Post-Natural Disaster Engineer RFP

Background

Following a storm event that impacts coastal South Carolina, the Department of Health and Environmental Control's Office of Ocean and Coastal Resource Management (Department) is required to make a determination as to whether or not erosion control structures are destroyed beyond repair (DBR).[1] Erosion control structures to be evaluated for damage include seawalls and bulkheads[2] and rock revetments[3] located within the State's beachfront jurisdiction.

Per S.C. Code of Laws, erosion control structures must not be repaired or replaced if destroyed more than fifty percent above grade.[4] Erosion control structures destroyed more than fifty percent above grade are deemed DBR.

After the initial damage assessment conducted by the Department, erosion control structures determined to be possibly destroyed beyond repair will be further evaluated by an engineer under contract to the Department. The determination of the degree of destruction must be made on a lot by lot basis by reference to county tax maps.[5]

In the case of seawalls and bulkheads, damage must be judged on the percent of the structure remaining intact at the time of damage assessment. The portion of the structure or device above grade parallel to the shoreline must be evaluated. The length of the structure or device parallel to the shoreline still intact must be compared to the length of the structure or device parallel to the shoreline which has been destroyed. The length of the structure or device parallel to the shoreline determined to be destroyed divided by the total length of the original structure or device parallel to the shoreline yields the percent destroyed. Those portions of the structure or device standing, cracked or broken piles, whalers, and panels must be assessed on an individual basis to ascertain if these components are repairable or if replacement is required.[6]

Revetments must be judged on the extent of displacement of stone, effort required to return these stones to the pre-storm event configuration of the structure or device, and ability of the revetment to retain backfill material at the time of damage assessment.[7] Specifically, revetment assessments are to include an evaluation of transects based on: a pre- and post-storm comparison of elevation at the original crest and toe stone locations, a pre- and post-storm comparison of slope, slumping, ability to retain backfill, and stone amount. Pre-storm crest stone and toe stone x,y,z data will be provided by DHEC OCRM.

Currently, the Department has an estimated 1,019 erosion control structures within its beachfront jurisdiction, shown by beachfront municipality in Table 1.

Beachfront Municipality	Erosion Control Structures
North Myrtle Beach	210
Arcadian Shores/Briarcliffe Acres	19
Myrtle Beach	106

[1] S.C. Code Ann. Regs. 30-14(D)(1)(c)
[2] R. 30-14(D)(3)(c)
[3] R. 30-14(D)(3)(d)
[4] S.C. Code of Laws §48-39-290(B)(2)(b)(iii)
[5] R. 30-14(D)(3)
[6] R. 30-14(D)(3)(c)(i)
[7] R. 30-14(D)(3)(d)

Beachfront Municipality	Erosion Control Structures
Surfside	9
Garden City	106
Litchfield Beach	10
Pawley's Island	32
Debidue Island	29
Dewees Island	0
Isle of Palms	10
Sullivan's Island	21
Folly Beach	13
Seabrook Island	50
Botany Bay Island	0
Edisto Beach	32
Harbor Island	3
Hunting Island	0
Fripp Island	215
Pritchard's Island	0
Capers Island	0
Little Capers Island	0
St. Phillips Island	1
Bay Point Island	0
Hilton Head Island	138
Daufuskie Island	15
Total	**1,019**

Table 1: Erosion control structures by beachfront municipality

Scope of Work

Following a natural disaster, the Department will conduct an initial damage assessment of erosion control structures within the State's beachfront jurisdiction. If the Department is unable to determine whether a structure is destroyed beyond repair, the Department will request that the engineer conduct an assessment to evaluate damage to the structure(s) in question.

For seawalls and bulkheads, the contractor will utilize the *DHEC OCRM Beachfront Vertical Erosion Control Structure Data Collection Form* when conducting assessments and incorporate this information into the findings report for each structure assessed. A sample copy of the from, and assessment instructions, are included in Appendix A.

For rock revetments, the contractor will utilize the *DHEC OCRM Beachfront Rock Revetment Data Summary Form* when conducting assessments and incorporate this information into the findings report for each structure assessed. A sample copy of the form, and assessment instructions, are included in Appendix B.

The Department will provide the engineer with an Excel spreadsheet containing the following information for each structure: TMS/PIN number, property address, and structure type (i.e. V = vertical wall, R = rock revetment, or No Data = ECS with no survey data). The spreadsheet will also have an empty column for total percent damage, which will be completed by the engineer (see Deliverables below). The Department will also provide, as available, survey data, historic site photos and post-event flight images.

Contractor's Standards of Responsibility

1.) At the time of the proposal and upon award of any tasking, the contractor must provide copies of any and all licenses, proof of insurance, permits, certifications, other relevant third-party experience, and/or other authorizations necessary to carry out the contracted project.

2.) The contractor will respond via phone or email to a DHEC OCRM request for damage assessment of designated structures no later than 36 hours after receipt of the DHEC OCRM request for assistance.

3.) The contractor will conduct site inspections as quickly as possible and submit deliverables within five (5) business days of completing the assessment.

4.) The contractor will assist DHEC OCRM in presenting and defending the conclusions of investigations conducted under this contract during meetings with property owner(s), agents and other involved parties; in administrative appeals and during any subsequent litigation.

5.) The contractor shall be required to submit copies of all invoices with adequate documentation for all requested reimbursement of expenditures.

Deliverables

1.) Final Report: The contractor will submit a report to the Department for each structure evaluated. The report should be submitted within five (5) business days of completing the assessment. The report should include the following information:
   a. Tax Map Number of Property
   b. Address
   c. Site Description
   d. Observed Deficiencies
   e. Inspection Photographs
   f. Assessment Conclusions (including percentage of structure deemed totally destroyed)

2.) Inspection Photographs: Photographic documentation of each structure is required. Photographs should be provided as individual JPEG images and must be labeled with the full address and the date of assessment (e.g. 3000 Marshall Blvd._ mmddyyyy).

3.) Excel Spreadsheet: This spreadsheet will be provided by the Department (see Scope of Work above). The column for total percent damage should be completed by the engineer.

4.) For revetments only, please also provide:

   a. Excel Spreadsheet with the following information for each transect.
      i. Pre-storm height
      ii. Pre-storm width
      iii. Pre-storm slope
      iv. Post-storm height
      v. Post-storm width
      vi. Post-storm slope
   b. Raw post-storm data collection (x, y, z data for original crest and toe stone locations and substrate characterization) in GIS format.

Relevant Definitions

Destroyed Beyond Repair (DBR): For erosion control structures means less than 50% of the structure above grade remains intact at the time of the assessment.

Erosion control structures (ECS):

1. Seawall: a special type of vertical retaining wall that is designed specifically to withstand normal wave forces;

2. Bulkhead: a vertical retaining wall designed to retain fill material but not to withstand wave forces on an exposed shoreline;

3. Revetment: a sloping structure built along an escarpment or in front of a bulkhead to protect the shoreline or bulkhead from erosion.

Panel: Vertical board or sheet of metal, which is part of a bulkhead or seawall that is held in place by whaler(s).

Pile: Cylindrical or flat member of wood or steel hammered vertically into sand to form part of a foundation for a bulkhead or seawall.

Stone Amount: Amount of stone in a revetment transect, which is recorded as (A) for adequate, (D) for deficient or (S) for surplus.

Whaler: Horizontal member of wood or steel of a bulkhead or seawall, which is attached to piles to hold panels in place between piles.

Appendix A: Vertical Erosion Control Structure Assessment Instructions

Complete the *Beachfront Vertical ECS Data Collection Form*, per instructions. Instructions and a sample form are included on the following pages. *For component definitions, refer to Relevant Definitions above*.

South Carolina Department of Health and Environmental Control
Office of Ocean and Coastal Resource Management

Beachfront Vertical Erosion Control Structure Data Collection Form

South Carolina Coastal Division Regulations

Per South Carolina Code of Regulations, damage to seawalls and bulkheads will be judged on the percent of the structure remaining intact at the time of damage assessment. The portion of the structure or device above grade parallel to the shoreline must be evaluated. The length of the structure or device parallel to the shoreline still intact must be compared to the length of the structure or device parallel to the shoreline which has been destroyed. The length of the structure or device parallel to the shoreline determined to be destroyed divided by the total length of the original structure or device parallel to the shoreline yields the percent destroyed. Those portions of the structure or device standing, cracked or broken piles, whalers, and panels must be assessed on an individual basis to ascertain if these components are repairable or if replacement is required (R.30-14(D)(3)(c)(i)).

Instructions for Completing Beachfront Vertical ECS Data Collection Form

Fill out the Date, Time, Address, and TMS/PIN fields at the top of the form.

Evaluate all visible materials the structure is composed of and circle all that apply.

Determine whether the structure is composed of a single component or multiple components, then evaluate the structure using the appropriate Single Component Wall or Multi-Component Wall sections. *Components include piles, whalers, and panels. Components may be made up of one or more than one material.*

A. Single Component Walls:
   1. Using the ECS survey data provided by DHEC OCRM, identify the "Length_FT" of the structure in the attribute table and enter this value as the ***original length*** in decimal feet (e.g. 100.5 feet; not 100 feet, 6 inches). *For structures with no survey data, measure the wall length within the extent of the parcel boundary (refer to past photos and evidence in the field to guide this measurement).*
   2. Evaluating the above-grade portion of the wall, measure the present length of the structure that is totally destroyed (i.e. the section of the wall where all components are cracked, broken, or missing) and enter length as ***present length totally destroyed*** in decimal feet. All lengths are shore-parallel, wing walls are not included.

B. Multi-Component Walls: Circle all visible components (piles, whalers, panels).
   1. Follow steps 1 and 2 above for Single Component Walls.
   2. For the remaining portion of the wall that is not totally destroyed, count and/or calculate/estimate the number of original components and the number of cracked, broken, or missing components (for each component type). Enter these numbers in the respective fields. If a component crosses a property boundary, determine which property includes the greatest portion or length of the component and count the component toward that property.

South Carolina Department of Health and Environmental Control
Office of Ocean and Coastal Resource Management

Beachfront Vertical Erosion Control Structure Data Collection Form

Damage assessment includes above-grade portion of the structure. All length measurements are shore parallel (wing walls are not included) and must be entered in decimal feet (e.g. 100.5 feet, not 100 feet 6 inches).

Date _____ Time _____

Address _____ TMS/PIN _____

Material(s) *(circle all materials that apply)* *Concrete* *Wood* *Metal* *Vinyl*

Single Component Wall:

Original Length* _____

Present Length Totally Destroyed** _____

Multi-Component Wall:

Original Length* _____

Present Length Totally Destroyed** _____

Components *(circle all components that apply)*

On the remaining portion of the wall, evaluate the following:***

Pilings	# of Original Pilings _____	# of Pilings Cracked/Broken/Missing _____
Whalers	# of Original Whalers _____	# of Whalers Cracked/Broken/Missing _____
Panels	# of Original Panels _____	# of Panels Cracked/Broken/Missing _____

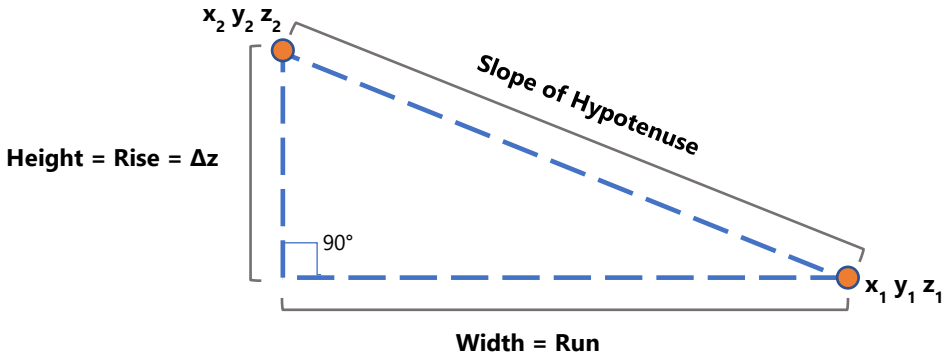
***Original Length:** For known structures, this can be found in the GIS data provided by DHEC OCRM (refer to Length_FT attribute). For suspected ECS, survey data will not be available. In these cases, measure the wall length within the extent of the parcel boundary (refer to past photos and evidence in the field to guide this measurement).*

*** **Present Length Totally Destroyed:** Portion of the structure that is completely destroyed (i.e. all components are cracked, broken, or missing). To be considered functional, a wall must be no more than 2 feet or 30 degrees out of alignment, whichever is less.*

**** **Remaining portion of the wall:** The portion of the wall that is not totally destroyed*

Appendix B: Rock Revetment Assessment Instructions

Pre-Storm Data Calculations: Using data provided by OCRM, calculate pre-storm dimensions of each revetment transect, as outlined below. *In the following schematic, the triangle represents a vertical cross section of the revetment at a transect. The orange points, x_2 y_2 z_2 and x_1 y_1 z_1 represent x, y, z coordinates at the crest stone and toe stone, respectively.*



- Calculate the change in ***height*** between the crest and toe stone (i.e. rise) at each transect. The height (Δz) should be calculated in decimal feet as follows.

$$Height = \Delta z = z_2 - z_1$$

- Determine the ***width*** (i.e. run) at each transect. The width should be calculated in decimal feet as the distance between coordinates x_2 y_2 and x_1 y_1.[8] Please identify the methodology that will be used to calculate this distance.
- Calculate the ***slope*** of the line between the crest stone and toe stone points (i.e. slope of the hypotenuse) at each transect. The slope should be calculated as rise over run (i.e. height divided by width).

$$Slope = \frac{Height}{Width}$$

Post-Storm Data Collection: At each transect, check into pre-storm x, y locations of the crest stone and toe stone, and capture new post-storm x, y, z coordinates at the original crest stone and original toe stone locations, noting (using codes) whether the substrate at each location is rock, sand, or other.

Post-Storm Data Calculation: Calculate post-storm dimensions at each transect that correspond to pre-storm dimensions, using the same instructions above (i.e. height, width, slope).

Pre-Storm/Post-Storm Comparison Calculations: Using pre- and post-storm dimensions, calculate:

- Change in elevation at original crest stone x, y location at each transect in decimal feet.

$$Change\ in\ Elevation_{Crest} = z_{2_{post-storm}} - z_{2_{pre-storm}}$$

- Percent change in elevation at original crest stone location at each transect.

[8] A variety of tools may be used to calculate the distance between coordinate sets, for example an online calculator may be used (e.g. https://gps-coordinates.org/distance-between-coordinates.php).

$$Percent\ Change\ in\ Elevation_{Crest} = \frac{z_{2_{post-storm}} - z_{2_{pre-storm}}}{z_{2_{pre-storm}}} \times 100$$

- Change in elevation at original toe stone x, y location at each transect in decimal feet.

$$Change\ in\ Elevation_{Toe} = z_{1_{post-storm}} - z_{1_{pre-storm}}$$

- Percent change in elevation at original toe stone location at each transect.

$$Percent\ Change\ in\ Elevation_{Toe} = \frac{z_{1_{post-storm}} - z_{1_{pre-storm}}}{z_{1_{pre-storm}}} \times 100$$

- Change in slope at each transect.

$$Change\ in\ Slope = Slope_{post-storm} - Slope_{pre-storm}$$

- Percent change in slope at each transect.

$$Percent\ Change\ in\ Slope = \frac{Slope_{post-storm} - Slope_{pre-storm}}{Slope_{pre-storm}} \times 100$$

Complete the *Beachfront Rock Revetment Data Summary Form* per instructions. Instructions and a sample form are included on the following pages.

South Carolina Department of Health and Environmental Control
Office of Ocean and Coastal Resource Management

Beachfront Rock Revetment Data Summary Form

South Carolina Coastal Division Regulations

Per South Carolina Code of Regulations, rock revetments must be judged on the extent of displacement of the stone, effort to return this stone to the pre-storm event configuration of the structure or device, and the ability of the revetment to retain backfill material at the time of the damage assessment (R.30-14(D)(3)(d)).

An inventory of a revetment will require that the seaward slope of the structure be determined by pulling at tape from the highest crest stone to the top of a representative toe stone. Revetment transects will begin at the northern property line and are to be repeated every 20 feet across the revetment to the southern property line. The frequency of these transects may be intensified to every 10 feet to encompass high or low extremes in the rock elevations. A schematic drawing shall depict the revetment by its transects. Beside each transect shall appear the letters (A) for adequate stone amounts, (D) for deficient stone amounts, and (S) for surplus stone amounts. Combinations of these letters on one transect will be separated by a short line that will distinguish one depiction from the other along the transect. The elevation at the top of the revetment must also be included (R.30-14(D)(4)(b)).

To determine if a revetment is destroyed beyond repair, revetment transects must be conducted as described in the inventory section, R.30-14(D)(4). The post-damage assessment transects will be compared to the original revetment configuration. If the revetment has slumped or stone been lost to the extent that the percentage of damaged revetment exceeds the percentages allowed in R.30-14(N)(3)(e), the structure is destroyed beyond repair (R.30-14(D)(5)(b)(ii)).

Instructions for Completing Rock Revetment Data Summary Form

Fill out the date, time, address, and TMS/PIN section.

Identify if the structure is a combination of a vertical wall fronted by a rock revetment.

Transect Assessment Table: For each transect, fill out the table with the following information.

- Enter calculated value of change in elevation at original crest stone x, y location in decimal feet.
- Enter calculated value of % change in elevation at original crest stone x, y location.
- Enter calculated value of change in elevation at original toe stone x, y location in decimal feet.
- Enter calculated value of % change in elevation at original toe stone x, y location.
- Enter calculated value of change in slope.
- Enter calculated value of % change in slope.
- Determine if the revetment has slumped at each transect. (Y or N).
- Determine if the revetment has the ability to retain backfill at each transect. (Y or N).
- Characterize the stone amount at each transect as S (surplus), A (adequate), or D (deficient).

Based on the assessment information above, and your professional expertise, enter the percentage of the revetment that is totally destroyed.

South Carolina Department of Health and Environmental Control
Office of Ocean and Coastal Resource Management

Beachfront Rock Revetment Data Summary Form

Date _____ Time _____ Address _____ TMS/PIN _____

Is this structure a combination of a vertical wall fronted by a rock revetment? Yes ____ No ____

Revetment Transects	Change in Elev. Crest	% Change in Elev. Crest	Change in Elev. Toe	% Change in Elev. Toe	Change in Slope	% Change in Slope	Slumped? (Y/N)	Ability to Retain Backfill? (Y/N)	Stone Amount (S/A/D)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									

Based on the assessment information above, and your professional expertise, enter the percentage of the revetment that is totally destroyed:
_____%