Project Name: Horseshoe Bend Island

Project Location: Atchafalaya River, Louisiana, USA

Award Category: Environmental Dredging

Team Members:
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Behind the dredge California, the river island at Horseshoe Bend on the lower Atchafalaya River, Louisiana is being self-designed by dredged sediment strategically placed upriver (lower right), allowing the river's energy to disperse the sediment. The dispersed sediment contributes to the island's growth, thus creating environmental and other benefits (Photography by Wings of Anglers, courtesy of Great Lakes Dredge and Dock).

Summary

Project Description: During the 1990s, placement of shoal material dredged from Horseshoe Bend occurred at eight wetland development sites located along the river's banklines adjacent to the channel. Capacity of these placement sites was nearly exhausted by 1999. Thus, to meet the anticipated disposal requirements for future channel maintenance, the US Army Corps of Engineers New Orleans District evaluated three placement alternatives: (1) convert the wetland development sites into upland disposal areas; (2) open water placement of dredged material via a long-distance pipeline into the open waters of Atchafalaya Bay; and (3) mounding of material at mid-river open water placement sites within a 350-acre (142 ha) area immediately adjacent to the navigation channel and upriver of a small naturally forming island. The third alternative was selected on a demonstration basis to investigate the impacts of mid-river placement on shoaling trends downriver of the site. Beginning in 2002, strategic placement of the sediment dredged from Horseshoe Bend occurred at the mid-river open water placement area. Placement of between 0.5 to 1.8 million cubic yards of sediment was conducted every 1 to 3 years which influenced and contributed to the development of an approximately 35 ha island mid-river. The practice of strategically placing dredged sediments upriver of a naturally-occurring island was conducted to aid the island's growth to produce greater environmental benefits than otherwise would be present using more conventional placement practices.

Goals: To help understand how and why the island was formed over the last 12 years, the USACE conducted studies to better understand the hydrology of the river used to transfer the mounded material onto the island. Information regarding ecosystem classification and mapping and floral and faunal composition of the island were conducted to document environmental and other benefits being realized. In addition, multiple moderate and high resolution aerial photographs available from prior to 2002 to the present clearly documented the growth of the island (Figure 1).

Objectives: The project objective was to demonstrate how dredged material can be used beneficially to nourish a naturally forming river island. Biology, ecology, and hydrodynamics were examined to catalog the island's maturation for determining the effectiveness of this individual project in terms of restoring, creating, enhancing, and protecting the coastal Louisiana landscape.

Accomplishments: The study used a multi-factor ecological assessment including: 1) landscape geomorphology, 2) ecosystem classification, 3) floral communities, 4) avian communities, 5) aquatic invertebrates, 6) soils and biogeochemical activity, and 7) hydrodynamic and sediment modeling. Ecological components comprising primary producers, microbial communities, invertebrates that form the basis of aquatic food webs, and higher organisms were studied, providing a comprehensive assessment of dredged material supported wetlands. This framework can be used in future studies examining the ecological, societal, and economic value of the strategic placement of dredged material applied in this manner. We demonstrated that each of the factors examined at Horseshoe Bend Island proved comparable or exceeded the other study areas examined, including the naturally formed riverine island and a traditionally created dredged material supported island. This innovative beneficial use of dredged material for creating Horseshoe Bend Island can be applied in other riverine project scenarios to demonstrate the success and potential benefits of this application of the Engineering With Nature practice of utilizing natural process for improving wetland creation and restoration outcomes.

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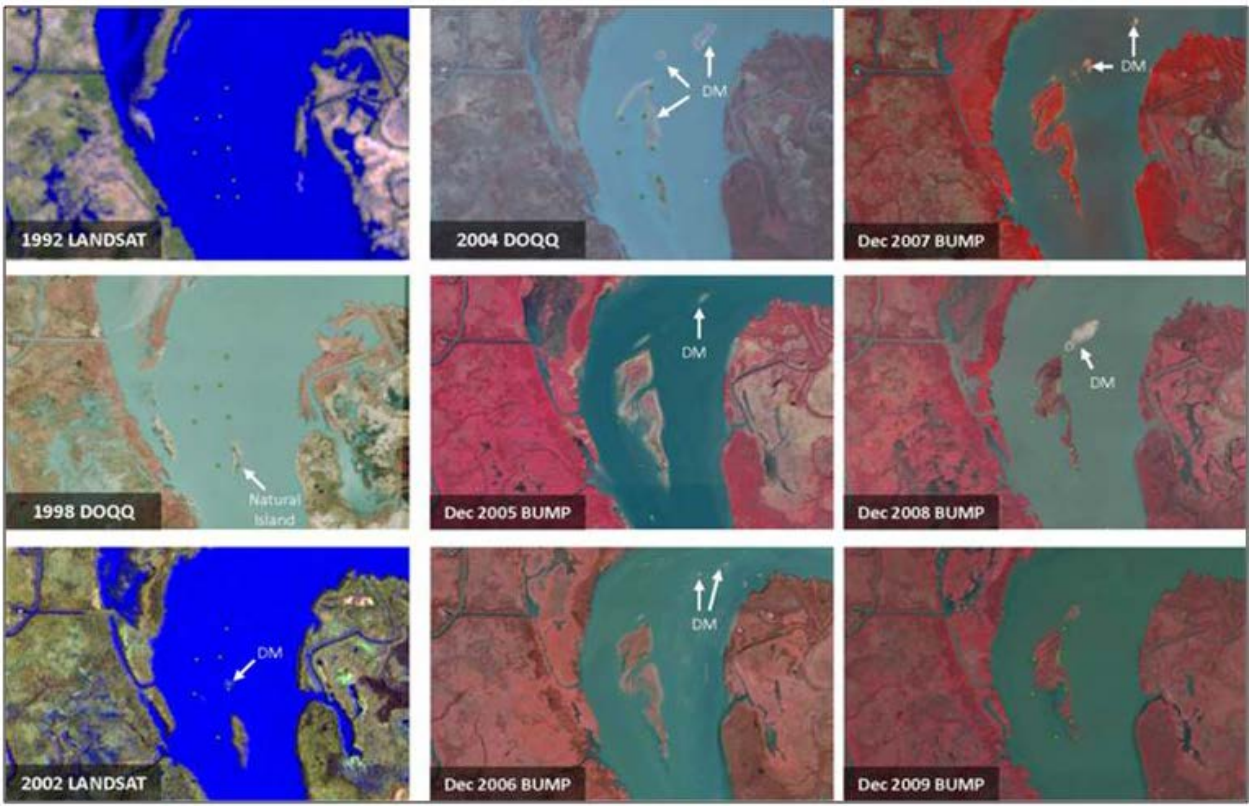

Figure 1: Imagery displaying island location prior to dredged material (DM) placement and subsequent formation (1992 and 1998 images), establishment, and growth since strategic dredged material placement began in 2002 (imagery provided by USACE MVN).

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B.C. Suedel and J.M. Corbino are current WEDA members. Corbino is the project manager, Suedel is the technical lead, and Berkowitz is the field lead. The USACE is the project owner and nominating entity.

Environmental Benefits: Previous studies only provided qualitative documentation of the fauna, flora, and geomorphology of the island. We recently completed quantitative surveys of the plant communities that have developed on the island (Figure 2). Our results indicated that Horseshoe Bend Island provides habitat and biogeochemical functions at rates comparable or exceeding observations made at a traditional dredged material supported island and a natural reference island in the area. Wetland classification and analysis of geomorphic features demonstrated that Horseshoe Bend Island provides a variety of habitat types supporting complex communities of vegetation, invertebrates, soil microbes, and higher organisms (i.e., avian species; Figure 3). The distribution of forested, shrub-scrub, emergent, and emergent aquatic bed habitat types corresponds to the natural distribution reported throughout the study area. Horseshoe Bend Island contains a wide variety of vegetation including >85% native species, with species richness values exceeding observations from both traditional dredged material supported and natural reference areas. The Engineering With Nature design utilized at Horseshoe Bend Island resulted in

landscape and landform characteristics (e.g., distance from shore, flooding regime) that support a large, successful wading bird rookery (Figure 3). Horseshoe Bend Island also supports more invertebrate abundance and diversity than natural islands in the region that lack the emergent aquatic bed landforms resulting from the strategic placement of dredged materials. Finally, the soils at the Horseshoe Bend Island display a capacity to sequester nutrients and other compounds and perform water quality functions at levels comparable to natural wetlands in the region.

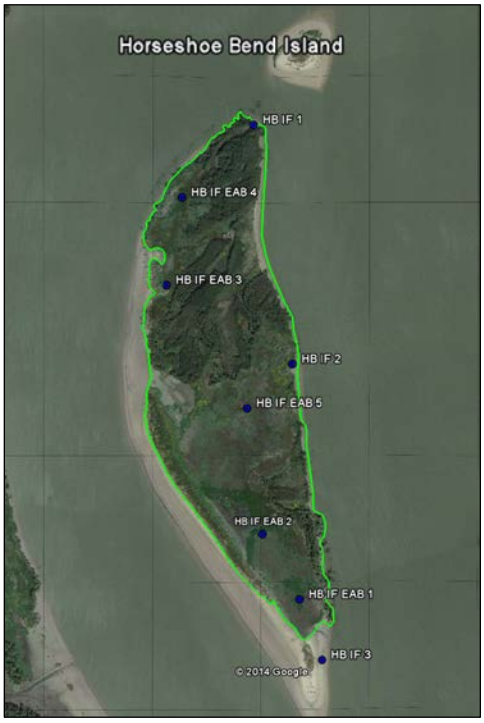

Figure 2. The infaunal community sampling locations at Horseshoe Bend Island (left photo). Infaunal sampling utilized a 7.5 cm coring device (right photo).

Figure 3: A diverse assemblage of native plant and animal life has colonized the island. In the left photo is an extensive stand of the native American lotus (*Nelumbo lutea*). A juvenile tricolored heron (upper right) and a juvenile snowy egret (lower right) were observed in nests on the island during nesting season (July 2014).

Innovation: Engineering With Nature (EWN) is a USACE initiative that seeks to support more sustainable practices, projects, and outcomes. The four key elements of EWN include: (1) use of science and engineering to produce operational efficiencies supporting sustainable delivery of project benefits, (2) use of natural processes to maximum benefit thereby reducing demands on limited resources, minimizing the environmental footprint of projects, and enhancing the quality of project benefits, (3) broaden and extend the base of benefits provided by projects to include substantiated economic, social, and environmental benefits, and (4) use science-based collaborative processes to organize and focus interests, stakeholders and partners to produce more broadly acceptable projects. The Atchafalaya River island project exemplifies what can be achieved through the application of EWN concepts and practices. Current EWN activities include documenting current USACE projects exemplifying the approach and communicating across the technical community and with USACE partners and stakeholders. Sediment dredged from the adjacent Federal navigation channel during routine maintenance was strategically placed in mounds upriver of the island over a period of 12 years. The mounded material was dispersed by the river's currents to self-design the island over time.

Economic Benefits: The project uses natural processes to maximum benefits, thereby reducing demands on limited resources, minimizing the environmental footprint of the project, and enhancing the quality of project benefits. Economic benefits are being realized as the enlarging island has reduced the overall cross sectional area of the river, increasing the river's flow through the navigation channel to velocities that were sufficient to reduce shoaling and maintenance dredging requirements. Costs were lower than the conventional approach because all other placement alternatives required additional equipment and land-rights to convey dredged material over long distances. Signs of human activity were also noted on the island, as the presence of shotgun shells signified that the island was being used for hunting. Intentionally aligning natural processes in the river with engineering processes via strategically mounding dredged material is realizing tangible environmental, social, and economic benefits.

Transferability: These investigations further quantifying the multiple benefits of using dredged material to create such riverine islands will provide a more complete understanding of the formation of the island so this concept can be integrated into other dredging projects in coastal Louisiana and elsewhere, thereby providing substantial environmental, social, and economic benefits as part of ongoing USACE maintenance dredging activities.

Outreach and Education:

Berkowitz, J.F., Beane, N.R., Evans, D.E., Suedel, B.C. and Corbino, J.M. 2015. Ecological Survey of a Dredged Material-supported Wetland in the Atchafalaya River, Louisiana: An Engineering with Nature Case Study. *Wetland Science and Practice*. 32(1):14-18.

Suedel, B.C., Fredette, T.J., and J.M. Corbino. 2014. Island Building in the Atchafalaya River, Louisiana USA: An Engineering with Nature Demonstration Project. *World Dredging*. 48(9/10):14-16.

Berkowitz, J.F., Beane, N.R., Evans, D.E., Suedel, B.C. and Corbino, J.M. 2014. "Preliminary Use of strategic placement of dredged sediment to support Horseshoe Island in the Atchafalaya River, Louisiana: A preliminary ecological survey." EWN Technical Notes Collection ERDC TN-EWN-14-4. Vicksburg, MS: US Army, Engineer Research and Development Center. *http://el.erdc.usace.army.mil/*.