CENAD-PD-P   23 October 2025

MEMORANDUM FOR RECORD

SUBJECT: Recommendation to Certify Beach-*fx* version 3.0 for Use in Estimating Economic Consequences of Coastal Storm Events

1. References:

   a. Engineer Circular (EC) 1105-2-412, Assuring Quality of Planning Models, 31 March 2011

   b. Planning Bulletin (PB) 2013-02, Assuring Quality of Planning Models (EC 1105- 2-412), 31 March 2013

   c. Memorandum, CECW-P, Modification of the Model Certification Process and Delegation of Model Approval for Use, 4 December 2017

   d. Memorandum, CECW-P, Delegation of Model Certification, 11 May 2018

   e. Memorandum, CENAD-PD-X, Recommendation for Planning Model Certification of Beach-*fx* v 2.0 with SBEACH Forcing for Use in Estimating Economic Consequences of Coastal Storm Events, 17 October 2023.

   f. Model Certification Review Plan, Beach-*fx* 3.0, 22 February 2024

   g. Model Certification Review Report, Beach-*fx* 3.0, 21 October 2025

2. The National Planning Center of Expertise for Coastal Storm Risk Management (PCX-CSRM) endorses certification of Beach-*fx* version 3.0 for estimating economic damages related to coastal storm events. This endorsement is based on a successfully completed model review process in accordance with references 1.a through 1.d.

3. Beach-*fx* software was developed by the U.S. Army Engineer Research and Development Center Coastal and Hydraulics Laboratory (ERDC-CHL) and the Architecture and Engineering (A/E) firm CDM Smith and is maintained by ERDC-CHL and ERDC Information Technology Laboratory (ITL). Beach-*fx* has been used extensively to provide risk-based projections of economic consequences from coastal storm events and is relied upon to accurately evaluate proposed coastal storm risk management (CSRM) measures for U.S. Army Corps of Engineers (USACE) planning studies. It has

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been tested rigorously since a useable beta version first became available in Fiscal Year
2006. The most recent version of the software to achieve certification was Beach-*fx*
version 2.0 (reference 1.e).

4.   Beach-*fx* is an event-based Monte-Carlo life cycle simulation model designed to
accurately evaluate the physical performance and economic benefits and costs of CSRM
projects including sandy beach alternatives and/or erosion management structures. The
software utilizes an event-based model to simulate and measure the impact of future
coastal storm damages over the project life while accounting for risk and uncertainty in
the analysis. Beach-*fx* applies a probabilistic storm suite through cross-shore modeling to
calculate spatially varying damages in the project area. The system links the predictive
capability of coastal evolution models with project area infrastructure information
(structure inventory), structural damage functions and economic valuations to estimate
the costs and benefits of alternative project designs. This enables Beach-*fx* to provide a
more realistic treatment of CSRM project evolution and optimize commonly applied
approaches. The software evaluates shoreline change and economic consequences
associated with three damage drivers: inundation, erosion, and wave attack. Beach-*fx* is
intended to accomplish the following analytical tasks:

*   Evaluates shoreline changes and economic consequences.

*   Track individual damage drivers (inundation, erosion, wave attack) to allow for
    evaluation of alternative plans and response.

*   Illustrate shoreline changes and resulting damages graphically.

*   Facilitate evaluation and communication of findings.

The analyses that Beach-*fx* makes are a combination of meteorology, coastal
engineering, and economic evaluations. As a data-driven model, its technical framework
incorporates inherent risk and uncertainty associated with CSRM, represented coastal
processes, and combines engineering and economic behavior.

A complete discussion of the workflow and computation logic in Beach-*fx* is provided in
the Beach-*fx* User's Manual on the ERDC website. The following link provides a more
detailed overview of the software and access to model documentation:

https://www.erdc.usace.army.mil/Locations/CHL/beach-fx/

5.   The model review team consisted of three internal reviewers and the model review
lead. The internal review team includes subject matter experts in economics and in
coastal hydraulics and hydrology. The internal reviewers were Gabe Todaro, Coastal
Engineer, SAJ; Idris Dobbs, Senior Coastal Economics Modeler, NAN; and Preston
Oakley, Planning Program Manager, NAD. They provided a detailed review of the

software for useability as well as verified coastal processes and economic consequences. Donald Cresitello, Technical Director, PCX-CSRM, operated as review team lead with significant assistance from Rusty Permenter, Research Hydraulic Engineer, ERDC-CHL.

6. Beach-*fx* consists of three main components: the Graphical User Interface (GUI), the storm response extraction routine, and the main processing routine to calculate morphology and damages. Due to the complexity of the model and the fact that the reviewed version of the model, version 3.0, was developed from the previously certified model (version 2.0), this certification effort was limited to evaluation and verification of model features that have been updated and/or added since implementation of version 2.0. Upon completion of the review and implementation of any model updates, the certified version is labeled version 3.0.

While Beach-*fx* version 3.0 may be employed using shoreline response data from either the SBEACH or CSHORE cross-shore change models, the current evaluation uses only CSHORE shoreline response data as use of SBEACH import data was certified for Beach-*fx* version 2.0 (reference 1.e). Though the storm response extraction routine verification and certification for Beach-*fx* version 3.0 applies to the importation of both SBEACH and CSHORE model data, CSHORE, as the USACE Headquarters Engineering & Construction - Hydrology, Hydraulics, and Coastal (HQUSACE E&C - HH&C) preferred model, is recommended for use in CSRM planning studies. Use of SBEACH will require an approval for use during the Study Review Plan review process.

7. The following ten major modifications to Beach-*fx* 2.0 were identified for evaluation and testing:

   a. CSHORE Shoreline Response Import and Actuation
   b. Dynamic Inventory Workbook Capability
   c. Cumulative Damage Threshold
   d. Scheduled Structure Removal
   e. Scheduled Structure Raising
   f. Triggered Structure Raising
   g. Scheduled Structure Floodproofing
   h. Emergency Nourishment Cutoff Date
   i. Planned Nourishment Cutoff Date
   j. Armor Failure Distribution

8. During testing and evaluation, the mechanism for triggered structure raising was deemed functional, but the underlying assumptions regarding trigger calculations and user input were deemed insufficient for certification. As such, the triggered structure raising modification in Beach-*fx* version 3.0 is not certified and will be re-considered for

certification under a future model version once adjustments to the methodology are applied. The remaining nine major modification are all certified in version 3.0.

9. Detailed explanations and evaluations of the modifications are provided in the Beach-*fx* Model Certification Review Plan (reference 1.f.) and the Model Certification Review Report (reference 1.g).

10. Beach-*fx* version 3.0 is available for download on the AppPortal. The dynamic inventory workbook described in Section 7 is available by contacting the PCX-CSRM, ERDC-CHL, or by accessing this link:

https://www.erdc.usace.army.mil/Locations/CHL/beach-fx/software/

11. The updated Beach-*fx* User's Manual that will accompany the release of Beach-*fx* version 3.0 will be published in Q1FY2026 following final editing and review at ERDC.

12. To address the residual model concerns identified during certification review (reference 1.g), ERDC-CHL and ERDC-ITL are preparing a minor iterative update of Beach-*fx* which will be reviewed and certified in FY2026.

13. The point of contact for this memo is Donald E. Cresitello, Technical Director PCX-CSRM, (347) 370-4591 and Donald.E.Cresitello@usace.army.mil

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