Dredging History of Southwest Florida Inland Waterways

The region's dredging history is linked to the recognized advantages afforded by shipping local products to market on inland waterways, as well as by the desire to control flooding with upland drainage. Oftentimes, these two objectives pitted competing and conflicting interest: waterway navigation versus land reclamation. As coastal settlements were established in the late 1800s, local communities sought governmental assistance in creating inland navigation routes. Prior to the extension of railroads south of Tampa Bay, there was great interest in opening steamboat communication across Florida. Several navigable routes were investigated: from Jacksonville, via the St. John's River, then by way of Topokalija Lake (now called Lake Tohopekaliga) to Charlotte Harbor; and down the Kissimmee River and Caloosahatchee to Ft. Myers.

With a surge in interest following the Civil War to develop lands adjoining Lake Okeechobee, the great liquid heart of Florida, private investors, armed with land grants from the state to subsidize drainage projects, attempted several canal dredging projects to link the lake with the Gulf. (These improvements are discussed further in the Caloosahatchee chapter.) By and large, however, local settlers sought to improve sheltered water routes that could provide safe passage for light-draft vessels within Charlotte Harbor and the lower Caloosahatchee, in Estero Bay, and between Naples and Marco Island. The chronology of events is summarized in Table 1 and illustrated in Maps 1 and 2.

The hydrographic charts produced by the U.S. Coast and Geodetic Survey (Coast Survey), along with U.S. Army Corps of Engineers (Army Engineers) reports and maps to Congress, provide an invaluable baseline of information on waterway conditions in Southwest Florida during the pre- and early development period. Ship captains use Coast Survey charts to navigate and pilot within coastal waters. The reports and maps of the Army Engineers result from field studies to determine the engineering feasibility and economic justification for waterway improvements. Safety of vessels at sea and commercial concerns guided expenditures of federal funds for navigation improvements. The Army Engineers were responsible for surveying and improving waterways judged to have national importance through the General Survey Act of 1824 and the Rivers and Harbors Act of 1878. The earliest source charts and maps cover Charlotte Harbor and Pine Island Sound (1863-1879) and the Caloosahatchee (1887-1893). As few coastal settlements existed beyond San Carlos Bay prior to 1900, there was little justification in extending comprehensive charting to the south. The Army Engineers undertook a centerline survey of Estero Bay in 1908, but the Coast Survey charting dates from 1970. The earliest charts for the inside passage from Naples to Caxambas, based on centerline surveys, date from 1930.

Caloosahatchee and Okeechobee Waterway

The earliest dredging improvements in the region, which focused on the Caloosahatchee, were linked to the land drainage schemes of Hamilton Disston and the Gulf Coast Canal and Okeechobee Land Co. (1881-1888). These projects were designed to develop the rich, black muck-lands adjoining Lake Okeechobee by connecting the upper reach of the Caloosahatchee (from Lake Flirt) to Lake Okeechobee, and by removing a waterfall at Ft. Thompson. A federal navigation project, begun in 1883, improved the downstream reach of the river by creating a 7-feet-deep by 100-feet-wide channel over the Gulf bar at the river's mouth below Punta Rassa and through the oyster shoals to Ft. Myers. In 1910, this channel was enlarged to a depth of 12 feet and a width of 200 feet. The middle reach of the Caloosahatchee, from Ft. Myers to Ft. Thompson, became federalized in 1887, when the Army Engineers dredged a 4-feet-deep by 35-feet-wide channel and removed snags and overhanging trees. In 1902, the Army Engineers dredged (4-feet-deep by 50-feet-wide) the Orange River (formerly Twelve Mile Creek, 12 miles upstream from Ft. Myers), a Caloosahatchee tributary, from its mouth to Buckingham.

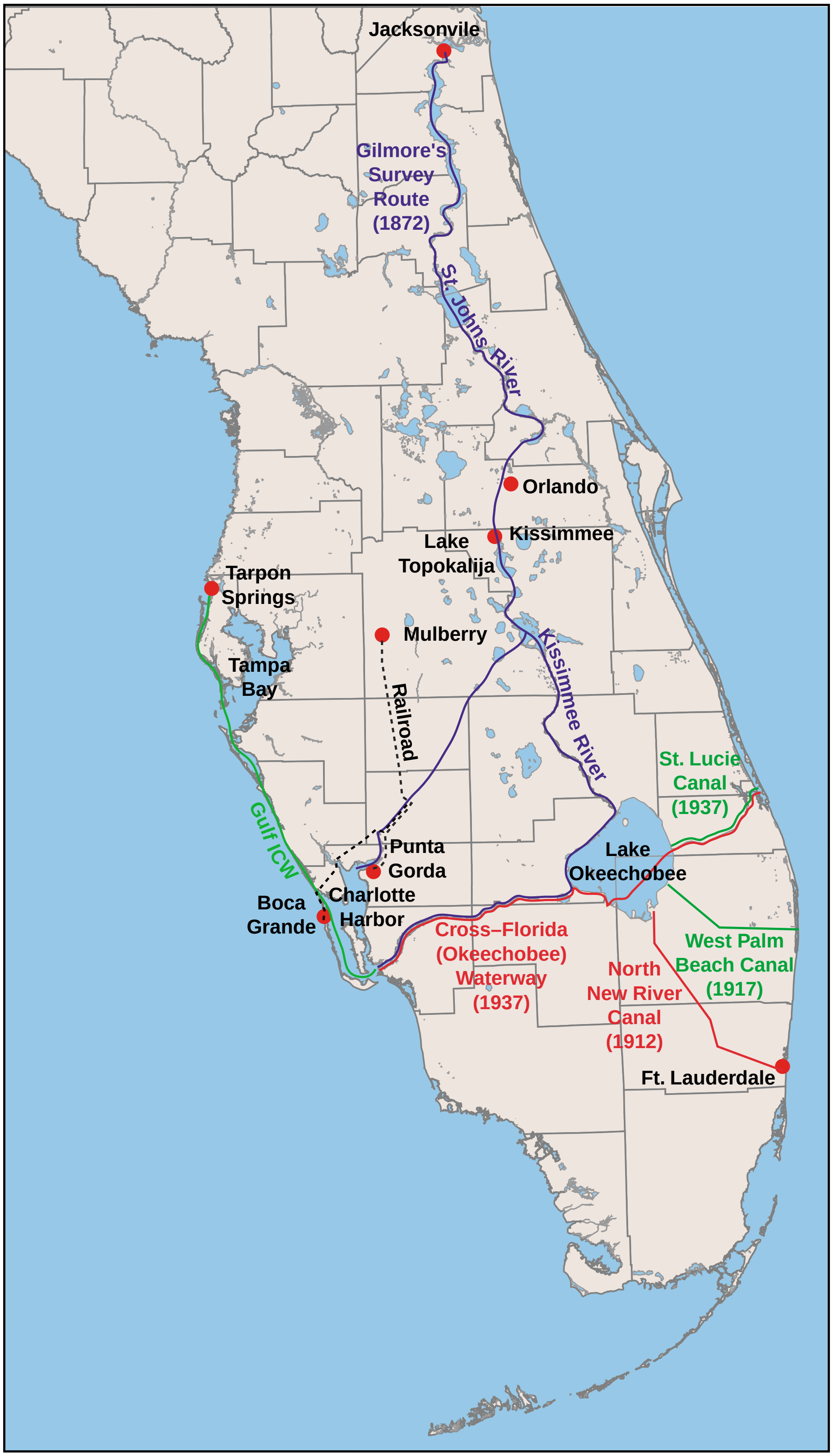
The development-era history of the Caloosahatchee is a record of competing demands for land drainage versus navigation. By 1883, a steamboat connection had been established between Ft. Myers and Kissimmee. In 1902, during tourist season (January-May), steamers ran daily between Ft. Myers and Punta Gorda. During the remainder of the year, the steamer service was three times per week. Another steamship line ran occasionally between Ft. Myers and Punta Gorda. Two schooners made semimonthly trips to Tampa. Other steamers made trips three times a week to upriver points as far as Ft. Thompson, a distance of 44 miles. Completion of the North New River (drainage) Canal, linking Lake Okeechobee to the Atlantic Ocean at Ft. Lauderdale, created a de facto Cross-Florida Waterway, but this easternmost route was closed to boat traffic in 1914 because of rock obstructions and hyacinths. The opening of the West Palm Beach (drainage) Canal in 1917 provided a temporary, alternative boat passage from the Gulf of Mexico to Florida's Eastern Seaboard.

In 1913, Florida Gov. Park Trammel advocated federal development of a navigable Cross-State Waterway in southern Florida, but this policy became law only on Aug. 30, 1935, through the Rivers and Harbors Act. And on March 22, 1937, the Cross-Florida Waterway, known today as the Okeechobee Waterway, was inaugurated; this passage included opening the St. Lucie Canal eastern segment and dredging a 7-feet-deep Caloosahatchee channel between Ft. Myers and Ft. Thompson.

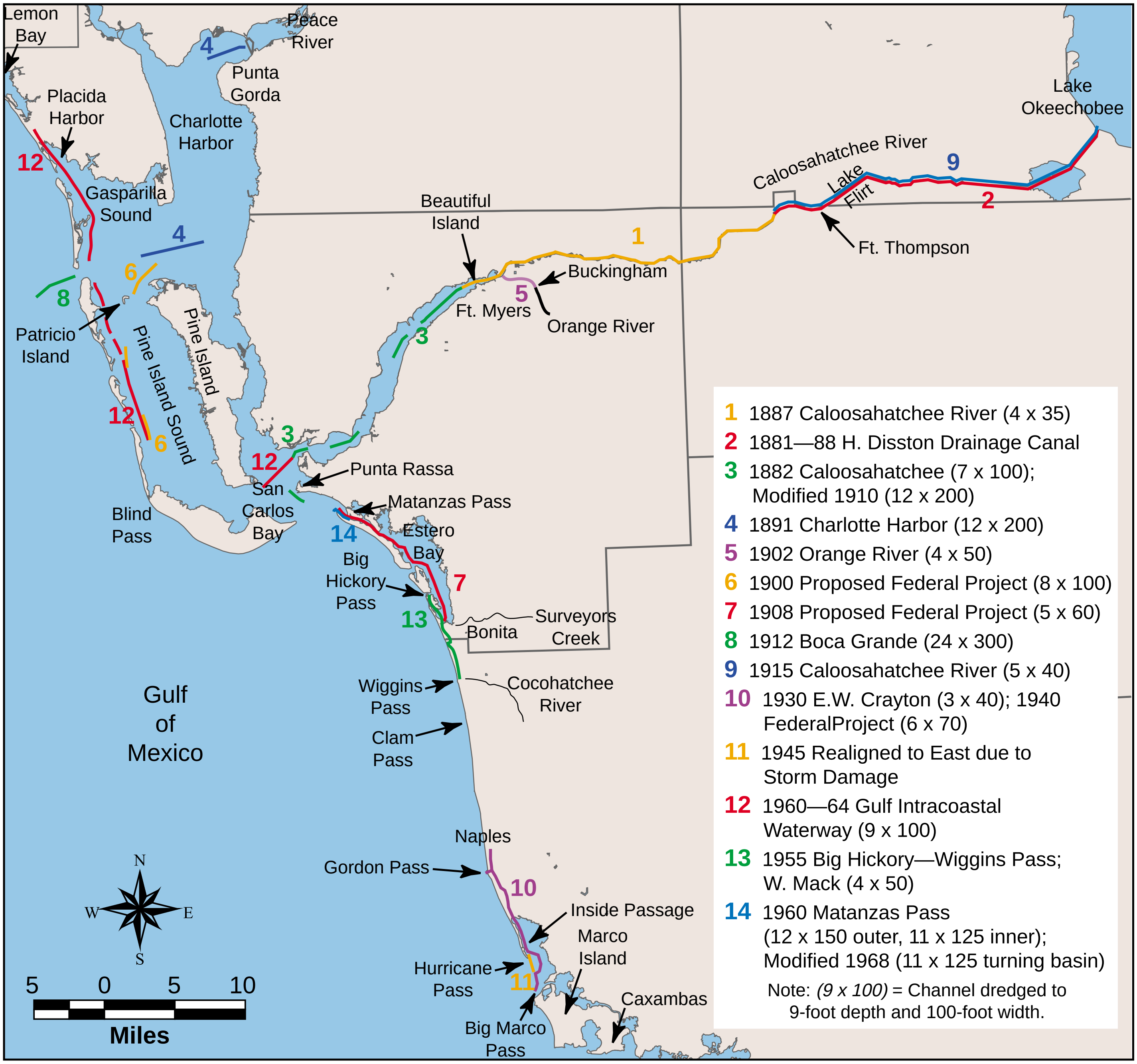
Historical Synopsis of Waterway Improvements in Southwest Florida (Volume Two).

1881-1888 Caloosahatchee (Upper)	Hamilton Disston (Atlantic and Gulf Coast Canal and Okeechobee Land Company): removed rock ledge waterfall at Ft. Thompson, straightened (removed bends) in river below Ft. Thompson; and dredged upper reach connecting river to Lake Okeechobee.
1882 Caloosahatchee (Lower)	Federal project: dredged channel from river mouth to Ft. Myers 100-feet-wide and 7-feet-deep.
1887 Caloosahatchee (Middle)	Federal project: dredged channel 4-feet-deep and 35-feet-wide, removed snags and overhanging trees from Ft. Myers to Ft. Thompson.
1891 Charlotte Harbor	Federal project established: channel 12-feet-deep and 200-feet-wide from inside Boca Grande Pass to Punta Gorda.
1900 Pine Island Sound	Army Engineers: recommended federal improvements for channel 8-feet-deep and 100-feet-wide through shoals northeast of Patricio Island and northeast of Blind Pass (not adopted).
1902 Orange River (Twelve Mile Creek)	Federal project established: channel 4-feet-deep and 50-feet-wide from mouth 6 miles upstream to head of navigation at Buckingham.
1908 Estero Bay	Army Engineers: recommended federal improvements for channel 5-feet-deep and 60-feet-wide from Matanzas Pass to mouth of Surveyors Creek (Imperial River) (not adopted).
1910 Caloosahatchee (Lower)	Federal project: modified to widen (200-feet) and deepen (12-feet) channel from bar below Punta Rassa to Ft. Myers.
1912 Cross - Florida Waterway	North New River Canal: connected Lake Okeechobee to Ft. Lauderdale. (Navigation usage terminated in 1914 due to rock obstructions and hyacinths.)
1912 Boca Grande	Federal project established: inlet channel through Boca Grande Pass to wharves at south end of Gasparilla Island, 24-feet-deep and 300-feet-wide.
1913 Cross - Florida Waterway	Gov. Trammel advocated federal government develop navigable Cross - State Waterway.
1915 Caloosahatchee (Upper)	State of Florida: dredged channel 5-feet-deep and 40-feet-wide from Lake Okeechobee to La Belle.
1917 Cross - Florida Waterway	West Palm Beach Canal to Lake Okeechobee: opened to boat traffic.
1930 Naples Bay - Marco (Inside Passage)	E.W. Crayton: dredged 3-feet-deep by 40-feet-wide inside passage, cut through oyster bars.
1935 Cross - Florida Waterway	Rivers and Harbors Act of Aug. 30, 1935: obligated federal government to build waterway; included St. Lucie Canal and dredging 7-feet-deep, Caloosahatchee channel between Ft. Myers and Ft. Thompson.
1937 Cross - Florida Waterway	Opened March 1937.
1939 Gulf Intracoastal Waterway	Board of Engineers for Rivers and Harbors: recommended federal intracoastal project, 9-feet-deep and 100-feet-wide, from Caloosahatchee (Ft. Myers) north to Anclote River (Tarpon Springs); World War II delayed funding until 1945.
1940 Naples Bay - Marco (Inside Passage)	Federal project: completed 6-feet-deep and 70-feet-wide channel from southern limit of Naples to landward side of Big Marco Pass, 10 miles.
1945 Naples Bay - Marco (Inside Passage)	Federal channel: relocated east of Hurricane Pass (due to storm damage).
1945 Gulf Intracoastal Waterway	Congress authorized and funded Gulf Intracoastal Waterway.
1948 Gulf Intracoastal Waterway	Modifying legislation revised cost-sharing arrangement between federal government and local interests.
1955 Big Hickory Pass - Wiggins Pass (Inside Passage)	Walter Mack: dredged 4-feet-deep by 50-feet-wide channel from south Estero Bay to the Cocohatchee (Wiggins Pass).
1960-64 Gulf Intracoastal Waterway	ICW: channel dredged 9-feet-deep by 100-feet-wide, began June 1960 at Punta Rassa and reached Placida in late 1964.
1960, 1968 Matanzas Pass Channel	Federal channel construction completed in 1961, 12-feet-deep and 150-feet-wide, from Gulf (San Carlos Bay) to Bowditch Point, and 11-feet-deep and 125-feet-wide (constricted to 85 feet by existing bridge) from Bowditch Point to Matanzas Pass; 1968 amendment added turning basin.

Table 1.



Map 1.
Surveyed routes and waterways across Florida.



MAP 2.
Surveyed routes and waterways on the Southwest coast and along the Caloosahatchee River.

"While the Pine Island Canal apparently was built by the Calusa or their ancestors, its construction could have involved the labor and knowledge of local as well as neighboring peoples…canoe canals were parts of a technology that was shared by many Florida Indians…the narrow, shallow channels of Florida Indian canoe canals reflect the character of Florida Indian watercraft…narrow, keel-less, shallow draft boats…their average width was approximately…16 inches…the draft of such canoes was apparently around 15 cm (6 inches) or less…The Pine Island Canal crossed the width of Pine Island and is believed to have facilitated canoe travel between Pine Island Sound and Matlacha Pass…Each end of the Pine Island Canal was at sea level. In between, the canal traversed land reaching a maximum elevation of 3.7–4.0 m (12–13 ft) above mean sea level near the center of the island… the evidence supports the interpretation that the Pine Island Canal functioned by using ground water in a controlled channel.

Charlotte Harbor and Pine Island Sound

Navigation improvements for a 12-foot-deep by 200-foot-wide channel from inside Boca Grande entrance to the wharf at Punta Gorda were authorized by the federal government in 1891 and completed in 1897, justified principally to accommodate barge shipments of phosphate rock from mines in the Peace River Valley. Railroads brought phosphate to the wharf at Punta Gorda; it was then lightered to vessels lying in Boca Grande anchorage. Other cargo shipped to and from Charlotte Harbor included cattle, grain, fish, oysters, lumber, and general merchandise.

In 1911, the Charlotte Harbor & Northern Railway — locals called the railway the Cold, Hungry and Naked — completed construction of a rail line from the pebble phosphate mines at Mulberry, Fla., to Southwest Florida and across Placida Harbor to south Boca Grande. Storage facilities there could accommodate 23,000 tons of phosphate rock, and a system of belt conveyors moved the ore aboard ship at dockside. At that time, Boca Grande Pass had a natural depth of 19 feet over the bar. As phosphate shipments increased, larger vessels required deeper water when loaded. Initially, vessels were partially loaded at the South Boca Grande terminal and completed loading from barges towed out beyond the channel shoal. This system proved hazardous, and in 1912, the federal government adopted a project to dredge a 24-foot-deep by 300-foot-wide channel from the Gulf to the south Boca Grande terminal.

The inside passage west of Pine Island, between Charlotte Harbor and San Carlos Bay, was an important thoroughfare during the early development era of Southwest Florida. Steamers, like the Plant Steamship Company's *Saint Lucie* and the *Lawrence*, plied between Punta Gorda and Ft. Myers, shipping southbound grain, general merchandise, and crate material, while returning north mostly with oranges, grapefruit, and early vegetables. Two shoals, less than 5 feet deep and 600 feet long, were situated along this route: one off Patricio Island at the north end of Pine Island and the other near the southern end of Pine Island opposite Blind Pass. These obstructions were in constricted segments of the channel, which made passage difficult and hazardous for fully loaded cargo vessels during "northwester" storms. The Army Engineers, in 1900, recommended federal improvements for a channel 8-feet-deep and 100-feet-wide through these shoals, but the improvements were not adopted until 1960. No effective inside passage, north of Gasparilla Sound to Lemon Bay, existed in the pre–development era. Most vessels heading north from Charlotte Harbor transited Boca Grande to the Gulf of Mexico.

Estero Bay

The region south of San Carlos Bay was *"mare incognitum"* in the pre-development period. As coastal settlements were few and far between, there was no incentive for the federal government to conduct bathymetric surveys and compile charts. Eventually, when the Army Engineers surveyed Estero Bay in 1908, they could not locate an inland water route from Matanzas Pass to Naples, even though the Coast Survey chart seemed to indicate an interior waterway as far south as Clam Pass. At the time, there were three very small gasoline freight launches running between Ft. Myers and the Estero River, one twice weekly and two three-times weekly. Also, a mail steamer provided service from Ft. Myers to Carlos. As many as 36 fishing smacks were counted on the bay during the fishing season, when one carload of fish could be taken every two days to Punta Gorda for shipment by railroad. The Army Engineers recommended dredging a 5-foot-deep by 60-foot-wide channel from the mouth of Matanzas Pass to Surveyor's Creek (Imperial River) in 1908. While this proposed project was not implemented, federal authorization was received in 1960, and amended in 1968, for improving the Matanzas Pass Channel from the Gulf to a turning basin off San Carlos Island. In 1955, private developer Walter Mack, with contributions from the Bonita (town) Chamber of Commerce, dredged a channel, 4-feet-deep by 50-feet-wide, from Big Hickory Pass south to the Cocohatchee, thereby providing boat access between Estero Bay and Wiggins Pass.

Dredge crew, circa 1900.

It is hypothesized the canal held a series of stepped impoundments by taking advantage of Pine Island's poorly drained soils and shallow fluctuating water table…the Pine Island Canal was not completely straight… stretches curved or angled from one side to another…in response to topographic features and allowed the canal to remain level or to have a very gentle slope, thus helping the canal to hold water."

—George M. Luer and Ryan J. Wheeler, "How the Pine Island Canal Worked: Topography, Hydraulics, and Engineering,"

—*The Florida Anthropologist*, Vol. 50, No. 3, September 1997.

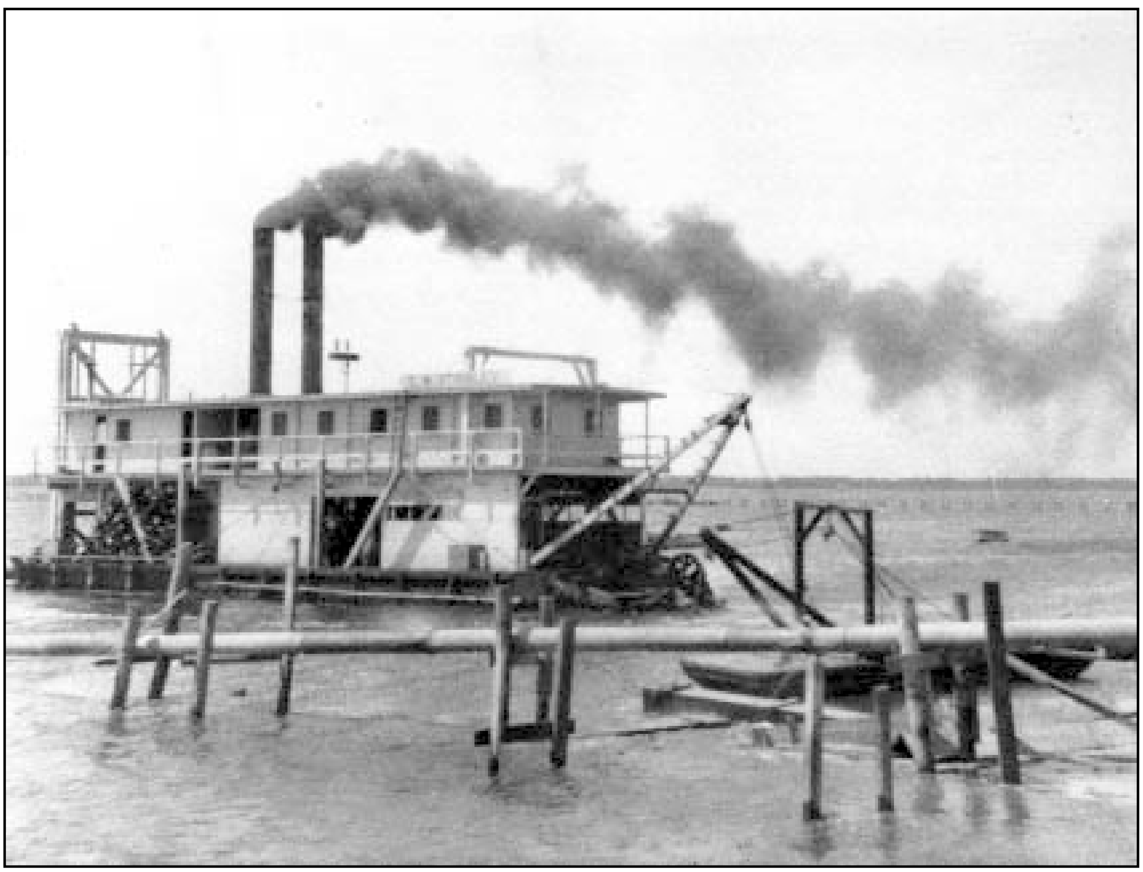
Naples and Marco Island

Naples constructed a pier in 1889 to accommodate steamship freight and passengers. Further improvements to waterway access to Naples were made in the 1930s by a local entrepreneur E. W. Crayton, who dredged and maintained cuts with depths from 3 to 8 feet and widths of 30 to 50 feet in the reach from Naples to Big Marco Pass. In 1940, the federal government assumed the project, which provides for an interior channel (6 feet deep and 70 feet wide) from the southern limit of the town of Naples to the landward side of Big Marco Pass. The waterway from Naples to Big Marco Pass is 14 miles long; local interests maintain the northerly four miles. The hurricane of October 1944 breached the barrier beach north of Big Marco Pass and severely shoaled the federal channel. The shoal was dredged in 1945 and the channel was relocated east of Hurricane Pass.

Gulf Intracoastal Waterway

The U.S. Board of Engineers for Rivers and Harbors recognized in 1939 the need to create a commercial water thoroughfare for passengers, goods, and services and recommended creation of the Gulf Intracoastal Waterway, a 9-foot-deep by 100-foot-wide channel stretching from the mouth of the Caloosahatchee to Lemon Bay and beyond (to Tarpon Springs). Federal funds, however, were not authorized until 1945. Dredging began from the south end in June 1960 and reached northern Gasparilla Sound by late 1964.

This federal project required a local sponsor to assist with funding channel maintenance, once the initial dredging had created the waterway. In 1947, the Florida Legislature created the West Coast Inland Navigation District (WCIND) as a special taxing authority for this purpose. The WCIND originally encompassed the counties of Lee, Charlotte, Sarasota, Manatee, and Pinellas, but Pinellas withdrew from the district in the 1970s. The district's mandate in time broadened to include other waterway management functions, such as dealing with anchorages, boat traffic, inlets, and beaches.



Dredge *Stribly,* 1926.

Contemporary Conditions

Today's system of arterial and secondary (access) channels provides boaters with unparalleled opportunities to transit the inland waterways of Southwest Florida. Key elements are: the Gulf Intracoastal Waterway, connecting Southwest Florida north to Tampa Bay and to coastal destinations in Alabama, Louisiana, and Texas; and the Okeechobee Waterway, providing a link across Florida to the U.S. Eastern Seaboard. These primary arteries interconnect at the mouth of the Caloosahatchee. A short four miles south is Matanzas Pass, the northern terminus of the route through Estero Bay to Wiggins Pass, utilized by shallow draft vessels en route to destinations south. Vessels must leave the inland waterway route at Wiggins Pass and transit along the Gulf shore 14 miles to Gordon Pass. At that point, boats enter the inside passage linking Naples with Marco Island. Such a boating infrastructure was unimaginable a century ago.

View west-northwest from Punta Rassa, Connie Mack Island at bottom of photo, with causeway leading to Sanibel Island in midground, Miserable Mile '1' of ICW appears as dredged cut with conical spoil islands on both sides of channel, leading to St. James City (Pine Island) and San Carlos Bay.

Gordon Pass jetties, looking north, Port Royal canal development in midground with the Naples downtown skyline on the horizon to the left.

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For Your Information...
Dredging Then and Now

The Army Engineers during the 1890s and early 1900s operated its own dredge, the U.S. Steam Snagboat and Dredge *Suwanee*, which made channel improvements and set day beacons in the inlets, inland waterways, and rivers in Southwest Florida. This vessel was a steam-driven, shallow-draft, square-bowed scow, 100 feet long, with a 24-foot beam and 4-foot draft. Although underpowered, she was suited to her task.

The *Suwanee* was put together inexpensively, as an experiment in creating a general-purpose vessel for work on small bays and rivers. Her suction dredge discharged the raised slurry upon the shore through pipes swung perpendicular to her sides, while her derrick provided the lifting power to raise rocks and snags from the bay bottom. It was difficult work, since much of the dredging had to be done from the bow of the boat, on bars too shallow to permit the *Suwanee*'s passage. Cuts were made by dragging the cutter — a hoof-shaped hood armed with teeth and a clear water valve above it — along the bottom using a hoisting tackle mounted on a guide pole. An auxiliary water jet from the boat's donkey pump was applied near and under the cutter.

The cut made at each move of the boat was 35 feet wide and 3 feet long. The average amount of solid material was about 25 percent of the discharge, but amounts as high as 85 percent were recorded. The total capacity of the pump — a 6-inch Edward's special cataract pump run by a belt from a flywheel on the hoisting engines — was 1400 gallons per minute or 800 gallons of water loaded with 25 percent of heavy material. The best day's work of the pump was 460 cubic yards. After discharge, the mud, which formed about 30 percent of the dredged material, floated for some distance, but the sand settled within 20 to 40 feet from the end of the pipe. The ship's complement included a 10-man crew to operate the snagboat, a launch, a float boat, and two rowboats.

Today, the Army Engineers contract private firms for maintenance dredging of federally-authorized inlets and the ICW. The West Coast Inland Navigation District directly hires contractors to dredge public secondary access channels. Most dredging operations — inlet operations aside — are designed to "surgically" remove accumulated silt and mud; the current general permit of the District allows it to dredge in Sarasota and Manatee counties up to 6,500 cubic yards at each authorized site over a 5-year period. Federal and state rules stringently regulate dredging to ensure that proper procedures are in place to protect bay and upland locales.

Steam tug towing phosphate-laden schooner out Boca Grande, circa 1890s.

One type of hydraulic dredging system, designed for open water conditions, operates from a 30 by 100 foot barge outfitted with twin Detroit Diesel engines and 5-foot diameter propellers for improved maneuverability. Four hydraulic "spuds" lift the vessel out of the water for special work conditions. This system can remove 60 percent solids in sandy material with a production rate of 600 cubic yards per hour; the amount of clay material as solid is on the order of 15 percent, with the removal rate of about 100 cubic yards per hour.

Small, handheld systems, the least intrusive to the environment and shoreline residents, are used increasingly. These diver-operated systems require no tugboat and barge or other, large, unsightly support equipment stationed at the dredge site. A single diver operating a hand dredge can pump 600 gallons per minute of 45–65 percent solid materials by volume. This precision dredging approach minimizes environmental impacts by allowing the diver to direct the dredge head by hand in order to avoid disturbing sensitive bay bottom. Spoil material can be removed through a pipe up to 1,000 feet from the dredge and placed onto an upland dewatering containment site or into tractor trailers outfitted with watertight dump beds for offsite disposal.

Dredge operators must exercise care to avoid raising the turbidity level at the dredge site. Any water returned from the dried-out spoil must meet permitting standards, which may require manipulation of conditioning chemicals in a mixing tank and mechanical dewatering of the mixture in a recessed chamber filter press in order to remove suspended solids. The need for maintaining a quality coastal environment should be apparent, given the increasing population pressures from both waterfront and water-based recreational uses.

When the Army Engineers operated in the region during the pre–development period, procedures were simple and costs modest, even by standards of those days. Aside from removing the dredged material and placing it on an adjacent spoil site, some additional expense might be incurred for engineering designs and contingencies. Today, costs are higher and the duration of work appreciably longer. Table 2 compares the actual costs, adjusted to 1982-84 dollars, for two similar dredging operations in the region. The relative cost increases by an order of 2.5 times more for dredging and removing spoil material, in large measure due to the special equipment and handling required in order to maintain a clean and healthy environment. The non-construction cost is 7.5 times greater today, due largely to the need to acquire and comply with permit conditions, including water quality monitoring and reporting, which may continue long after the dredging event. Notwithstanding the overall increase in cost, however, the per unit of effort for removing a cubic yard of spoil is much less today than 100 years ago, making for a much more efficient operation, with the savings attributable to modern technology.

Phosphate ore carrier at Port Boca Grande, 1978.

Cost comparisons of dredging 1,000 cubic yards in pre–development and contemporary periods.

Dredging Project	Actual Coast ($)	Actual Cost Adjusted to Comparable Values ($)
Pre–development (1900)*		
Removing Material	250	2,526
Engineering and Contingencies	37	376
Total	287	2,902
Contemporary (2001)**		
Removing Material	11,000	6,211
Engineering and Contingencies	5,000	2,823
Total	16,000	9,034
Relative Cost Increases		
Dredging	2.5 times more costly	
Non-Construction***	7.5 times more costly	

Costs normalized using Bureau of Labor Statistics Consumer Price Index (1982-84 base = 100):
Price indices are: 1913.....9.9; 1982-84.....100.0; 2001....177.1

* Army Corps of Engineers dredging “Horseshoe Shoal,” northern Pine Island Sound, 1900 (assume cost comparable to 1913 figure), 7,399 cubic yard project, use 13.5 percent of cost to estimate 1,000 cubic yard volume,

** West Coast Inland Navigation District dredging Gottfried Creek, Lemon Bay, 2000-2001 10,000 cubic yard project, use 10 percent of cost to estimate 1,000 cubic yard volume,

*** Permitting, engineering, monitoring, excluding legal expenses.

Table 2.