the boat or mooring was the primary criteria for transferring the of parcel information. This type of problem is symptomatic of discrepancies between the two databases, which introduced a level of inaccuracy in assigning a facility designation to a parcel.

⁵The PIN, also, was assigned to relate boats and moorings to parcel ownership information contained in the Manatee County Property Appraiser spatial database. As in the case of relating facility type with parcel ownership, so too there are a number of factors that limit the utility of relating boats and mooring to parcel information. One factor is the 1-meter resolution digital orthophoto quarter quadrangles (DOQQs) obtained from the United States Geological Survey (USGS), which was utilized as the base map for the project. The DOQQs provided the most consistent representation

of physical features, such as shoreline, and land use/land cover for the project area. Boats and moorings were surveyed in the field utilizing GPS and, if necessary, their mapped positions were adjusted to the image base map. In order to transfer PIN numbers to each boat and mooring, the image base map was overlaid with the property ownership spatial data base. The degree of spatial correspondence between physical features from the base map and the property ownership data base was good, but some interpretation is necessary when assigning the correct PIN to a boat or a parcel. Another limiting factor was in cases where parcels did not carry PIN numbers.

⁶Each file is described by a data dictionary that includes information on identification; data quality; spatial data organization; spatial referencing; entities and attributes; distribution and metadata references.

⁷This may be considered an extended application of the FDEP Rule for Aquatic Preserve Waters, which requires, in non-man-made canals or previously un-dredged portions of coastal streams, a 1 ft clearance at the dock between the lowest point of the boat hull or fixed drive unit (whichever is lower) and any submerged bottom lands or tops of sea grasses.

⁸There is great variation in channel width within the canals and waterways of Manatee County. To account for the variation, a base channel width of 20 feet was used to calculate estimated dredge volumes for all restricted channel segments. This 20-foot base channel width, or improvement footprint, will accommodate the majority of recreational boats when two pass abreast of each other. There are locations, however, when a restricted channel will require either a width greater than 20 feet or can only accommodate a narrower width. To determine an estimated dredge volume that accounts for a wider or narrower channel, simply multiply the estimated dredge volumes contained in the report by the ratio of the required width and the base channel width. For instance, to adjust estimated dredge volumes to account for a required dredge width of 30 feet, multiply the estimated dredge volume within the report by a factor of 1.5 (30 feet / 20 feet). Conversely, to adjust for a 15 ft channel, use a factor of 0.75

References

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Table 1. Counts of Boat Types for the Braden and Manatee Rivers.

Boat Types	All Boats			Manatee River			Braden River		
	Boat Counts	Column Percent	Row Percent	Boat Counts	Column Percent	Row Percent	Boat Counts	Column Percent	Row Percent
Open Utility	145	27%	43%	62	23%	43%	83	30%	57%
Kayak/Row/Canoe	138	25%	55%	76	28%	55%	62	23%	45%
Recreational Fishing	126	23%	47%	59	22%	47%	67	25%	53%
Speed	63	12%	51%	32	12%	51%	31	11%	49%
Power Cabin	25	5%	64%	16	6%	64%	9	3%	36%
Personal Water Craft	18	3%	50%	9	3%	50%	9	3%	50%
Sail	14	3%	57%	8	3%	57%	6	2%	43%
Other*	14	3%	57%	8	3%	57%	6	2%	43%
Total:	543	100%	50%	270	100%	50%	273	100%	50%

*"Other" includes the following vessels: 3 Market Fish, 7 Houseboats, and 4 Unknown

Table 2. Distribution of Boat Facilities for the Braden and Manatee Rivers.

Facility Types	All Boats		Manatee River			Braden River		
	Facility Counts	Column Percent	Facility Counts	Column Percent	Row Percent	Facility Counts	Column Percent	Row Percent
Anchorage	1	0.3%	1	0.8%	100%	0	0.0%	0%
Business	3	0.8%	2	1.7%	67%	1	0.4%	33%
Government	4	1.1%	3	2.5%	75%	1	0.4%	25%
Marina	2	0.6%	2	1.7%	100%	0	0.0%	0%
Multi-Family	11	3.1%	9	7.6%	82%	2	0.8%	18%
Single Family	333	94%	101	86%	30%	232	98%	70%
Total:	354	100%	118	100%	33%	236	100%	67%

Table 3. Boat Access Levels for the Braden and Manatee Rivers.

Access Level	All Boats		Manatee River			Braden River		
	Boats	Column Percent	Boats	Column Percent	Row Percent	Boats	Column Percent	Row Percent
All Boats	543	100%	270	100%	50%	273	100%	50%
Unrestricted Boats	236	43%	160	59%	68%	76	28%	32%
Restricted Boats	307	57%	110	41%	36%	197	72%	64%
Somewhat Restricted	215	70%	83	75%	39%	132	67%	61%
Restricted	81	26%	25	23%	31%	56	28%	69%
Severely Restricted	10	3%	2	2%	20%	8	4%	80%
Blocked	1	0%	0	0%	0%	1	1%	100%

Boat access levels refer to the difference between a boat's draft and the depth (MLLW) of the shallowest downstream channel segment:

- Somewhat Restricted: 0.0 feet or 0.5 feet deeper.
- Restricted: 1.0 feet or 1.5 feet deeper.
- Severely Restricted: 2.0 feet or 2.5 feet deeper.
- Blocked: 3.0 feet or more deeper.

Table 4. Number of Restricted Boats by Boat Draft Category for the Braden and Manatee Rivers.

Draft Category	All Boats		Manatee River			Braden River		
	Boats	Column Percent	Boats	Column Percent	Row Percent	Boats	Column Percent	Row Percent
Shallow	153	49.8%	12	11%	8%	141	72%	92%
Medium	153	49.8%	97	88%	63%	56	28%	37%
Deeper	1	0.3%	1	0.9%	0.7%	0	0.0%	0.0%
Total	307	100%	110	100%	72%	197	100%	129%

Shallow: 0.5 to 1.5 feet

Medium: 2.0 to 3.5 feet

Deeper: 4.0 feet and greater

Table 5. Variable Draft Capability of Restricted Boats for the Braden and Manatee Rivers.

Restriction Level	All Boats				Manatee River				Braden River			
	Boats	Variable Draft		Percent Boats Variable Draft	Boats	Variable Draft		Percent Boats Variable Draft	Boats	Variable Draft		Percent Boats Variable Draft
		No	Yes			No	Yes			No	Yes	
Somewhat Restricted	215	31	184	86%	83	5	78	94%	132	26	106	80%
Restricted	81	11	70	86%	25	5	20	80%	56	6	50	89%
Severely Restricted	10	1	9	90%	2	1	1	50%	8	0	8	100%
Blocked	1	1	0	0%	0	0	0		1	1	0	0%
Total Restricted Boats	307	44	263	86%	110	11	99	90%	197	33	164	83%
Percent of Column Total	100%	14%	86%		100%	10%	90%		100%	17%	83%	

Table 6. Variable Draft Capability by Boat Draft for Restricted Boats on the Braden and Manatee Rivers.

Draft (feet)	All Boats						Manatee River				Braden River			
	Boats		Variable Draft		Row Percent	Boats	Variable Draft		Row Percent	Boats	Variable Draft		Row Percent	
	No	Yes	No	Yes			No	Yes			No	Yes		
0.5	25	24	1	4%	0	0	0	0	100%	25	24	1	4%	
1.0	28	1	27	96%	1	1	0	1	100%	27	1	26	96%	
1.5	100	3	97	97%	11	0	0	11	100%	89	3	86	97%	
2.0	89	2	87	98%	49	0	0	49	100%	40	2	38	95%	
2.5	41	4	37	90%	28	3	3	25	89%	13	1	12	92%	
3.0	19	6	13	68%	18	6	6	12	67%	1	0	1	100%	
3.5	4	3	1	25%	2	1	1	1	50%	2	2	0	0%	
4.0	1	1	0	0%	1	1	1	0	0%	0				
Total	307	44	263	86%	110	11	11	99	90%	197	33	164	83%	

Note: Row and column percentages are based on the number of restricted boats with variable draft capabilities.

Table 7. Boat Access Levels for the East and West Branch Channels of the Braden River.

Access Level	Both Branches		West Branch			East Branch		
	Boats	Column Percent	Boats	Column Percent	Row Percent	Boats	Column Percent	Row Percent
All Boats	273	100%	81	100%	30%	192	100%	70%
Unrestricted Boats	76	28%	6	7%	8%	70	36%	92%
Restricted Boats	197	72%	75	93%	38%	122	64%	62%
Somewhat Restricted	132	67%	31	41%	23%	101	83%	77%
Restricted	56	28%	37	49%	66%	19	16%	34%
Severely Restricted	8	4%	7	9%	88%	1	1%	13%
Blocked	1	1%	0	0%	0%	1	1%	100%

Boat access levels refer to the difference between a boat's draft and the depth (MLLW) of the shallowest downstream channel segment:

- Somewhat Restricted: 0.0 feet or 0.5 feet deeper.
- Restricted: 1.0 feet or 1.5 feet deeper.
- Severely Restricted: 2.0 feet or 2.5 feet deeper.
- Blocked: 3.0 feet or more deeper.

Table 8. Channel Restrictions.

a. Braden and Manatee Rivers.

Restriction Level	All Channels			Manatee River			Braden River		
	Length (feet)	Column Percent	Percent of Total ¹	Length (feet)	Column Percent	Row Percent	Length (feet)	Column Percent	Row Percent
All Channels	160,345	100%	100%	79,300	100%	49%	81,045	100%	51%
Unrestricted Channels	119,554	75%	75%	63,189	80%	53%	56,364	70%	47%
Restricted Channels	40,792	25%	25%	16,111	20%	39%	24,681	30%	61%
Somewhat Restricted	26,576	65%	17%	12,065	75%	45%	14,511	59%	55%
Restricted	12,876	32%	8%	3,578	22%	28%	9,299	38%	72%
Severely Restricted	1,252	3%	1%	468	3%	37%	784	3%	63%
Blocked	88	0.2%	0.1%		0.0%	0.0%	88	0.4%	100.0%

¹Percentage of the total length of all channels in the study area (30 miles).

b. East and West Branch of the Braden River.

Restriction Level	Both Branches			West Branch			East Branch		
	Length (feet)	Column Percent	Percent of Total ¹	Length (feet)	Column Percent	Row Percent	Length (feet)	Column Percent	Row Percent
All Channels	48,703	100%	60%	17,419	100%	36%	31,284	100%	64%
Unrestricted Channels	35,278	72%	63%	9,448	54%	27%	25,830	83%	73%
Restricted Channels	13,426	28%	54%	7,971	46%	59%	5,455	17%	41%
Somewhat Restricted	8,105	60%	56%	4,560	57%	56%	3,545	65%	44%
Restricted	4,923	37%	53%	3,013	38%	61%	1,910	35%	39%
Severely Restricted	398	3%	51%	398	5%	100%	-	0%	0%
Blocked	-	0.0%	0.0%	-	0%	0%	-	0%	0%

¹Percentage of the total length of all Braden River channels (15.4 miles).

Restriction Level Refers to the difference between a channel segment depth

(MLLW) and the deepest draft boat located upstream from the segment:

Somewhat Restricted: 0.0 feet or 0.5 feet shallower.

Restricted: 1.0 feet or 1.5 feet shallower.

Severely Restricted: 2.0 feet or 2.5 feet shallower.

Blocked: 3.0 feet or more shallower.

Table 9. Restricted Channel Length and Number of Restricted Boats for Nine Main Channel Locations.

Main Channel Location ¹	Total Restricted Length (ft)	Restriction Level	Restricted Boat Count ²	Restriction Level	Restricted Boat Count ²	Restriction Level	Restricted Boat Count ²	Restriction Level	Restricted Boat Count ²	Maximum Number of Boats Restricted ³
		0.5 ft		1.0 ft		1.5 ft		2.0 ft		
1. Manatee	340	340	14							14
2. Manatee	189	26	14	163	30					30
3. Manatee	107			107	23					23
4. Manatee	231			231	23					23
5. Braden East	318			190	14-16	128	51			51
6. Braden East	612			500	39	112	107			107
7. Braden West	3119	1252	10-16	1289	31	319	53	259	73	73
8. Braden West	1556	267	11-16	791	17-31	358	26-32	140	26	32
9. Braden East	980			841	22	139	72			72
Total	7452	1519		2921		816		399		

¹Refer to Figure 9 to identify main channel locations by number.

²The number of restricted boats may vary among channel segments.

³The maximum number of boats restricted by any one channel segment at the location.

Table 10. Projected Dredge Requirements for Restricted Channels.

a. Normal Clearance (Cubic Yards).

Restriction Level	All Channels	Manatee River		Braden River		
		All Channels	Main Channel	All Channels	West Branch	East Branch
Somewhat Restricted	4313	1717	739	2596	736	478
Restricted	10919	3084	491	7835	2541	1555
Severely Restricted	1897	694		1204	590	
Blocked	194			194		
Total	17324	5495	1230	11829	3867	2033

b. Additional Foot Clearance (Cubic Yards).

Restriction Level	All Channels	Manatee River		Braden River		
		All Channels	Main Channel	All Channels	West Branch	East Branch
Somewhat Restricted	23999	10654	4662	13345	4114	3102
Restricted	20457	5734	982	14723	4773	2970
Severely Restricted	2825	1041		1784	885	
Blocked	259			259		
Total	47540	17429	5644	30111	9772	6072

Table 11. Projected Normal Dredge Requirements for Nine Main Channel Locations (Cubic Yards).

Main Channel Location ¹	Restriction Level 0.5 ft	Restricted Boat Count ²	Restriction Level 1.0 ft	Restricted Boat Count ²	Restriction Level 1.5 ft	Restricted Boat Count ²	Restriction Level 2.0 ft	Restricted Boat Count ²	Total Dredge Volume	Maximum Number of Boats Restricted ³
1. Manatee	126	14							126	14
2. Manatee	10	14	120	30					130	30
3. Manatee			79	23					79	23
4. Manatee			171	23					171	23
5. Braden East			141	14-16	142	51			283	51
6. Braden East			370	39	124	107			495	107
7. Braden West	464	10-16	955	31	354	53	384	73	2157	73
8. Braden West	99	11-16	586	17-31	398	26-32	207	26	1290	32
9. Braden East			623	22	154	72			777	72
Total	563		2164		907		591		5508	

¹Refer to Figure 9 to identify main channel locations by number.

²The number of restricted boats may vary among channel segments.

³The maximum number of boats restricted by any one channel segment at the location.

Table 12. Distribution of Boating-Related Signs for Bishop Harbor and the Braden and Manatee Rivers.

a. Categories of Signs.

Sign Category	All Signs		Manatee River		Braden River		Bishop Harbor	
	Count	Column Percent	Count	Column Percent	Count	Column Percent	Count	Column Percent
Business	4		4	3%				
Government	4	2%	4	3%				
Hazard Warning	11	5%			2	3%	9	82%
Navigation Guide	107	45%	67	45%	40	51%		0%
Other	5	2%	3	2%			2	18%
Private Ownership	49	21%	35	23%	14	18%		
Resource Protection	4	2%	1	1%	3	4%		
Speed Regulation	55	23%	36	24%	19	24%		
Total	239	100%	150	100%	78	100%	11	100%

b. Types of Signs.

Sign Type	All Signs		Manatee River		Braden River		Bishop Harbor	
	Count	Column Percent	Count	Column Percent	Count	Column Percent	Count	Column Percent
Buoy	1	0%			1	1%		
Other	6	3%	6	4%				
Structure	49	21%	22	15%	27	35%		
Pilings	183	77%	122	81%	50	65%	11	100%
Metal	9	4%	7	5%	2	3%	1	9%
PVC	71	30%	35	23%	33	43%	2	18%
Wood	103	43%	80	53%	15	19%	8	73%
Total	239	100%	150	100%	77	100%	11	100%

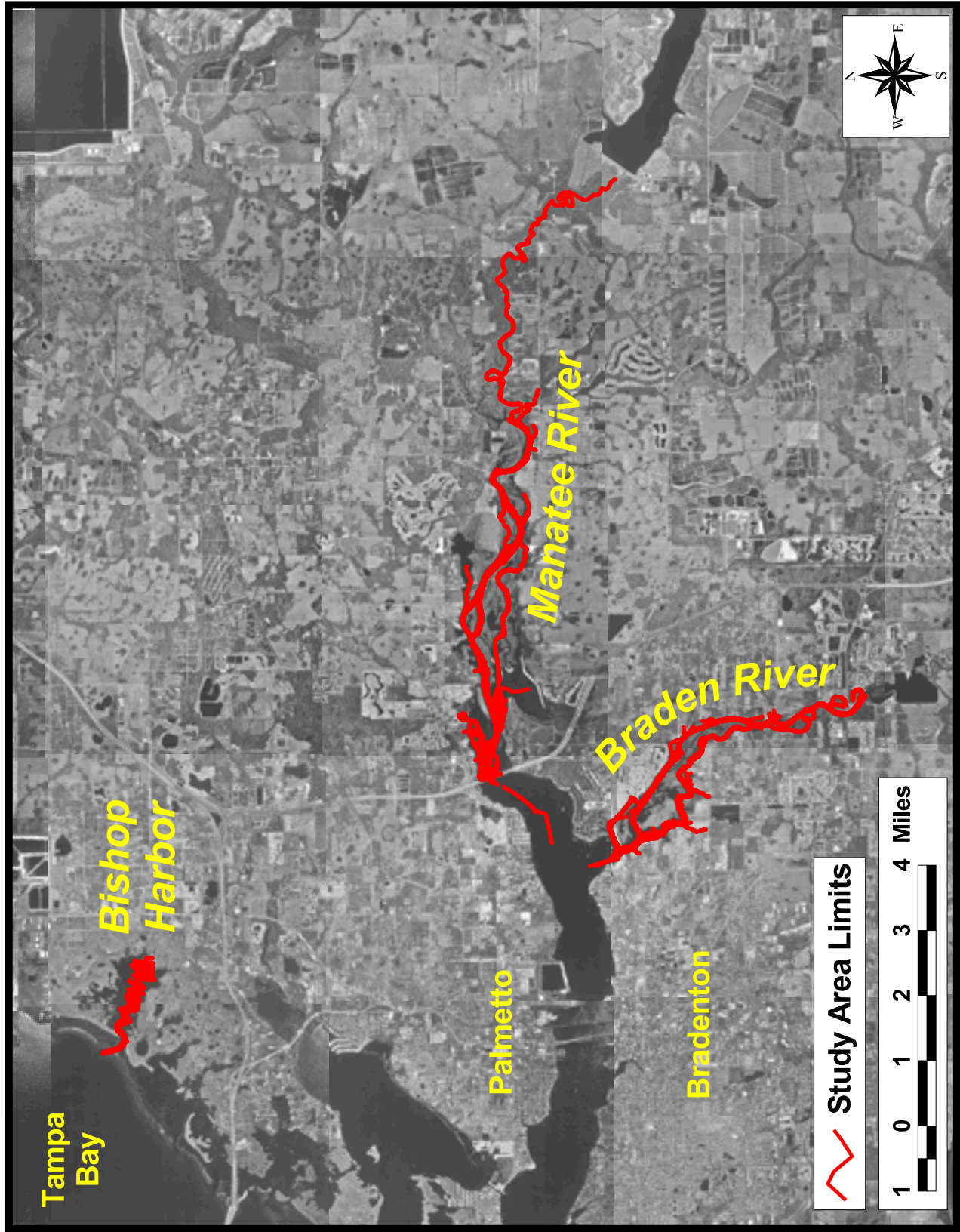


Figure 1. Project Area: Bishop Harbor, Tidal Braden River, and Lower Reaches of the Upper Manatee River.

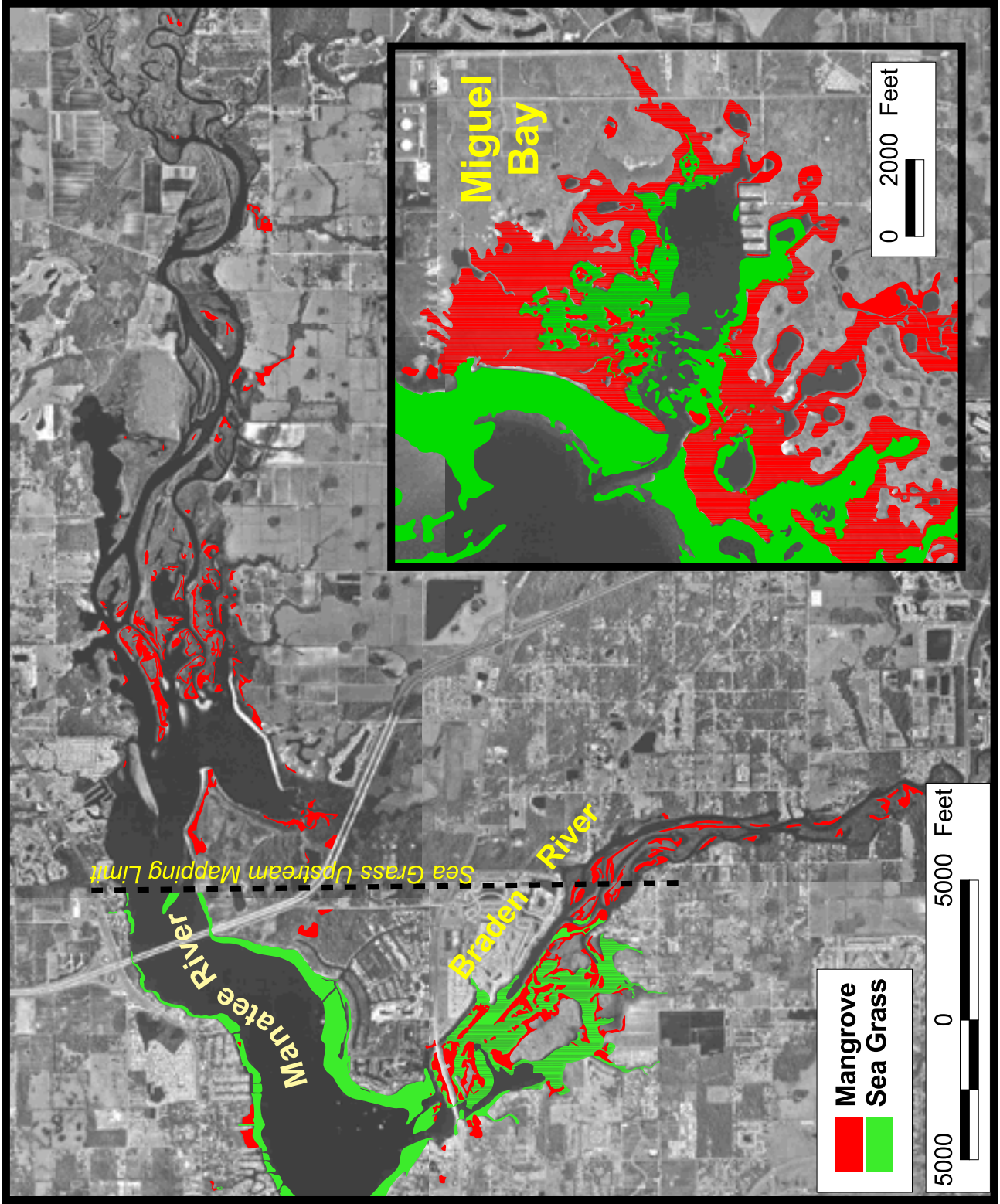


Figure 2. Approximate Distribution of Mangrove and Sea Grass Communities Mapped for Bishop Harbor, and the Braden and Manatee Rivers.

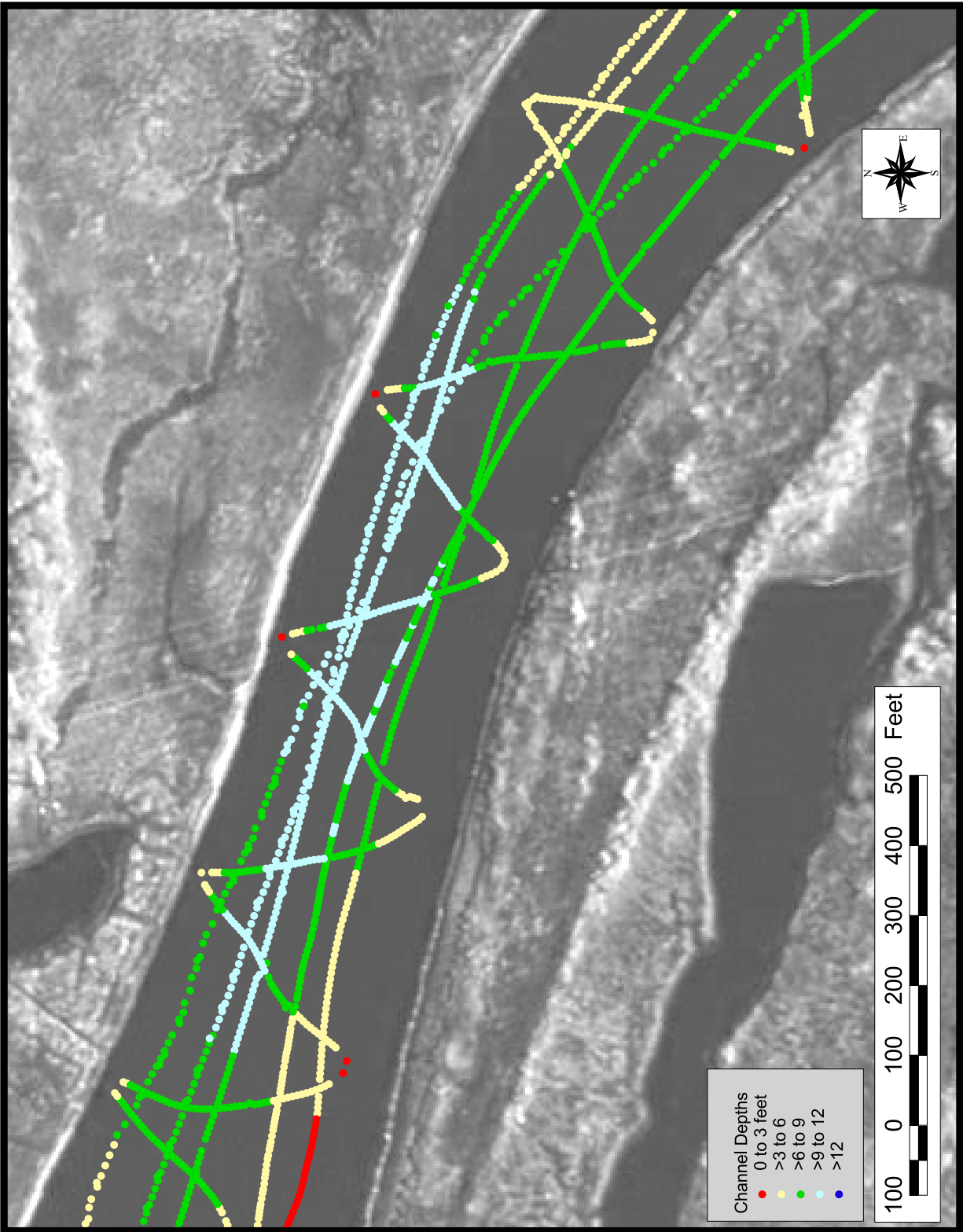


Figure 3. Example of Transect and Survey Line Soundings.

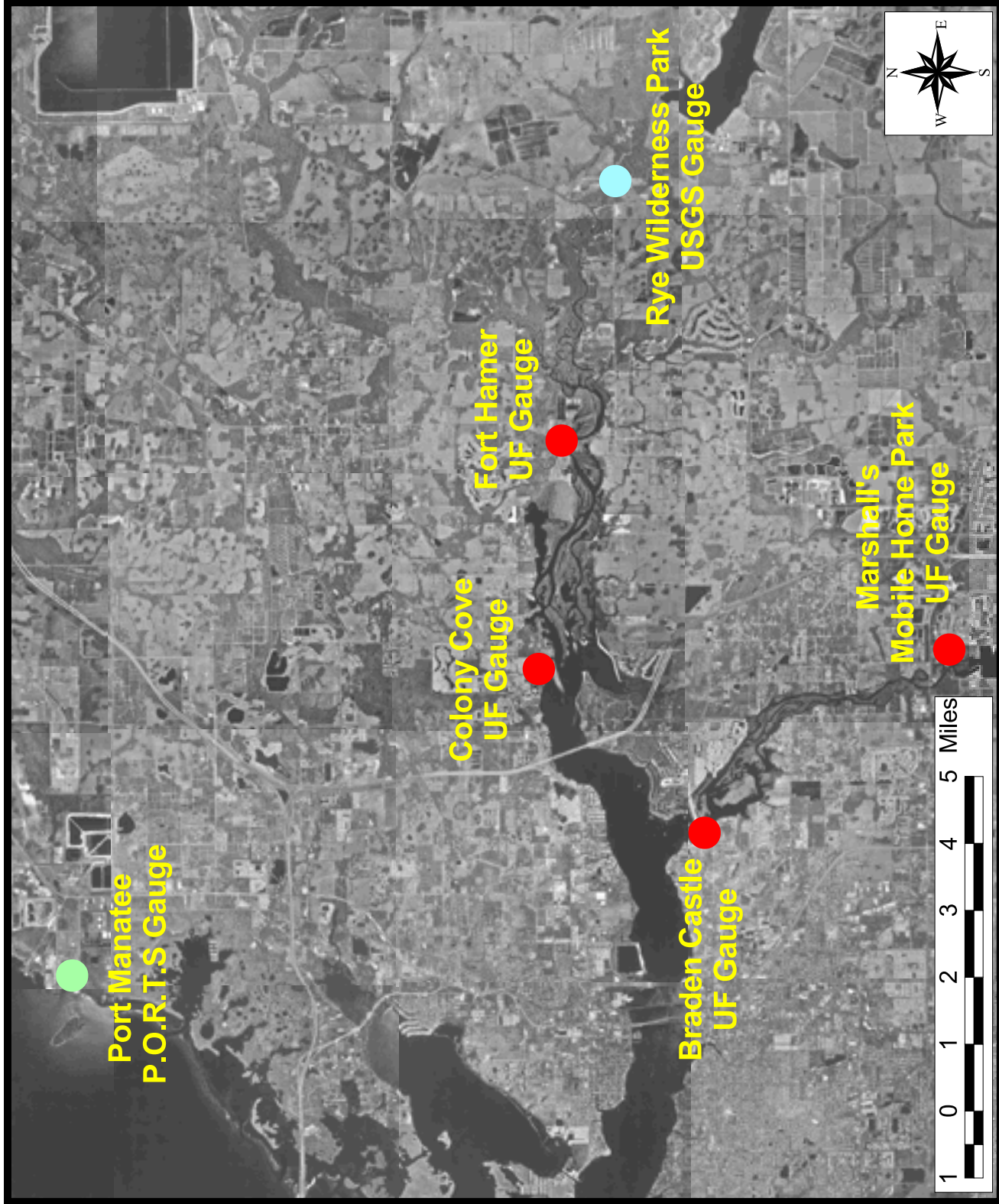


Figure 4. Locations of Tide Stations Used to Correct Depths to MLLW for the Braden and Manatee Rivers and Bishop Harbor.

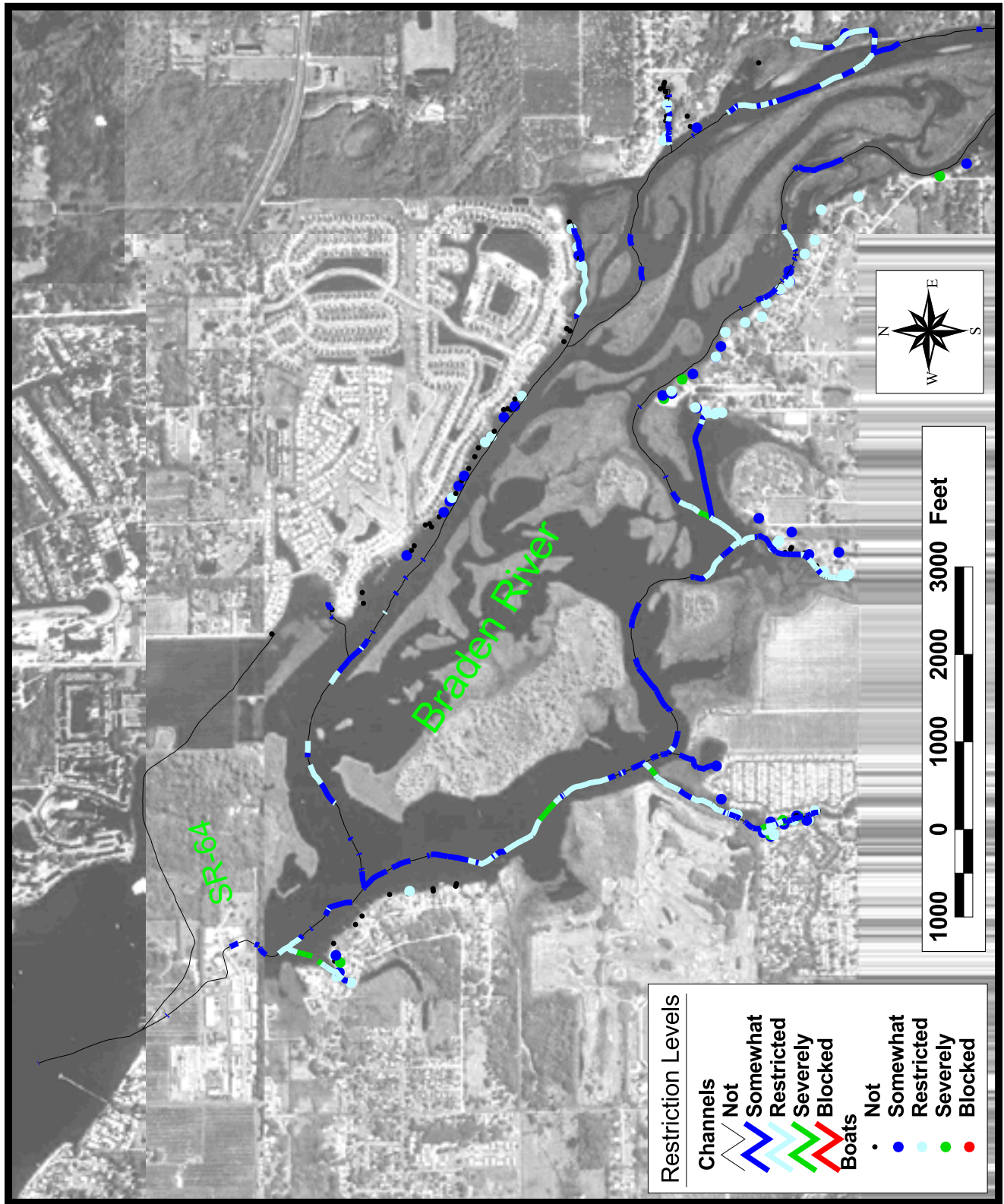


Figure 5. Example of Analysis Results, Showing Restricted Boats and Channels.

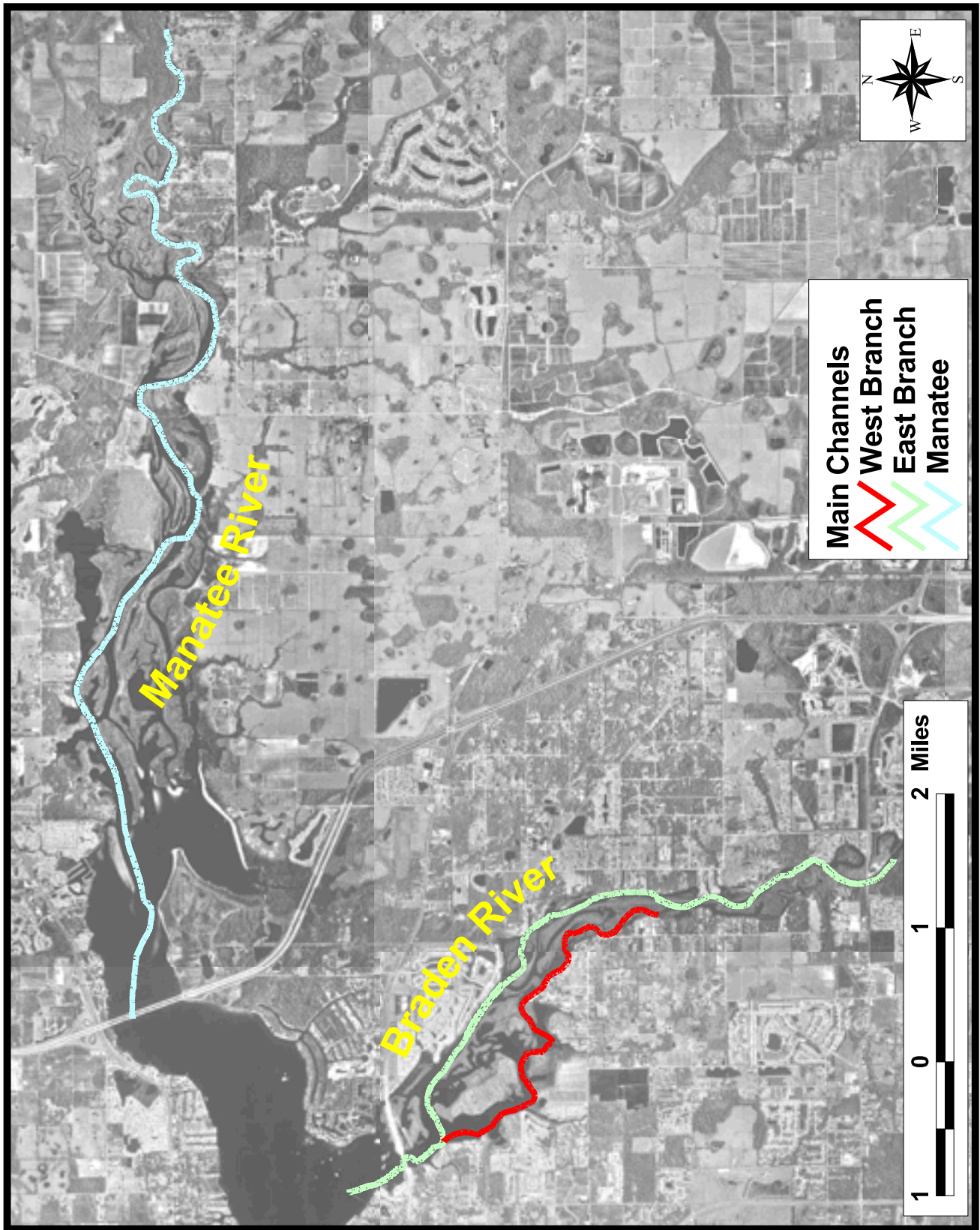


Figure 6. Main Channels for the Braden and Manatee Rivers.

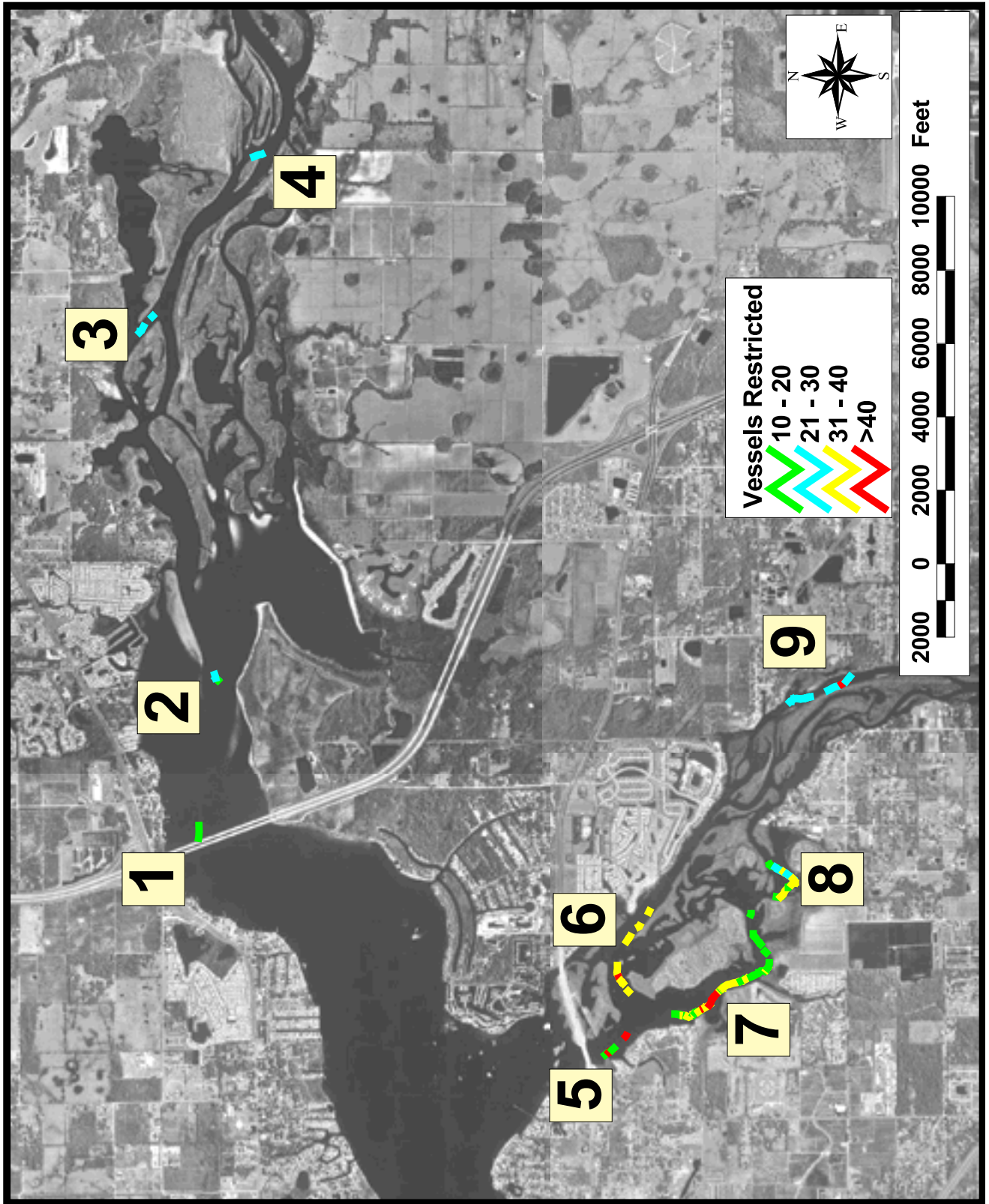


Figure 7. Nine Main Channel Locations that Impede 10 or More Boats at MLLW.

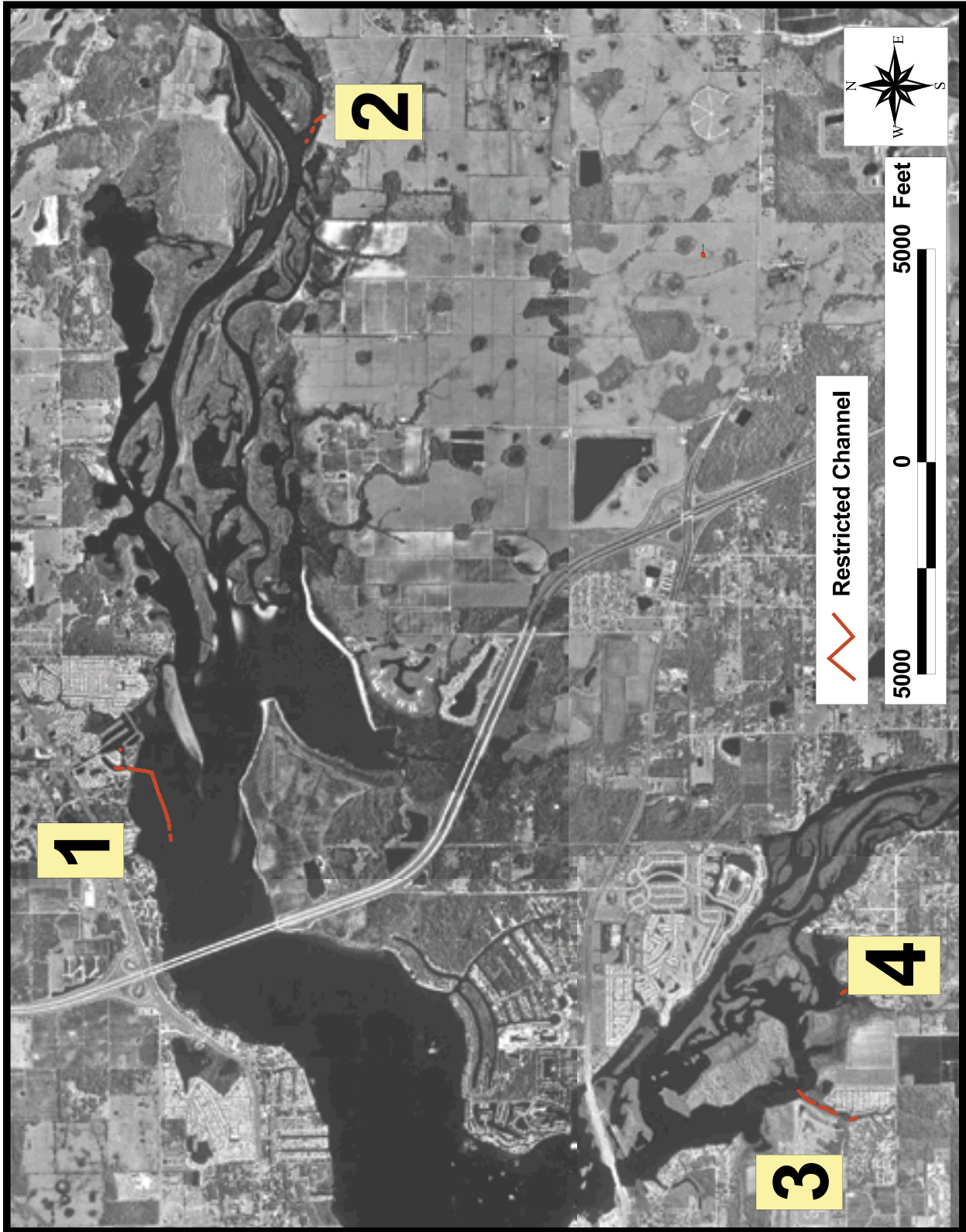


Figure 8. Four Secondary Channel Locations that Impede 10 or More Boats at MLLW.

Appendix A
Memorandum of Agreement

MEMORANDUM OF AGREEMENT

Among

The Florida Department of Environmental Protection
Florida Sea Grant College Program
and
West Coast Inland Navigation District

Relating to

A REGIONAL WATERWAY MANAGEMENT SYSTEM

Article I

Whereas, it is recognized by all parties that the waterways of Southwest Florida have high recreational and ecological value and are subject to a wide variety of uses; and

Whereas, it is recognized by all parties that significant use is by recreational vessels traversing sensitive bay habitats while navigating to varied destinations; and

Whereas, it is acknowledged by all parties that a management framework is needed now to deal with issues and problems associated with increasing use; and

Whereas, all parties have the common goal of preserving the recreational and ecological values of southwest Florida waterways in a manner that balances vessel access with respect for shore community concerns and adequate protection of marine resources; and

Whereas, all parties recognize the benefit of comprehensive planning and associated regional project review for public safety and resource preservation; and

Whereas, all parties are desirous of creating a regional management framework for southwest Florida that uses science and extension education to fashion environmentally acceptable ways of maintaining boat access in bays and estuaries; and

Whereas, all parties recognize that Net Ecosystem Benefit must be identified and provided concurrent with development and implementation of a regional permitting/planning framework.

NOW THEREFORE, in accordance with the purposes of this Memorandum of Agreement, the parties hereto agree to work together in implementing a standardized regional approach to waterway planning , permit review and project application, utilizing methodologies being developed by the Florida Sea Grant College Program and the West Coast Inland Navigation District, and included herein as Attachment I.

Article II

- A. This agreement shall become effective upon execution by all parties.
- B. This agreement may be terminated at any time by mutual consent, or any party may withdraw by providing 60 days written notice to all other parties.
- C. This agreement includes waterways of Manatee, Sarasota, Charlotte and Lee Counties.
- D. This agreement provides an effective avenue for pursuing changes to existing laws, rules, or policies that are determined to be problematic. Although encouraging appropriate changes in support of the principals in Article I, this agreement in and of itself in no way waives or modified any existing laws, rules, or policies governing the activities of any party.
- E. Local governments and local waterfront community organizations are recognized as critical players and all parties to this agreement will actively seek their participation.
- F. This agreement serves as a basis and commitment to enter into an agreement in order to take on regional approach with all affected parties to accomplish the objectives of ecosystem management.

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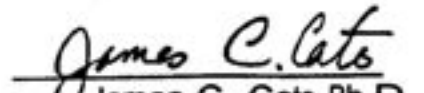
Memorandum of Agreement
Southwest Florida Waterway Management
Page 3 of 3

IN WITNESS WHEREOF, his memorandum of agreement has been executed by
the undersigned duly authorized parties on 26 September, 1997.

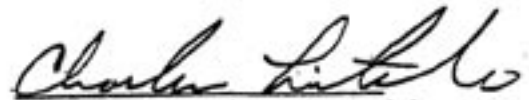
Department of Environmental Protection


Virginia B. Wetherell
Secretary

Florida Sea Grant College Program


James C. Cato, Ph.D.
Director

West Coast Inland Navigation District


Charles W. Listowski
Executive Director

Attachment 1
A Regional Waterway Management System (Plan)
for Southwest Florida

A. Introduction and Background

Florida's coasts have been transformed over the past two decades as population growth and unprecedented demand for individual shore access to bays and estuaries have led to the creation of residential canal developments. Thousands of miles of channels and basins have been dredged as a by-product of this urbanization process. These navigable waterways are being stressed by boat traffic and canalside activities. Southwest Florida's boating population is increasing at twice the state's rate of change and the region's coastal population is experiencing double the national growth rate. Resource managers, scientists and informed users agree that a holistic, place-based region-wide system is needed to deal with waterway problems associated with channel maintenance, habitat restoration, traffic and signage, and boat maintenance. Such a system can ensure safe, environmentally sustainable waterways for the boating public. Implementation of this system provides a continued opportunity to demonstrate the feasibility of the non-regulatory approach to waterway management on a regional basis.

B. Management Goals

The overall goal of this management initiative is to preserve the ecological and recreational values of southwest Florida waterways. Achieving success will require the following:

- fitting channel maintenance to boat draft requirements
- minimizing impacts on surrounding bay habitats
- prioritizing and evaluating management alternatives on a regional basis
- developing maintenance standards for secondary/arterial waterways
- developing map and other information products for boaters and shore residents to encourage environmental awareness and stewardship by users of the neighborhood waters and boat access channels.
- providing waterway communities and boating organizations with information and technical support to enable them to take an active role in managing their waterways

These goals will be pursued through a combination of management tools, with a focus on acquiring the necessary information on waterway and user characteristics in order to map and evaluate boat access needs, providing waterway communities with technical support to develop local management implementation strategies, and disseminating map and guide products to waterway residents which foster stewardship and environmentally responsible boating practices.

Development and implementation of these management tools will be a joint effort between the Florida Department of Environmental Protection (DEP), Florida Sea Grant (FSG), and the West Coast Inland Navigation District (WCIND). Local governments, local waterway communities and boating groups are recognized as critical players and are encouraged to participate.

B. Creating the Regional Waterway Management System

The Gulf Intracoastal Waterway System (GICW) was dedicated in 1967 prior to most of the coastal development in evidence today. Over the past 30 years, the need has grown for the development and maintenance of appropriate secondary access channels to accommodate boat traffic from residential waterways to the arterial GICW, bays, estuaries, and Gulf waters. The WCIND recognizes the need to provide data for proper decision-making. The WCIND also acknowledges the need for productive agency partnerships to provide cost-efficient public service/resource preservation.

- WCIND to establish the Regional Waterway Management system (RWMS) via a M.O.A.
- Define the RWMS and System Components
 - Data Sources
 - Information Coordination and Storage
 - Analysis (cartographic, statistical, carrying capacity, simulation)
 - Output (map, policy)
 - Application (region, county, local community)

A. Participants and Their Roles

- Florida Department of Environmental Protection
 - Adopt FSG/WCIND data base initiatives
 - Regional permit review and approval
 - Local site technical evaluation/cooperative effort
- Florida Sea Grant
 - Field surveying
 - GIS inventory and evaluation
 - Regional waterway planning
 - Publication and dissemination of map and guide products to boaters and shore residents
 - Technical support to waterway communities in local planning and site evaluation
- West Coast Inland Navigation District
 - Coordination of RWMS
 - Networking with counties and municipalities
 - Funding of public waterway projects through its Waterway Development Program

Page 3.

- Other Participants
 - Waterfront homeowners associations (and informal groups)
 - Local boating organizations

CWL:mms
9/12/97



Science Serving Florida's Coast

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