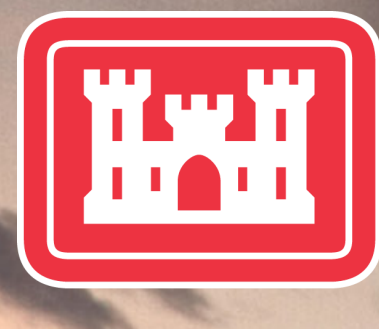# ENGINEERING WITH NATURE® (EWN) TOOLKIT FOR ERDC'S COASTAL STORM MODELING SYSTEM (CSTORM) NUMERICAL MODELING

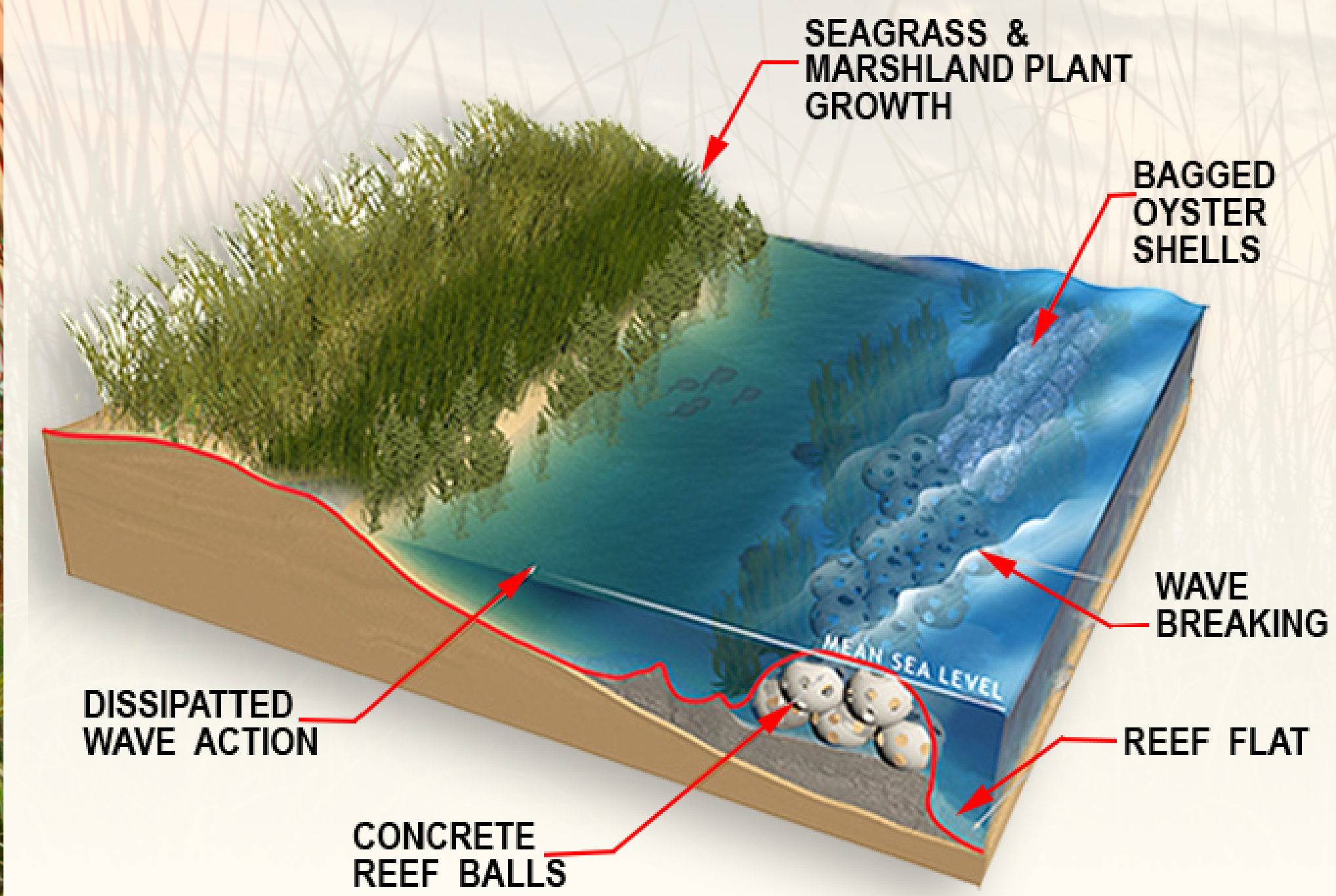**U.S. ARMY CORPS OF ENGINEERS • ENGINEER RESEARCH AND DEVELOPMENT CENTER (ERDC)**
Dr. Amanda Tritinger • Margaret Owensby • Dr. Chris Massey • Dr. Candice Piercy • Mary Bryant • Rachel Innocenti • Abi Wallace
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PROBLEM/OBJECTIVE

Problem
EWN features are being considered more frequently as a comprehensive approach to dredged material management (beneficial use) and for use in coastal flood management projects. However, numerical hydrodynamic modeling of these EWN features is a time consuming and laborious process with limited guidance or procedures.

SEAGRASS & MARSHLAND PLANT GROWTH
BAGGED OYSTER SHELLS
WAVE BREAKING
DISSIPATTED WAVE ACTION
REEF FLAT
MEAN SEA LEVEL
CONCRETE REEF BALLS

Objective
Develop a modeling framework for quantifying the performance and added resiliency benefit of EWN feature utilization.
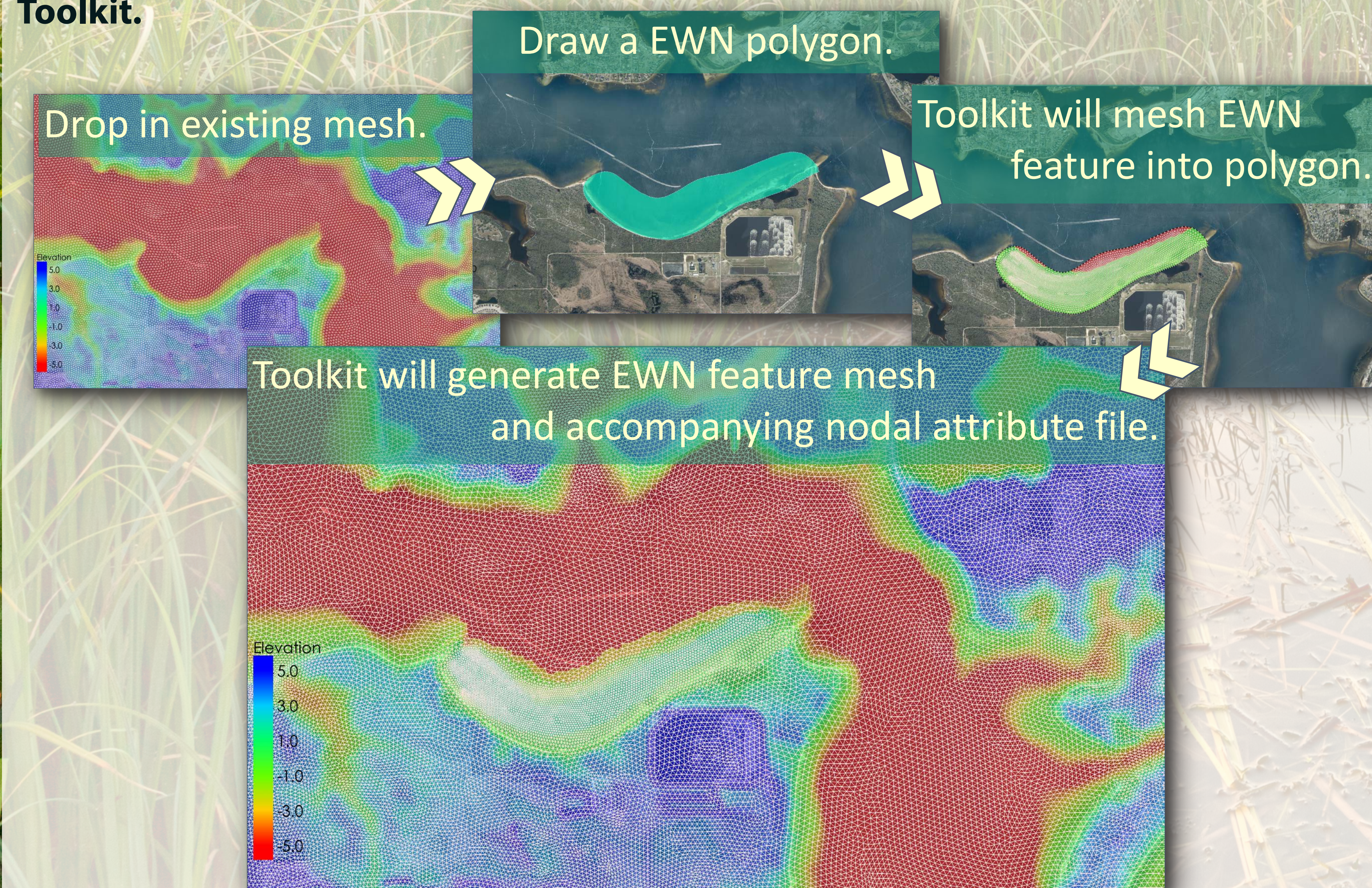Streamline and standardize the hydrodynamic modeling process within a USACE sanctioned and publically available Graphical User Interface, the SurfaceWater Modeling System (SMS); **the EWN CSTORM Toolkit.**

Drop in existing mesh.

Draw a EWN polygon.

Toolkit will mesh EWN feature into polygon.

Toolkit will generate EWN feature mesh and accompanying nodal attribute file.

SOLUTION/APPROACH

Provide a modular GUI within the SMS (and python) that allows rapid representation of EWN features in numerical models.

EWN features will be represented as polygons within the GUI and will have assigned properties.

The EWN polygons can be imported from existing shapefiles or created interactively.

The model mesh/grid must have proper resolution to capture the feature and the
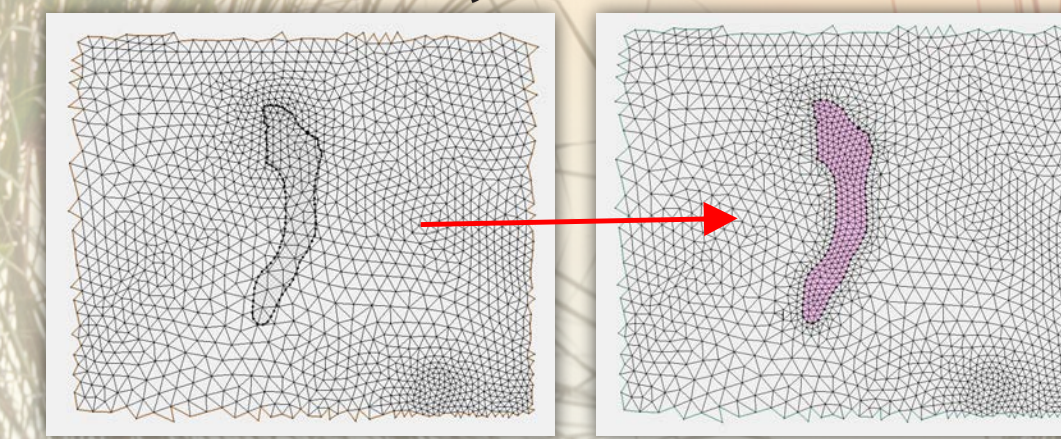
EWN features will come with an options tab or drop down menu to adjust various modeling parameters for that feature by the user, such as topographic or bathymetric values, resolution enhancements, and vegetation drag relationships.

Such parameter settings will be based on existing literature studies and can be interactively selected or refined by the user.

resulting hydrodynamic conditions.
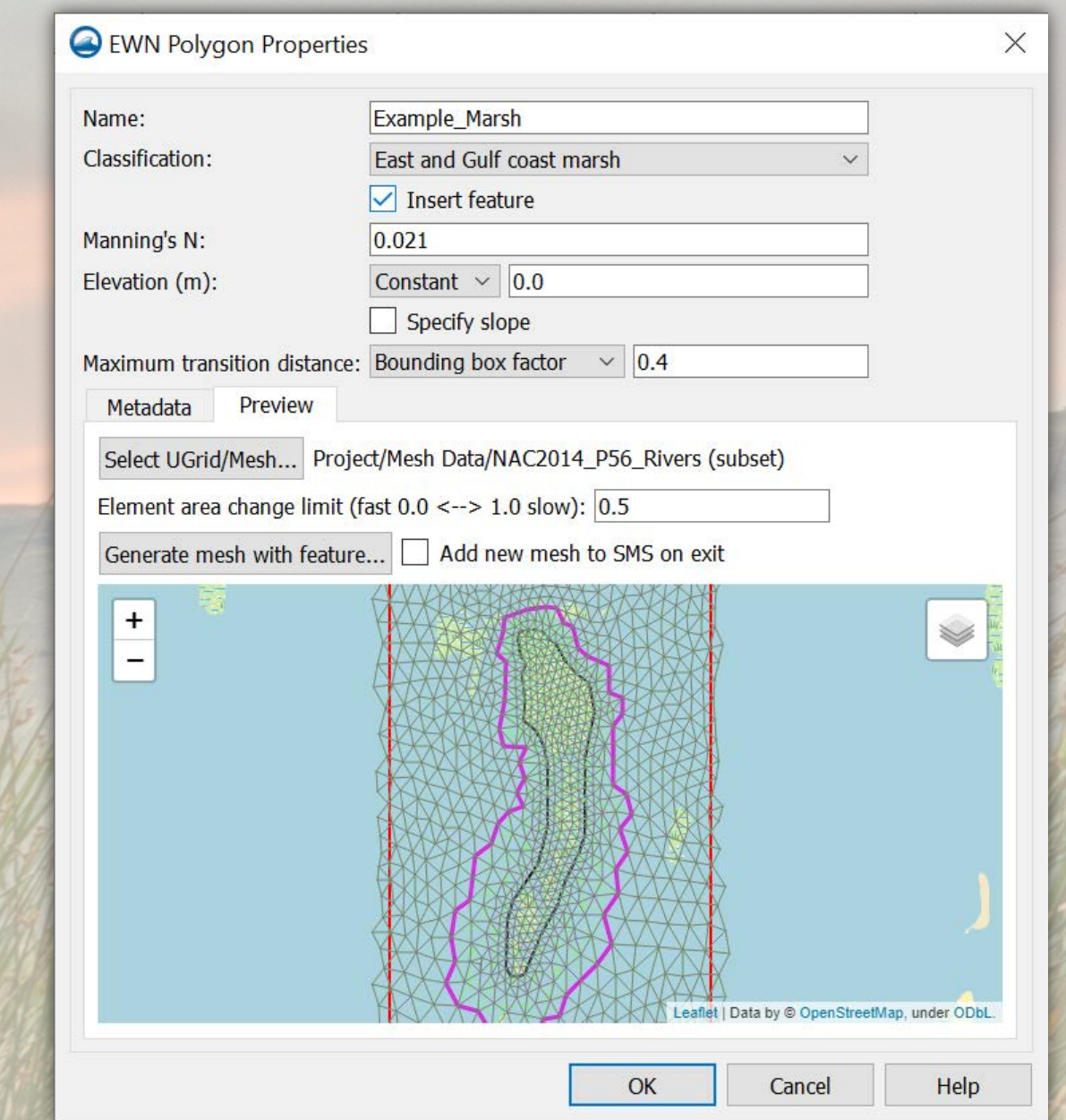
Topographic and bathymetric values for the EWN feature will be assigned by the user and blended into the existing values via the modular procedures.

THE EWN CSTORM TOOLKIT

The EWN CSTORM Toolkit will reduce computational and personnel resources associated with integrating Natural and Nature Based Features (NNBFs) into hydrodynamic numerical modeling analysis. This is achieved by allowing users the ability to interactively add features through a standardized and streamlined work flow that provides them the ability to quickly manipulate multiple aspects of their design. This capability will make hydrodynamic modeling of EWN features less cumbersome to implement and more accessible for evaluation, thus leading to increased innovation in coastal resiliency design work.

"We rely on natural processes and landscapes to sustain human life and well-being. Our energy, water, infrastructure, and agriculture systems use these processes and landscapes to satisfy our most basic human needs. One motivation, therefore, for protecting the environment is to sustain the ecosystem goods and services upon which we depend."

– The Engineering With Nature Atlas

Social
Acceptable
Equitable
Sustainable
Environmental
Economic
Viable