2019 Inlet Setback Factors

Based on shoreline change rates calculated for the study: *"Inlet Hazard Area Boundary, 2019 Update: Science Panel Recommendations to the North Carolina Coastal Resources Commission."*

February 12, 2019
NC Division of Coastal Management

1.0 INTRODUCTION

Inlet Hazard Areas (IHA) are one of three Areas of Environmental Concern (AEC) within the Ocean Hazard Area. Since 1979, the construction setback factor applied within the IHA is actually that of its adjacent Ocean Erodible AEC (oceanfront) that is calculated using the oceanfront shoreline long-term change methodology (end-point) and data (two shorelines); which doesn't necessarily reflect erosion hazards at inlets.

In 2019, the Coastal Resources Commission's Science Panel on Coastal Hazards and the North Carolina Division of Coastal Management (DCM) presented results from the recent study titled, "*Inlet Hazard Area Boundary, 2019 Update: Science Panel Recommendations to the North Carolina Coastal Resources Commission*." The purpose of this study was to develop methods for analyzing inlet shoreline change, and to provide the CRC with inlet erosion rates and updated Inlet Hazard Area boundaries for the ten active and developed tidal inlets in North Carolina (Tubbs, Shallotte, Lockwood Folly, Carolina Beach, Masonboro, Mason, Rich, New Topsail, New River, and Bogue Inlets).

For the first time, NC DCM is proposing inlet setback factors calculated using inlet shoreline change rates.

2.0 METHODOLOGY

DCM has calculated long-term oceanfront shoreline change (erosion/accretion) rates since 1979 using the end-point method, which is based on the change between the earliest and most recent dates. Any short-term change between those dates, no matter how significant, is not directly captured. Because inlet shorelines are constantly moving and fluctuating in position, the end-point method is less effective in capturing the dynamics of an inlet or for quantifying its long-term trends. Instead, linear regression, a statistical measure using multiple shorelines, was used for this study (Thieler et al., 2009).

2.a Shoreline Data

DCM's growing database of oceanfront and inlet shorelines facilitated this study by allowing many different approaches to be tried and tested. Most of the shorelines used were mapped using historic orthophotography to digitize the wet-dry line (Figure 1), considered a proxy for the Mean High Water (MHW) line. Three shorelines represented the location of MHW - either derived from lidar (1997 and 2004), or NOS T-Sheets (either from the 1930s or 1940s). Two studies carried out by DCM (Limber et al., 2007a; 2007b) indicated that the lidar-derived MHW line could be used interchangeably with the wet-dry shorelines.

Although shoreline data existed between 1930 and 2016, the temporal focus here is on shorelines between 1970 and 2016 for several reasons:

- The 1930 to 1940 shorelines were excluded at most inlets because of uncertainties on the hydrodynamics at each inlet associated with the construction and maintenance dredging of the Atlantic Intracoastal Waterway (AIWW) and other waterways. This specifically affected the inlets in the southern portion of the State, where one to four shorelines were excluded.

- Shorelines based on photography taken immediately or within one year after major storms or beach nourishment projects were excluded.

- The primary imagery used were NC DOT shoreline images between 1970 and 2000.

These criteria resulted in the number of shorelines used, ranging between 10 and 24 at each inlet. Oceanfront and inlet shorelines were analyzed along a series of numbered, shore-perpendicular transects spaced at 25-meter (82-foot) intervals using USGS's Digital Shoreline Analysis System (DSAS) with ESRI's ArcGIS. Due to the curvature of inlet shorelines where there is a transition from the oceanfront into the inlet throat, transects were cast from an onshore baseline to create

radial transects that retained shore-perpendicular orientation and spacing. These radial transects were used to compute shoreline changes inside the inlet.

Figure 1. Interpretation of the "wet-dry" shoreline using orthophotography.

2.b Shoreline Change Rates: Linear Regression

DCM has calculated long-term oceanfront shoreline change (erosion/accretion) rates since 1979 using the end-point method, which is based on the change between the earliest and most recent dates. Any short-term change between those dates, no matter how significant, is not directly captured. Because inlet shorelines are constantly moving and fluctuating in position, the end-point method is less effective in capturing the dynamics of an inlet or for quantifying its long-term trends. Instead, linear regression, a statistical measure using multiple shorelines, was used for this study (Thieler et al., 2009).

At each transect, there are a series of shoreline-transect intersections that represent the shoreline's position through time. Linear regression minimizes the distance between the known values (actual shoreline positions) and a best-fit regression line (Figure 2). The slope of this line is the Linear Regression Rate (LRR) of shoreline change or the local erosion or accretion rate.

Figure 2. *Relative shoreline position as a function of time (circles). The slope of the best fit, dotted line is the linear regression rate (LRR) of shoreline change (in this case, it is eroding at 19 feet per year).*

5
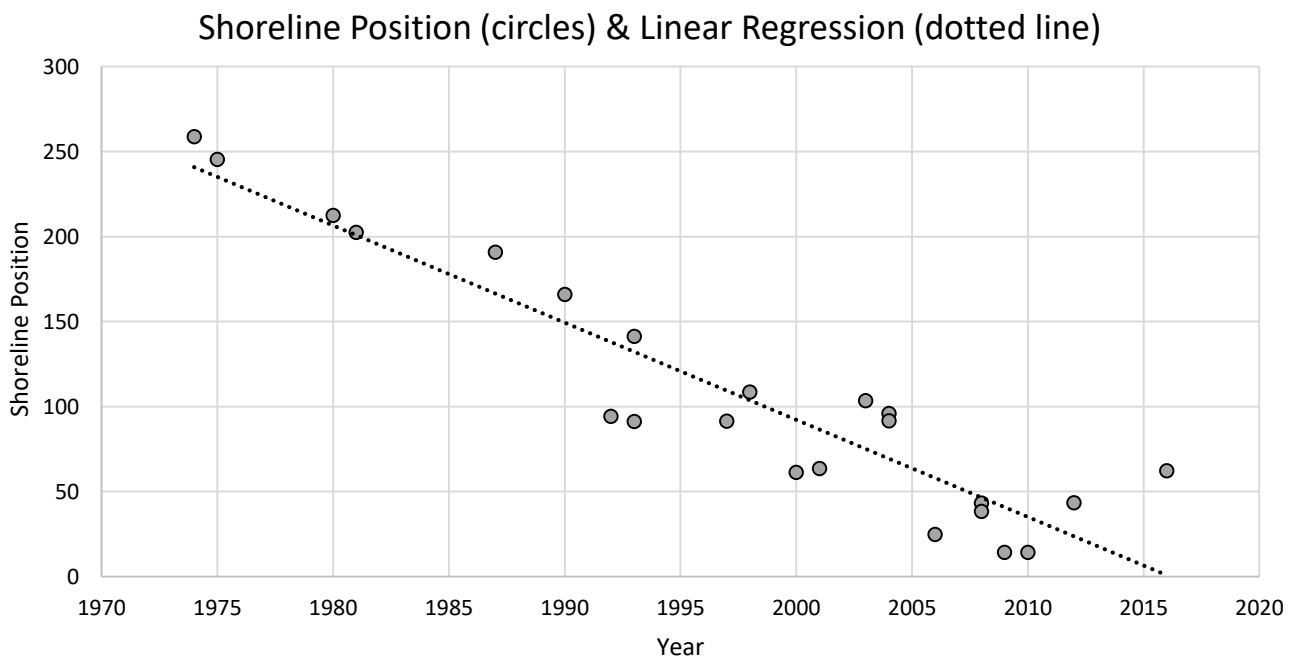
The benefits of linear regression include (Dolan et al., 1991):

- All data are used, regardless of changes in trend or accuracy.
- The method is purely computational.
- The calculation is based on accepted statistical concepts.
- The method is easy to employ.

Although the linear regression method is less sensitive to individual points, it is susceptible to outliers; it assumes that the computed trend is linear, and it tends to underestimate the rate of change relative to other statistics, such as the end-point rate (Dolan et al., 1991; Genz et al., 2007).

Once computed, the linear regression rate was then smoothed using a 17-transect running-average alongshore. This follows the blocking computation historically used for the oceanfront shoreline rates and further smooths the alongshore variation in the shoreline change rate.

2.c Shoreline Change Rates: Smoothing

Smoothing raw data has been applied in all oceanfront shoreline position change studies since 1979, and effectively filters short-term dynamic shoreline phenomena such as beach cusps, smaller sand waves, and the attachment of landward migrating portions of offshore bar systems. Cusps and similar features range in size from approximately 5 feet to 5,000 feet and have a life span ranging from days (smaller features) to seasons or years (larger sand waves) (Dolan and Ferm, 1968) (Davis, 1978). Bars generally range around 328 feet in length with migration and attachment rates ranging from seasons to years (Davis, 1978). Variations associated with larger, longer lived features such as capes are not filtered by the smoothing.

The procedure for spatially smoothing shoreline change rate data is a simple moving average, or running mean technique described by Davis, 1973. Commonly referred to as "17-point running

average," this technique by default consists of at least 17 transects spaced 25-meters apart (approximately 0.25 miles of shoreline). An average is calculated for each of the 17 transects, each time centered on the ninth transect (with 8 transects on each side). This spatially averaged value is the "smoothed rate." Approaching inlets, the number of transects used in the average is decreased by two (dropping one from each side of the centered transect calculation) until the end transect is reached. The last value is calculated by taking the weighted average using the last two transects.

$$R_s = (2 \times T_1 + T_2) / 3$$

R_s = *smoothed rate*

T_1 = *erosion rate at last transect adjacent to the inlet*

T_2 = *erosion rate at second to last transect adjacent to inlet*

As can be seen in Figure 3, results from smoothing are most noticable in areas experiencing accelerated erosion or accretion (*e.g.* near inlets).

2.d Shoreline Change Rates: Blocking

The technique of "blocking" smoothed rate data creates spatially uniform rate segments along the shoreline. In other words, blocking groups neighboring transects along the same shoreline segment that have similar smoothed shoreline change rates. This allows for management of like sections of shoreline that have the same or similar shoreline change rates, rather than having to refer rates at each individual transect. Blocked shoreline change rate data serve as Setback Factors (historically referred to as "erosion rates"), and used to calcualte the construction setback within Ocean Hazard AEC, and to calculate the landward boundary of the Ocean Erodible Area (OEA) (Figure 3).

Blocking procedures, itemized below, represent refinments and clarifications of procedures established by and used in all previous update studies. These refinements and clarifications are the result of improved accuracy of the data brought about by improvements in the shoreline

delineation methodology and quantitative requirements that allow for increased repeatabiltiy of results. In areas experiencing an accelerated change in rates, this refinement resulted in smaller blocked groups. The following list describes the process, or "rules" of blocking:

1. Group "like" erosion rate segments based on rate at transect (*e.g.,* 2.0, 2.2, 2.1, 2.5, 2.6, 2.1, . . . 2.9) and use the mean of each segment as the blocked rate. Transitioning at one-foot intervals are prefered for rate block boundaries. Fractional rates are rounded down to the nearest foot, or half foot interval for segments dominated by a half foot value and do not have values greater than the next highest one foot interval (*e.g.*, a rate segment equal to 5.4 would be rounded to 5.0; and 5.7 would be rounded to 5.5).

2. Blocked shoreline change rate segments must be comprised of at least eight (8) transects. In areas experiencing rapid erosion or accretion (*e.g.,* approaching inlets), it is not always possible achieve a one-foot transition from one blocked rate segment to the next, thus making it necessary to evaluate segments based on its mean so that transitions from one blocked segement to the next was as near to the one-foot interval as feasible.

3. In areas where blocked segments transition from one value to another (*e.g.*, from 3 to 4 feet per year) a determination must be made to select the transect that will serve as a delineation between the change in values. The lower rate would be applied towards the higher blocked segment.

4. Where two blocked boundaries meet and divide a property or parcel, the lower of the two blocked rates is applied in the direction of the higher rate in order to give the property owner the benefit of the lower rate. Where a large parcel containing multi-family structures was divided by a transition boundary, the lower of the two blocked rates is applied towards the higher rate so that no structure was split and also giving the structure the benefit of the lower rate.

5. For segments that result in measured accretion, or where measured erosion rates are less than two (2.0) feet per year, they are assigned the default minimum, a blocked rate value (Setback Factor) of two (2) in accordance with the minimum Inlet Hazard Area setback of 60 feet, or 30 times the Setback Factor based on blocked inlet shoreline change rates (proposed rule amendment: 15A NCAC 07H .0304(a)(2).
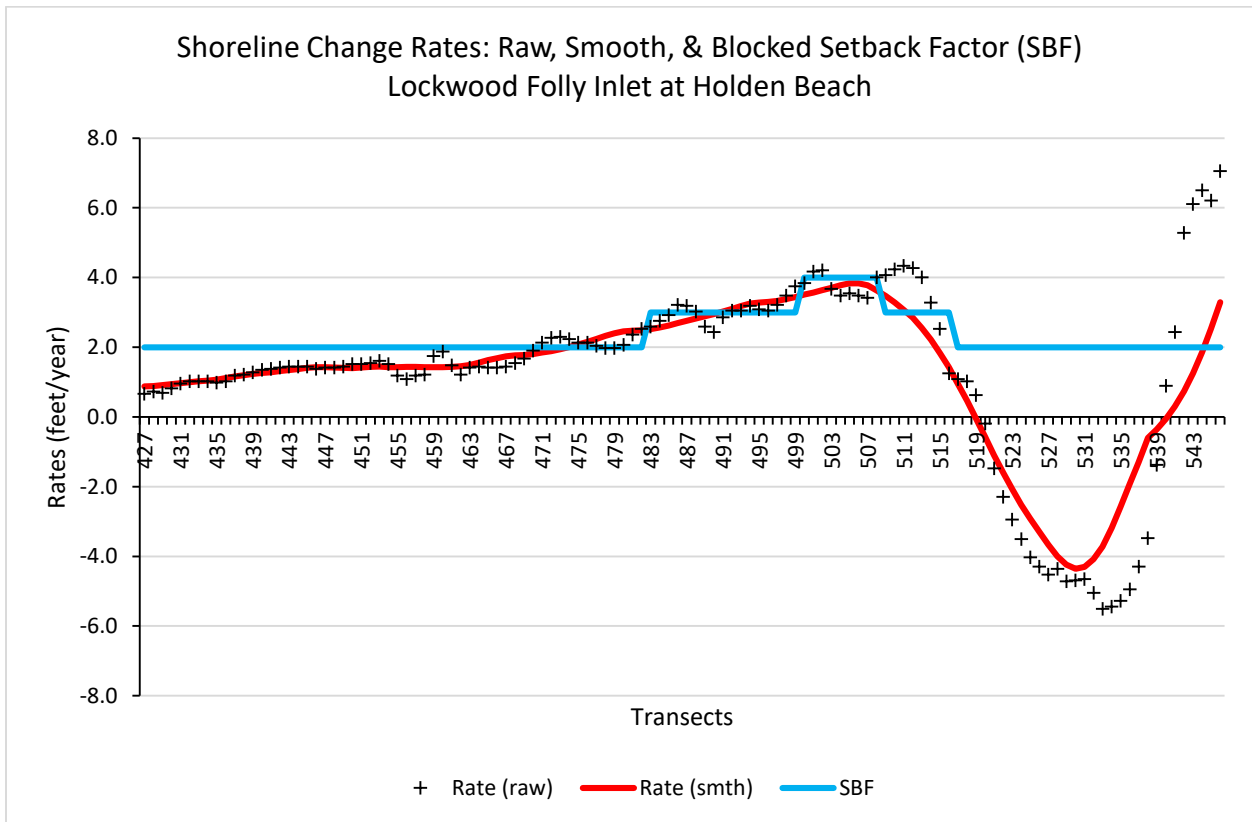
Figure 3. Example of Raw (points), Smoothed (solid green and red line), and Blocked (solid black line) data.

3.0 RESULTS

The following maps illustrate proposed inlet setback factors calculated using inlet shoreline change rates (CRC Science Panel & NC DCM, 2019). For purposes of illustrating how setback factors correspond to shoreline change rates, positive values represent erosion and negative values represent accretion. Where accretion is measured, or the erosion rate is less than two feet per year, the default setback factor is 2.

2019 Inlet Setback Factors
Tubbs Inlet at Sunset Beach

SBF = 2

SBF = 2

Tubbs Inlet

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.125   0.25   0.5 Miles

Legend

☐ Inlet Setback Factors (2019)

☐ Inlet Hazard Areas (2019)

This map illustrates proposed 2019 Inlet Hazard Areas updated boundaries and inlet setback factors using inlet shoreline change rates.

This map is provided for public review only as these data and maps have not been formally adopted by the North Carolina Coastal Resources Commission.

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February 20, 2019

Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Tubbs Inlet at Sunset Beach

Note: on this graph negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

Rate (feet/year)

Transects

Tubbs Inlet

+ Rate (smth) —— SBF —— #REF!

2019 Inlet Setback Factors
Tubbs Inlet at Ocean Isle

SBF = 2

SBF = 2

Tubbs Inlet

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.125   0.25   0.5 Miles

Legend

⌐ ⌐ Inlet Setback Factors (2019)

☐ Inlet Hazard Areas (2019)

February 20, 2019

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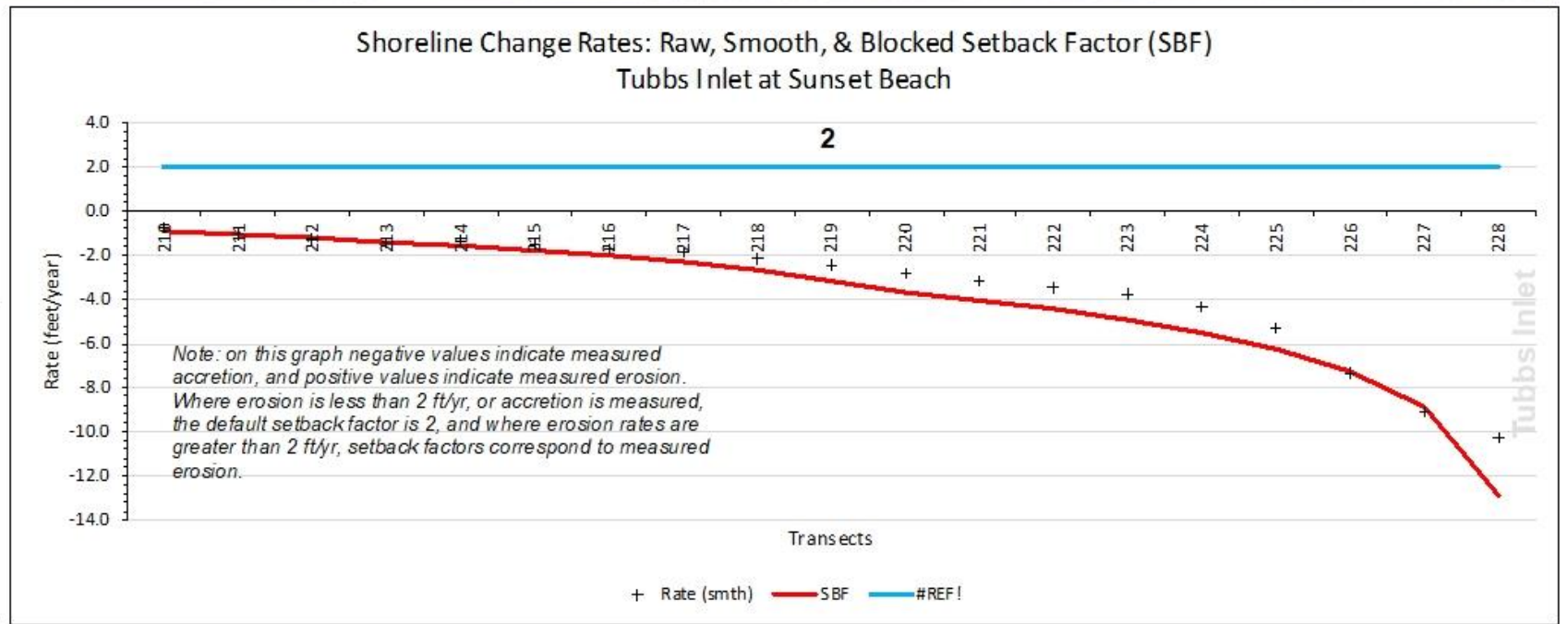
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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Tubbs Inlet at Ocean Isle

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

Transects

+ Rate (raw)   — Rate (smth)   — SBF

2019 Inlet Setback Factors
Shallotte Inlet at Ocean Isle

SBF = 14

SBF = 2

SBF = 4

SBF = 6

SBF = 8

SBF = 10.5

SBF = 13

Shallotte Inlet

E SECOND ST

E FIRST ST

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

| 0 | 0.125 | 0.25 | 0.5 Miles |

Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

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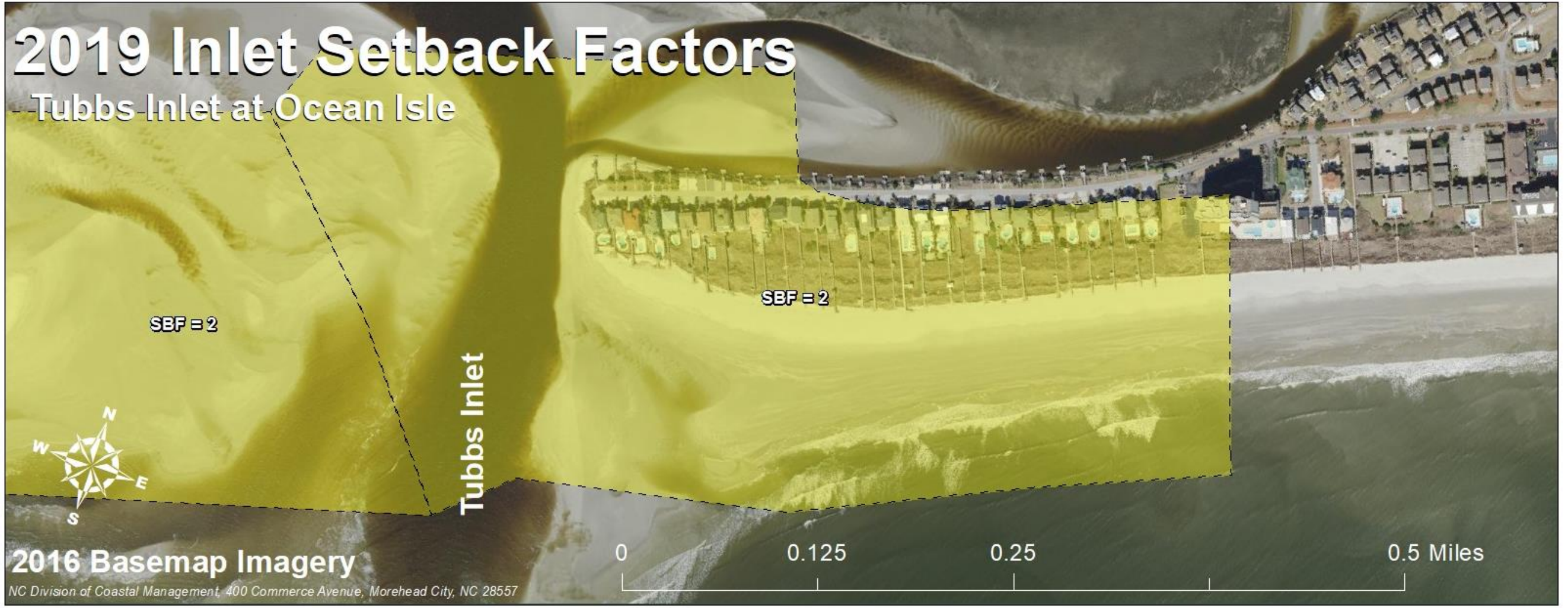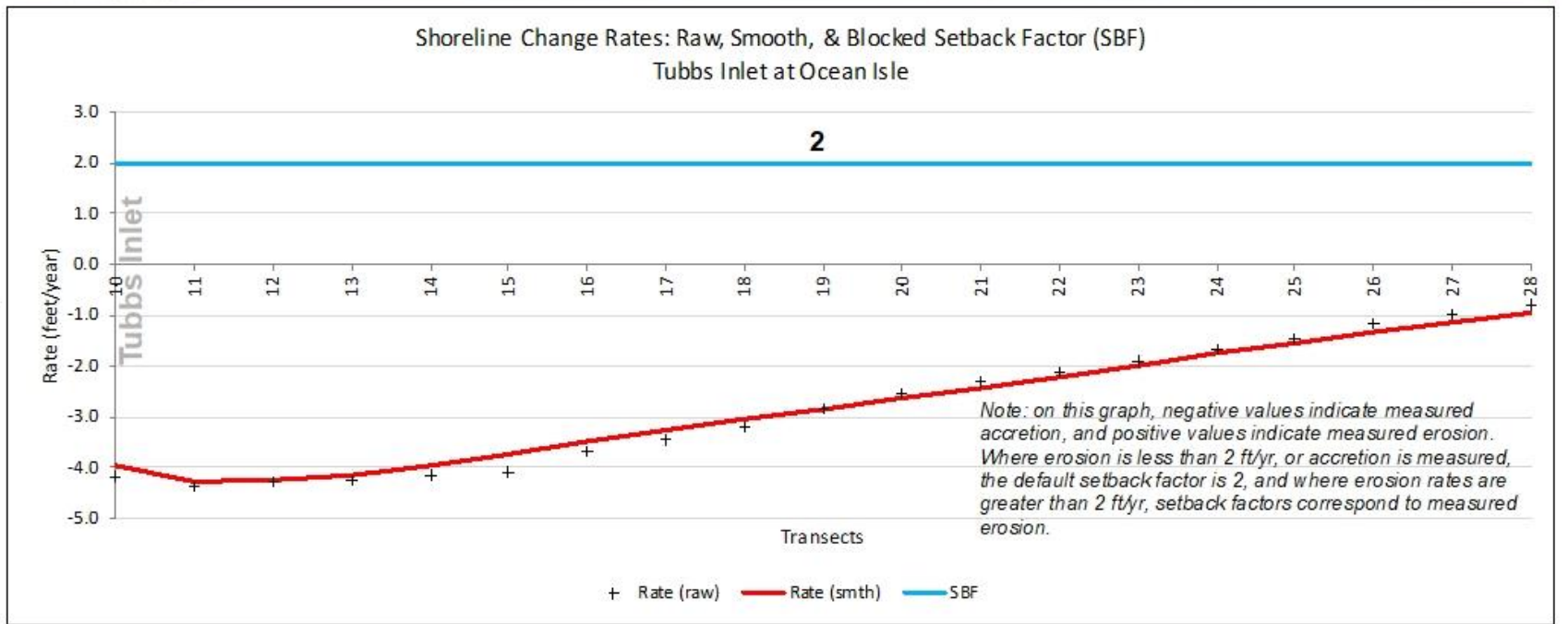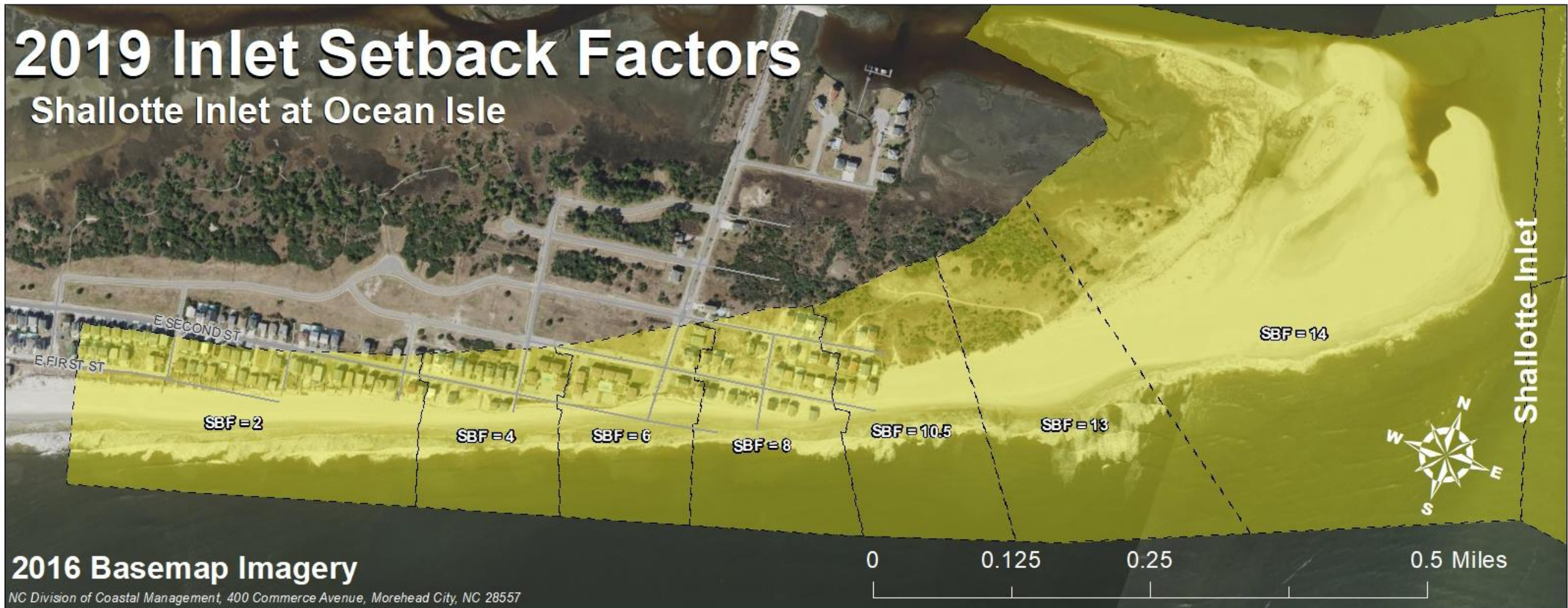
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Shoreline Change Rates: Raw, Smooth, Blocked Setback Factors (SBF)
Shallotte Inlet at Ocean Isle

Shallotte Inlet

2

4

6

8

10.5

13

14

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

+ Rate (raw)   —— Rate (smth)   —— SBF

13

2019 Inlet Setback Factors
Shallotte Inlet at Holden Beach

SBF = 7.5

Shallotte Inlet

SBF = 2

N
W E
S

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.25   0.5   1 Miles

Legend

☐ Inlet Setback Factors (2019)

▨ Inlet Hazard Areas (2019)

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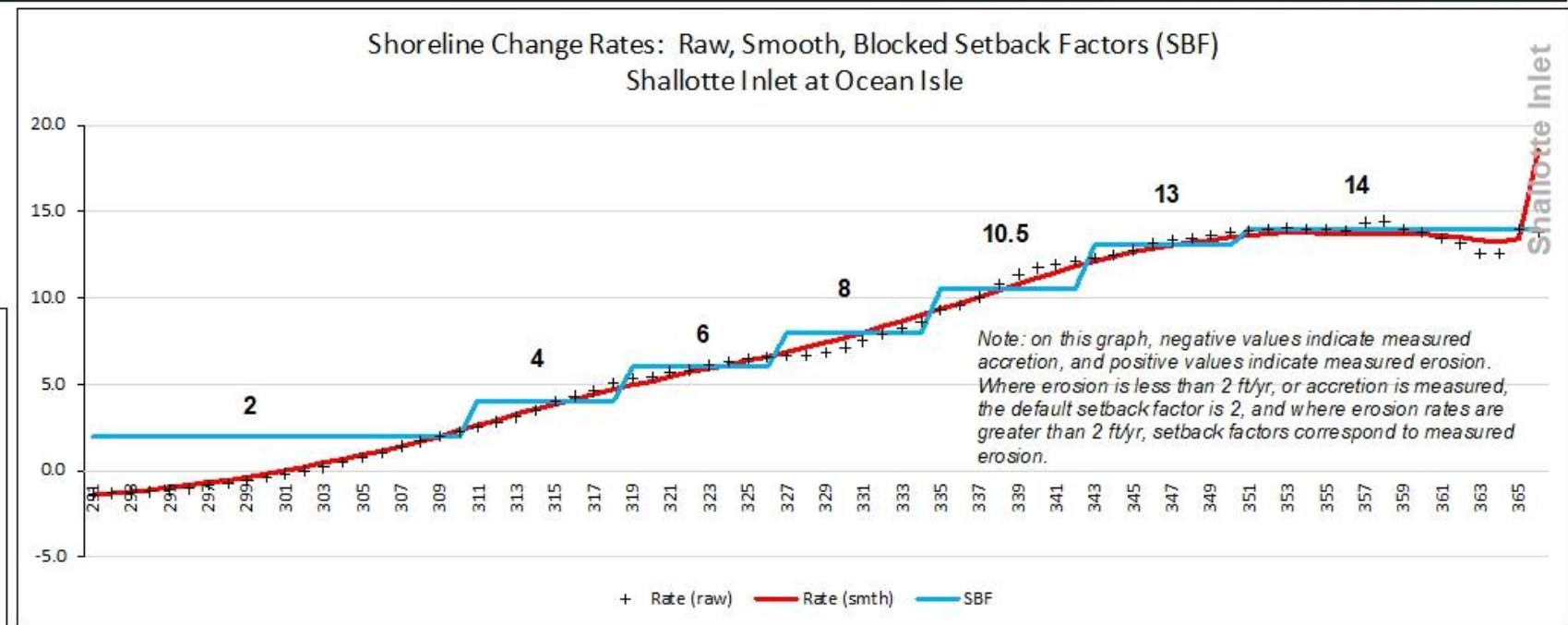
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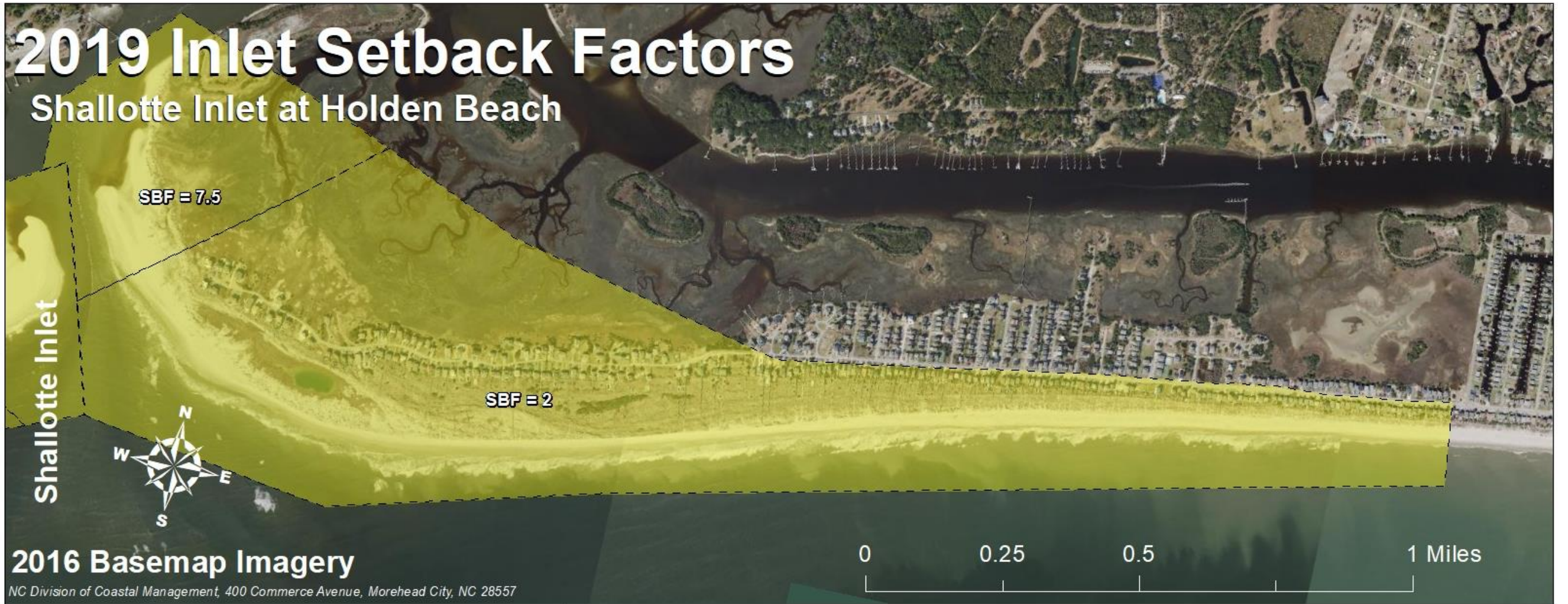
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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Shallotte Inlet at Holden Beach

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

7.5

2

Rate (feet/year)

Shallotte Inlet

Transects

+ Rate (raw) — Rate (smth) — SBF

2019 Inlet Setback Factors
Lockwood Folly Inlet at Holden Beach

SBF = 4.5
SBF = 2
SBF = 3
SBF = 4
SBF = 3
SBF = 2

Lockwood Folly Inlet

2016 Basemap Imagery
NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.125   0.25   0.5 Miles

Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

This map illustrates proposed 2019 Inlet Hazard Areas updated boundaries and inlet setback factors using inlet shoreline change rates.

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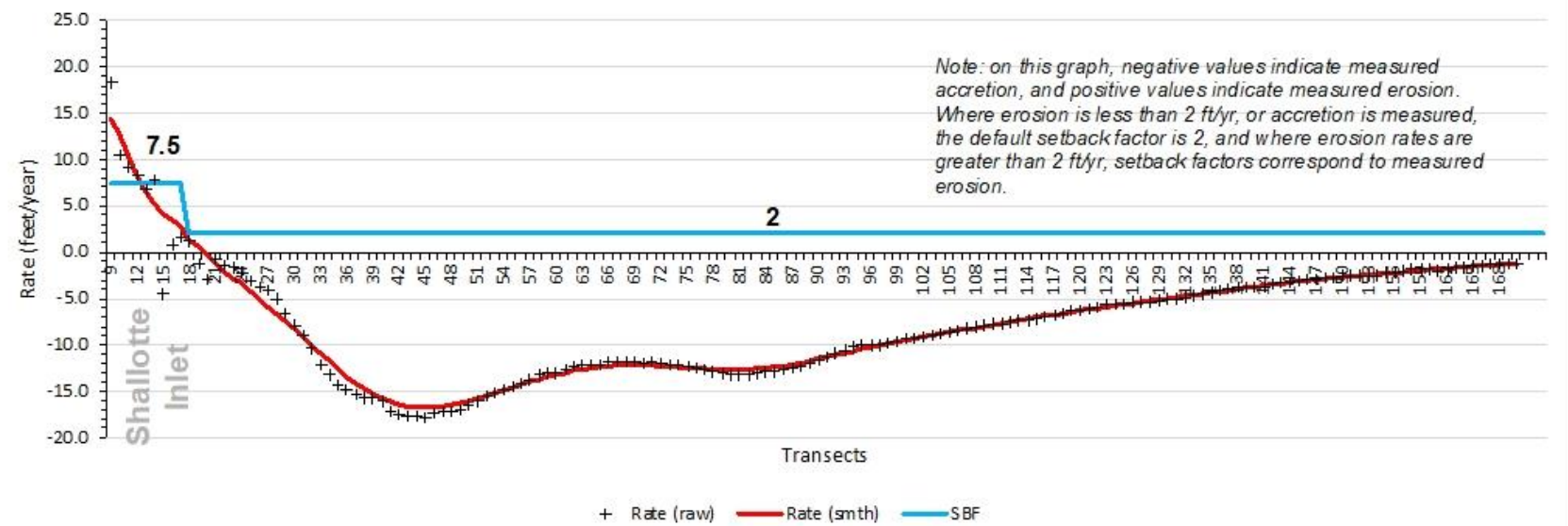contact: ken.richardson@ncdenr.gov

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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Lockwood Folly Inlet at Holden Beach

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

Transects

+ Rate (raw)   — Rate (smth)   — SBF

15

2019 Inlet Setback Factors
Lockwood Folly Inlet at Oak Island

SBF = 4.5

Lockwood Folly Inlet

SBF = 2

N
W   E
S

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.125   0.25   0.5 Miles

Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

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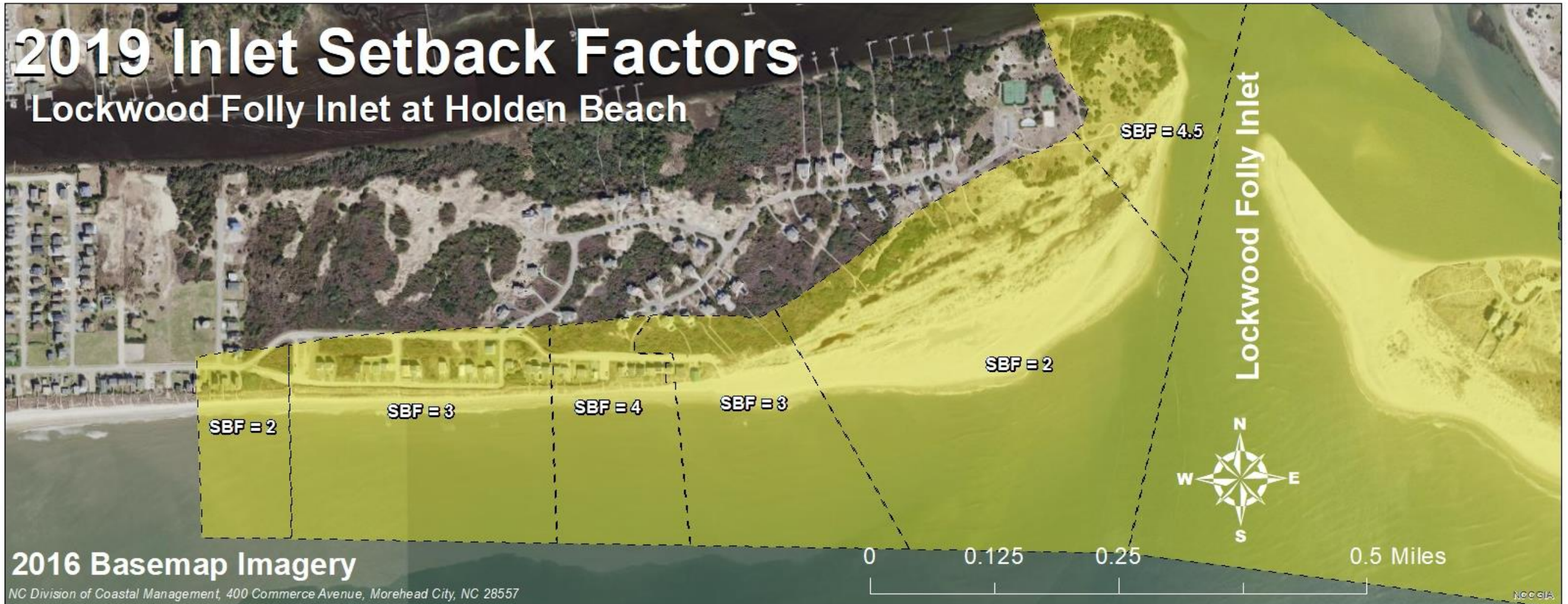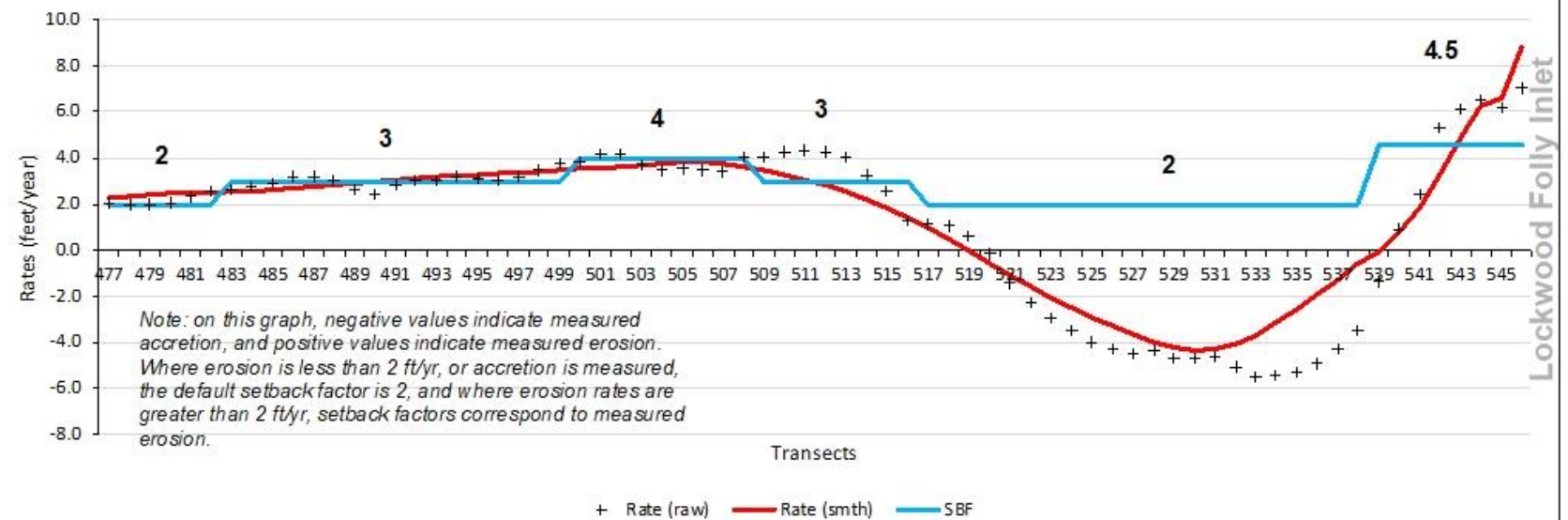
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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Lockwood Folly Inlet at Oak Island

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

+ Rate (raw)   — Rate (smth)   — SBF

2019 Inlet Setback Factors
Carolina Beach Inlet at Carolina Beach

SBF = 2

Carolina Beach Inlet

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.25   0.5   1 Miles

Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

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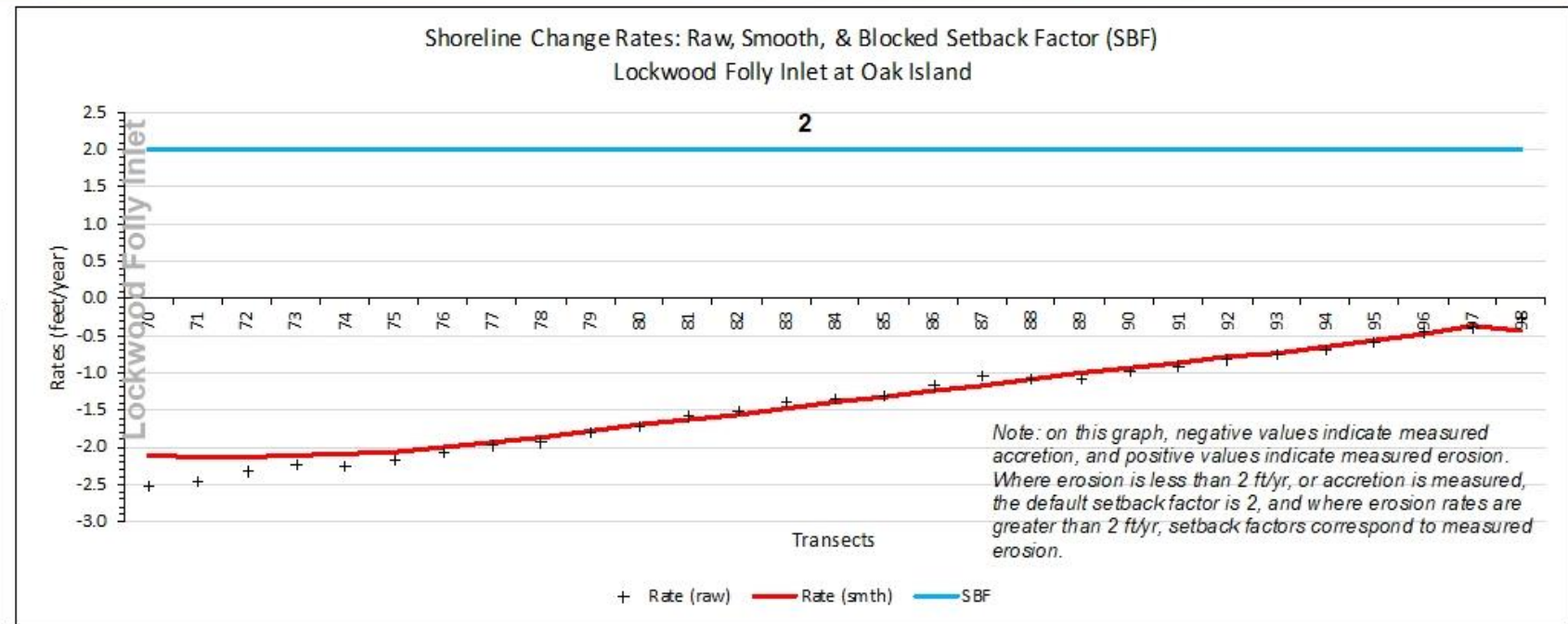
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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Carolina Beach Inlet at Carolina Beach

Rates (feet/year)

Transects

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

+ Rate (raw)   — Rate (smth)   — SBF

Carolina Beach Inlet

17

2019 Inlet Setback Factors
Masonboro Island (Carolina & Masonboro Inlets)

Carolina Beach Inlet

Masonboro Inlet

SBF = 12
SBF = 14
SBF = 16
SBF = 15
SBF = 13
SBF = 14.5
SBF = 17
SBF = 18
SBF = 17
SBF = 16
SBF = 15
SBF = 14
SBF = 13
SBF = 12
SBF = 11
SBF = 10
SBF = 9
SBF = 8
SBF = 7
SBF = 6
SBF = 5
SBF = 2

2016 Basemap Imagery

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0   0.75   1.5   3 Miles

Legend

☐ Inlet Setback Factors (2019)

▨ Inlet Hazard Areas (2019)

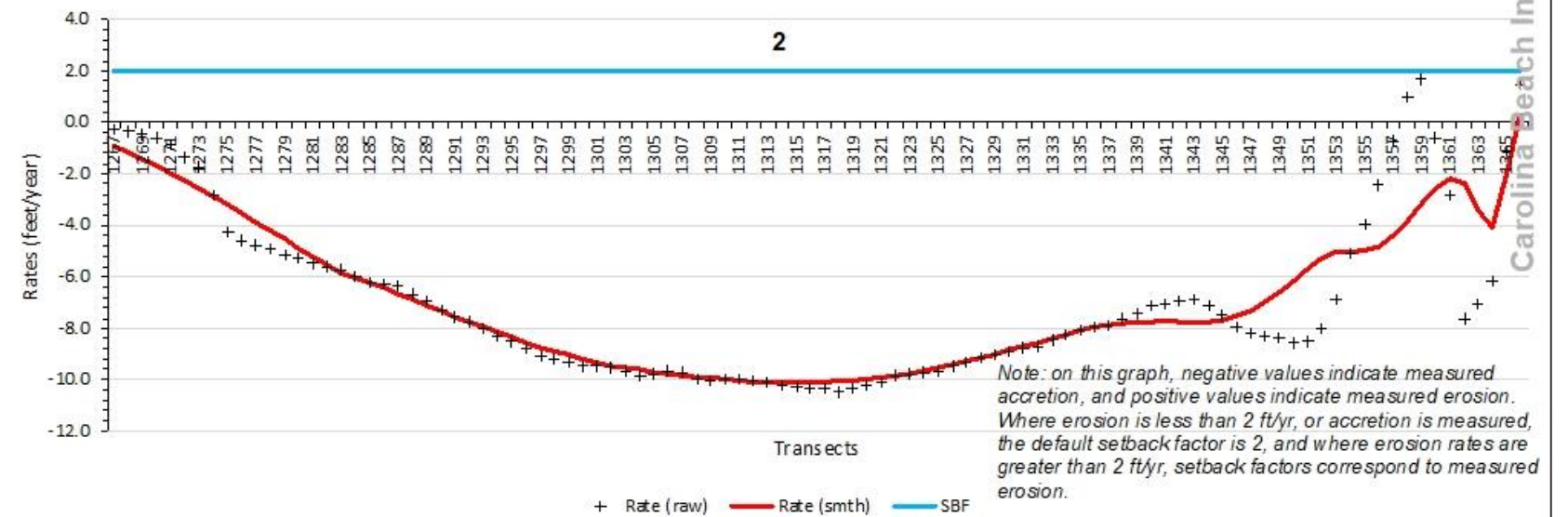NC DIVISION OF COASTAL MANAGEMENT

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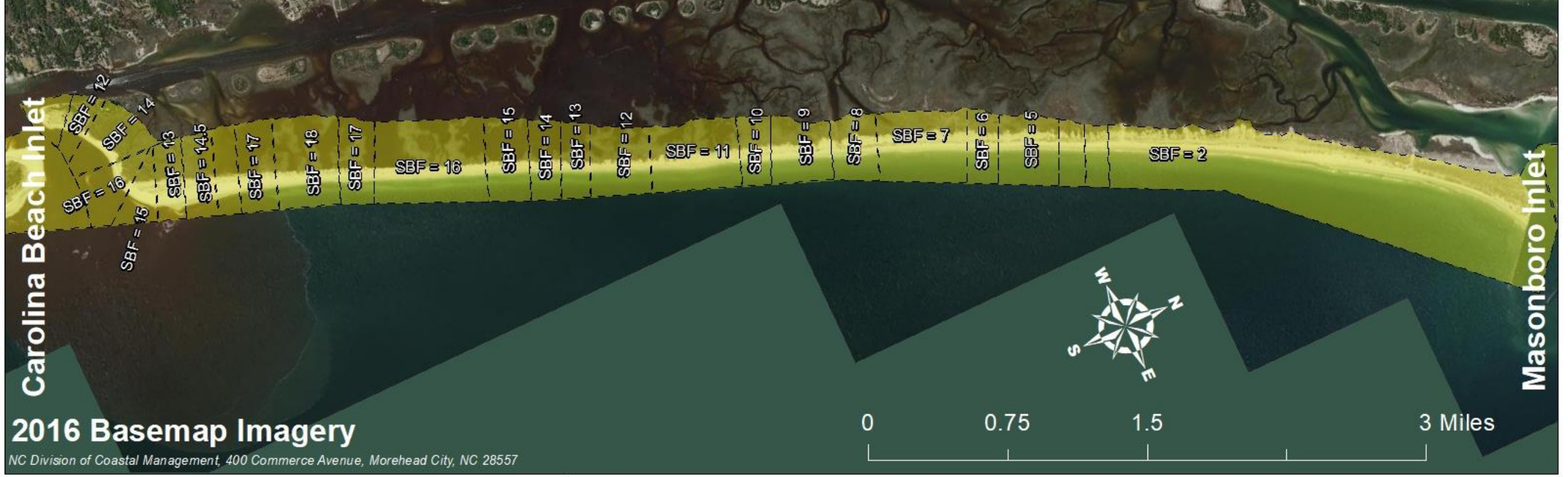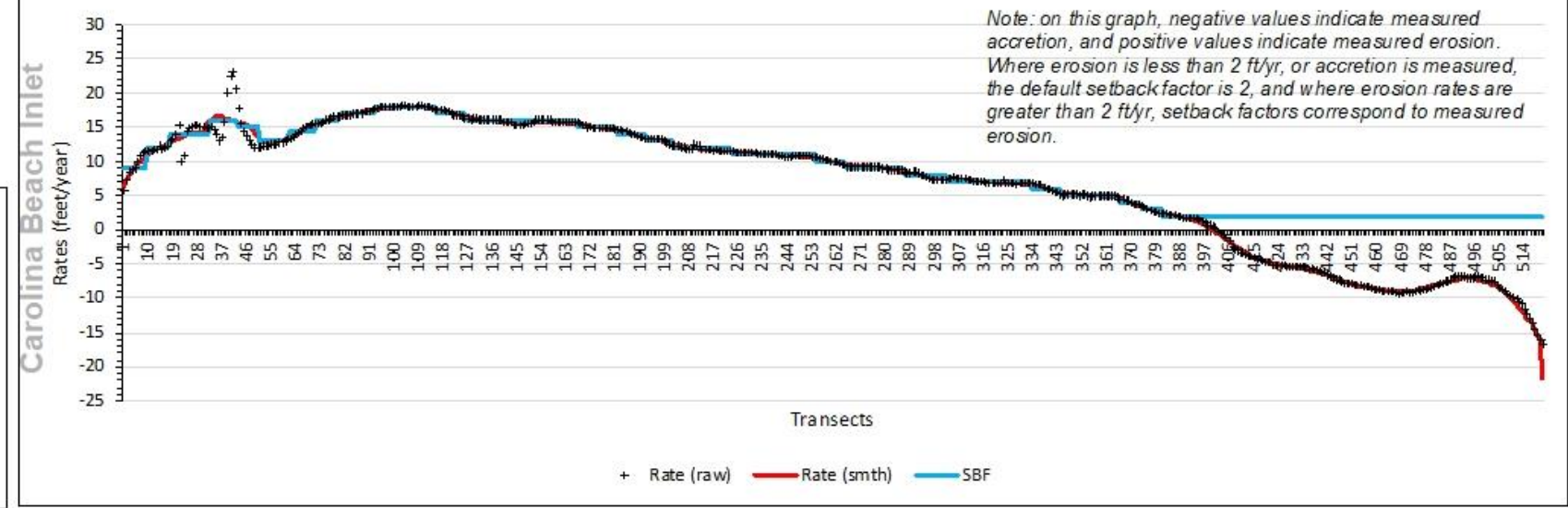
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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Masonboro Island

Carolina Beach Inlet

Rates (feet/year)

Transects

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

+ Rate (raw)   — Rate (smth)   — SBF

2019 Inlet Setback Factors
Masonboro Inlet at Wrightsville Beach

Masonboro Inlet

SBF = 2

2016 Basemap Imagery

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| 0 | 0.125 | 0.25 | | 0.5 Miles |

Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

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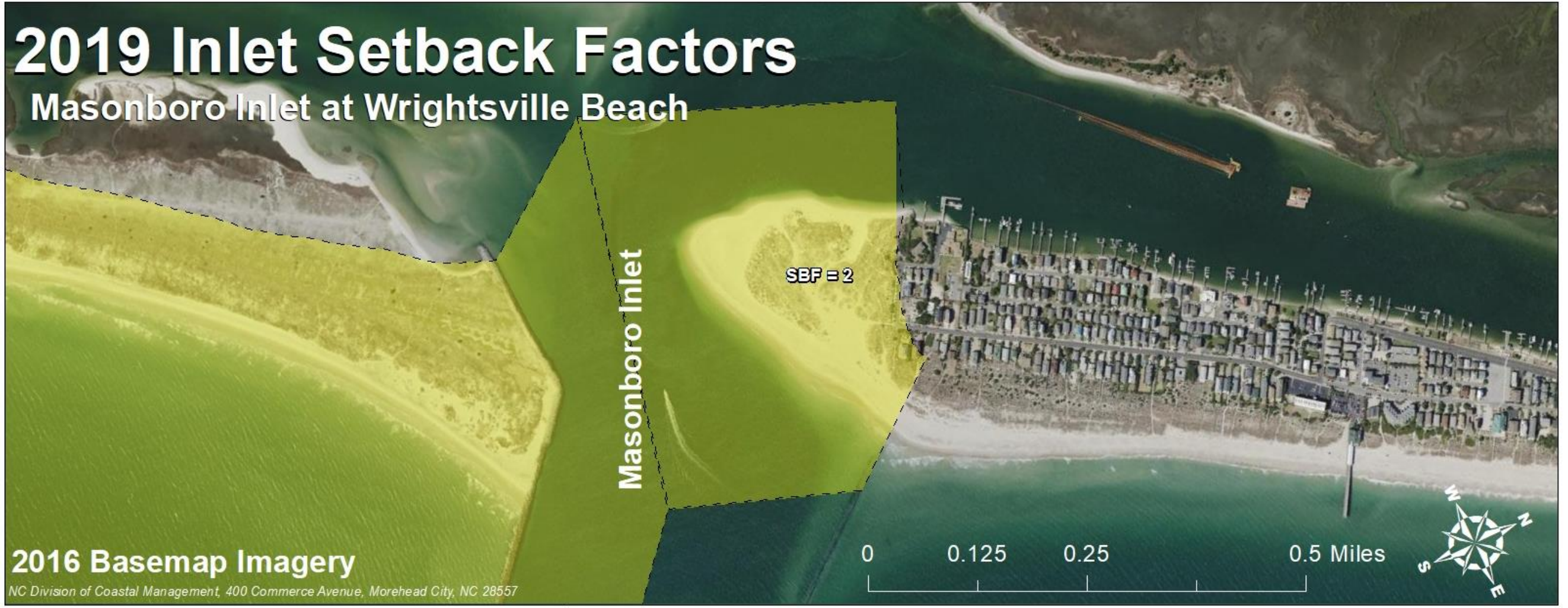contact: ken.richardson@ncdenr.gov

Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
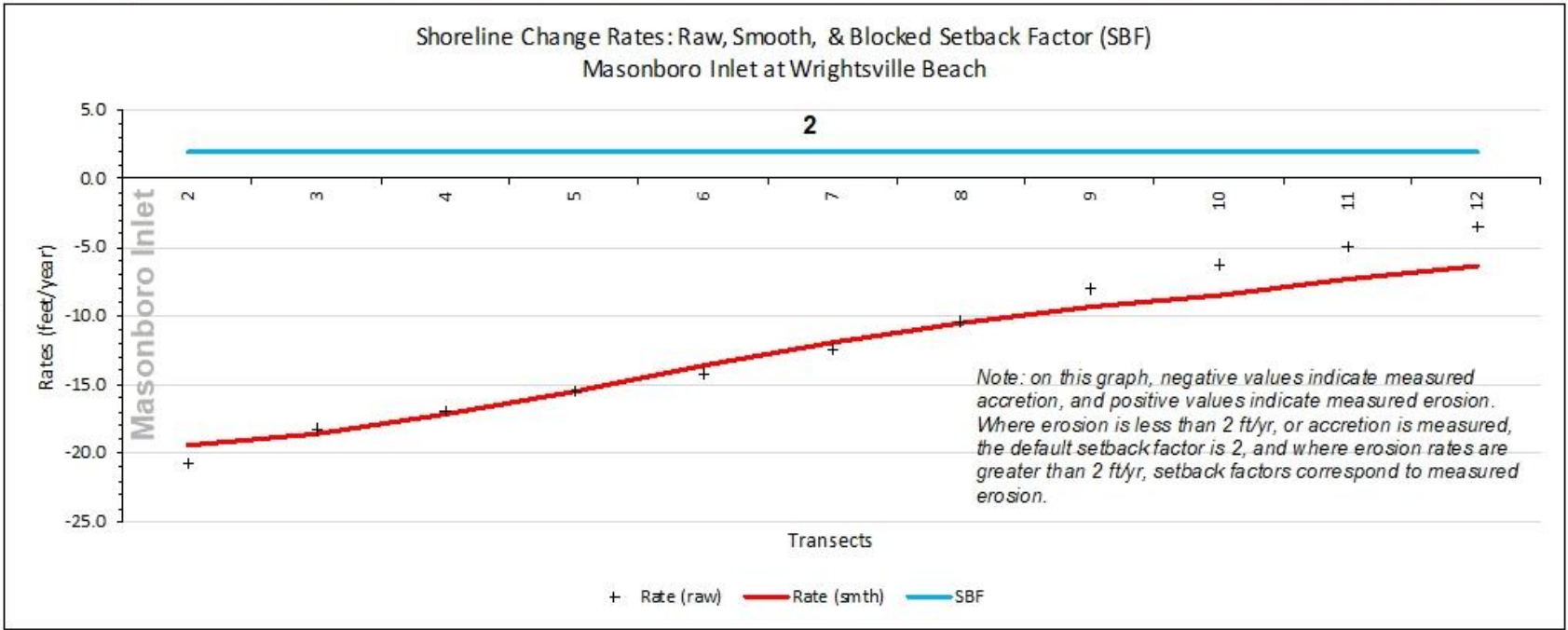### Masonboro Inlet at Wrightsville Beach

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

Rates (feet/year)

Masonboro Inlet

Transects

+ Rate (raw) — Rate (smth) — SBF

2019 Inlet Setback Factors
Mason Inlet at Wrightsville Beach

SBF = 2

Mason Inlet

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

| 0 | 0.125 | 0.25 | | 0.5 Miles |

Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

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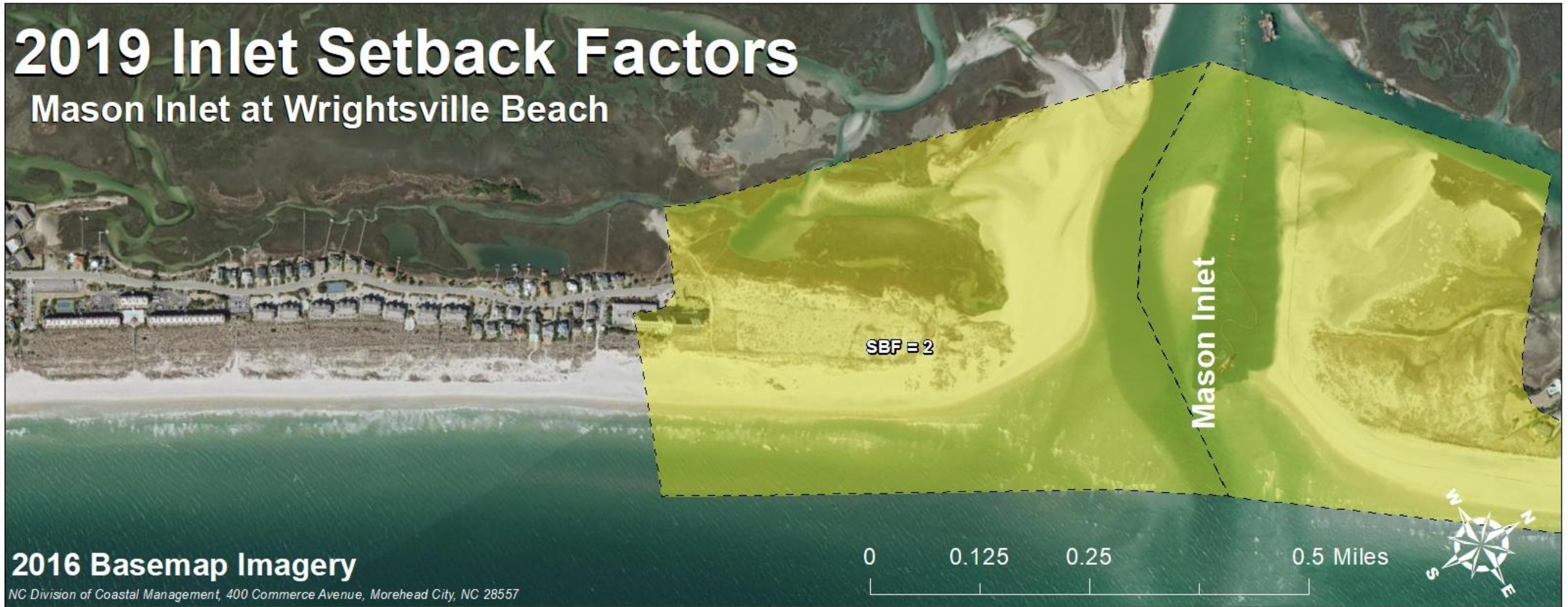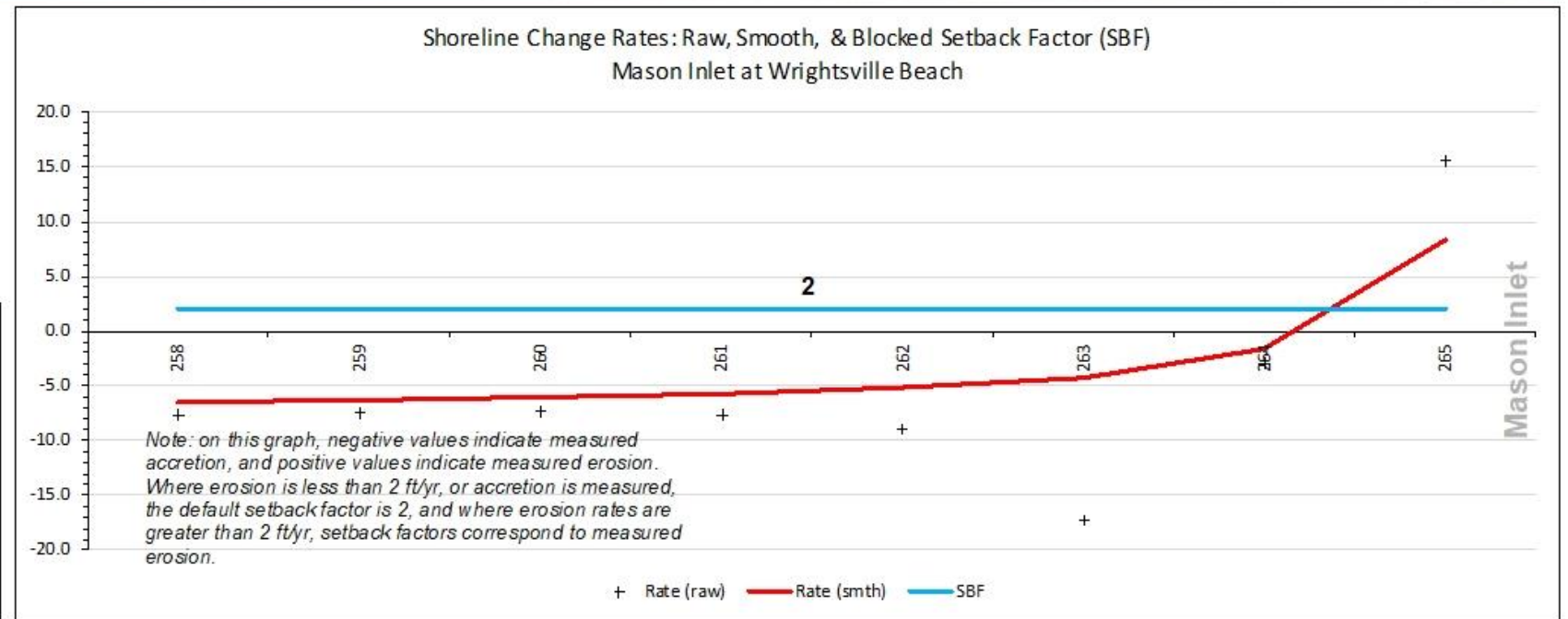
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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Mason Inlet at Wrightsville Beach

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

+ Rate (raw) —— Rate (smth) —— SBF

2019 Inlet Setback Factors
Mason Inlet at Figure Eight Island

Mason Inlet

SBF = 2

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.125   0.25   0.5 Miles

Legend

▢ Inlet Setback Factors (2019)

▢ Inlet Hazard Areas (2019)

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February 20, 2019

This map illustrates proposed 2019 Inlet Hazard Areas updated boundaries and inlet setback factors using inlet shoreline change rates.
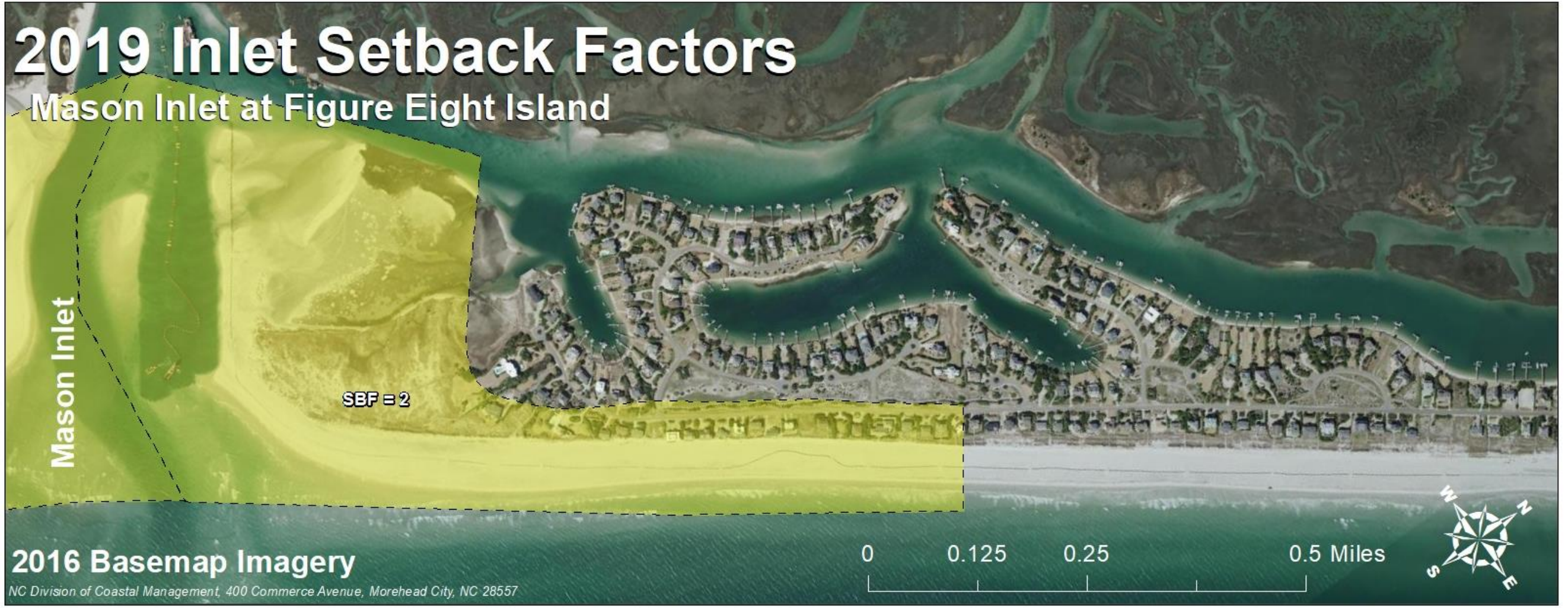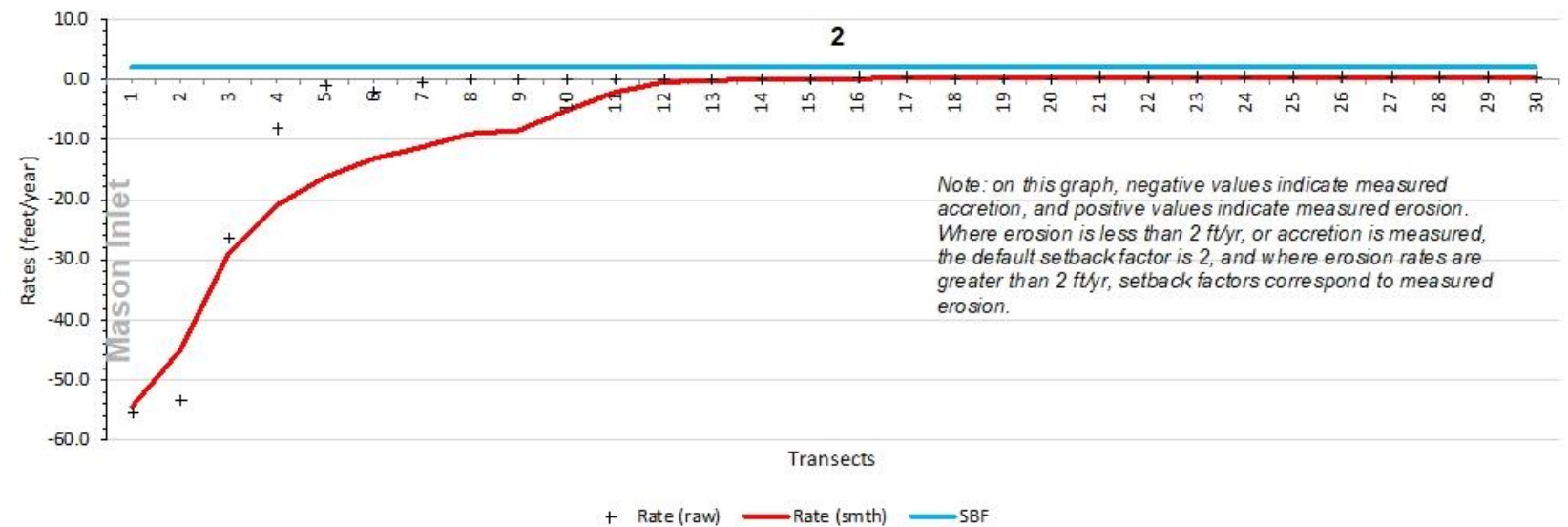
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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Mason Inlet at Figure Eight Island

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

Rates (feet/year)

Mason Inlet

Transects

+ Rate (raw)   ― Rate (smth)   ― SBF

2019 Inlet Setback Factors
Rich Inlet at Figure Eight Island

Rich Inlet

SBF = 2

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.25   0.5   1 Miles

Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

February 20, 2019

NC DIVISION OF COASTAL MANAGEMENT

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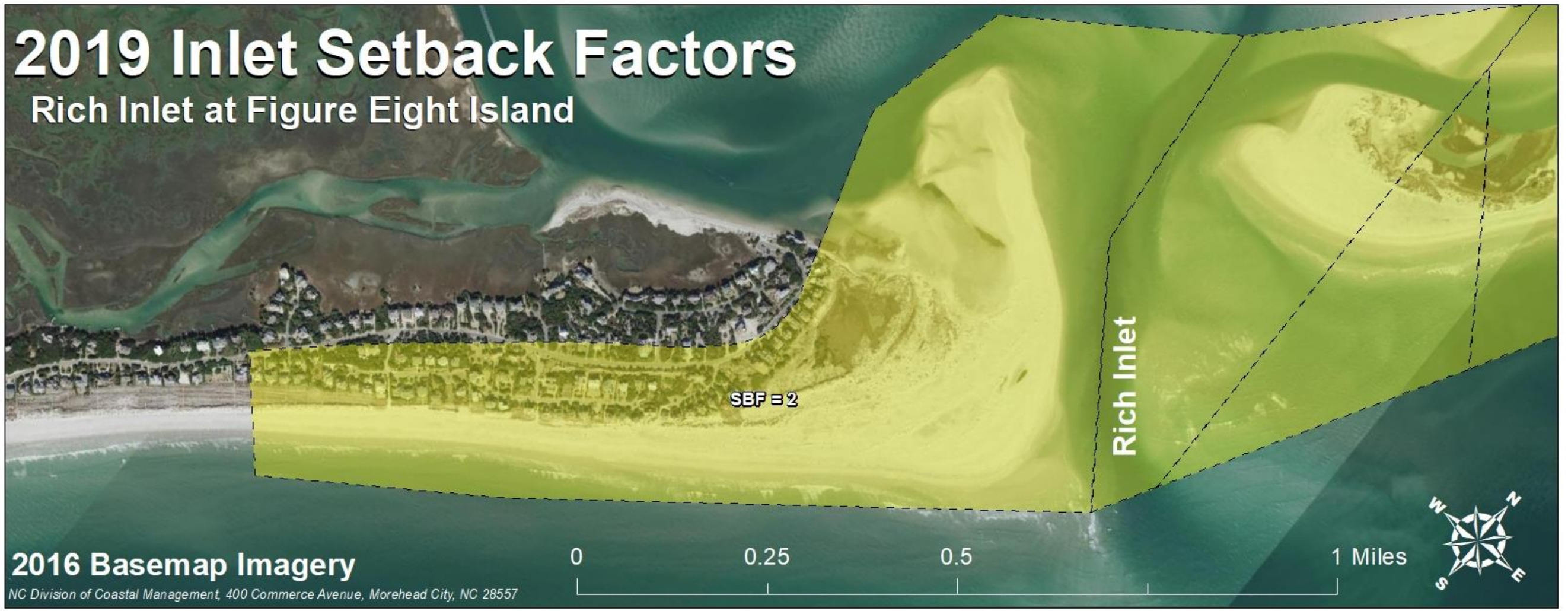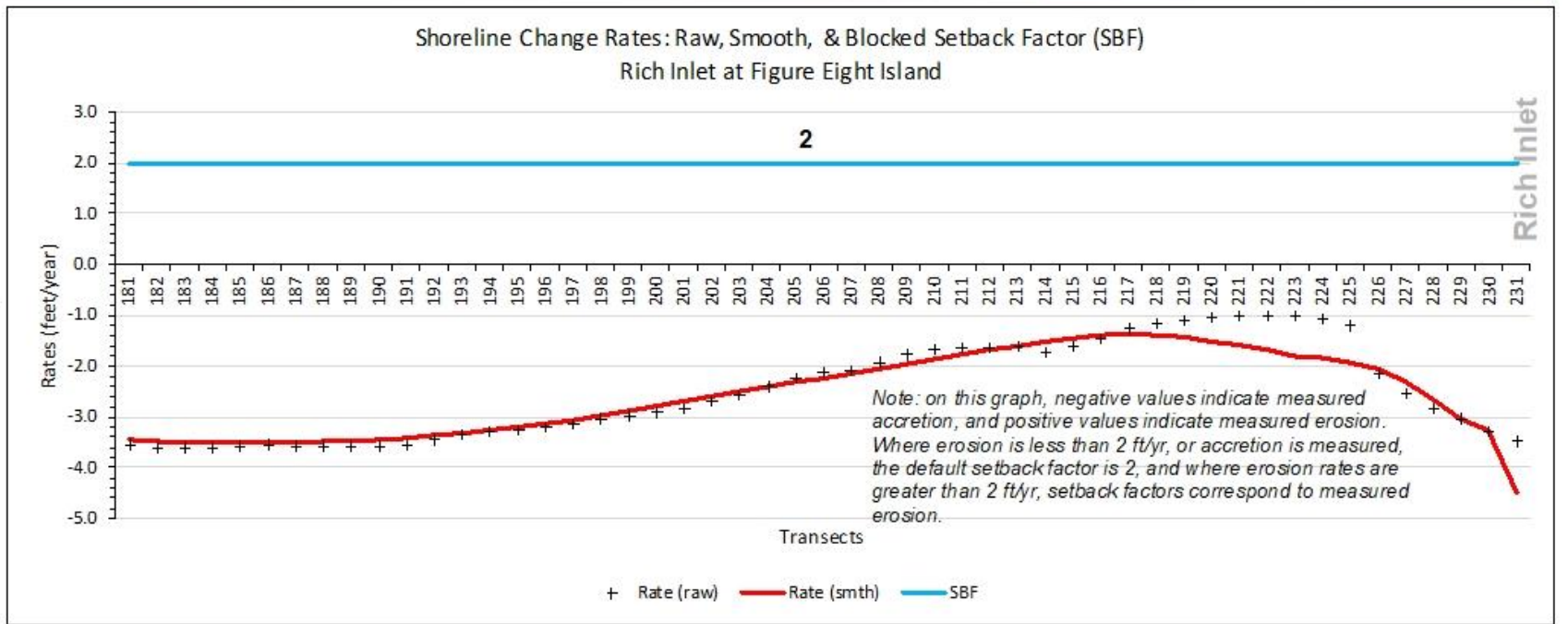
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Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Rich Inlet at Figure Eight Island

Rich Inlet

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

Rates (feet/year)

Transects

+ Rate (raw) —— Rate (smth) —— SBF

2019 Inlet Setback Factors
Lea-Hutaff Island (Rich and New Topsail Inlets)

Rich Inlet

New Topsail Inlet

SBF = 2
SBF = 9
SBF = 17
SBF = 14
SBF = 15
SBF = 8
SBF = 3
SBF = 3
SBF = 2
SBF = 3
SBF = 4
SBF = 5
SBF = 6
SBF = 7
SBF = 8
SBF = 9
SBF = 9
SBF = 9
SBF = 10
SBF = 9
SBF = 8
SBF = 7
SBF = 15
SBF = 37

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.5   1   2 Miles

Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

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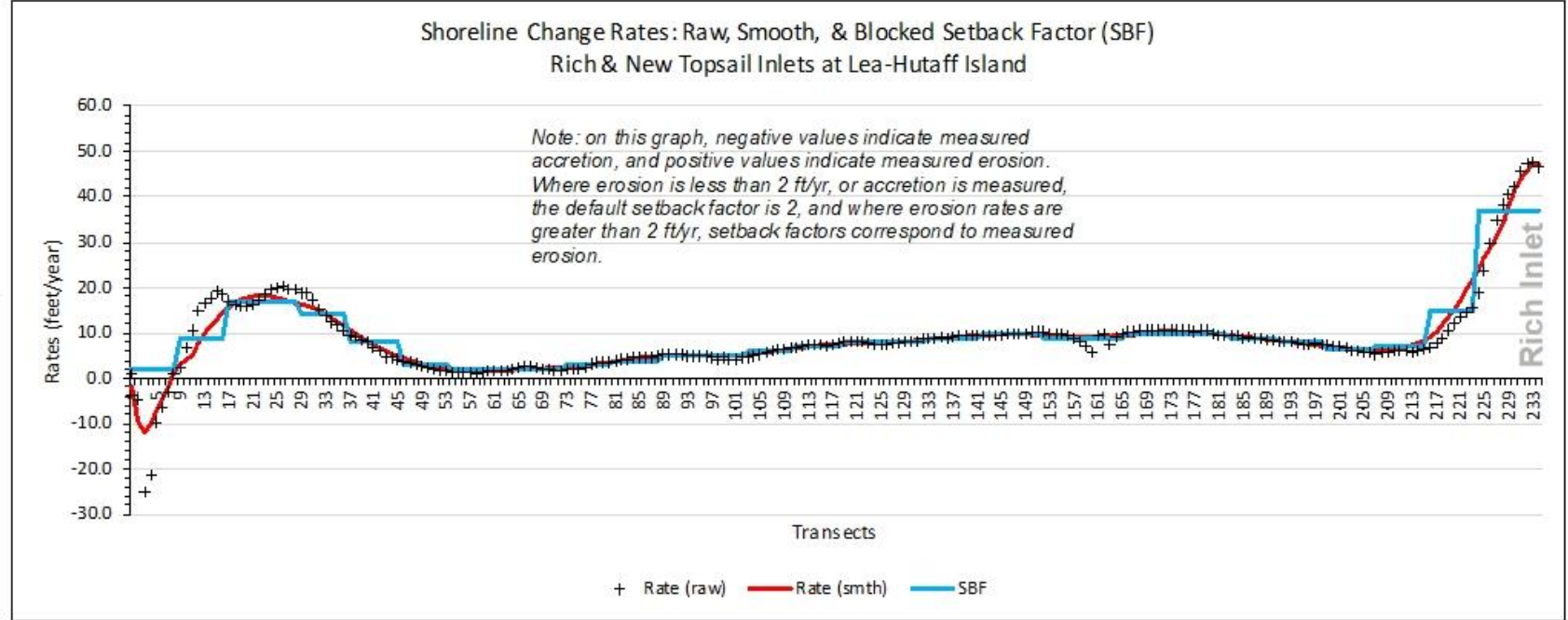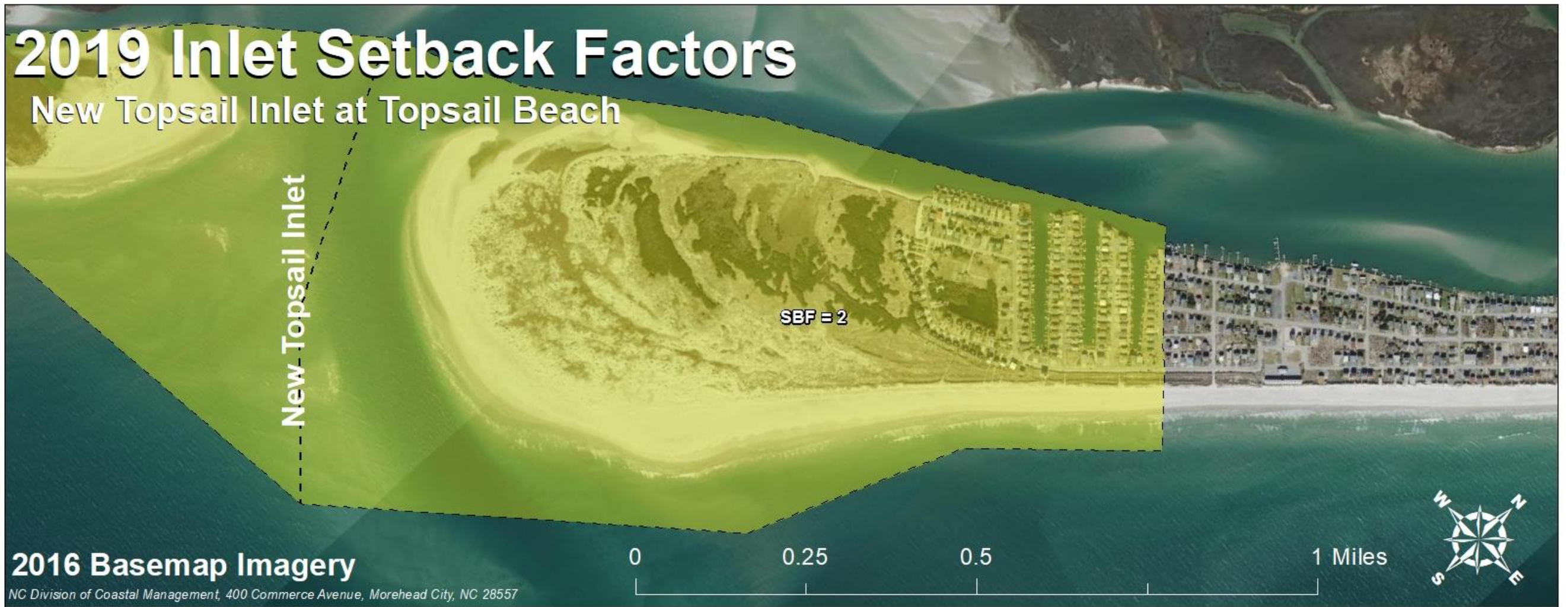contact: ken.richardson@ncdenr.gov

February 20, 2019

NC DIVISION OF COASTAL MANAGEMENT

Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Rich & New Topsail Inlets at Lea-Hutaff Island

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

Rates (feet/year)

Transects

+ Rate (raw)   — Rate (smth)   — SBF

23

2019 Inlet Setback Factors
New Topsail Inlet at Topsail Beach

New Topsail Inlet

SBF = 2

2016 Basemap Imagery

NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.25   0.5   1 Miles
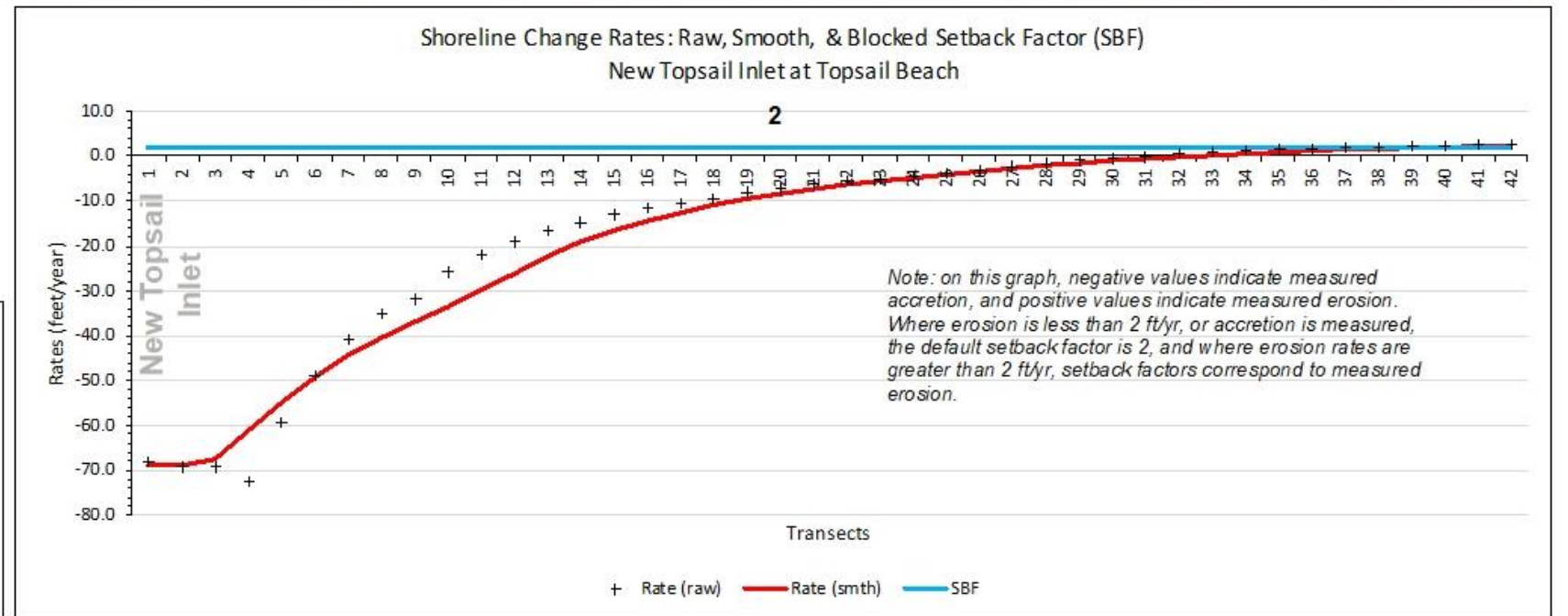
Legend

┆ ┆ Inlet Setback Factors (2019)

▦ Inlet Hazard Areas (2019)

This map illustrates proposed 2019 Inlet Hazard Areas updated boundaries and inlet setback factors using inlet shoreline change rates.
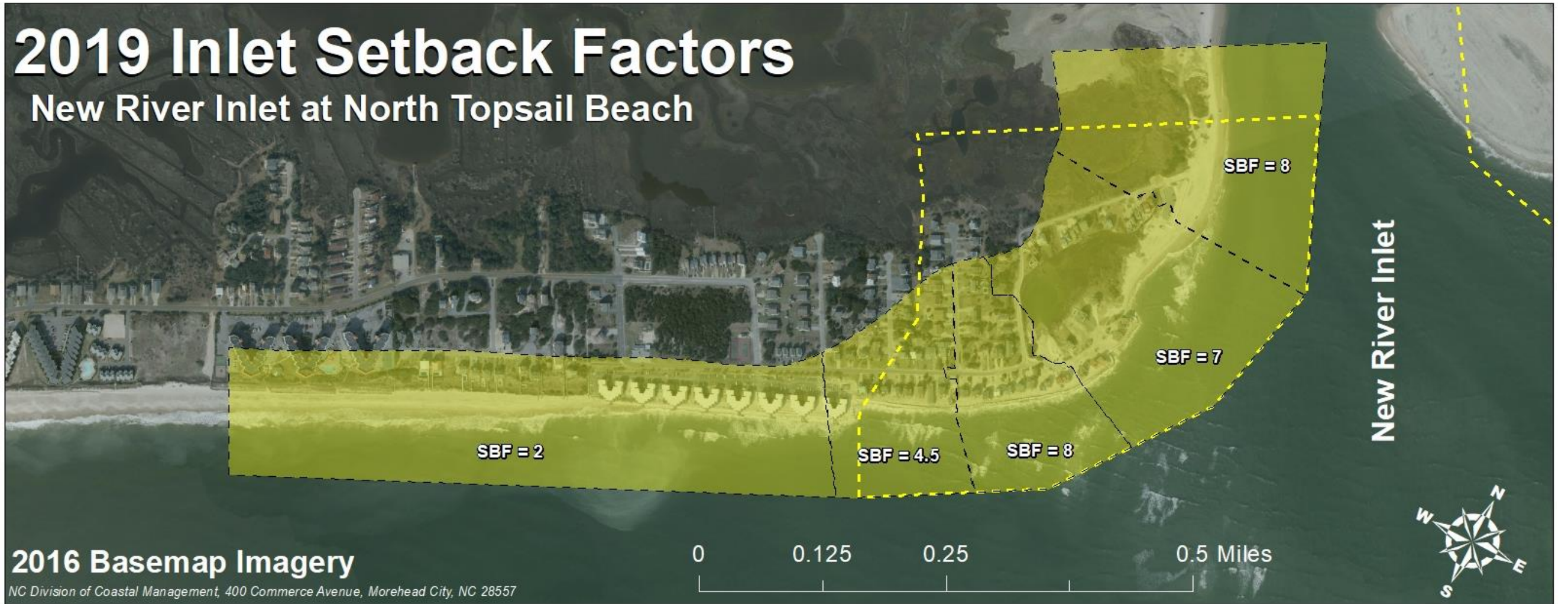
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February 20, 2019

Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
New Topsail Inlet at Topsail Beach

New Topsail Inlet

Rates (feet/year)

Transects

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

+ Rate (raw) ▬ Rate (smth) ▬ SBF

2019 Inlet Setback Factors
New River Inlet at North Topsail Beach

SBF = 8

SBF = 7

SBF = 2

SBF = 4.5

SBF = 8

New River Inlet

2016 Basemap Imagery

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0   0.125   0.25   0.5 Miles

Legend

Inlet Setback Factors (2019)

Inlet Hazard Area - Propososed (2019)
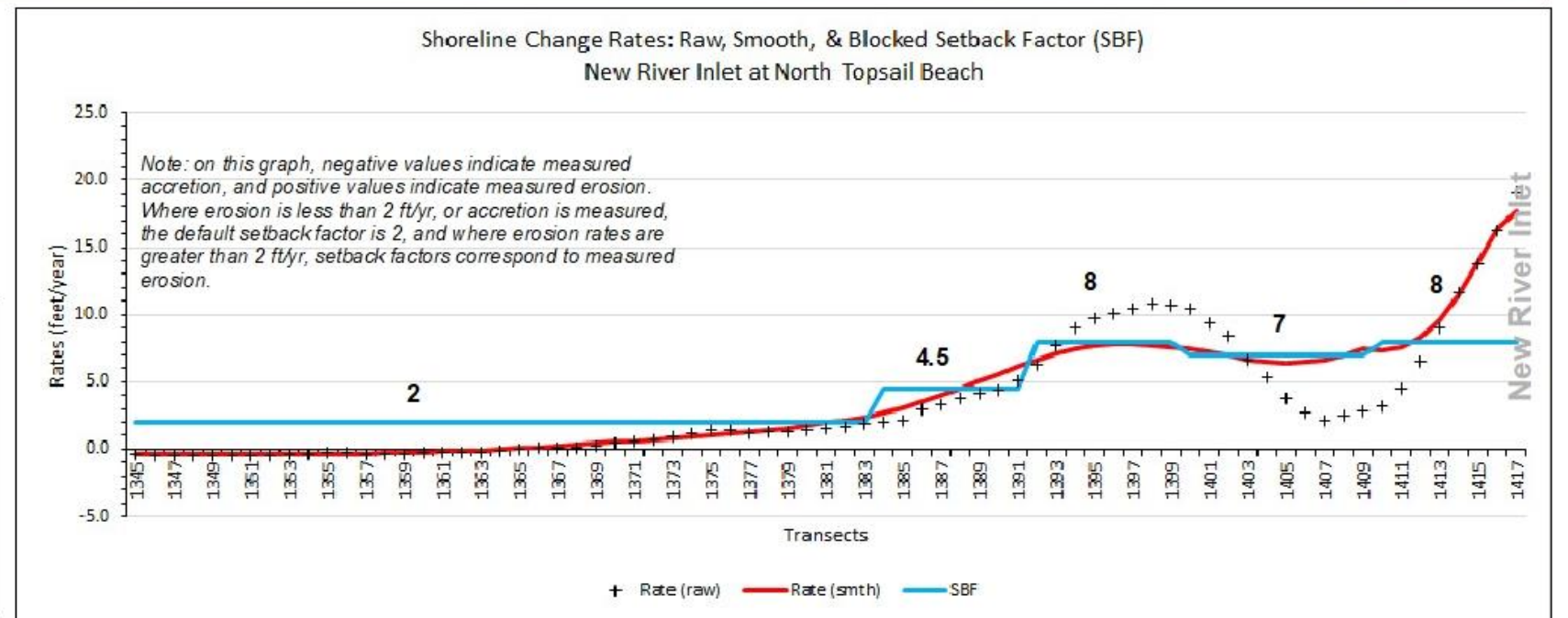
Inlet Hazard Area - Existing (1979)

This map illustrates proposed 2019 Inlet Hazard Areas updated boundaries and inlet setback factors using inlet shoreline change rates.

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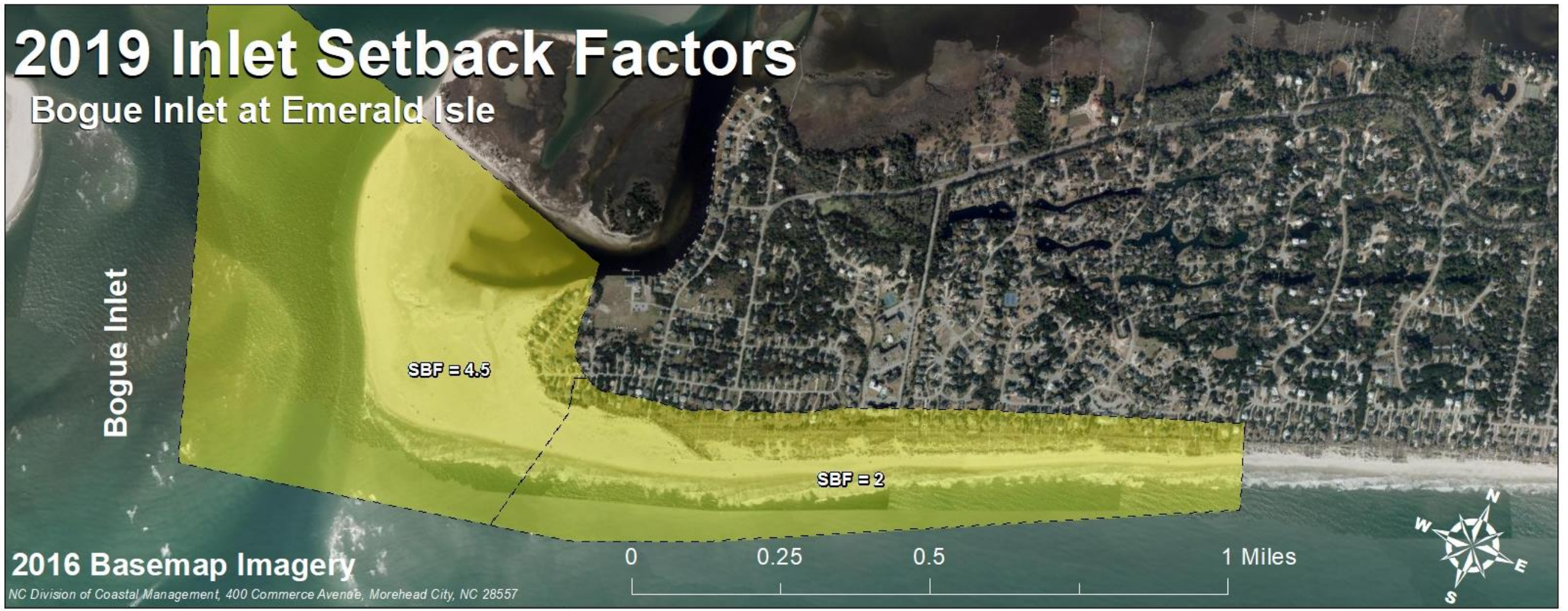
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February 20, 2019

Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
New River Inlet at North Topsail Beach

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

Rates (feet/year)

Transects

+ Rate (raw)   —— Rate (smth)   —— SBF

2019 Inlet Setback Factors
Bogue Inlet at Emerald Isle

Bogue Inlet

SBF = 4.5

SBF = 2

2016 Basemap Imagery
NC Division of Coastal Management, 400 Commerce Avenue, Morehead City, NC 28557

0   0.25   0.5   1 Miles
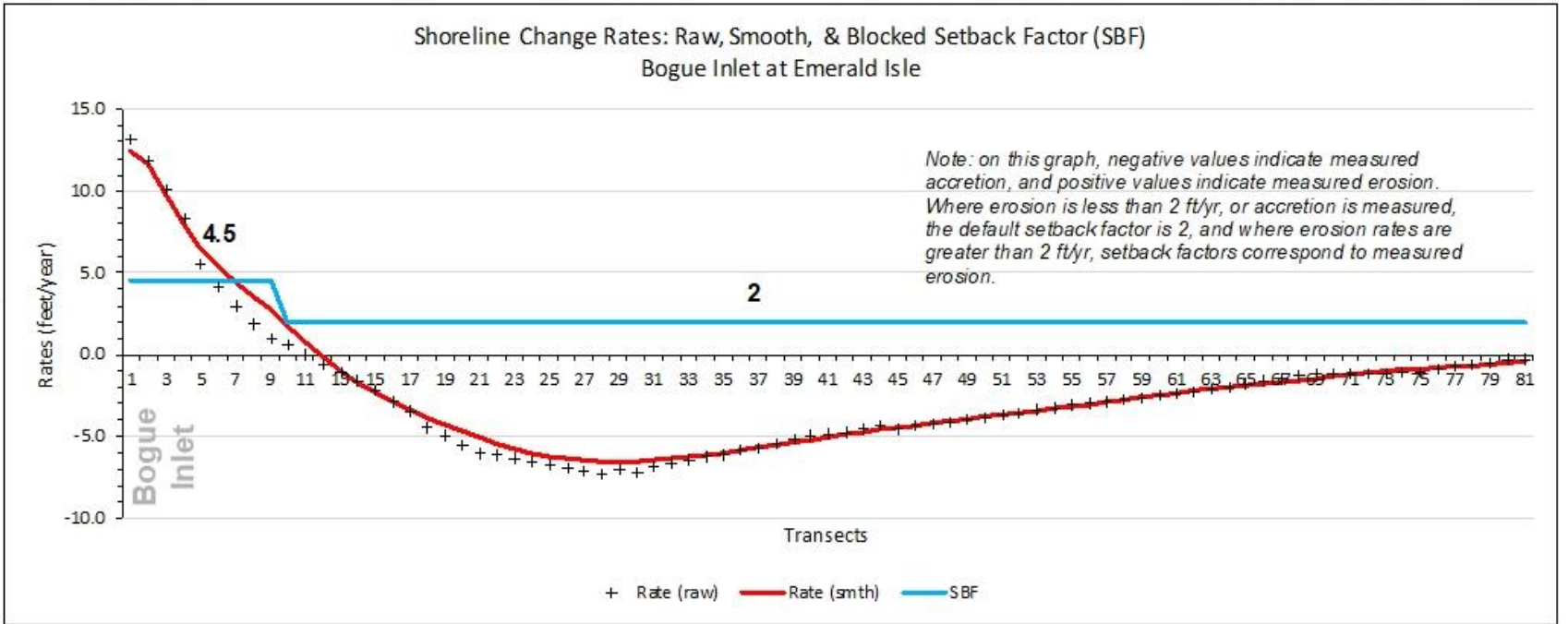
Legend

Inlet Setback Factors (2019)

Inlet Hazard Areas (2019)

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February 20, 2019

Shoreline Change Rates: Raw, Smooth, & Blocked Setback Factor (SBF)
Bogue Inlet at Emerald Isle

Note: on this graph, negative values indicate measured accretion, and positive values indicate measured erosion. Where erosion is less than 2 ft/yr, or accretion is measured, the default setback factor is 2, and where erosion rates are greater than 2 ft/yr, setback factors correspond to measured erosion.

4.5

2

Rates (feet/year)

Bogue Inlet

Transects

+ Rate (raw)   — Rate (smth)   — SBF

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