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U.S. Fish & Wildlife Service Forsythe Refuge (New Jersey) Marsh Restoration Using Dredged Material
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GUEST EDITORIAL

The USACE dredges approximately 200 to 300 million cubic yards of sediments annually from over 25,000 kilometers of navigable waterways and hundreds of commercial ports in the United States to support local and national economies, national security, and community resilience. The historical default was to place much of this dredged sediment upland or to discard it in the open ocean. However, strategically selected and used dredged sediment based on type can be a valuable resource that can provide significant environmental, economic, and social benefits.

Beneficial use of dredged material (BUDM) encompasses the targeted use of sediments to achieve positive outcomes, including wetland restoration, shoreline stabilization, habitat creation, beach nourishment, flood-risk reduction, coastal resilience/uplift, and ecosystem restoration. Across the nation, successful projects demonstrated that dredged sediment could rebuild eroding wetlands, restore ecosystems, nourish beaches and coastlines, enhance natural and nature-based infrastructure, and strengthen communities' adaptive resilience to the impacts of extreme storms.

Despite these successes, beneficial use of sediments can still increase, particularly for fine-grained sediments. While technical feasibility is established, implementation faces barriers (e.g., technical, institutional, regulatory, financial, perceptual and logistical). Traditional project planning and funding mechanisms frequently favor least-cost alternatives, and it is currently unclear how to incorporate the longer-term value of environmental benefits of sediment reuse into decision-making and cost-assessment processes. Opportunities for regional sediment management, interagency collaboration, and innovative project delivery are sometimes constrained by organizational silos and fragmented authorities.

Expanding beneficial use from a collection of exemplary projects to a standard practice across the dredging industry will require a fundamental shift in how sediment is valued, planned for, funded, and managed. The USACE Chief of Engineers 70/30 goal encourages consideration of BUDM opportunities and underscores the technical, policy, funding, and partnership considerations associated with broader implementation.

Innovation will also play a critical role. Advances in engineering design, sediment placement technologies, advanced manufacturing transforming sediment into usable infrastructure, beneficial use economics, nature-based solutions, and digital decision-support tools can improve project efficiency and expand the range of feasible applications. Equally important is the development of a skilled workforce and a culture that prioritizes collaboration, adaptive management, and long-term stewardship of sediment resources.

The future of sustainable sediment management in the United States hinges on recognizing sediment as an asset rather than a liability; a public perception paradigm shift from "waste-to-resource". By making BUDM the preferred and routine outcome whenever feasible, the nation can simultaneously support navigation, restore ecosystems, enhance resilience, and maximize the public value derived from dredging investments. This WEDA Journal of Dredging issue presents three complimentary studies that were conducted to further BUDM – the first two examining the institutional, technical and regulatory barriers to BUDM and suggesting potential solutions to overcome those, while the third paper presents a case study of how BUDM can be implemented on a large-scale basis, using Texas as

an example. We hope that our readers will use the information presented to advance the BUDM 70/30 vision by identifying opportunities, challenges, and pathways for making beneficial use of dredged material more prevalent across the nation.

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OVERCOMING BARRIERS TO BENEFICIAL USE OF DREDGED MATERIALS IN US ARMY CORPS OF ENGINEERS AND OTHER AGENCY PROGRAMS

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ABSTRACT

Dredged material (i.e., sediment) is increasingly being recognized as a valuable resource instead of waste, leading to nationwide efforts to increase its use for beneficial activities such as shoreline stabilization and environmental restoration. This attitudinal shift was amplified in 2023 when the Chief of Engineers of the U.S. Army Corps of Engineers (USACE), which accounts for approximately 300 million cubic yards of dredging annually, issued a Command Philosophy Notice setting an enterprise-wide goal of beneficially using by 2030 up to 70% of all navigational dredged material throughout the United States, an approach that was codified in WRDA 2024 [WRDA 2024 Section 117(c)(2)(B)]. This triggered a series of internal and external evaluations of the Corps' and state navigational dredging programs, with a view to optimizing processes and finding new ways of beneficially using dredged material. This paper presents the results of a study that examined the barriers and opportunities for beneficial use of dredged material (BUDM) that was undertaken by the authors in response to a specific request by USACE Headquarters.

Our study found that engineering needs do not necessarily pose substantial barriers to BUDM implementation over the long term; the main barriers to BUDM implementation are related to logistic and process issues, communication, and coordination in and out of USACE and other lead agencies. Primary barriers to BUDM consist of different policies and processes for justifying projects; cumbersome or lengthy environmental-compliance processes; inconsistent information-sharing and knowledge transfer; inconsistent vertical messaging within agencies leading to risk aversion and reluctance to explore innovative solutions; inadequate communication causing misperceptions among agency partners, stakeholders, and the public (resulting in poor interagency coordination and reluctance by local partners to implement BUDM); and insufficient use of state-of-the-art comprehensive benefits assessment tools.

The study provided recommendations to overcome the identified barriers to BUDM in three major areas: 1) improve internal communication and processes; 2) improve external communication and coordination between agencies; and 3) overcome technical barriers, including improving benefits assessment tools. These recommendations are intended for USACE as well as other federal, state and local agencies, that desire to increase BUDM. The recommendations are intended to be

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aspirational, recognizing that many may require changes in policy, guidance and standard practices, and hence, may take some time to implement.

Keywords: Dredging, Beneficial Use, Hurdles, Barriers, Solutions

INTRODUCTION

Every year approximately 200 million to 300 million cubic yards of sediment are dredged from Federally owned or maintained navigation channels across the United States to support safe, reliable waterborne transport. Historically, most of this sediment has been placed in designated and permitted ocean or upland disposal locations. These locations are selected through an established planning and environmental compliance process. Alternatively, dredged sediment can be used to support environmentally or socially desirable projects. This alternative use is referred to as beneficial use of dredged material (BUDM). Beneficial use is the productive use of dredged material from navigation dredging, including applications in habitat restoration (e.g. shorebird nesting islands), recreation (e.g., beach nourishment) and industrial/commercial uses (e.g., roadbed fill; USACE 2015). The U.S. Army Corps of Engineers (USACE) estimates that only 30% to 40% of sediment was used beneficially between 1998 and 2021, and the balance of this material was disposed of in onshore or offshore confined disposal facilities (Regional Sediment Management Viewer, Searcy Bell et al. 2021, USACE 2022). Increasing BUDM is a national priority established by Congress in the 2020 and 2024 Water Resources Development Act and many state and local agencies have also expressed goals of increasing sediment use (vs. disposal) for many purposes. Beyond the commercial and environmental benefits, increasing BUDM can help extend the life of a disposal area and ensure sufficient confined disposal capacity for contaminated materials by reducing the amount of clean material that is disposed of. In 2023 the USACE Chief of Engineers established a Command Philosophy to increase BUDM of dredged material to 70% by 2030. The Chief of Engineers also established several research-related priorities related to BUDM: flood mitigation; supporting resilient communities; and ensuring environmental sustainability and resilience.

Recent data from the USACE Sediment Placement Data Viewer (USACE 2022) suggest that, as of 2022, BUDM has increased and approximately 50% of dredged sediment was being directed to BUDM. The goal of this paper is to identify and summarize institutional, policy/regulatory, and inter-organizational barriers blocking USACE and other state and local agencies from achieving national BUDM goals and to propose strategies to overcome those barriers.

APPROACH

To identify barriers, we summarized findings common in prior reports and studies to better understand the challenges and opportunities for enhancing BUDM. We then used these findings as the basis for a series of questions for focused one-on-one interviews with USACE subject matter experts (SMEs), staff at ten USACE Districts throughout the country, and staff at state partner agencies. These interviews sought to clarify hurdles, identify solutions to overcome those hurdles, and capture key lessons learned from specific BUDM projects. A structured set of interview

questions were asked of all USACE personnel that were interviewed, with modifying questions asked based on individual responses provided, if there was a need to seek clarifying information or underlying facts. Questions covered the staff's length of tenure at the USACE, their responsibilities within the program, input on hurdles to BUDM (from a technical, regulatory, policy, or operational aspect), improvements to means and methods, data gaps (including planning, design, implementation and long-term monitoring), and a discussion of one case study (from their experience locally) where BUDM was implemented successfully, and another one where the project was held up (with a discussion of why it was held up, identify root causes for analysis). A total of 10 staff were interviewed, spanning the USACE functions from planning, engineering and construction/operations. Experience levels were generally senior level project managers or above, including in a few cases, branch chiefs. Input gathered was synthesized thematically to identify specific topics that need to be improved. We complemented this with reviews of past efforts from other agencies and experts to develop a set of recommendations for how to advance goals of BUDM by USACE and in parallel, advance the practice of BUDM by other federal, state and local agencies.

We recognize that internal policies, agency guidance, procedures, and in some cases regulatory requirements may make some changes impractical or infeasible. We did not constrain our recommendations by what is currently possible, recognizing that achieving national BUDM goals may require shifts in current policies and guidance.

We reviewed findings from the following prior and ongoing efforts related to BUDM:

- "Hurdles to Beneficial Use of Dredged Material: Root Cause Analysis" (Ousley et al. 2024) – an internal study which evaluated perceived barriers that are preventing widespread use of BUDM within the USACE.
- "Beneficial Use Implementation Barriers. Planning Associates Capstone Project, Savannah District" (Lopes 2023) – a study which evaluated federal agency perspectives on overcoming barriers to BUDM, especially focusing on regulatory hurdles.
- "Hurdles to Beneficial Use of Dredged Material: Stakeholder Perspectives" (Mohan et al. 2025) – a study which evaluated external (stakeholder/partner) perspectives on barriers to BUDM and topics needing resolution.
- "Efficient Permitting Roadmap: A guide to the regulatory process for coastal sediment management actions" (Kordesch and Delaney 2024) – outlines steps to streamline permitting for coastal sediment management projects.
- "Regional Sediment Management and Beneficial Use Database Viewer" (USACE 2022) – a web-based tool to track BUDM within the USACE.
- "Challenges to Implementation of Beneficial Use of Dredged Material: Findings of Regional Workshops" (Tyler et al. 2024) – Summary of findings from a series of regional workshops conducted by USACE/ERDC to advance BUDM.
- "Beneficial Use of Dredged Material" (Suedel et al. 2022) – a summary paper on a report by PIANC which outlines various options for BUDM.

SUMMARY OF BARRIERS TO BENEFICIAL USE

The interviews identified several challenges associated with internal agency processes and decision factors, clarity on accountability, addressing concerns about risk, and interagency coordination to complete environmental compliance (Table 1). Major hurdles to maximizing BUDM, include synchronicity of dredging and placement schedules, stakeholder coordination, placement site availability, knowledge of proper placement methods based on material composition, and environmental compliance challenges. From the interviews and reviews of existing and past BUDM projects (both successes and failures), we identified the following barriers to widespread application of BUDM:

1. Internal communication, process and decision factors with the lead dredging agency
    - BUDM projects may have costs that make it difficult to justify as part of typical benefit-cost analysis
    - Existing policies and agency cultures that lead to low risk tolerance, especially for trying out innovative nature-based solutions and similar approaches
    - Limitation on permissible uses of funding along with difficulty in designing and implementing flexible field approaches that include adaptive management techniques to manage the project over the long term
2. External communication, coordination and governance outside the lead dredging agency
    - Challenges in meeting environmental regulations, obtaining necessary permits and clearances, and satisfying agency coordination requirements
    - Coordination barriers across consulting and/or coordinating agencies based on different goals, priorities, and technical approaches
    - Misperceptions among local partners and organizations affected community members and other stakeholders regarding the safety and efficacy of BUDM
3. Technical and analytical considerations
    - Difficulty in conducting comprehensive benefits assessments and trade-off analyses and how to incorporate those into evaluation against the Federal Standard which requires that USACE and its non-Federal partners select the least costly, environmentally acceptable method for disposing or placing dredged material
    - Inconsistent interpretation and application of outputs from models and evaluation tools
    - Challenges in identifying sufficient, suitable sediment placement sites and matching those with candidate source areas

Table 1: Summary of BUDM Challenges, Observations, Lessons Learned and Proposed Solutions Based on USACE District Subject Matter Expert Interviews (*Grey shaded rows represent successful BUDM projects)*

Project Name/Location	Description	Challenges	Observations and Insights
Galveston Beach Project, Texas	Beach nourishment	Difficulty in cost-sharing beach nourishment under existing funding authorities	Need to find leverage opportunities for creative cross-program funding
Galveston Beach Nourishment Continuing Authorities Project, Texas	Beach nourishment (project was halted)	Project could only be implemented if justified via traditional benefit-cost analysis as part of the Federal Standard rule	Need flexibility in benefit-cost approach (project could have been more beneficial if eventual movement of sand to downstream area could have been accounted for)
Northern Illinois Public Beaches BUDM 1122 Pilot Project	Beach nourishment (project was halted)	Perceived (legacy) asbestos contamination (material quality) and a lack of a human health risk assessment caused the communities to withdraw their support (material was beach quality sands—requirements put forth by communities led to project not proceeding)	More fully evaluate potential and perceived risks. Include the public and stakeholders in the process; Improve transparency of weighing "net positive" long-term benefits (i.e., better beach) against potential health risks
San Rafael Canal, California	Ecosystem restoration	Existing restoration site along the channel mouth, BUDM timing did not align with breeding season constraints. Site design lagged, and permits were not obtained on time. It was difficult to coordinate with external entities on processes/timelines.	Early identification of barriers, coordination and planning are key to success of BUDM projects, especially those involving external groups such as state agencies, private landowners or non-governmental organizations

Project Name/Location	Description	Challenges	Observations and Insights
Avalon and Ring Island, Cape May County, New Jersey (part of Seven Mile Island Innovation Laboratory)	Thin layer placement and habitat creation on degraded marsh	Sandy material was hard to place on Ring Island, better on Avalon with finer-grained sediments. These were initial pilot projects and over-engineered containment caused challenges for dredging and placement.	Learned that material type was quite important for success. Used field flexibility to adaptively manage placements and produce lessons learned for thin layer placement versus "thicker" placements.
Jacksonville Harbor BUDM project, Florida	Harbor dredged material used for creating additional marsh habitat with silt/sand material	Overall harbor project was highly successful. Additional marsh creation project was met with hurdles. Unacceptable essential fish habitat tradeoff required by national marine fisheries service. Material type challenges (e.g., silts).	In hindsight, a (regional) working group could have been helpful to identify restoration sites so that the team can evaluate options more effectively
Cormorant Island, Upper Mississippi River, Illinois	Use of emergency dredge material to renourish (historically eroding) sand bar island (which was nesting habitat for Cormorant, other birds, etc.)	Avoidance windows from migratory birds' act had to wait for younger birds to leave nests or area. Required dredging an access channel to the island for construction. Initially considered other areas to integrate into project but had to drop due to other environmental considerations.	Timing and existing partnership with local stakeholders. They had an existing permit in place that accounted for the placement site already, which helped with the implementation of this project. Left open the option to renourish in the future.
Starved Rock Lock and Dam, Illinois River, Illinois.	Construction/commercial BUDM projects, using dredged material stockpiles	Contractor had determined that it was cheaper to use an alternate (mined) material than get free material from stockpile (due to loadout and transport—costs)	It is good to explore whether the USACE can offset any part of the incremental (rehandling) cost to free up stockpile capacity

Project Name/Location	Description	Challenges	Observations and Insights
Hamilton Wetlands, Novato, California	Wetland restoration	Project was costly due to specialized equipment needs, as well as material subsidence. Required adaptive management (controlling water control structure plus natural accretion over time)	Material was readily available (from channel dredging). Highly collaborative process—true partnership across agencies
Cat Island, Green Bay, Wisconsin	Dredged material island habitat	Habitat restored for Piping Plover has become a restriction that limits the window of when additional material can be placed	Need to utilize navigation authority and cost-sharing to build a dredged material containment facility for new material
Gull Island (part of 7-mile island Innovation Laboratory site), Cape May County, New Jersey	Wetland restoration and coastal resiliency including marsh elevation enhancement, marsh edge protection, and creation of intertidal shallows	Varying habitats and elevations required flexible (unconfined) containment	Developed trusted local partnerships; understood the range of sediments relative to features that could be constructed; managed expectations with respect to habitat. Picked key area of BUDM and worked around it (used wye-valves for efficient material distribution and builds; revegetated fast by natural recruitment).
Mordecai Island, Ocean County, New Jersey	Island restoration	Material was 70% sand but needed to prevent fines from migrating into protected submerged aquatic vegetation beds. Goal was to restore breached area between two sections of island preventing further loss that was imminent	Use of specialized turbidity curtain to contain material and stabilize fines. Project objectives were to restore breach to adjacent marsh elevations but had to adaptively manage elevations to meet ecological needs when birds started to nest in low-lying initial placement. Learned how to raise/sculpt by pushing up berms and placing them within, then regrading.

Project Name/Location	Description	Challenges	Observations and Insights
Sturgeon Island, Cape May County, New Jersey (located within Seven Mile Island Innovation Laboratory)	Island/marsh rehabilitation	Goal was to build elevation with mixed sediments and try different techniques to distribute material over a flooded marsh as well as contain material in relatively small area.	Built in multiple phases and elevation work continues after material consolidation. Used sediment distribution pipe, temporary water-filled barriers, coir logs, and wye-valve to manage construction and try to meet elevation goals. Overcame field changes of sediment in channel through use of the wye valve.
Continuing Authorities Project- Section 204 Project - Unity Island, Buffalo, New York	Habitat conversion	Public skepticism, proving that material was appropriate and safe was hard. Needed source of non-federal money.	Backed concept with good science and data (bench scale studies, modeling). Completed project was an effective "show and tell" for future restoration projects. Leveraged non-federal money.
Upland Sites, Ohio	Non-federal upland sediment recycling facilities (initially funded by state)	Challenging to use the state facilities and cost-share; timelines can be long	Streamline internal USACE process for stakeholder collaboration
Deer Island Restoration, Biloxi, Mississippi	Shoreline and wetland restoration	State agencies wanted bottom aquaculture areas to be avoided. Critical species and habitats (Gulf Sturgeon). High initial project cost; hence, pivoted to less engineered, more adaptive designs—huge savings in cost.	Strong local partnerships—interagency working groups. State BUDM mandate promotes local relationships and funding. Used Engineering With Nature (EWN) principles (natural breakwater, beaches, wetlands, islands, lagoon). Natural seeding of habitat occurred over time; open water ponding reduced.

Project Name/Location	Description	Challenges	Observations and Insights
Mobile Bay BUDM (Mobile Harbor Deepening), Alabama	Regional sediment management (BUDM) approach	Regional partnerships took effort and time to establish. Some BUDM concepts were introduced late in the project/study (required specific designs). Matching and aligning schedules was challenging.	Did a large-scale demolition project in 2012 (approximately 9 to 12 million cubic yards) thin layer placement in bay—did modeling and monitoring to show stability. Provided source material to balance in-bay sediment deficit. Having project implementation and "science" committees were valuable.
Jekyll Island, Atlantic Intercoastal Waterway, Georgia	Dredging with thin layer placement onto marsh to improve habitat	Too much water retention from coconut coir logs. Needed long-term funding to measure rate of vegetation recovery for 5 years.	Partnership based approach for small area and volume limited risk for demonstration type project. Monitoring done by a collaboration of state and federal agencies and academic partners.

RECOMMENDED SOLUTION PATHWAYS

Top-Level Recommendation

We offer these recommendations fully recognizing that the USACE must follow a specific set of dredged material disposal/placement frameworks, the Federal decision context, associated feasibility/cost constraints, and project specific environmental compliance requirements. Further, we also acknowledge that in that context, many placement options will need to be reviewed in parallel by USACE, including open water placement and upland disposal, along with BUDM opportunities, and while also considering factors such as sediment suitability, placement site availability, schedule feasibility and environmental and economic aspects. However, these recommendations are made so that appropriate policy and framework revisions may be contemplated at the enterprise level, led by USACE Headquarters.

We propose that all agencies, including USACE, should consider BUDM as a standard practice across all mission areas and establish BUDM as the default (preferred) project alternative for all appropriate projects. District-level implementation should similarly prioritize BUDM and tailor national direction to local conditions, supported by consistent metrics, tracking, and accountability that meet the following agency goals and Congressional mandates:

- USACE and State or regional dredging agencies (e.g., Port districts) should work with resource and regulatory agencies to align shared goals and guidelines
- Agencies should develop incentives to explore and innovate BUDM approaches
- Agencies and the research community should develop the ability to better quantify comprehensive benefits (e.g., Suedel et al. 2025) and should use comprehensive benefits in decision-making and project justification.

This top-level recommendation may require changes in how projects are selected and funded.

To further help address these barriers we identified a series of recommendations, organized by the following three overarching themes:

1. Internal communication, process, and decision factors

2. External communication, coordination, and governance

3. Technical and analytical considerations

Recommendation 1: Overcome Internal Communication, Process and Decision Factors

Enhancing BUDM will require receptivity to change and risk tolerance to try new approaches at all levels. Justifying BUDM projects requires flexibility in how benefit cost analysis is applied and how eco-system benefits (and co-benefits) are fully quantified. Project managers need to be supported in developing creative approaches to project justification, for example, by incorporating ecological metrics, such as indices of biotic integrity or functional assessment scores or ecosystem service indices, that allow quantification of ecological or social benefits. Fostering improved cross-program coordination and cosponsoring projects could facilitate increased receptivity to creative implementation.

Efforts should be made to improve knowledge sharing across all agencies to promote successful BUDM implementation. It is crucial that resources (e.g., funding and staff) are provided to ensure the development or enhancement of databases that are comprehensive, accessible across programs and agencies, understood by staff, and maintained. Databases should track assessment tools used to justify BUDM and key barriers addressed so that future projects can take better advantage of lessons learned. Inadequate knowledge about the purpose of database and how to use it hinders broad-scale implementation and leads to "reinventing the wheel."

Beyond knowledge sharing, there should be improved BUDM-specific training, which appears to be limited for project managers, engineering design, and cost-estimating staff. In particular, best management practices, assessment methods, how to overcome identified risk concerns (and address uncertainty), and how to take a multi-disciplinary approach for BUDM projects should be shared.

Establish Coordination Across Mission Areas

Selecting BUDM as a preferred placement alternative can be justified when the associated costs, benefits, and cost efficiencies support the project. Coordinating project planning across mission areas — such as Flood Risk Management or Ecosystem Restoration — may create opportunities to achieve efficiencies, cost savings, and benefits that allow sediment placement to meet the objectives of multiple programs. In some cases, this approach may necessitate policy changes to enable funding from different sources to be applied to multi-objective projects, or to allow funding from one source to support co-benefits associated with projects carried out under a separate authority.

USACE and other lead agencies should modify their evaluation process to allow consideration of "net positive environmental benefits" instead of "least costly" as a way to overcome barriers to BUDM project implementation. This may be challenging given that the Federal Standard requires selection of the least costly alternative unless the additional costs are justified or a non-federal sponsor agrees to pay the difference. Achieving this recommendation may require development of new assessment methods or approaches that internalize the opportunity costs of BUDM (e.g.,

Wainger et al. 2020, Suedel et al. 2025) and could ultimately require Congressional action. This will also require agreement among agencies on terms and the standards used to evaluate projects. Agencies should continue to publish and disseminate success stories to foster more BUDM projects. Agencies should continue their efforts to implement permitting efficiencies, such as development of any applicable regional general permits for BUDM projects. There is also a need to improve training and education for regulatory staff related to BUDM, including methods to evaluate long-term benefits versus short term impacts, sediment transport processes, and ecosystem response can help reduce inconsistent interpretation and application of BUDM during the permitting process. Additional discussion of these topics can be found in Ulibarri et al. (2020) and Tullos et al. (2021).

Review Policy Changes That May Be Required to Facilitate More BUDM Projects

A policy should be implemented to promote sustainability and ensure continuity of BUDM goals as an enterprise-wide "standard business practice." Methods to revise project justification procedures to promote more BUDM projects should be reviewed. Methods to incorporate ecosystem valuation provided by BUDM projects into the benefit-cost-analysis procedures, as part of a future modified Federal Standard, can help this topic. Consideration should also be given to establishing regional proving grounds to pilot test innovative BUDM concepts in lower risk environments. These proving grounds can build on existing Engineering with Nature proving grounds established by USACE, as well as the Section 1122 BUDM projects implemented across the USACE. Pilot projects should be in coordination with multi-agency and stakeholder working groups to improve mutual understanding of factors that contribute to success or failure and to build trust among partner organizations.

Review Construction and Operations Protocols to Promote BUDM Master Planning Processes

A process or framework should be developed for regional BUDM sediment management practices, for example to better coordinate a large, multi-year dredging project with a multi-year, multi-use BUDM or restoration site. Regional Sediment Management plans and other "Master plans" and databases should be developed to seamlessly connect dredging sites with placement sites and to proactively develop multiple BUDM sites in a region that can be accessed by multiple users including all stakeholders and partners.

Develop and Issue Consistent Technical Guidance on Selecting and Evaluating BUDM Projects

Guidance should be developed on ways to improve project justification and approval procedures. The guidance should help establish consistent terminology, language, and benchmarks; better align objectives and approaches; and establish processes and incentives for funding across agency mission areas. This can be facilitated by mainstreaming the use of existing tools and pilot testing tools currently in development – some examples are the ecosystem valuation tools recently being developed by USACE/ERDC (Cushing et al., 2025), case study evaluations and best management

practices to advance nature-based solutions (Kurth, 2025, Smith and Kurth, 2025), revisions to planning procedures (USACE 2023), and the engineering design guidance for nature-based-solutions that are currently under development by USACE.

Guidance should serve to better align objectives and approaches across agency program areas that reward the early identification of BUDM projects and their prioritization in the budget process. This should include planning, design, and cost estimation staff to promote co-development of innovative projects. Establish collaboration within and across agencies so that BUDM evaluation metrics are defined clearly; tools to evaluate them are clearly discussed and are consistent across regions. Establish a task force to develop a BUDM project evaluation metrics analysis using past and ongoing BUDM projects as example case studies.

Guidance on what constitutes "tolerable risk" of project failure (especially for experimental methods) for BUDM would foster innovation and experimentation by reducing concerns about staff consequences for partially successful projects (for example, use of innovative containment measures). Such guidelines ideally would build on existing guidance (like the Engineer Research and Development Center's [ERDC's] Natural and Nature-Based Features [NNBF] guidance) and would acknowledge that expectations for the success and longevity of BUDM projects are different than those for more traditional projects. This guidance should be distributed to staff from all mission areas within agencies (e.g. planning, engineering, design, cost-estimation) to help foster increased tolerance for risk in innovative and experimental BUDM projects. Recognition of the importance of adaptive management (and providing funding) to ensure long-term performance is key. It is important to clarify that project maintenance activities will not be seen as failures. Clear communication plans should be developed and a structured approach employed to share with stakeholders and regulatory agencies, such as the lessons learned from BUDM projects including their performance data and operation and maintenance aspects.

Conduct Training and Knowledge-Sharing Workshops

In general, BUDM-specific training is lacking. Agencies should invest specifically in BUDM-focused training. Training should aim to increase knowledge about types of BUDM and under what conditions they may or may not be appropriate, benefits of BUDM and how to quantify them, long-term management and maintenance needs and how to account for these in project scoping (and other topics that may be identified along the way). These trainings should be conducted regularly to encourage multi-disciplinary and multi-functional staff to attend for "cross-pollination" purposes and to break out of the typical agency "stove pipes." Such training could also help develop enterprise-wide interest and support for BUDM.

There should be enhanced outreach, education, and case studies on tools currently being developed (e.g., USACE Beneficial Use Goods and Services Tool; Suedel et al. 2025). Education should include additional knowledge transfer on the intersections of sediment and ecological processes and on evaluating, mitigating, and communicating the potential risks of BUDM. Guidance should

encourage the exploration of innovative approaches that agencies could use to enhance the community of practice and create mechanisms for sharing experiences (positive and negative) about past BUDM projects. This could include a reference database of BUDM projects, the processes used to justify them, the challenges they faced, and their post-placement performance and condition. The database can build on existing sites, such as the USACE Beneficial Uses of Dredged Sediment website (https://budm.el.erdc.dren.mil/successstories.html) and should be public facing, map-based, and user friendly.

Develop a Process for Sharing Experiences, Challenges, and Lessons Learned from Successful and Unsuccessful BUDM Projects

Effective data management is critical to be able to answer basic questions about BUDM effectiveness, track progress of placement sites, provide information and resources across program areas, and share experiences to promote broader adoption of BUDM. To advance BUDM adoption, we recommend improving BUDM regional databases' connections with each other and with enterprise-wide data systems. Databases should be expanded to include anticipated dredging projects and available restoration or other BUDM sites so that project managers know of dredged material sources (including type of material and volumes) and end-use options (i.e., location, distance, and volume needs). Information sharing efforts should also aim to improve coordination of ongoing research and studies across different agencies and research centers so that knowledge is freely shared and duplication is avoided. Implementing this recommendation will require development and consistent implementation of standard data templates, formats, structures, and vocabulary. Moreover, there is a need to assign agency staff responsible for maintaining the database, so it continues to function over time.

Recommendation 2: Improve External Communication, Coordination and Governance

BUDM implementation can be fostered by building trust through increased coordination and enhanced communication among partner agencies and the public. The objective is to reduce misconceptions, facilitate environmental clearances, and gain knowledge and experience from tools and resources developed by others.

Overcoming External Communication and Coordination Barriers

There is a need to provide incentives for interorganizational coordination and innovation of BUDM practices. This begins with high-level coordination among agencies. New funding sources and support from Federal and State agencies should be provided for organizations to act as leaders and support existing interagency sediment management workgroups to better coordinate activities. This funding will need to be beyond existing sources, such as the Harbor Maintenance Trust Fund. Consistent, ongoing communication and coordination are needed with potentially affected stakeholders that may lack the resources and knowledge to effectively engage in the coordination process.

Promote High-Level Interagency Engagement to Develop Shared Goals and Joint Guidelines

Enhanced interagency collaboration through facilitation, support, and incentives for engagement with partner agencies, can enhance BUDM. Targeted discussions with senior leaders at key agencies, including USACE, National Oceanic and Atmospheric Administration (NOAA), U.S. Environmental Protection Agency (USEPA), and U.S. Fish and Wildlife Service, should be held to develop shared goals and promote a common vision for BUDM. Strategies should include initiatives to streamline Federal and State environmental review and approval processes (e.g. Federal Clean Water Act, Endangered Species Act, state regulations). Agencies should also develop common screening criteria that are consistent with their agency mandates, but allow joint evaluation of candidate projects. Effectively communicating the outcomes of these meetings and the shared vision to staff-level personnel will be critical to enhance knowledge sharing and build trust.

Engage in Outreach and Education with All Stakeholders

Agencies should develop a communication workflow plan (or augment existing communication plans) for proactively transmitting clear information about inherent uncertainties in BUDM projects, and the appropriate use of data to efficiently design and manage potential outcomes associated with BUDM implementation (such as incorporation of long-term monitoring and adaptive management, as appropriate)

Communication begins with simplifying terminology, creating clear definitions, and depicting BUDM concepts in clearly understandable graphical illustrations and includes making that information broadly available to all partners. This will help reduce barriers to engagement by the public who may be intimidated by the complexity of the process or lack trust in public agencies. Collaborative programs should be established that educate the public about the benefits and hazards of sediment placement, especially for beaches or recreational areas. Ideally, these programs would be led locally but co-implemented with Federal agency partners. Pilot projects can be used to reassure skeptical managers, state and local regulators, and the public about BUDM's effectiveness and to identify "champions of BUDM" who can connect to audiences. Long-term monitoring partnerships (including funding, especially for adaptive management) can facilitate ongoing interactions and partnerships, build support, and facilitate exploration of new technologies. Regional monitoring collaboratives and partnerships can include universities, tribal governments, non-governmental organizations, and community-based science and monitoring organizations. These ongoing partnerships can be formed via interagency agreements, joint powers authorities or other mechanism that allow for joint funding and co-management.

Promote Sharing and Co-Development of Assessment Tools with Other Agencies and Industry Partners

Co-development and implementation of assessment tools and best practices can serve to build trust and reduce barriers that arise from misaligned priorities and approaches among partners. Coordination should include exploring tools and knowledge about new technologies and benefits assessment with agencies such as USACE, Federal Highway Administration, USEPA, Federal Emergency Management Agency, and NOAA. Such knowledge sharing may also reduce dependence on traditional economic models and broaden perspectives to include analyses of non-market benefits. Similarly, industry workgroups should be engaged to co-develop new technologies and assessment tools.

Coordination among agencies and the private sector can also be facilitated via expert workgroups and periodic "data hackathons" in which computer programmers collaborate with one another or with people in other specialties over a relatively short period of time to create code usually for a new software product or service. These are useful strategies for engaging partners and the public in developing innovative solutions to challenges of data management, data dissemination, and data visualization. Hackathons can also broaden awareness of and support for BUDM. Note this recommendation is contingent on developing the integrated, open data systems recommendation.

BUDM projects require commitments to long-term monitoring and programmatic adaptive management to ensure they continue to perform and meet their objectives over time. Monitoring plans should include evaluation of ecosystem functions and environmental services. Similarly, routine operation and maintenance should incorporate lessons learned from the monitoring of previous projects. Co-developed assessment tools can also be used to prepare coordinated long-term monitoring and adaptive management programs with local sponsors and other partners. Monitoring partnerships with state and local agencies can be used to overcome the limitations of USACE funding for long-term monitoring. In some cases, project-specific monitoring can be integrated into existing regional monitoring and assessment programs, for example, the Chesapeake Bay Program, Puget Sound Partnership, Southern California Bight Regional Monitoring Program, Galveston Bay Regional Monitoring Database. Data collected through these efforts should use compatible open-data standards and be submitted to existing or newly developed publicly available databases.

Improve Environmental Compliance Coordination and Facilitate Local Partnerships

Difficulty in the environmental compliance process is often cited as a key impediment to BUDM implementation. Enhanced communication and coordination can help lower regulatory barriers. Coordinated environmental review processes could help address misalignments in requirements among agencies. Integrated multi-agency review teams (for example, the USACE San Franciso Dredged Material Management Office and the San Francisco Bay Restoration Regulatory Integration Team) can streamline permitting through coordinated project reviews. Teams can also

build trust by co-developing solutions to regulatory challenges, such as how to quantify benefits of "out of kind" restoration particularly when it promotes climate change adaptation.

Recommendation 3: Advance Technical and Analytical Solutions

BUDM implementation can be enhanced by addressing a variety of technical needs. Ideally, addressing these needs would be done collaboratively between multiple agencies, the academic research community, and the end user community, who can inform practical considerations for new tool and knowledge development.

Promote Continued Development of Comprehensive Benefits Assessment Tools

Further development, testing, and application of comprehensive benefits assessment tools will allow BUDM alternatives to be considered along with more traditional disposal alternatives. Current tools omit certain social or ecological benefit categories or may use inconsistent valuation methods. This can cause decision criteria to default to disposal. Developing methods that evaluate a broad range of benefit categories using consistent approaches and metrics would improve the ability to quantify the benefits of BUDM. Increased awareness and training in existing resources and guidelines for comprehensive benefits assessments and evaluations of ecosystem goods and services would facilitate broader implementation of BUDM projects. This should include enhanced web accessibility and focused workshops with staff to work through real-world examples and share best management practices, and lessons learned.

Comprehensive benefits assessments should focus on consideration of the "net positive" benefits of projects, especially when they involve ecosystem function tradeoffs. This should include consideration of non-monetary valuation methods that can provide a more appropriate way to assess ecosystem benefits of BUDM (e.g., Duke Coastal Ecosystem Services Toolkit, USEPA Final Ecosystem Goods and Services Approach). Tools need to be developed that better consider the tradeoffs between short-term impacts and long-term benefits through comprehensive life-cycle analyses, which could include combinations of monetary and non-monetary approaches (e.g., Chivulescu et al. 2024). This should include establishing protocols by which long-term gains, especially the regional benefits that many BUDM projects provide—can be accounted for in the project cost and benefit evaluation process. Because initial applications of comprehensive benefits assessments will be experimental, progress may be iterative and decision-making systems should account for uncertainty during the initial implementations. A system should be developed to capture information from these early applications (e.g., successes, failures, lessons learned, sample tools and outputs) and to broadly disseminate lessons learned to promote continued learning from early experiences.

Develop Tiered Tools for Benefits Evaluation for BUDM Projects

The inability to fully consider the benefits of BUDM alternatives often results in their not being advanced as the preferred approach. Several levels of tools are needed to allow consideration of all monetary and non-monetary benefits for a more comprehensive benefits evaluation. A quick screening tool for assessing ecological and social benefits would enable project managers to quickly identify promising projects for BUDM and advance them for further consideration and a more-detailed comprehensive benefits assessment. This should be accompanied by detailed benefit (and co-benefit) assessment tools for the analysis of short-listed projects. These tools should include both market and non-market evaluation methods (e.g., social and ecological) and could draw on existing practices (Carlsson et al. 2025). Application of these tools may require agencies to consider best value or an alternative to traditional benefit cost analysis when a BUDM option meets diverse social or environmental needs. Comprehensive benefits assessment tools will enable feasibility studies to better valuate the "true cost" of dredge disposal (e.g., life cycle analysis) and apply these assessments more broadly across all mission areas. Development of new tools or enhancement of existing tools should be accompanied by outreach, education, and case studies. This can include the development of a reference database (or enhancement of existing databases) of existing BUDM projects, the processes used to justify them, the challenges they faced, and their post-placement performance and condition.

Facilitate Connections to Help Consolidate and Summarize Guidance Across Agencies or Government Institutions

In collaboration with agencies from over 70 countries, ERDC led the development of international NNBF guidelines, an excellent document on the effective implementation of Beneficial Use/Engineering with Nature (EWN) projects (Bridges et al. 2021). The European Union (EU) has also developed numerous guidance documents on BUDM as part of the Water Framework Directive. These documents contain valuable ideas and approaches that can inform the development of evaluation tools. In addition to the overall EU strategy, other countries, including the Netherlands, France, United Kingdom, and Ireland, have developed guidelines and policy guidance. These documents should be reviewed and summarized to help develop approaches that would be appropriate for local and national agency programs (Newcomer-Johnson et al. 2020; Reed et al. 2013; Weidner et al. 2017).

Develop a Readiness Scale to Better Communicate Maturity of New and Emerging Tools

A scale to show the relative technological readiness of BUDM approaches would help convey uncertainty more transparently and improve trust in and adoption of new methods. Such scales would promote a common understanding of a technology's status (i.e., which BUDM alternatives seem to be most mature now, and where do we need to target more development), support risk management associated with adopting new tools, and guide decisions about the implementation of emerging transition of technologies. Several extant readiness scales could serve as models,

including those developed by NASA and NOAA and the NIH National Library of Medicine Technology Readiness Levels.

Continue to Develop Tools that Match Sediment Source Areas to BUDM Opportunity Areas

ERDC's Natural Infrastructure and Opportunities Tool (NIOT) could be expanded to connect locations and proponents of dredging and restoration projects. Sediment matching tools could be deployed both regionally and nationally and linked to regional sediment management plans. That will require national and regional systems to proactively identify sites and acquire permissions (including potential ownership or easements) to implement BUDM projects. Agencies should also consider developing a regional sediment/BUDM banking system that is pre-screened and used to obtain permits for placement areas that could be used by local dredging projects. This effort would also enhance partnerships with industry and local agencies.

Adopt Open Data Management Standards

We recommend a shift in data management philosophy to adopt open data standards consistent with the Foundations for Evidence-Based Policymaking Act and OMB Circular A-119. The following general considerations and practices are recommended:

- Strive for an integrated, electronic data flow through all steps of the data management process, from data collection through publication
- Manage data in a geospatial format to enhance data visualization and interpretation and to facilitate data integration across programs
- Use an open data format, which may include web services and application program interfaces (APIs), to facilitate data access and sharing

Other desired properties in addition to these general practices will improve the success and longevity of data management systems. These include accessibility, integration, stability, and quality control. Additional discussion of the need for, and recommended approaches to, data management can be found in the Internet of Water Principles and the FAIR (Findability, Accessibility, Interoperability, and Reuse) principles.

Support Continued Research and Development

Funding for research entities (e.g., ERDC, IWR, USGS, NOAA) should continue so they can develop specific technical guidance to advance the knowledge base of BUDM. Agencies should sponsor workshops to identify and review technical data gaps in planning, design, construction, operations, and climate change impacts and to develop a list of research needs and a timeline for tackling them. Topics could include, but not be limited to:

- Advancing means and methods to use fine-grained dredge material for BUDM
- Unconfined material placement considerations to minimize migration
- Coastal wetland restoration techniques
- Approaches to incorporate sediment recycling facilities as a tool to promote BUDM
- Mechanisms to evaluate projects that involve aquatic resource type conversion
- Monitoring strategies and approaches such as regional partnerships, leveraging opportunities, and low-cost options (e.g., remote sensing)

Depending on their intended use and topic, research findings can be published in technical notes, technical reports, or fact sheets. Publication in the peer-reviewed literature will make technical products and case studies easier to discover, will foster wider acceptance by the broader user community, may encourage stronger collaboration with academia, and will help promote coordination across federal and state agencies.

CONCLUSIONS AND RECOMMENDATIONS

Federal, state, and local agencies, including USACE, have made meaningful progress in increasing acceptance and implementation of BUDM, supported by strong leadership and expanding technical tools. Achieving stated targets (e.g., 70% BUDM) is likely achievable in many contexts, but will require addressing communication, coordination, and technical barriers, along with a shift toward greater information sharing, innovation, and risk tolerance. Some of the recommendations provided are aspirational and may not be practical without changes in agency policies, guidance, or practices. We recommend the following priority next steps to facilitate continued progress toward increasing BUDM:

- Improve retrospective evaluation of BUDM projects by developing standardized processes and metrics to assess past analyses and track program effectiveness over time.
- Enhance benefits assessment methods by advancing non-market and non-monetary approaches to better capture social and ecological benefits and costs.
- Improve evaluation of dredging costs by incorporating life cycle and analyses of a broader set of costs and benefits across mission areas.
- Strengthen stakeholder engagement through sustained, ongoing coordination with key partners, including tribal nations.
- Enable innovation through pilot testing by allowing the application of new and emerging analytical tools and approaches.

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