



CHIEF OF ENGINEERS
ENVIRONMENTAL ADVISORY BOARD
WASHINGTON, D.C. 20314-1000 (CECW-P)

Lieutenant General Todd T. Semonite
Commanding General and Chief of Engineers
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441 G Street NW
Washington, DC 20314-1000

9 April 2020

Subject: Capturing Environmental Benefits in Civil Works Projects

Dear LTG Semonite:

This memorandum by the U.S. Army Corps of Engineers (Corps) Chief of Engineers' Environmental Advisory Board (EAB), a Subcommittee of the Army Science Board, addresses an ongoing challenge for the Corps -

- The Corps has been struggling with the measurement and tracking of environmental and other socio-economic benefits, costs, and impacts of Civil Works projects for prioritizing projects and better communicating their value to the nation.
- The Director of Civil Works (DCW) called for this multi-objective approach which builds on years of work in the Corps and by the EAB, and as an added inducement, recently Congress required that the Corps develop guidelines for implementation of the 2013 Principles, Requirements and Guidelines for water resource investments which has similar requirements.
- The EAB recommends that new metrics that more fully capture the value and impacts of projects be integrated into all phases of the project lifecycle (particularly plan formulation) across all business lines and be a priority for the Corps.
- The EAB suggests that EAB members be used as an expert resource to help the Corps develop a set of metrics for this purpose from six important categories of potential project effects: ecosystem goods and services; risk management; restoration potential; landscape and watershed considerations; sustainability, and; climate effects and resilience.
- The EAB suggests that the Corps quickly move to develop a strategy for testing the selected metrics with retrospective case studies, applying that knowledge to new pilot projects, and setting up processes for shared learning, updating, broader roll out, and training.

Introduction

The EAB reviewed the Corps' progress towards evaluating a broader array of benefits and impacts of their projects. It is clear that the Corps has been laboring for years with issues related to improving the measurement and tracking of environmental and other socio-economic benefits, costs, and impacts of Civil Works projects. To set the stage for the EAB's thinking about the recommendations contained herein, a short background summarizing some of these efforts, including previous and ongoing Corps efforts centered on metrics, are provided as an attachment to this memorandum.

The EAB believes that identifying and incorporating additional metrics in decision making can better enable the Corps to prioritize projects and communicate the value of: (1) aquatic ecosystem restoration; (2) natural and nature based infrastructure; and, (3) multi-purpose projects that cross business lines/mission areas. Improved and/or new metrics could be used for more comprehensive decision making (plan selection, prioritization, budgeting) throughout the project life cycle, including the study (formulation and environmental compliance), design, construction, operations and maintenance, and monitoring and adaptive management phases of water resource development projects.

Recommendations

The EAB believes that the on-going effort within the Corps to develop metrics that better capture comprehensive benefits and impacts of civil works projects is critical to advance Corps missions and address the water resource needs of the nation. The EAB would like to continue to support that effort moving forward and offers the following recommendations in this regard:

1. Increase support and engagement from Corps' Senior Leadership to elevate the priority of identifying metrics and provide resources needed to expeditiously move forward and meet the goals of the June 2017 DCW Memorandum. Integration of metrics into the plan formulation process across business lines is critical as plan formulation is probably the most restrictive of decision-making points. The EAB emphasizes that early integration of metrics is a critical first step that will inform all other phases in the project lifecycle. Leadership engagement with the Office of the Assistant Secretary of the Army (Civil Works) to garner support for potential changes to the Corps decision framework is also important for institutional changes to occur.
2. Utilize EAB members as experts to inform the metrics work effort. The EAB is in a unique position to be involved with the metrics work team as advisors and reviewers throughout metric development, testing and implementation in order to provide the Corps with related expertise and independent/external input.
3. Consider a broad set of critical environmental benefit categories when selecting metrics. These can be built from metrics already in use by the Corps for various compliance evaluations. Metrics would ideally be objective and quantitative, but if that is not feasible, objective and qualitative metrics could still allow better decision making and communicating of overall project value. We recommend the following comprehensive categories be considered (see attachment for more detail on examples under each category):
 - a. Ecosystem goods and services (e.g. food web, nutrient cycling, supporting or provisioning services, cultural, floodwater storage).
 - b. Public Interest (e.g. reduction and control of societal risks).
 - c. Restoration potential (e.g. ecosystem/environmental lift by quantity and quality).
 - d. Landscape and watershed (e.g. connection between watershed characteristics and aquatic systems, local/regional/national/international connectivity).
 - e. Sustainability/Threat (e.g., natural resilience [lifespan], adaptability, self-sustaining).

Collectively, metrics should be directly comparable across business lines based on the following attributes: (1) be quantitative to semi-quantitative, or at least objectively scalable; (2) compatible with business line objectives; (3) be adaptable for consistent cross-comparison and decision-making; and, (4) capable of indicating either beneficial or adverse effects.

Strategy

To avoid having the perfect be the enemy of the good, we suggest the Corps quickly move beyond general discussions to make decisions on an initial array of metrics, develop a scoring rubric for each selected metric, and initiate testing in retrospective cases and pilot projects. The Corps should test metrics with a diverse set of projects that are in different phases where possible and evaluate possible metrics (can try multiple sets) in light of the various decision points of the subject projects. We suggest the following:

1. Retrospective evaluations -

a. Conduct a retrospective metrics test on projects that include beneficial use (BU) of sediments when the BU plan was not the least cost alternative. For example, the Corps could evaluate the developed metrics on dredged materials management plans in cases where a BU plan was considered, but not pursued due to the increased costs associated with beneficial use. The evaluation could explore whether adding other metrics changes the outcome of cost-benefit analyses for beneficial use alternatives. The Corps should evaluate each retrospective case study with multiple sets and subsets of metrics to inform an optimal approach. This retrospective study could have applicability to on-going discussions on the federal standard¹ for sediment placement.

b. Conduct a retrospective metrics test on multi-purpose projects, such as flood risk management with ecosystem restoration, to explore whether adding other metrics would have affected the trade-off analyses and whether different alternatives would have provided greater net benefits overall.

2. Pilot project evaluations -

a. The Aquatic Ecosystem Restoration (AER) Business Line Manager should select ecosystem restoration projects that are in the feasibility (study) phase to be pilot projects for testing new metrics beginning with the earliest phase in the project lifecycle.

b. The Corps should also consider applying new metrics in pilots from programs that are already pursuing multi-purpose efforts, such as: the Sustainable Rivers Partnership (an operational program), levee setbacks (pursued in both planning and emergency ops through PL 84-99), the Urban Waters Federal Partnership (projects addressing both restoration and flood risk such as Proctor Creek), the joint navigation-restoration program in the Upper Mississippi River, or regional planning efforts like Texas Coastal.

3. Metric Development -

¹ Federal standard means the dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the 404(b)(1) evaluation process or ocean dumping criteria. 33 CFR Parts 335 through 338.

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After a limited period of retrospective and pilot metric testing, a review should follow to develop lessons learned and confirm selected metrics, develop new metrics, or evaluate scoring rubrics to capture a broader array of benefits and impacts that will be integrated into Corps decision making processes. The Corps should develop training and support to help with operationalizing these new metrics, and adaptively manage their integration by incorporating review and revision into the roll out plan. We suggest involvement of the EAB in the selection of initial metrics for testing, in the development of scoring rubrics, and in future review and revision.

The EAB recommends the Corps more completely account for the broad breadth of environmental benefits and harms (and trade-offs) in decisions for **all business lines** (flood risk management, navigation, etc...), and at **all steps in Corps decision processes** (feasibility studies, planning, budget prioritization, monitoring and adaptive management etc...), to enable a full assessment of whether water resource development projects are “smart investments”, enable cross business line projects, and achieve maximum benefit per dollar spent for the American public.

The lead EAB members for this task were Dr. Lydia Olander, Professor Si Simenstad, and Dr. Sam Atkinson, who are available to answer any questions. We hope the recommendations will be useful and look forward to working with your staff on implementation.

Sincerely,



Mary C. Barber, PhD
Chair, Environmental Advisory Board
Subcommittee of Army Science Board

Attachments

CF:
Chief, Planning and Policy Division
Chief, Environmental Division
Director, ERDC, Environmental Laboratory

Attachment 1: Background

In general, Civil Works planning studies are required to formulate the National Economic Development (NED) Plan² - the plan that reasonably maximizes net national economic benefits, expressed in monetary units, consistent with the Federal objective.³ The exception is when the project purpose is aquatic ecosystem restoration, in which case the Corps determines the National Ecosystem Restoration (NER) Plan - the plan that maximizes monetary and non-monetary beneficial effects to the ecosystem over the monetary and non-monetary costs. The Corps' current approach means that the full range of benefits and impacts may not be evaluated when developing plans, and that perhaps the most beneficial projects are not being implemented.

In recognition of this, in a June 2017 Headquarters memorandum⁴, the Director of Civil Works noted that *"The nation and the communities we serve have a variety of objectives for USACE's Civil Works water resources development projects, such as public safety, economic vitality, recreation, and quality of life. Existing policies and practices in Civil Works are sometimes hampered by a single-objective look at water resource development, which constrains our ability to apply our full technical and problem-solving capability to water resources problems."* The memorandum recognized the importance of "fully identifying, describing, and considering a broader array of potential project benefits" as important to ensuring that water resource projects are smart investments. It additionally noted that all Civil Works programs should consider how and under what circumstances expanded objectives and social and environmental considerations can be undertaken within existing legislated or policy-directed timelines.

More recently Congress, in the 2020 Appropriations Act, called on the Corps to develop final interagency guidelines for the Principles, Requirements and Guidelines (PR&G) for Federal Investments in Water Resources released in March 2013. The PR&G calls for projects to account for the full suite of variables and alternatives that lead to sustainable, resilient and enduring investments, including economic, social, and environmental factors. This is an additional inducement to prioritize this work within the Corps and move quickly to meet Congressional timelines.

A considerable effort has gone into incorporating concepts of integrated water resources management, climate variability, resilience, sustainability, natural and nature-based solutions, and ecosystem goods and services into Planning guidance and procedures. The Planning and Policy Division is leading a team to develop metrics that better capture the benefits and impacts of projects for all business lines. The work is on-going and builds on a wide range of previous Corps efforts in Ecosystems Services Research, Natural and Nature-Based Features Research and Policies, and Reports from the EAB (examples below):

² The Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (P&G). 10 March 1983.

³ The Federal objective is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements. Additionally, per Section 904 of WRDA 1986, the prevention of loss of life is required in the formulation and evaluation of alternative plans.

⁴ CECW-ZB Memorandum for Major Subordinate Commands and Districts. Subject: *Further Advancing Project Delivery Efficiency and Effectiveness of USACE Civil Works*. 21 June 2017.

1. Ecosystem Services Research – A foundation for the Corps' contemporary work on the topic of Ecosystem Goods and Services (EGS) can be found among publications produced by the Corps' Institute for Water Resources (IWR) during the late 1980s and early 1990s, and continued with research in the 1990's and onward by the Evaluation of Environmental Investments Research Program (EEIRP), a program sponsored by Headquarters and jointly assigned to IWR and the Corps' Engineer Research and Development Center (ERDC) - Environmental Laboratory. More recent research has been undertaken on this topic through the Ecosystem Management and Restoration Research Program (EMRRP) and related publications include the following, with a number of other Technical Reports and Technical Notes under review for publication:

a. IWR Report 2013-R-07. "Using Information on Ecosystem Goods and Services in Corps Planning: An Examination on Authorities, Policies, Guidance, and Practices." 2013.

b. ERDC Technical Note EMRRP-ER-18. "Incorporating Ecosystem Goods and Services in Environmental Planning: Definitions, Classification and Operational Approaches." 2013.

c. ERDC Technical Report TR-13-17. "Incorporating Ecosystem Goods and Services in Environmental Planning - A literature review of definitions, classification and operational approaches." 2013.

d. ERDC Special Report-19-xx (in publication process). "A Proposed Ecosystem Services Analysis Framework for the US Army Corps of Engineers." 2019.

2. Natural and Nature-Based Features (NNBF) Research and Policies – NNBF refer to those features that are created through natural processes over time or are human engineered to mimic natural conditions and act in concert with natural processes. An integrated approach to risk management that combines NNBF with other nonstructural and structural measures aims to produce engineering value along with other social, economic, and ecological benefits that promote community resilience. In accordance with §1184 of WRDA 2016 and §1149 of WRDA 2018, the Corps considers NNBF, nonstructural, and structural measures when studying feasibility of projects for flood risk management, hurricane and storm damage reduction, and ecosystem restoration. Additionally, as part of the Corps' Engineering with Nature (EWN) initiative, application of NNBF is being expanded by a range of research and development, technology transfer, and stakeholder engagement.

3. Previous EAB reports delivered to the Corps –

a. Criteria for Aquatic Ecosystem Restoration - EAB Memorandum to Chief of Planning and Policy Division, 8 April 2013. The EAB identified four criteria which could be used to identify and prioritize aquatic ecosystem restoration projects suitable for Corps involvement. The recommendations focused on the rationale for the criteria, rather than the specific descriptions of which project characteristics might be considered in determining whether the criteria are met.

b. Recommendations for Improving the Process of Setting Priorities for Aquatic Ecosystem Restoration Projects - EAB Memorandum to the Chief of Engineers, 19 April 2016. The report represented the 2nd phase of the EABs task (with the 1st phase being the report noted in para 3.a). The 2nd phase report recommended changes to the current process of selecting aquatic ecosystem restoration projects for budgeting and implementation. These included

improving transparency in decision making by separating continuing projects from new start projects; a simpler pre-proposal with minimum information requirements for new starts; and developing metrics of ecosystem goods and services at the watershed planning level that can be used across multiple Corps' business lines for budgeting.

c. Incorporating Ecosystem Services into Communication, Collaboration and Decision Making within the US Army Corps of Engineers – EAB Memorandum to the Chief of Engineers, 19 April 2016. This report provided: (1) an overview of the rationale, benefits and challenges of using ecosystem services; (2) a description of how use of ecosystem services may fit with federal agency and Corps decision making; and, (3) three recommendations for how the Corps might move forward to consider the use of ecosystem services for communication, collaboration, and decision making.

Attachment 2: Important Categories of Metrics

Examples of comprehensive categories of metrics that could be employed to assess effects of projects across business lines (not including benefit:cost ratio, and other direct cost or funding factors).

1. Ecosystem Goods and Services

(Sustainable benefits to humans derived from ecosystems as a “complex and dynamic combination of plants, animals, micro-organisms and the natural environment, existing together as a unit, and depending on one another”.)

- a. Provisioning (food; freshwater; fuel)
- b. Regulating (climate; flood; water quality)
- c. Cultural (aesthetic; education; recreational; spiritual)
- d. Supporting (nutrient cycling; primary production)

2. Public Interest –

(Factors of importance for security, safety and viability of humans and their communities)

- a. Flood risk management (population/life safety at risk; levee and dam safety; shoreline protection)
- b. Navigation (human life and dam safety and risk of failure)
- c. Social and economic impacts (people, business and farm displacement; land ownership, use and development change; economic vitality)
- d. Transportation (transit; traffic)
- e. Air and water quality (circulation; contaminants)
- f. Historic, archaeological and cultural resources (effects on Native Americans; contaminants)

3. Restoration potential –

(Inhibition and constraints on potential to restore natural ecosystem processes and services to humans)

- a. Area (aquatic and wetland; watershed)
- b. Significance (scarcity; complexity and connectivity; hydrologic character)

4. Landscape and Watershed –

(Constraints on natural ecosystem processes that are connected and regulated at landscape/watershed scales)

- a. Impacts to or facilitation of migratory species (effects on migratory pathways and reproduction habitat)
- c. Wetland integrity (hydrologic impacts)
- d. Large/basin-scale climate effects (degradation of natural connectivity)

5. Sustainability/threat –

(Capacity to maintain extant environmental processes in the face of increasing and predicted ecosystem change)

- a. Shoreline (storm vulnerability)
- b. Coastal inundation (relative sea level rise)
- c. Natural resistance/resilience to traumatic events (degradation of natural and human instituted capacity to resist or recover from climate changes)