UPDATED 01/22/20

SPECIAL MEETING/WORKSHOP OF CITY COUNCIL
JANUARY 23, 2020 – 4:00 PM
MUNICIPAL COURTROOM
GEORGETOWN, SOUTH CAROLINA

Notice of this meeting has been made in accordance with the South Carolina Code of Laws as amended.

1. CALL TO ORDER

2. ANNOUNCEMENT CONCERNING ELECTRONIC DEVICES

3. PUBLIC COMMENTS

4. FEASIBILITY STUDY ADDRESSING THE HARBOR SILTING ISSUE IN GEORGETOWN, SC:

Attachments:

1	Final Report Harbor Silting Study 31Dec19 FINAL VERSION	(PDF)
2	Harbor Silting - Phase II Proposal	(PDF)
3	TH proposal - Gtown Co Siltation	(PDF)

A. Phase I: Final Report Presentation.

B. Phase II: Developing A Strategy To Overcome Georgetown Harbor Silting.

5. STORMWATER ORDINANCE AND UTILITY FEE PROPOSED REVISIONS

Attachments:

1	Stormwater Ordinance Revisions Outline	(DOCX)
2	ARTICLE_VI.__STORMWATER_UTILITY-draft1	(PDF)
3	APPENDIX_B (Chapter 23)__DRAINAGE-draft1	(PDF)

6. PRESENT DRAFT STRATEGIC PLAN

Attachments:

1	DRAFT Strategic Plan	(PDF)

7. PORT TANK COLOR SELECTION AND LOGO

Attachments:

1	Port Tank KC Blue	(PDF)
2	GEORGETOWN_CityLogo SE Clock	(PDF)

8. ADJOURNMENT

A. Motion to adjourn the Special Meeting of City Council.

120 North Fraser Street · Georgetown, SC 29440 · (843) 545-4000

INFORMATION ITEM

DOC ID: 2952

Council Meeting Date:	23 January 2020
Department:	Administration
Issue Under Consideration:	Feasibility Study Addressing the Harbor Silting Issue in Georgetown, SC:

Feasibility Study Addressing the Harbor Silting Issue in Georgetown, SC

Oct 2018 – Dec 2019

– Final Report –

Till J.J. Hanebuth, Ph.D.

Coastal Geosystems Research Lab

Coastal Carolina University

Coastal Geosystems
Research Lab
Department of Coastal and Marine Systems Science

December 2019

Summary for Policymakers

- This feasibility study addressing the chronic Georgetown inner-harbor silting issue aimed at identifying potential engineering solutions that provide a long-term, sustainable, and economic strategy against the silting compared to traditional cost-intensive dredging. The study combined field monitoring with numerical modeling to simulate various engineering scenarios.
- Since the 1880's, when Georgetown harbor had developed towards an industrial-scale maritime hub, frequent dredging was essential to keep the Sampit River navigable. At that time, bars and shoals – made of sand – which were located at the entrance to Winyah Bay had to be addressed.
- Since the Sampit shortcut was opened in 1949 by the USCAE to provide direct access to the industrial docks, the inner harbor became disconnected from the strong natural river flow, which had instantaneously initiated a chronic silting issue.
- In the past, both the western and the eastern harbor entrances completely silted up – made of mud – about 2 years after each of the recurrent dredging campaigns.
- Dredging the inner harbor to the depths and widths maintained by the USACE until 2006 would come with an estimated cost of $15 million, calculated for 2019.
- The simulations show that a complete re-closure of the artificial shortcut would lead to significant silting at state dock and steel mill dock, and to significant erosion along the historic working waterfront. This attempt to restore the original conditions is, thus, not a viable option anymore due to past man-made riverbank modifications (i.e. turning basins, bank straightening).
- Tested alternative engineering solutions have the potential to significantly reduce the harbor silting issue but may also cause minor negative side-effects:
    - *Installation of underwater deflection walls* probably promotes higher silting rates.
    - *Narrowing both inner-harbor entrances* probably promotes higher silting rates.
    - *Connecting the inner harbor to the Sampit River* at an upstream location via valve-controlled pipes may mitigate rapid silting to some degree.
- The following Phase II will combine this scientific approach with engineering expertise, with the goal to select the most effective technical solutions, test theoretical details on their design, and provide cost estimates for each of the prioritized scenarios by end of 2020.
- Long-term solutions should also take into account how river flooding, storm surges, a rising sea level, and environmental health demands can jointly be addressed in an engineering strategy.

Feasibility Study
Addressing the Harbor Silting Issue
in Georgetown, SC

Oct 2018 – Dec 2019

– Final Report –

Till J.J. Hanebuth, Ph.D.
Coastal Geosystems Research Lab
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December 2019

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Postgraduate: Patricia Silveira

Graduates: John 'JT' Durica and Madison Fink with Christina Boyce, Madison Keyes, Mary Lee King, Samantha Ladewig

Undergraduates: Ezekiel Meyers with Ariel 'Lili' Clark, Sarah Collins, Corinna Kurth, Mimi Oliver, Matthew Oswald

Contents

Terminology used in this report in regards to the silting material in the inner harbor:

Sediment: Solid, granular material, which is composed of mineral grains and organic matter.

Silt: Demotic expression for sediment accumulating under water. Scientifically, it is the coarser fraction of mud.

Mud: Fine-grained material, comparable to the muds found in marshes and swamps; rich in organic matter, tend to accumulate contaminants – this is the type of sediment found in the Georgetown inner harbor. Scientifically, mud is composed of the coarser silt and finer mud fractions.

Sand: Coarse-grained material, comparable to beach sands in terms of grain size.

Summary

To prevent significant loss for local businesses along the historic working waterfront and the harbor industry, both the City of Georgetown and Georgetown County are seeking a lasting and sustainable solution to address the chronic silting issue in the inner harbor, which is also more cost-effective than traditional recurrent dredging. This feasibility study aimed at setting up a powerful computer-based simulation tool that allows for fully quantitative, highly localized projections for various alternative engineering solutions to prevent or reduce silting along this particular stretch of the Sampit River.

During this study, the riverbed depth (bathymetry) of the lower Sampit River and northern Winyah Bay was surveyed in detail and a monitoring network was installed at strategic sites in the inner harbor and the lower Sampit River. These data were used to setup a sophisticated numerical model with the aim to simulate, quantify, and evaluate both positive changes of the current river water flow as well as unwanted negative side-effects on the existing harbor infrastructure resulting from a major engineered modification.

The monitoring data suggest that the controlling hydrodynamic conditions on the Sampit River are highly complex due to a) an interplay of the discharges from three individual rivers with each other, b) the strong tidal influence, c) the significant effect of wind direction on water levels, and d) a temporarily occurring water column stratification together with the formation of a saltwater wedge, which interacts with the local riverbed topography.

First simulations of four contrasting engineering scenarios to overcome silting in the inner harbor have shown that:

- *Installation of deflection walls* is unlikely to prevent from silting inside the inner harbor, and may even promote higher silting rates due to advection of suspended mud into the inner harbor together with the redirected tidal currents.
- *Narrowing both inner-harbor entrances* would lead to high silting rates due to strong flux of suspended silt into the inner harbor during flooding tide.
- *Complete closure of the artificial shortcut* would most likely keep the main channel navigable. However, this alone would not help to restore the original natural flow patterns, due to several constructional modifications of the Sampit River (turning basins, dock straightening). As a negative effect, the resulting tidal currents may lead to significant erosion along the historic working waterfront, and to silting off the state dock and the steel mill dock.
- *Connecting the inner harbor to the Sampit River* at an upstream location via valve-controlled pipes may mitigate rapid silting to some degree, as suspended sediment will be flushed out of the inner harbor when the valves are opened during ebb tide.

The following Phase II in 2020 will focus on the combination of science and engineering to identify and evaluate the most promising engineering solutions and work on optimizing their design.

Rationale

The Georgetown inner harbor, located in a natural loop of the Sampit River at its exit to Winyah Bay (Fig. 1), is home for major industrial and the private businesses (Fig. 2). Unhindered access is essential to support the historic working waterfront as well as the heavy industry. The inner harbor, however, experiences chronic, rapid silting, which seriously inhibits navigability with major negative consequences for the economy.

The riverbed was naturally deeper than 20 ft, but it has shallowed up to the current 1-5 ft only at passages critical for navigation. This access-limiting sediment accumulation is the result of both an artificial waterway shortcut, opened by the U.S. Army Corps of Engineers (USACE) in 1949, and the termination of commercial dredging in 2008. Channel dredging in the past usually did not lead to a lasting deep-water situation due to the high silting rates, which made frequently repeated dredging efforts an existential requirement.

The task of this feasibility study was to explore potential engineering solutions to restore and maintain the inner-harbor vessel navigability. Such a technical construction is supposed to provide on long-term, a more *cost-effective, sustainable, and lasting* solution to keep the silting rates along both inner-harbor entrances low and at water depths required for unhindered industrial vessel, professional fishery, and recreational boating traffic.

In preparation of this study, a number of possible engineered scenarios have been discussed with representatives of Georgetown County, the City of Georgetown, and the Working Waterfront Coalition. A complete closure of the artificial shortcut to redirect the water flow through the inner harbor was proposed and triggered the question to what extent such a drastic change would entail unwanted side-effects, such as riverbank erosion or an amplification of tides and storm surges. Any type of technical solution would be a cost-intensive effort at the front end, and might have not only positive effects but also negative consequences for the existing infrastructure and buildings.

The complex interaction of various natural sedimentation-driving mechanisms (tides, river discharges and water levels, waves, turbidity maximum related to saltwater wedge, wind-driven water levels, storm surges) makes a projection of the changes that may result from a major river-flow modification highly advisable and required. The intension of this feasibility study was, thus, to develop a computer-based prognostic tool which allows for simulating, identifying, and quantifying the consequences in the wake of a particular engineered construction.

Particular questions that needed to be addressed were: What will be the overall effect of full or partial closure of the artificial shortcut for individual locations along the waterfront and upstream the Sampit River? Will the tidal currents be strong enough to flush the silts out of the inner harbor? Which of the tidal current components dominates sediment transport? Does local erosion along the industrial docks and the historic waterfront need to be taken into account? How will tide levels and storm surge dynamics change with an engineered modification along the historic waterfront? Does the potential for an environmental hazard need to be evaluated should it arise when mobilizing the mud in the waterfront loop?

Figure 1: *Overview map of Winyah Bay with Georgetown located at the Sampit River (yellow circle).*

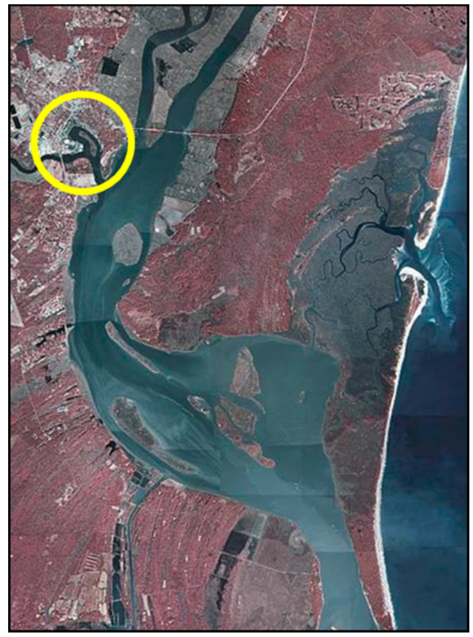


Figure 2: *Current situation of the inner harbor with the heavy industry in its western part and the local businesses along the historic working waterfront to the east.*

Design of Study, Methods

The goal of this study was to generate a comprehensive understanding of the modern and historic hydro-dynamic and sediment-dynamic conditions (Fig. 3). A reliable simulation with a high-resolution numerical model requires, above all, the input of highly detailed and accurate data sets to be measured in the field. The *field component* of this study, thus, was a state-of the-art, high-resolution analysis of the riverbed topography and of the current hydro- and sediment-dynamic situation. In the subsequent *modeling component* numerical sediment-transport model was set up based on those data sets.

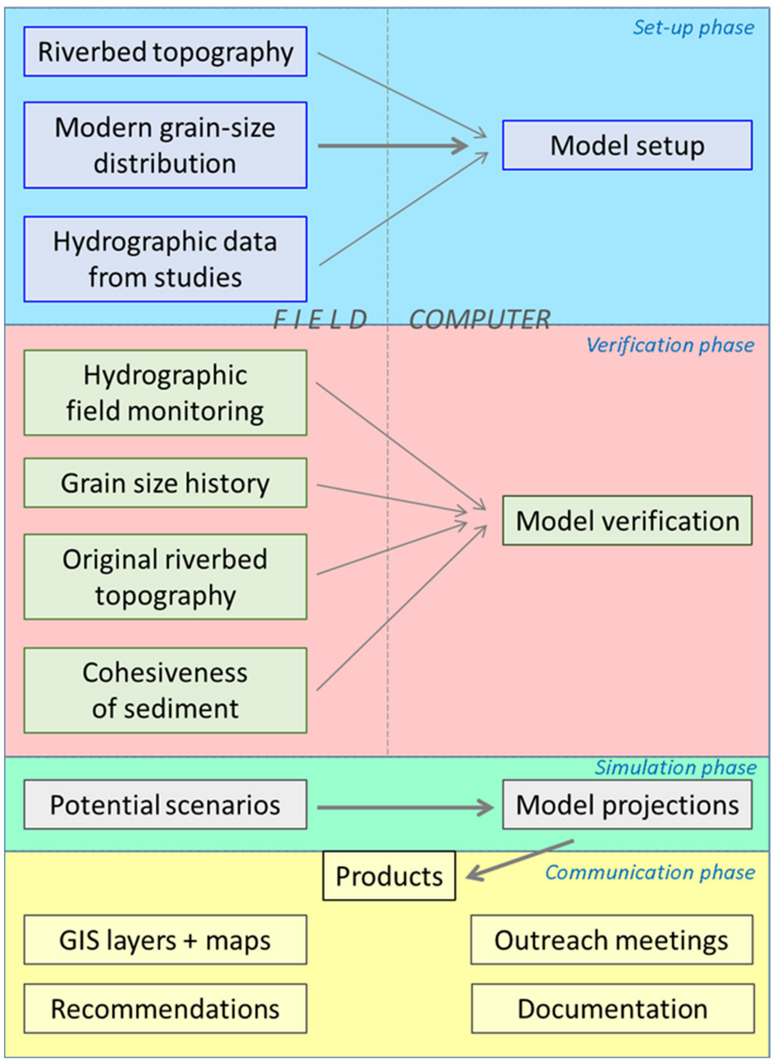


Figure 3: *Conceptual flow chart illustrating the successive steps of the feasibility study. The left column contains analytical field and lab activities, the right column setup and validation of the computer simulation. The lower half of the chart focuses on the outcome.*

To obtain the most realistic field data, a *wider study area* was chosen to extend from the Sampit River at International Paper to the whole northern section of Winyah Bay (Fig. 4). The bathymetry (water depth) of this wider area was mapped to provide the numerical model with bounding morphological, hydrodynamic, and sediment-dynamic information. The southern boundary was located in the central part of Winyah Bay; the northern boundary at the two Hwy 17 bridges across the Pee Dee and Waccamaw Rivers. The modeling approach requires these boundary conditions, since these predetermine the complex hydro- and sediment-dynamics within the *inner study area*. The inner study area was defined from right at the Hwy 17 bridge across the Sampit River to the mouth of the Sampit River, including the inner harbor.

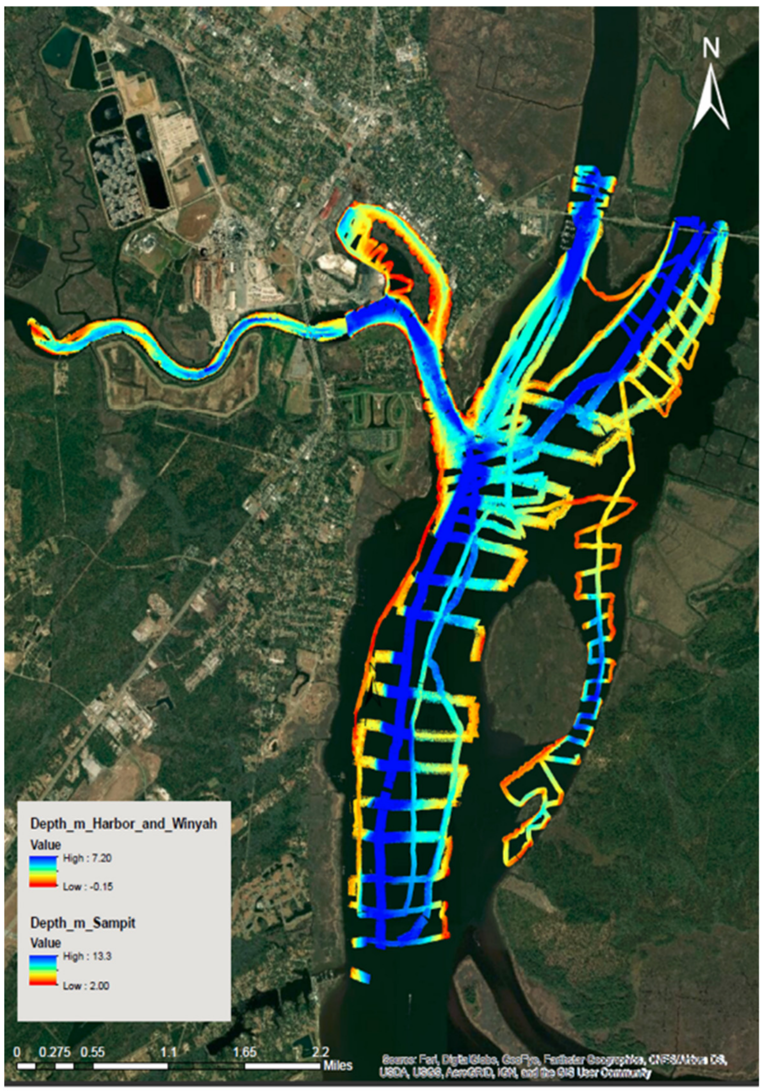


Figure 4: *New detailed bathymetric survey in northern Winyah Bay, the lower Sampit River and the inner harbor loop. These data were required as a baseline for the model setup. The uncovered spots were closed by sufficient interpolation.*

A. Collection of Field Data

a) Bathymetric Mapping

The seabed was mapped in full width along the Sampit River and northern Winyah Bay from October to December 2018, (Fig. 4). This provided detailed information on topography and water depths, as well as on existing current-induced bedforms. 106 lines with a total length of 127 km (79 mi) were collected in August 2018 and February 2019. Several locations, specifically in the inner-harbor loop, were surveyed twice to improve resolution. The deployed shallow-water sidescan sonar 3DSS-DX-450 PING was mounted approximately 1 m (40 in) below the water surface and towed at a vessel speed of 4.5 knots (5.2 mph). The frequency of the sonar is 450 kHz with a beam width of 0.4 degrees. The swath width is approximately 15 times the respective water depth and was set to a maximum of 25 m (82 ft). The sonar was connected to an on-board computer and GPS to examine the data in real-time, and to control data collection through the Display and Control Panel licensed PING programs. Tide corrections were made to all data sets from NOAA tide predictions station 8662926. Boat moves (pitch, roll, yaw) were corrected by an internal motion reference unit (IMRU). Data processing was performed with the software SonarWiz v.7.03.02 and illustrated with ArcMap v.10.5.1. A lateral resolution of 1-m (40 in) was chosen for the inner harbor, compared to 10 m (33 ft) resolution for the surrounding Sampit River and Winyah Bay.

As an additional source of information in regards to historic changes in the inner harbor, a depth sounding map of Georgetown harbor collected by the United States Coast and Geodetic Survey in 1879 was digitized (Fig. 5).

b) Environmental Monitoring

A network of sensors was installed between October 2018 and February 2019 to monitor water level and turbidity *in-situ*. These loggers were installed at strategic sites where changes in water properties were expected to be most relevant for the following computer simulation (Fig. 6). These sites were located at the entrance to Winyah Bay, the western and eastern entrances to the inner harbor, and at the lower Sampit River. *Water level* data was required to quantitatively calculate volume and current speed of the incoming and outgoing water, and to understand spatial and temporal changes. Five Onset HOBO OBS3+ water-level loggers were deployed and the Onset software HOBOware version 3.7.18 was used for recording changes in water level. These loggers also monitor water temperature, used here as a parameter of water mixing. *Water turbidity* data was used to quantitatively calculate volume of suspended sediment load, also in regards to spatial and temporal changes. Four Campbell CR300 turbidity sensors were deployed and the Campbell software PC200W version 4.5.0 was used for recording changes in turbidity.

Additional data were obtained from the permanent National Estuarine Research Reserve (NERR) Station in central Winyah Bay (at the southern boundary of the numerical model), which is managed by a partnership of the National Oceanic and Atmospheric Administration (NOAA), the Southeast Ocean Observing Regional Association (SECOORA), and the Belle W. Baruch Institute for Marine and Coastal Sciences, University of South Carolina (USC). This station continuously monitors water level, turbidity, salinity, oxygen, and temperature at the surface and near the bottom. Also, the USGS tide gauge # 02136350, which is permanently installed at the old Hwy 17 bridge across the Pee Dee River (at the northern boundary of the numerical model), was used for water-level data.

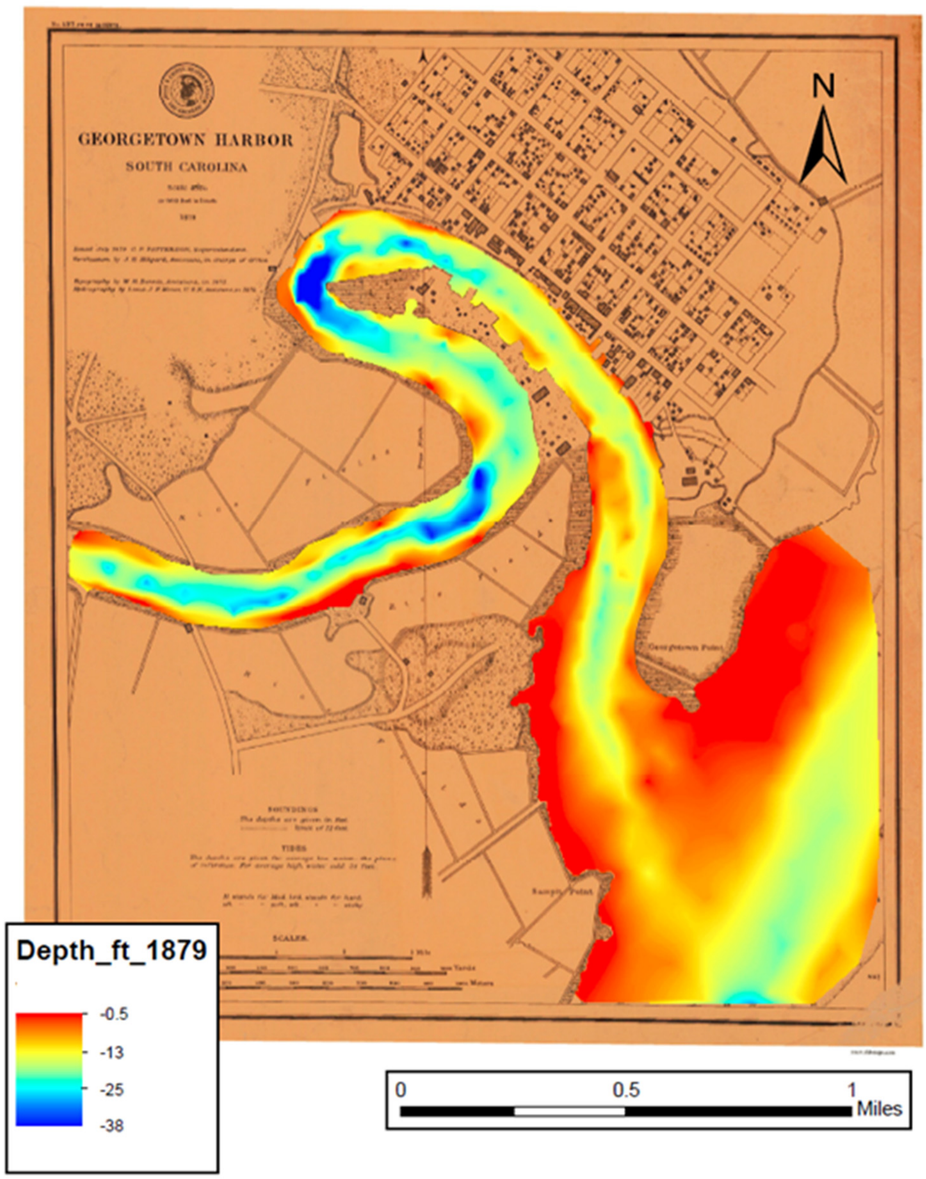


Figure 5: *Map generated from an **1879** bathymetric survey. Along the central part of the working waterfront, the Sampit River was naturally deep enough (green, blue colors) for commercial vessels. To the Southeast (the lower Sampit River and around the entrance to Winyah Bay) sand shoals, however, caused issues for the incoming maritime traffic and needed to be dredged since the harbor operations had gained in the 1880's (Keyes, 2019).*

Figure 6: *Examples showing how the various existing constructions are used for the sensor installation.*

c) Sensor Calibration

In addition to the manufacturer's initial calibration of each of the sensors, we compared the measured turbidity data with recurrently taken YSI measurements at each installation site. The YSI is a highly accurate, hand-held probe which collects temperature, salinity and turbidity data *in situ*. The NERR Station Winyah Bay data were used for controlling the quality of the YSI measurements.

The HOBO water-level logger data needs to be corrected in regards to atmospheric pressure changes (weather conditions). For this purpose the nearby NERR Station in North Inlet was selected, which provides meteorological data online.

d) Sediment Sampling and Analysis

Seabed sediment sampling and coring was planned for a reliable calculation of bottom-current velocities. Four 1.5-m (5 ft) long sediment cores were taken, analyzed for grain-size distribution and trace-metal content, and dated by the $^{210}Pb/^{137}Cs$ method. Since this data set is, however, not representative enough due to local variability of these parameters, and since we had technical and administrative difficulties to obtain 5.5-m (18 ft) long sediment cores, this part of the study got transferred to Phase II at no additional costs.

B. Numerical Model Simulations

A three-dimensional coastal-ocean circulation model incorporating functional modules of sediment transport and seabed morphodynamics was applied to the study area for investigating the hydro- and sediment-dynamic driving mechanisms behind the silting processes. The simulation provides quantitative estimates for water flow velocities, and for the specific responses of both sediment transport and morphology to the various engineering solution scenarios. The unstructured grid model allows for a comprehensive application to the local study area in regards to both a spatial as well temporal high resolution. Based on assumed extreme weather conditions (river flooding, storm surge) the simulations has the ability to provide specific projections on:

a) Water-table changes along the working waterfront and around Goat Island;
b) Local changes in water flow velocity;
c) Immediate and long-term sediment mobilization effects;
d) The relocation of the mobilized sediment; and
e) Potential erosional hazard along the waterfront.

The hydrodynamics of northern Winyah Bay were simulated using the modeling system SCHISM (Zhang, 2014). SCHISM solves the hydrodynamic equations for the vertical velocity using finite element methods on an unstructured grid. Horizontal velocity and time evolution are considered in both a finite volume and finite difference approach. Sediment transport and morphodynamic models are coupled to SCHISM (Lopez and Baptista, 2017; Pinto et al., 2012).

The model setup includes 10 vertical water layers, and the horizontal resolution varies from 40 m (130 ft) in the inner harbor to 150 m (490 ft) in northern Winyah Bay. Meteorological forcing through wind drag, evapo-transpiration and heat transfer are considered. The model was run for 30 days starting on October 10, 2018. The unstructured grid onto which the equations are discretized is created using the finite element mesh generator GMSH (Geuzaine and Remacle, 2009).

The model domain combines sidescan bathymetry data with a digital land-elevation model from airborne surveys (Fig. 7). Constant shallowest water depth is assumed where the water was too shallow for boat access (<60 cm/2 ft) during the bathymetric survey. The domain has been chosen to include Goat Island inside the harbor, Rabbit/Hare islands in northern Winyah Bay, as well as parts of the surrounding marsh located along the banks of the estuary, all of which may be prone to inundation during river flooding and storm surges. The main channel in the estuary reaches a depth of 10 m (32 ft). A sharp transition between this main shipping channel and the surrounding area occurs due to the past dredging of this channel.

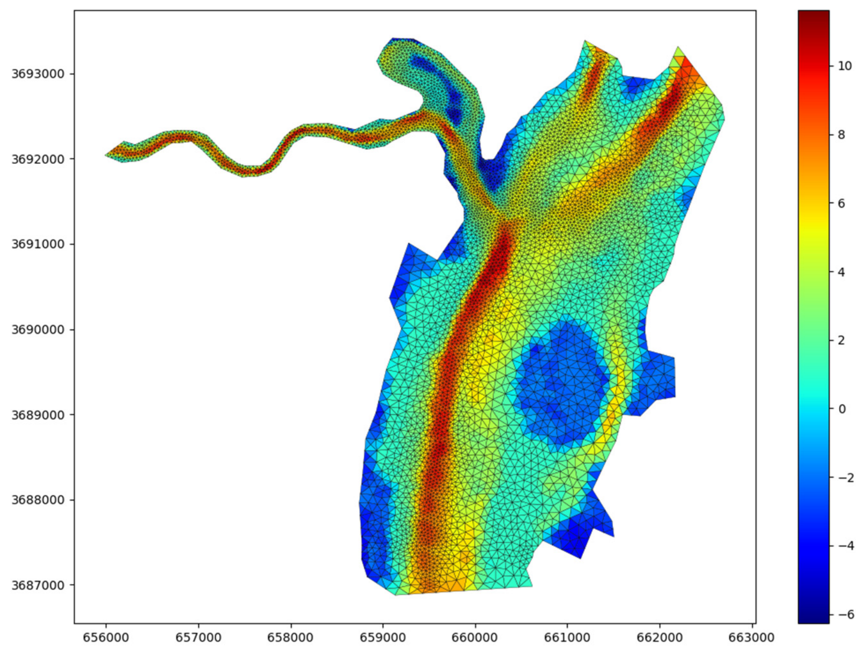


Figure 7: *Bathymetric map showing the area covered by the model and the resolution of the grid. The model considers all forces important to understand the silting: three individual rivers, tides, saltwater/freshwater flux, and levels of silt in suspension. Water depth (color scale) in meters (1 m/3 ft). Warm colors indicate deeper water, thus, where water flow is stronger; cold colors represent shallow areas, where silt settling is common.*

Water level is imposed at the four open boundaries. Water level data are obtained from the United States Geological Survey (USGS, 2019a-c) and the NERR station in Winyah Bay providing historical and real-time measurements collected at Waccamaw, Pee Dee, and in Winyah Bay, respectively.

Four engineering modifications to the Sampit River and the inner harbor were tested within the numerical model in order to assess their effectiveness in both keeping the harbor free of silt and flushing out existing silt: 1. Placement of underwater deflection walls at both inner harbor entrances; 2. Complete closure of the inner harbor shortcut in order to redirect all of the tidal current into the inner harbor; 3. Narrowing of both harbor entrances to 10 m (32 ft) by walls and simultaneous splitting of the harbor into two independent basins by placement of a wall at its backend in order to keep silt from entering the harbor while allowing vessels to pass through the openings; 4. Connection of the inner harbor with the upstream Sampit River via valve-controlled pipes and simultaneous splitting of the harbor into two independent basins by placement of a wall at its backend in order to flush out silt during ebb tide.

Important to note, all simulations were initialized with a dredged inner harbor according to Table 1, wherein 5.4 m (18 ft) depth with variable width and 2.6 m (8 ½ ft) depth with 91 m (100 yd) width were chosen for the western and eastern channels, respectively (Fig. 8).

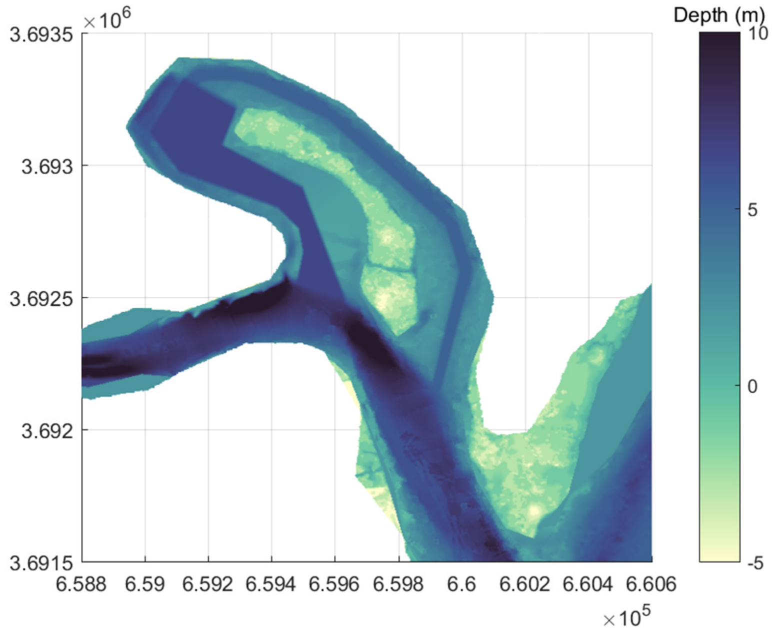


Figure 8: *Virtual initial bathymetry for testing the various potential engineering solutions: the inner harbor is dredged down to the depth maintained by the USACE until 2006.*

Because the main source(s) of silt in the study area is not yet been determined, two theoretical model experiments were conducted for each of the four scenarios, which differed only in the initial bottom sediment conditions applied: In the first experiment, 1 cm (0.4 in) of silt was placed only *inside* the inner harbor area; in the second experiment, 1 cm (0.4 in) of silt was placed only *outside* of the inner harbor (in Winyah Bay, Sampit River; Fig. 9).

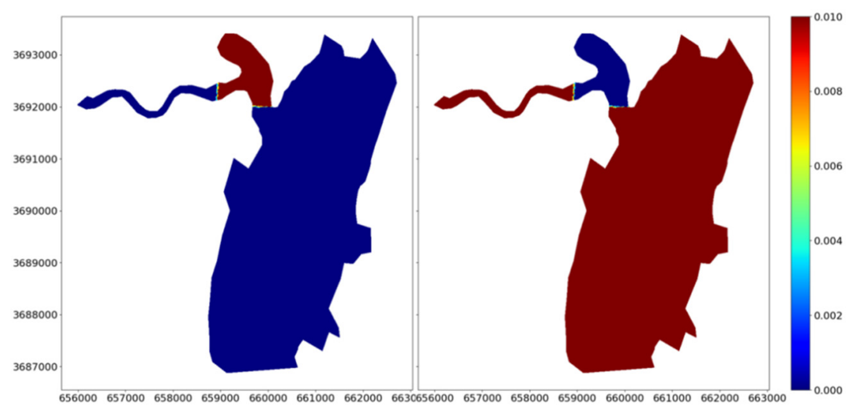


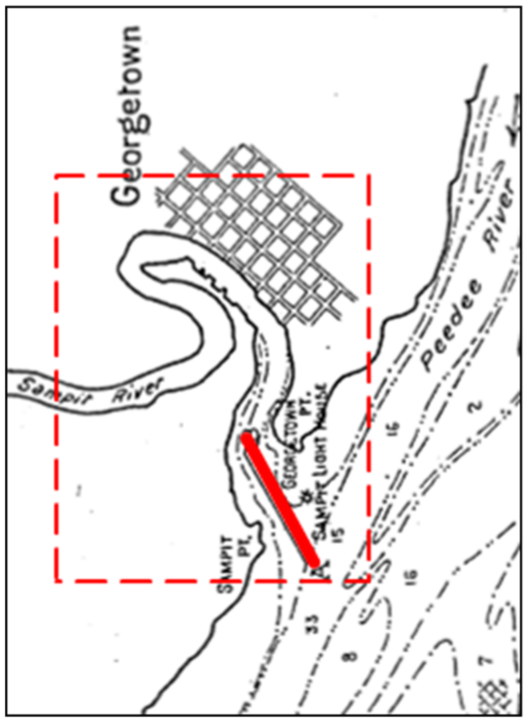
Figure 9: *Initial thicknesses of a theoretical mud layer added for testing the various scenarios with the numerical model. Red areas denote a layer of 1 cm (0.4 in) of sediment, blue areas denote no added sediment. Left scenario: addition of a sediment layer only in the inner harbor. Right scenario: sediment added only outside the inner harbor.*

Results

A. Literature Survey

Morphological System

a) The inner-harbor loop was originally part of the active Sampit River meander system. The natural flow led to the carving of the riverbed down to 6-12 m (20-40 ft) (Fig. 5). The outer section of the harbor and the entrance to Winyah Bay had to be dredged since the start of larger vessel traffic (1880's) because the widening of the river banks led to the natural formation of sand bars and shoals (Fig. 10).



1892

Figure 10: *USACE map showing where the lower Sampit River had to be dredged since the 1880' due to the rapid and chronic built-up of sand bars and sand shoals at its mouth.*

Hydrodynamic System

b) The Sampit River's freshwater discharge contributes only 1-4 % to the freshwater riverine input into Winyah Bay (Trawle, 1978; Voulgaris et al., 2002). The Sampit River's water supply, however, multiplies during flooding events and storm surges.

c) The tidal current regime is the only powerful mechanism for sediment transport in the Sampit River (with an average tidal range of 1 m (3.3 ft), 1.2 m (3.9 ft) during spring tides, and a suggested maximum bottom current velocity of 90 cm/s (35.5 in/s); Trawle, 1978; Goni et al., 2005). The tidal currents show a significant asymmetry: the bottom current related to the incoming flow (flooding) is stronger and occurs duringr a shorter time period than the outgoing flow (ebbing), resulting in a net inland sediment transport at the riverbed.

d) Frequent storm surges lead to maximum water levels along the waterfront and high bottom current velocities in the Sampit River. Data on these dynamics are not available yet and will be in the scope of *Phase II*.

e) The USACE shortcut from 1949, turning a natural peninsula into Goat Island (Fig. 11), has probably changed the water levels along the waterfront and up the Sampit River due to much higher (tidal) flow rates through the shortcut. Data on this effect are not available.

Figure 11: *Natural situation of the inner harbor loop (top) and the new conditions after the opening of the shortcut in 1949.*

f) Water column stratification and density differences (salinity) in Winyah Bay have a strong influence on local mud remobilization (Goni et al., 2005; Kim and Voulgaris, 2008). These occasional, erosional bottom conditions lead to short-lived but highly elevated mud levels in the water. Salinity inside the inner harbor varies from 0 to 20 ppm depending on the season and event (Trawle and Boland, 1979; Goni et al., 2005; own measurements).

Silting System

a) It has to be assumed that the Sampit River (with a small catchment area of 920 km^2) does not discharge a significant amount of sediment since it meanders through swampy, material-trapping lowlands. It probably supplies high amounts of organic matter, including large amounts of organic material released by International Paper (own observations).
b) Winyah Bay is a major sink for river-supplied mud and it has been suggested that only 20% of the mud discharged by the four rivers (Waccamaw, Pee Dee, Black, and Sampit) eventually reach the open ocean (Patchineelam et al., 1999). Thus, the mud available in Winyah Bay probably acts a main source being pumped into the harbor loop by tidal currents. Recent own observations, however, question the quantity of mud retained by Winyah Bay. Since it is crucial for an understanding of the exact timing when mud in suspension is available in the lower Sampit River, we will attempt to identify the actual sand and mud sources (Sampit marshes vs. Pee Dee suspended load vs. reworking in Winyah Bay) in Phase II.
c) The artificial divergence of the Sampit water flow, due to the USACE shortcut from 1949, influences local silting dynamics in northern Winyah Bay as well as favoring mud remobilization and its settling inside the inner harbor (Patchineelam et al., 1999).
d) USACE annual reports since 1950 suggest that traffic-hindering re-silting happens instantaneously after a dredging campaign, probably within the first 1 to 2 years.
e) The muddy infill of the inner harbor contains metals and organic contaminants at severe levels (Long et al., 1998; Clark and Hanebuth, 2018), a situation that need to be address when deciding to relocate the harbor mud.

Man-Made Modifications

a) Settlement and industrial activity have led to partial reshaping and hardening of the inner-harbor and lower Sampit-River banks (Fig. 12). This physical alteration brought the inner-harbor loop geometry to a certain degree out of its natural equilibrium.
b) The operations of the steel mill since 1969 and of other professional and recreational activities over three and a half centuries in and around the harbor have probably led to an accumulation of wasted material in the inner harbor (Long et al., 1998; Ward et al., 1993). It has to be assumed that these materials got lastingly trapped there and might also contain unwanted environmentally relevant compounds.

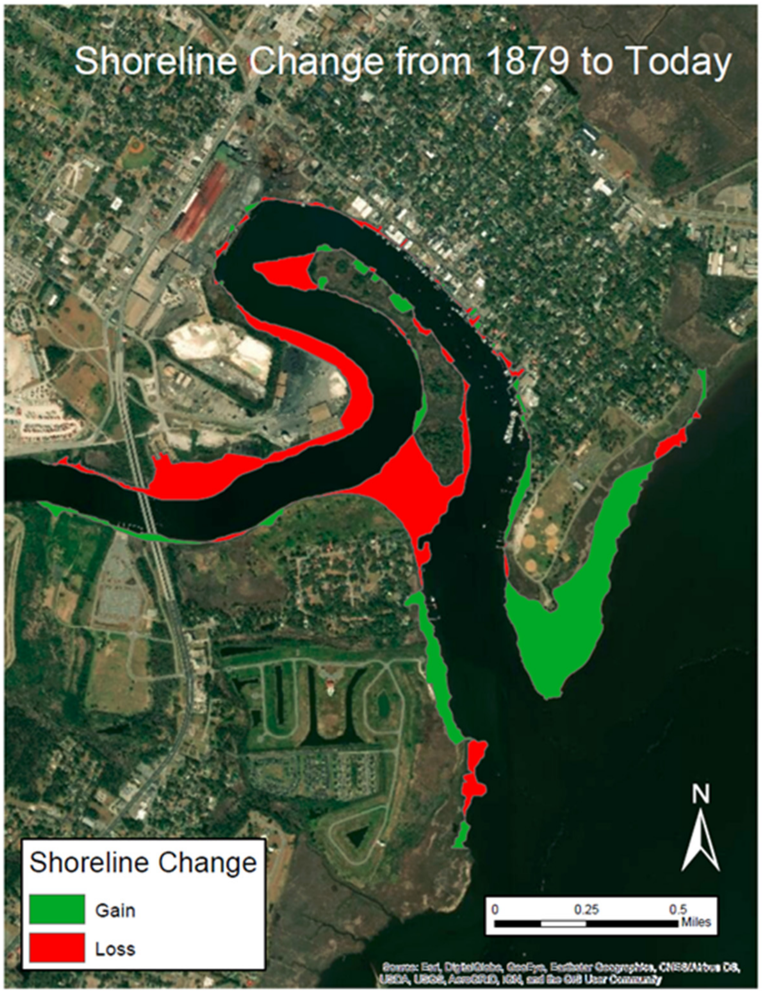


Figure 12: *Map showing land gain of land along the Sampit River banks since 1879. Most of the loss (red) is the related to: River course modifications for the construction of major docks and the two turning basins; and the USACE built shortcut creating Goat Island. Georgetown Point/East Bay Point at the entrance to Winyah Bay experienced major growth (green). The reason behind this extension still needs to be understood.*

B. Field Survey and Sensor-Based Monitoring

Bathymetric situation

The new high-resolution bathymetric survey illustrates the silting issue in the inner harbor in very detail (Fig. 13). The natural water flow keeps the Sampit River and the artificial shortcut at water depths of 6-7.5 m (20-25 ft), a depth that often coincides with the top of the natural bedrock and that is deep enough for any vessel traffic. The two inner-harbor entrances, however, are clogged by mud barriers (Fig. 13). The western entrance (off the state dock) has a current water depth (Mean Low Water/MLW) of 0.3-0.6 m (1-2 ft) and becomes partly exposed during extremely low water levels. The water depth at the steel mill dock is 4.5-5.5 m (15-18 ft) indicating that silting happens at low rates here. The western part off the historic waterfront has a water depth of 4.3 m (14 ft), which resembles the original depth of the canal that was dredged in 2006. This part of the harbor, however, shallows towards the southeast. The eastern entrance is 1.5-1.8 m (5-6 ft) deep. The situation where this entrance is significantly deeper than the western entrance is owed to the fact that the propellers of commercial shrimp boats regularly mobilize the mud here. Without this specific traffic, the eastern entrance would also be inaccessible.

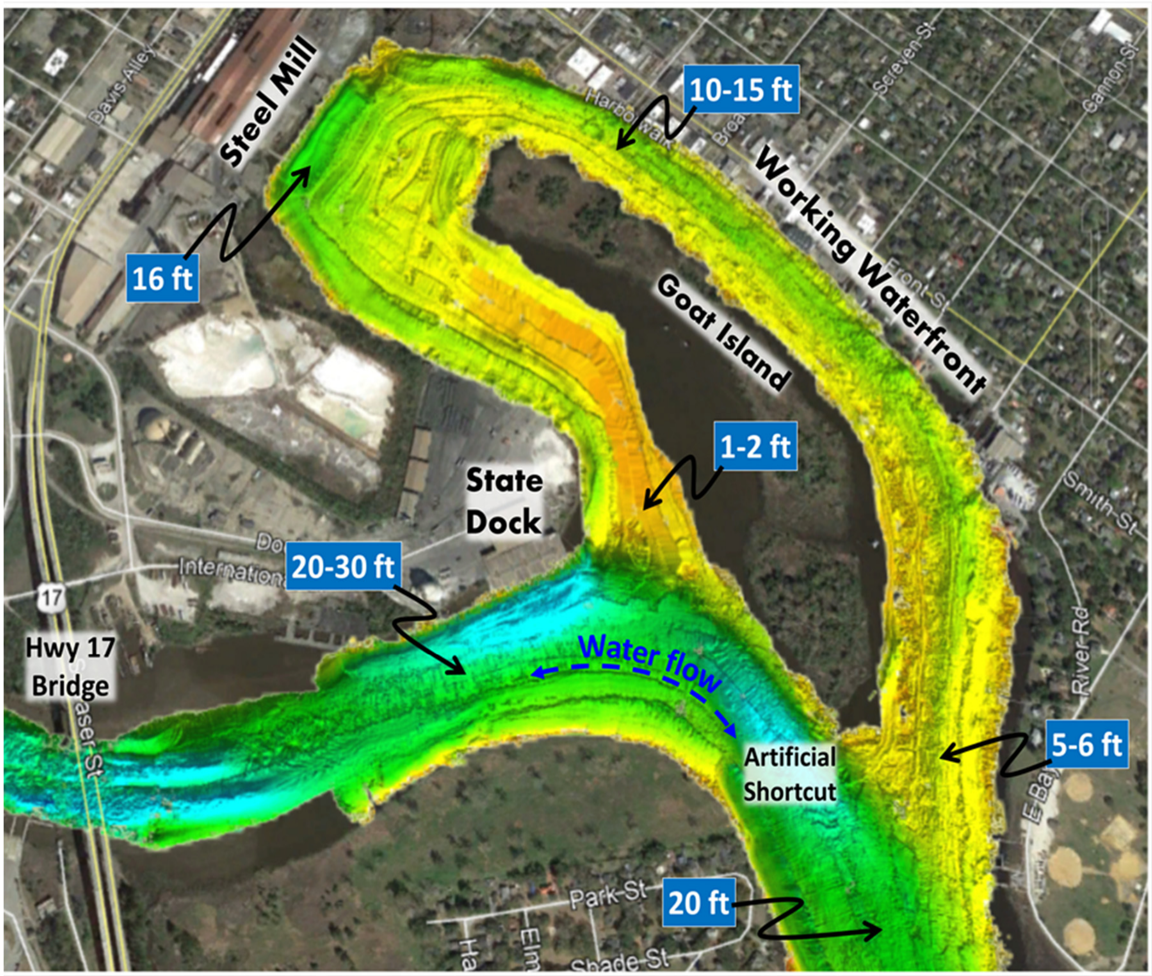


Figure 13: *New detailed bathymetric map of the inner harbor (fall 2018). Blue colors indicate water depths greater than 20 ft, red colors less than 2 ft. It can clearly be seen how the western entrance is nearly filled, while the eastern shows shore-parallel stripes at the riverbed, as a result of the shrimp boat traffic. The fast flowing water of the Sampit River follows the most direct way into and from Winyah Bay, thus keeping the artificial shortcut deep.*

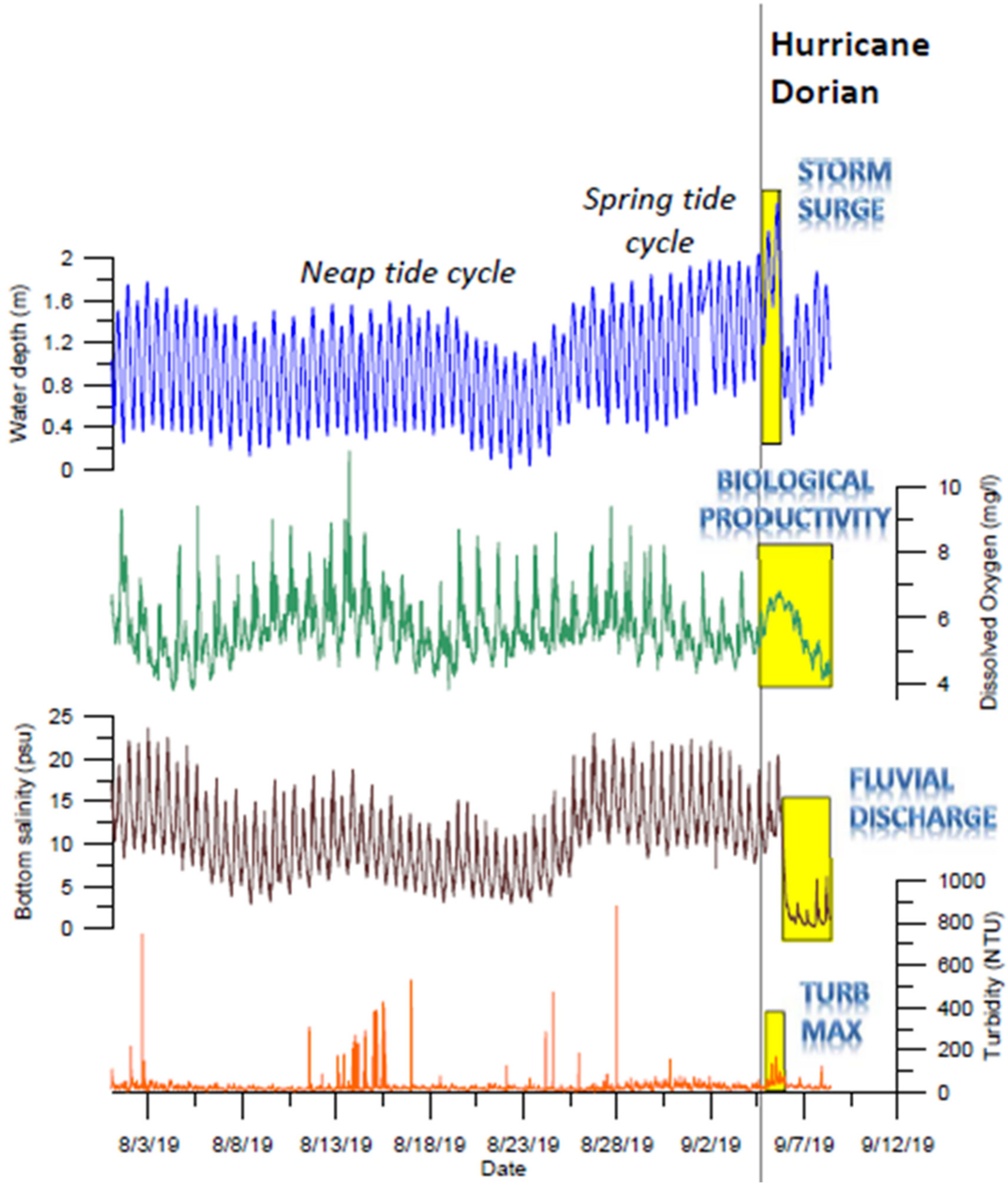


Figure 14: *Data recorded in the northern Winyah Bay (NERR station) prior, during, and after Hurrican Dorian. All parameters illustrate how this fluvial-estuarine system is dominated by the tides. It also indicates that the storm surge (blue line: water level) lasted for only two tidal highstands and dropped afterwards due to the changing wind direction. The salinity (brown line) dropped to zero after the event due to the incoming high fluvial discharge. Most important to note: suspended sediment load potentially responsible for silting in the inner harbor did not increase significantly, pointing to the fact that other configuations between discharge, tides, wind, waves, and saltwedge lead to higher suspended sediment load at other times.*

Environmental Monitoring

The sensor network continuously monitors hydrographic conditions and suspended mud availability. First findings show that the tidal currents of the Sampit River occasionally transport significant amounts of mud in suspension. The new data show that the mud content in the Sampit River changes significantly and abruptly with tides and incoming saltwater, which varies on daily to seasonal scales. This observation suggests that silting in the inner-harbor loop happens in the form of short-lasting pulses leading to extreme mud settling events.

Since it has to be expected that most of the suspended sediment availability is related to high-energy events, the impact by Hurricane Dorian (September 2019) received particular attention (Fig. 14). The monitored data showed that the highest water levels were associated with two tidal highstands, meaning that the storm surge only pressed water against the harbor for a few hours during each of the two highstands. The level of suspended sediment in the water was not remarkably higher than usual, which was in notable contrast to previous hurricane-related events, where the Winyah waters were highly turbid and yellowish brown for several weeks to months due to the large amounts of suspended material (Hurrican Matthew, October 2016; Hurricane Florence, September 2018). This observation indicates that each of the high-energy events come with very individual conditions, which is a main argument why the monitoring via the installed sensor network will not only be continued in *Phase II* but also two new sensors will be added for a better tackling of these system-immanent dynamics.

Estimates of Material Volumes and Dredging Costs

Given the recently raised urgency to secure navigability of the inner harbor for commercial and recreational vessels, it was communicated that a dredging effort is required as soon as possible. The activities following this feasibility study, required for design, implementation and installation of an alternative engineering solution, will need a few more years until completion. Table 1, thus, provides a rough estimate what the to be expected costs of a one-time dredging effort would be in 2019.

Remarks: The following calculation is based on the assumption of $8 per 1 cubic yard (cy) dredged material, which is in the upper range of dredging costs and might be up to 20 % lower ($6 per 1 cy). The calculated costs are rough estimates, not taking into account that a channel profile is not simply rectangular but conical at its base. Also, any additional cost items like for mob/demob, additional assessments, work plans, and other considerations are not considered here. For the eastern channel, four alternative dredging scenarios are calculated, for the western channel three alternative dredging scenarios.

Note: The author is an academic scientist, not an engineer. The calculated numbers are, thus, based on available professional USACE information but might be not fully comprehensive.

Table 1: Cost estimate for various dredging scenarios based on dredging strategies in the past.

Location	Width	Area	Depth	Volume	Estimated Cost
Eastern channel – narrow/8 ½ ft	50 yd	58,000 cy	8 ½ ft	165,000 cy	$1.3 million
The 8 ½ feet of water depth is the same as maintained until the last dredging of 2008. A width of 50 yards is half of what got dredged in the past.					
Eastern channel – narrow/12 ft	50 yd	58,000 cy	12 ft	232,000 cy	$1.9 million
A depth of 12 feet was discussed as a sufficient depth for larger recreational traffic during low tide. This depth was maintained until 1974, and stepwise reduced to 8 ½ feet afterwards. A width of 50 yards is half of what was dredged in the past.					
Eastern channel – wide/8 ½ ft	100 yd	165,000 cy	8 ½ ft	470,000 cy	$3.8 million
A depth of 12 feet was discussed as a sufficient depth for larger recreational traffic during low tide. This depth was maintained until 1974, and stepwise reduced to 8 ½ feet afterwards. A width of 100 yards was the original width during past dredging campaigns. It would mean that the half width of the whole channel will be deepened.					
Eastern channel – wide/12 ft	100 yd	165,000 cy	12 ft	660,000 cy	$5.3 million
A depth of 12 feet was discussed as a sufficient depth for larger recreational traffic during low tide. This depth was maintained until 1974, and stepwise reduced to 8 ½ feet afterwards. A width of 100 yards would mean that the half width of the whole channel will be dredged.					
Western channel – 13 ft	variable	240,000 cy	13 ft	1,040,000 cy	$8.3 million
The 13 ft of water depth are the same as maintained until the last dredging of 2008.					
Western channel – 18 ft	variable	240,000 cy	18 ft	1,440,000 cy	$11.5 million
A water depth of 18 feet allows for commercial barge traffic, as it got maintained until 1996.					
Western channel – 27 ft	variable	240,000 cy	27 ft	2,160,000 cy	$17.3 million
A water depth of 18 feet allows for commercial barge traffic, as it got maintained until 1996. A depth of 27 ft means that all of the silt down to the natural bedrock gets dredged out of the channel.					

<u>For comparison:</u>

Murrells Inlet 2017 (penny sales tax)	519,000 cy	$9 million
Murrells Inlet (Georgetown County Capital Improvement Plan 2018)	7 ft	$9 million
Charleston Harbor 2019	6 million cy	$47 million
Beach nourishment 2018 (Garden City to NMB) (fed emergency funded)	3 million cy	$45 million

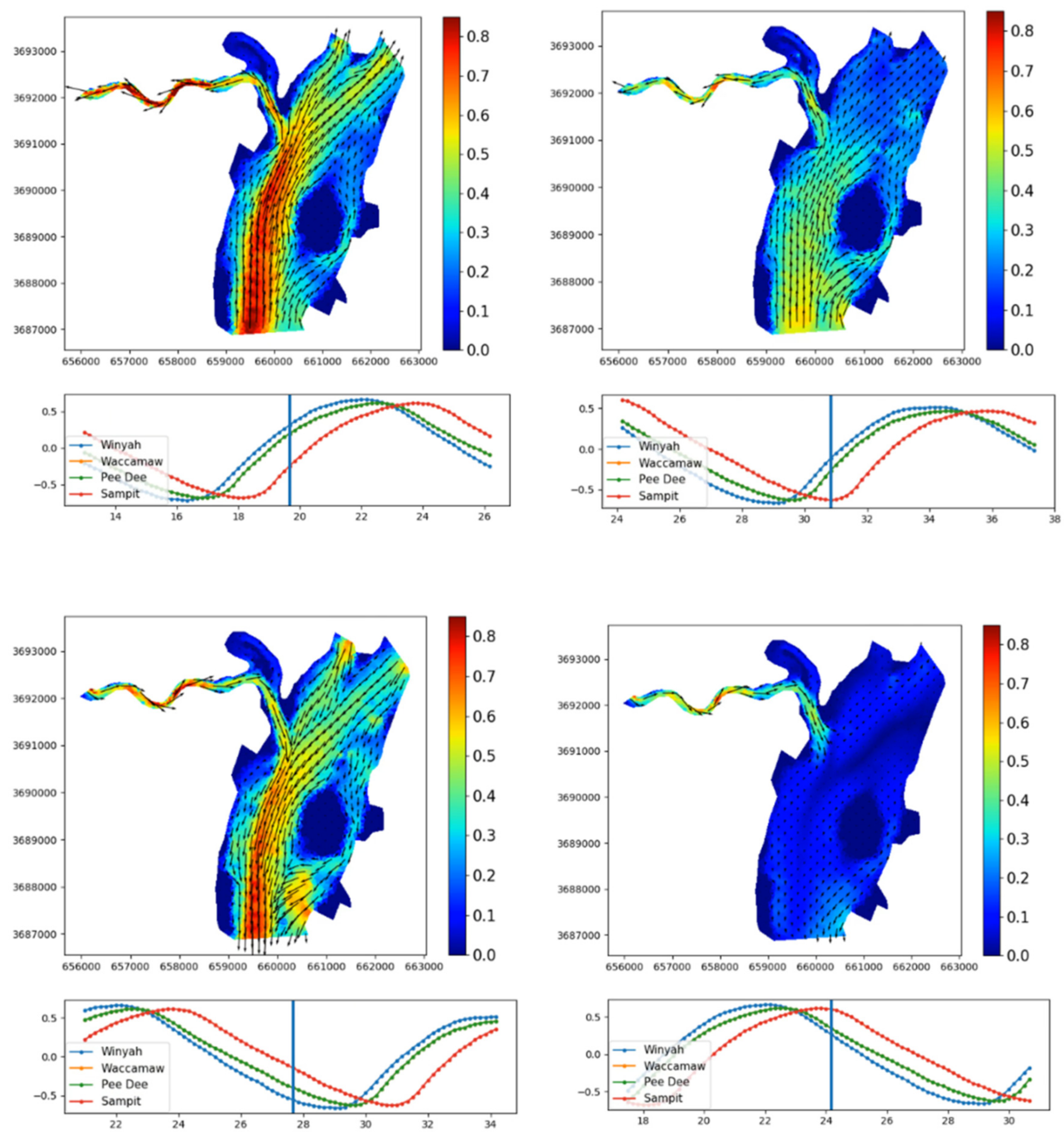


Figure 15: *Model simulation of the current hydrodynamic situation in Winyah Bay and the lower Sampit River. The sinuous lines below the maps show a tidal cycle, the vertical blue line inside this box indicate the timing of the simulation. The two left panels show maximum flow speeds during incoming (upper) and outgoing (lower) tides. Note that the flooding tidal currents are stronger than the ebbing tides. The two right panels show the early initiation of water flow right after slackwater. Note how quickly the Sampit River responses to the tides due to the fact that it carries almost no freshwater discharge.*

C. Simulation of Potential Engineering Solutions

First runs of the numerical simulation resemble the water flow and the mud behavior in a nearly satisfying way and received significant benefit from the recent surge related to Hurricane Dorian (Fig. 15). Also, first mud and sand settling simulations resemble the current silting issue realistically (Fig. 16), which is a significant step forward toward a robust and reliable simulation of extreme events and their consequences. These initial tests also repeatedly indicated that some of the sensor locations had to be adjusted to further improve the simulation quality.

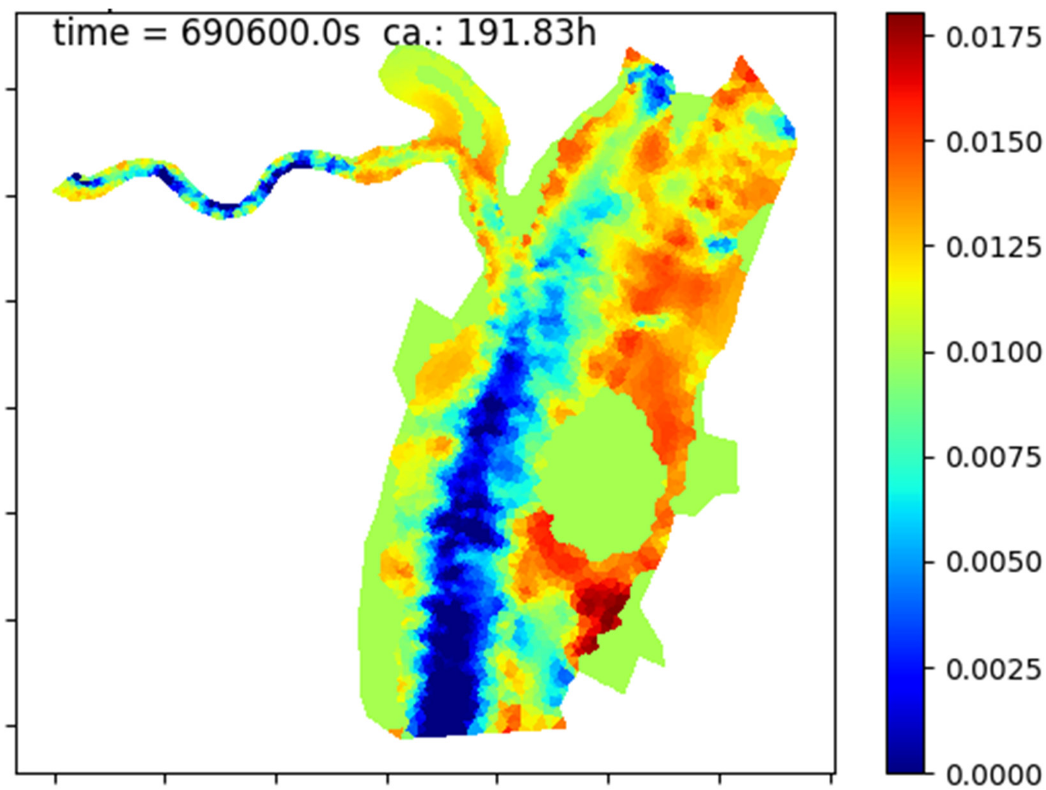


Figure 16: *Map showing an initial model simulation of mud settlement under the currently conditions. Warm colors indicate rapid silting areas, cold colors non-deposition (color scale in meters [1 m/3 ft]). Note the two inner harbor entrances closing rapidly. The simulation suggesst that within a very short time (months to very few years) the two harbor entrances will silt up forming sill-like barriers (see Fig. 13).*

Four contrasting technical scenarios were selected and simulated to provide a first evaluation of different potential engineering solutions. Each of these scenarios assumed that the inner harbor will have been dredged before the installation of the engineered construction.

Simulation Scenario 1 – Installation of Near-Bottom Deflection Walls (Figure 17)

Two curved walls were implemented inside the Sampit River right in front of both entrances to the inner harbor with the aim to redirect parts of the natural tidal currents into the inner harbor (Fig. 17). The elevation of these walls is 6 ft above seabed which is low enough to avoid an interference with vessel traffic.

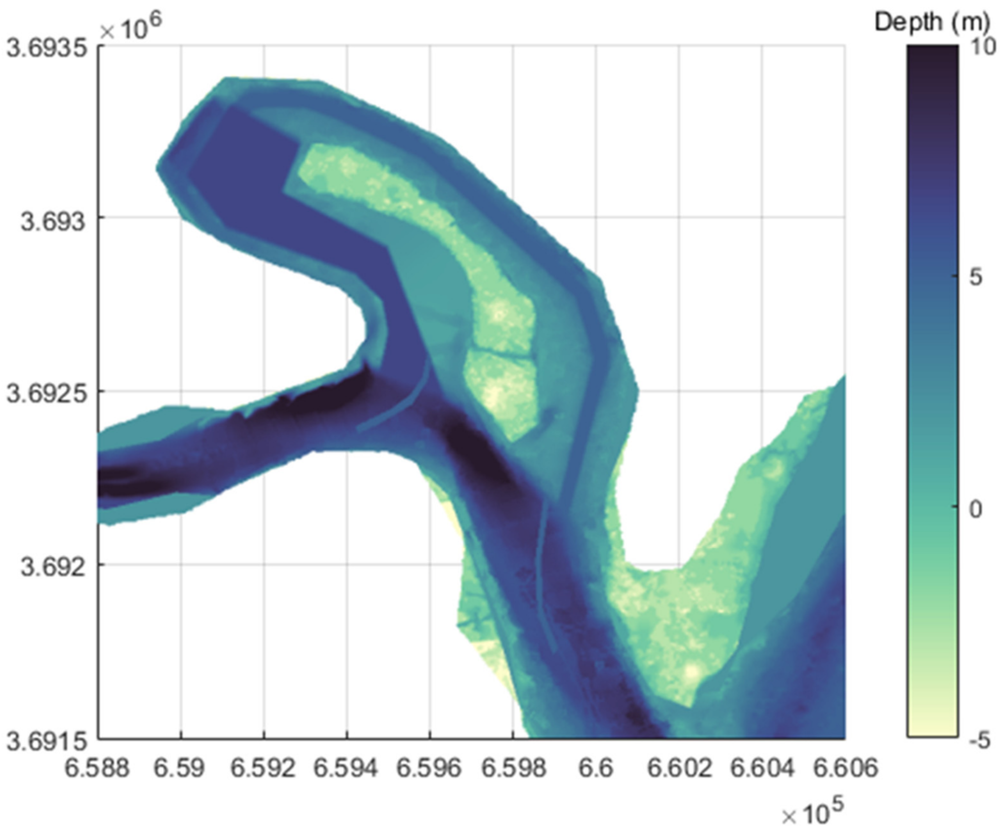


Figure 17: ***Scenario 1 - Installation of bottom deflection walls at both entrances*** *(bluish curved lines in front of the two harbor entrances) with the aim to partially guide both tidal currents into the inner harbor. Western and eastern parts of the harbor were virtually dredged (see Figure 8) before the simulation.*

Result: In the experiment where sediment was initially added *outside* the inner harbor, the resulting currents import suspended sediment into the inner harbor, which settles there during slack tide, leading to rapid silting (Fig. 18). The redirected current is, however, not strong enough to resuspend and carry this sediment out of the inner-harbor loop again. This negative inwards-directed pumping effect is evidenced by the experiment with initial sediment added *inside* the inner harbor (Fig. 19), where little to no erosion has taken place in the inner-harbor loop by the end of the simulation – apart from the shortcut, which has experienced significant erosion.

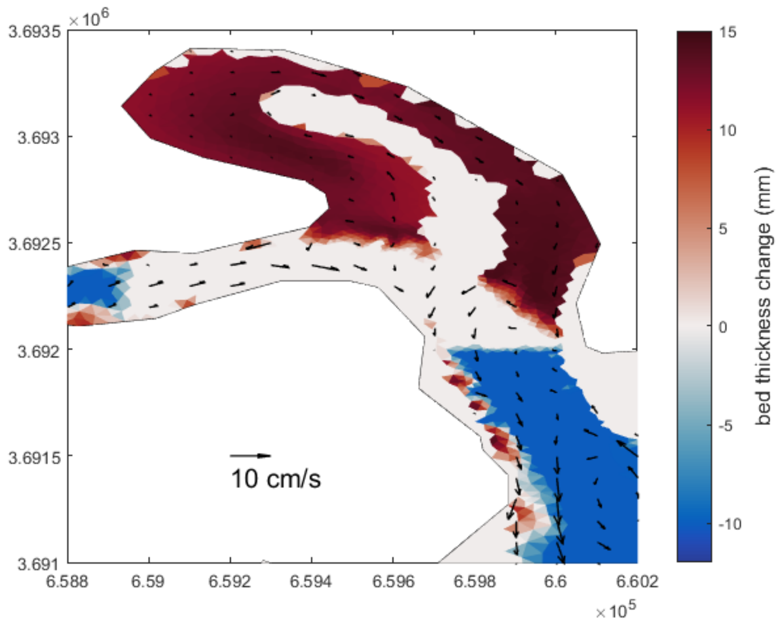


Figure 18: ***Scenario 1 – Installation of bottom deflection walls at both entrances*** *(sediment layer added only outside the inner harbor). Average water currents (arrows) and bed thickness (colors) change at the end of the simulation: the whole inner harbor experienced silting.*

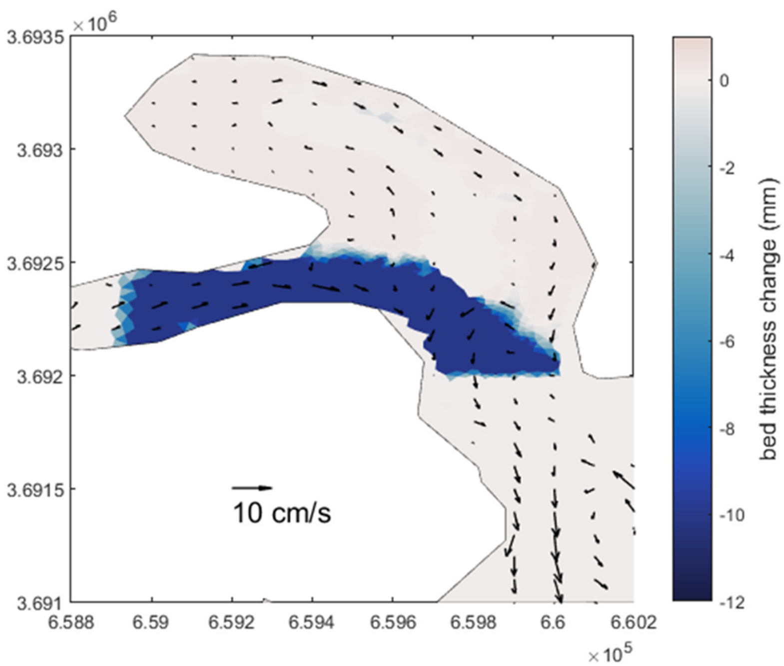


Figure 19: ***Scenario 1 – Installation of bottom deflection walls at both entrances*** *(sediment layer added only inside the inner harbor). Average near-bottom velocities (arrows) and bed thickness (color) change at the end of the simulation: the inner harbor was not emptied from sediment.*

Simulation Scenario 2 – Partial Closure of Both Harbor Entrances (Figure 20)

With the intention to keep the suspended sediment out of the inner harbor, both entrances received walls in this scenario that significantly narrow the passage into the harbor. The inner harbor was also split into two basins in the attempt to reduce the effect of the tidal currents which carry the suspended sediment (Fig. 20).

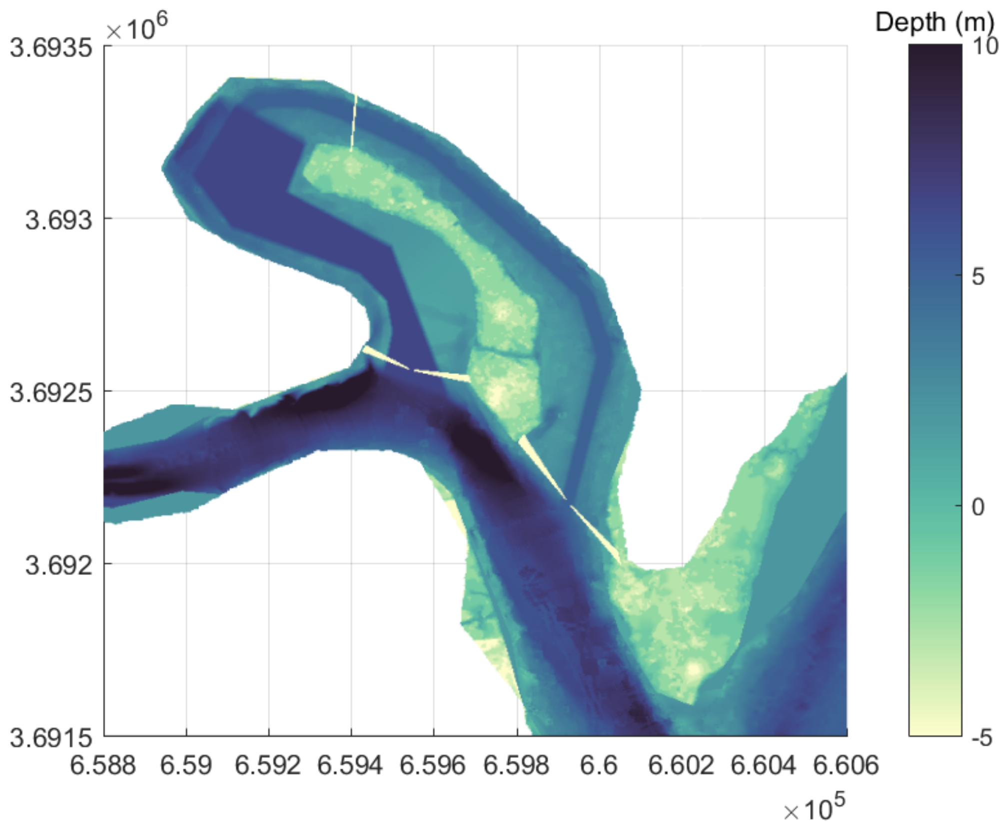


Figure 20: ***Scenario 2 – Narrowing of both entrances and separation into two basins*** *(white lines inside both harbor entrances) with the intension to reduce the amount of mud entering the inner harbor. To further reduce the current velocity a wall was also added east of the steel mill sturning basin, which physically separates western industrial harbor basin from an eastern working waterfront basin.*

Result: Although the velocities within the two semi-enclosed basins are reduced to near-zero at all times, suspended sediment does still enter the inner harbor during flooding tide (Fig. 21). This effect may be attributed to the water-level difference between Winyah Bay and the inner harbor during flooding tide and the resulting pressure gradient which pushes water through the narrow entrances into the basins. This mechanism leads to rapid silting.

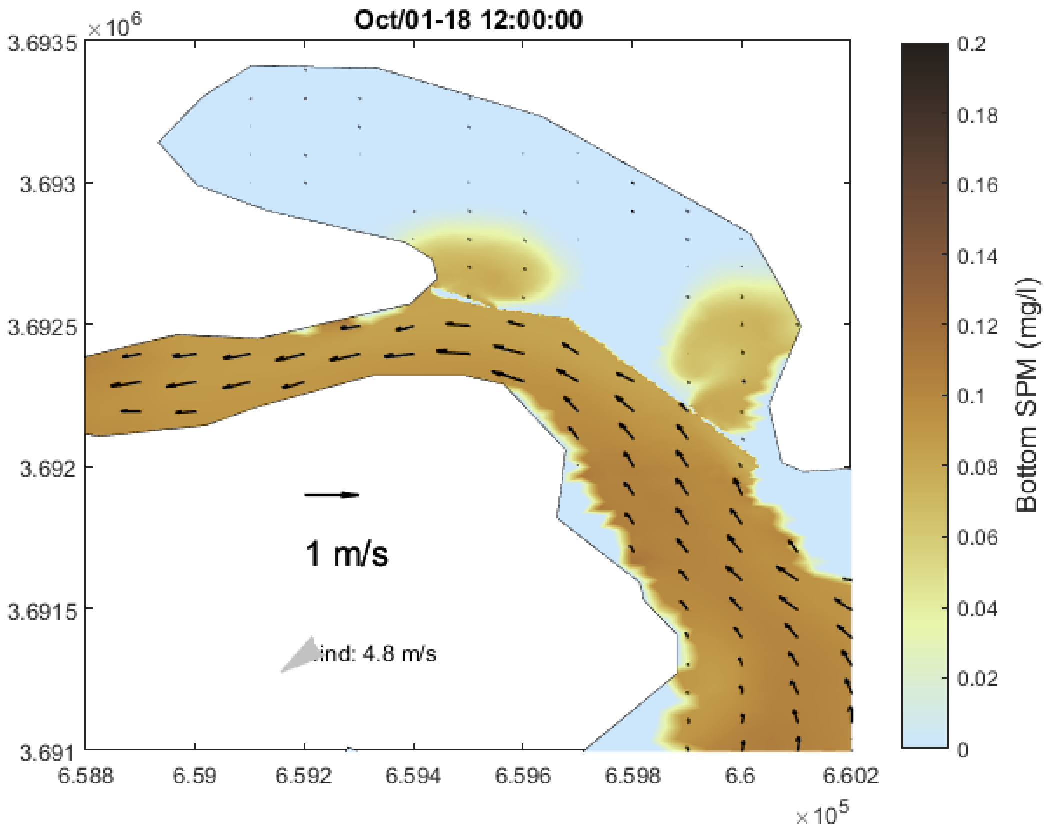


Figure 21: ***Scenario 2 – Narrowing of both entrances and separation into two basins.***
Snapshot of near-bottom mud suspension concentration (color; SPM = Suspended Particulate Matter Concentration) and near-bottom current velocities (arrows) during incoming tide.

Simulation Scenario 3 – Complete Closure of the Artificial Shortcut (Figure 22)

The assumption of this scenario is that hen re-establishing the connection of Goat Island to the mainland, the water flow will be completely redirected into the inner-harbor loop, thus restoring the natural pre-1949 conditions (Fig. 22).

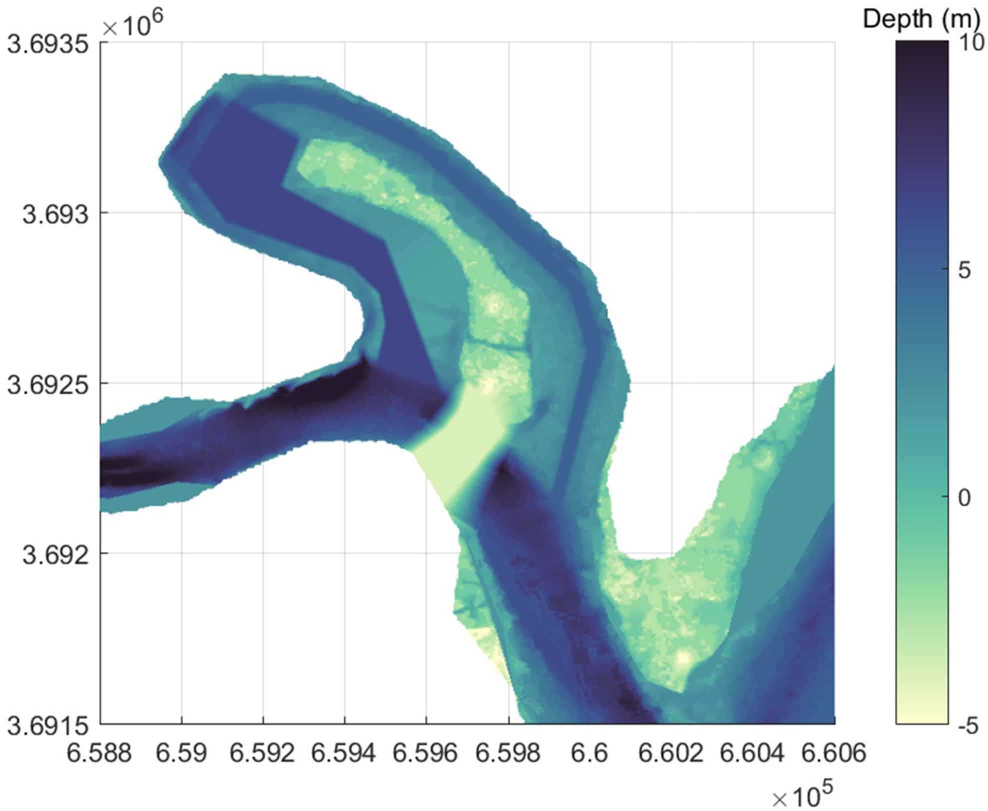


Figure 22: ***Scenario 3 – Complete closure of the artificial shortcut****. Restauration of Goat Peninsula with the aim to completely redirect the original Sampit River flow through the inner harbor as it was the natural situation prior to the shortcut opening.*

Result: The river flow does not fully return into its original course. Rather, the water flow chooses a short-cutting way, which leads to significant erosion along the historic working waterfront, and silting off the state dock and off the steel mill dock (Fig. 23). The reason for this negative effect is linked to the artificial widening and straightening of the river (Fig. 12).

The experiment added a sediment layer outside the inner harbor (simulating flooding tide sediment transport) indicates new deposition in the lower Sampit River (Fig. 24); more significant is, however, the experiment in which sediment was added only inside the inner harbor (simulating transport during ebbing tide) , which shows widespread erosion in the inner harbor (Fig. 25), but to an excess that has the capacity to damage existing waterfront constructions.

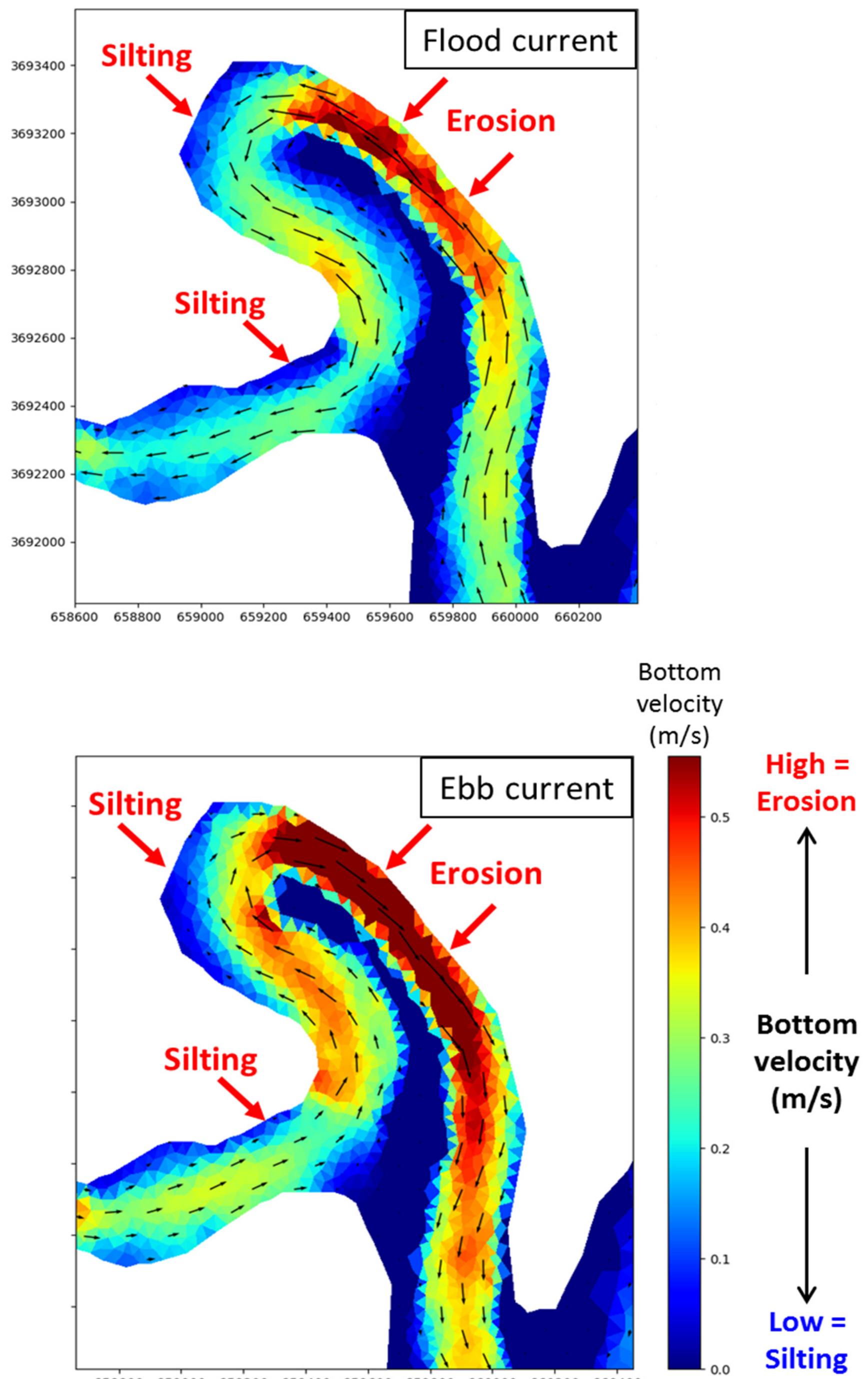


Figure 23: ***Scenario 3 – Complete closure of the artificial shortcut*** *(simulation without added sediment layer). Upper scenario during incoming tide, lower scenario during outgoing tide. Warm colors indicate potential erosion due to high current velocity, cold colors indicate potential silting due to low velocity. Note that the working waterfront is severely exposed to erosion whilst the state dock and the steel mill dock show silting-preferable conditions.*

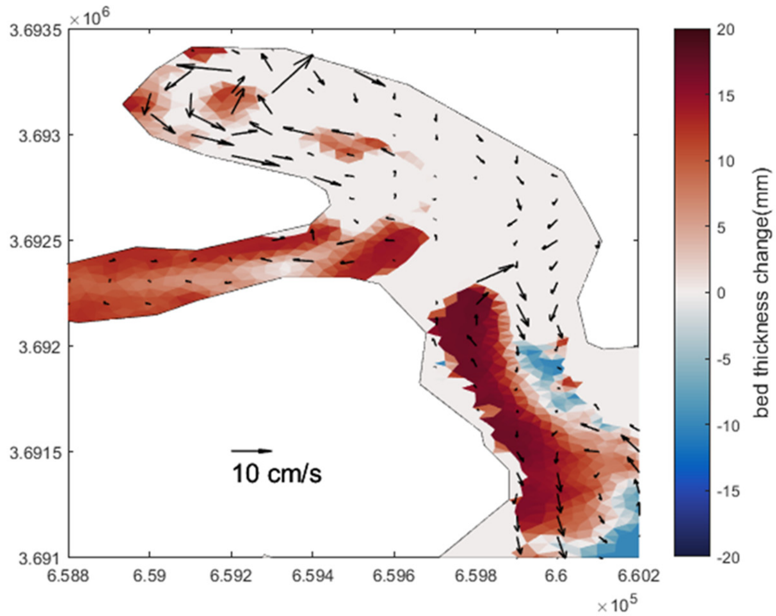


Figure 24: ***Scenario 3 – Complete closure of the artificial shortcut*** *(sediment layer added only <u>outside</u> the inner harbor). Average near-bottom currents (arrows) and bed thickness change (colors) at the end of the simulation. Red colors indicate silting, blue colors indicate erosion.*

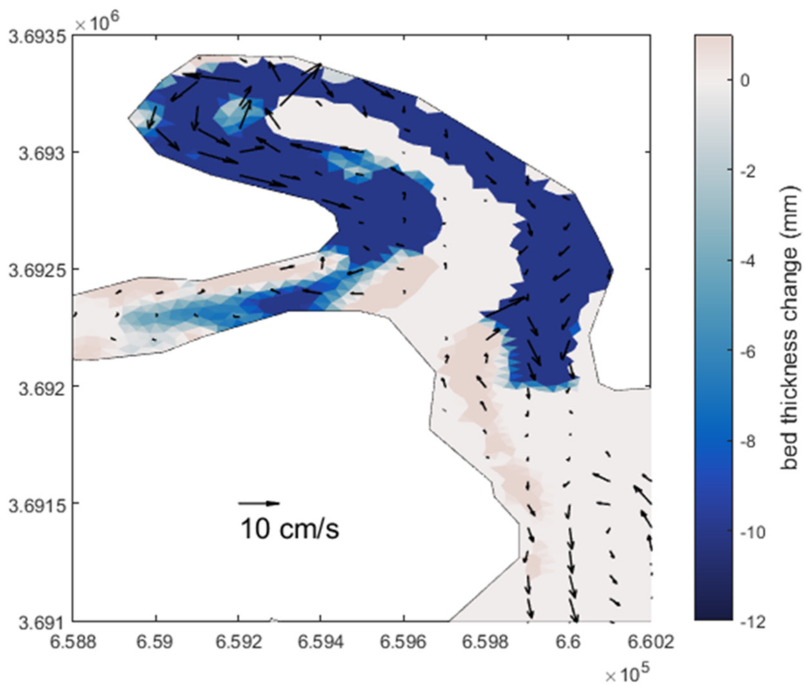


Figure 25: ***Scenario 3 – Complete closure of the artificial shortcut*** *(sediment layer added only <u>inside</u> the inner harbor). Average near-bottom currents (arrows) and bed thickness change (colors) at the end of the simulation. Red colors indicate silting, blue colors indicate erosion.*

Simulation Scenario 4 – Pipe Connection Between Sampit River and Inner Harbor (Fig 26)

A virtual pipe connecting the Sampit River, starting at an upstream location, with the backend of the inner harbor was implemented in this scenario. The inner harbor was also split into two separate basins to guarantee that flow is directed out of both inner-harbor entrances. The valves, controlling the water flow through the pipes, were opened during ebb tide only, and a controlled flow rate was chosen as a small fraction (~10 %) of the total flow rate through the Sampit River. This flow is taken in at the pipe inlet and distributed equally among the two outlets within the inner harbor (Fig. 26).

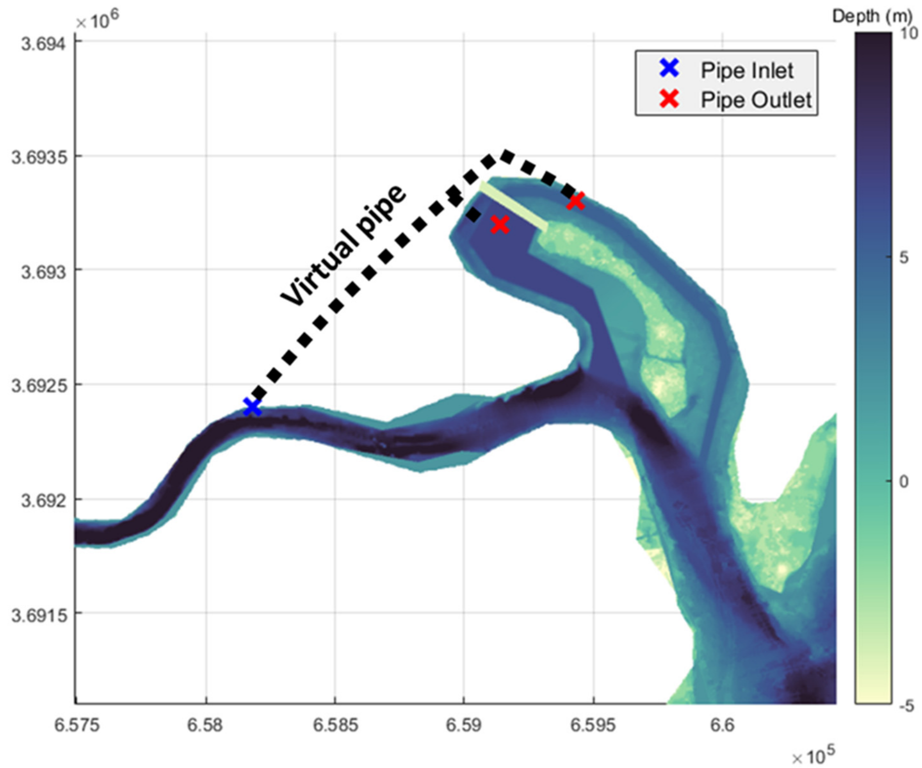


Figure 26: ***Scenario 5 – Pipe connection between Sampit River and inner harbor.*** *The intension of this theoretical arrangement was to evaluate what the effect of a natural flow of water through the full lengths of the two artificially separated harbor basins would be.*

Result: This scenario lead to a slight decreased in silting by the end of the simulation (Fig. 27), as the outflow from the two outlets creates an additional local pressure gradient that forces suspended sediment out of the inner harbor during ebb tide. However, the flow from the outlets is not strong enough to sufficiently resuspend already settled mud. The silting rates also increase from around the pipe outlets toward the inner-harbor entrances, where the mud preferentially accumulates. The smaller and shallower eastern basin experiences lower silting rates overall, because the same amount of water flow generates a stronger current here compared to the larger western basin.

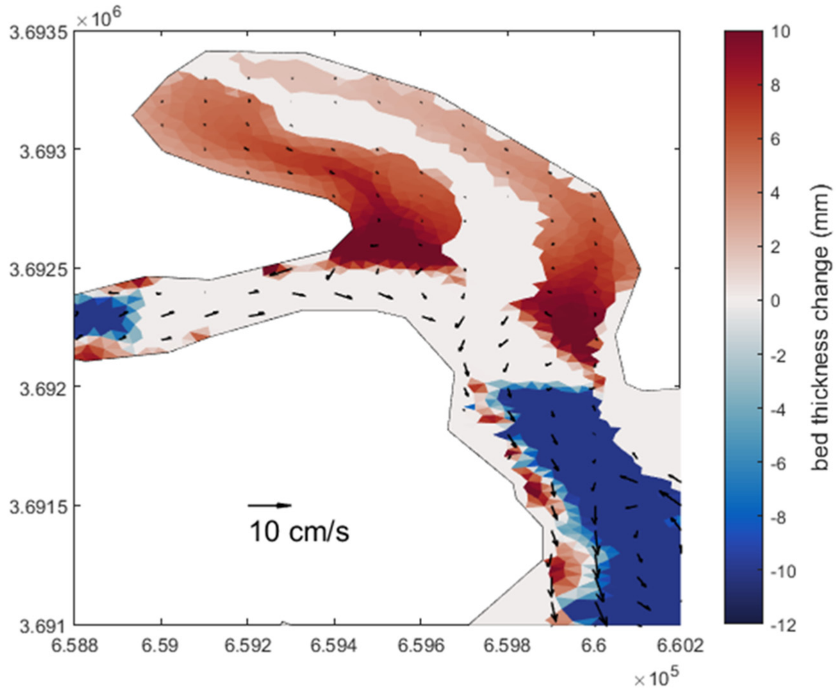


Figure 27: ***Scenario 5 – Pipe connection between Sampit River and inner harbor*** *(sediment layer added only <u>outside</u> the inner harbor). Average near-bottom currents (arrows) and bed thickness change (colors) at the end of the simulation. Red colors indicate silting, blue colors indicate erosion.*

Critical Evaluation

Sensor-based monitoring

Biofouling and biological overgrowth of the sensors, particularly the optical turbidity sensors, made frequent maintenance necessary. This was not only a time-consuming effort but also led to a loss in data quality. To compensate this issue, the sensors will be run continuously during *Phase II* as well. The strong and reversing tidal currents acted as a major destructive force on the installations leading to the loss of some installation parts but not to the damage or loss of sensors. We addressed this issue by improving the robustness of the installations. A vessel collision with the navigation mark at the entrance to Winyah Bay forced us to remove the sensor temporarily. A major outcome of this study was the determination where exactly the sensors should be located to provide the best possible input data for the numerical model. We, thus, continuously adjusted the geographic sites where the individual sensors need to be located. This is an ongoing process, which will be supported by the new installation of two further sensors in Phase II.

Numerical modeling

The numerical model is able to reasonably reproduce the hydrodynamics of Winyah Bay, the lower Sampit River and the inner harbor. Although the silting experiments provide a qualitative overview of the possible effects from various technical harbor modifications, many model parameters are still over-simplified, estimated, or rely on vague values found in the literature. More field monitoring data on the sediment sources and seabed sediment properties in the study area will allow a more sophisticated and realistic treatment of the sediment dynamics.

Outlook

Phase II of the Feasibility Study: Combination of Science and Engineering.

The monitoring and simulation achievements during Phase I will be combined with engineering expertise provided by Mrs. Jen Hayes and her team (Thomas & Hutton) in the following Phase II. The goal is to identify and evaluate a number of potential engineering solutions, which will be tested by repeated model simulation runs. This step will enable us to jointly (scientists & engineers) select a few promising designs, which will then be modified and optimized by reiteration cycles of simulation runs and result evaluation.

What also needs to be analyzed in detail is the harbor mud composition with the aim to identify the original source(s). Potential mud sources are a) the marshes and swamps along the Sampit River banks, b) the marshes surrounding northern Winyah Bay, c) the suspended load of the PeeDee River, and d) the turbidity maximum related to saltwater intrusion at the bottom of Winyah Bay. Finding out which of these is the major source has major implications on the ultimate engineered solution because the timing, *when exactly and how often* major amounts of suspended mud are available and enter the inner harbor. In parallel, the existing CCU monitoring network will be extended by two additional sensors and continual data collection, which will be simultaneously fed into the numerical model to further increase simulation accuracy and sensitivity to major disturbances, particularly to those related to extreme events (flooding, surges). These data can also be used to address other urgent issues and test possible solutions in the future, such as river flooding, storm surges, and the rising sea level.

The final product will be a priority list, in which we will introduce a few engineering designs and discuss their individual positive impacts, negative side-effects, and provide an estimate on their expected short-term and long-term costs.

Thematically linked issues that deserve serious attention.

A quantitative study should also look at engineering solutions to minimize, reduce or at least delay the effect of *river flooding* and *storm surges* along the waterfront and the surrounding low-lying areas. This approach would be a logical next step following the harbor silting study since the same monitoring data sets and the same numerical model can be applied.

A quantitative study should address the distribution of *heavy metals* (and other contaminants) in the harbor muds prior to dredging to identify the metal sources. The sparse existing data suggest high contamination and pollution levels. The aim would be to provide recommendations how their discharge can managed in a more appropriate way to seriously improve societal and environmental health.

A local study considering the two components of a rising water table: *sea level rise* and *land lowering should* be performed. First personal data seem to suggest that the regional water table is rising at a rate slightly higher than that in Charleston, SC. A precise number would provide a concrete baseline in regards to sustainably govern local river-flooding and storm-surge hazards, as well as urban and infrastructure drainage and groundwater extraction in the future.

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Scope of Work
Between

Coastal Carolina University
and
Georgetown County
and
City of Georgetown

Project Title: Feasibility Study-Developing a Strategy to Overcome Georgetown Harbor Silting – Phase II

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This Scope of Work is by and between Georgetown County, hereinafter referred to as "County"; the City of Georgetown, hereinafter referred to as "City"; and Coastal Carolina University, hereinafter referred to as "CCU", wherein the parties agree to the following:

A. Scope of Work:

Funding will support the work of a second phase associated with the feasibility study aimed at producing a simulation tool that allows for fully quantitative, highly localized projections of different technical solution scenarios to mobilize and export the silts along the Sampit River. Full project description is shown in **Attachment A**.

B. Project Period

This Agreement is for work that will be performed during a period of one year, beginning January 1, 2020 and ending December 31, 2020.

C. Budget

Project cost is $111,577. Itemized costs shown in **Attachment B**.

D. Billing

Both the County and the City will be invoiced for expenses incurred quarterly with 50% being allocated to each party. A final invoice will be provided by CCU to each party by January 31, 2021.

FOR COASTAL CAROLINA UNIVERSITY

Signature: ______________________ Date: 11-27-19

Name: Dr. David DeCenzo
Title: President

Witness: Jennifer Packard

Name: JENNIFER PACKARD

FOR GEORGETOWN COUNTY

Signature: ______________________ Date: ______________

Name: Sel Hemingway
Title: County Administrator

Witness: ______________________

Name: ______________________

FOR CITY OF GEORGETOWN

Signature: ______________________________ Date: ____________________

Name: Sandra Yúdice
Title: City Administrator

Witness: ______________________________

Name: ______________________________

ATTACHMENT A

Project Description

Current Status (end of Study Phase I)

Phase I (jointly initiated and funded by City of Georgetown and Georgetown County) will be completed by Dec 31, 2019. The three major achievements of this phase were a) the installation of a sensor network, which monitors hydrodynamic and silting properties in and around the inner harbor. These data together with b) a new set of high-resolution bathymetric data were used to establish c) a numerical model[1] for simulating water flow and silt behavior in the inner harbor and the lower Sampit River.

The simulations demonstrate that a complete closure of the artificial shortcut would lead to two significant, unwanted effects: severe erosion along the Working Waterfront and substantial silting off steel mill and state dock. First implementations of flow modification structures demonstrate that the water flow in the harbor loop can indeed be regenerated, but various negative local effects need to be quantitatively addressed when developing a best-possible compromise between a lasting and sustainable solution against rapid re-silting on the one hand, and disadvantageous side effects on the other.

As major outcome of this first phase, we will recommend a strategy, which includes one-time dredging the inner harbor as part of the installation of a smart, sustainable solution. This essential removal of the existing silt should be performed in close conjunction with the new technical solution, which probably has to be in place prior to the dredging effort to prevent rapid re-silting, which would quickly lead to a loss of the anticipated dredging effect.

Proposed Phase II

1. Goal of Study Phase II

In this phase, the monitoring and modeling achievements of Phase I will be combined with engineering expertise provided by Mrs. Jen Hayes and her team (Thomas & Hutton). The goal is to identify and evaluate a number of potential technical solutions, which will be tested by recurrent model simulation runs (on the base of an initially dredged harbor situation). This step will enable us to jointly (scientists & engineers) selected a few most promising designs, which will then be modified and optimized by reiteration cycles of simulation runs and result evaluation.

What we also need to analyze in detail is the harbor mud composition with the aim to identify the original source of the silt. Potential sources are a) the marshes and swamps along the Sampit River banks, b) the marshes surrounding northern Winyah Bay, c) the suspended load of the PeeDee River, and d) the turbidity maximum related to saltwater intrusion at the bottom of Winyah Bay. Finding out which of these options is the major source for the silt has major implications on the ultimate technical solution because the timing, when and how often major

[1] Based on SCHISM: Semi-implicit Cross-scale Hydroscience Integrated System Model; http://ccrm.vims.edu/schismweb/

amounts of silt are exactly available in the water and enter the inner harbor, has significant impact on the design of a possible non-permanent solution.

In parallel, the existing CCU monitoring network will continue to collect data, which will be persistently fed into the model with the aim to increase simulation accuracy and sensitivity to major disturbances, particularly to those related to extreme events (flooding, surges). These data can also be used to address other urgent issues and possible solutions in the future, such as flooding events, storm surge hazards, and a rising sea level. Besides the continuation of the currently installed sensor network monitoring in and around the inner harbor we would like to install two new additional sensors at the northern boundary of the model: the Hwy 17 bridges across Pee Dee and Waccamaw. These installations will help to capture and differentiate major flood events and the associated silt suspended load.

Originally, we planned to analyze the harbor muds in regards to their material composition in Phase I since this information is required for reliably simulating silt erodibility and settling. Due to technical constraints, we decided to move this approach from Phase I to Phase II and the associated cost item is included in the current budget.

The final product will be a priority list, in which we will introduce and discuss a few prioritized technical designs in regards to positive impacts, negative side effects, and expected short-term and long-term cost estimates for each solution scenario. Parts of the results will be summarized and illustrated in a way that allows for details to be differentiated, but also pragmatic and transparent communication with policy makers, business owners and local residents.

2. Approach and Product

- Selection and evaluation of potential technical solutions, jointly with Mrs. Jen Hayes and her team. Testing of the selected scenarios with the numerical model. Prioritization of a few technical solutions and providing a detailed cost-benefit calculation.
- Continuation of the monitoring effort in and around the harbor. Analyzing composition of the harbor mud to identify the main silt source. *This analysis will include stable isotopes on organic matter fractions (plant types); trace metals (local vs remote sources); microscopy of organic matter; microorganisms (type of ecosystem); silt component analysis and comparison with upstream samples; modeling components.*
- Repetitive bathymetric surveys (Jan, June, Nov 2020) of the harbor to capture sediment dynamics and silting rates.
- Organization of informative meetings and public outreach activities.
- Contribution to ongoing and future 'Team Georgetown' activities for further raising attention and support by our SC representatives.
- Involvement of the next generation of students at the interface between science, engineering, and decision-making.

- Final product: a detailed report – evaluating and discussing the favored technical options for a sustainable solution of the chronic inner-harbor silting, including colorized visualization material for informing policy makers and the public.

3. Timeline

Jan 1, 2020	Start of Phase II
- until Feb	Selection process with engineering group for setting up various technical solutions
- until June	Test simulations of these solution scenarios with the model, identification of most promising solution options
- until Oct	Detailed optimization cycles of this set of solutions; evaluation of benefits vs negative consequences for each of these scenarios; evaluation of short-term vs long-term cost-effectiveness
Dec 31, 2020	Final report with ranking and justification of most appropriate solutions

4. Collaborative partners

Dr. Till Hanebuth and team (Geo/Hydrodynamics), Coastal Geosystems Research Group, Coastal Carolina University, Conway/SC

Dr. Wenyan Zhang and team (Numerical modeling), Helmholtz Center for Materials and Coastal Research, Germany

Mrs. Jen Hayes and team (Engineering), Thomas & Hutton, Charleston/SC (*will submit separate proposal in parallel*)

Continued technical cooperation with: SCACE, SCPA, SCCG, SCDOT, SCDNR, local businesses and residents

ATTACHMENT B

Budget - Project Period: January 1, 2020 – December 31, 2020

BUDGET ITEM	No. of Individuals	Description	Grant Funds
Salary and Wages			
Principal Investigator	1	1.5 months of PI summer salary	$ 15,000
Research Assistant- Graduate Student	2	160 hours @ $20 ph for two summer months	$ 6,400
Undergraduate Students	varies	hourly wages for work to support the project	$ 2,000
Total Salaries and Wages			$ 23,400
Fringe			
Faculty Fringe	1	30.26%	$ 4,539
Student Fringe	varies	0.07%	$ 59
Total Fringe			$ 4,598
Total Salary, Wages, and Fringe			$ 27,998
	Description		
Supplies			
Sensor maintenance consumables			$ 500
Field and lab work consumables			$ 500
Mud source analysis			$ 1,500
Water level logger	1 for the Waccamaw Hwy 17 bridge		$ 600
Turbidity sensor, logger, solar panel & battery	1 for Pee Dee Hwy Hwy 17 bridge		$ 2,700
CCU data processing	hardware, computer capacity		$ 1,000
HZG data processing	hardware, computer capacity		$ 1,000
Lab maintenance costs			$ 5,000
Total Supplies			$ 12,800

Travel		
In-state travel - staff/students	meetings and field work	$ 1,500
Travel - modeling specialists	travel and accommodations	$ 4,500
Total Travel		$ 6,000
Other Costs		
Sensor maintenance	transportation, vessel	$ 2,000
Bathymetric mapping	transportation, vessel; 3 days	$ 500
Contract - Modeling Specialists	cost for six-month contracts	$ 48,840
Total Other		$ 51,340
Total Direct Costs		$ 98,138
Indirect Costs		$ 13,439
Total Costs - Phase II		**$ 111,577**
Balance from Phase I funds @ 12.31.19	to carryover and be applied to Phase II activities	- $ 15,255
Total **additional costs** Phase II		$ 96,322

THOMAS & HUTTON
682 JOHNNIE DODDS BLVD, SUITE 100 | POST OFFICE BOX 1522
MOUNT PLEASANT, SC 29465-1522 | 843.849.0200
WWW.THOMASANDHUTTON.COM

December 15, 2019

Sel Hemingway, County Administrator
Georgetown County
716 Prince Street
Georgetown, SC 29440

Re: Georgetown Harbor Siltation Study
Engineering Support for Concepts
Letter Agreement for Services

Dear Sel,

Thank you for requesting our professional engineering services to assist with the evaluation of the ongoing siltation of the Georgetown Harbor channel (a section of the Sampit River). Without regular maintenance dredging, the siltation of the channel has significantly decreased the water depth in several areas and has become a hinderance to the desired uses of the harbor. Georgetown County and the City of Georgetown engaged Dr. Till Hanebuth, a professor at Coastal Carolina University (CCU), to assist with the evaluation of the siltation and determination of a long-term solution.

In 2018 and 2019, Dr. Hanebuth coordinated and led a team of scientists in the monitoring and modeling of the siltation of the channel. It is our understanding that Phase 1 of Dr. Hanebuth's study, to be completed at the end of 2019, will produce a working computer model of the hydraulics and siltation of the channel. You have requested that Thomas & Hutton collaborate with Dr. Hanebuth and the CCU team to continue working towards the development of a long-term solution that will provide and maintain the desired channel depths in the Georgetown Harbor.

The following is our understanding of the services you have requested:

Scope of Services:

- **Concept Development:** Based upon our initial discussions with you and Dr. Hanebuth, we intend to have up to three (3) brainstorming sessions with T&H, the CCU team and Georgetown County. The intent of these sessions is to generate a list of options and combinations of options anticipated to mitigate the siltation of the channel. We will weigh the pros and cons for each option from various perspectives and select several options to be incorporated into the base model.

  We will create plan layout concepts drawings to be used for both team discussions and meetings with regulatory agencies that have jurisdiction in the channel. Agencies will include, at a minimum, SCDHEC-OCRM and USACE. The purpose of meeting with the agencies at this stage is to obtain input and concurrence with the options before they are incorporated into the model.

  Hydraulic and siltation modeling simulations will be completed by a subconsultant to the CCU team. Following results of the modeling simulations, we will meet to discuss the results and impacts of each option (as predicted by the models). This is intended to continue in an iterative approach (up to three (3) cycles) with the goal of determining

_______ Owner's Initials

AH Consultant's Initials

an acceptable solution that will either eliminate or significantly reduce the need for dredging of the channel.

- **Preliminary Engineering:** Based on the results of the modeling efforts, we will select up to three (3) options for which we will complete a preliminary structural design. The purpose of this phase is to produce exhibits with approximate layouts of the options that can be used for internal consideration / coordination, regulatory evaluation, public outreach, and generation of an opinion of cost. Using the bathymetric data provided by CCU, we will also perform the calculations required to determine the effort of the initial dredge that is assumed to precede implementation of any of the long-term solutions.

  Since the concepts have not yet been identified, the level of preliminary design effort is unknown and could vary greatly. The proposed amount in this proposal is for budgeting purposes only and should be evaluated once the three concepts have been selected.

- **Opinions of Cost:** We will generate an opinion of cost for each of the three (3) options for which we provide preliminary engineering. The intent of this task is to generate a realistic cost that can be considered for financing of the project as well as long-term financial requirements for maintenance, repair and/or replacement. The initial dredge effort will be included in each of the options, as that is assumed to be performed prior to implementation of any of the options.

Compensation:

Phase	**Fee Structure**	**Lump Sum or T&E Budget**
Concept Development	T&E	$ 25,000
Preliminary Engineering	T&E	$ 40,000
Opinions of Cost	T&E	$ 10,000
Reimbursables (mileage, printing)	T&E	$ 700
	Estimated Total:	**$ 75,700**

This proposal, between Georgetown County (Owner), and Thomas & Hutton Engineering Co. ("Consultant" or "Thomas & Hutton"), consisting of the General Provisions, our hourly rates, and this letter with authorized signatures, represents the entire understanding between you and us with respect to the Project. This agreement may only be modified in writing if signed by both of us. It is our understanding that no work will commence until written authorization is provided to us by you for the Project.

EXCULSIONS: Items not included in the scope of services are as follows:

- Construction Documents.
- Permitting.
- Structural Design other than Preliminary noted herein.
- Hydraulic Modeling or Design.
- Materials Testing.
- Geotechnical Investigations.
- Act as an expert witness for legal activities.
- Environmental services.

_______ **Owner's Initials**

_______ **Consultant's Initials**

These excluded items can be coordinated or provided, as a separate contract, upon request by the Owner.

If the arrangements set forth in these documents are acceptable to you, please sign and initial the enclosed documents in the spaces provided below and return to us. This proposal will be open for acceptance until January 30, 2020 unless changed by us in writing. We appreciate the opportunity to prepare this proposal and look forward to working with you on the project.

The parties agree and acknowledge that any of the parties hereto may execute this agreement by electronic signature, and the other party may rely upon such electronic signature as an original record of signature.

Very truly yours,

THOMAS & HUTTON ENGINEERING CO.

By________________________________
Jennifer A. Hayes, P.E.
Structural Department Manager

Enclosures: General Provisions
2019 Hourly Rates

ACCEPTED: ________________________, 2019

By ________________________________

____
TITLE

_______ **Owner's Initials**

Consultant's Initials

PAYMENT FOR SERVICES

For services rendered, OWNER shall pay CONSULTANT as outlined in the Letter Agreement for Services.

Payment for services on the basis of "Time & Expense" shall be paid in accordance with the schedule of charges attached hereto.

Project related costs for printing, reproductions, materials, and travel will be billed as reimbursable expenses.

Projects will be billed monthly or at the completion of the work, whichever comes sooner, with payment due upon receipt. Payment shall be considered overdue after forty–five (45) days from date of invoice, with interest charged at a monthly rate of 1.5 percent (18 percent annual rate).

CONSULTANT reserves the right to suspend work hereunder or any other work to be performed by CONSULTANT for OWNER or any of its affiliates under a separate agreement or agreements with CONSULTANT in the event of delinquent payment by OWNER to CONSULTANT hereunder or in the event of delinquent payment by OWNER or its affiliates to CONSULTANT under a separate agreement or agreements. For all purposes hereof, affiliate shall mean (i) in the case of an individual, any relative of any person listed among the following, (ii) any officer, director, trustee, partner, manager, employee or holder of 5 percent or more of any class of the voting securities of or equity interest in the OWNER; (iii) any corporation, partnership, limited liability company, trust or other entity controlling, controlled by or under common control with the OWNER; or (iv) any officer, director, trustee, partner, manager, employee or holder of 5 percent or more of the outstanding voting securities of any corporation, partnership, limited liability company, trust or other entity controlling, controlled by, or under common control with the OWNER.

In the event legal action is necessary to enforce the payment terms of this Agreement, the CONSULTANT shall be entitled to collect from the OWNER any judgment or settlement sums due, plus reasonable attorneys' fees, court costs and other expenses incurred by the CONSULTANT for such collection action and, in addition, the reasonable value of the CONSULTANT's time and expenses spent for such collection action, computed according to the CONSULTANT's prevailing fee schedule and expense policies.

ASSIGNMENT

Neither party to this Agreement shall transfer, sublet or assign any rights or duties under or interest in this Agreement, including but not limited to monies that are due or monies that may be due, without the prior written consent of the other party. Subcontracting to subconsultants, normally contemplated by the CONSULTANT as a generally accepted business practice, shall not be considered an assignment for purposes of this Agreement.

OWNER'S RESPONSIBILITIES

A. Access

OWNER shall make provisions for the CONSULTANT to enter upon public and private lands as required to perform such work as surveys and inspections in development of the Project.

B. OWNER's Representative

The OWNER shall designate in writing one person to act as OWNER's Representative with respect to the work to be performed under this Agreement. This Representative shall have complete authority to transmit instructions, receive information, interpret, and define OWNER's policy and decisions, with respect to the *product*, materials, equipment, elements, and systems pertinent to the work covered by this Agreement.

C. Fees

The OWNER is responsible for payment of fees associated with the project. Such fees include permit review and application fees, impact fees, and capacity fees. The CONSULTANT will notify the OWNER regarding the amount of fees and timing of payment.

CONSULTANT'S RESPONSIBILITIES

In providing services under this Agreement, the CONSULTANT shall perform in a manner consistent with that degree of care and skill ordinarily exercised by members of the same profession currently practicing under similar circumstances at the same time and in the same or similar locality. No other representation, expressed or implied, and no warranty or guarantee is included or intended in the Agreement, or in any report, opinion, document, or otherwise.

OWNERSHIP OF INSTRUMENTS OF SERVICE

All reports, drawings, specifications, computer files, electronic files, BIM models, field data, notes and other documents and instruments prepared by CONSULTANT as instruments of service shall remain the property of the CONSULTANT. The CONSULTANT shall retain all common law, statutory, and other reserved rights, including, without limitation, the copyrights thereto. The CONSULTANT shall retain these records for a period of two (2) years following their completion during which period paper copies will be made available to the Project OWNER at reasonable times.

ELECTRONIC FILES

In accepting and utilizing any drawings, reports and data on any form of electronic media generated and furnished by the CONSULTANT, the OWNER agrees that all such electronic files are instruments of service of the CONSULTANT, who shall be deemed the author, and shall retain all common law, statutory law and other rights, without limitation, including copyrights.

The OWNER agrees not to reuse these electronic files, in whole or in part, for any purpose other than for the Project. The OWNER agrees not to transfer these electronic files to others without the prior written consent of the CONSULTANT. The OWNER further agrees to waive all claims against the CONSULTANT resulting in any way from any unauthorized changes to or reuse of the electronic files for any other project by anyone other than the CONSULTANT.

The OWNER is aware that differences may exist between the electronic files delivered and the printed hard-copy construction documents. In the event of a conflict between the signed construction documents prepared by the CONSULTANT and electronic files, the signed or sealed hard-copy construction documents shall govern.

In addition, the OWNER agrees, to the fullest extent permitted by law, to indemnify and hold harmless the CONSULTANT, its officers, directors, employees and subconsultants (collectively, CONSULTANT) against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, arising from any changes made by anyone other than the CONSULTANT or from any reuse of the electronic files without the prior written consent of the CONSULTANT.

Under no circumstances shall delivery of electronic files for use by the OWNER be deemed a sale by the CONSULTANT, and the CONSULTANT makes no warranties, either express or implied, of merchantability and fitness for any particular purpose. In no event shall the CONSULTANT be liable for indirect or consequential damages as a result of the OWNER's use or reuse of the electronic files.

CERTIFICATIONS, GUARANTEES, AND WARRANTIES

The CONSULTANT shall not be required to sign any documents, no matter by whom requested, that would result in the CONSULTANT's having to certify, guarantee or warrant the existence of conditions whose existence the CONSULTANT cannot ascertain or any way might, in the sole judgment of the CONSULTANT, increase the CONSULTANT's contractual or legal obligations or risks, or adversely affect the availability or cost of its professional or general liability insurance. The OWNER also agrees not to make resolution of any dispute with the CONSULTANT or payment of any amount due to the CONSULTANT in any way contingent upon the CONSULTANT's signing any such certification.

ACCESSIBILITY

The OWNER acknowledges that the requirements of the Americans with Disabilities Act (ADA), Fair Housing Act (FHA) and other federal, state and local accessibility laws, rules, codes, ordinances and regulations will be subject to various and possibly contradictory interpretations. The CONSULTANT, therefore, will use its reasonable professional efforts and judgment to interpret applicable accessibility requirements in effect as of the date of [*the execution of this Agreement, submission to building authorities, or other appropriate date*] and as they apply to the Project. The CONSULTANT, however, cannot and does not warrant or guarantee that the OWNER's Project will comply with all interpretations of the accessibility requirements and/or the requirements of other federal, state, and local laws, rules, codes, ordinances, and regulations as they apply to the Project. Any changes in the applicable law or contrary interpretations of existing law subsequent to the issues of permits which requires CONSULTANT to perform redesign will be considered an additional service.

SUBSTITUTIONS

Upon the written request or direction of OWNER, CONSULTANT shall evaluate and advise OWNER with respect to proposed or requested changes in materials, products, or equipment. CONSULTANT shall be entitled to rely on the accuracy and completeness of the information provided in conjunction with the requested substitution. CONSULTANT shall not be responsible for errors, omissions, or inconsistencies in information by others or in any way resulting from incorporating such substitution into the Project. OWNER shall be invoiced for this service on a Time & Expense basis unless both parties mutually agree on a lump sum fee.

OPINIONS OF PROBABLE COSTS

Since the CONSULTANT has no control over the cost of labor, materials, or equipment, or over the Contractor's methods of determining prices, or over competitive bidding or market conditions, his opinions of probable construction costs provided for herein are to be made on the basis of his experience and qualifications. These opinions represent his best judgment as a design professional familiar with the construction industry.

However, the CONSULTANT cannot and does not guarantee that proposals, bids, or the construction cost will not vary from opinions of probable construction costs prepared by him.

BETTERMENT

If, due to the CONSULTANT's negligence, a required item or component of the Project is omitted from the CONSULTANT's construction documents, the CONSULTANT shall not be responsible for paying the cost required to add such item or component to the extent that such item or component would have been required and included in the original construction documents. In no event will the CONSULTANT be responsible for any cost or expense that provides betterment, upgrades, or enhances the value of the Project.

CHANGED CONDITIONS

If, during the term of this Agreement, circumstances or conditions that were not originally contemplated by or known to the CONSULTANT are revealed, to the extent that they affect the scope of services, compensation, schedule, allocation of risks or other material terms of this Agreement, the CONSULTANT may call for renegotiation of appropriate portions of this Agreement. The CONSULTANT shall notify the OWNER of the changed conditions necessitating renegotiation, and the CONSULTANT and the OWNER shall promptly and in good faith enter into renegotiation of this Agreement to address the changed conditions. If terms cannot be agreed to, the parties agree that either party has the absolute right to terminate this Agreement in accordance with the Termination provision hereof.

CODE COMPLIANCE

The CONSULTANT shall exercise usual and customary professional care in its efforts to comply with applicable laws, codes and regulations in effect as of the date of this agreement was written. Design changes made necessary by newly enacted laws, codes and regulations after this date shall entitle the CONSULTANT to a reasonable adjustment in the schedule and additional compensation in accordance with the Additional Services provisions of this Agreement.

In the event of a conflict between laws, codes and regulations of various governmental entities having jurisdiction over this Project, the CONSULTANT shall notify the OWNER of the nature and impact of such conflict. The OWNER agrees to cooperate and work with the CONSULTANT in an effort to resolve this conflict.

VALUE ENGINEERING

(If) OWNER has elected to engage in value engineering of the Project, OWNER has established cost as a primary project objective over other programming, performance, and aesthetic objectives and recognizes that in doing so, it has limited the available design and product options. These limitations may impact the overall project cost, schedule, and performance. OWNER has accepted these risks and impacts in recognition of the importance it has placed on project cost.

DELEGATED DESIGN

Where any design services are provided by persons or entities not under CONSULTANT's direct control, CONSULTANT's role shall be limited to its evaluation of the general conformance with the design intent and the interface with CONSULTANT's design and portion of the project. Except to the extent, it is actually aware of a deficiency, error, or omission in such design by others, CONSULTANT shall have no responsibility for such design and may rely upon its adequacy, accuracy, and completeness in all respects.

LIMITS OF LIABILITY

Nothing contained in this Agreement shall create a contractual relationship with or a cause of action in favor of a third party against either the OWNER or the CONSULTANT. The CONSULTANT's services under this Agreement are being performed solely for the OWNER's benefit, and no other party or entity shall have any claim against the CONSULTANT because of this Agreement or the performance or nonperformance of services hereunder. The OWNER and CONSULTANT agree to require a similar provision in all contracts with contractors, subcontractors, subconsultants, vendors, and other entities involved in this Project to carry out the intent of this provision.

To the fullest extent permitted by law, and not withstanding any other provision of this Agreement, the total liability, in the aggregate, of the CONSULTANT and the CONSULTANT's officers, directors, partners, employees and sub-consultants, and any of them, to the OWNER and anyone claiming by or through the OWNER (including, but not limited to construction contractors &

subcontractors), for any and all claims, losses, costs or damages, including attorneys' fees and costs and expert-witness fees and costs of any nature whatsoever or claims expenses resulting from or in any way related to the Project or the Agreement from any cause or causes shall not exceed **the value of this contract. It is intended that this limitation apply to any and all liability or cause of action however alleged or arising, unless otherwise prohibited by law. This liability cap may be increased by mutual consent of both parties and in exchange for additional compensation.**

TIME BAR TO LEGAL ACTION

All legal actions by either party against the other arising out of or in any way connected with this Agreement or the services to be performed hereunder shall be barred and under no circumstances shall any such legal action be initiated by either party after five (5) years from the date of Substantial Completion, unless this Agreement shall be terminated earlier, in which case the date of termination of this Agreement shall be the date on which such period shall commence. Nothing in this Agreement is construed to waive any protections granted under existing laws of the state in which the work is performed.

ACTS OF OTHERS

The CONSULTANT shall not be responsible for the means, methods, techniques, sequences, or procedures of construction selected by Contractor(s) or the safety precautions and programs incident to the work of Contractor(s). CONSULTANT shall not be responsible for the failure of Contractor(s) to perform the work in accordance with the Contract Documents.

The CONSULTANT shall not be responsible for the acts or omissions of any Contractor, or sub–contractor, or any of the Contractor(s)', or sub–contractors' agents, or employees or any other persons (except CONSULTANT's own employees and agents) at the site or otherwise performing any of the Contractor(s)' work. However, nothing contained herein shall be construed to release CONSULTANT from liability for failure to perform properly the duties undertaken by CONSULTANT in the Contract Documents.

The CONSULTANT shall not be responsible for the acts, omissions, means, methods, or specifications of other design professionals not directly retained by CONSULTANT.

INDEMNIFICATION

The CONSULTANT agrees, to the fullest extent permitted by law, to indemnify and hold harmless the OWNER, its officers, directors and employees (collectively, OWNER) against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, to the extent caused by the CONSULTANT's negligent performance of professional services under this Agreement and that of its subconsultants or anyone for whom the CONSULTANT is legally liable.

The OWNER agrees, to the fullest extent permitted by law, to indemnify and hold harmless the CONSULTANT, its officers, directors, employees and subconsultants (collectively, CONSULTANT) against all damages, liabilities or costs, including reasonable attorneys' fees and defense costs, to the extent caused by the OWNER's negligent acts in connection with the Project and the acts of its contractors, subcontractors or consultants or anyone for whom the OWNER is legally liable.

Neither the OWNER nor the CONSULTANT shall be obligated to indemnify the other party in any manner whatsoever for the other party's own negligence or for the negligence of others.

CONSEQUENTIAL DAMAGES

Notwithstanding any other provision of this Agreement, and to the fullest extent permitted by law, neither the OWNER nor the CONSULTANT, their respective officers, directors, partners, employees, contractors or subconsultants shall be liable to the other or shall make any claim for any incidental, indirect or consequential damages arising out of or connected in any way to the Project or to this Agreement. This mutual waiver of consequential damages shall include, but is not limited to, loss of use, loss of profit, loss of business, loss of income, loss of reputation and any other consequential damages that either party may have incurred from any cause of action including negligence, strict liability, breach of contract and breach of strict or implied warranty. Both the OWNER and the CONSULTANT shall require similar waivers of consequential damages protecting all the entities or persons named herein in all contracts and subcontracts with others involved in this project.

DISPUTE RESOLUTION

Any dispute or claim arising out of or relating to this Agreement shall be determined as follows: CONSULTANT and OWNER will negotiate in good faith to reach agreement. If negotiations are unsuccessful, CONSULTANT and OWNER agree the dispute shall be settled by mediation. In the event the dispute or any issues remain unresolved after the above steps, the disagreement shall be decided by such remedies of law as they are available to the parties. The appointment of a mediator and location will be subject to agreement between CONSULTANT and OWNER with each party being responsible for their portion of those costs.

JOBSITE SAFETY

Neither the professional activities of the CONSULTANT, nor the presence of the CONSULTANT or its employees and subconsultants at a construction/project site, shall impose any duty on the CONSULTANT, nor relieve the General Contractor of its obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending and coordinating the Work in accordance with the Contract Documents and any health or safety precautions required by any regulatory agencies. The CONSULTANT and its personnel have no authority to exercise any control over any construction contractor or its employees in connection with their work or any health or safety programs or procedures. The OWNER agrees that the General Contractor shall be solely responsible for jobsite and worker safety and warrants that this intent shall be carried out in the OWNER's contract with the General Contractor. The OWNER also agrees that the General Contractor shall defend and indemnify the OWNER, the CONSULTANT and the CONSULTANT's subconsultants. The OWNER also agrees that the OWNER, the CONSULTANT and the CONSULTANT's subconsultants shall be made additional insureds under the General Contractor's policies of general liability insurance.

HAZARDOUS MATERIAL

Both parties acknowledge that the CONSULTANT's scope of services does not include any services related to the presence of any hazardous or toxic materials and/or mold. In the event the CONSULTANT or any other person or entity involved in the project encounters any hazardous or toxic materials and/or mold, or should it become known to the CONSULTANT that such materials may be present on or about the jobsite or any adjacent areas that may affect the performance of the CONSULTANT's services, the CONSULTANT may, at its sole option and without liability for consequential or any other damages, suspend performance of its services under this Agreement until the OWNER retains appropriate qualified consultants and/or contractors to identify and abate or remove the hazardous or toxic materials and warrants that the jobsite is in full compliance with all applicable laws and regulations.

APPLICATIONS FOR PERMITS AND CERTIFICATES REQUESTED ON BEHALF OF OWNER

The OWNER shall indemnify and hold the CONSULTANT harmless from and against any and all judgments, losses, damages, and expenses (including attorney fees and defense costs) arising from or related to claims by third parties to challenge the issuance of permits or certificates for the Project by agencies with jurisdiction in the premises. Defense costs shall include the time and expenses of the CONSULTANT's personnel to assist in the defense of the issuance of the permit or certificate.

TERMINATION

In the event of termination of this Agreement by either party, the OWNER shall within fifteen (15) calendar days of termination pay the CONSULTANT for all services rendered and all reimbursable costs incurred by the CONSULTANT up to the date of termination, in accordance with the payment provisions of this Agreement.

Either party may terminate this Agreement for the convenience and without cause upon giving the other party not less than fifteen (15) calendar days' written notice.

Either party may terminate this Agreement for cause upon giving the other party not less than seven (7) calendar day's written notice for any of the following reasons:

- Substantial failure by the other party to perform in accordance with the terms of this Agreement and through no fault of the terminating party;
- Assignment of this Agreement or transfer of the Project by either party to any other entity without the prior written consent of the other party;
- Suspension of the Project or the CONSULTANT's services by the OWNER for more than ninety (90) calendar days, consecutive or in the aggregate;
- Material changes in the conditions under which this Agreement was entered into, the Scope of Services or the nature of the Project, and the failure of the parties to reach agreement on the compensation and schedule adjustments necessitated by such changes.

In the event of any termination that is not the fault of the CONSULTANT, the OWNER shall pay the CONSULTANT, in addition to payment for services rendered and reimbursable costs incurred, for all expenses reasonably incurred by the CONSULTANT in connection with the orderly termination of this Agreement, including but not limited to demobilization, reassignment of personnel, associated overhead costs and all other expenses directly resulting from the termination.

SIGNAGE

OWNER agrees to allow CONSULTANT to place a sign on the job site during construction. The sign will include general information relative to the CONSULTANT. CONSULTANT shall be responsible for the sign installation and removal.

AMENDMENT

This Agreement for Services can be amended by addenda if agreed to in writing and signed by both parties.

THOMAS & HUTTON

Consulting Services on a Time and Expense Basis

January 1, 2019 – Rev. January 30, 2019

Thomas & Hutton provides services on a time and expense basis as follows:

1. This basis includes allowance for direct salary expenses and for direct non–salary expenses. It also provides for services we may subcontract to others.
2. Direct salary expenses are generally based upon our payroll costs. The payroll costs include the cost of salaries and wages (including sick leave, vacation, and holiday pay) for time directly chargeable to the project; plus, unemployment, excise, payroll taxes, and contributions for social security, employment compensation insurance, retirement benefits, and medical and insurance benefits.

   The current hourly rate charges for each skill position for 2019 are as follows:

Hourly Rate	Engineer	Survey	Landscape	GIS	Quality Control	Business/ Administrative
$ 240.00	Consultant	Consultant	Consultant	Consultant	Consultant	
$ 220.00	Senior Manager	Senior Manager	Senior Manager	Senior Manager	Senior Manager	Senior Manager
$ 200.00	Project Manager V Project Engineer V	Survey Manager V Project Surveyor V Survey Party (3–Men)	Landscape Architect V LA Project Manager V	GIS Manager V		
$ 185.00	Project Manager IV Project Engineer IV	Survey Manager IV Project Surveyor IV	Landscape Architect IV LA Project Manager IV	GIS Manager IV		Senior Application Developer IV, Software/Computer Consultant IV
$ 170.00	Project Manager III Project Engineer III	Survey Manager III Project Surveyor III	Landscape Architect III LA Project Manager III	GIS Manager III		Senior Application Developer III, Software/Computer Consultant III
$ 160.00	Project Manager II Project Engineer II	Survey Manager II Project Surveyor II	Landscape Architect II LA Project Manager II	GIS Manager II	Construction Administrator II	Senior Application Developer II, Software/Computer Consultant II
$ 145.00	Project Manager I Project Engineer I	Survey Manager I Project Surveyor I Survey Party (2–Men)	Landscape Architect I LA Project Manager I	GIS Manager I	Construction Administrator I	Grant Administrator, Senior Application Developer I, Software/Computer Consultant I
$ 135.00	Designer IV Engineering Technician IV	Staff Surveyor V Survey Field Supervisor	Landscape Designer IV	GIS Analyst IV	Field Representative V	Application Developer IV
$ 125.00	Designer III Engineering Technician III	Staff Surveyor IV	Landscape Designer III	GIS Analyst III	Field Representative IV	Application Developer III
$ 115.00	Designer II Engineering Technician II	Staff Surveyor III	Landscape Designer II	GIS Analyst II		Application Developer II
$ 105.00	Designer I Engineering Technician I	Survey Party (1–Man) Staff Surveyor II	Landscape Designer I	GIS Analyst I	Field Representative III	Application Developer I, Permit Coordinator II, Admin IV
$ 95.00	CADD Technician III	Survey Technician III Staff Surveyor I	Landscape Technician III	GIS Technician III	Field Representative II	Permit Coordinator I
$ 90.00	CADD Technician II	Survey Technician II	Landscape Technician II	GIS Technician II		
$ 85.00	CADD Technician I	Survey Technician I	Landscape Technician I	GIS Technician I	Field Representative I	Admin III
$ 80.00						Admin II
$ 75.00						Admin I
$ 400.00	Expert Witness					

3. When warranted, overtime will be charged for any non–salary employees. Overtime hours will be billed at 1-1/2 times the individuals charge rate.
4. Direct non–salary (reimbursable) expenses, including printing, reproduction, air travel, lodging, and meals are billed at cost. Travel in company or private vehicles will be billed at $0.55 per mile and may be revised based on fuel pricing. Outside consultant fees will be billed at 1.15 times the cost.
5. All rates and charges are effective through January 1, 2020, including printing, reproductions, materials, and travel and are subject to change at that time. New rates and costs will become immediately effective to contracts in effect at the time of rate changes.

Owner's Initials

Consultant's Initials

120 North Fraser Street · Georgetown, SC 29440 · (843) 545-4000

INFORMATION ITEM

DOC ID: 2949

Council Meeting Date:	23 January 2020
Department:	Engineering
Issue Under Consideration:	Stormwater Ordinance and Utility Fee Proposed Revisions

City of Georgetown

Stormwater Ordinance Revisions Outline

1. Stormwater Drainage

2. Stormwater Utility Rates

- Residential: $8/month/meter (water or electric)
- Non-Residential: $12/month/ERU*
- Vacant or Undeveloped Parcels: $4/month/parcel billed semi-annually or annually

*Equivalent Residential Unit (ERU) is 2,995 square feet.

3. Stormwater Design Standards

Draft 1
Date: 1-23-2020

ARTICLE VI. - STORMWATER UTILITY

Ord. of January 23, 2020

Sec. 22-196. - Establishment.

A stormwater utility is hereby created pursuant to Chapter 14, Title 48 of the 1976 South Carolina Code of Laws as amended by Act 114, 1991. Criteria for implementation of this utility is established in Section 72-310 of the South Carolina Land Resources Conservation Commission Standards for Stormwater Management and Sediment Control.

~~(Ord. of 3-18-93)~~

Sec. 22-197. - Basis for fees.

(a) Fees shall be established to fund the stormwater utility. In establishing such fees, City Council shall consider, among other factors, the following criteria:

(1) The fee system must be reasonable and equitable so that users pay to the extent they contribute to the need for the utility, and the fees must bear a substantial relationship to the cost of the service.

(2) The components of the calculations used to establish fees may include, but shall not be limited to, the following cost factors:

a. Stormwater management planning and preparation of comprehensive watershed master plans for stormwater management;

b. Regular inspections of public and private stormwater management facilities and measures and the construction thereof;

c. Maintenance and improvement of stormwater management facilities that have been accepted by the city for that purpose;

d. Plan review and inspection of sediment control and stormwater management plans, measures, and practices;

e. Retrofitting designated watersheds to reduce existing flooding problems or to improve water quality;

f. Acquisition of interests in land, including easements;

g. Design and construction of stormwater management facilities and measures and acquisition of equipment;

h. Administration and enforcement;

i. Water quantity and water quality management, including monitoring and surveillance; and

j. Debt service and financing costs.

(3) ~~The practical difficulties and limitations related to establishing, calculating and administering such fees.~~ Billing and collection of stormwater utility fees shall be deposited into a Stormwater Fund which shall be used for all expenditures related to operations, maintenance, and capital improvements of stormwater facilities.

(b) Calculation of residential equivalency units:

(1) One Equivalent Residential ~~equivalency~~ Unit, ~~REU~~ (ERU), shall be equal to one detached single-family dwelling unit ~~use~~ as determined by the existence of one water or electric meter, whether the structure is occupied or vacant. The number of ERUs ~~REUs~~ of a multifamily complex, boarding house, mobile home park, garage apartment, and similar residential use shall be determined by the number of water or electrical meters, whichever is greater, on the subject property.

(2) The stormwater utility fee shall be billed monthly for every active and occupied residential and non-residential unit. Non-residential units include commercial, industrial, nonprofit, public or semi-public properties. Vacant or undeveloped parcels shall be billed semi-annually.

(3) ~~The stormwater management fee billed each month for a residential lot with more than a single-family use shall be based on one REU times the electric or water meters, whichever is greater.~~ Structures designed for short-term occupancy such as bed and breakfast establishments and overnight boarding houses shall be considered commercial uses.

(4) ~~One acre of commercial, industrial, nonprofit, public, or semipublic property shall be equal to 6.3 REU's or residential equivalency units. Accordingly, fees will be assessed at a standard rate per REU, as determined by City Council.~~ Any non-residential ~~commercial~~ property less than one acre shall be considered one acre when computing the fee.

(5) ~~Multiple tenants on commercial properties identified in part (4) above shall be billed monthly on a prorated basis based on the percentage of structure they occupy. The total fee shall be divided among the tenants based on the square footage of the structure they occupy divided into the total square footage of the structure.~~ The total fee for non-residential properties shall be calculated based on the square footage of impervious surface and building coverage.

(6) The impervious surface area on any given parcel relates to the amount of runoff water, rate of discharge, and pollutant loading into the storm drainage system. Therefore, the impervious surface method shall be used to calculate the stormwater utility fee on non-residential properties.

(7) The impervious surface area of two thousand five hundred and ninety-five (2,595) square feet shall be designated as one (1) Equivalent Residential Unit.

(8) Impervious surface is defined as any type of regular concrete surface, asphalt pavement, concrete or brick pavers, wood, or any type of solid materials. Non-residential properties with surfaces featuring gravel, pervious concrete, porous pavers, grass, and detention or retention ponds shall not be included as part of the calculation for the impervious surface.

(~~Ord. of 3-18-93; Ord. of 7-20-95; Ord. of 6-21-2001; Ord. of 9-18-03(1))~~

Sec. 22-198. - Billing of stormwater utility fee.

The stormwater management utility fee shall be billed monthly to users by being included on the monthly water, sewer and/or electric bill for those real properties having active water, sewer and/or electric billing accounts. For real properties not having active accounts, the fee shall be billed annually or semiannually to the owners or other persons listed on the real property tax records for such properties and shall be due on or before the thirtieth day after such billing. Annual or semiannual fees unpaid as of the thirty-first day after billing shall constitute a lien against the property on which they are due. After written notice to the owners or other persons listed on the real property tax records, the past due annual or semiannual fees may be added to the real property taxes due on any such property. The city administrator shall develop guidelines and procedures for the implementation of the provisions of this section.

~~(Ord. of 3-18-93)~~

Sec. 22-198.1. – Schedule of rates, deposits and miscellaneous charges.

All rates, deposits, and miscellaneous charges for service shall be adopted and amended from time to time by ordinance of city council. A schedule of such rates, deposits and charges in effect will be maintained and on file in the office of the City Clerk of the City of Georgetown, South Carolina.

Sec. 22-198.2. - Rate Calculation Formula for Non-Residential properties:

Impervious Surface (IS) in square feet.
Building Coverage (BC) in square feet.
One Equivalent Residential Unit (ERU) equals 2,595 square feet
Divide Impervious and Building Coverage total by 2,595.
Multiply by Monthly Rate per ERU
Calculation of New Stormwater Fee per month = ((IS + BC) / 2,595) x Monthly Rate

Sec. 22-198.3 -Deposits and miscellaneous charges.

The collection of stormwater utility fees and miscellaneous charges related to the enforcement of this ordinance shall be deposited in the Stormwater Fund.

~~(Ord. of 6-21-2001)~~

~~**Editor's note**— An ordinance adopted June 21, 2001 enacted provisions which were intended for use as a new § 22-199, thereby necessitating the renumbering of subsequent sections of the article. At the discretion of the editor, to avoid confusion which could result from the renumbering of several existing sections, the new provisions have been placed in their intended order, but renumbered as § 22-198.1, as set out herein.~~

Sec. 22-199. - Management, enforcement and penalties.

(a) The manager of stormwater utilities or such other official(s) as the city administrator shall designate shall be the responsible official for the provisions of this article.

(b) It shall be unlawful for any person to violate any provision of this article, and any such violation shall be punished as prescribed in section 1-16 of the Code. Each day a violation continues constitutes a separate offense.

(c) In addition to any other penalties or remedies provided in this article, the city, upon the recommendation of the city attorney and approval of the mayor, may institute a civil action in the appropriate court to obtain compliance with the provisions of this article or remedy or prevent the violation or threatened violation of any provision of this article.

~~(Ord. of 3-18-93)~~

Sec. 22-200. - Municipal liability.

Nothing in this article and no action or failure to act under this article shall or may be construed to:

(1) Impose any liability on the city, or its departments, agencies, officers or employees for the recovery of damages; or

(2) Relieve any person engaged in a land-disturbing activity of duties, obligations, responsibilities, or liabilities arising from or incident to operations associated with such activity or imposed by the provisions of this article or the laws and regulations pursuant to which it was adopted.

~~(Ord. of 3-18-93)~~

Sec. 22-201. - Appeals.

A property owner may apply to the city stormwater management fee Stormwater Appeals Board once per twelve (12) months for a reduction in the fee. This board shall be appointed by City Council and may grant a reduction in fees only due to the presence of ~~previous~~ pervious surface. In no event shall the board grant a reduction in fee which equals less than the fee would total if all impervious surfaces are considered the lot size.

~~(Ord. of 3-18-93)~~

Sec. 22-202. - Stormwater ~~management fee~~ Appeals Board.

The City Council shall appoint a three-person board to review appeals regarding the stormwater management fee and notices of violation. The terms for members shall be three (3) years, with the initial appointment being staggered. The board shall develop written procedures which must be reviewed and approved by City Council.

~~(Ord. of 3-18-93)~~

Sec. 22-203. - Severability.

It is declared the intent of City Council that the sections, subsections, paragraphs, sentences, clauses and phrases of this article are severable; and if any such provision shall be declared unconstitutional or otherwise invalid or unenforceable by a court of competent jurisdiction, it shall not affect the validity or enforceability of any remaining provisions of this article, and it is the intent of council that such provisions shall continue in full force and effect.

(Ord. of 3-18-93)

Sec. 22-204. - Effective date.

This article shall take effect ~~April 1, 1993~~ July 1, 2020.

Secs. 22-205—22-220. - Reserved.

Draft 1
Date: 1-23-2020

~~APPENDIX B~~ CHAPTER 23- DRAINAGE

(This revision converts Appendix B to Chapter 23-Drainage)

Ordinance of January 23, 2020

~~**—(1)—**~~

~~**State Law reference**— Power to adopt regulations addressing stormwater conferred to city by state, S.C. Code 1976, Title 5, Chapter 7, § 30.~~

ARTICLE I. - AUTHORITY AND ENACTMENT CLAUSE

In pursuance of authority conferred by the General Statutes of South Carolina, 5-7-30, Code of Laws, 1976 as amended, and for the purpose of promoting the health, safety, morals, or general welfare of the community, the City Council of the City of Georgetown does ordain and enact into law the following articles and sections.

~~(Ord. of 6-18-92)~~

ARTICLE II. - DEFINITIONS

200 *City's authorized agent:* The Director of Water Utilities, the City Engineer or such other official (s) as designated by the City Administrator shall be the representative responsible for reviewing stormwater management plans, design reports, granting variances, determining requirements, approving calculation methods, and any other decisions ~~pertinent~~ pertaining to the enforcement of this ordinance.

~~(Ord. of 6-18-92)~~

201 *Development:* Any activity which meets any of the following criteria:

(1) The construction, installation, demolition or removal of a structure, impervious surface, or drainage facility;

(2) Cleaning, scraping, grubbing, killing or otherwise removing the vegetation from a site; or

(3) Adding, removing, exposing, excavating, leveling, grading, digging, burrowing, dumping, piling, dredging or otherwise significantly disturbing the soil, mud, sand, or rock of a site.

~~(Ord. of 6-18-92)~~

202 *Developer:* Any person who engages in development either ~~in~~ on his/her own behalf or as the agent of an owner of the property.

~~(Ord. of 6-18-92)~~

203 *Designer:* The following persons/professions are authorized by the Code of Laws of South Carolina, 1976, as amended, to design and certify storm drainage plans/systems:

(1) Professional engineers registered and licensed in the State of South Carolina. ~~as defined in Section 40-21-10 (4) and Regulation 49-19; or~~

(2) Landscape architects registered and licensed in the State of South Carolina. ~~as defined in Section 40-28-10 (b) and Regulation 49-19; or~~

(3) ~~TIER "B"~~ Land surveyors registered and licensed in the State of South Carolina. ~~as defined in Section 40-21-10 (7).~~

~~(Ord. of 6-18-92)~~

204 Design storm event:

(1) ~~10-year, twenty-four-hour storm: Statistical rainfall event that has a probability of occurring once every 10 years. The rainfall lasts over a twenty-four-hour period.~~

Ten-Year frequency storm: A storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in 10 years. It may also be expressed as an exceedance probability with a 10 percent chance of being equaled or exceeded in any given year.

(2) ~~Twenty-five-year, twenty-four-hour storm: Statistical rainfall event that has a probability of occurring once every twenty-five years. The rainfall lasts over a twenty-four-hour period.~~

Twenty-five Year frequency storm: A storm that is capable of producing rainfall expected to be equaled or exceeded on the average of once in 25 years. It may also be expressed as an exceedance probability with a 4 percent chance of being equaled or exceeded in any given year.

~~(Ord. of 6-18-92)~~

205 Free flow: Flow through a pipe system that does not rely on hydraulic head to provide the required capacity.

~~(Ord. of 6-18-92)~~

ARTICLE III. - CONFLICTS WITH OTHER ORDINANCES, REGULATIONS

300 All the requirements of this ordinance are in addition to federal, state, and local requirements. Where regulations are not consistent between agencies, the developer shall adhere to the most stringent. Other agencies include, but are not limited to~~, South Carolina Coastal Council,~~ Environmental Protection Agency, South Carolina Department of Health and Environmental Control, and South Carolina ~~Land Resources Commission~~ Department of Natural Resources.

~~(Ord. of 6-18-92)~~

ARTICLE IV. - FREE FLOW

400 All new stormwater drainage facilities on site shall be designed for minimum free flow at a 10-year, ~~twenty-four-hour~~ frequency storm event. The design of all permanent structural facilities (pipes, structures, channels, ponds, etc.) shall be based on post-development flow.

~~(Ord. of 6-18-92)~~

Draft 1
Date: 1-23-2020

ARTICLE V. - POST-DEVELOPMENT STORMWATER DISCHARGE

500 The post-development stormwater discharge rate from all one acre or more developments ~~an overall tract development of five acres or more proposing a fifteen per cent increase or 40,000 S.F. (whichever is less) in surface impermeability,~~ shall not exceed the predevelopment rate of a 10-year, ~~twenty-four-hour~~ frequency storm for all rainfalls up to a 25-year~~, twenty-four-hour~~ frequency storm.

~~(Ord. of 6-18-92)~~

~~*501* Tract developments of two acres up to five acres proposing a thirty per cent increase or 30,000 S.F. (whichever is less) in surface impermeability, should have a post-development discharge rate not to exceed the predevelopment rate of a 10-year, twenty-four-hour storm for the same storm event.~~

~~(Ord. of 6-18-92)~~

~~*502* All other tract development shall be evaluated on a case-by-case basis depending on the impact of the proposed development to the stormwater drainage basin. The City's Authorized Agent will determine the requirements of developments under two acres.~~

~~(Ord. of 6-18-92)~~

ARTICLE VI. - DOWNSTREAM IMPROVEMENTS

600 The developer shall be required to make all downstream drainage improvements if necessary to accommodate increased post-development peak rate and volume of runoff from the site, or provide adequate detention so that post-development peak rate and volume of runoff does not exceed the capacity of the downstream facilities.

~~(Ord. of 6-18-92)~~

ARTICLE VII. - STORMWATER MANAGEMENT PLAN

700 All new developments ~~in excess~~ of one acre or greater, except single-family house parcels, shall be required to submit a stormwater management plan, designed and stamped by a designer registered in the State of South Carolina, for approval by the City's Authorized Agent, prior to development. The plan should address both temporary and permanent erosion and sedimentation control facilities, and permanent structural facilities such as the pipe system, detention/retention ponds, channels, swales, etc. The stormwater management plan shall also demonstrate that storm events up to a 100-year flood will not result in property damage on-site or off-site.

701 The stormwater management plan shall include pre and post-development calculations.

~~(Ord. of 6-18-92)~~

ARTICLE VIII. - MAINTENANCE

800 The maintenance of all on-site stormwater management facilities such as detention basins, drainage swales, drainage channels, yard inlets, manholes, catch basins, and pipe systems outside the public right-of-way shall be the responsibility of the ~~landowner~~ property owner unless dedicated to the City by easement agreement.

801 Upon entry approval, the City may conduct regular inspections of private stormwater management facilities and implement measures to enforce maintenance by property owners.

802 The City shall give written notice to the property owner of record for failure to properly maintain stormwater management facilities and order corrective action as necessary, within 30 calendar days from the date of the City's discovery of the said failure.

803 In the event that a property owner fails to take corrective action within the determined time period, the City shall issue a fine to the property owner in the amount of $ 20 (????) per day per notice until such time that the property owner has taken the required corrective action or filed an appeal with the Stormwater Appeals Board.

~~(Ord. of 6-18-92)~~

ARTICLE IX. - APPEALS

900 Any person alleging an error in the interpretation of this ordinance by the City or who maintains that the literal enforcement of the provisions of this ordinance results in unnecessary hardship may appeal said matter to the ~~City Zoning~~ Stormwater Appeals Board (the "Board") ~~of Appeals~~, following all procedures associated with said Board, which procedures shall be promulgated by the Board once constituted, and which may be modified from time to time. The appeal procedures shall be made available to any petitioner requesting such an appeal.

901 The Board shall be constituted by three (3) City residents appointed by Council to serve on a three-year term. The residents shall select a Chairperson amongst themselves, and if none can be selected, then the Mayor shall appoint a Chairperson as needed from time to time.

902 The City Engineer and/or his/her designee shall act as the liaison between the Board and the petitioner.

903 Following the conclusion of the Board's consideration of the petitioner's appeal, the Board shall make a decision related to the appeal and inform the petitioner, in writing, on the results of the decision within 30 calendar (????) days thereafter. The Board's decision shall be determined to be final.

904 Should the petitioner disagree with the Board's final decision; the petitioner is entitled to further appeals of that decision through the legal system.

~~(Ord. of 6-18-92)~~

ARTICLE X. - FEES

1000 A base rate of one hundred dollars plus fifty dollars per hour ($150/Hr.) of plan review time shall be charged for plan review. This fee is nonrefundable. The base rate shall be paid at plan submission and the hourly charge paid before any building permit is issued or development takes place. The City shall timely provide an estimate of fees as requested by any developer or contractor. Fees collected shall be deposited into the Stormwater Fund.

~~(Ord. of 6-18-92)~~

Draft 1
Date: 1-23-2020

ARTICLE XI. - SEVERABILITY

Should any particular requirement or section hereof be found to be invalid, said requirement or section shall be null and void. Invalidity of any one or more provisions of this ordinance shall not nullify otherwise valid requirements or sections of the ordinance.

~~(Ord. of 6-18-92)~~

ARTICLE XII- DESIGN STANDARDS

1.0 Introduction
2.0 Stormwater Management Plan
3.0 Hydrologic Analysis
4.0 Storm Drainage Systems
5.0 Culvert Design
6.0 Open Channel Hydraulics
7.0 Stormwater Detention Design
8.0 Erosion and Sediment Control
9.0 Drainage Easements
10.0 Plan Submittal Checklist

Draft 1
Date: 1-23-2020

1.0 INTRODUCTION

The Stormwater Design Standards (the "Standards") have been developed to assist in the design and evaluation of stormwater drainage systems within the City of Georgetown, South Carolina. It provides engineering design guidance to:

- Engineers responsible for the design of stormwater drainage systems and management structures; and
- Developers involved in site planning and design.

Design engineers are encouraged to work with the City Engineering Department as early in the planning and development process as possible.

The Standards are intended to establish the minimum uniform design practices; they neither replace the need for sound engineering judgment nor preclude the use of information or methods not presented. The City's Standards and ordinances are based on SCDHEC's Standards for Stormwater Management and Sediment Reduction Regulations.

Application of the Standards will contribute to more uniform design and analysis of stormwater drainage systems throughout the City of Georgetown. Implementation of the Standards and adherence to the Plan Submittal Checklist will also create uniformity in plan submittal, and therefore allow the City to provide more consistent engineering review services.

In addition to the engineering procedures and criteria necessary for stormwater management, there are many drainage planning concepts that should be considered during the design phase. When considered early in a project, these concepts can be worked into the design to benefit developers, residents and local governments:

- Land use planning and location of developments should be carefully coordinated with drainage planning to prevent drainage problems.
- Consideration should be given to major flood events, local drainage from small areas, and environmental consequences of proposed actions. As an example, when planning a new subdivision, various drainage configurations should be considered before decisions are made on block layout and street location.
- Sensitive environmental areas should be identified and integrated into the final plan. It is perhaps at this point in the development process where the greatest impact can be made on the cost of proposed drainage facilities.
- Consider flood hazard areas at an early stage to avoid unnecessary complications.

Advantages may include lower cost drainage systems, decreased flooding and maintenance problems, and facilities that provide more benefits.

There are also many secondary benefits received from proper drainage planning:

- Reduced street maintenance costs;
- Reduced street construction costs;
- Improved movement of traffic;
- Improved public health;
- Lower cost open space;
- Lower cost park areas and more recreational opportunities;
- Development of otherwise undevelopable land;

- Opportunities for lower building costs;
- Reduced city administrative costs, and;
- Reduced maintenance costs of drainage facilities.

Engineering design methods other than those referenced in this document can be used if approved by the City Engineer. Complete documentation of other methods may be required for approval.

All requirements outlined in this document are in addition to federal, state, and local requirements. Where regulations are not consistent between agencies, the developer shall adhere to the most stringent. Other agencies include, but are not limited to, U.S. Environmental Protection Agency, South Carolina Department of Health and Environmental Control, and South Carolina Department of Natural Resources.

2.0 STORMWATER MANAGEMENT PLAN

All site development activities which disturb one acre or greater, except for single-family parcels, shall be required to submit a stormwater management plan, designed and stamped by a designer registered in the State of South Carolina, for approval by the SC Department of Health and Environmental Control, and the City's Authorized Agent, prior to development. The plan should address both temporary and permanent erosion and sedimentation control and permanent structural facilities such as the pipe system, stormwater control measures, channels, swales, etc.

The submittal shall consist of three parts and must include:

1. The approved SCDHEC NPDES stormwater permit;
2. Technical engineering calculations including pre and post-development discharge calculations signed and sealed by a design professional; and
3. Construction Documents and Plans (plans, details, specifications, stormwater pollution prevention plan, erosion control plan),signed and sealed by a design professional.

The Stormwater Management Plan ("SWMP") will be reviewed after the City receives payment of plan review fees. The SWMP approval is contingent upon approval by the SCDHEC.

Stormwater Engineering Plans must include soil erosion and sediment controls, drainage pipe systems, stormwater structures, detention ponds, channels, swales, grading plans, pipe profiles, 100-year flood elevation, etc. Refer to SCDHEC Standards for Stormwater Management and Sediment Reduction Regulations for design standards and details in addition to these minimum standards.

3.0 HYDROLOGIC ANALYSIS

The purpose of the hydrologic analysis of a site is to define and address change in stormwater runoff and the impacts of that change on and off the site. Hydrologic analysis should be performed in accordance with the following general guidelines:

- Methodology for analysis shall follow the National Resource Conservation Service (NRCS) Technical Release No.55 (TR-55), June 1986.
- Design storm duration shall be the 24-hour rainfall event, using the NRCS Type III rainfall distribution with no more than a 6-minute time increment.
- The following rainfall depths should be used in hydrologic design and analysis.

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	24-Hour Rainfall Depth for City of Georgetown					
Return Period (Years)	2	5	10	25	50	100
Depth (inches)	4.56	5.90	6.99	8.52	9.79	11.1

Source: NOAA Atlas 14 Point Precipitation Frequency Estimates - Georgetown 2 E (38-3468) Station

In consideration of the hydrologic function of the stormwater drainage elements on a site, the following is a list of minimum stormwater drainage system design requirements for a residential subdivision and commercial development.

Summary of Design Frequencies

Description	Design Storm
Roadway Inlets	10 year
Storm drainage systems	25 year
Open Channels	25 year
Culverts (subdivision streets)	25 year
Culverts (thoroughfare streets)	50 year
Permanent Storage Facilities	25 year
Emergency Spillways	100 year
Energy Dissipaters	Same as Outlet System

Additional analysis may be required. See the section on storm drainage systems for further clarification.

The use of hydrologic software for the design of detention basins and open channels is encouraged. Acceptable models include, but are not limited to, Pond Pack, HEC RAS, Flow Master, and Hydraflow.

4.0 STORM DRAINAGE SYSTEMS

The design of a storm drainage system should demonstrate adequate capacity to convey storm events for design frequencies as specified below under free-flow (no surcharge) conditions. In addition to pipe capacity, attention should be given to the proper design of surface drainage characteristics, gutter flow and inlet capacity. For more detailed guidance on the design of these systems, see Federal Highway Administration (FHWA) HEC-12, Drainage of Highway Pavements (1984) and American Association of State Highway Transportation Officials (AASHTO) Model Drainage Manual (1991).

Hydraulic analysis should be performed in accordance with the following general guidelines:

- Methodology for analysis may follow NRCS TR-55 or the Rational Method.
- Design storm duration shall be the 24-hour rainfall event, using the NRCS Type III rainfall distribution with no more than a 6-minute time increment.
- The following rainfall depths should be used in hydraulic design and analysis.

	24-Hour Rainfall Depth for City of Georgetown					
Return Period (Years)	2	5	10	25	50	100
Depth (inches)	4.56	5.90	6.99	8.52	9.79	11.1

Source: NOAA Atlas 14 Point Precipitation Frequency Estimates - Georgetown 2 E (38-3468) Station

All drainage structures and pipes installed within City limits shall comply with SCDOT standards.

As part of the drainage analysis, the capacity of the downstream facilities to which the development discharges shall be evaluated to ensure said capacity is not exceeded. In the event that the capacity is exceeded, the project design and construction shall include all downstream drainage improvements if necessary to accommodate increased post-development peak rate and volume of runoff from the site or provide adequate detention so that post-development peak rate and volume of runoff does not exceed the capacity of the downstream facilities.

The following criteria shall be used for inlet design within either existing City of Georgetown Rights-of-Way or proposed Rights-of-Way that are to be included in the City system.

Design Frequencies

	Facility Design Storm			
Roadway Type	Gutter Spread	Roadside Ditch	Storm Drain	Culvert Drainage
Arterial	10-yr	25-yr	25-yr	50-yr
Collectors	10-yr	25-yr	10-yr	25-yr

Additional considerations to be incorporated into the design of the system:

- No curb overtopping may occur in a sag.
- Maximum spread of eight (8) feet in a travel lane for all curb types.
- Depth of spread should not exceed six (6) inches.
- Inlet spacing should not exceed 300 feet.

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The maximum and minimum slopes for storm drains should conform to the following criteria:

- The maximum pipe velocity shall not exceed 20 feet per second and shall not cause scour or other erosion problems in the receiving channel.
- Slopes required to maintain minimum velocity of three (3) feet per second at full flow are as follows:

Minimum Slope		
Manning n:	0.013	0.013
Pipe Size (in.)	RCP (ft.)	Corrugated HDPE (ft.)
15	0.00325	0.00325
18	0.00255	0.00255
24	0.00174	0.00174
30	0.00129	0.00129
36	0.00101	0.00101
42	0.00082	0.00082
48	0.00069	0.00069

Additional criteria for storm drainage system design includes the following:

1. All structures shall allow for access to the storm drainage system with a grate, manhole ring, and cover, or a lid capable of being removed. No “blind boxes” are permitted.
2. Structures shall be required at changes in grade and/or alignment and at pipe junctions.
3. The maximum spacing between two manholes, or inlet structures, in any instance, shall be 300 feet.
4. Headwall or flared end sections shall be required at the inlet and outlet of all pipe systems.
5. Energy dissipaters shall be designed and constructed at the outlets of all pipe systems to prevent erosion in the receiving watercourse.
6. The minimum size storm drain pipe diameter shall be 15 inches.
7. All storm drainage pipe used within a City right-of-way shall be corrugated High-Density Polyethylene (HDPE) or Reinforced Concrete Pipe (RCP) in compliance with SCDOT standards. All RCP shall be Class III or higher.
8. A minimum of one (1) foot cover shall be provided for all storm drain pipes unless otherwise specified in the SCDOT standards (SCDOT Standard 714-205-01, 714-205-02, 714-605-01, and 714-605-02).
9. Alternative pipe shapes may be approved where required by cover and/or utility conflicts.

5.0 DESIGN OF CULVERTS

Culverts shall be checked for overtopping for the following flood frequencies:

- Cross-drainage culverts under arterial streets[1] – 100-year frequency
- Cross drainage culverts under other streets – 50-year frequency
- Other culverts – 25-year frequency.

Outlet protection shall be provided where discharge velocities will cause erosion problems.

Culvert skews shall not exceed 45 degrees as measured from a line perpendicular to the roadway centerline without approval.

The minimum culvert diameter shall be 18 inches for those culverts located within subdivision streets. The minimum culvert diameter shall be 24 inches for those culverts located on arterial roads.[1]

Notes:
[1]Arterial streets include all numbered routes and all roads with four or more travel lanes or otherwise designated "arterial" by the City of Georgetown.

6.0 OPEN CHANNEL HYDRAULICS

In general, the following criteria should be used for open channels:

- Low flow sections shall be considered in the design of channels with large cross-sections (Q>100cfs).
- Channel side slopes shall be stable throughout the entire length and side slope shall depend on the channel material. A maximum of 3:1 is allowed for vegetative cover and 2:1 for rip rap unless otherwise justified by calculations.
- Superelevation of the water surface at horizontal curves shall be accounted for with increased freeboard. See SCDHEC design standards for further information.
- Trapezoidal or parabolic cross-sections are preferred, and triangular shapes should be avoided.

The following criteria shall be considered at channel transitions:

- Transition to channel sections shall be smooth and gradual.
- Energy losses in transitions shall be accounted for as part of water surface profile calculations.

Open channel drainage systems shall be sized to handle a 25-year design storm. If for the specified design storm, the peak flow in the channel equals or exceeds fifty (50) cubic feet per second under ultimate build-out conditions, the 100-year design storm shall be routed through the channel system to determine if the 100-year flood elevation restrictions are exceeded, structures are flooded, or flood damages are increased. The post-development 100-year flood elevations and limits shall be shown on the recorded subdivision plat.

Additional analysis or measures may be required in areas that are documented as known drainage problems. For further information contact City Engineering.

Notes:
The intent/purpose of analyzing the 100-year storm is to verify that no structures will be flooded by the 100-year event and that any flooding that occurs within the streets is acceptable as determined by the staff of the governing authority. It is not the intent that the channel or pipe contains the 100-year event, but that buildings are not flooded, and no streets made impassable by the flooding

7.0 STORMWATER DETENTION AND QUANTITY CONTROL

In accordance with the City of Georgetown code of ordinances, the post-development stormwater discharge rate from developments of one acre or more shall not exceed the predevelopment rate of a 10-year, frequency storm for all rainfalls up to a 25-year, frequency storm.

All other development shall be evaluated on a case-by-case basis, depending on the impact of the proposed development of the stormwater drainage basin. The City's Authorized Agent will determine the requirements of developments under one acre.

8.0 EROSION AND SEDIMENT CONTROL

For erosion and sediment control, see the South Carolina Department of Health and Environmental Control (SCDHEC) Stormwater BMP Handbook.

The South Carolina Stormwater and Sediment Reduction Act is administered by the State in the City of Georgetown. All subject projects must submit plans to the regional office of the South Carolina Department of Health and Environmental Control (SCDHEC). Projects that are 5 acres or larger will also need to obtain a permit for the discharge of stormwater from construction sites. NPDES General Permit SCR100000 is available for this discharge.

9.0 DRAINAGE EASEMENTS

Drainage easements will be required by the City for all open ditches, closed pipe systems, swales, or other systems dedicated to the City outside of public rights-of-way. Such rights-of-way or easements shall be centered over the closed pipe, culvert or watercourse with minimum widths based on the following:

- Easement Widths for Closed Pipe Systems
- Easement Width = the greater of 20 feet or;
- 10' + (the diameter or total outside width for multiple pipes) + (2 X invert depth), rounded to the nearest five (5) foot increment.

Drainage easements associated with culverts may be offset as long as a minimum of 10 feet is provided on both sides.

Easement Widths for Open Channels

Drainage Area, ac	Easement Width, ft.
< 50 ac	10' on each side
> 50 ac	20' on each side

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10. Development Plan Submittal Checklist for Engineering Review

The following items are required for Development Plan Submittals. Enclose this checklist with final design plan submittal. The construction plans must show all the information required on the preliminary subdivision plat, plus the following as it relates to the particular project.

Name of Project: ________________________ Name of Project Contact: _______

Phone Number: ________________________________

General Plan Requirements

Engineer	Reviewer	N/A	Item
☐	☐	☐	Name, address and phone number of developer, property owner and design engineer on the Cover Sheet.
☐	☐	☐	Plan shall bear the note: "All construction to be in accordance with all City of Georgetown Standards and Specifications."
☐	☐	☐	Vicinity Map
☐	☐	☐	Scale on plan view no smaller than 1"=50'; scale on profile view no smaller than 1"=50' horizontally and 1"=5' vertically using a grid showing 1'intervals.
☐	☐	☐	All elevations in relation to mean sea level.
☐	☐	☐	Benchmark elevations and locations shall be shown on plan view.
☐	☐	☐	Plan view shall have a north arrow on each drawing.
☐	☐	☐	Building setback lines on plan view.
☐	☐	☐	All driveways and parking lots shall be shown.
☐	☐	☐	Houses, building numbers and property owners shown on existing property.
☐	☐	☐	Plan view shall show all property lines rights-of-way and easements. All street rights-of-way and easement widths shall be clearly labeled.
☐	☐	☐	Plan view shall show all street names and state road numbers if applicable.

☐	☐	☐	Floodplain boundaries and elevations, where applicable.
☐	☐	☐	Delineated wetlands surveyed and shown all plans, where applicable.
☐	☐	☐	Proposed and existing curb and gutter, storm sewers, drainage structures, driveway pipes, water mains, sanitary sewers, etc. All existing and proposed pipes shall have clearly labeled the material, size, class, slope and length.
☐	☐	☐	Plan views shall show all existing and proposed utility layout, including fiber optic, electric, gas, and cable located on the right-of-way.
☐	☐	☐	Profile view shall show existing and proposed centerline elevations and slopes, in addition to left and right top of curb or edge of pavement elevations.
☐	☐	☐	Street typical sections include street and right-of-way width, sidewalk location, cross-slopes, street width (measured to back of curb) and pavement design.
☐	☐	☐	Dimensions and construction details of all pertinent items including but not limited to curb and gutters, handicap ramps, sidewalks, catch basins, manholes, outlet protection, erosion control measures and headwalls.

Storm Drainage Design Requirements

Provide the following engineering design calculations where applicable. Refer to the City Storm Drainage Minimum Design Standards for specific requirements.

Engineer	Reviewer	N/A	Item
☐	☐	☐	Narrative describing how water entering, traveling within, and leaving the site will be controlled and the extent the development will impact existing conditions on-site and off-site.
☐	☐	☐	Topographic maps (min. 2' contours) clearly showing site limits. Maps extend a minimum of 1000 feet beyond the site boundaries or to the ridgelines of the contributing areas if less than 1000 feet.
☐	☐	☐	Gutter spacing and spread calculations.
☐	☐	☐	Pipe sizing calculations including proposed flows and velocities.
☐	☐	☐	Post-development discharges for specified design storm at all outlets.
☐	☐	☐	Culvert sizing calculations and headwater analysis.
	☐	☐	Open channel sizing calculations including proposed flows and velocities.

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☐	☐	☐	Where applicable, 100-year flood routing calculations through a channel system. Provide post-development 100-year flood elevations on the plan.
☐	☐	☐	2-year, 10-year, 25-year, and 100-year flood routing analysis through all detention/retention facilities.

If a 100-year floodplain analysis is required provide the following:

Engineer	Reviewer	N/A	Item
☐	☐	☐	100-year flood elevations
☐	☐	☐	100-year floodplain limits
☐	☐	☐	Location and Elevation of the lowest floor in all proposed and existing buildings adjacent to the floodplain
☐	☐	☐	Summary of impacts from the 100-year flood

Provide the following information where applicable:

Engineer	Reviewer	N/A	Item
☐	☐	☐	Maintenance Plan for all stormwater facilities
☐	☐	☐	Name and address of entity responsible for maintenance
☐	☐	☐	Landscaping details for stormwater management

Provide the following site information. For proposed residential subdivisions, use planned average house sizes to determine the proposed impervious area.

		Percentage of Total Site
Total Parcel Area	____________ ac	
Existing Impervious Area	____________ ac	____________ %
Proposed Impervious Area	____________ ac	____________ %
Percentage Increase in Impervious Area	____________ %	

Comments:

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120 North Fraser Street · Georgetown, SC 29440 · (843) 545-4000

INFORMATION ITEM

DOC ID: 2950

Council Meeting Date: 23 January 2020
Department: Administration
Issue Under Consideration: Present DRAFT Strategic Plan

November 2019

City of Georgetown

Strategic Direction

Draft Vision Statement

The City of Georgetown will be a destination city known for its rich history and natural beauty. It will continue to be recognized as one of the best small coastal towns in the United States. It will continue to be a great place to visit, live, work, and play.

Drat Mission Statement

The mission of the City of Georgetown is to provide for the safety and general wellbeing of its residents and visitors. The City enhances the quality of life for its citizens by protecting its natural environment, fostering a vibrant and diverse economy that will create economic opportunities, ensuring orderly growth, and providing excellent services, amenities, and infrastructure. The City plays a proactive leadership role in shaping the future of the community based on input from its stakeholders.

Draft Values/Guiding Principles

Integrity: Standards of honesty, objectivity, inclusiveness, and ethical conduct will guide all that we do and is essential to the City building and maintaining a bond of trust with its residents, customers, and among its elected officials and employees.

Loyalty: We are loyal to the City's mission, its residents, and to our fellow employees. We recognize the importance of working together as a team.

Professionalism/High Performance: We are committed to excellence and the delivery of quality services. We are dedicated to conducting all our business in an impartial, consistent and reliable manner. Our employees are knowledgeable and display a strong work ethic.

Initiative: As City officials and employees we will look for new and creative ways to address the needs of our residents. Our employees are encouraged to work independently and to use their best judgement as they fulfill their duties and responsibilities. We strive to go "the extra mile."

Transparency: We will be accountable for and take responsibility for our actions and decisions and will openly communicate with our residents and other stakeholders and will seek their input.

Inclusiveness: The diversity of our residents and our employees is a strength. As a City we are committed to serving and involving all segments of our community.

Draft Strategic Issues and Broad Goals

A Vibrant and Diverse Economy

Broad Goals

- Reduce the number of vacant storefronts
- Create jobs that pay a "living wage" with benefits; technology based jobs
- Establish an Arts District
- Attract headquarters operations

Amenities

Broad Goals

- Create a hub/central park to serve as a community gathering place and location for festivals, events, concerts, farmers market, the arts and cultural activities
- Improve the waterfront/inner harbor and increase water activities
- Secure amenities such as a movie theater, live music venues, microbreweries, walking trails
- Increase number of large events
- Increase use of baseball field

Housing

Broad Goal

- Increase the amount and diversity of the housing stock; particularly affordable housing

Stable Energy Supply

Broad Goal

- Ensure a stable energy supply and costs

Intergovernmental Relations

Broad Goals

- Achieve greater efficiencies in service delivery
- Reduce costs
- Greater coordination and increased partnerships with other governments
- Increase opportunities for conversations with officials with other governments

Infrastructure, Facilities, Equipment

Broad Goals

- Reduce maintenance costs
- Decrease flooding
- Complete City Hall
- Ensure that adequate facilities are in place to support City services
- Study use of fiber optics

Recruitment and Retention of Quality Workforce

Broad Goals

- A quality and stable workforce
- Reduce turnover
- Succession planning and employee development
- Maintain an attractive benefits package

Adequate Funding

Broad Goals

- Secure sufficient funding to provide quality services
- Maintain a healthy fund balance
- Identify new funding sources
- TIF district

Drug/Opioid Abuse

Broad Goals

- Partner with other entities to secure recovery and rehabilitation resources
- Decrease the number of overdoses and drug use

Next Steps

Description	Time Frame[1]
1. City Council: a. Reviews draft plan. b. Provides direction to staff on any further revisions. c. Directs staff to draft an implementation plan.	**December 2019**
2. Draft implementation plan will include: a. Broad goals with specific objectives that are measureable and achievable by a determined time frame. b. Staff will seek the input from stakeholders and the community (charrettes).	**Winter/Spring 2020**
3. Staff brings back the draft strategic plan with the proposed implementation plan back to Council for review and discussion (workshop).	**Summer 2020**
4. Council to adopt the plan as presented or with further reviews (regular Council meeting).	**Summer/Fall 2020**
5. Staff: a. Implement plan, that is, use plan as blueprint to develop future operating and capital budgets b. Provide quarterly reports to Council.	**Fall 2020 in preparation of FY 2021**

[1] If necessary, the Time Frame may be shortened and we will strive to produce a quality plan.

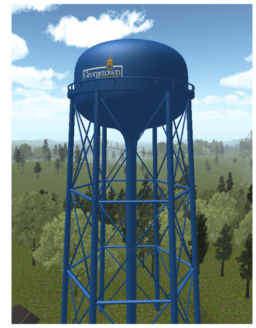
120 North Fraser Street · Georgetown, SC 29440 · (843) 545-4000

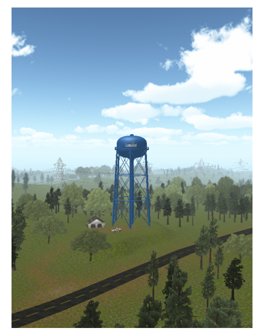
INFORMATION ITEM

DOC ID: 2951

Council Meeting Date: 23 January 2020
Department: Water Utilities
Issue Under Consideration: Port Tank Color Selection and Logo

The Port Tank Rehab project is a budgeted project and the bid documents will be released in early February. We have chosen a dark blue for the paint color and we wanted to show what it will look like with the logo. We decided on a darker color instead of the normal tank white so that fading due to age, and potential staining from particulate matter would not be as noticeable.





PROJECT NAME: Port Tank

PROJECT LOCATION:

COMPLETION DATE:

FABRICATOR:

COLORS SELECTED:

KC Blue | 21BL

ADDITIONAL INFORMATION:

Tank3D is provided as a general, visual representation for water tank color schemes and is not intended to provide an exact, properly scaled design. Logo, lettering, and physical attributes of the water tank within the Tank3D program will vary from real-world water towers.

Tnemec Company Tank Colorization

Please visit **www.tnemec.com** to request accurate color swatches or to contact your local representative.

6800 Corporate Drive • Kansas City, MO 64120 • 1-800-TNEMEC1

TNEMEC

Georgetown
SOUTH CAROLINA