ENGINEERING AND CONSTRUCTION BULLETIN

US Army Corps of Engineers

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SUBJECT: Risk Informed Decision Making for Engineering Work During Planning Studies.

CATEGORY: Guidance.

1. **References**:

a. Planning Manual Part II: Risk Informed Planning (IWR 2017-R-03), July 2017

b. Director's Policy Memorandum Civil Works Program (DPM CW) 2018-05, Subject: Improving Efficiency and Effectiveness in USACE Civil Works Project Delivery (Planning Phase and Planning Activities), 3 May 2018

c. ER 1110-1-12, Quality Management, 21 July 2006, including Change 1, 30 September 2006 and Change 2, 31 March 2011

d. EC 1165-2-217, Review Policy for Civil Works, 20 February 2018

e. ER 1110-2-1302, Civil Works Cost Engineering, 16 July 2016

f. ER 1110-2-1150, Engineering & Design for Civil Works Projects, 31 August 1999

g. ER 1110-2-8159, Life Cycle Design and Performance, 31 October 1997

h. ER 1105-2-100, Planning Guidance Notebook, 22 April 2000

i. ER 1105-2-101, Risk Analysis for Flood Damage Reduction Studies, 17 July 2017

j. ER 1100-2-8162, Incorporating Sea Level Changes in Civil Works Programs, 31 December 2013

2. **Purpose.** This Engineering and Construction Bulletin (ECB) outlines concepts, goals and provides interim guidance for the engineering and construction components associated with planning studies under the Director's Policy Memorandum CW 2018-05 issued in May 2018, "Improving Efficiency and Effectiveness in USACE Civil Works Project Delivery (Planning Phase and Planning Activities)." A maxim of execution is that expedience is not to be prioritized over sound engineering judgment. The concepts in this ECB can also be applied, as appropriate, to other risk-informed efforts.

3. **Background.** The Civil Works Planning process is undergoing an initiative to better align our project development processes with national priorities and to better address the water resources challenges and needs of the Nation. One of the transformation initiatives is Risk-Informed Planning, which is defined as an analytic-deliberative process to efficiently reduce uncertainty by gathering only the evidence needed to make the next planning decision, and to

manage the risks that result from doing so without more complete information. Risks in planning could be study risks (those affecting the validity and accuracy of analysis in the study), implementation risks (those affecting ultimate constructability and functionality of the plan), outcome risks (those affecting whether our proposed plan achieve the desired benefits), or schedule risks (those affecting the timeline and/or budget of study and/or plan implementation). The concept of risk acceptance includes several ideas. One is that, during the study process, a risk may be determined to be acceptable and the team would then monitor the risk throughout the study to ensure it remains acceptable, while devoting resources to manage other unacceptable risks. Another is that, as the study progresses, the determination might be made that the risk has been managed to an acceptable level, so that no further resources are devoted to its reduction or prevention. The team must determine whether a risk has been managed to a level tolerable to the agency and affected stakeholders. This effort seeks to improve transparent decision-making within existing policies and technical guidance.

4. **Applicability.** This ECB is applicable to all Headquarters USACE (HQUSACE) elements, Divisions, Districts, laboratories and field operating activities related to Civil Works projects. The actions and policies in this ECB will also be applied in the execution of the studies funded by the 2018 Disaster Relief supplemental appropriations (P.L. 115-123).

5. **Directive.** For all Civil Works studies using the new paradigm as directed by reference b, engineering and construction components of planning studies will incorporate the following concepts:

a. Uncertainty and Decision Making. The Risk Informed Decision Making (RIDM) concept is dependent on effective and collaborative PDT communication and discussion during plan formulation. This will require increased use of critical thinking (i.e., sound engineering judgment and realistic assessments of risk) for project scope and risk identification, to formulate conceptual alternative designs, define future with- and without project conditions, and portray total project costs (including a range of costs where necessary for comparison to a range of benefits as described in the Planning Manual Part II) from an early phase. The PDT, engaging the engineering technical lead, will work thoroughly to define the full scope of each alternative plan, the Tentatively Selected Plan and the Recommended Plan, and the levels of risk associated with each based on the uncertainties, assumptions, and decisions made during each phase of the process. This can involve multiple iterations throughout each phase of the process in order to proceed to the next milestone. Analysis of specific design alternatives, selection of a final recommended plan, and development of credible cost estimates, schedule products, and risk identification and assessment over the project life cycle are part of project formulation, and are critical elements that enable risk-informed decision making. Proper risk identification and documentation are essential to this concept. Risk management plays a major factor because risks are identified and then explored or managed to determine what sort of analyses or work efforts may be conducted in order to evaluate the acceptability of the risk(s) and measures that could be taken to buy down the risk(s) deemed unacceptable. A unified PDT decision on the definition of acceptable risk for a given project will ultimately govern the decision making process. While this approach must not lead USACE to accept additional life safety risk in projects, it may be appropriate to make a risk informed decision to defer some design details or analyses to the Preconstruction Engineering and Design (PED) phase, provided that full and proper scoping has been achieved, as scope growth is not covered by project contingency and cost growth due to

known cost risks associated with planning decisions are not part of cost contingency. A Class 3 cost estimate is still required in the final planning report for recommended plans. Focusing early efforts on project scope while providing sufficient documentation and justification is key to this effort.

b. Appropriate Level of Engineering Detail in Each Phase of Planning Studies. The Chief of Engineering at each USACE district is responsible for the quality, including scope and scale, of the engineering information needed to inform decision making in the planning study. The question of "How much engineering is enough" to fully understand the likelihood and consequences of each decision is a critical element of RIDM. A series of questions can help frame these decisions, depending on the phase and the nature of the decision. Regardless of the discipline and the fact that additional technical effort can generally reduce uncertainty or improve understanding, the team should consider the benefit to the current effort or decision to decide what efforts should be pursued, and what trade-offs should be made. Trade-offs should consider time and schedule constraints, and whether the identified risks make it necessary for the PDT to reallocate or request additional resources. Framing questions can include, but are not limited to:

(1) Can the additional effort be deferred (or omitted) by making conservative assumptions, rough estimates, or using abbreviated methods with little impact on the decision at-hand?

(2) Does the current effort support a critical decision, such as one that impacts life-safety, or does it materially impact a factor that could damage the performance of the project over the life cycle, or the reputation or credibility of the USACE?

(3) Does this additional effort increase confidence in factors that would impact the plan selection or illuminate the acceptability of the resulting risk?

(4) Is the additional effort important in defining the scope of the project?

(5) Does the additional effort increase confidence in the base cost estimate (not including contingency), schedule, project benefit calculations, important design factors that impact cost and schedule, and performance over the project life cycle? Or could the uncertainty be dealt with by conservative assumptions?

(6) Is this effort more efficient and effective in reducing risk and uncertainty about the current decision compared to another effort?

(7) Will this effort appreciably improve the quality or confidence in the proposed solution, or significantly reduce the risk and uncertainty of the decision at-hand?

(8) Does existing information exist that can be used or updated to identify risks or reduce uncertainties? For example, previous studies or risk assessments from dam or levee safety? Do the efforts create additional life safety risks not identified in previous risk assessments or transfer those risks to others?

c. Documentation of Level of Effort. In cases where a risk informed decision leads to deferral of some design details or analysis to later design phases, this must be clearly and specifically documented in the project Risk Register. This will ensure follow-up in subsequent project phases. Additional documentation, such as Memoranda for the Record (MFRs) providing more details can also be prepared.

d. Alternatives Milestone. In order to make the best decisions possible, engineering and construction team members must be fully engaged early on in project development to help scope and implement the plan formulation process and identify potential risks that may arise during the feasibility level planning and design and PED phase. Particularly in the scoping, formulation, and alternatives comparison phases of a planning study, experienced engineering staff and/or subject matter experts should weigh in on the scope, risks, and consequences of the project and be present throughout the formulation process. If an issue will significantly impact quality, cost, schedule, or project performance over the life cycle, it should be discussed further and potentially investigated so that any consequences can be identified; decisions on such critical issues should not be delayed until later design phases. Team discussion may be appropriate to scope the cost estimates so all members understand the uses and limitations of the estimates being prepared, considering the decision being made. Additionally, it is important to ensure there is an understanding of all costs associated with each alternative. Cost estimates for alternatives must consider all facets of scope, including risks to quality, costs and schedule, when presenting costs – this includes both construction and non-construction costs, as well as Operations & Maintenance (O&M) costs, so as not to underestimate the full cost of implementing each alternative plan. The total project cost should always be presented when discussing potential costs of alternative plans at a comparable level of detail that is necessary to differentiate between the alternatives.

e. Project Cost Estimates. The bulk of the effort in cost estimating is to be placed early on in the study. Therefore, engage the estimator from the beginning of the study and provide the estimator sufficient time to prepare credible estimates. Since the decision is made to move forward based on the final array of alternatives, the cost estimates for the final array must be appropriately developed. This means the estimates should be based on the full scope of a usable project, prepared using professionally accepted standards, and reviewed in compliance with policy. To achieve the full scope of a usable project, appropriate to the current effort, all necessary features need to be included, and quantities for those features need to be of sufficient accuracy for the decision being made, consistent with the concept of RIDM, and at a comparable and appropriate level of detail. Contingency for each alternative needs to be based on an individualized understanding and analysis of the risks in the identified scope appropriate to the estimate level and decision at-hand. A review needs to be conducted to ensure the estimates are technically sound and accurate, and the review documented as a requisite prior to release of the costs to the public.

f. Vertical Team Engagement. As outlined in SMART Planning initiatives, vertical team engagement remains a vital component of the decision making process. Though the vertical team will stay engaged throughout the planning process, no redundant reviews or decision-making will be added. Risk communication must be a transparent discussion between the PDT and the vertical team.

6. **Update.** All new requirements will be included in the next appropriate policy document update.

7. **Point of Contact.** The point of contact for this ECB is Mr. Bob Bank, P.E., Chief, Civil Works Branch, E&C, HQUSACE, 202-761-5532, email: Robert.Bank@usace.army.mil.

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