TAYLOR ENGINEERING, INC.

Jacksonville Harbor: Dredged Material Management—Planning and Execution

Jonathan T. Armbruster, P.E.

Senior Vice President, Taylor Engineering, Inc.

What Is Dredged Material Management Planning? Why Should We Do It? How Is It Done?

- **What:** A planning process to determine the most efficient, cost-effective, and environmentally acceptable approach to manage a Port's dredged material
- **Why:**
  - Keep the cargo moving
  - Save money
  - Promote sustainability
    - Business practices
    - Environmental stewardship
- **How:** Jacksonville Harbor offers a case study in how to plan and execute for dredged material management

JAXPORT – Blount Island Marine Terminal, Ongoing Berth 22 Expansion

Jacksonville Harbor Dredged Material Management Planning: Purpose

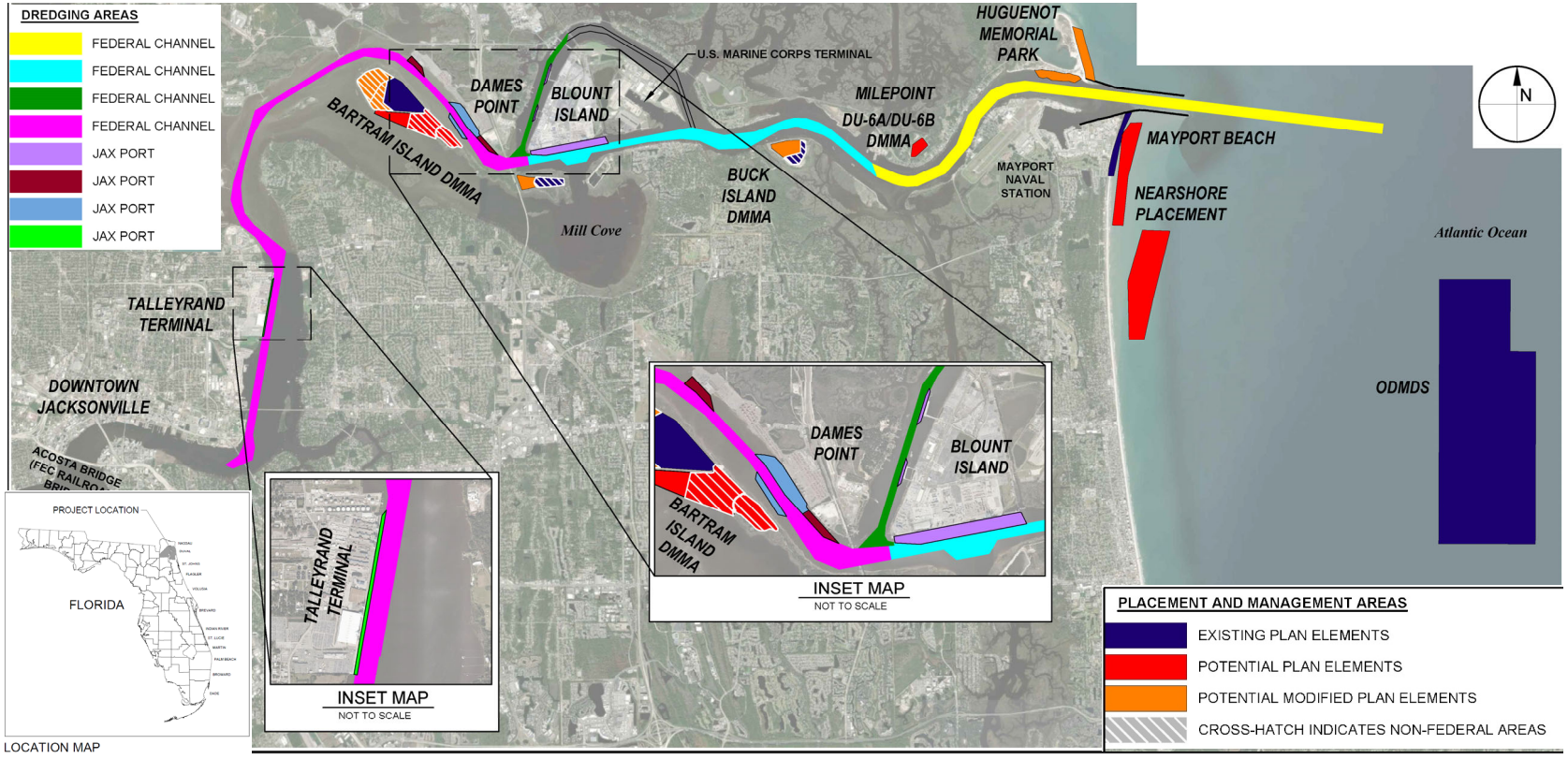
To conduct an analysis and determine the most efficient, cost-effective, and environmentally acceptable approach to manage dredged material for both federal and non-federal dredging of Jacksonville Harbor for the next 20 years.

JAXPORT – Blount Island Marine Terminal

Jacksonville Harbor Dredged Material Management Planning: Process

- Completed data acquisition and analysis to develop a 20-year historical summary of dredging and dredged material management actions
- Applied the data to develop and assess expected dredging and dredged material management needs for the next 20 years
- Developed potential plan alternatives to provide required long-term dredged material management capacity
- Evaluated potential plan alternatives in terms of gained capacities, costs, and permitting feasibility
- Vetted and refined plan alternatives to develop a 20-year plan, including implementation tasks and timelines

Jacksonville Harbor



Shoaling Analysis – Dredging Need

SECTION:	SECTION 1 CUTS 3-13	SECTION 2A CUTS 14-42	SECTION 2B BI Cuts F & G	SECTION 3 CUTS 43-TC	AVG. ANNUAL (CY/YR)	20-YR NEED (THROUGH FY40) (CY)
CURRENT PLACEMENT OPTION (BASED ON MATERIAL QUALITY):	BEACH/BUCK/ODMDS	BUCK/ODMDS	BARTRAM	BARTRAM/ODMDS		
FEDERAL AVG. ANNUAL DREDGED MATERIAL MANAGEMENT NEED (CY/YR):	173,515	94,982	20,546	228,244	**517,287**	**10,345,735**
NON-FEDERAL AVG. ANNUAL DREDGED MATERIAL MANAGEMENT NEED (CY/YR):	0	49,562	44,578	503,948	**598,088**	**11,961,756**
				TOTALS:	**1,115,375**	**22,307,491**

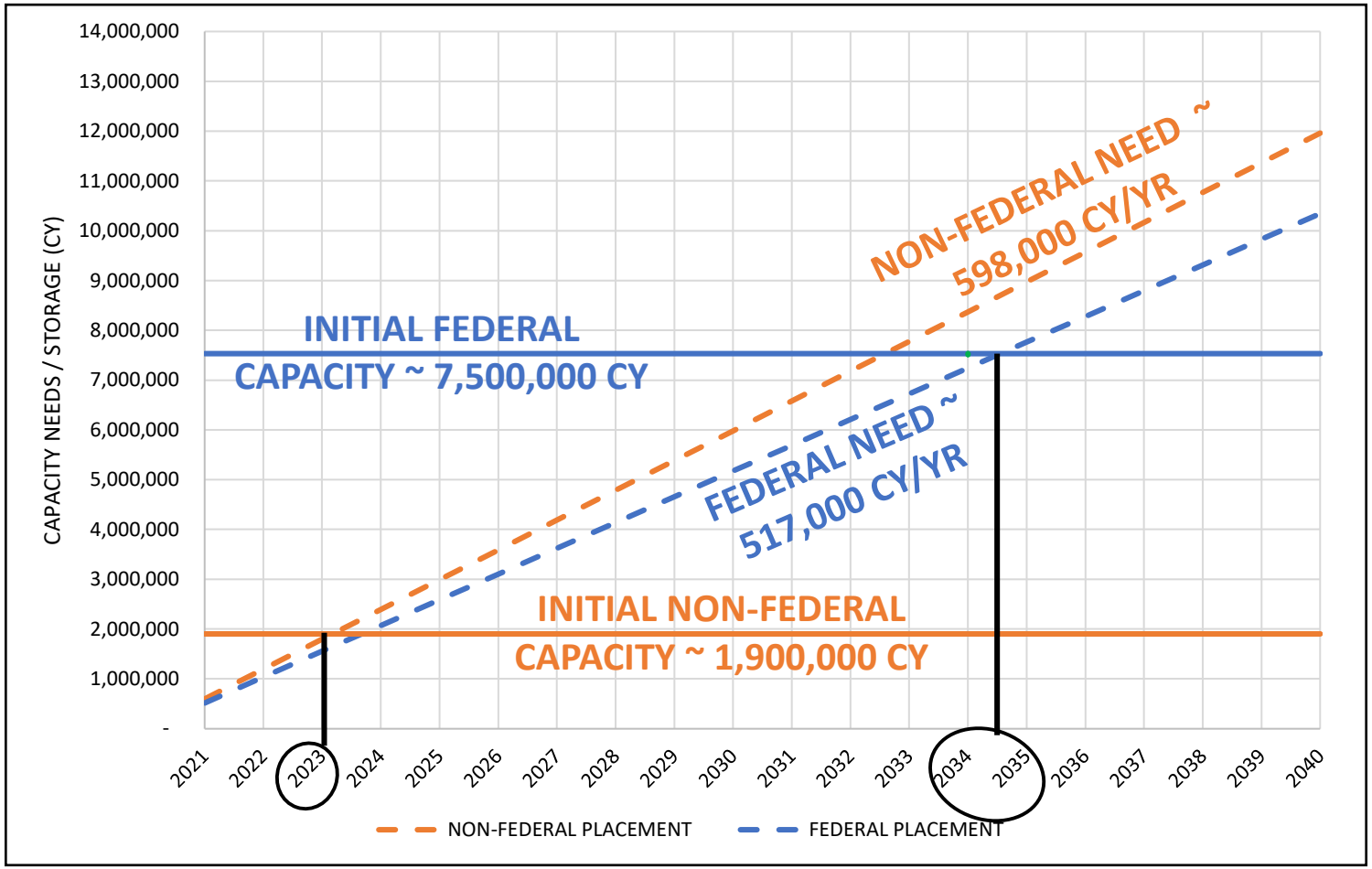
Capacity Analysis – Available Storage

DMMA	Cell	Remaining Capacity (CY)	
		Federal	Non-Federal
Bartram Island	A	5,282,159	600,000
	B	-	91,400
	B-2	-	12,760
	C	-	-
	F	547,237	-
	G	0	-
Buck Island	A	1,699,682	-
	B	-	1,200,000
Total Initial Capacity (CY)		**7,529,078**	**1,904,160**

Deficit Analysis – Storage Shortfall

Capacities/Deficits (CY)	Federal	Non-Federal
Initial Capacity	7,529,078	854,160
Buck Island Offloading	0	1,050,000
Base Capacity	**7,529,078**	**1,904,160**
Annual Requirement	517,287	598,088
20-year Requirement	20 years X 517,287 CY	20 years X 598,088 CY
	10,345,740	**11,961,760**
Total Deficit	**-2,816,662**	**-10,057,600**

Graphic Summary of Initial Conditions with Projected Timeline

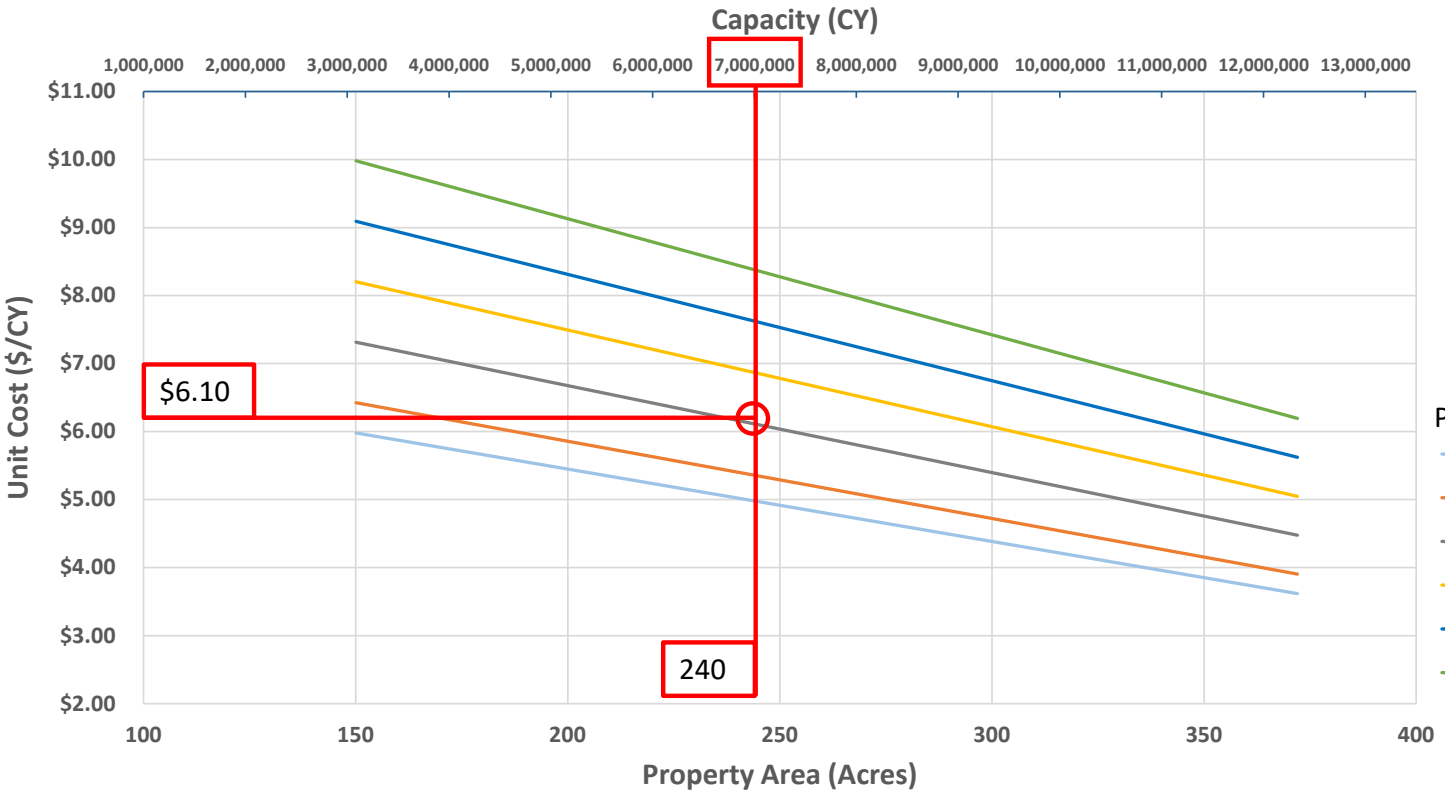


Potential Plan Elements

- Conducted a brainstorming session to identify the full range of potential plan elements that could provide additional capacity
- Winnowed down the full list to remove any concepts that presented obvious feasibility flaws; identified the full spectrum or reasonable potential plan elements
- Evolved each potential plan element to a conceptual design with a sufficient level of detail to allow comparison and trade-off analysis

Plan Element		
Plan Element #	**Description**	**Lifecycle Capacity (CY)**
1	New DMMA (4.1MCY @ $200k/acre)	4,100,000
2	Buck Island Cell A Subdivide	1,154,600
3	Bartram Cell C Dike Raising	1,224,000
4	RSM Nearshore placement	842,388
5	RSM Mayport Beach	842,388
6	RSM Huguenot Park	505,433
7	Bartram Cell B Capping	604,000
8	FIND Site DU-6A / DU-6B	982,100
9	Bartram Island Expansion	5,965,900
10	Bartram Cell F Dike Raising	982,250
11.1	Expanded Use of ODMDS (Cut 3-13)	609,306
11.2	Expanded Use of ODMDS (Cut 14-42)	609,306
11.3	Expanded Use of ODMDS (Cut 43-49)	609,306

Plan Element #1: New DMMA – Acreage & Capacity vs. Unit Cost

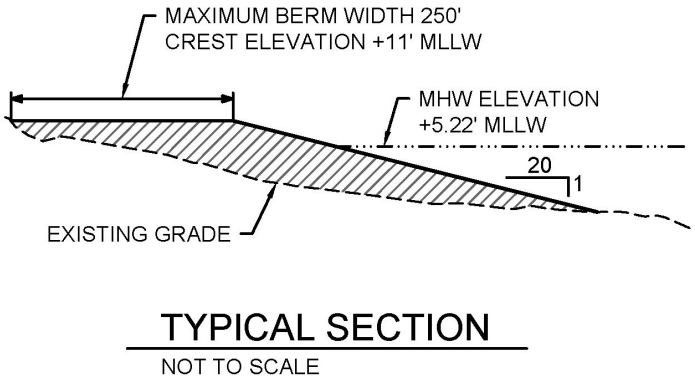


- Target Storage Capacity = 7 Million CY
- Approximate Real Estate Acquisition = 240 Acres
- Expected Property Cost = $40,000/Acre
- Storage Unit Cost of Infrastructure (Land + Construction) = $6.10/CY
- Infrastructure Budget (Land + Construction) = $42.7 Million

Potential Plan Elements

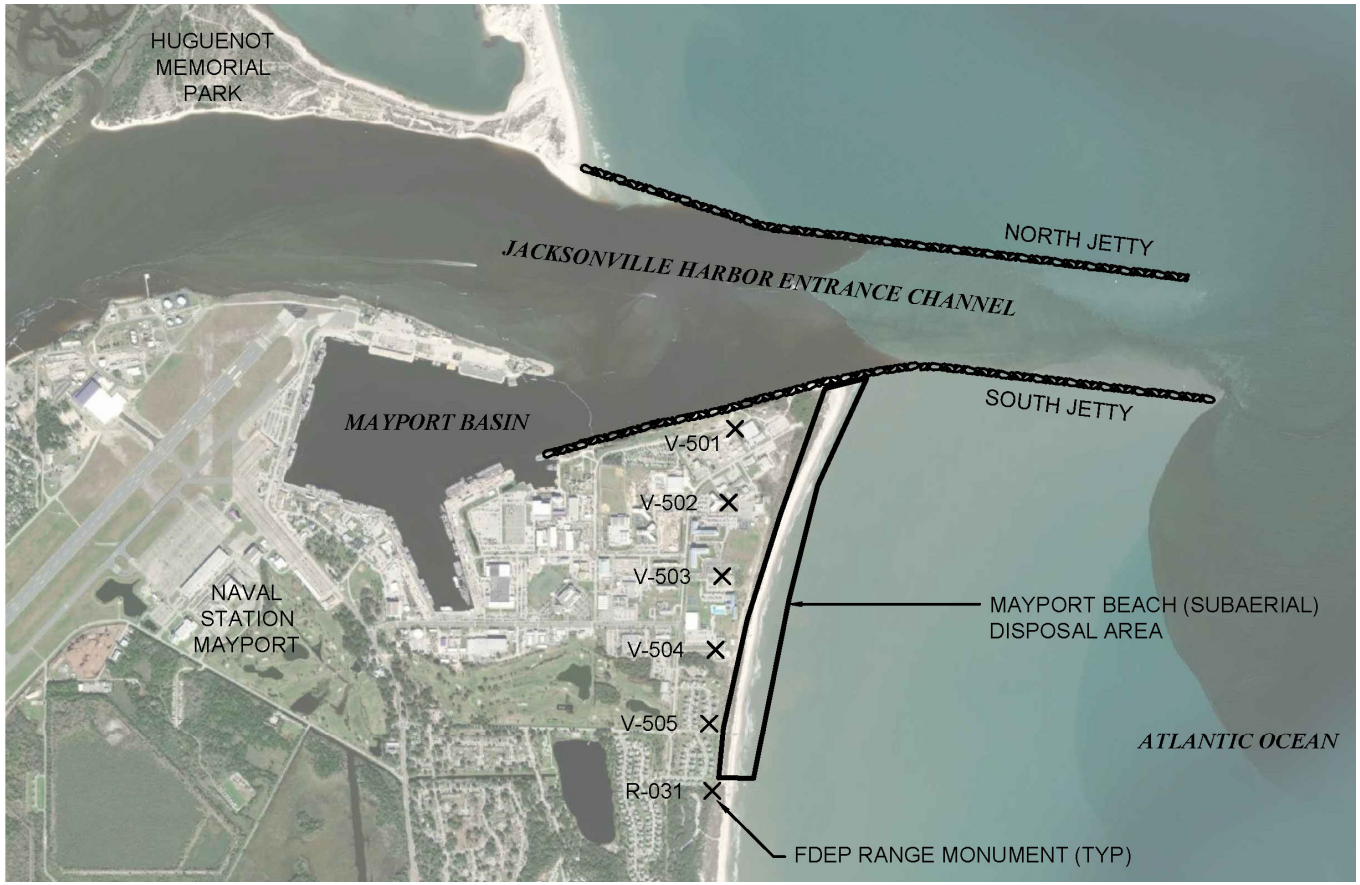
Plan Element		
Plan Element #	**Description**	**Lifecycle Capacity (CY)**
1	New DMMA (4.1MCY @ $200k/acre)	4,100,000
2	Buck Island Cell A Subdivide	1,154,600
3	Bartram Cell C Dike Raising	1,224,000
4	RSM Nearshore placement	842,388
5	RSM Mayport Beach	842,388
6	RSM Huguenot Park	505,433
7	Bartram Cell B Capping	604,000
8	FIND Site DU-6A / DU-6B	982,100
9	Bartram Island Expansion	5,965,900
10	Bartram Cell F Dike Raising	982,250
11.1	Expanded Use of ODMDS (Cut 3-13)	609,306
11.2	Expanded Use of ODMDS (Cut 14-42)	609,306
11.3	Expanded Use of ODMDS (Cut 43-49)	609,306

Plan Elements # 5: RSM Mayport Beach



TYPICAL SECTION

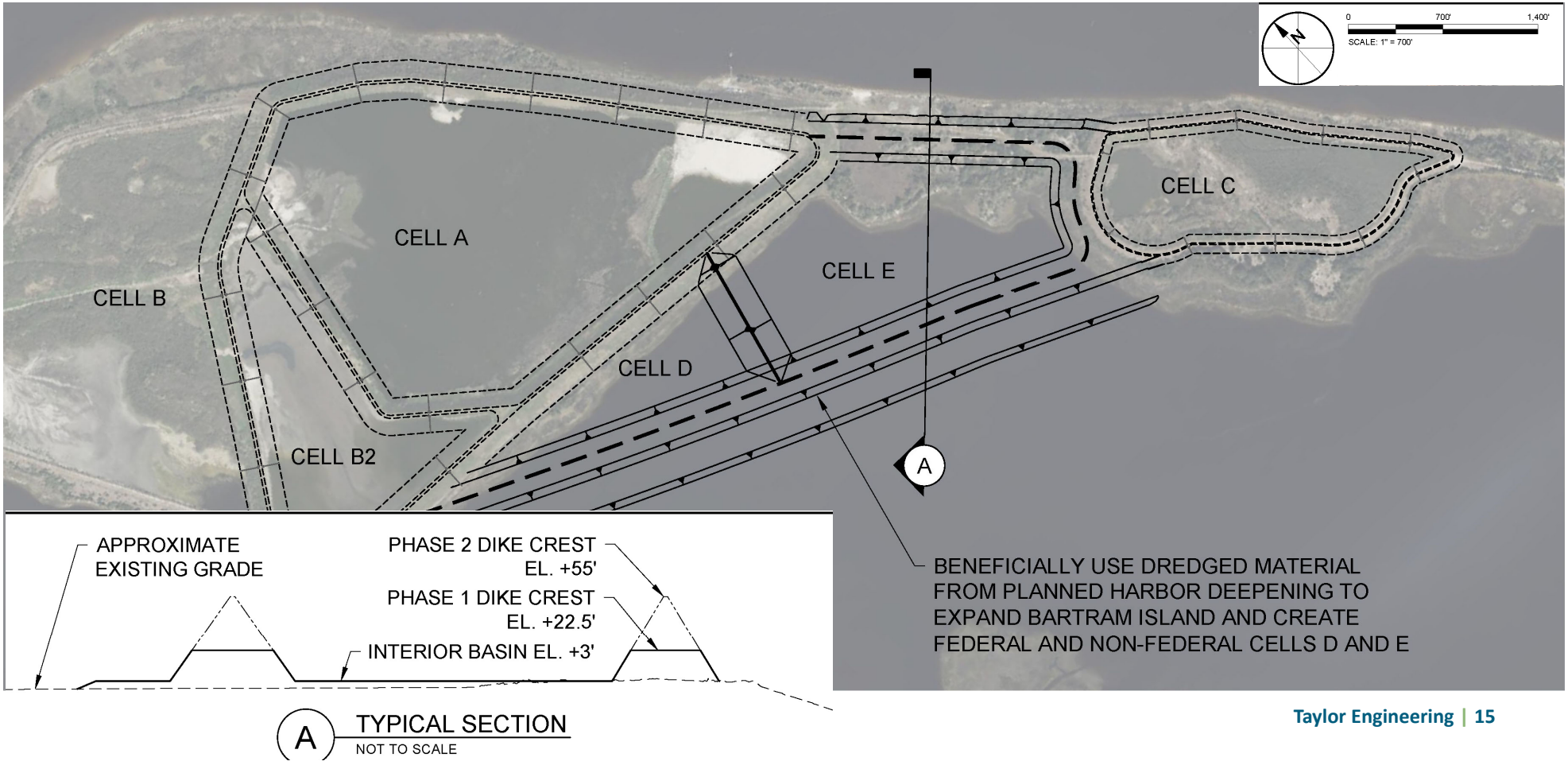
NOT TO SCALE



Potential Plan Elements

Plan Element		
Plan Element #	**Description**	**Lifecycle Capacity (CY)**
1	New DMMA (4.1MCY @ $200k/acre)	4,100,000
2	Buck Island Cell A Subdivide	1,154,600
3	Bartram Cell C Dike Raising	1,224,000
4	RSM Nearshore placement	842,388
5	RSM Mayport Beach	842,388
6	RSM Huguenot Park	505,433
7	Bartram Cell B Capping	604,000
8	FIND Site DU-6A / DU-6B	982,100
9	Bartram Island Expansion	5,965,900
10	Bartram Cell F Dike Raising	982,250
11.1	Expanded Use of ODMDS (Cut 3-13)	609,306
11.2	Expanded Use of ODMDS (Cut 14-42)	609,306
11.3	Expanded Use of ODMDS (Cut 43-49)	609,306

Plan Elements # 9: Bartram Island Expansion



Potential Plan Elements

Plan Element		
Plan Element #	**Description**	**Lifecycle Capacity (CY)**
1	New DMMA (4.1MCY @ $200k/acre)	4,100,000
2	Buck Island Cell A Subdivide	1,154,600
3	Bartram Cell C Dike Raising	1,224,000
4	RSM Nearshore placement	842,388
5	RSM Mayport Beach	842,388
6	RSM Huguenot Park	505,433
7	Bartram Cell B Capping	604,000
8	FIND Site DU-6A / DU-6B	982,100
9	Bartram Island Expansion	5,965,900
10	Bartram Cell F Dike Raising	982,250
11.1	Expanded Use of ODMDS (Cut 3-13)	609,306
11.2	Expanded Use of ODMDS (Cut 14-42)	609,306
11.3	Expanded Use of ODMDS (Cut 43-49)	609,306

Plan Elements # 2: Bartram Cell C Dike Raising

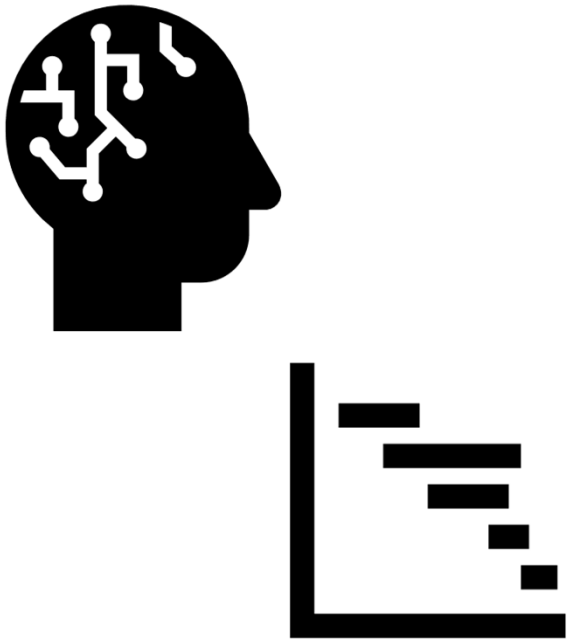
Potential Plan Elements

Plan Element		
Plan Element #	**Description**	**Lifecycle Capacity (CY)**
1	New DMMA (4.1MCY @ $200k/acre)	4,100,000
2	Buck Island Cell A Subdivide	1,154,600
3	Bartram Cell C Dike Raising	1,224,000
4	RSM Nearshore placement	842,388
5	RSM Mayport Beach	842,388
6	RSM Huguenot Park	505,433
7	Bartram Cell B Capping	604,000
8	FIND Site DU-6A / DU-6B	982,100
9	Bartram Island Expansion	5,965,900
10	Bartram Cell F Dike Raising	982,250
11.1	Expanded Use of ODMDS (Cut 3-13)	609,306
11.2	Expanded Use of ODMDS (Cut 14-42)	609,306
11.3	Expanded Use of ODMDS (Cut 43-49)	609,306

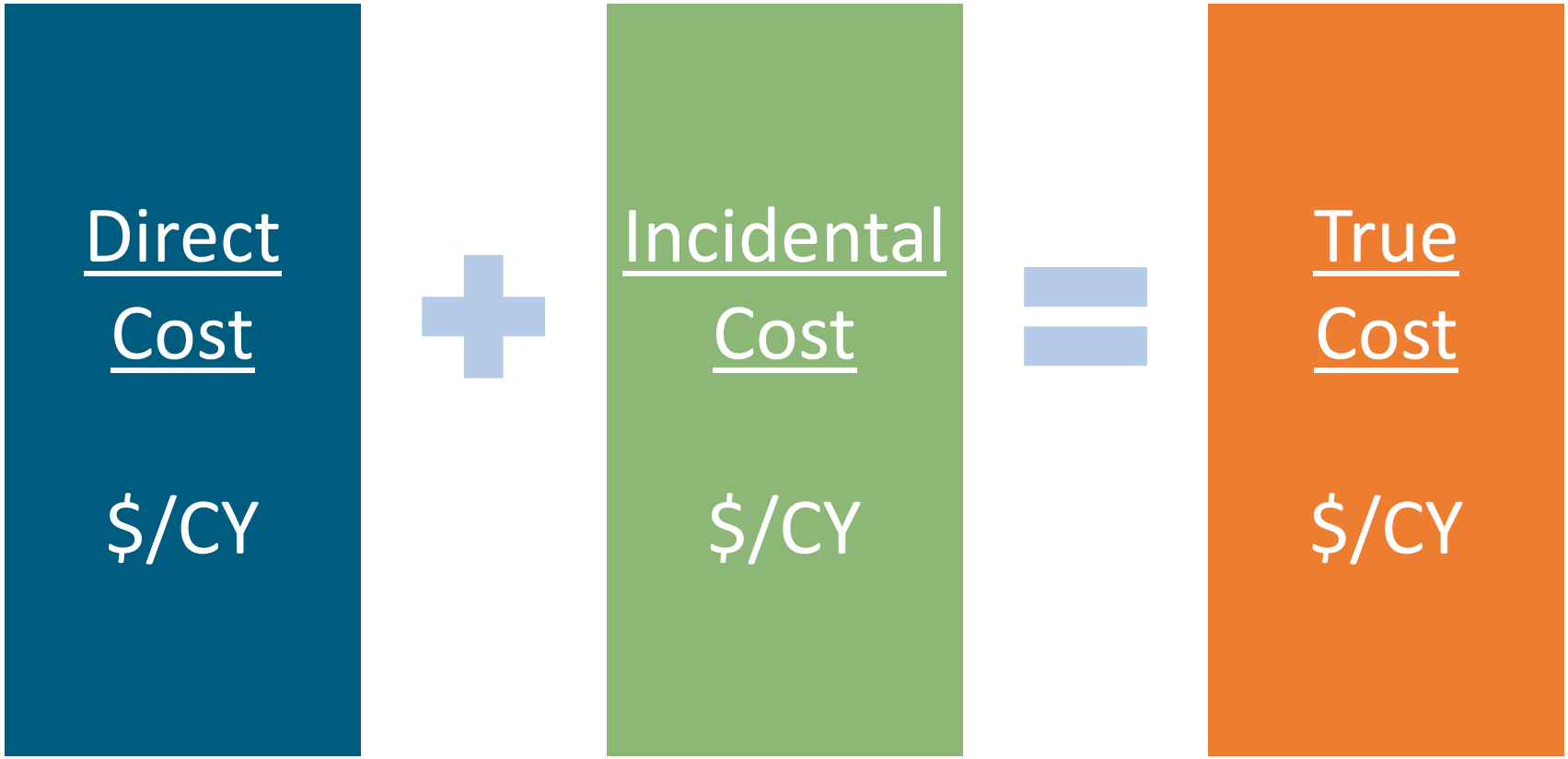
Plan Elements # 11: Expanded Use of ODMDS

Trade-Off Analysis

- Evaluated, compared, and contrasted each potential plan element in terms of:
  - Lifecycle capacity
  - Cost
  - Environmental considerations and permit requirements
  - Implementation tasks and timelines



True Cost Of Dredging: Definitions



- **Concepts based on "True Cost of Dredged Material Management: Jacksonville Harbor Case Study" (Summa et al., 2017)**
- **All costs in 2021 dollars**

True Cost Of Dredging: Definitions

Direct Cost

Cost of Dredging Event

- Mobilization
- Dredging
- Conveyance
- Management of Material

+

Incidental Cost

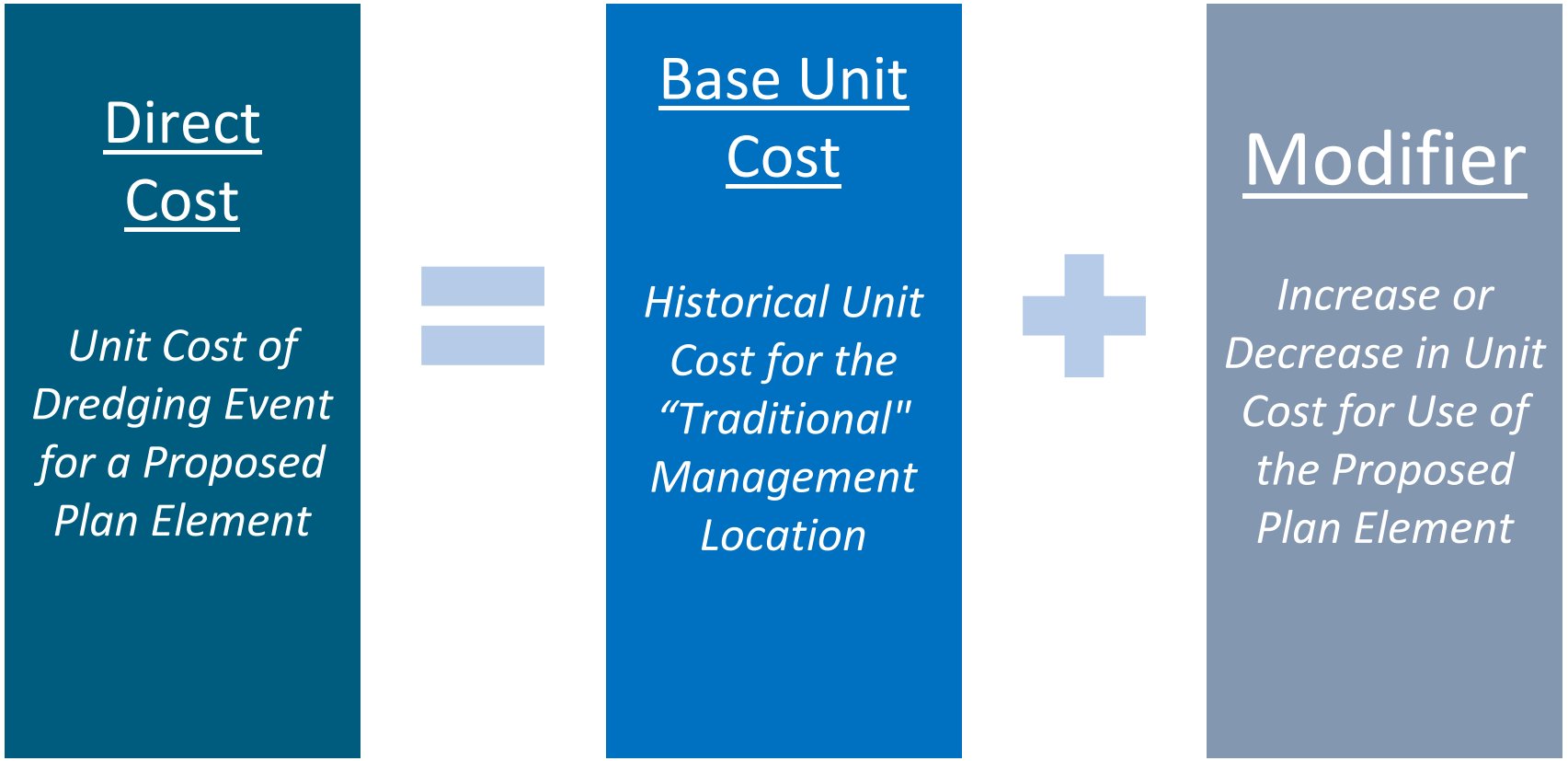
Lifecycle Cost of Dredged Material Management Infrastructure

- Permitting
- Construction
- Maintenance
- Monitoring

=

True Cost

Dredging Cost: Definitions



Potential Plan Elements

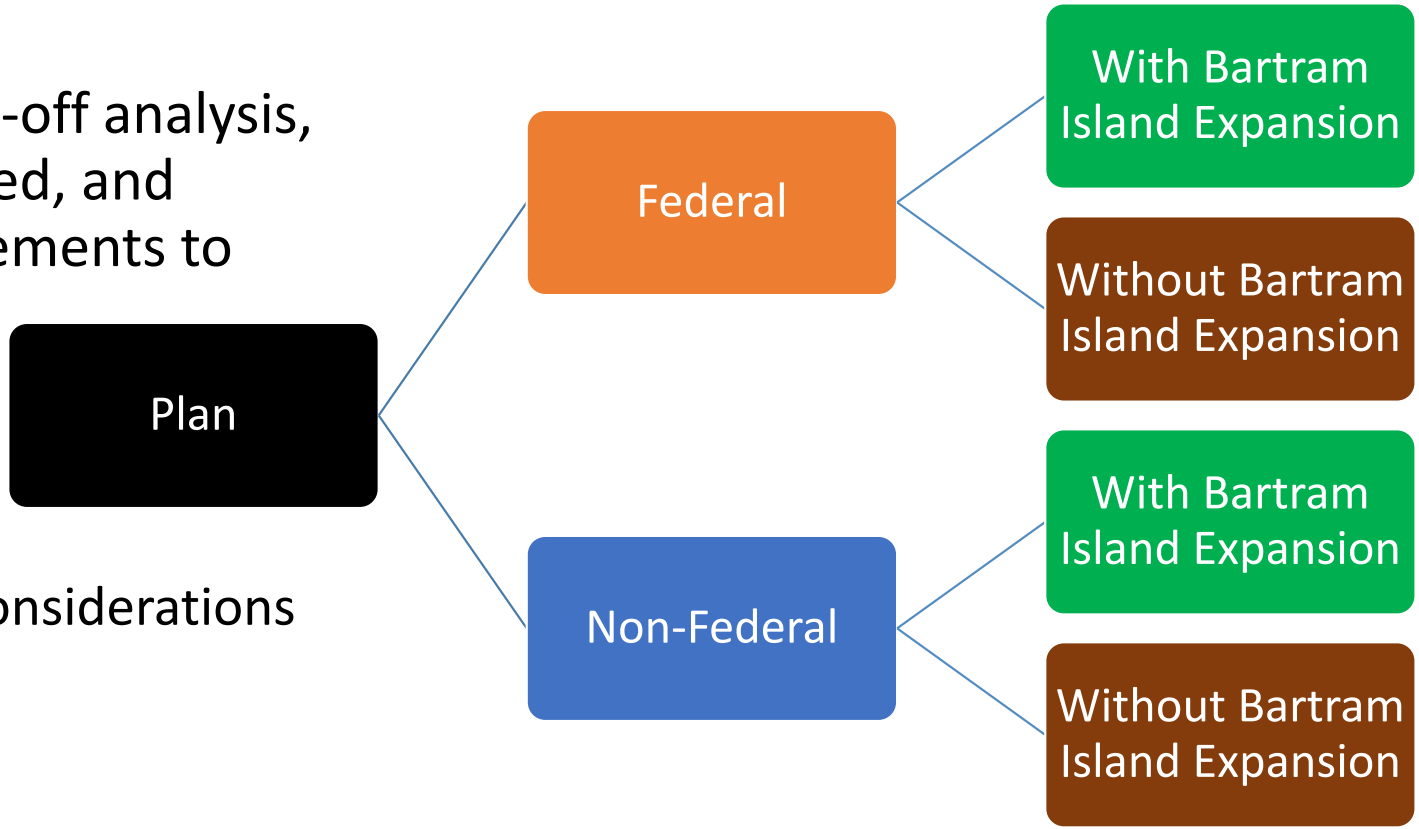
Plan Element			Direct Costs			Incidental Costs		True Costs
Plan Element #	Description	Lifecycle Capacity (CY)	Base Unit Cost ($)	Modifier ($)	Modified Unit Cost ($)	Incidental Cost ($)	Incidental Unit Cost ($/CY)	True Unit Cost ($/cy)
1	New DMMA (4.1MCY @ $200k/acre)	4,100,000	$15.81	$0.00	$15.81	$56,375,000	$13.75	$29.56
2	Buck Island Cell A Subdivide	1,154,600	$16.07	$0.00	$16.07	$6,534,970	$5.66	$21.73
3	Bartram Cell C Dike Raising	1,224,000	$15.81	$0.00	$15.81	$15,197,862	$12.42	$28.23
4	RSM Nearshore placement	842,388	$18.04	$3.51	$21.54	$2,238,614	$2.66	$24.20
5	RSM Mayport Beach	842,388	$18.04	$9.27	$27.30	$2,596,253	$3.08	$30.38
6	RSM Huguenot Park	505,433	$18.04	$9.27	$27.30	$11,971,738	$23.69	$50.99
7	Bartram Cell B Capping	604,000	$15.81	$0.00	$15.81	$8,464,611	$14.01	$29.83
8	FIND Site DU-6A / DU-6B	982,100	$20.22	$0.00	$20.22	$22,974,783	$23.39	$43.62
9	Bartram Island Expansion	5,965,900	$15.81	$0.00	$15.81	$43,222,643	$6.94	$22.75
10	Bartram Cell F Dike Raising	982,250	$15.81	$0.00	$15.81	$29,275,623	$29.80	$45.62
11.1	Expanded Use of ODMDS (Cut 3-13)	609,306	$18.68	-$6.58	$12.10	$2,000,000	$3.28	$15.38
11.2	Expanded Use of ODMDS (Cut 14-42)	609,306	$21.42	-$3.41	$18.01	$2,000,000	$3.28	$21.30
11.3	Expanded Use of ODMDS (Cut 43-49)	609,306	$14.41	$11.23	$25.64	$2,000,000	$3.28	$28.92

Tradeoff Analysis Results

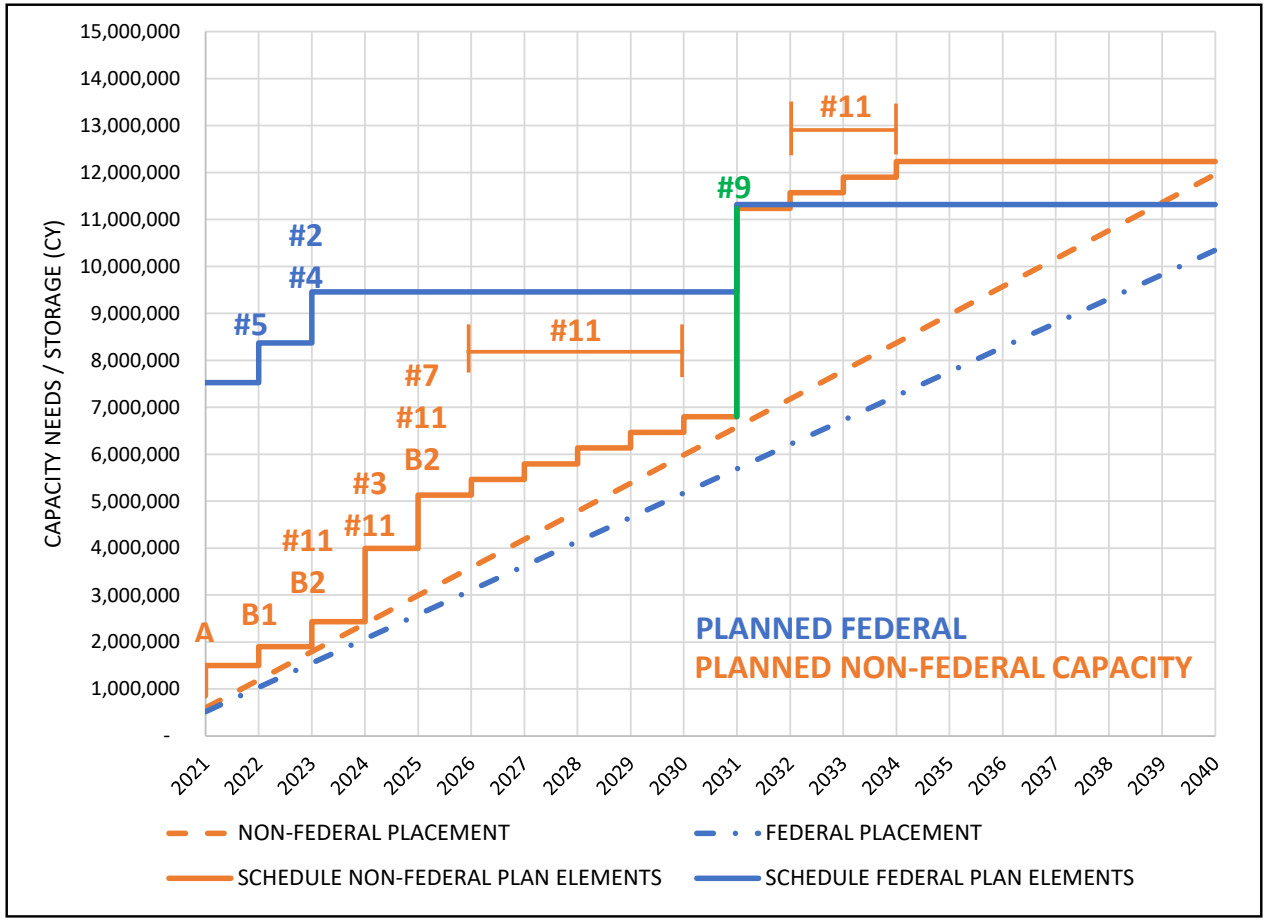
Plan Element #	Description	20-year Capacity Gain (CY)	True Unit Cost ($/CY)	Permitting Feasibility	Timeline Duration (Yrs)
11.1	Expanded Use of ODMDS (Cut 3-13)	609,306	$15.38	2	1.5
11.2	Expanded Use of ODMDS (Cut 14-42)	609,306	$21.30	2	1.5
2	Buck Island Cell A Subdivide	1,154,600	$21.73	3	1.3
4	RSM Nearshore placement	842,388	$24.20	6	0.7
1	New DMMA (4.1MCY @ $200k/acre)	4,100,000	$27.50	9	5.3
9	Bartram Island Expansion	5,965,900	$27.73	10	7.5
3	Bartram Cell C Dike Raising	1,224,000	$28.23	5	2.3
11.3	Expanded Use of ODMDS (Cut 43-49)	609,306	$28.92	2	1.5
7	Bartram Cell B Capping	604,000	$29.83	4	2.2
5	RSM Mayport Beach	842,388	$30.38	1	0.4
8	FIND Site DU-6A / DU-6B	982,100	$43.62	7	3.0
10	Bartram Cell F Dike Raising	982,250	$45.62	5	3.4
6	RSM Huguenot Park	505,433	$50.99	8	1.7

Plan Development and Selection

- Based on the trade-off analysis, identified, prioritized, and sequenced plan elements to optimize
  - Timing
  - Capacity
  - Cost
  - Environmental considerations



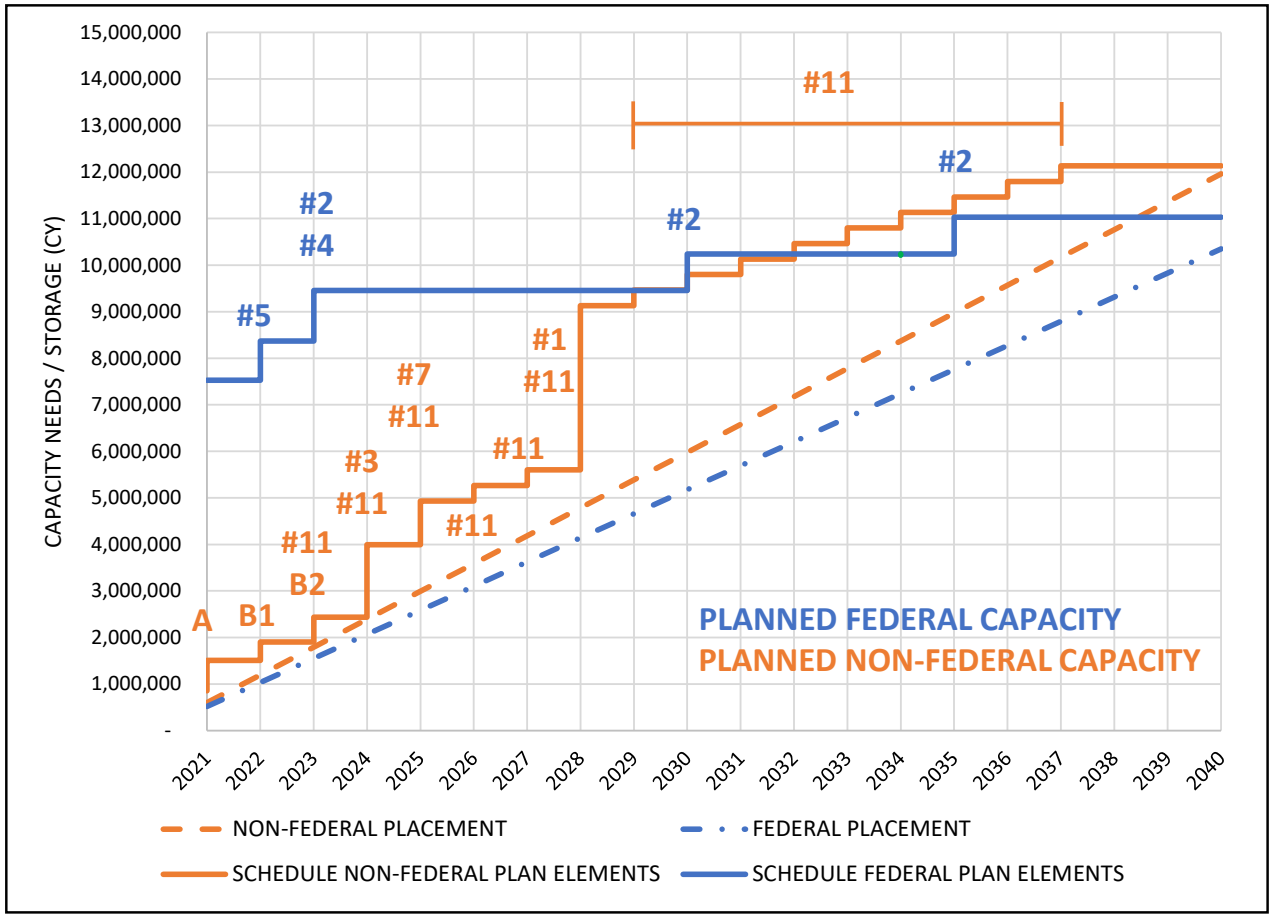
Plan with Bartram Island Expansion



A - Ongoing Buck B Toe Dike
B1 - Ongoing Buck B Offloading
B2 - Stopgap Buck B Offloading
#11 - Stopgap ODMDS
#3 - Bartram C Dike Raising
#7 - Bartram B Capping & Closure
#5 - RSM Mayport Beach
#2 - Buck Recycling Cell
#4 - RSM Nearshore Plcmt
#9 - Bartram Island Expansion

Plan	Total Cost	Average Annual Cost
Federal	$287.8 M	$14.3 M
Non-Federal	$408.1 M	$20.4 M

Plan without Bartram Island Expansion



A - Ongoing Buck B Toe Dike
B1 - Ongoing Buck B Offloading
B2 - Stopgap Buck B Offloading
#11 - Yearly use of ODMDS
#3 - Bartram C Dike Raising
#7 - Bartram B Capping & Closure
#1 - New DMMA (3.2 MCY)
#5 - RSM Mayport Beach
#2 - Buck Recycling Cell
#4 - RSM Nearshore Plcmt

Plan	Total Cost	Average Annual Cost
Federal	$194.5 M	$9.7 M
Non-Federal	$327.8 M	$16.4 M

From Planning to Execution

- Planning study resulted in a comprehensive understanding of the alternatives, costs, and tradeoffs associated with dredged material management for the Jacksonville Harbor
- With execution of the selected plan, Jacksonville Harbor stakeholders should be well prepared to manage dredged material over the next 20 years in a responsible, environmentally acceptable, and cost-effective manner
- Execution requires:
  - Action: JAXPORT and USACE are in various stages of implementing plan elements including:
    - Bartram Cell C Dike Raising – Completed
    - Expanded Use of ODMDS – Expected complete 2025
  - Flexibility: “Plans change at the point of departure, and every plan requires branches and sequels.”

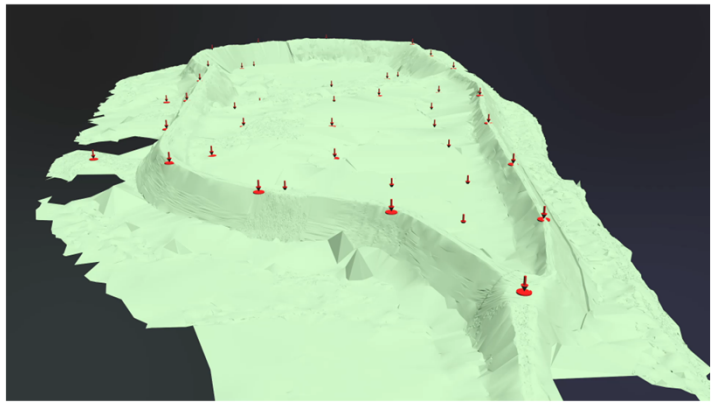
Bartram Cell C Dike Raising

History and Context

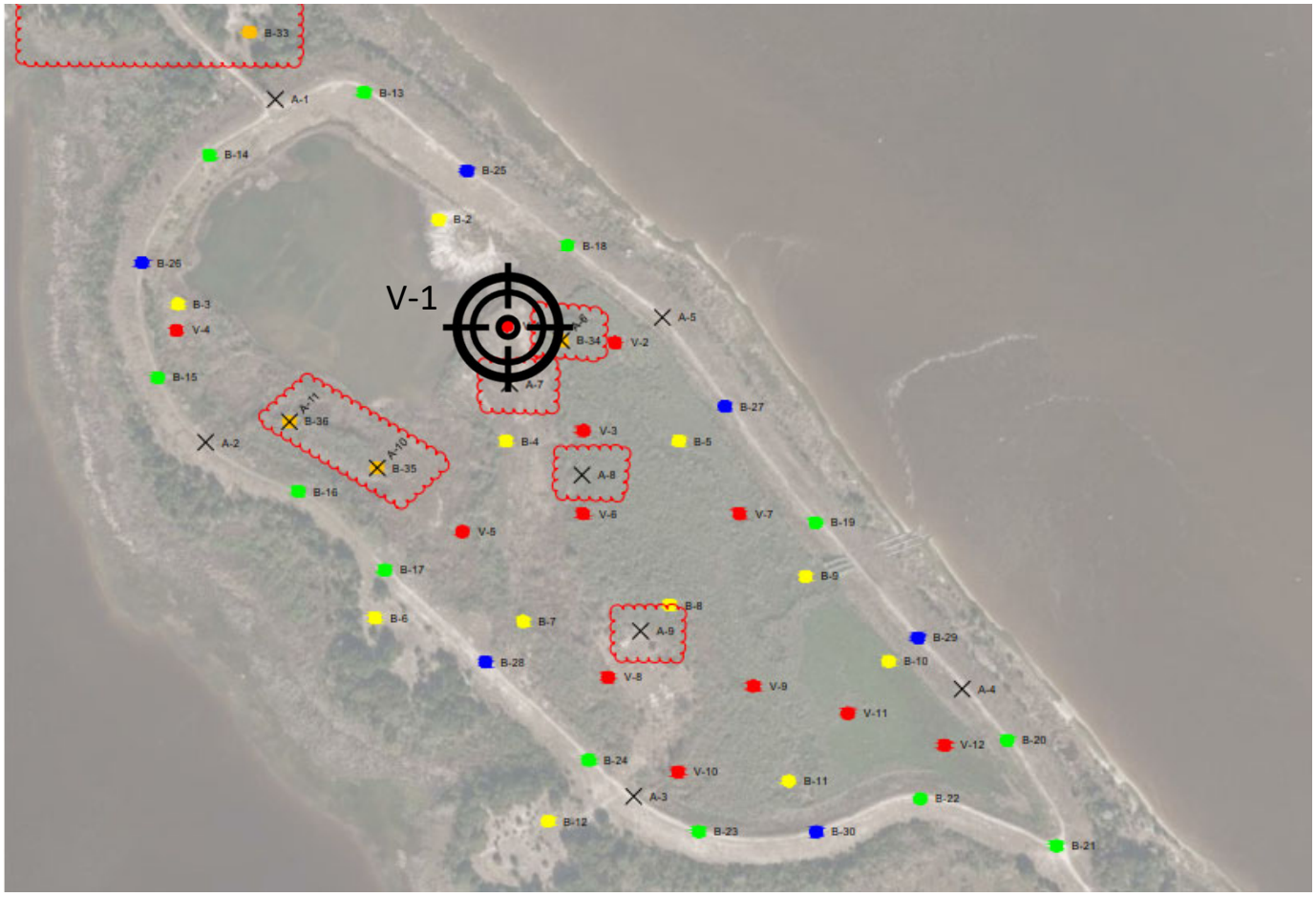
- Cell C was originally constructed as a single-use DMMA to manage materials dredged during construction of new Dames Point Marine Terminal
  - Relatively low containment dikes offer opportunity for capacity gains
  - Reasonable expectation of quality material for dike construction

Bartram Cell C Dike Raising: Design and Permitting

- Topographic survey
- Geotechnical investigation
- Environmental considerations and permitting
- Engineering design



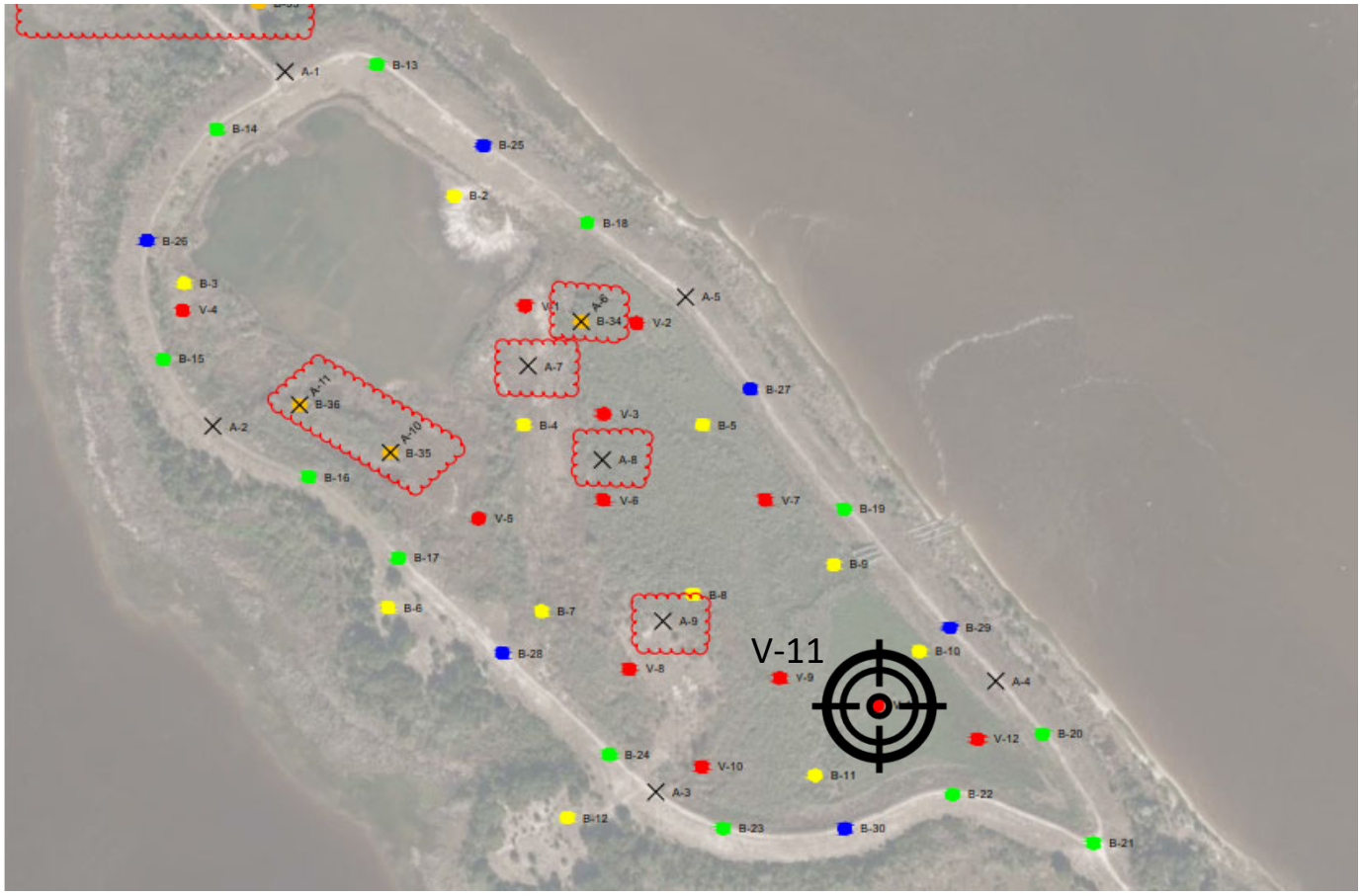
Bartram Cell C Dike Raising: Geotechnical Investigation



- 20 FT VIBRACORE
- 20 FT SPT
- 40 FT SPT
- 60 FT SPT
- 90 FT SPT
- 20 FT AUGER

Vibracores: Example of Suitable Material (V-1)

Bartram Cell C Dike Raising: Geotechnical Investigation



- 20 FT VIBRACORE
- 20 FT SPT
- 40 FT SPT
- 60 FT SPT
- 90 FT SPT
- 20 FT AUGER

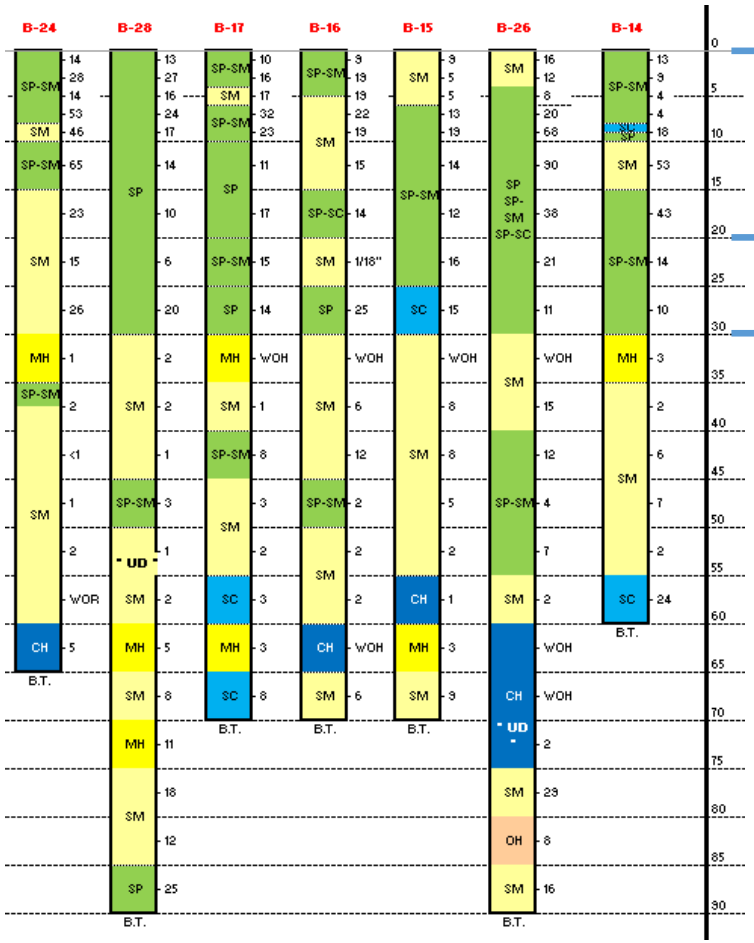
Vibracores: Example of Unsuitable Material (V-11)

Bartram Cell C Dike Raising: Geotechnical Investigation

20 FT VIBRACORE
20 FT SPT
40 FT SPT
60 FT SPT
90 FT SPT
20 FT AUGER

Vibracores: Stratigraphy (V-10)

Standard Penetration Tests (SPT): Dike Crest



Bartram Cell C Dike Raising: Environmental Considerations

Wetland Impact Avoidance

Gopher Tortoise Relocation

Bartram Cell C Dike Raising: Engineering Design

Seepage and Slope Stability Analysis

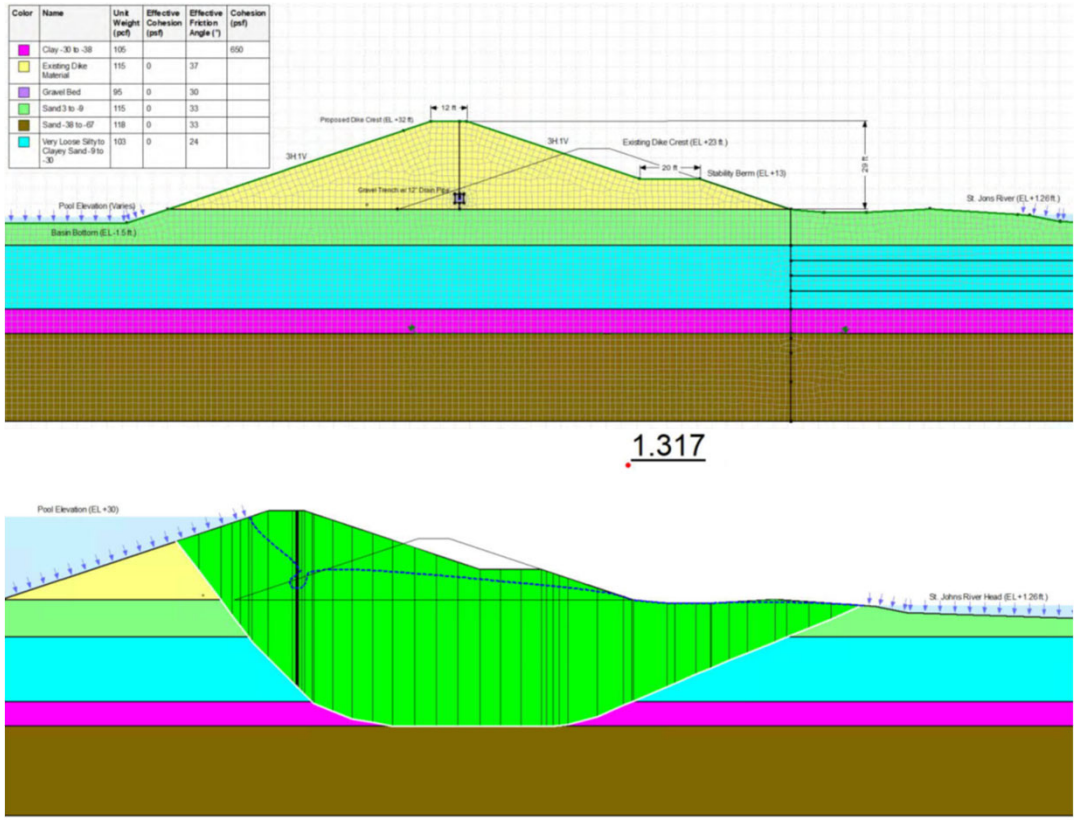
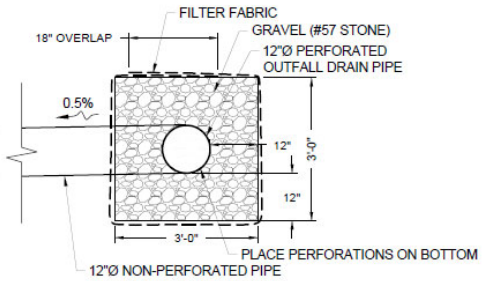


Table 1. Recommended Minimum Factors of Safety and Slope Stability Analysis Results

Condition	Minimum FOS USACE	Resultant FOS from GeoStudio Analyses
End of Construction	1.3	1.35
Steady Seepage	1.3	1.32
Rapid Drawdown	1.0	1.03*



E6 TYPICAL DIKE GRAVEL DRAIN DETAIL

22x34: 1" = 2'
11x17: 1" = 4'

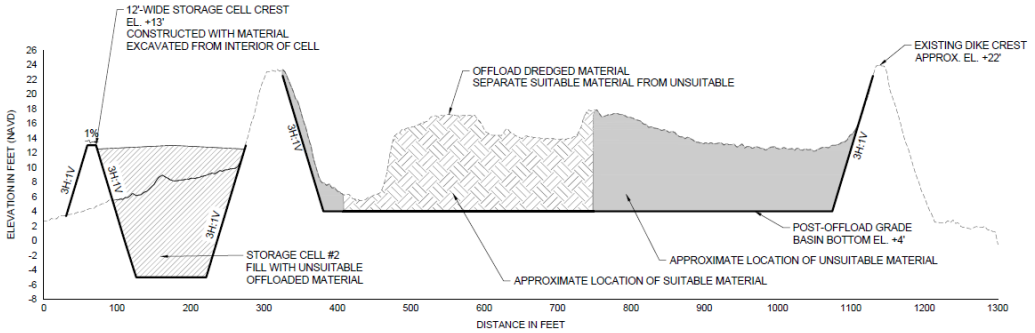
0 2' 4'

Bartram Cell C Dike Raising: Engineering Design

Water Quality and Weir Discharge Systems

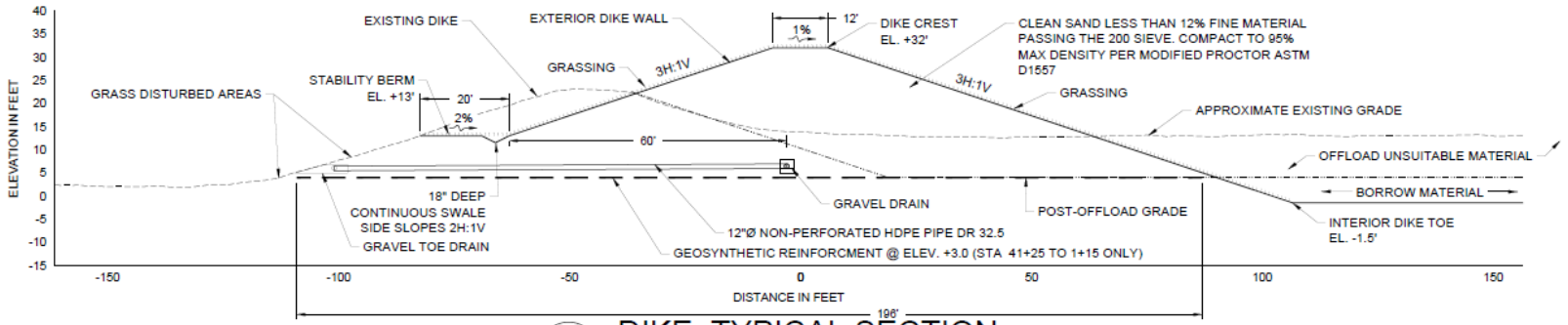
Bartram Cell C Dike Raising: Engineering Design

Engineering Details



C4 DIKE OFFLOAD AND STORAGE CELL SECTION 2

22x34: 1" = 100'
11x17: 1" = 200'



G4 DIKE TYPICAL SECTION

22x34: 1" = 20'
11x17: 1" = 40'

Bartram Cell C Dike Raising: Construction

Unsuitable Material Offloading/Suitable Material Segregation

Bartram Cell C Dike Raising: Construction

Geotextile Reinforcement Installation

Bartram Cell C Dike Raising: Construction

Internal Gravel Drain Installation

Bartram Cell C Dike Raising: Construction

Weir Relocation

Bartram Cell C Dike Raising: Completed 2024

Expanded Use of ODMDS: Location and Current Authorization

Expanded Use of ODMDS: Location and Current Authorization

- Final Environmental Impact Statement (EIS) for expansion completed October 2014
  - Federal Register October 14, 2015
- Sized primarily for Mayport and Federal Harbor
  - Deepening
    - -47’ MLLW Expansion
    - Deepening beyond -47’
  - Mayport Maintenance
  - 50-year capacity
- Placement is available for all users meeting criteria
  - Potential to use capacity designated for deepening beyond -47’

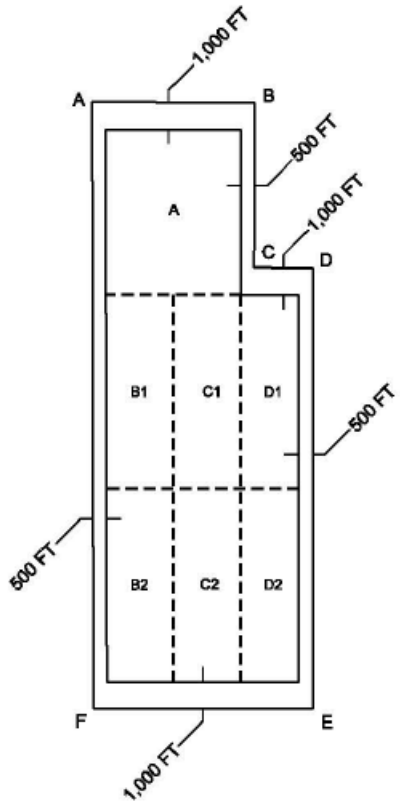


Figure 2: Disposal Release Zones

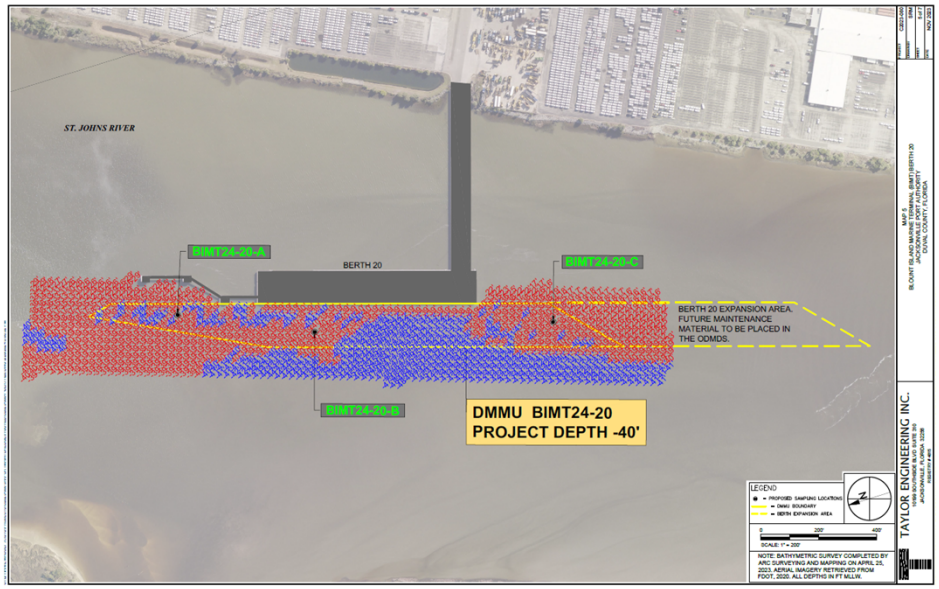
Expanded Use of ODMDS: Suitable Material for ODMDS Placement

Dredged material found suitable for ocean disposal pursuant to the regulatory criteria for dredged material, or characterized by chemical and biological testing and found suitable for disposal into ocean waters, will be the only material allowed to be disposed at the expanded ODMDS. (40 CFR Part 228[EPA–R04–OW–2014–0372; FRL–9934–57–Region 4])

- Demonstrate acceptability through specified testing
  - Maintenance dredge material
  - New-work dredge material
  - Offloading of previous placed material
- Unacceptable material
  - Material not passing evaluation criteria
  - Trash or debris
  - Material practical for beneficial use

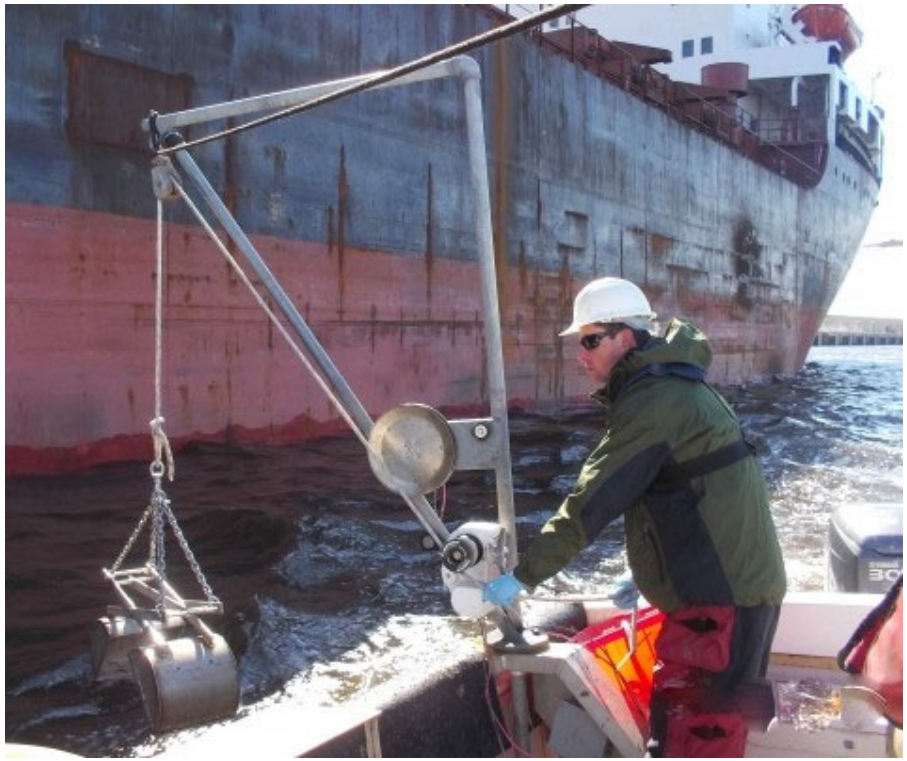
Expanded Use of ODMDS: Steps for Evaluation of Material

- Coordinate with EPA/USACE
- Develop Sampling and Analysis Plan (SAP)
  - Southeast Regional Implementation Manual (SERIM)
  - Review and approval by EPA/USACE
- Execute SAP
  - Sample collection through report delivery
- Submit results for review and approval
- Timeframe: >1 year from start of SAP development



Expanded Use of ODMDS: Executing the SAP – Sampling

- Material collection
  - Location 3-5 subsamples/DU
  - Develop sample representative of material proposed for ODMDS placement
  - Type of collection (cores or grabs)
- Reference sample
  - Area free of contamination

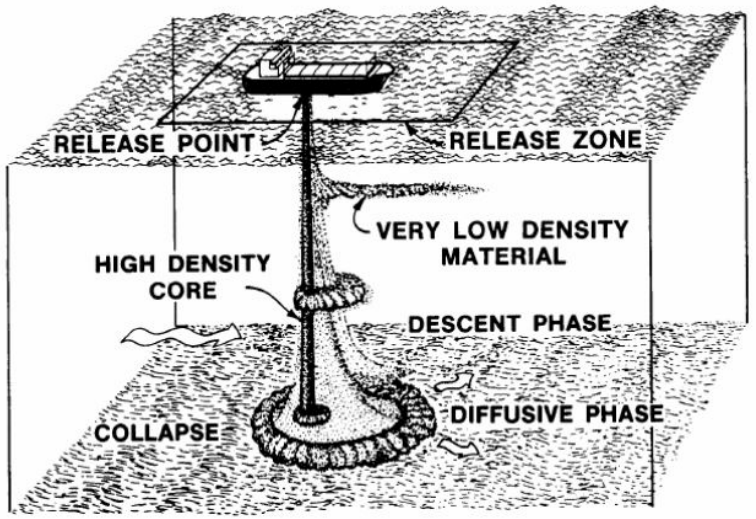


Expanded Use of ODMDS: Executing the SAP – Lab Analysis

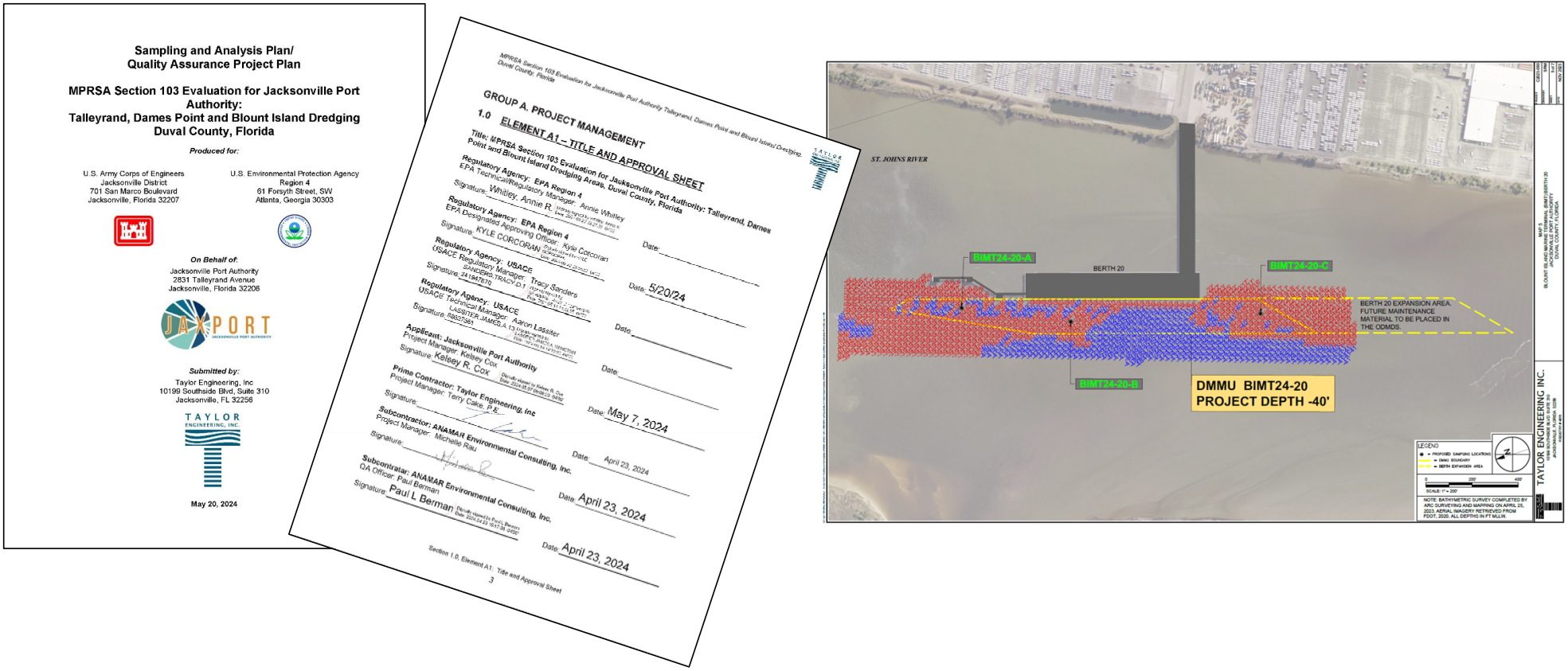
- Sample analysis
  - Physical
    - Grain size, specific gravity, Atterberg limits
  - Chemical
    - Analytes per SERIM and site-specific information
    - Sediment and elutriate
  - Bioassay
    - Sediment and elutriate
  - Bioaccumulation
    - Two species/5-replicates
  - Tissue analysis

Expanded Use of ODMDS: Executing the SAP – Data Processing

- Organize data into tables
- Statistical analysis of tissue chemistry
  - Are results statistically significantly different from the reference?
- Disposal modeling
  - STFATE
    - Will there be a water quality violation at the ODMDS border?
    - Adjust placement/load size if required
- Prepare and submit final report
- Coordinate with EPA for review and (hopefully) approval



Expanded Use of ODMDS: SAP Approval



Sampling and Analysis Plan/
Quality Assurance Project Plan

MPRSA Section 103 Evaluation for Jacksonville Port Authority:
Talleyrand, Dames Point and Blount Island Dredging
Duval County, Florida

Produced for:

U.S. Army Corps of Engineers
Jacksonville District
701 San Marco Boulevard
Jacksonville, Florida 32207

U.S. Environmental Protection Agency
Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303

On Behalf of:
Jacksonville Port Authority
2831 Talleyrand Avenue
Jacksonville, Florida 32206

Submitted by:
Taylor Engineering, Inc
10199 Southside Blvd, Suite 310
Jacksonville, FL 32256

May 20, 2024

GROUP A. PROJECT MANAGEMENT

1.0 ELEMENT A1 – TITLE AND APPROVAL SHEET

Title: MPRSA Section 103 Evaluation for Jacksonville Port Authority: Talleyrand, Dames Point and Blount Island Dredging Areas, Duval County, Florida

Regulatory Agency: EPA Region 4
EPA Technical/Regulatory Manager: Annie Whitley
Signature: Whitley, Annie R.

Regulatory Agency: EPA Region 4
EPA Designated Approving Officer: Kyle Corcoran
Signature: KYLE CORCORAN

Date: 5/20/24

Regulatory Agency: USACE
USACE Regulatory Manager: Tracy Sanders
Signature: SANDERS.TRACY.D.1

Regulatory Agency: USACE
USACE Technical Manager: Aaron Lassiter
Signature: LASSITER.JAMES.A.13

Date: May 7, 2024

Applicant: Jacksonville Port Authority
Project Manager: Kelsey Cox
Signature: Kelsey R. Cox

Date: April 23, 2024

Prime Contractor: Taylor Engineering, Inc
Project Manager: Terry Cakes, P.E.
Signature:

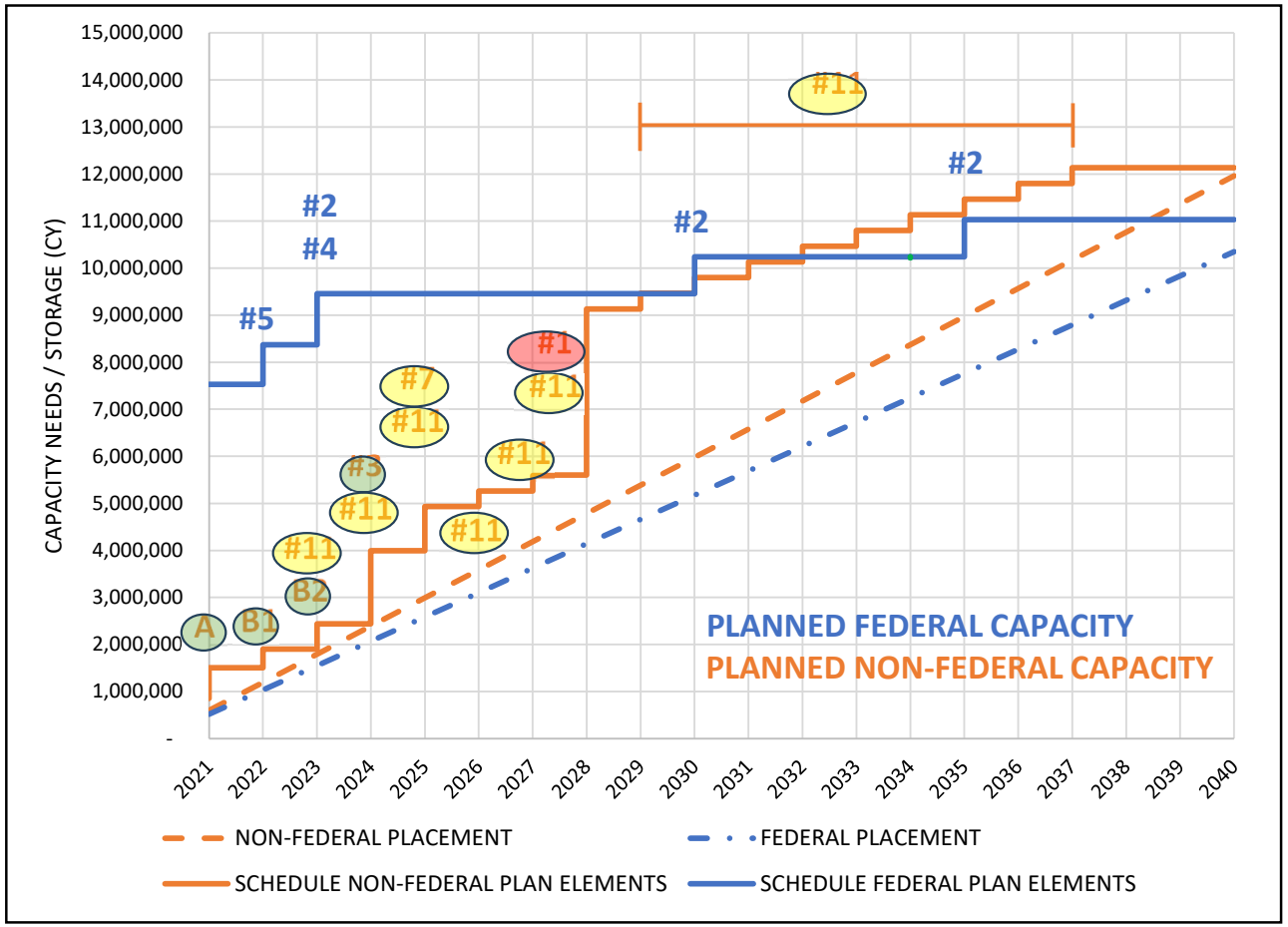
Subcontractor: ANAMAR Environmental Consulting, Inc.
Project Manager: Michelle Rau
Signature:

Date: April 23, 2024

Subcontrator: ANAMAR Environmental Consulting, Inc.
QA Officer: Paul Berman
Signature: Paul L Berman

Date: April 23, 2024

Status of the Plan



A - Ongoing Buck B Toe Dike
B1 - Ongoing Buck B Offloading
B2 - Stopgap Buck B Offloading
#11 - Yearly use of ODMDS
#3 - Bartram C Dike Raising
#7 - Bartram B Capping & Closure
#1 - New DMMA (3.2 MCY)
#5 - RSM Mayport Beach
#2 - Buck Recycling Cell
#4 - RSM Nearshore Plcmt

Plan	Total Cost	Average Annual Cost
Federal	$194.5 M	$9.7 M
Non-Federal	$327.8 M	$16.4 M

Acknowledgements

Thank You!

Jonathan Armbruster, P.E. | Senior Vice President of Waterfront Engineering

Taylor Engineering, Inc.

10199 Southside Blvd., Suite 310, Jacksonville, FL 32256

Main: 904-731-7040 | Direct: 904-256-1362 | Cell: 904-710-4309

www.taylorengineering.com

Questions?