APPENDIX C

Case Study Matrix

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Name of Project: Prime Hook National Wildlife Refuge

Location: Sussex County, Milton, DE

Year: 2016 (ongoing)

Area (acres): 4,000 acres of degraded tidal marsh and barrier beach. 30 miles of dredged channels.

Total Project Cost: $19,805,000 **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Channel dredging

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Habitat Restoration. The site's salt marsh habitat has been adversely affected by 30 years of impounded freshwater drowning marsh plants. In addition, storm surge from Hurricane Sandy and other storms caused a series of breaches along the impoundments. The tidal marsh restoration project was completed in September 2016 by dredging channels within impounded areas. Spartina patens and Spartina alterniflora plugs were planted in exposed mudflats after channel restoration was completed

Preservation of Built Infrastructure / Direct Connection to Public Use: Habitat Restoration. The site's salt marsh habitat has been adversely affected by 30 years of impounded freshwater drowning marsh plants. In addition, storm surge from Hurricane Sandy and other storms caused a series of breaches along the impoundments. The tidal marsh restoration project was completed in September 2016 by dredging channels within impounded areas. Spartina patens and Spartina alterniflora plugs were planted in exposed mudflats after channel restoration was completed

Monitoring, Updates, Results: Restored marshes were covered with new vegetation after one growing season in many areas where there was shallow open water prior to restoration. The first documented piping plover nest was identified on the restored shoreline along with other nesting shore birds of interest. Monitoring of the biological and physical response of the tidal marsh to restoration will continue over upcoming years.

Additional Information (if any): Approximately 30 miles of channels were dredged across the 4,000 acre tidal marsh restoration area. Locations of these drainage channels were largely based on historic channel locations prior to impoundment. This project was funded through the Hurricane Sandy Disaster Relief Act of 2013 through the Department of Interior.

References: https://tlp.el.erdc.dren.mil/case-studies/#prime-hook https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Prime-Hook_07112017.pdf

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Name of Project: Anacostia River Fringe Wetland Creation

Location: Washington D.C.

Year: 2003

Area (acres): 2 areas created: one 4 acres and one 13 acres

Total Project Cost: $3,000,000 **Cost per Area (estimate):** $194,117/acre

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Dredged material used to create wetlands. Restore marsh habitat that was destroyed in the 1990s

Method of Sediment Transport and Placement: Hydraulically

Purpose of the Project: To restore pieces of the once extensive tidal freshwater marsh habitat that bordered the river historically, prior to the dredge and fill operations and sea wall installation that took place in the early to mid-1900's

Preservation of Built Infrastructure / Direct Connection to Public Use: To restore pieces of the once extensive tidal freshwater marsh habitat that bordered the river historically, prior to the dredge and fill operations and sea wall installation that took place in the early to mid-1900's

Monitoring, Updates, Results: Monitored for 5 years post-construction (2003-2007)

Additional Information (if any): A series of 3 total marsh restoration projects on the Anacostia River (Kenilworth (1993) and Kingman Marsh (2000) the first two) and Fringe Wetlands being the third

References: https://tlp.el.erdc.dren.mil/case-studies/#anacostia
https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/Anacostia-Fringe-Report-02-04-2009.pdf

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Name of Project: **John H. Chafee National Wildlife Refuge

Location: Narragansett and South Kingstown, RI

Year: 2016 (ongoing)

Area (acres): 14 acres of degraded tidal marsh (part of the 550-acre refuge)

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: The addition of dredged material to 14 acres of degraded salt marsh occurred in the winter of 2016-2017. Areas of marsh with signs of stressed vegetation and expanding pond areas were targeted to receive sediment. The sediment was obtained from channel dredging for eelgrass restoration in a nearby tidal flat. The sediment was

mainly composed of fine sands, with some fines present. Sediment was placed on the marsh surface using mechanical methods to reach target elevations for high marsh habitat.

Purpose of the Project: Habitat Restoration. A combination of sea level rise and storm impacts from Hurricane Sandy resulted in the degradation of this tidal salt marsh

Preservation of Built Infrastructure / Direct Connection to Public Use: Habitat Restoration. A combination of sea level rise and storm impacts from Hurricane Sandy resulted in the degradation of this tidal salt marsh

Monitoring, Updates, Results: Extensive monitoring prior to restoration and construction was completed and will continue as the salt marsh recovers. Monitoring efforts include estuarine fish, salt marsh nekton, water quality, tidal flow and volumes, shoreline conditions, salt marsh elevations, and bird usage.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#chafee https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Narrow-River_07112017.pdf

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Name of Project: Barataria Basin, LA

Location: Lafourche Parish, LA

Year: 1986

Area (acres): 17 m^2

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: Approximately 17 square meters of salt marshes located in Barataria Basin, LA received sediment applications at depths of 2-3 cm or 4-5 cm. The applied sediment consisting of 40% fine sand, 28% coarse-fine silt, and 32% clays and organics was manually applied to the marsh surface from a nearby location.

Purpose of the Project: Marsh nourishment. The main purpose of this project was to ameliorate vegetation stress from increased inundation and accumulation of toxic sulfides.

Preservation of Built Infrastructure / Direct Connection to Public Use: Marsh nourishment. The main purpose of this project was to ameliorate vegetation stress from increased inundation and accumulation of toxic sulfides.

Monitoring, Updates, Results: Aboveground biomass and vertical marsh accretion was assessed between reference marshes and marshes that received sediment. The addition of sediment to the

marsh surface increased plant productivity, and decreased inundation due to an increase in elevation and nutrient supply.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#barataria https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Barataria-Basin-LA_07112017.pdf

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Name of Project: Bayou Lafourche

Location: Lafourche Parish, Leeville, LA

Year: 2002

Area (acres): 7.5 hectares

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: Dredged material was placed on the marsh using the sediment-slurry technique, which utilizes a high water to sediment ratio to spread dredged material across the marsh surface. Sediment was hydraulically dredged from Bayou Lafourche and applied to the marsh surface. The sediment-water slurry consisted of 20-30% solids and 70-80% water

Purpose of the Project: Marsh nourishment. This marsh experienced a large scale disturbance in 2000 as a result of a record drought. The drought caused the sudden dieback of Spartina alterniflora. In some areas the marsh did not re-vegetate after the disturbance and was converted to mudflats. Dredged material was placed on previously vegetated areas to promote vegetation regrowth

Preservation of Built Infrastructure / Direct Connection to Public Use: Marsh nourishment. This marsh experienced a large scale disturbance in 2000 as a result of a record drought. The drought caused the sudden dieback of Spartina alterniflora. In some areas the marsh did not re-vegetate after the disturbance and was converted to mudflats. Dredged material was placed on previously vegetated areas to promote vegetation regrowth

Monitoring, Updates, Results: Seven years after placement, the marshes that received dredged material had equivalent total aboveground biomass, live biomass, stem density, and height of Spartina alterniflora comparable to the reference marsh.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#lafourche https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Bayou-Lafourche_07112017.pdf

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Name of Project: Big Egg Marsh Experimental Restoration in Jamaica Bay

Location: Jamaica Bay, New York

Year: The dredging and spraying were planned to start in summer 2003, immediately after the environmental compliance was completed.

Area (acres): N/A

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: The remaining two "action" alternatives that were considered further depended on excavating sand from a trench in the adjacent tidal creek. One of these alternatives was to dredge a thin layer off the entire creek bottom, and the other was to dredge a deep narrow trench. The latter, the ecologically preferred alternative, was chosen because it was expected to provide the purest sand for the marsh surface while having the least impacts on the local fauna. The selected method for applying sand to the experimental restoration site is by means of a small barge with a swing-ladder dredge and a high-pressure spray (Figure 8). The intake end is the swing ladder, which moves side-to-side across a swath 6.7 m wide with a maximum depth of 1.8 m. The intake pipe has a rotating cutting head at its distal end. The slurry that enters is pumped through a 20-cm diameter pipe, and then reduced to a 10-cm diameter nozzle that sits 3 m above the stern. The slurry spray is supposed to deliver to a distance of around 60 m. This spray technique was chosen because it was expected to be less destructive to the remnant marsh than conventional dredging. The plan was to add layers of sand to elevate the treatment site generally a minimum of 20 cm above the plane of the highest existing remnant Prescribed places within the site were to receive an additional layer of sand up to 23 cm thick, to attain a maximum elevation of 43 cm above the reference plane. The lowest-lying mudflats and drainages (which cut below the reference plane) were, therefore, to receive up to 100 cm of fill. The design was to place most of the sand in an L-shaped ridge, paralleling a bend in the adjacent creek. The total volume of sand needed was estimated at 5,000 to 6,000 cu m. Sand was to be dredged from a trench along the deepest part of the creek bottom, and sprayed throughout the fill site.

Purpose of the Project: To address the question of what is an effective and long-lasting method for saltmarsh restoration, Gateway National Recreation Area undertook the Big Egg Marsh experimental restoration. The project area comprises approximately 1 ha of restored saltmarsh and an adjacent 1 ha of control (or reference) marsh in the southern side of Jamaica Bay. This site was selected because the saltmarsh is well along in transforming to a bare mudflat. It also is conveniently located adjacent to Broad Channel village, where there is easy access for interpretive activities and for the public's participation in the Volunteers-in-Parks (VIP) program.

Preservation of Built Infrastructure / Direct Connection to Public Use: To address the question of what is an effective and long-lasting method for saltmarsh restoration, Gateway National Recreation Area undertook the Big Egg Marsh experimental restoration. The project area comprises approximately 1 ha of restored saltmarsh and an adjacent 1 ha of control (or reference) marsh in the southern side of Jamaica Bay. This site was selected because the saltmarsh is well along in transforming to a bare

mudflat. It also is conveniently located adjacent to Broad Channel village, where there is easy access for interpretive activities and for the public's participation in the Volunteers-in-Parks (VIP) program.

Monitoring, Updates, Results: The Big Egg Marsh experimental restoration is technically successful insofar as the sand is transforming into a silty and organic saltmarsh soil, there is a dense cover of smooth cordgrass, and an appropriate animal community is becoming established on the treatment site. Geese grazing and rooting increased in intensity inside the fenced treatment site after the first ten months, apparently due to habituation. Consequently the goose-deterring fence will need to be rigorously maintained in place for an additional year, or alternative goose-scaring methods will be needed. Although the results are good to date, it remains to be seen how many decades the restored site will last. Gateway currently is collaborating with the Army Corps of Engineers to restore at least 12 ha of saltmarsh at Elder's Point, in the north side of Jamaica Bay. The findings from Big Egg Marsh will be useful for designing and monitoring the Elder's Point restoration.

Additional Information (if any): N/A

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studie.May 2010. Prepared by Craig Vogt Inc.

Name of Project: Craney Island

Location: Virginia

Year: N/A

Area (acres): N/A

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Continuous dredged material deposition activities occur at the Craney Island facility year-round. It has been the researchers' experience that dredged material deposition operations and nesting birds can coexist. Management efforts include plans for all seasons, including managing cells for nesting, migrating, and wintering seasons. For example, water levels in the cells can be raised during the migration season and lowered during the wintering season.

Preservation of Built Infrastructure / Direct Connection to Public Use: Continuous dredged material deposition activities occur at the Craney Island facility year-round. It has been the researchers' experience that dredged material deposition operations and nesting birds can coexist. Management efforts include plans for all seasons, including managing cells for nesting, migrating, and wintering seasons. For example, water levels in the cells can be raised during the migration season and lowered during the wintering season.

Monitoring, Updates, Results: Habitat creation using dredged material works. The maximum of 287 pairs of nesting Least Terns constitutes the most successful Least Tern site in Virginia. Also there were five pairs of nesting Piping Plovers. Predation has been significant, especially from foxes, feral cats, and wild dogs. Predation control has had limited or no success. Greater than half of the shoreline foraging area has been removed due to the addition of riprap; this is particularly important for the Piping Plover. Moreover, increased dredging operations are removing the 3-year rotational cell concept; now all three cells receive dredged material every year. This practice is adversely impacting previously successful nesting sites.

Additional Information (if any): The current management approach includes seven principal features:

- Yearly joint planning sessions with Corps' representatives
- The creation of suitable habitat for beach nesting species using dredged material
- Continued maintenance of sites
- Identifying, posting, and protection of all active nesting sites
- Frequent monitoring of the seasonal bird communities
- Predator management and control
- Production of weekly reports and recommendations to on-site management of cells.

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Deer Island

Location: Mississippi Sound

Year: Containment dike completed in March 2003. Filled from May 2003-August 2003.

Area (acres): 30

Total Project Cost: $1,000,000 **Cost per Area (estimate):** $33,333/acre

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: Dredged material from maintenance of Biloxi Harbor was used to create approximately 30 acres (300 feet by 4300 feet) of tidal marsh on the north shore of the east end of the island. Material removed from the channel by hydraulic dredge was deposited inside a containment levee constructed of natural material from the adjacent bottom. Deposited fill material was managed to achieve drying, settlement, and consolidation at the desired final elevation of +2 - - .5 NGVD, a range suitable for marsh establishment. The final grade of the restoration matches the elevation of the existing shoreline and provides drainage away from the island. Once the desired elevation was achieved, the containment dikes were lowered to match the elevation of the restored marsh.

Purpose of the Project: N/A

Preservation of Built Infrastructure / Direct Connection to Public Use: N/A

Monitoring, Updates, Results: After a consolidation period estimated at less than two years, the marsh elevation was finalized and native marsh plants were planted.

Additional Information (if any): N/A

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Fowl River

Location: Mobile County, Mobile, Alabama

Year: 1986 (dredging operations completed in one month)

Area (acres): 240

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: The material was dredged hydraulically with a 6-blade cutterhead at 487-497 CY/hr and placed in the disposal area with a wing-mounted baffle plate connected to the pipeline slurry discharge.

Purpose of the Project: The main purpose of this project was to determine the physical and biological impacts caused by thin layer placement

Preservation of Built Infrastructure / Direct Connection to Public Use: The main purpose of this project was to determine the physical and biological impacts caused by thin layer placement

Monitoring, Updates, Results: N/A

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#fowl https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Fowl-River-final.pdf

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Name of Project: Galveston GIWW, Laguna Madre

Location: Nueces, Kenedy, Kleberg, Willacy and Cameron Counties, Multiple cities in the South Texas Gulf Coast, TX

Year: N/A

Area (acres): N/A

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: The Laguna Madre section of the GIWW requires regular maintenance dredging, hence the Dredged Material Placement Plan (DMPP) is considering thin layer placement for three placement areas (PAs). These PAs will be managed primarily for reducing impact to nearby seagrass habitat, bird use, or vegetation control.

Preservation of Built Infrastructure / Direct Connection to Public Use: The Laguna Madre section of the GIWW requires regular maintenance dredging, hence the Dredged Material Placement Plan (DMPP) is considering thin layer placement for three placement areas (PAs). These PAs will be managed primarily for reducing impact to nearby seagrass habitat, bird use, or vegetation control.

Monitoring, Updates, Results: N/A

Additional Information (if any): Long term impacts to seagrass from being covered with a thin layer of dredge material would be minimized if the material is placed in the winter months when the seagrass is photosynthetically inactive (Galveston Bay Foundation 2012)

References: https://tlp.el.erdc.dren.mil/case-studies/#galveston-giww,-laguna-madre
https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet-Laguna-Madre-final.pdf

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Name of Project: Gull Rock

Location: Hyde County, Swanquarter, NC

Year: 1982

Area (acres): N/A

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: Approximately 10,000 to 20,000 CY of dredged material consisting of clay, silt, and fine sand were sprayed on one site with a 6-in. pipeline that split to feed two 3-in. independent discharge nozzles. Sediment layer thickness ranged from 0.4 to 4 in., with an

average thickness of about 2 in. Additional material was sprayed on a 2nd site site in a thin layer ranging from 0.4 to 8 in., with an average thickness of approximately 4 in.

Purpose of the Project: Evaluate physical and environmental effects of dredged material placed 9 years earlier in two different marsh areas located in Gull Rock, NC.

Preservation of Built Infrastructure / Direct Connection to Public Use: Evaluate physical and environmental effects of dredged material placed 9 years earlier in two different marsh areas located in Gull Rock, NC.

Monitoring, Updates, Results: Nine years after thin layer placement, the canal and marsh were assessed to capture the long-term effects of the placement activities

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#gull https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Gull-Rock-final.pdf

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Name of Project: High Salt Marsh in Georgia

Location: Glynn County, Brunswick, Brunswick, GA

Year: 1978

Area (acres): N/A

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: The purpose of this project was to evaluate the recovery response of salt marsh vegetation and impact of selected species of crabs and snails upon thin layer placement of dredged material.

Preservation of Built Infrastructure / Direct Connection to Public Use: The purpose of this project was to evaluate the recovery response of salt marsh vegetation and impact of selected species of crabs and snails upon thin layer placement of dredged material.

Monitoring, Updates, Results: The results from this pilot scale study indicated that marsh elevation could be altered through thin layer placement of dredged material up to 23 cm (9 in.) without loss of the functional values of the ecosystem and environment.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#high-salt-marsh-in-georgia https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet-template_Georgia-final.pdf

Name of Project: Honga River and Tar Bay

Location: N/A

Year: N/A

Area (acres): N/A

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: Hydraulically "placed hydraulically behind containment"

Purpose of the Project: N/A

Preservation of Built Infrastructure / Direct Connection to Public Use: N/A

Monitoring, Updates, Results: N/A

Additional Information (if any): Initially the material was contained with geotubes, but failure of the geotubes required later armoring with rock. The site was planted approximately one month post placement. The placed material was mainly composed of sand; therefore, bulldozers were used to keep moving the material and achieve final grading. Multiple placement events occurred at the site over a period of 8 years.

References: https://tlp.el.erdc.dren.mil/case-studies/

Name of Project: Houston Galveston Bay

Location: N/A

Year: N/A

Area (acres): Since the project was initiated, 4,500 acres of marsh/habitat have been created

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: Great Lakes Dredge and Dock Co., using the dredge California, completed all placement area levees. Renda Marine, Inc., a sub-contractor, completed placing beach fill on the bird island in mid-August 2000. Placement of geotubes around the marsh at Bolivar was completed in late September 2000.

Purpose of the Project: N/A

Preservation of Built Infrastructure / Direct Connection to Public Use: N/A

Monitoring, Updates, Results: N/A

Additional Information (if any): The project was awarded the 1996 American Association of Port Authorities Environmental Enhancement Award.

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Jamaica Bay

Location: Queens County, New York City, NY

Year: 2000

Area (acres): N/A

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Marsh nourishment/habitat restoration. The main objectives were to evaluate the effectiveness of a new method of sediment transfer and placement to increase marsh elevation and the growth of marsh vegetation through thin layers of placed sediment

Preservation of Built Infrastructure / Direct Connection to Public Use: Marsh nourishment/habitat restoration. The main objectives were to evaluate the effectiveness of a new method of sediment transfer and placement to increase marsh elevation and the growth of marsh vegetation through thin layers of placed sediment

Monitoring, Updates, Results: The project site, along with a 2 acre control site, was monitored one year pre- and post-construction

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#jamaica-bay https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Jamaica-Bay-final.pdf

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Name of Project: Johns Island

Location: Lake Worth Lagoon Estuary, North Palm Beach, Florida

Year: Construction contract completed in 2004

Area (acres): N/A

Total Project Cost: $826,000 **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Originally, a portion of Johns Island was a submerged shallow-water habitat. Because of the numerous dredging activities, most of the island has become an impacted upland dominated by exotic species such as, Seaside Mahoe, Australian Pine, and Brazilian Pepper. The purpose of the project is to restore the submerged shallow water habitat for fisheries and wildlife. The restoration project included the following features: 1) restoration of approximately 1.7 acres of existing mangroves, 2) creation of approximately 3.3 acres of red mangroves, and 3) enhancement of approximately 1.4 acres of maritime hammock.

Preservation of Built Infrastructure / Direct Connection to Public Use: Originally, a portion of Johns Island was a submerged shallow-water habitat. Because of the numerous dredging activities, most of the island has become an impacted upland dominated by exotic species such as, Seaside Mahoe, Australian Pine, and Brazilian Pepper. The purpose of the project is to restore the submerged shallow water habitat for fisheries and wildlife. The restoration project included the following features: 1) restoration of approximately 1.7 acres of existing mangroves, 2) creation of approximately 3.3 acres of red mangroves, and 3) enhancement of approximately 1.4 acres of maritime hammock.

Monitoring, Updates, Results: N/A

Additional Information (if any): N/A

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Mississippi Sound

Location: Hancock, Harrison, Jackson and Mobile (AL) Counties, Waveland/Dauphin Island, MS/AL

Year: 1992-1993

Area (acres): 1 MCY from the channel (maintenance material) that were subsequently placed in a thin layer with thickness ≤ 12 in. in three, 300-acre disposal areas along the west side of the channel. Similarly, 1 MCY of new work material was removed and placed in a thi

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: N/A

Preservation of Built Infrastructure / Direct Connection to Public Use: N/A

Monitoring, Updates, Results: Each disposal area was monitored for water quality and benthic community responses predisposal, during disposal, short-term postdisposal, and long-term after post disposal.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#mississippi-sound
https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Mississippi-Sound-final.pdf

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Name of Project: Munyon Island

Location: Lake Worth Lagoon Estuary, North Palm Beach, Florida

Year: Munyon Island has been the site of major restoration efforts since 1992

Area (acres): The sponsor (Palm Beach County) had completed restoration of 9.6 acres of wetland habitat prior to this project. The third phase resulted in restoration of approximately 9.6 acres of mangrove and spartina wetland habitat.

Total Project Cost: $1,714,000 **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: The Munyon Island Environmental Restoration Project is designed to provide habitat for fisheries and wildlife to rejuvenate Lake Worth Lagoon Estuary by increasing habitat and food supply for estuarine dependent fauna and flora.

Preservation of Built Infrastructure / Direct Connection to Public Use: The Munyon Island Environmental Restoration Project is designed to provide habitat for fisheries and wildlife to rejuvenate Lake Worth Lagoon Estuary by increasing habitat and food supply for estuarine dependent fauna and flora.

Monitoring, Updates, Results: N/A

Additional Information (if any): Cost shared 75% Federal and 25% non-Federal.

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Paul J. Rainey Wildlife Sanctuary

Location: Vermillion Parish, LA

Year: 2008

Area (acres): 20, 3m by 4m sites

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: Dredged material was mechanically pumped from a nearby oil canal into 20, 3 m by 4 m contained areas within the marsh located in the Paul J. Rainey Wildlife Sanctuary, LA. Four different sediment depths were achieved by using the high water to sediment ratio sediment-slurry technique for spreading the dredged material. Sediment was applied to depths of either no sediment (control), 0-10 cm, 10-15 cm, or 15-20 cm.

Purpose of the Project: Marsh nourishment. The objective of this restoration project was to mechanically place dredged material on the marsh surface to increase the elevation and decrease inundation.

Preservation of Built Infrastructure / Direct Connection to Public Use: Marsh nourishment. The objective of this restoration project was to mechanically place dredged material on the marsh surface to increase the elevation and decrease inundation.

Monitoring, Updates, Results: After three years, elevation gains of 3 cm were seen in the highest deposition areas as a result of consolidation and compression of the organic material below. Increased plant productivity due to nutrient additions was observed despite the small elevation gain. In addition, thicker thin layer placement applications onto the marsh resulted in a decrease in sulfide concentration and an increase in sulfate concentration.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#rainey https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Rainey-Wildlife_071120177.pdf

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Name of Project: Peanut Island

Location: Lake Worth Lagoon Estuary, North Palm Beach, Florida

Year: N/A

Area (acres): Island is 79 acres. Environmental restoration includes 46 acres of habitat in the Lake Worth Lagoon. Clearing 60 acres of exotic vegetation. Excavating/removing 1.2 million cubic yards of dredged material deposits to create upland/wetland habitat and publ

Total Project Cost: $32,000,000 **Cost per Area (estimate):** $38,000/acre

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: The environmental enhancement of Peanut Island will provide integral habitat for fisheries and wildlife in the Lake Worth Lagoon, while interfacing with the Island's function as a dredged material management site and popular boating and recreational destination for the public. The environmental restoration project at Peanut Island includes restoration of 43 acres of habitat in the Lake Worth Lagoon. The project consists of clearing/chipping 60 acres of exotic vegetation and excavating/removing approximately 1.2 million cubic yards of dredged material deposits to create upland/wetland habitat and public access features.

Preservation of Built Infrastructure / Direct Connection to Public Use: The environmental enhancement of Peanut Island will provide integral habitat for fisheries and wildlife in the Lake Worth Lagoon, while interfacing with the Island's function as a dredged material management site and popular boating and recreational destination for the public. The environmental restoration project at Peanut Island includes restoration of 43 acres of habitat in the Lake Worth Lagoon. The project consists of clearing/chipping 60 acres of exotic vegetation and excavating/removing approximately 1.2 million cubic yards of dredged material deposits to create upland/wetland habitat and public access features.

Monitoring, Updates, Results: N/A

Additional Information (if any): Peanut Island is located in the north-central Lake Worth Lagoon Estuary. The island was created by the Lake Worth Inlet District in 1918 with dredged material from the original excavation of the channel between Lake Worth and the ocean. The island has been used by the U.S. Army Corps of Engineers (USACE), the Florida Inland Navigation District (FIND), and the Port of Palm Beach for placement of dredged material. The area that includes Peanut Island was a submerged shallow water habitat. The entire island has become an impacted upland dominated by the exotic species known as Australian pine due to fill placed from numerous dredging projects.

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Poplar Island

Location: Poplar Island, Port of Baltimore, Chesapeake Bay, Maryland

Year: Plan conceived 1996 (Phase 1 2000; Phase 2 2002; Phase 3 2004; Phase 4 2008)

Area (acres): Under the 1996 plan, the restoration of the island involves placing approximately 42 million cubic yards of dredged material behind 40,000 feet of containment dikes to create a 1,140-acre island with equal areas of tidal marsh and upland habitat.

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: The project consists of reconstructing Poplar Island using clean dredged material from the from the Chesapeake Bay approach channels to the Port of Baltimore. The plan for rebuilding the island was developed through the cooperative efforts of many federal and state agencies, as well as private organizations.

Preservation of Built Infrastructure / Direct Connection to Public Use: The project consists of reconstructing Poplar Island using clean dredged material from the from the Chesapeake Bay approach channels to the Port of Baltimore. The plan for rebuilding the island was developed through the cooperative efforts of many federal and state agencies, as well as private organizations.

Monitoring, Updates, Results: Through the 2006-2007 inflow season, approximately 17 million cubic yards of dredged material from the Port of Baltimore approach channels have been placed at Poplar Island. Future dredged material placement will occur annually over the life of the project. As the dredged material continues to be placed and shaped on the island, wetland and upland cells will be graded to final elevations and planted.

Additional Information (if any): N/A

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Port Fourchon: Restoration of a Maritime Forest Ridge and Marsh Habitats

Location: Fourchon, Louisiana

Year: Initial 2001

Area (acres): 970

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: This project includes pumping earthen material via hydraulic dredge and placed in shallow open water to a height of plus four feet. Constructed in phases, each of the three components when finished will mean the restoration of over 100 acres of chenier ridge/marsh habitat that will encompass some 12,000 linear feet in length by 400 feet in width. The earthen material once dried will be shaped into a marsh platform at a plus 1.6 feet elevation and the crown of the ridge at a plus eight feet.

Purpose of the Project: This project serves several purposes. First, it will help protect the mitigation areas to its south from the continual pounding of waves thereby helping preserve the existence of these newly developed mitigation sites. Second, it will serve as habitat not only for many fish and shellfish species but also for many neotropical migratory bird species and small furbearers. Third, it will provide for ecotourism opportunities once completed.

Preservation of Built Infrastructure / Direct Connection to Public Use: This project serves several purposes. First, it will help protect the mitigation areas to its south from the continual pounding of waves thereby helping preserve the existence of these newly developed mitigation sites. Second, it will serve as habitat not only for many fish and shellfish species but also for many neotropical migratory bird species and small furbearers. Third, it will provide for ecotourism opportunities once completed.

Monitoring, Updates, Results: N/A

Additional Information (if any): In early 2001, the Barataria-Terrebonne National Estuary Program and the Greater Lafourche Port Commission fostered a partnership with other organizations to reestablish a chenier ridge and associated coastal marsh habitats in south east Louisiana. This partnership was born from a desire to further the knowledge and expand the focus of habitat restoration in coastal Louisiana from purely a vision that supported marsh restoration to one that encompassed other natural landscape features. Louisiana's unparalleled coastal wetland loss problem means dire consequences for many species of birds. But of as equal importance or the distributary ridges and chenier ridges that too are being lost at an alarming rate. These ridge habitats and associated wetlands are extremely important for millions of migrating Neotropical songbirds that cross the Gulf of Mexico in the spring each year on their way back to their breeding grounds in the eastern United States and Canada. Both herbaceous grasses and woody plants that tolerate the harsh growing conditions of coastal Louisiana will be planted. The woody plants that are to be used are those that are known to be important to Neotropical migrant songbirds.

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Snook Islands

Location: Lake Worth Lagoon Estuary, North Palm Beach, Florida

Year: N/A

Area (acres): This project has effectively added 100 acres of good quality wetland habitat to the central part of Lake Worth Lagoon

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Snook Islands Natural Area was created with the 1.2 million cubic yards of material removed from Peanut Island.

Preservation of Built Infrastructure / Direct Connection to Public Use: Snook Islands Natural Area was created with the 1.2 million cubic yards of material removed from Peanut Island.

Monitoring, Updates, Results: The Snook Island project has effectively added 100 acres of good quality wetland habitat to the central part of Lake Worth Lagoon and is expected to improve the poor water quality in this area. Seagrasses are already recruiting in the shallow-water habitat, birds are utilizing the open areas of shoreline and mud flats, and fishermen have reported catching numerous large snook, redfish, snapper, jacks, and flounder.

Additional Information (if any): Significant construction issues emerged during the placement of the 1.2 million cubic yards of the material transported to the site. The project intent was to cap the existing sediments with the sandy material transported to the site. The intentions were not realized. The inability to cap the material required changes in the project design and also resulted in a significant cost increase. The final project is an excellent example of restoration but could have been even better had the designers intent been realized.

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Sonoma Baylands

Location: California

Year: In late 1992, Congress directed the Corps of Engineers to construct the Sonoma Baylands Wetland Demonstration Project.

Area (acres): 830 (and a 39-acre pilot project at Sonoma Baylands)

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: N/A

Purpose of the Project: The Sonoma Land Trust and the California State Coastal Conservancy conceived and developed the Sonoma Baylands project to protect and restore agricultural lands, seasonal wetlands and tidal salt marsh on a 830-acre parcel of land. As part of that overall project, the Conservancy funded the development of a plan to restore tidal salt marsh on a 320-acre hayfield on the shoreline of San Pablo Bay. The Conservancy's restoration consultant recommended the use of dredged material to accelerate the restoration of salt marsh on lands that had subsided up to six feet.

Preservation of Built Infrastructure / Direct Connection to Public Use: The Sonoma Land Trust and the California State Coastal Conservancy conceived and developed the Sonoma Baylands project to protect and restore agricultural lands, seasonal wetlands and tidal salt marsh on a 830-acre parcel of land. As part of that overall project, the Conservancy funded the development of a plan to restore tidal salt marsh on a 320-acre hayfield on the shoreline of San Pablo Bay. The Conservancy's restoration consultant recommended the use of dredged material to accelerate the restoration of salt marsh on lands that had subsided up to six feet.

Monitoring, Updates, Results: The Sonoma Baylands project began attracting large numbers of shorebirds and waterfowl even before the restoration of tidal action. The Corps and Coastal Conservancy are continuing to closely monitor the development of the marsh. The tidal channels that connect the project to the open waters of the Bay have gradually expanded, increasing the range of tidal action and the amount of sediment deposition in the restoration area. Salt marsh vegetation quickly colonized the entire perimeter of the restoration area and is gradually expanding further toward the center of the site as additional sediment is naturally deposited over the dredged material. The site continues to provide a feeding and resting area for large numbers of shorebirds and waterfowl as development of the young marsh continues to progress

Additional Information (if any): N/A

References: Report For Great Lakes Council Final Report, Beneficially Using Dredged Materials to Create/Restore Habitat and Restore Brownfields, and Team Collaborative Efforts that have Achieved Succes, Examples/Case Studies. May 2010. Prepared by Craig Vogt Inc.

Name of Project: Southern Mississippi River Delta

Location: Plaquemines Parish, Venice, LA

Year: 1992

Area (acres): 43 acres

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): N/A

Method of Sediment Transport and Placement: The salt marsh received sediment additions as a slurry (85% liquid, 15% solids)

Purpose of the Project: Marsh nourishment. The salt marsh was degraded due to a combination of a high rate of sea level rise, subsidence, and sediment deficiencies as levees prevent regular flooding from the Mississippi River. The rate of sea level rise for the Mississippi River Delta experienced by this degraded marsh ranged between 0.36 and 1.77 cm yr-1.

Preservation of Built Infrastructure / Direct Connection to Public Use: Marsh nourishment. The salt marsh was degraded due to a combination of a high rate of sea level rise, subsidence, and sediment deficiencies as levees prevent regular flooding from the Mississippi River. The rate of sea level rise for the Mississippi River Delta experienced by this degraded marsh ranged between 0.36 and 1.77 cm yr-1.

Monitoring, Updates, Results: The addition of sediment to the marsh surface at intermediate depths reduced vegetation stress associated with prolonged inundation by increasing soil aeration and reducing the accumulation of toxic sulfides. After 15 years, the marsh area that received intermediate sediment depths were stable and resilient to experimental disturbances, suggesting sediment additions to degraded marshes at appropriate depths is a sustainable restoration technique

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#southern-MS https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_South-Venice-LA_07112017.pdf

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Name of Project: Bayou Segnette Waterway

Location: Jefferson Parish, New Orleans, LA

Year: 2010

Area (acres): 21,772 acres

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Sediment remediation/thin layer capping

Preservation of Built Infrastructure / Direct Connection to Public Use: Sediment remediation/thin layer capping

Monitoring, Updates, Results: Visual inspection of the 2010 thin layer placement sites indicated that the areas appeared to be thriving one growing season after placement. Results obtained from this study showed that thin layer capacity is dependent on the location of the discharge pipe and the placement thickness of the material. If the discharge pipe is located at the top of the spoil bank (as assumed) most of the material can be placed directly on the marsh.

Additional Information (if any): The success of thin layer placement on floating marsh depends on the ability of the marsh to maintain buoyancy during and after placement, and the resiliency of marsh vegetation which are influenced by the placed material thickness and physical characterization.

References: https://tlp.el.erdc.dren.mil/case-studies/#bayou-segnette-waterway https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Bayou-Segnette-Waterway-final.pdf

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Name of Project: Blackwater National Wildlife Refuge Restoration

Location: Maryland

Year: N/A

Area (acres): 2 1-2 acre sites

Total Project Cost: 300,000 **Cost per Area (estimate):** $100,000/acre

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: Hydraulically

Purpose of the Project: Ecosystem restoration

Preservation of Built Infrastructure / Direct Connection to Public Use: Ecosystem restoration

Monitoring, Updates, Results: N/A

Additional Information (if any): Hydroseeding was attempted by adding seeds to the dredged material spray. The material was placed in 2 lifts of small thickness which allowed the sites to become revegetated in a short period of time

References: https://tlp.el.erdc.dren.mil/case-studies/

Name of Project: Commercial Township Salt Hay Farm

Location: Cumberland County, Commercial Township, NJ

Year: 1996

Area (acres): 42 hectares (of 1670 hectares- Part of a larger Estuary Enhancement Program)

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: The restoration project comprises of 1,670 ha of degraded coastal marshes as a result of being diked.The objective of this project was to restore salt marsh function to the area and improve high marsh and channel habitat; the use of thin layer placement of dredged material was used to accelerate marsh restoration. The addition of sediment to low elevation areas within the restoration site occurred in 1996 by utilizing dredged material from the site construction, mainly from excavation of channels and breaches in the dike. The addition of dredged material to areas of low elevation resulted in raising the marsh elevation greater than mean high water to support high marsh habitat.

Purpose of the Project: Habitat Restoration. The combination of reduced sedimentation, soil compaction from heavy machinery, and soil oxidation resulted in the subsidence of the marsh surface.

Preservation of Built Infrastructure / Direct Connection to Public Use: Habitat Restoration. The combination of reduced sedimentation, soil compaction from heavy machinery, and soil oxidation resulted in the subsidence of the marsh surface.

Monitoring, Updates, Results: After three years, the Spartina alterniflora cover was 10% of the marsh surface at the Commercial Township Salt Hay. The slow recovery of the vegetation may be attributed to lower elevations than necessary for Spartina alterniflora to vegetate.

Additional Information (if any): The Estuary Enhancement Program and subsequent restoration of the Commercial Township Salt Hay farm is the result of a legal settlement to offset environmental effects, particularly loss of fish biomass, from power generation on the Delaware Bay. Project was funded by The Public Service Electric and Gas Company, Trenton, NJ.

References: https://tlp.el.erdc.dren.mil/case-studies/#commercial-township
https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Delaware-Bay_07112017.pdf

Name of Project: Freeman Creek

Location: North Carolina

Year: 2017 (ongoing)

Area (acres): 75 square meters

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: The purpose of this demonstration project is to provide the foundation for use of thin layer placement of dredged material in similar location by developing a list of parameters and models predictions that are necessary for applying thin layer placement of dredged material to coastal wetlands. The results of the Coastal Wetland monitoring program indicate that the marsh platform at the project site is 20-25 cm below "optimal" growth elevations for Spartina alterniflora. Approximately 5 to 10 cm of dredged material were placed in three experimental plots in March/April 2017.

Purpose of the Project: Demonstration Project; Marsh nourishment. The results of the Coastal Wetland monitoring program indicate that the marsh platform at the project site is 20-25 cm below "optimal" growth elevations for Spartina alterniflora. Output from the Marsh Equilibrium Model (MEM; Morris et al 2002) suggest that this marsh is in danger of drowning by the end of the century due to its low elevation and limited sediment supply. The application of dredged material to coastal ecosystems to provide resilience to sea level rise and coastal storms is of growing interest in the Southeast region. A primary goal of this demonstration project is to provide the foundation for use of thin layer placement of dredged material in similar locations by developing a list of parameters and model predictions that are necessary for applying this technology to coastal wetlands

Preservation of Built Infrastructure / Direct Connection to Public Use: Demonstration Project; Marsh nourishment. The results of the Coastal Wetland monitoring program indicate that the marsh platform at the project site is 20-25 cm below "optimal" growth elevations for Spartina alterniflora. Output from the Marsh Equilibrium Model (MEM; Morris et al 2002) suggest that this marsh is in danger of drowning by the end of the century due to its low elevation and limited sediment supply. The application of dredged material to coastal ecosystems to provide resilience to sea level rise and coastal storms is of growing interest in the Southeast region. A primary goal of this demonstration project is to provide the foundation for use of thin layer placement of dredged material in similar locations by developing a list of parameters and model predictions that are necessary for applying this technology to coastal wetlands

Monitoring, Updates, Results: The site was monitored before thin layer implementation and will be monitored every 2 months for the first 2 years, then annually. Pore water sampling devices were installed in all plots for analysis of inorganic nutrient concentrations and water level sensors were installed on-site for generation of site-specific tidal datums.

Additional Information (if any): The success of thin layer placement of dredged material as a marsh nourishment strategy is dependent not only upon the final elevation achieved, but also on the

impact of sediment addition to site-specific edaphic factors that influence plant growth. The data generated through controlled thin layer placement experiments like this one will lead to a better understanding of how to best target thin-layer placement of dredged material to achieve optimum success. The experimental design also provides an assessment of coir log installations on plant growth and sediment accretion.

References: https://tlp.el.erdc.dren.mil/case-studies/#freeman-creek https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Freeman-Creek_07112017.pdf

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Name of Project: Galveston GIWW Dredging West Bay

Location: Galveston and Brazoria Counties, Galveston, Texas

Year: 2012 (ongoing)

Area (acres): N/A

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin Layer

Method of Sediment Transport and Placement: Hydraulically

Purpose of the Project: Marsh nourishment/Dredged material disposal

Preservation of Built Infrastructure / Direct Connection to Public Use: Marsh nourishment/Dredged material disposal

Monitoring, Updates, Results: The site will be monitored pre- and post-construction for seagrass and thin layer thickness

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#galveston https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Galveston-GIWW-Dredging-at-West-Bay-final.pdf

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Name of Project: Masonboro Island

Location: New Hanover County, Wilmington, NC

Year: 2000

Area (acres): A pilot scale study was conducted in a 1,800 ft^2 area consisting of 2 non-deteriorated and 2 deteriorated sites of 450 ft2 each

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: N/A

Purpose of the Project: To investigate the effects of placing dredged material on the surface of a back barrier tidal salt marsh located in Masonbro Island, NC, where sedimentation accrection is insufficient to maintain elevation in equilibrium with sea level rise

Preservation of Built Infrastructure / Direct Connection to Public Use: To investigate the effects of placing dredged material on the surface of a back barrier tidal salt marsh located in Masonbro Island, NC, where sedimentation accrection is insufficient to maintain elevation in equilibrium with sea level rise

Monitoring, Updates, Results: Monitoring of thin layer thickness, plant density, benthic community assemblage and abundance, and oxidation reduction potential was conducted every other month for approximately a year.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#masonboro-island
https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet-template_Masonboro-Island-final.pdf

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Name of Project: Mobile Bay

Location: Mobile County, Mobile, Alabama

Year: 2012/2014

Area (acres): N/A

Total Project Cost: $4,000,000 **Cost per Area (estimate):** $4 per cubic yard

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Sediment budgeting/Dredged material disposal

Preservation of Built Infrastructure / Direct Connection to Public Use: Sediment budgeting/Dredged material disposal

Monitoring, Updates, Results: Emergency in-bay thin layer placement was approved in 2012. Approximately 9 MCY dredged material were placed in a thin layer (thickness smaller than 12 in.) using a hydraulic cutterhead. A monitoring and modeling program were established to evaluate short and long term fate and transport of in-bay thin layer placement. The results of this program indicated that thin layer placement of dredged material in the bay will have negligible impact, hence a long-term in-bay thin layer placement program was approved in 2014.

Additional Information (if any): In 2014, 1MCY of dredged material was placed in a thin layer in-bay using a spill barge with a system of winches and a continuous GPS tracking system. Both of these thin layer placement efforts resulted in significant savings in dredging costs, less erodible material in the sediment surface, and a quick recovery of the benthic community.

References: https://tlp.el.erdc.dren.mil/case-studies/#mobile-bay https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet-Mobile-final.pdf

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Name of Project: Pepper Creek

Location: Sussex County, Dagsboro, DE

Year: 2013

Area (acres): 25

Total Project Cost: $125,000 **Cost per Area (estimate):** $5,000/acre

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: Hydraulically

Purpose of the Project: Mitigate the effects of marsh subsidence and sea level rise by placing a thin layer of dredged material over the marsh

Preservation of Built Infrastructure / Direct Connection to Public Use: Mitigate the effects of marsh subsidence and sea level rise by placing a thin layer of dredged material over the marsh

Monitoring, Updates, Results: The placement area was monitored daily and is still being monitored for layer thickness, vegetation, and biological and chemical conditions.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#pepper-creek https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Pepper-Creek-final.pdf

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Name of Project: Sachuest Point National Wildlife Refuge

Location: Middletown, RI

Year: 2015 (ongoing)

Area (acres): 11 acres of tidal salt marsh

Total Project Cost: $640,000 **Cost per Area (estimate):** $58,000/acre

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: Eleven thousand cubic yards of sand were spread across the marsh using mechanical methods to target marsh elevation ranging between 2.2 and 2.3 NAVD88. This target elevation range is on the high end of the elevation range for Spartina patens. A thin layer of sand ranging from 2.5 to 30 cm was placed in the marsh to achieve these target elevations

Purpose of the Project: Habitat Restoration. Elevation of the marsh prevented proper drainage at low tide. Development, redirection of the Maidford River, and storm impacts have accelerated marsh degradation due to sea level rise and lack of mineral sediment deposition. The marsh is experiencing a relative sea level rise of 0.28 cm y-1, a rate that is almost two times the estimated marsh accretion rates of 0.15 cm y-1. Storm surge and erosion have also led to marsh degradation. The main objective of the Maidford marsh restoration project is to mitigate storm impacts, i.e. flooding, vegetation death, and marsh break up, and enhance marsh habitat for endangered bird species through thin layer placement of dredged material.

Preservation of Built Infrastructure / Direct Connection to Public Use: Habitat Restoration. Elevation of the marsh prevented proper drainage at low tide. Development, redirection of the Maidford River, and storm impacts have accelerated marsh degradation due to sea level rise and lack of mineral sediment deposition. The marsh is experiencing a relative sea level rise of 0.28 cm y-1, a rate that is almost two times the estimated marsh accretion rates of 0.15 cm y-1. Storm surge and erosion have also led to marsh degradation. The main objective of the Maidford marsh restoration project is to mitigate storm impacts, i.e. flooding, vegetation death, and marsh break up, and enhance marsh habitat for endangered bird species through thin layer placement of dredged material.

Monitoring, Updates, Results: The addition of sand to the marsh has improved marsh drainage, alleviated flooding of nearby roads, and improved habitat necessary for the growth of salt marsh plants critical for Saltmarsh Sparrow nesting. Plugs of marsh grasses were planted in May 2016 in locations were thin layer thickness was greater than 10 cm.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#sachuest https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Sachuest-Point_07112017.pdf

Name of Project: Seal Beach

Location: Orange County, Seal Beach, CA

Year: 2015/2016

Area (acres): 10

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: An 8 to 10 in. thin layer of dredged material will be placed over 10 acres of a low elevation salt marsh in Oct-Jan 2015/2016. Approximately 10,000 to 13,500 CY of clean dredged material from the Main Channel West of Sunset Harbor will be placed on the site via rainbow sprayer, open pipe, or end-of-pipe baffle impingement.

Purpose of the Project: improve habitat quality and facilitate sea level rise (SLR) adaptation

Preservation of Built Infrastructure / Direct Connection to Public Use: improve habitat quality and facilitate sea level rise (SLR) adaptation

Monitoring, Updates, Results: Monitoring of vegetation, sediment dynamics, elevation, invertebrates and birds communities, and wetland biogeochemistry is planned pre and post placement.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#seal-beach https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Seal-Beach-NWR_final.pdf

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Name of Project: Silver Lake

Location: Berhshire County, Pittsfield, MA

Year: 2006/2013

Area (acres): 26 acres

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Sediment remediation/thin layer capping

Preservation of Built Infrastructure / Direct Connection to Public Use: Sediment remediation/thin layer capping

Monitoring, Updates, Results: In 2014, GE initiated inspection, monitoring and maintenance activities at the site to ensure that the capping systems were functioning effectively

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#silver-lake https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Silver-Lake-final.pdf

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Name of Project: South Slough National Estuarine Research Reserve

Location: Cooks County, Charleston, OR

Year: 1996

Area (acres): 5 acres

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: The addition of sediment to the 5 acre marsh occurred in 1996 by excavating the top 15 to 30 cm of existing marsh soil and vegetation; this material was stockpiled for redistribution once the marsh surface was elevated through thin layer placement. Approximately 10,000 cubic meters of dredged material was excavated from the Kunz Marsh dike and mechanically spread across the marsh to the desired marsh elevation. The stockpiled marsh soil was redistributed over the dredged material. Three marsh elevations were established: high, middle, and low intertidal marsh elevations to assess the formation of tidal channels.

Purpose of the Project: Habitat restoration. Dredged material was placed to mitigate loss of elevation due to diking. Diking of the marsh excluded tidal flooding while ditches redirected freshwater off the marsh. The combination of reduced sedimentation and soil oxidation resulted in the subsidence of the soil surface in Kuntz Marsh.

Preservation of Built Infrastructure / Direct Connection to Public Use: Habitat restoration. Dredged material was placed to mitigate loss of elevation due to diking. Diking of the marsh excluded tidal flooding while ditches redirected freshwater off the marsh. The combination of reduced sedimentation and soil oxidation resulted in the subsidence of the soil surface in Kuntz Marsh.

Monitoring, Updates, Results: Salt marsh vegetation communities responded faster in the high and mid marsh elevation. By 1999, permanentmarsh species were well established, particularly in the high marsh elevation. Permanent marsh species took longer to establish in the mid and low marsh elevation, but were recovering in a similar trajectory as the high marsh. The mid marsh elevation vegetated quickly and developed tidal channels at a rate that also enhanced sediment accretion on the marsh suggesting marsh elevation within the tidal prism and slope of the marsh are important contributing factors to successful marsh restoration.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#south-slough https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_Coos-Bay_07112017.pdf

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Name of Project: Ward Cove

Location: Ketchikan Gateway County, Ketchikan, AK

Year: 2001

Area (acres): 250

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: N/A

Purpose of the Project: Remediation of contaminated sediments

Preservation of Built Infrastructure / Direct Connection to Public Use: Remediation of contaminated sediments

Monitoring, Updates, Results: N/A

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#ward-cove https://tlp.el.erdc.dren.mil/wp-content/uploads/2016/08/Factsheet_Ward-Cove-final.pdf

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Name of Project: Northern Mississippi River Delta

Location: Plaquemines Parish, Venice, LA

Year: 1996

Area (acres): 1 hectare

Total Project Cost: N/A **Cost per Area (estimate):** N/A

Type of Installation (thin layer, new marsh, creation vs. conversion, planted, etc.): Thin layer

Method of Sediment Transport and Placement: The use of thin layer placement of dredged material was intended to restore elevations in shallow open water areas to a suitable elevation for emergent marsh and to assess the impact of the spray dredging technique on vegetated marsh. The salt marsh received thin sediment additions from a nearby canal in July 1996 utilizing the spray (rainbow)

dredging technique. The thickness of sediment application was 23 ± 5 mm on the marsh and 116 ± 11 mm in the shallow open water areas.

Purpose of the Project: Marsh nourishment. Marshes in this area experience high rates of sea level rise, subsidence, and anthropogenic disturbances including oil/gas exploration.

Preservation of Built Infrastructure / Direct Connection to Public Use: Marsh nourishment. Marshes in this area experience high rates of sea level rise, subsidence, and anthropogenic disturbances including oil/gas exploration.

Monitoring, Updates, Results: The addition of sediment increased the marsh elevation, which allowed emergent vegetation to colonize the once open water areas via rhizome growth from the edge of the marsh. Overall, the emergent marsh and shallow open water areas responded positively to thin layer placement.

Additional Information (if any): N/A

References: https://tlp.el.erdc.dren.mil/case-studies/#northern-MS https://tlp.el.erdc.dren.mil/wp-content/uploads/2017/07/Factsheet_North-Venice-LA_07112017.pdf

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