SBEACH Model Studies for Florida Atlantic Coast: Brevard, St. Johns, Volusia, and Indian River Counties

Report 2

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REPORT 2

This Report 2 volume contains presentation of the SBEACH model 15- and 25-year storm erosion simulation results for St. Johns, Volusia, and Indian River counties. The Report 1 volume contains the Table of Contents, Foreword, Executive Summary, and Background portions of the report documentation for both report volumes. The Report 1 and Report 2 volumes are accompanied by report appendices in separate volumes as listed in the Table of Contents in Report 1. The report appendices include supporting information and results from SBEACH model calibration work presented in Report 1. The appendices also contain the SBEACH 15- and 25-year storm erosion plots at all FDEP range locations in St. Johns, Volusia, and Indian River counties.

3.0 St. Johns County SBEACH Application

3.1 Model Configuration

The SBEACH model configuration for St. Johns County for high-frequency storm erosion simulation, including model input parameters, was based on the model calibration results from St. Johns County described Report 1 of this report documentation. The specific Reach input values, including sediment grain size, maximum slope prior to avalanching, and sediment transport parameters were based on the model calibration work described in detail in Report 1.

Storm tide hydrographs developed by BSRC (2009) for 15- and 25-year storms were used as storm input in SBEACH for St. Johns County. As with the model calibration work in St. Johns County, consideration was given to accounting for the set-up component in the storm tide elevations, as well as, set-up computations within SBEACH. As a result, revised, adjusted versions of the FSU-BSRC hydrographs were used.

The BSRC hydrographs were adjusted down in elevation to compensate for the set-up generated by SBEACH. The hydrograph reductions were proportional reductions of the BSRC hydrographs based on trial and error evaluations performed during model calibration work for St. Johns County. Use of the adjusted BSRC hydrographs resulted in final average maximum water elevations with set-up values from SBEACH which were equivalent to the BSRC peak storm tide elevations for the 15- and 25-year storm tide hydrographs. A graph depicting the original BSRC 15- and 25-year storm tide hydrographs and the adjusted/reduced hydrographs used in the final SBEACH erosion model runs for St. Johns County is shown in Figure 51. A listing of recommended Reach and Storm input values for use in 15- and 25-year storm erosion simulations using SBEACH is contained in Appendix VI of this report. Time series values for the original and adjusted hydrographs for St. Johns County are tabulated in Appendix VII of this report.

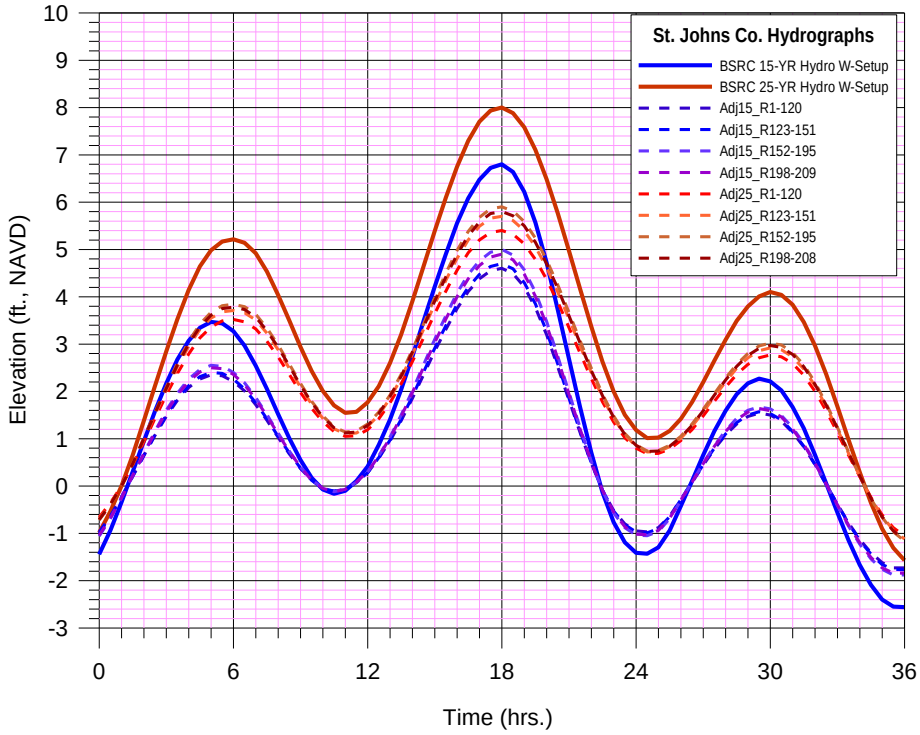

Figure 51. 15- and 25-yr BSRC and adjusted storm tide hydrographs for St. Johns Co.

Specific wave conditions associated with 15- and 25-year return interval storm events for SBEACH model input were not found to be available at the time of this study. Development of such wave conditions were beyond the scope of this study. However, testing performed during the model calibration phase of this study presented in Report 1 of this report documentation provided constant wave conditions for use for high-frequency storm events. Therefore, the constant wave conditions listed in Appendix VI were used in the SBEACH model for the 15- and 25-year storm erosion simulations.

3.2 Model Application and Results

Graphic plots of the 15- and 25-year storm erosion profiles generated from SBEACH for St. Johns County for the 209 range location profiles are provided in Appendix VIII of this report. The survey profiles used as the input profiles in SBEACH are BBCS profiles from 2007/2008. The plots in Appendix VIII are shown in the NAVD88 vertical datum. The map in Figure 52 below depicts the FDEP profile range locations across the St. Johns County shoreline. An example of 15 and 25-yr erosion profiles obtained from SBEACH for FDEP range R120 is shown in Figure 53.

Graphic plot overlays of the measured pre- and post-storm erosion profiles and SBEACH-generated erosion profiles obtained from model calibration work are provided in Appendix I of this report. Three sets of plots are provided in Appendix I; one for the Thanksgiving Storm for St. Johns County, and two for Brevard County, for Hurricane Frances and Hurricane Jeanne.

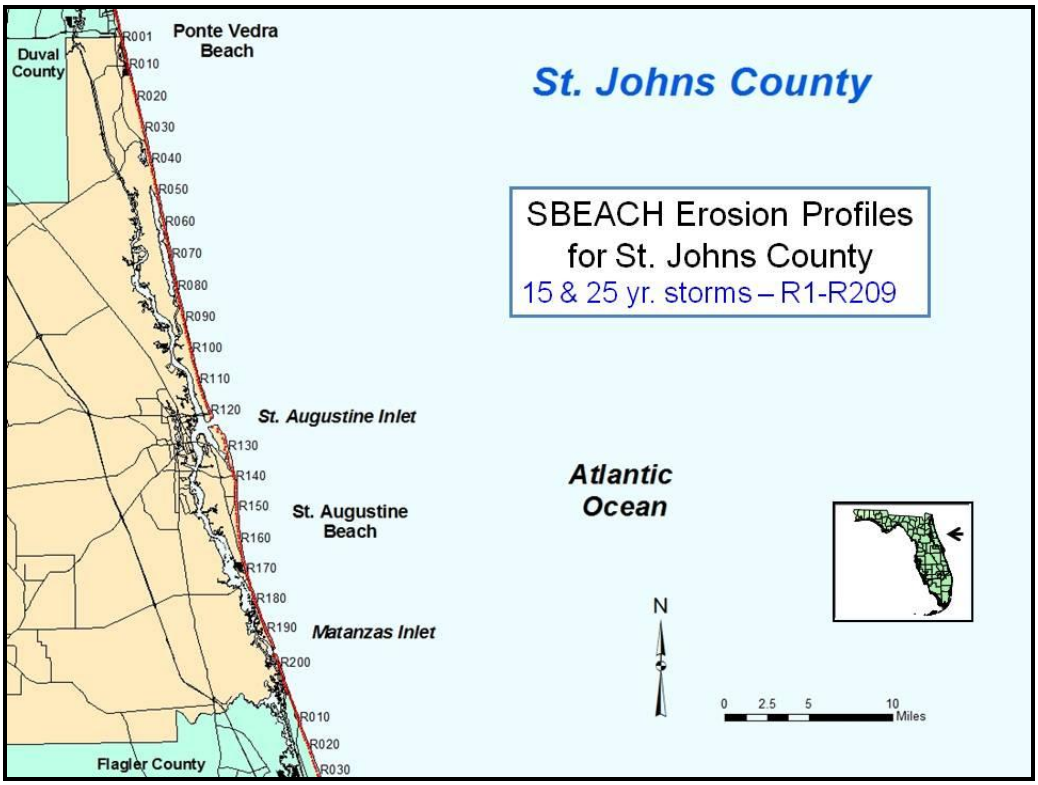

Figure 52. Map of FDEP profile range locations across the St. Johns County shoreline.

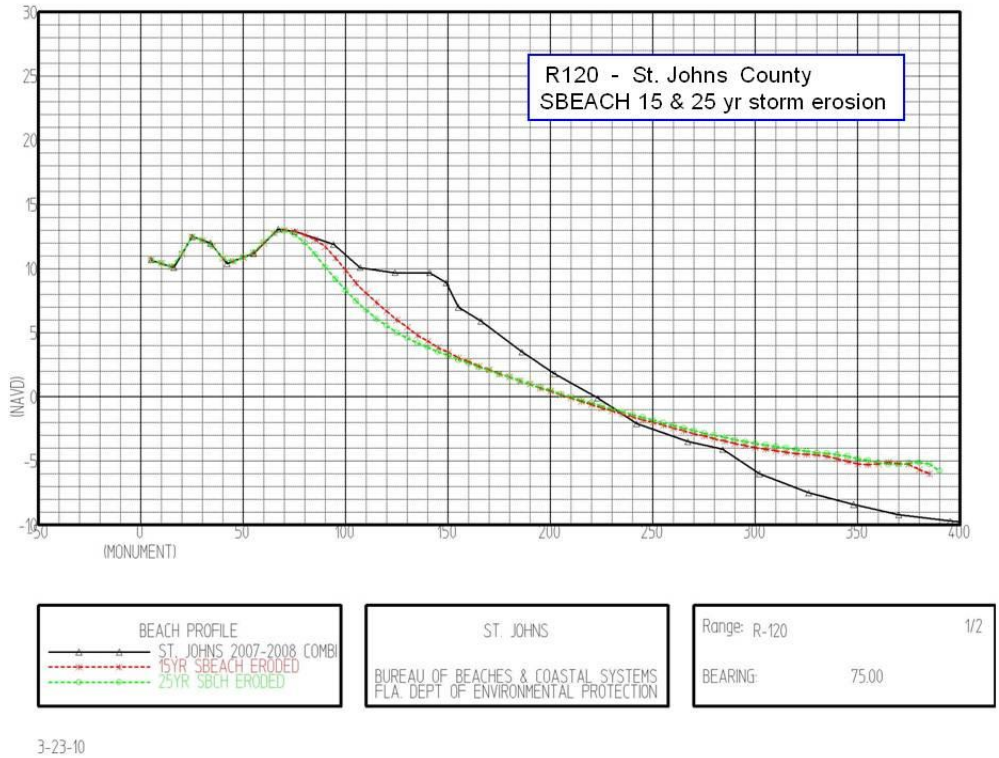

Figure 53. Example of 15 and 25-yr storm erosion profiles at R120 in St. Johns County.

4.0 Volusia County SBEACH Application

4.1 Model Configuration

The SBEACH model configuration for Volusia County for high-frequency storm erosion simulation, including model input parameters, was based on the model calibration results from St. Johns County described Report 1 of this report documentation. The specific Reach input values, including sediment grain size, maximum slope prior to avalanching, and sediment transport parameters were based on results from the St. Johns County calibration work.

The Reach input values for these parameters for Volusia County were generated from measured beach slopes from profile surveys of Volusia County and from relationships between these parameters and beach slope obtained from St. Johns County. A graph depicting beach slopes from 1987 profile surveys and average beach slopes for selected reaches along the County shoreline is shown in Figure 54. Graphs of beach slopes based on other available Volusia County profile survey data sets are contained in Appendix V. A graph of mean sediment grain size values for Volusia County based on application of the beach slope versus sediment grain size relationship from St. Johns County is shown in Figure 55. Mean grain size values of 0.15-0.2 mm. south of Ponce de Leon Inlet between R150-190 were verified by data collection reported by Taylor Engineering, Inc. (2003). Similarly, values for maximum slope prior to avalanching and sediment transport coefficient, K, were obtained through the relationships developed for St. Johns County presented in Report 1 of this report documentation.

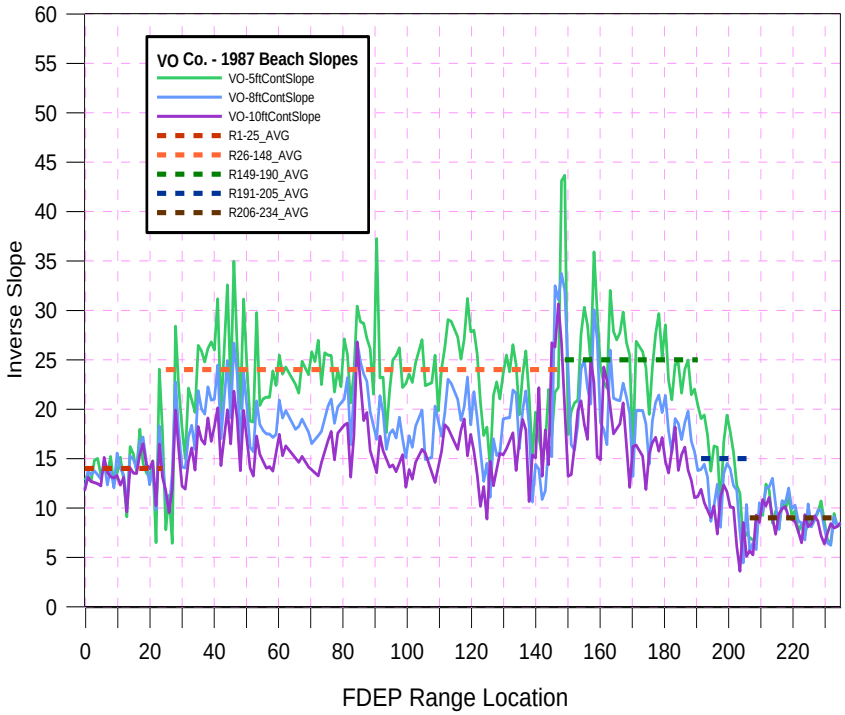

Figure 54. Beach slopes from 1987 profile surveys with selected averages for Volusia Co.

Storm tide hydrographs developed by BSRC (2009) for 15- and 25-year storms were used as storm input in SBEACH for Volusia County. As with the model calibration work in St. Johns County, consideration was given to accounting for the set-up component in the storm tide elevations, as well as, set-up computations within SBEACH. As a result, revised, adjusted versions of the FSU-BSRC hydrographs were used.

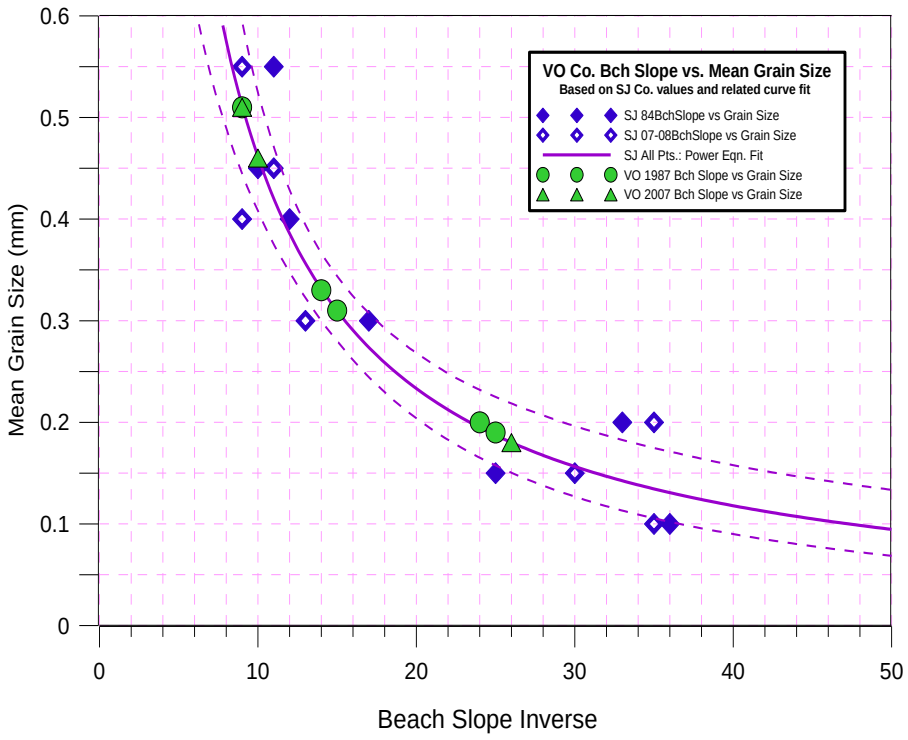

Figure 55. Sediment grain size values obtained from beach slopes measured from Volusia County profile surveys based on beach slope vs. sediment grain size relationship from St. Johns County.

The BSRC hydrographs were adjusted down in elevation to compensate for the set-up generated by SBEACH. The hydrograph reductions were proportional reductions of the BSRC hydrographs based on trial and error evaluations performed during initial SBEACH model application for Volusia County.

Use of the adjusted BSRC hydrographs resulted in final average maximum water elevations with set-up values from SBEACH which were equivalent to the BSRC peak storm tide elevations for the 15- and 25-year storm tide hydrographs. A graph depicting the original BSRC 15- and 25-year storm tide hydrographs and the adjusted/reduced hydrographs used in the final SBEACH erosion model runs for Volusia County is shown in Figure 56.

A listing of recommended Reach and Storm input values for use in 15- and 25-year storm erosion simulations using SBEACH is contained in Appendix VI of this report. Time

series values for the original and adjusted hydrographs for Volusia County are tabulated in Appendix VII of this report.

Specific wave conditions associated with 15- and 25-year return interval storm events for SBEACH model input were not found to be available at the time of this study. Development of such wave conditions were beyond the scope of this study. However, testing performed during the model calibration phase of this study presented in Report 1

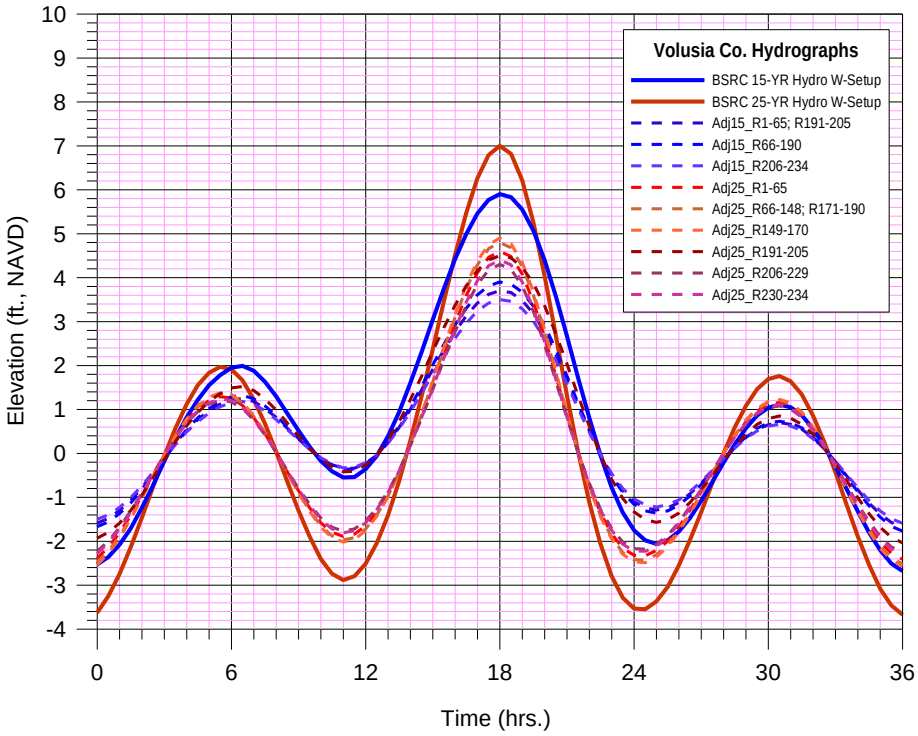

Figure 56. 15- and 25-yr BSRC and adjusted storm tide hydrographs for Volusia Co.

of this report documentation provided constant wave conditions for use for high-frequency storm events. Therefore, the constant wave conditions listed in Appendix VI were used in the SBEACH model for the 15- and 25-year storm erosion simulations.

4.2 Model Application and Results

Graphic plots of the 15- and 25-year storm erosion profiles generated from SBEACH for Volusia County for the 234 range location profiles are provided in Appendix IX of this report. The survey profiles used as the input profiles in SBEACH are BBCS profiles from 2007/2008.

The plots in Appendix IX are shown in the NAVD88 vertical datum. The map in Figure 57 below depicts the FDEP profile range locations across the Volusia County shoreline. An example of 15 and 25-yr erosion profiles obtained from SBEACH for FDEP range R196 is shown in Figure 58.

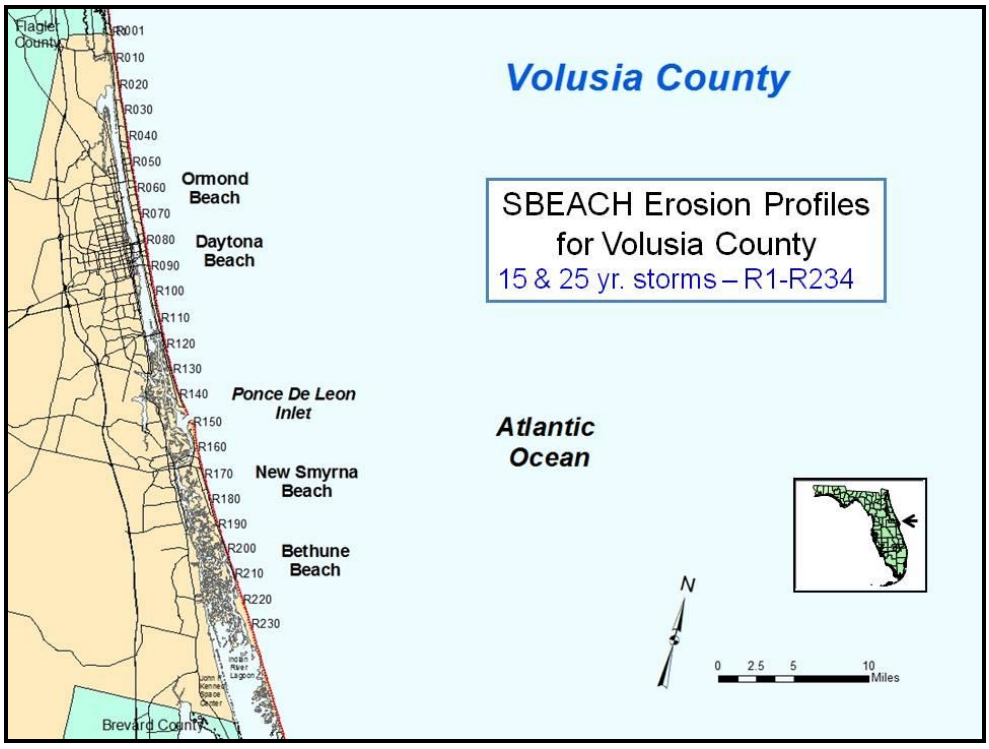

Figure 57. Map of FDEP profile range locations across the Volusia County shoreline.

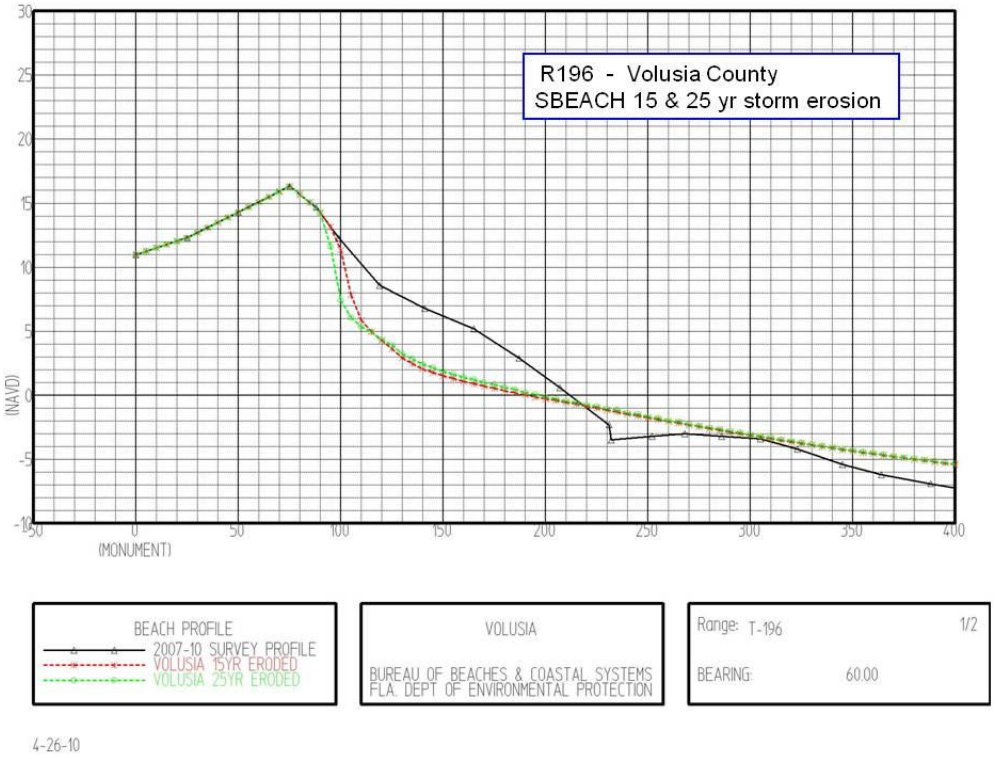

Figure 58. Example of 15 and 25-yr storm erosion profiles at R196 in Volusia County.

5.0 Indian River County SBEACH Application

5.1 Model Configuration

The SBEACH model configuration for Indian River County for high-frequency storm erosion simulation, including model input parameters, was based on the model calibration results from Brevard County and from St. Johns County described Report 1 of this report documentation. The specific Reach input values, including sediment grain size, maximum slope prior to avalanching, and sediment transport parameters were based on results from the St. Johns County calibration work.

The Reach input values for these parameters for Indian River County were generated from measured beach slopes from profile surveys of Indian River County and from relationships between these parameters and beach slope obtained from St. Johns County. A graph depicting beach slopes from a combined July 2006 profile surveys and average beach slopes for selected reaches along the County shoreline is shown in Figure 59. Graphs of beach slopes based on other Indian River County profile survey data sets are contained in Appendix V. A graph of mean sediment grain size values for Indian River County based on application of the beach slope versus sediment grain size relationship from St. Johns County is shown in Figure 60. Mean grain size values of 0.36-0.4 mm. for north Indian River County were verified by data collection reported by Corps of Engineers (1977) and Coastal Tech (2008). Similarly, values for maximum slope prior to avalanching and sediment transport coefficient, K, were obtained through the

Figure 59. Beach slopes from 2006 profile surveys with selected averages for IR Co.

relationships developed for St. Johns County presented in Report 1.

Storm tide hydrographs developed by BSRC (2010) for 15- and 25-year storms were used as storm input in SBEACH for Indian River County. As with the model calibration work in St. Johns County, consideration was given to accounting for the set-up component in the storm tide elevations, as well as, set-up computations within SBEACH. As a result, revised, adjusted versions of the FSU-BSRC hydrographs were used.

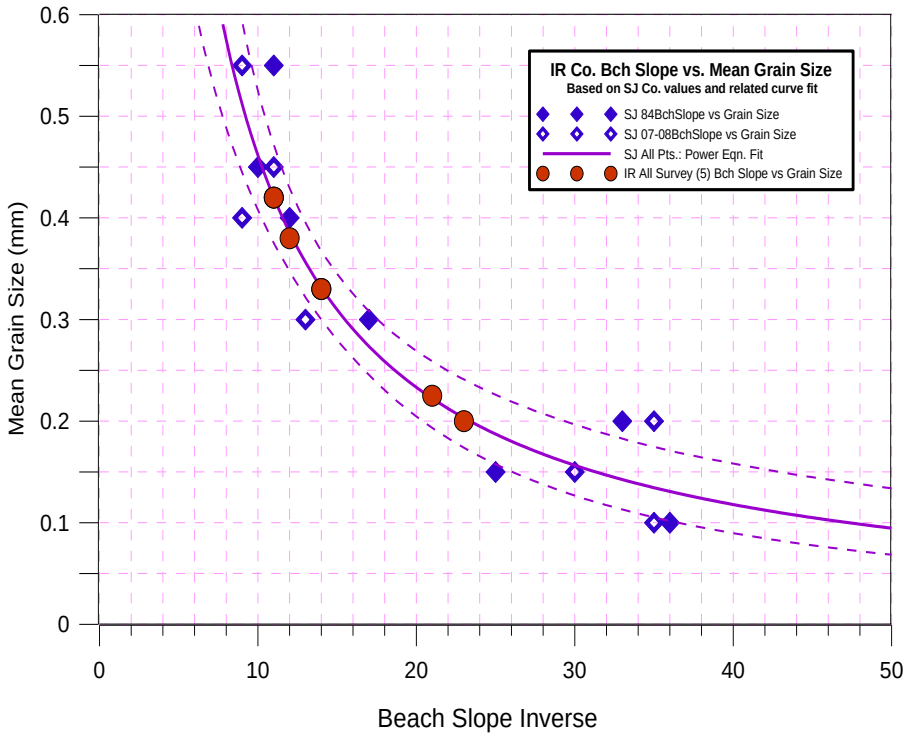

Figure 60. Sediment grain size values obtained from beach slopes measured from Indian River County profile surveys based on beach slope vs. sediment grain size relationship from St. Johns County.

The BSRC hydrographs were adjusted down in elevation to compensate for the set-up generated by SBEACH. The hydrograph reductions were proportional reductions of the BSRC hydrographs based on trial and error evaluations performed during initial SBEACH model application for Indian River County.

Use of the adjusted BSRC hydrographs resulted in final average maximum water elevations with set-up values from SBEACH which were equivalent to the BSRC peak storm tide elevations for the 15- and 25-year storm tide hydrographs. A graph depicting the original BSRC 15- and 25-year storm tide hydrographs and the adjusted/reduced hydrographs used in the final SBEACH erosion model runs for Indian River County is shown in Figure 61.

A listing of recommended Reach and Storm input values for use in 15- and 25-year storm erosion simulations using SBEACH is contained in Appendix VI of this report. Time

series values for the original and adjusted hydrographs for Indian River County are tabulated in Appendix VII of this report.

Specific wave conditions associated with 15- and 25-year return interval storm events for SBEACH model input were not found to be available at the time of this study. Development of such wave conditions were beyond the scope of this study. However, testing performed during the model calibration phase of this study presented in Report 1

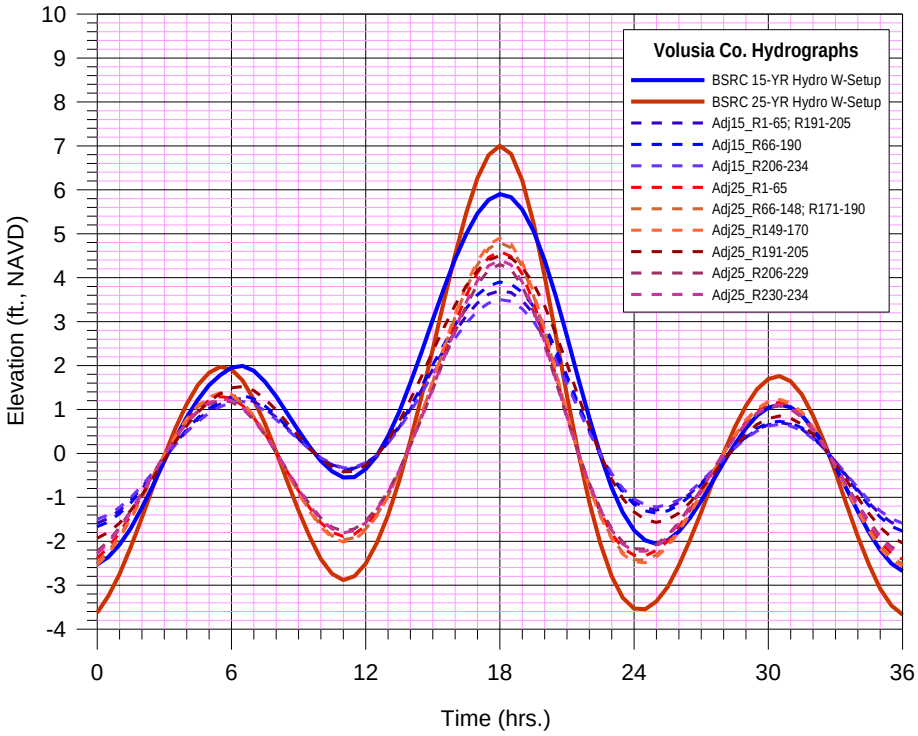

Figure 61. 15- and 25-yr BSRC and adjusted storm tide hydrographs for Indian River Co.

of this report documentation provided constant wave conditions for use for high-frequency storm events. Therefore, the constant wave conditions listed in Appendix VI were used in the SBEACH model for the 15- and 25-year storm erosion simulations.

5.2 Model Application and Results

Graphic plots of the 15- and 25-year storm erosion profiles generated from SBEACH for Indian River County for the 119 range location profiles are provided in Appendix X of this report. The survey profiles used as the input profiles in SBEACH are a combination of the most recent BBCS profiles from 2006, 2007, and 2008.

The plots in Appendix X are shown in the NAVD88 vertical datum. The map in Figure 62 below depicts the FDEP profile range locations across the Indian River County shoreline. An example of 15 and 25-yr erosion profiles obtained from SBEACH for FDEP range R50 is shown in Figure 63.

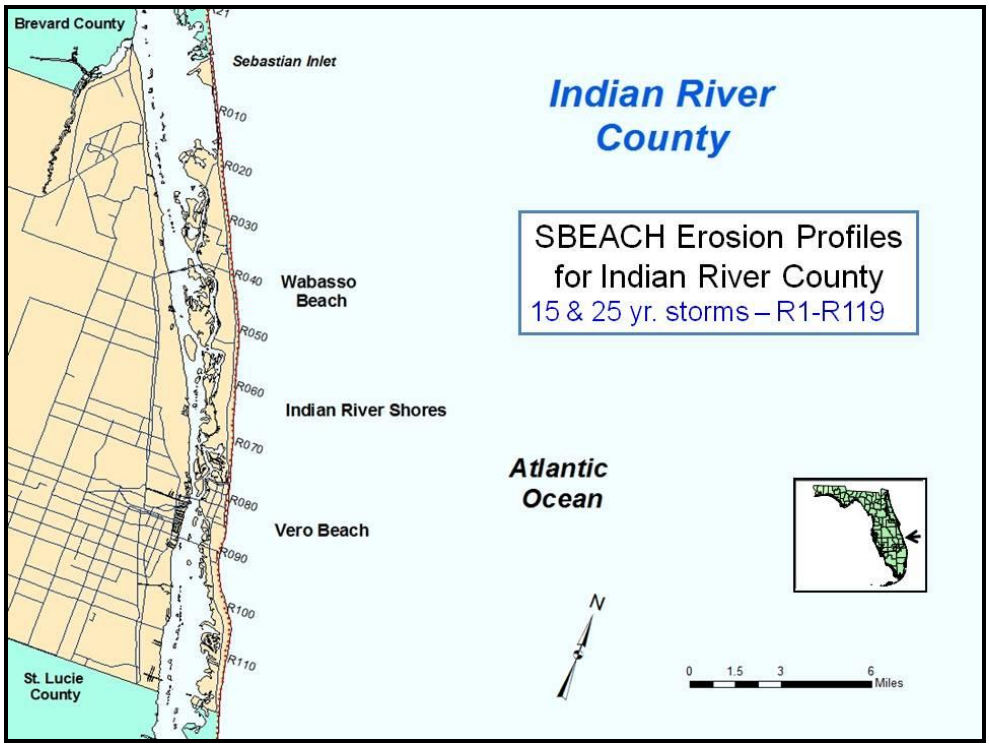

Figure 62. Map of FDEP profile range locations along Indian River County shoreline.

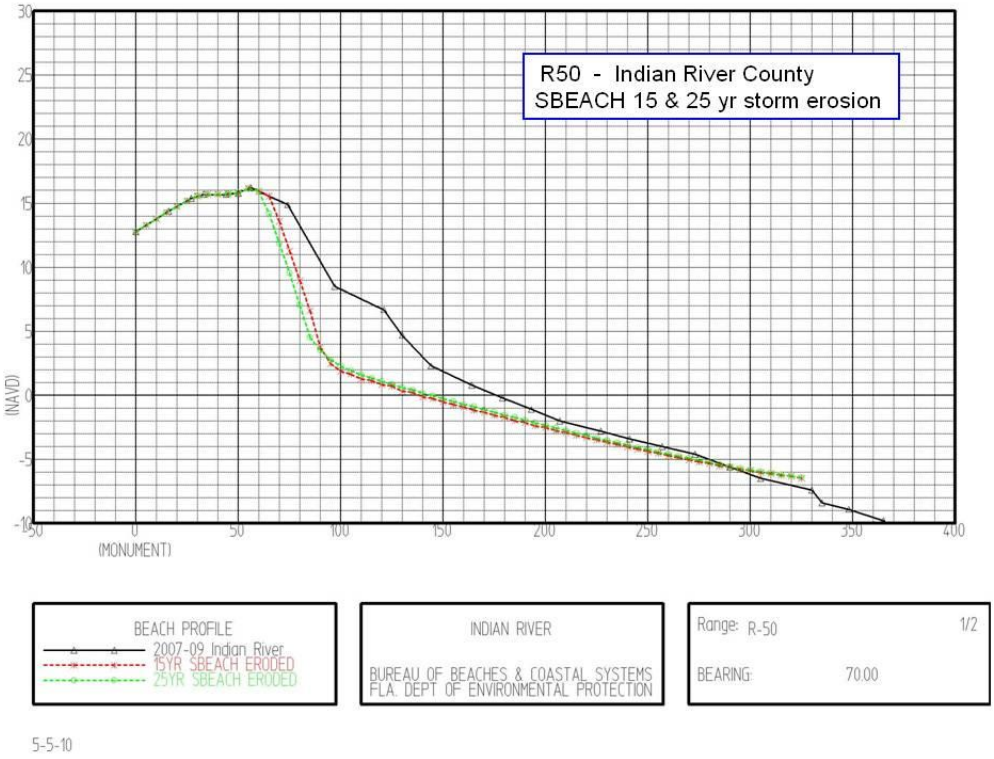

Figure 63. Example of 15 and 25-yr storm erosion profiles at R50 in Indian River Co.

6.0 References

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