TAYLOR ENGINEERING, INC.

Engineering With Nature: Designing Navigation Infrastructure for Greater Environmental Sustainability
USACE Workshop, Charleston, SC

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September 7, 2011

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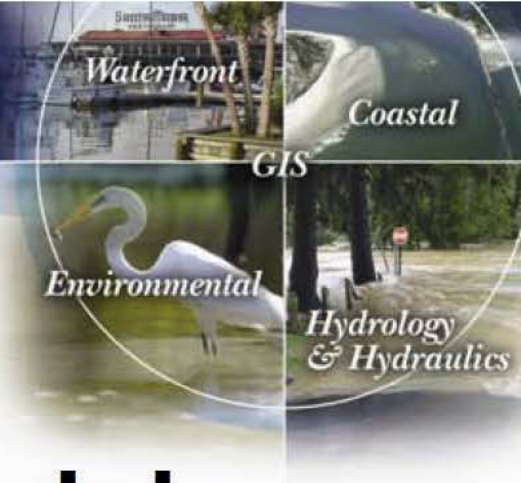

The Manatee Pocket Dredging Project: Environmentally Beneficial, Sustainable, and Cost-Effective

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(2) Coastal Engineer, Martin County Engineering, 2401 SE Monterey Road, Stuart, FL 34996
(3) President, Dickerson Florida, Inc., 3122 N 25th St, Fort Pierce, FL 34946

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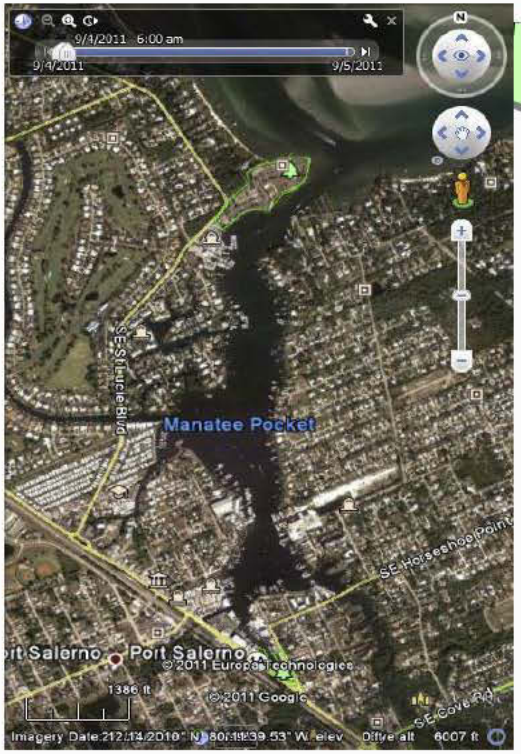
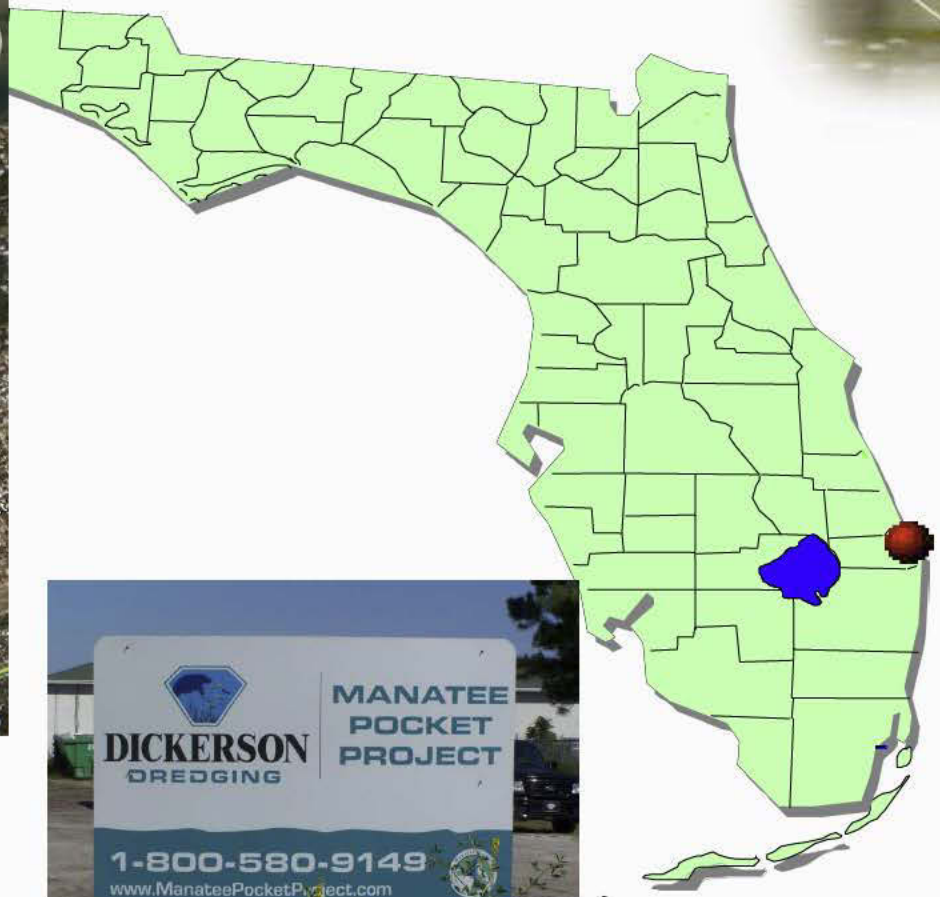
Project Location





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Manatee Pocket Site Constraints

Salerno Creek

Manatee Pocket

The Pocket, a long, narrow estuarine embayment lined with marinas and homes, contains shoals of sandy and organic sediments affecting navigation and water quality.

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The Hydraulic Dredge

Dickerson-Florida's Miss Margaret

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Project Benefits and Challenges

Project Benefits

- A successful environmentally sustainable dredging project,
- Benefits local navigation,
- Creates marine infrastructure, and
- Increases benthic habitat environment in Martin County FL.

Project Challenges

- Hydraulic dredging of potentially contaminated sediments,
- Pumping of the dredge slurry through more than four miles of residential development to a confined disposal facility (CDF) at the end of a local airport runway.
- Required intensive batch testing of each truckload of sediment taken from the CDF to allow determination of appropriate sediment disposal (lined landfill disposal or commercial industrial use).

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Clients and Team's Goals

For Martin County:

- Complete Dredging of Manatee Pocket to permitted depth (FDEP and USACE) including channel creation, development of submerged benthic habitat, and increasing the tidal flow
- Complete as economically as possible
- Complete project in accordance with project schedule

For Dickerson Florida:

- Reduction of high concentrations of contaminants of concern at specific locations and
- Cost-effective alternatives to a very risky dredge material management plan.
- Utilize the design-build concept, with engineers working on the contractor's team.

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Our Design-Build Concept

ORGANIZATIONAL CHART

The Dickerson Team
Dickerson Florida, Inc.
Taylor Engineering, Inc.
Environmental PR Group
Ecological Associates, Inc.
Base Line Land Surveyors, Inc.
Geosyntec
* Key Personnel (Resume Included)

Client Manager
*Larry Dale

Project Manager
*Wendy Brann

Technical Support
*Michael Whelan, P.E.
*David Stites, Ph.D.
Rajesh Srinivas, Ph.D., P.E.

Operations Manager
*Larry Heimer, Jr.

DMMA Engineering / Design
*Joseph Wagner, P.E.
Jonathan Armbruster, P.E.

Communications
*Honey Rand, Ph.D., APR
Doreen Poreba, APR

Dredging
*Jody Newhouse
Kevin Horton

Upland DMMA
*Billy Hataway
Mike Taylor

Environmental Monitoring
*Robert Ernest, M.S.
Eric Martin
Matt Goff

As Built / Pay Surveys
*Christopher Lindstedt, PSM
Thomas Whidden

Geotechnical
*Daniel Schauer, P.G., C.F.E.A., R.E.P.A
Christopher Heron, P.E.

Safety / Risk Management
*Louie Boylston
*Jeff Ehrhard (SSHO)

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Project Team's Approach

- Resolve project challenges at the proposal stage and submitted an alternate engineering plan with its bid.
- Team must accept some failure risk at the bid and initial project stages but allowed the team to provide the county with a better project than identified in the bid offering.
- Required the collection of additional field samples to clarify the distribution of the contaminants of concern and use that data to define a dredging plan mixing sediments with high and low contaminant concentrations to achieve industrial/commercial cleanup standards.
- Relocated the CDF to a safer, closer location (the Dickerson team had identified several acceptable locations at the proposal stage).
- Develop a two-cell CDF design
- Reduce the number of booster pumps in the overland conveyance of the dredged sediments from 4 to 1

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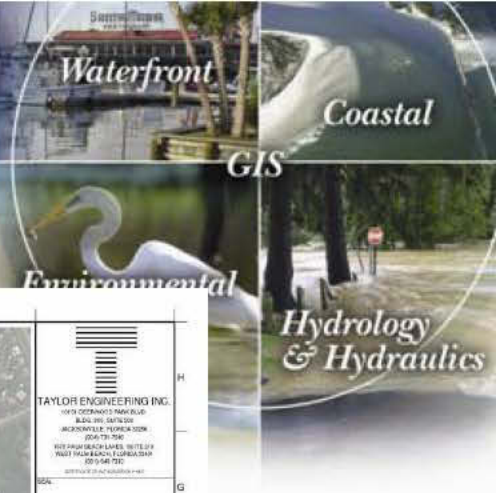
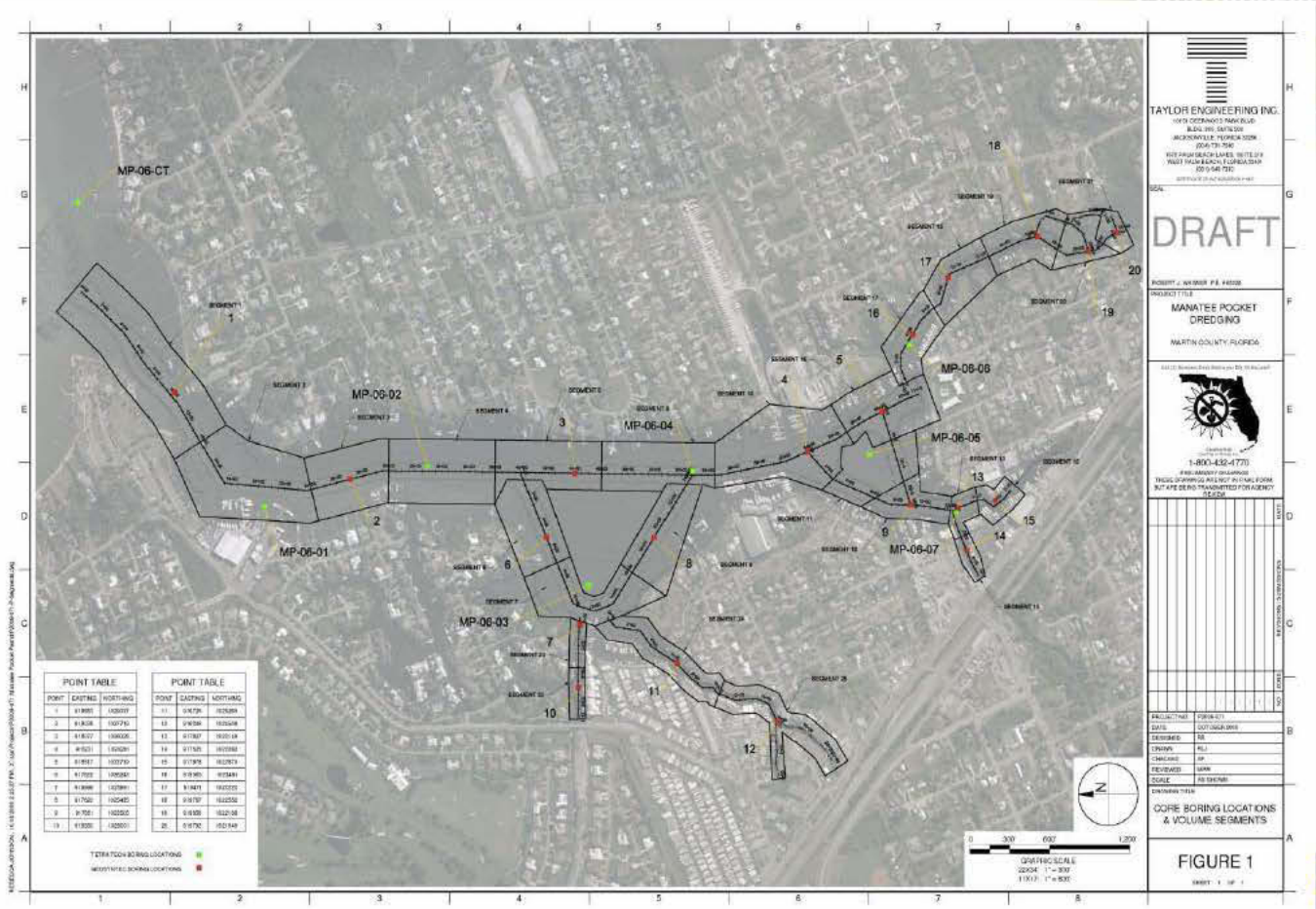


Contaminated Sediments



Channel Segments

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Sediment Soil Analysis

Table D-1: Dredging Volumes per Segment

SEGMENTS	VOLUME (CY)	% FINER THAN 200 SIEVE	SEGMENTS	VOLUME (CY)	% FINER THAN 200 SIEVE
1	22,198	10.9	14	831	20.6
2	15,811	6.8	15	1,413	8.3
3	8,156	36.0	16	27,824	31.5
4	10,765	42.0	17	6,690	19.4
5	11,040	38.0	18	6,453	13.8
6	14,217	14.6	19	5,053	26.6
7	30,269	17.2	20	1,877	16.6
8	20,226	36.3	21	800	18.3
9	12,656	46.5	22	2,306	5.4
10	27,517	31.6	23	2,607	7.8
11	16,298	42.4	24	8,809	9.1
12	16,298	22.2	25	3,522	6.8
13	4,280	12.6	TOTAL VOLUME		278,276

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Sediment Chemistry

Table D-2: Weighted Average Concentrations

		Soil Cleanup Target Levels		
	Units	Residential	Commercial/ Industrial	Weighted Total
Semi-volatile Organic Compounds				
Acenaphthene	mg/kg	2,400	20,000	0.016
Acenaphthylene	mg/kg	1,800	20,000	0.011
Anthracene	mg/kg	21,000	300,000	0.020
Benzo(a)anthracene	mg/kg	#	#	0.019
Benzo(a)pyrene	mg/kg	0.1	0.7	0.018
Benzo(b)fluoranthene	mg/kg	#	#	0.021
Benzo(g,h,i)perylene	mg/kg	2,500	52,000	0.015
Benzo(k)fluoranthene	mg/kg	#	#	0.014
Chrysene	mg/kg	#	#	0.019
Dibenzo(a,h)anthracene	mg/kg	#	#	0.014
Ideno (1,2,3-c,d)pyrene	mg/kg	3200	59000	0.004
1-Methylnaphthalene	mg/kg	2,600	33,000	0.006
2-Methylnaphthalene	mg/kg	#	#	0.014
Naphthalene	mg/kg	200	1,800	0.013
Phenanthrene	mg/kg	210	2,100	0.015
Pyrene	mg/kg	55	300	0.022
Benzo[a]pyrene Toxicity Equivalent Calculations				
Benzo[a]pyrene TEQs	mg/kg	0.1	0.7	0.021
Metals				
Aluminum	mg/kg	80,000	NA	7743.54
Arsenic	mg/kg	2.1	12	3.22
Cadmium	mg/kg	82	1,700	0.31
Copper	mg/kg	150	8,900	27.94
Lead	mg/kg	400	1,400	12.04
Mercury	mg/kg	3	17	0.12
Zinc	mg/kg	26,000	630,000	40.51

Notes: # = Refer to Benzo[a]pyrene TEQ (Total Equivalent Value) for the calculated Benzo(a)pyrene equivalent value and applicable screening criteria.

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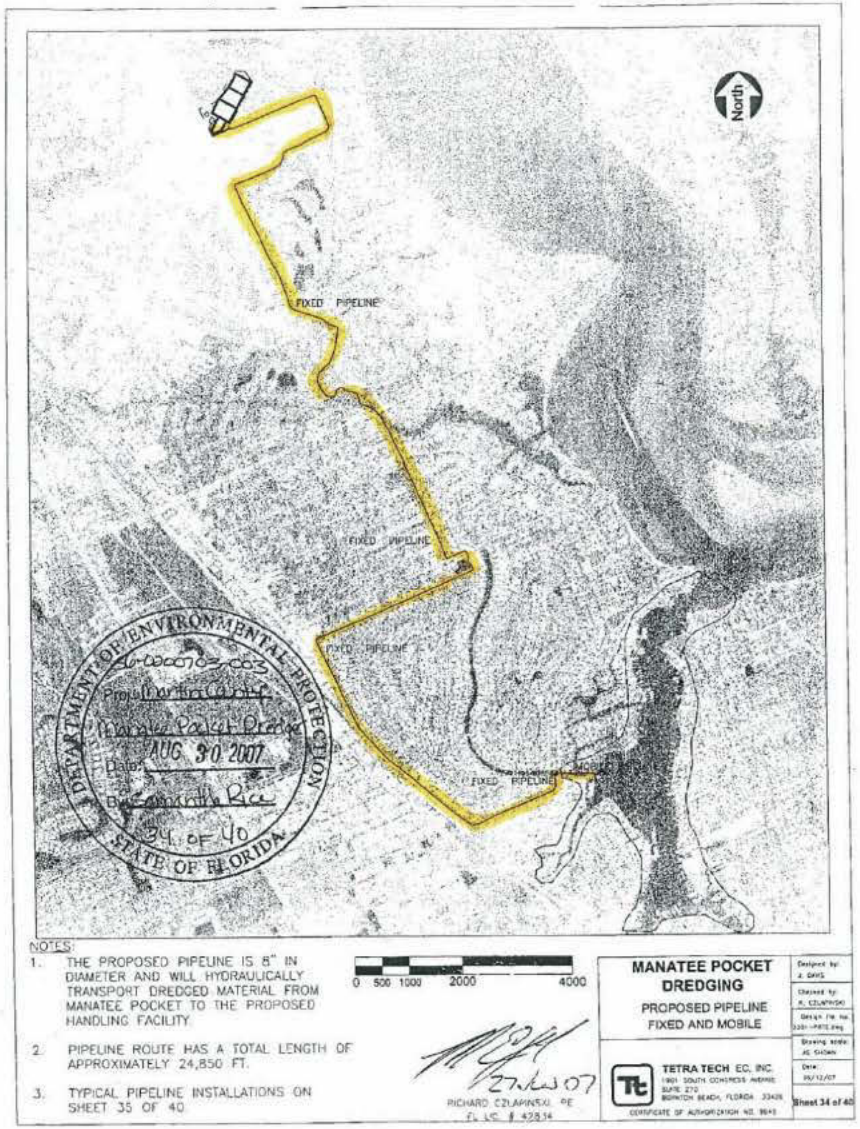
Permitted Pipeline Routes



- Used Airport Site
- +/- 4 miles of Pipeline through Residential neighborhoods
- Crossings through Residential driveway
- Directional drills under local streets
- Through Gopher tortoise habitat
- Through Golf Course and surrounding Community

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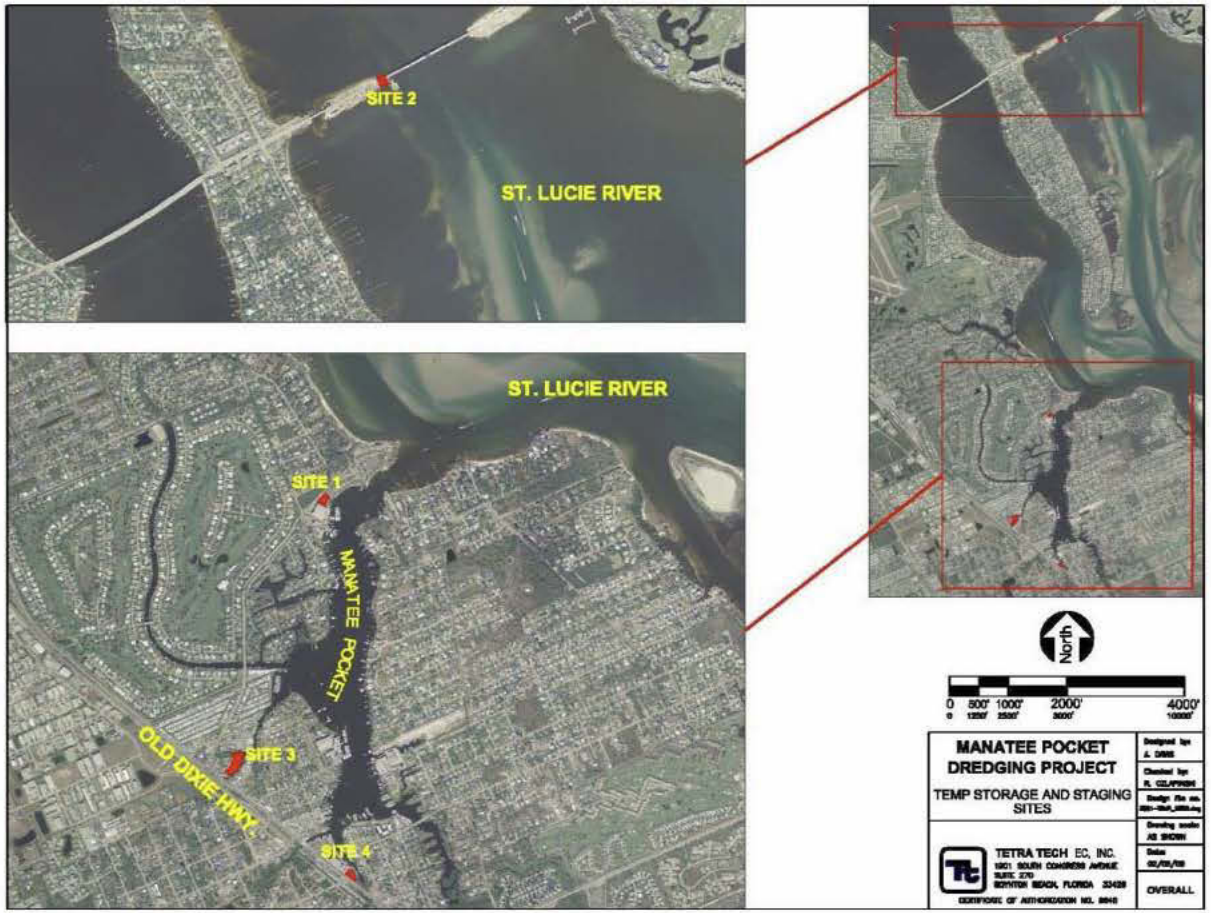
Permitted Staging Areas



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Waterfront
Coastal
GIS
Environmental
Hydrology & Hydraulics

Teams solution to the CDF

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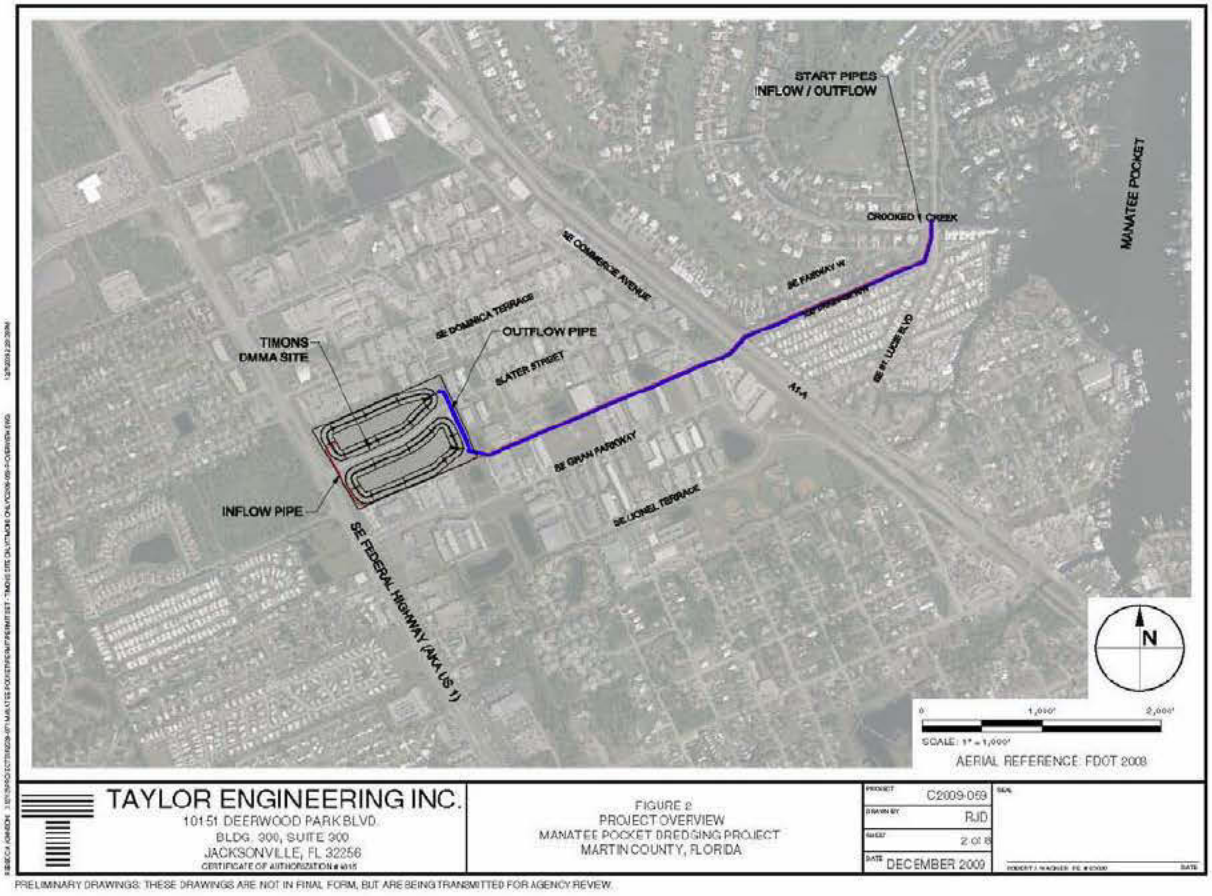
Team's Pipeline Route



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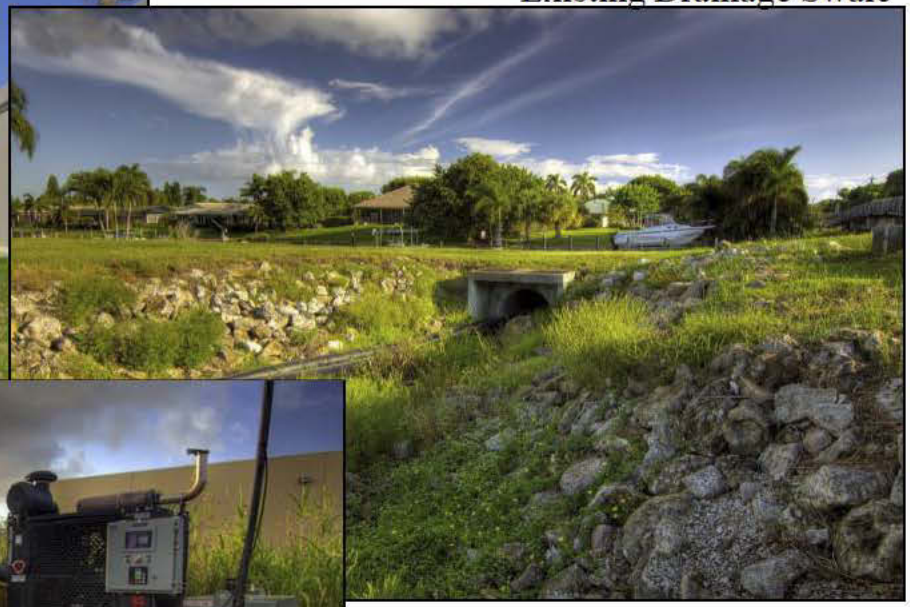
Pipeline Routes Using Existing R/O/W

Existing Drainage Swale



Existing Drainage Swale

Booster Pump Placed in Industrially Zoned Area

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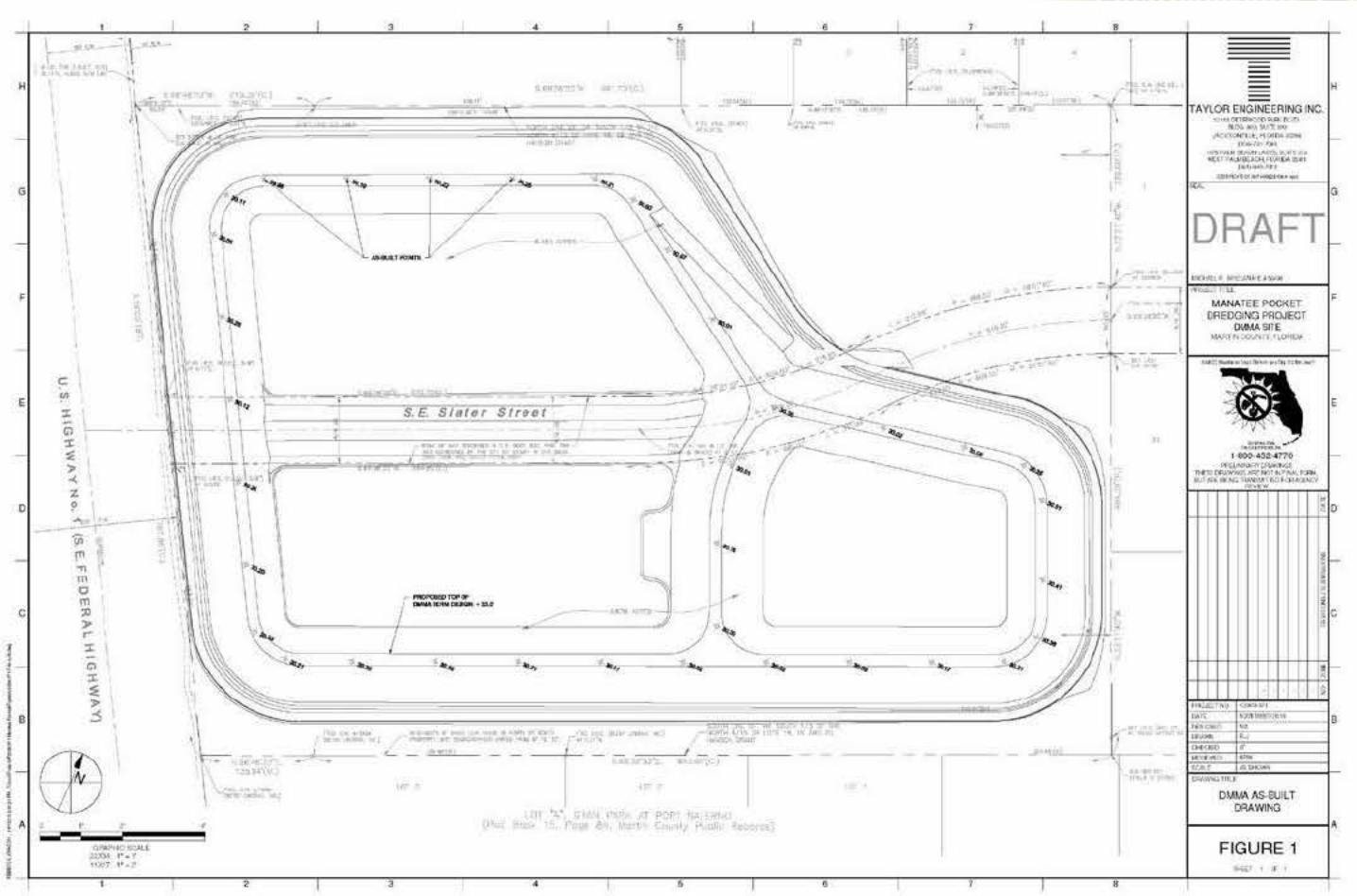
Proposed Temporary CDF



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Temporary CDF Facility

Temporary Weirs

Temporary Seepage Swale

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Temporary CDF

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Temporary CDF in Operation

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Project's Final Results

- Risk acceptance and engineering design work in the proposal a winning bid and approved permit modifications.
- All of the dredged sediments met commercial industrial use standards.

- Reduced overland pipeline route to about one mile long, reduced booster pump requirements from four to just one and eliminated costs to put the pipeline under residential driveways and roads.
- Smaller project allowed a shorter dredging period
- Reduced the project carbon footprint
- Increased sediment reuse, and
- Achieved Clients and Team's goals

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Questions ?

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