

GUIDANCE FOR THIN LAYER PLACEMENT OF DREDGED MATERIAL

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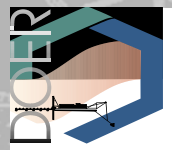
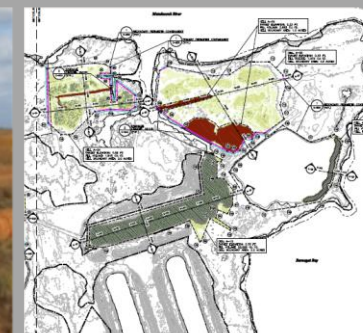
Dr. Ram Mohan

Texas A&M University, College Station TX

WEDA Eastern Chapter Meeting

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Wilmington DE



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What is Thin Layer Placement (TLP)?

- Involves the placement of dredged sediments in thin layers to provide optimization opportunities for sediment management.
- Focuses on beneficial use of dredged material (ecological and/or) social enhancement.
- Application of thin layers of sediment has displayed advantages over more traditional, thicker sediment placement applications.
- Variety of environments where these thicker layers pose potential challenges (natural resources & navigation).

What is “Thin Layer Placement (TLP)?”

Terms associated with TLP within available literature	
Term	Source
Marsh nourishment	LA CPRA, 2018
Artificial sediment enhancement	La Peyre et al., 2009
Thin layer placement	USACE, others
Thin layer deposition	Ford et al., 1999
Sediment subsidy	Mendelssohn and Kuhn, 2003
Sediment slurry application/addition/amendment	Schrift et al., 2008
Sediment enrichment	Slocum et al., 2005
Thin layer sediment renourishment	Croft et al., 2008
Thin layer disposal	USACE, others

(Modified after Berkowitz et. al. 2019)

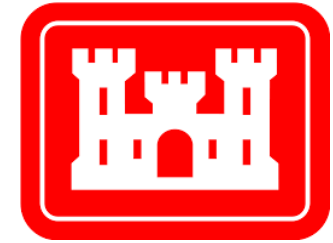
Thin Layer Placement (TLP)

- Recently in the U.S. there's been increasing interest and effort on TLP.
- Nexus –
 - sea level rise
 - degrading wetlands
 - sediment starved systems
 - limited dredged material placement and disposal areas
- Shifting perspectives/shifting priorities.
- But, due in large part to the relatively early development spiral that TLP currently exists, there is limited information and little guidance available to practitioners.

Ergo the Production of this Guidance

Thin Layer Placement (TLP)

Majority of TLP projects have been, and are currently being conducted in wetlands, *but there are also open water applications as well.*



Thin Layer Placement (TLP)



- TLP of dredged material in degrading wetlands can enhance the sustainability of this Natural and Nature Based Feature (NNBF).
- Various reports document the benefits of wetland TLP that include:
 - increased marsh elevation
 - improved soil stability
 - enhancement of wetland functions while maintaining characteristic plant communities
 - benefits of TLP applications to marsh vegetation capacity for recovery after deposition of 30 cm or less thick layer (Mohan et al, 2016)

Thin Layer Placement (TLP)

- Strategic TLP of dredged material in open water to augment sediment supply to help sustain:
 - wetlands or other NNBF landscape features such as beaches, barrier islands, etc.
 - protection of erosion of infrastructure

Natural and Nature-Based Infrastructure at a Glance

GENERAL COASTAL RISK REDUCTION PERFORMANCE FACTORS:
STORM INTENSITY, TRACK, AND FORWARD SPEED, AND SURROUNDING LOCAL BATHYMETRY AND TOPOGRAPHY



<https://ewn.el.erdc.dren.mil/nnbf.html>

Thin Layer Placement (TLP)

Definition

Purposeful placement of thin layers of sediment (e.g., dredged material) in an environmentally acceptable manner to achieve a target elevation or thickness. Thin layer placement projects may include efforts to support infrastructure and/or create, maintain, enhance, or restore. ecological function.



ERDC TN-19-1
February 2019
**Thin Layer Placement: Technical
Definition for U.S. Army Corps of
Engineers Applications**

By Jacob. F. Berkowitz, Candice Piercy, Tim Weip, and Christine VanZomeren

<https://apps.dtic.mil/dtic/tr/fulltext/u2/1067526.pdf>

Thin Layer Placement (TLP)

USFWS Blackwater National Wildlife Refuge

- In 2002, a thin layer of fine-grained material was sprayed onto 2.5 acre sites - total project cost: \$300,000
- Modified hydroseeding technique attempted by adding seeds to the spray
- Post placement monitoring indicated revegetation occurred immediately within the refuge and outside of the treatment area as well
- Larger follow up project conducted initiated in 2016 with 26,000 yd³ to restore 40 acres at a total cost of approximately \$1.1 M



Source: Bob Blama



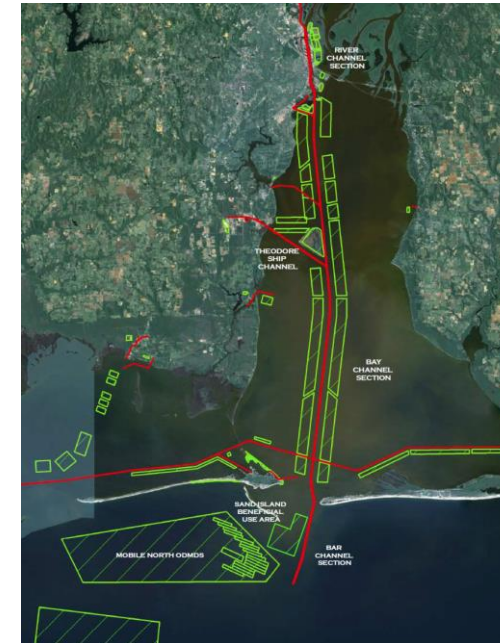
Source: Dredge America

Thin Layer Placement (TLP)

USACE Mobile District Style

Mobile Bay AL (2012)

- \$5.00 - \$7.00/yd³ prior TLP permit
- \$2.00 - \$3.00/yd³ post TLP permit (30 cm or less thick)
- Reduced dredging budget request ~\$6M/year
- Returning sediment to a starved system
- Gained greater flexibility to shop dredging market
- Improved channel reliability
- Consistent customer relationships



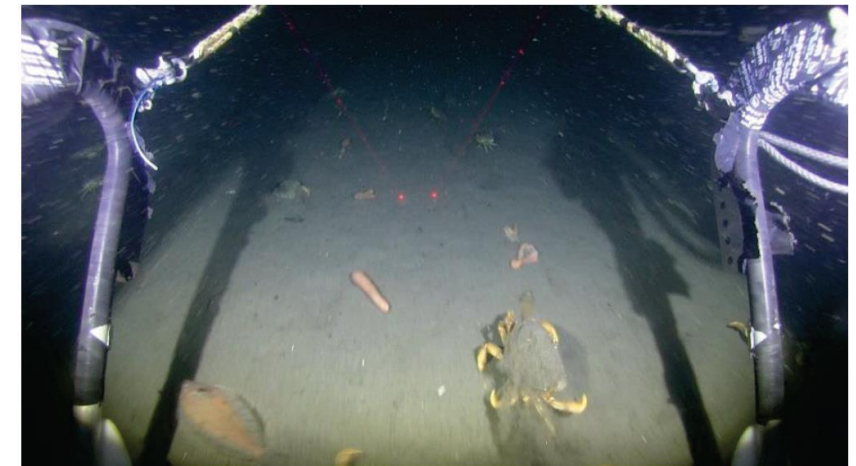
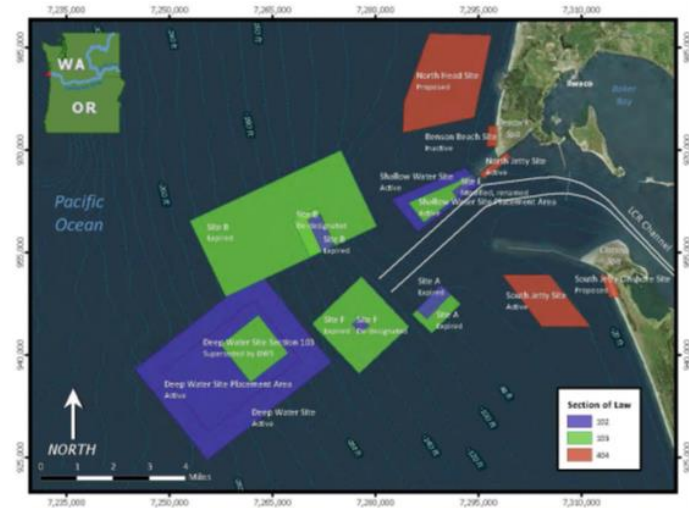
Parsons et al. 2015

Thin Layer Placement (TLP)

USACE Portland District Style

Mouth of Columbia River OR (2015)

- Recession poses stability threat to both the navigation channel and the MCR South Jetty
- 2012 the ESSAYONS began operational TLP in the SJS placing 340,000 yd³ that was studied extensively - sediment layer thickness of 5 cm or less
- Preliminary findings from NOAA indicate no crab mortality
- NWP currently TLPs approximately 500,000 yd³/year in the SJS



Guidance for Thin Layer Placement (TLP)



Dredging Operations and Environmental Research (DOER) Program

Purpose:

Provide engineers, scientists, and other practitioners guidance on the design and construction of dredged sediment TLP projects based on the *current state-of-the-practice* with application to *both wetland and open water* environments.



Ecosystem Management and Restoration Research Program

Framework for Understanding Ecological Considerations Associated with Restoration Techniques and Intervention Measures to Sustain Existing Marshes in the Face of Relative Sea Level Rise

Presents a framework to decide what type of wetland restoration effort, including TLP, is appropriate given the mode of wetland degradation.

Guidance for Thin Layer Placement (TLP)

Approach used to develop these guidelines:

- Conducted literature search and field survey of (primarily) design and construction-related aspects of TLP projects.
- Survey phase involved direct and indirect interaction with federal/state/government/private/industry/academia.
- Direct interaction consisted of a workshop to discuss state-of-practice TLP aspects with personnel who have been directly involved with TLP projects.



TLP Workshop

Hosted by EA Engineering, Science, and Technology
Hunt Valley, MD

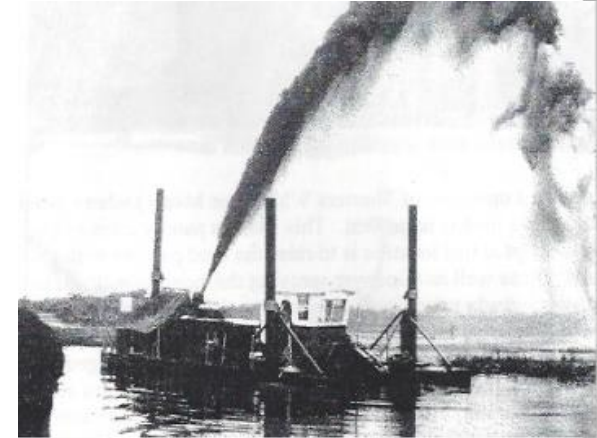


Guidelines preliminarily formulated and subsequently refined through further interaction with these TLP practitioners.

TLP Guidance Contents

- A chronology of different wetland and open water TLP events
- TLP is defined and the context for its application discussed
- Process framework is laid out for initiating, planning, designing, constructing, and monitoring wetland TLP
- TLP design and construction aspects
- Project contracting, scheduling, and production considerations
- Hydraulic dredging & wetland construction equipment and operational methodologies
- Post construction wetland monitoring
- TLP knowledge gaps and current research and development activities

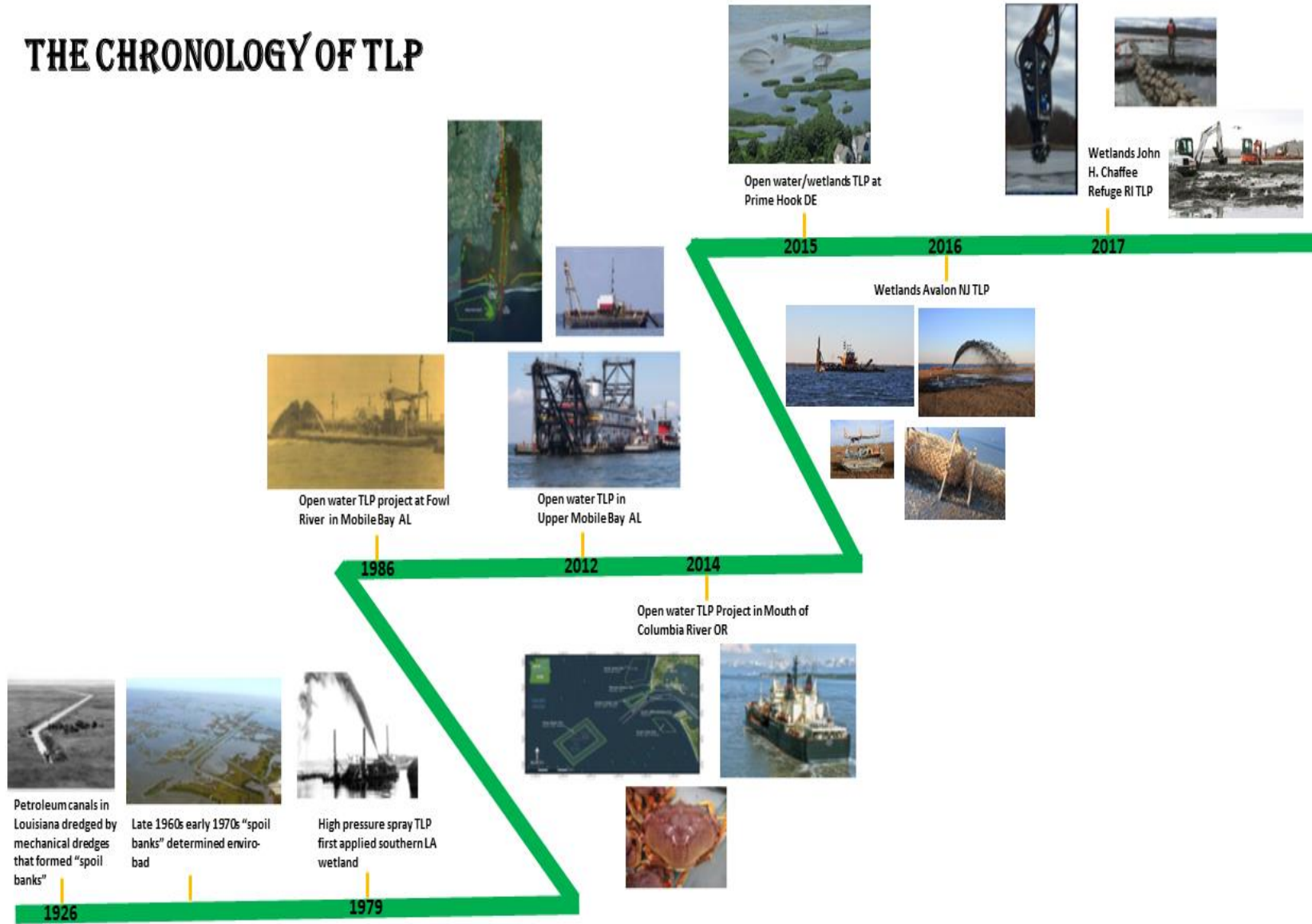
TLP Documented History



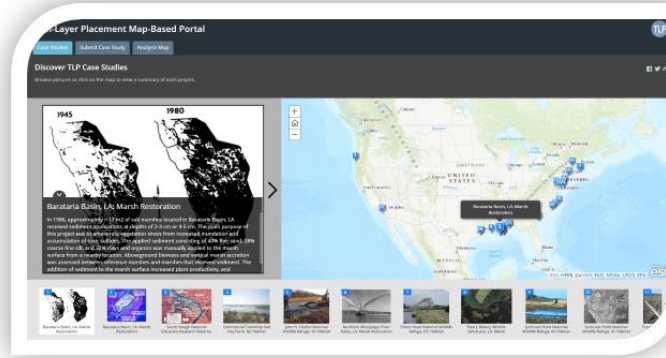
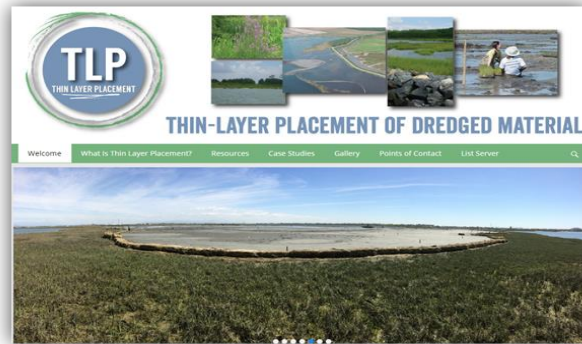
Source: Cahoon and Cowan 1988

- Louisiana oil and gas exploration started dredging access canals for submersible drilling barges in late 1930s with draglines and cutterheads – spoil banks
- Late 1960s early 1970s spoil banks determined enviro-bad
- High pressure spray placement first applied southern Louisiana 1979*

THE CHRONOLOGY OF TLP



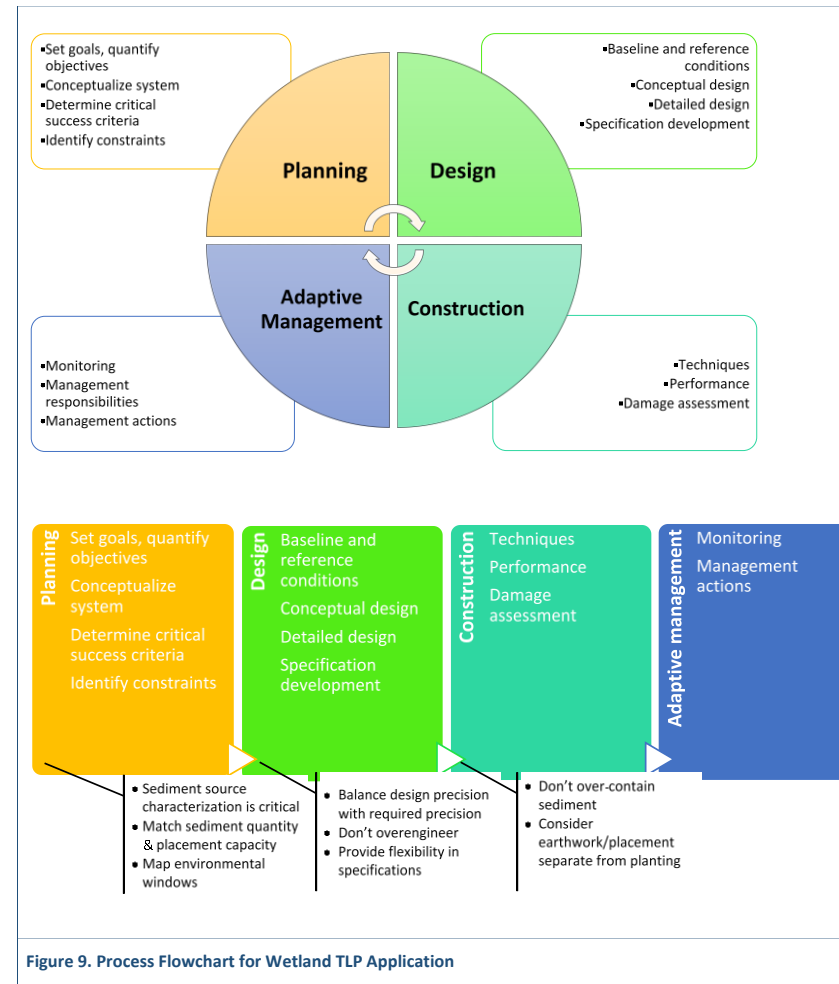
USACE TLP Website and Database



- Aggregate the current state of knowledge regarding thin layer placement of dredged material
- Consolidate literature/references pertaining to all project phases – from design to post-construction monitoring
- Provide centralized, accessible, and consolidated resource for case studies

<https://tlp.el.erdc.dren.mil>

TLP Project Process Framework



TLP General Lessons Learned

- Early engagement and “buy in” is critical
- Approach permitting agencies early on

Examples of Stakeholder Groups that Were Essential to TLP Project Successes	
Mobile Bay Interagency Working Group (IWG) Members	
<ul style="list-style-type: none"> • Alabama State Port Authority (ASPA) • USACE, Mobile District • USACE, Engineering Research and Development Center (ERDC) • Alabama Department of Conservation and Natural Resources (ADCNR), State Lands Division • ADCNR, Marine Resources Division (MRD) • ADCNR, Wildlife and Freshwater Fisheries Division (WAFF) • Alabama Department of Environmental Management (ADEM) • Geological Survey of Alabama (GSA) • U.S. Fish and Wildlife Service (USFWS) • National Marine Fisheries Service (NMFS), Habitat Conservation • Mobile Bay National Estuary Program (NEP) • Environmental Protection Agency (EPA) • Dauphin Island Sea Lab (DISL) • The Nature Conservancy (TNC) • Mobile County Environmental Department • Mobile Bay Keeper 	
Lower Columbia Solutions Group (LCSG)	
<ul style="list-style-type: none"> • National Oceanic and Atmosphere Administration (NOAA) • Environmental Protection Agency (EPA) • Oregon’s Governor’s Office • Washington Governor’s Office • WA Department of Ecology (WDOE) • Columbia River Crab Fishers Association (CRCFA) • Washington Department of Natural Resources (WDNR) • Oregon Department of Land Conservation and Development • Oregon Sea Grant • Portland State University • Oregon State University • Oregon Health Sciences University 	<ul style="list-style-type: none"> • National Policy Consensus Center • Oregon Department of Environmental Quality (ODEQ) • Port of Astoria • Port of Ilwaco • Port of Chinook • Pacific County, WA • Clatsop County, OR • Oregon Department of State Lands (ODSL) • USFWS • Oregon Department of Fish and Wildlife (ODFW) • Washington Department of Fish & Wildlife (WDFW) • Lower Columbia Solutions Group (LCSG) • Institute for Natural Resources • Center for Public Service

TLP General Lessons Learned

- TLP should be a “wetland restoration or maintenance” project, and not designed “just” as a dredged material disposal project
- TLP requires the blending and balancing of the different perspectives and objectives of wetland owners and dredging contractor.



Communication Tools

CELL	HABITAT TYPE (USFWS)	ACRES (horizontal extent) (Amec)	BIOLOGIC PRIORITY (USFWS)	Constructibility rank (depth, compactness)	Cell Area Rank	Capacity rank	NJDOT - equal rank	USFWS score	NJDOT score	Combined rank max
			1 = Highest priority 2 = Medium priority 3 = Lowest priority	Priority to large areas	Fill extent	*1: >5000;2:>100				
BRB-1	High Marsh	21.27	1	1	1	1	1.00	1.00	1.00	1.00
BRB-2	High Marsh	10.29	1	2	1	1	1.33	1.00	0.85	0.85
BRB-3	High Marsh	17.6	1	2	1	1	1.33	1.00	0.85	0.85
BRB-4	Low Marsh	0.99	2	2	3	3	2.67	0.55	0.25	0.14
BRB-5	High Marsh	9.44	1	1	1	1	1.00	1.00	1.00	1.00
BRB-6	Low Marsh	1.02	3	2	3	3	2.67	0.10	0.25	0.03
BRB-7	Low Marsh	2.31	1	3	3	2	2.67	1.00	0.25	0.25
BRB-8	High Marsh	7.13	1	3	1	2	2.00	1.00	0.55	0.55

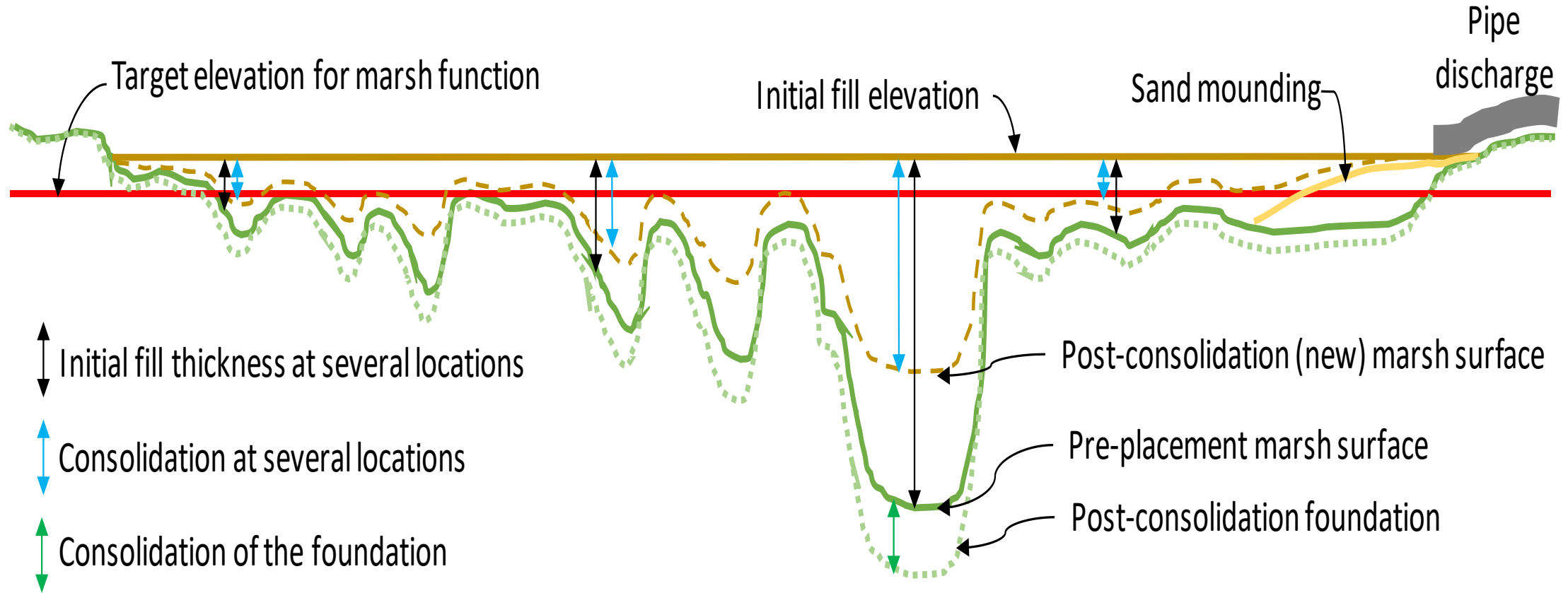
Using communication and simple tools to facilitate discussions and negotiations – balance economic/efficient placement versus ecological goals

TLP General Lessons Learned

- Incorporate adaptive management from project beginning, during construction, and long term monitoring – can be key to success
- Adequate characterization of the dredged material and placement site are vital to project success
 - Bathymetry, topography, water levels, tides
 - Grain size, Atterberg properties, moisture/solids content, texture, contamination, etc.
- Use numerical models when possible, verified by real-world data



TLP General Lessons Learned



TLP General Lessons Learned

- Do not over-engineer or over-prescribe
- Prequalify contractors - evaluate for demonstrated experience on similar projects
- Provide (where possible) the contractor with the ability to innovate in the field



Gary Ray 2007

Marsh Buggy - Not Swamp Buggy



WILCO



Mississippiriverdelta.org

Marsh Buggy



Swamp Buggy

cnn.com

General Lessons Learned

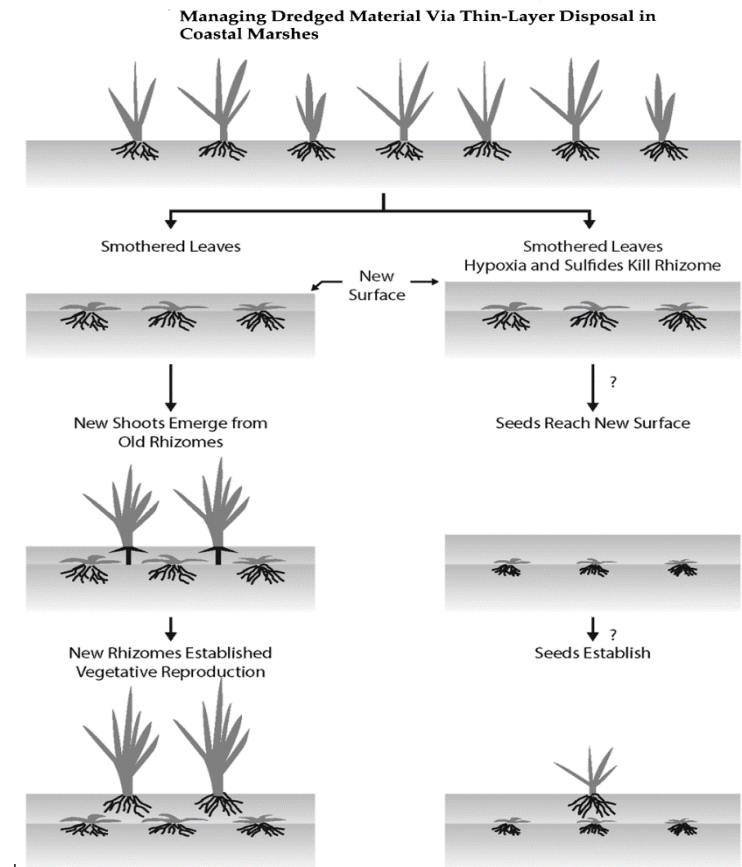
EEDP-01-32
July 1993



*Environmental
Effects of Dredging
Technical Notes*



- Vegetation responds well to TLP generally in the range of 15 to 30 cm thicknesses
- Allow for natural processes to facilitate long-term recovery (3 – 5 years)
- Direct placement still has some challenges
 - Damage to marsh during construction
 - Material containment questions
 - Relatively small volumes at relatively high costs



Questions for Audience

- Got TLP costs?
- Got TLP projects (in particular open water ones)?
- Got something you really think should be in guidance?

- let Tim know 601-634-2083

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(Iron Hill Brewery?)

- let Ram know 215-756-5030

rmohan@tamu.edu

- let Candice know 601-634-7253

Candice.D.Piercy@usace.army.mil

- This guidance is intended to augment, not replace, the professional judgment of the practitioner.
- Upon completion, the report will be made available on the DOER website (<https://doer.el.erdcdren.mil/>) for unlimited distribution.

**BUT WHEN TIM?
WHEN IS THIS GUIDANCE GETTING PUBLISHED?**

QUESTIONS?



Source: Bob Blama