Middle Peninsula Local Government Dredging Implementation Plan

10 Year Feasibility and Implementation Study

Conducted for

Middle Peninsula Chesapeake Bay Public Access Authority

by

Community Futures

Shore Consulting LLC

and

Virginia Institute of Marine Science at William & Mary

With help from

The Berkley Group

and

Many others

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Executive Summary

The Virginia Institute of Marine Science's (VIMS) April 2021 report, *Dredging Implementation Prioritization and Management for Middle Peninsula Shallow Draft Channels*, identified 120 shallow draft channels in the region of which 55 (46%) were restricted or semi-restricted and 39 (32%) were completely shoaled or have shoaled greater than 50% of the channel. This research highlights the extent of shoaling which has occurred over time and the need for a proactive approach for dredging across the region which can restore navigability to historic levels, which once provided the safe and expedient marine transit needed to support the region's marine-based economies.

Dredging projects in the Middle Peninsula have historically been conducted by the US Army Corps of Engineers (USACE) but due to the reduction in funding for shallow draft navigation projects and shifts to other higher priorities, the USACE has only completed five dredging projects within the region over the period 1990-2020. As the federal budget for shallow draft dredging projects has declined it has become apparent that a different approach is required to fund channel dredging in the future. In addition, local governments and non-governmental organizations have performed very limited dredging of creeks in the region. Recent funding provided through the Virginia Port Authority's Waterways Maintenance Fund ($1.35MM in 2020) would only allow a very select few projects to be supported annually, nowhere near addressing the dredging needs throughout the region or the Commonwealth.

Without continual maintenance of the navigable waterways in the Middle Peninsula, marine traffic will have to be diverted, boating safety will be jeopardized, and recreational and economic activity curtailed. The impact will result in reduced economic activity, reduced shoreline property values, and fewer real estate taxes flowing to local governments.

The Middle Peninsula Chesapeake Bay Public Access Authority (MPCBPAA) requested funding from the Virginia Port Authority's Waterways Maintenance Fund to develop a **Middle Peninsula Local Government Dredging Implementation Plan.** This Plan analyzes the costs of dredging 22 channels and determines the feasibility of establishing a regional dredging program either through contracting with the private sector, establishing a publicly operated dredging program or a combination public/private partnership. The individual localities selected the creeks that would be a part of this analysis.

As an initial part of the planning process, the Virginia Institute of Marine Science (VIMS) Shoreline Studies Program conducted an in-depth analysis of the physical characteristics of the 22 channels. One channel, Mattaponi River, was determined not to require dredging within the 10-year time horizon of the analysis; however, the remaining channels were found to need immediate or near-term dredging. In-depth research was conducted related to USACE's previous and current dredging projects, experience of dredging firms that work on the East Coast and other dredging feasibility studies. The experience of other localities along the East and Gulf Coasts that operate dredging programs was reviewed and their experience is presented in selected case studies.

The cost of dredging each channel or combination of channels through competitive bid procurement was estimated. The total cost of contracting for the dredging of all 21 channels is approximately $30M (Gloucester - $9.2M, Mathews - $12.6M and Middlesex - $8.2M). The cost of managing a regional dredging program including equipment, staffing, and administrative costs was calculated for several scenarios based on this research and estimated to be $3.4M annually and the cost of dredging all of the 21 channels at a rate of $27 per cubic yard is $21.3M (Gloucester - $8.5M, Mathews - $9.8M and Middlesex - $3M). There is an overall 29% savings ($8.7M - Gloucester - $.7M, Mathews - $2.8M and Middlesex - $5.2M) operating a regionally dredging program over contracting the dredging work with private contractors. It is evident that the most cost-effective course of action would be for the Middle Peninsula counties to join together to purchase and operate their own medium-sized hydraulic cutter dredge to carry out most of the work. This option saves each locality in the long term and is the most financially feasible option. Such an approach optimizes the investment of public resources.

Operating a regional dredging program also gives the localities flexibility and control in how they prioritize channels, improves the economic development opportunities for marine industries, provides a way to improve the resiliency of the creeks and shorelines through beneficial reuse, maintains and increases waterfront property values, and provides that real estate tax revenues from waterfront properties will increase over time. It also serves as a pilot for financing future resiliency projects of this magnitude in rural coastal areas.

While the plan focuses on the identified dredging needs in Gloucester, Mathew and Middlesex Counties, the recommendations allow for all of the Middle Peninsula to request that dredging projects be added as those needs are identified and the requisite engineering, design, and environmental efforts are completed. The counties of King and Queen, King William, and Essex will be able to buy into the program or pay for services on a per-cubic-yard basis.

The feasibility analysis reviewed an array of potential grants available to reduce the cost of the dredging projects and a variety of methods of financing the dredging projects including, revenue-generating mechanisms available to localities (special tax districts), and debt financing options. Based on these various financing options, the impact of the annual cost of the dredging projects was translated into the estimated increases in real estate taxes required to pay for the projects. The most efficient and equitable method of financing the dredging projects is through a countywide increase in the real estate tax. The estimated increases in real estate tax rates necessary to fund the cost of contracting the dredging projects without any grant funding for each county are: Gloucester - $.023/$100, Mathews - $.079/$100 and Middlesex - $.046/$100. The impact of a regionally operated dredging program on the real estate tax rates drops to: Gloucester - $.021/$100, Mathews - $.061/$100 and Middlesex - $.017/$100.

While hard to quantify, the inaction of local political leaders to address the dredging needs of the creeks and waterways of the region will likely have a direct and significant reduction in future waterfront land values thus a commensurate reduction in real estate tax revenues to the respective counties.

Introduction

The History of Dredging in the Middle Peninsula

The navigability of the natural channels located within the Middle Peninsula has decreased substantially over the course of the past several centuries due to sedimentation occurring from land use practices and natural erosion. These changes have and continue to present a major challenge to the region's commercial, industrial, and recreational marine industries. To address these issues, dredging has served as the primary means of channel maintenance.

The Middle Peninsula has enjoyed a rich history of navigation channels which were funded and maintained with federal appropriations. Beginning in 2010 federal budgeting began to focus on national metrics which provided fewer dollars for shallow draft navigation channels. Historically, shallow draft dredging in the localities comprising the Middle Peninsula was accomplished via Congressional authorization and appropriation for the necessary studies, designs, construction, and periodic maintenance activities. Within the Middle Peninsula Planning District Commission boundaries there are seventeen such channels, generally referred to as federal channels. As the federal budget for maintenance of these projects has declined, it has become apparent that if maintenance of these channels is to continue, a different approach is required. In that connection, an implementation plan has been developed and will be presented herein.

Based on inputs from Gloucester, Mathews, and Middlesex Counties, eleven of the seventeen federal channels were selected and incorporated into the analysis contained in this implementation plan. Each of those channels are listed and described in Table 1.

As Table 2 indicates, the last 3 federally funded shallow draft maintenance dredging efforts occurred at Winter Harbor (2009-2010), Broad Creek (2010), and Queens Creek (2019). Hoskins Creek was last dredged in 2015, Rappahannock River and Jackson Creek were last dredged in 1970, Urbanna Creek was last dredged in 1956, Pamunkey River was last dredged in 1931, and Locklies Creek was last dredged in 1924, however these channels are not a part of this evaluation. Table 2 also presents the expenditures of federal funds for shallow draft navigation channels in the Middle Peninsula over the period 1990 through 2020. The expectation is that federal funding will not return to historical levels for the foreseeable future.

Table 1. Dredging Background for Federally Authorized Navigation Channels

FEDERAL CHANNEL NAME	COUNTY IDENTIFIER	FEDERAL CHANNEL AUTHORIZATION	DESCRIPTION OF AUTHORIZED FEDERAL NAVIGATION CHANNEL[1]	DATE LAST DREDGED
Mattaponi River	Multiple	River and Harbor Act of 2 March 1919 and modified by the River and Harbor Act of 30 August 1935, as amended	Channels 9 feet deep and 150 feet wide from the mouth to Locust Grove; 7 feet deep and 100 feet wide from Locust Grove to Rosespout; a silt basin at Rosespout Bend 180 feet by 400 feet by 7 feet deep; removal of snags between the mouth and Dunkirk.	1941
Aberdeen Creek	Gloucester	Section 107 of the River and Harbor Act of 1960, as amended	A channel 1.0 mile long, 80 feet wide, and 6 feet deep from that depth in York River to and including a turning basin of the same depth, 450 feet long and 400 feet wide opposite the public landing.	1974
Davis Creek	Mathews	River and Harbor Act of 17 May 1950, as amended	A channel 10 feet deep and 80 feet wide, extending from the 10 foot contour in Mobjack Bay into the western arm of Davis Creek to a point near the existing public landing, a distance of approximately 4,130 feet and an anchorage and turning basin opposite the public landing 10 feet deep, 165 feet to 230 feet wide, and 720 feet long.	1971
Horn Harbor	Mathews	River and Harbor Act of 3 July 1930 and modified by the River and Harbor Act of 30 August 1935, as amended	A channel 7 feet deep at mean low water and 100 feet wide across the entrance bar.	2003

[1] All depths referred to mean low water. Some projects have not been maintained to full authorized dimensions.

FEDERAL CHANNEL NAME	COUNTY IDENTIFIER	FEDERAL CHANNEL AUTHORIZATION	DESCRIPTION OF AUTHORIZED FEDERAL NAVIGATION CHANNEL[2]	DATE LAST DREDGED
Winter Harbor	Mathews	River and Harbor Act of 17 May 1950, as amended	A channel 12 feet deep and 100 feet wide, extending from the 12-foot contour in Chesapeake Bay into Winter Harbor to a point just east of the present public landing area, a distance of approximately 7,600 feet, and a mooring and turning basin opposite the public landing 12 feet deep and 400 square feet, with a flared entrance 300 feet long.	2009-10
Queens Creek	Mathews	Section 107 of the River and Harbor Act of 1960, as amended	A channel 6 feet deep, 60 feet wide, and 4,100 feet long extending from that depth in Hills Bay into Queens Creek to a turning basin of the same depth 200 feet wide and 400 feet long.	2019
Milford Haven	Mathews	River and Harbor Act of 3 March 1899 and modified by the River and Harbor Act of 6 June 1900, as amended	A channel 10 feet deep and 200 feet wide from Piankatank River through northwest entrance and between Cricket Hill and Callis Wharf; construction of a stone jetty 1,183 feet long at northwest entrance.	1936
Broad Creek	Middlesex	River and Harbor Act of 2 March 1945, as amended	A channel 7 feet deep and 100 feet wide from deep water in Rappahannock River to deep water in Broad Creek, a distance of about 4,100 feet.	2010
Mill Creek	Middlesex	River and Harbor Act of 30 August 1935, as amended	A channel 11 feet deep and 100 feet wide from Rappahannock River to new Mill Creek wharf with turning basin 300 feet square at head of project.	1936
Whiting Creek	Middlesex	River and Harbor Act of 2 March 1945, as amended	A channel 4 feet deep and 70 feet wide between the 4-foot depth in the Rappahannock River and the 4 foot depth in Whiting Creek.	2003
Parrotts Creek	Middlesex	River and Harbor Act of September 1954, as amended	A channel 6 feet deep, 60 feet wide, and 4,800 feet long from deep water in Rappahannock River through the entrance to Parrotts Creek, suitably widened at bends, with turning basin of same depth, 120 feet square, at the public landing.	1956

[2] All depths referred to mean low water. Some projects have not been maintained to full authorized dimensions.

Table 2. Dredging and Dredge Material Disposal (Placement) History for Federal Navigation Channels

FEDERAL CHANNEL NAME	COUNTY IDENTIFIER	NUMBER OF DREDGING EFFORTS 1990-2020[3]	DATE LAST DREDGED	LAST VOLUME DREDGED (CUBIC YARDS)	DREDGE TYPE USED FOR MOST RECENT DREDGING EFFORT	LAST PLACEMENT SITE USED[4]	COST OF MOST RECENT DREDGING EFFORT (2)[5,6]
Mattaponi River	Multiple	0	1941	109,505	Unknown	Upland	$29,984
Aberdeen Creek	Gloucester	0	1974	50,426	Unknown	Upland	Unknown
Davis Creek	Mathews	0	1971	45,367	Unknown	Upland	$46,846
Horn Harbor	Mathews	3	Combined with Whiting Creek in 2003	4,096	Hydraulic	Beach	$191,000
Winter Harbor	Mathews	1	2009-10	87,090	Hydraulic	Beach/Upland	$640,912
Queens Creek	Mathews	4	2019	20,220	Hydraulic	Beach/Upland	$876,907
Milford Haven	Mathews	0	1936	29,566	Unknown	Beach	Unknown
Broad Creek	Middlesex	2	2010	38,491	Hydraulic	Upland	$430,212
Mill Creek	Middlesex	0	1936	24,632	U.S. Hydraulic Dredge Dalecarlia	Beach	Unknown
Whiting Creek	Middlesex	4	Combined with Horn Harbor in 2003	13,285	Hydraulic	Beach	$191,000
Parrotts Creek	Middlesex	0	1956	66,823	Unknown	Beach	$36,545
TOTALS		**14**		**489,501**			**$2,443,406**
AVERAGE		**~1.3**		**44,500**			**$305,426**

[3] US Army Corps of Engineers (USACE).
[4] Most recent if available, otherwise based on dredging prior to the most recent dredging effort. Costs based on price levels in existence at the time dredging occurred.
[5] Includes placement site preparation costs if available. Does not include pre-construction engineering and design/permits, disposal site acquisition, or supervision and administration costs.
[6] Source: USACE Chief of Engineers Annual Reports, Norfolk District USACE records.

In addition, there are eleven non federal channels provided by the individual counties which will be addressed in this implementation plan. Table 3 provides a listing of those channels. In addition, the implementation plan considers combinations of channels and associated dredge material placement sites in an effort to gain efficiencies and cost savings as compared to one each dredging/dredge material placement sites.

Table 3. Non Federal Navigation Channels

NON FEDERAL CHANNEL NAME	COUNTY IDENTIFIER	POTENTIAL DREDGING DEPTH (FT)[7]
Cedarbush Creek	Gloucester	-(6+1)
Timberneck Creek	Gloucester	-(6+1)
Sarah Creek	Gloucester	-(6+1)
Perrin River	Gloucester	-(6+1)
Free School Creek	Gloucester	-(4+1)
Whittaker Creek	Gloucester	-(4+1)
Mill Creek 2	Mathews	-(4+1)
Put In Creek	Mathews	-(4+1)
Hole In The Wall	Mathews	-(6+1)
Bush Park Creek	Middlesex	-(4+1)
Robinson Creek	Middlesex	-(6+1)

Given the expectation of limited future federal funding exacerbated by:

1. the continually growing need for funding for the dredging of the existing navigation channel portfolio, and
2. the need for funding to dredge the inventory of new needs.

The Middle Peninsula Chesapeake Bay Public Access Authority partnered with the Norfolk District USACE to complete a shallow draft dredging and sediment management plan in 2011. That plan quantified the dredging and disposal placement costs for maintaining seventeen existing federal navigation channels and presented issues for local governments to better understand the complexities of providing predictable funding on an annual basis. Since that time the needs for dredging and dredge material placement have increased and the identification of a regional strategy has taken on added importance. The implementation plan is intended to address the dredging and dredge material disposal (placement) needs of those twenty-two projects over a reasonably foreseeable future.

[7] An additional 1 foot of allowable over-depth dredging is also anticipated.

Overview of Channels

For its Dredging Implementation Prioritization and Management study, the Virginia Institute of Marine Science (VIMS) Shoreline Studies Program collected data on 120 creeks in the Middle Peninsula.[8] Twenty-two (22) of those were looked at in-depth for the purposes of this Dredging Plan, including bathymetric surveys, soil conditions, and the minimum volume of material that would need to be removed in order to bring them back to navigable depths (usually including 1 foot overdepth). Twenty-one (21) of those are explored here (Mattaponi River was determined to not need dredging). Separate consideration is given to combined creek projects (or those with combined disposal sites).[9]

River systems are home to diverse ecosystems. Though the dredging of any of these channels will impact the benthic environment, it may also allow for an improvement in water circulation and water quality. In general, none of the projects discussed are expected to cause long-term adverse effects on the surrounding ecosystem. Any effects on the environment should be minimal and be offset by the project benefits of maintaining safe navigation and commerce. Short-term impacts associated with the projects may include destruction of the non-motile benthic community and temporary changes in water quality, air, and/or noise emissions. Short-term impacts would cease with the completion of construction. Long-term impacts to soils and bathymetry, typical for a dredging project, would be expected as a result of these projects. Impacts will be identified and addressed during a joint permit application.

The dredging and placement of dredged material is a dynamic process. For example, as technologies are identified and refined, additional disposal options may become available thus providing additional opportunities such as thin layering, island restoration/creation, industrial beneficial reuse such as the use of dredged material for the production of concrete, and development of combination dredge material placement facilities. Such technologies may be applied to future maintenance dredging efforts to ensure compatibility within the broadest range of resiliency strategies.

[8] Additional detail can be found in the 2020 Virginia Institute of Marine Science Dredge Channel Data Report and the April 2021 Virginia Institute of Marine Science Dredging Implementation Prioritization and Management for Middle Peninsula Shallow Draft Channels report.

[9] All creeks were evaluated as part of a Virginia Port Authority grant entitled "Advancing Construction Implementation Funding Alternatives for Virginia Waterway Maintenance Funded Construction Design Projects: Middle Peninsula Local Government Business Construction Implementation Plan".

Aberdeen Creek[10]

INTRODUCTION

Aberdeen Creek is an existing federal navigation channel which was constructed under authority of Section 107 of the River and Harbor Act of 1960, as amended. The existing federal project consists of a channel one mile long, 80 feet wide and 6 feet deep (mean low water) from that depth in the York River to and including a turning basin of the same depth, 450 feet long and 400 feet wide opposite the public landing. The channel and turning basin were last dredged by the USACE in 1974. The mean range of tide is 3.00 feet.

STUDY AREA

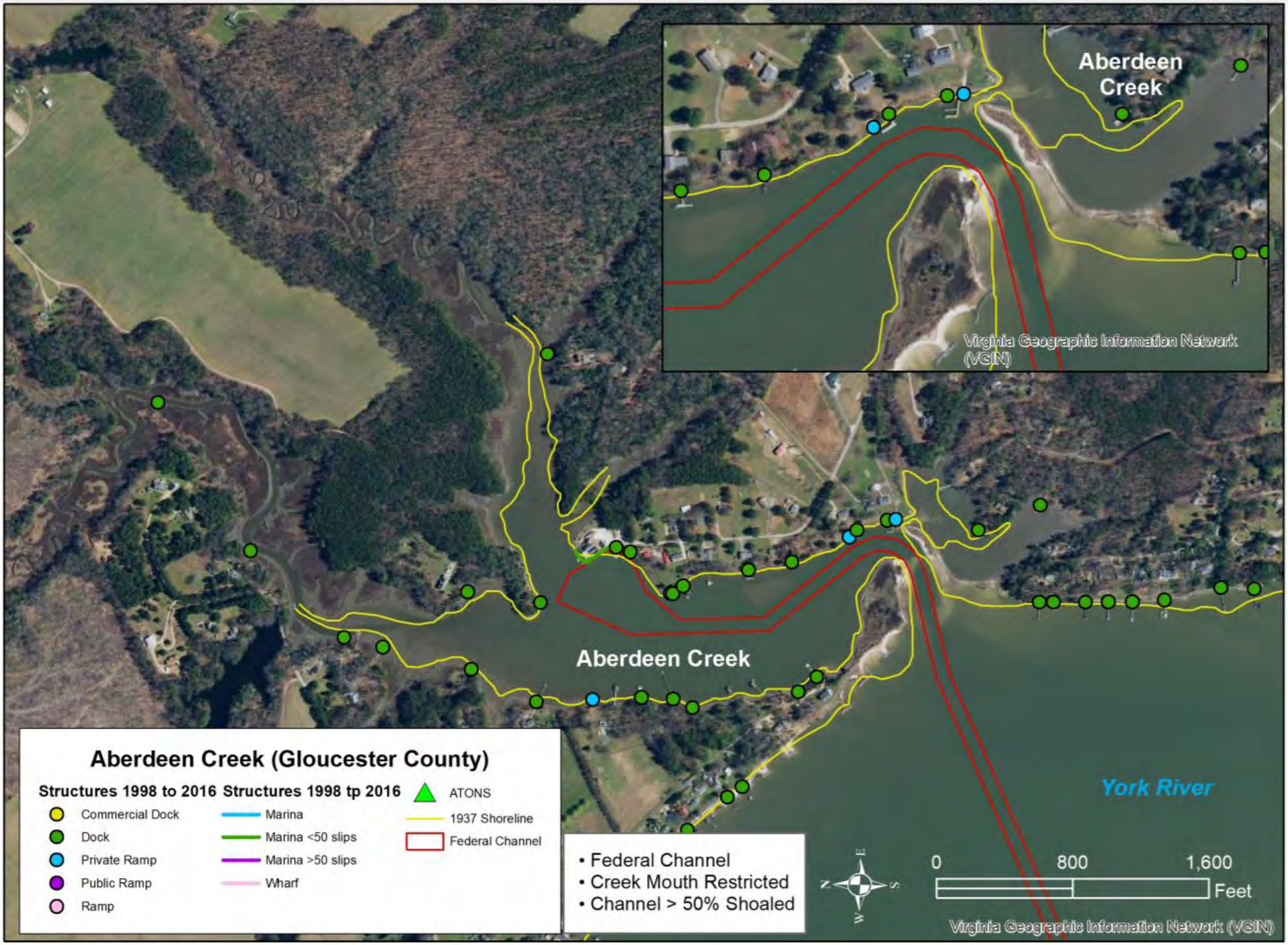
Aberdeen Creek is located on the York River in Gloucester County, Virginia. At the narrow confluence of the York and Aberdeen, the creek takes about a 90-degree bend to the north and widens to about 700 to 800 feet (ft) for about 2,000 ft. The creek then divides into two branches, one continuing north and one going east. These two prongs narrow quickly and become thin meandering tidal channels with adjacent marsh. The land use around the creek is mostly agricultural and wooded with some residential properties along its east side and along the York River shoreline. The west side of the creek is defined by a sand spit vegetated with high and low marsh that widens quickly into a peninsula north of the entrance. This spit has formed over the years of southward transport of eroding bank sediment along the York River. A sandy spit also occurs on the south side of the channel and has moved across a small tidal channel/marsh coming into Aberdeen Creek from the southeast. The creek mouth is restricted and greater than 50 percent of the channel is shoaled. The average depth of the creek mouth is -1.0 feet and the maximum depth of the creek mouth is -1.3 feet. The water surface area is 77 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Today, narrowing of the channel at the entrance to Aberdeen Creek makes it difficult for ingress and egress of commercial and recreational vessels to the working waterfront public landing at the end of Aberdeen Creek Road. Commercial boat traffic must swerve to enter the creek along the south side of the channel. A public boat dock is presently being utilized as Aberdeen Creek provides seasonally critical access for landing, docking, and mooring in close proximity to public and private oyster grounds and public crabbing grounds on the York River. Maintenance dredging of Aberdeen Creek is necessary to re-establish the authorized navigable depths to provide safe navigation for vessels utilizing the working waterfront located on the creek. Aberdeen Creek has 22 piers, 1 marina and 4 boat ramps.

In addition, private oyster leases are found in the creek on either side of the authorized Federal channel. Outside the creek, the outbound channel crosses both private leases and public grounds. However, as a federally authorized channel, these should not adversely impact permitting.

[10] VIMS Study Information: Creek ID Number: 110 Locality: Gloucester Water Body: York River Channel Type: Federal Latitude: 37.3375 Longitude: -76.5924 Number of Marinas: 1 Number of Boat Ramps: 4 Number of Piers: 22 Creek Mouth Morphology: Restricted %Shoaling of Creek: >50% of channel Tide Range (ft): 3.0 Creek Area (acres): 77 Average Depth of Creek Mouth (ft): -1.0 Maximum Depth of Creek Mouth (ft): -1.3


Aberdeen Creek
Aberdeen Creek
Virginia Geographic Information Network (VGIN)
York River
Aberdeen Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
800
1,600
Feet
Virginia Geographic Information Network (VGIN)

Cedarbush Creek[11]

INTRODUCTION

Cedarbush Creek is located in Gloucester County, Virginia. The creek has no federal authorization and has never been dredged. The mean range of tide is 2.84 feet.

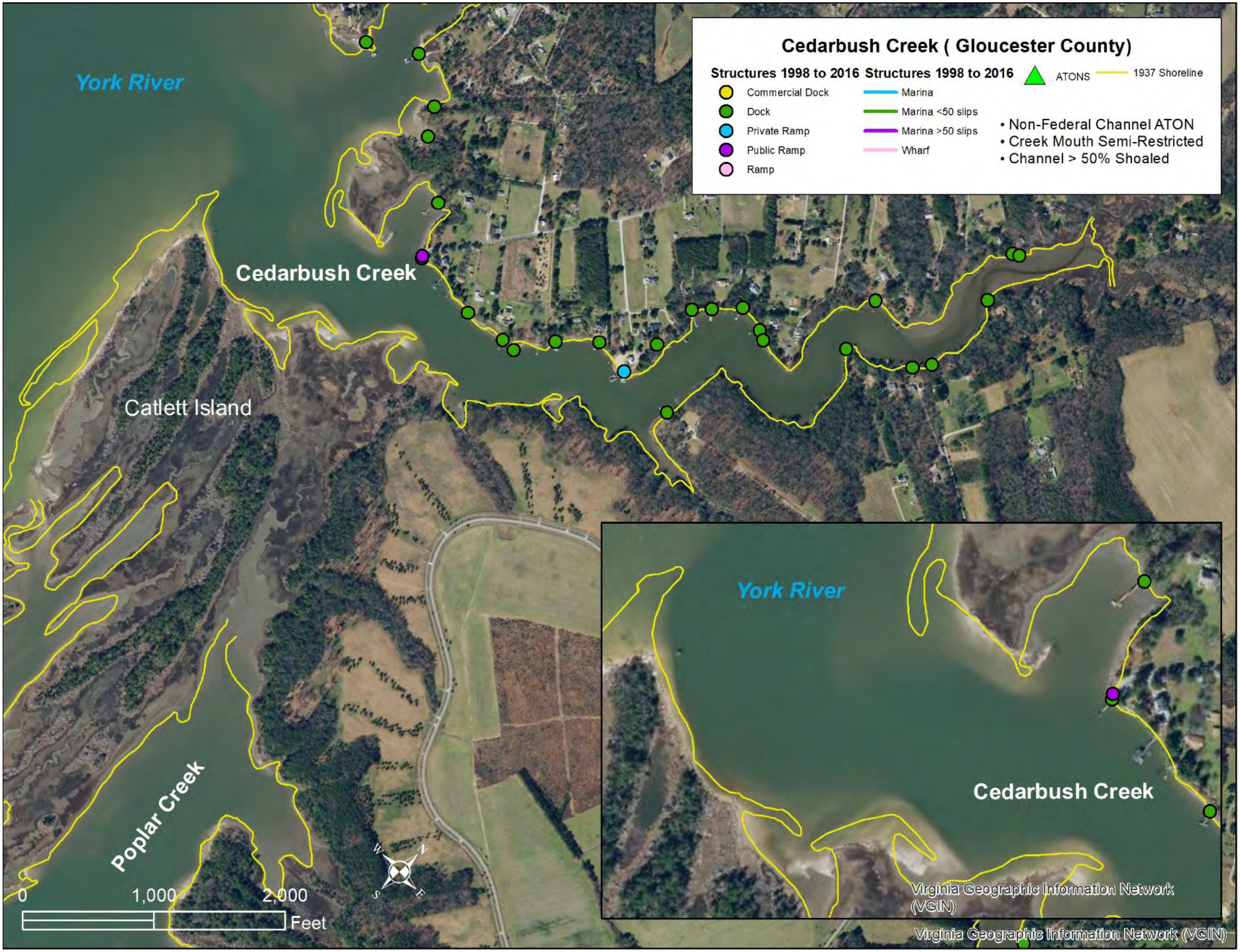
STUDY AREA

The creek mouth is semi-restricted and greater than 50 percent of the channel is shoaled. The average depth of the creek mouth is -0.3 feet and the maximum depth of the creek mouth is -0.3 feet. The water surface area is 82 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The dredging of Cedarbush Creek is necessary to establish navigable depths sufficient to provide safe navigation for vessels utilizing the creek for commercial and recreational activities. The creek contains working waterfront infrastructure. Creating a defined channel by way of dredging which provides for safe access is needed. Cedarbush Creek has 21 piers and 2 boat ramps.

[11] VIMS Study Information: Creek ID Number: 108 Locality: Gloucester Water Body: York River Channel Type: Non-Federal Latitude: 37.3102 Longitude: -76.5565 Number of Marinas: 0 Number of Boat Ramps: 2 Number of Piers: 21 Creek Mouth Morphology: Semi-Restricted %Shoaling of Creek: >50% of channel Tide Range (ft): 2.8 Creek Area (acres): 82 Average Depth of Creek Mouth (ft): -0.3 Maximum Depth of Creek Mouth (ft): -0.3



Cedarbush Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Semi-Restricted
• Channel > 50% Shoaled
York River
Cedarbush Creek
Catlett Island
Poplar Creek
0
1,000
2,000
Feet
York River
Cedarbush Creek
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Timberneck Creek[12]

INTRODUCTION

Timberneck Creek is located in Gloucester County, Virginia. It is a long, but narrow creek that empties into the York River. The mouth is a wide embayment, but farther north, the creek narrows to about 400 ft wide and extends for about 2 miles to its marshy headwaters. The interior of the creek is irregular with many very small lateral creeks/marsh drainages. The creek has no federal authorization and has never been dredged, but the US Coast Guard does maintain aids to navigation. However a USCG study has flagged the creek as having shoaling problems which are restricting the agency's ability to access the aids for maintenance. The mean range of tide is 2.67 feet.

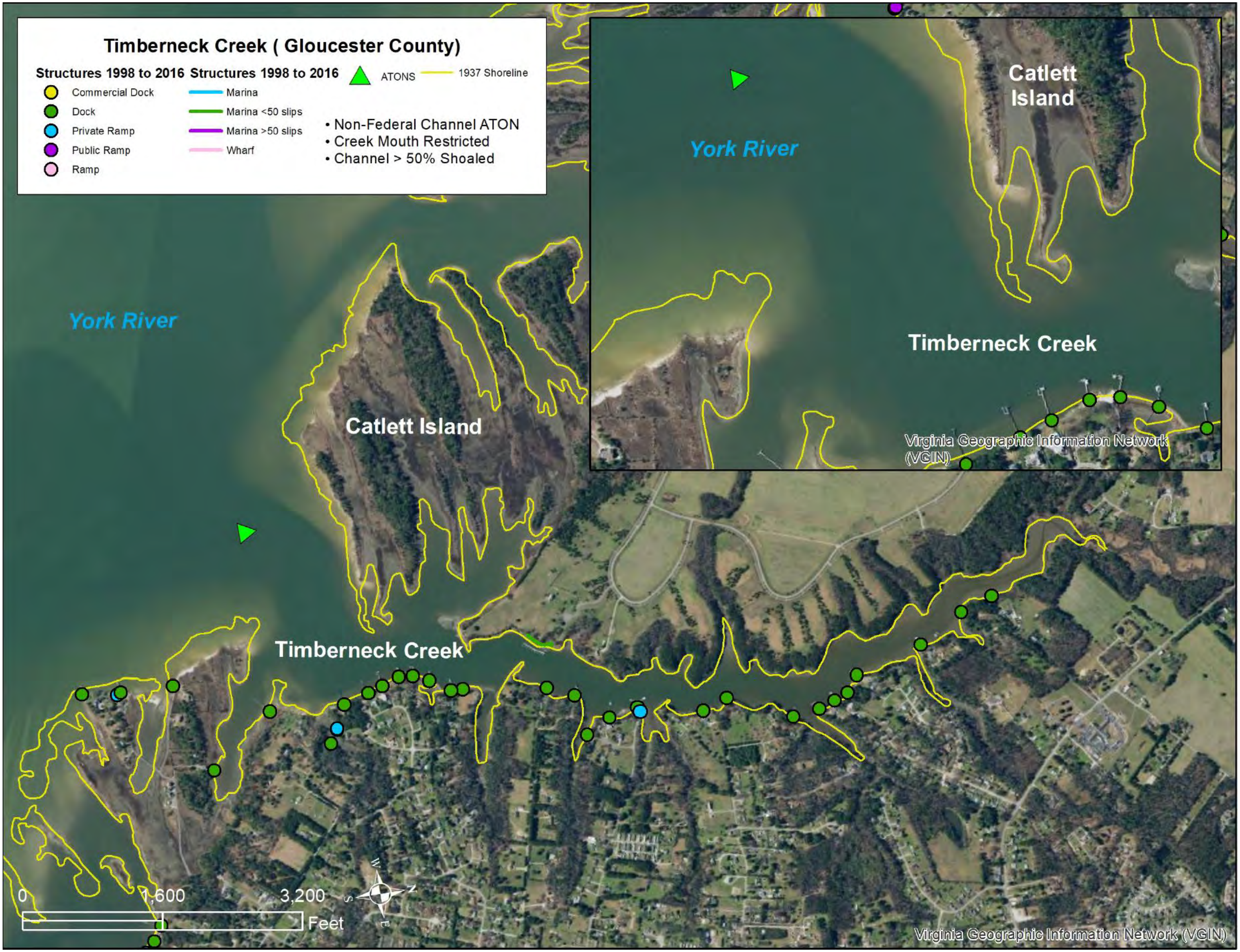
STUDY AREA

The Catlett Islands occur at the mouth of Timberneck Creek and display a ridge-and-swale geomorphology. The Islands consist of multiple parallel ridges of forested wetland hammocks, forested upland hammocks, emergent wetlands and tidal creeks surrounded by shallow subtidal areas that once supported beds of submerged aquatic vegetation. The Chesapeake Bay National Estuarine Research Reserve owns most of the islands (460 acres) except for 79 acres on the northern tip adjacent to Cedarbush Creek which is privately owned. The Islands are adjacent to the new State Park. Creek morphology is similar today as it was in 1937 with the Islands abutting the upland. The Islands have had a low to medium (-1 and -5 ft per year) erosion rate between 1937 and 2017. The interior shorelines of Timberneck have very low erosion rates. The new Machicomoco State Park occurs adjacent to the west shore of Timberneck Creek and opened during 2021. It covers 644 acres between Timberneck and Cedarbush Creeks. The Park has boat slips for users to access the site. In addition, the public Williams Landing, which is a working waterfront consisting of a public pier and boat ramp, occurs just upriver of the Park on the eastern side of the Creek. The land use of the adjacent uplands is fallow agriculture with narrow tree buffers along the west shoreline, but the eastern side of the Creek is generally more developed with waterfront homes and piers. The creek mouth is restricted and greater than 50 percent of the channel is shoaled. The average depth of the creek mouth is -2.9 feet and the maximum depth of the creek mouth is -5.4 feet. The water surface area is 202 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The dredging of Timberneck Creek is necessary to establish navigable depths sufficient to provide safe navigation for vessels utilizing the creek for commercial and recreational activities. The creek contains working waterfront infrastructure. Creating a defined channel by way of dredging which provides for safe access is needed. Timberneck Creek has 27 piers, 1 marina, and 2 boat ramps.

[12] VIMS Study Information: Creek ID Number: 107 Locality: Gloucester Water Body: York River Channel Type: Non-Federal ATON Latitude: 37.2919 Longitude: -76.5347 Number of Marinas: 1 Number of Boat Ramps: 2 Number of Piers: 27 Creek Mouth Morphology: Restricted %Shoaling of Creek: >50% of channel Tide Range (ft): 2.7 Creek Area (acres): 202 Average Depth of Creek Mouth (ft): -2.9 Maximum Depth of Creek Mouth (ft): -5.4


Timberneck Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Restricted
• Channel > 50% Shoaled
York River
Catlett Island
Timberneck Creek
Virginia Geographic Information Network (VGIN)
0
1,600
3,200
Feet
York River
Catlett Island
Timberneck Creek
Virginia Geographic Information Network (VGIN)

Sarah Creek[13]

INTRODUCTION

Sarah Creek is located in Gloucester County, Virginia. The creek has no federal authorization and has never been dredged. The mean range of tide is 2.50 feet.

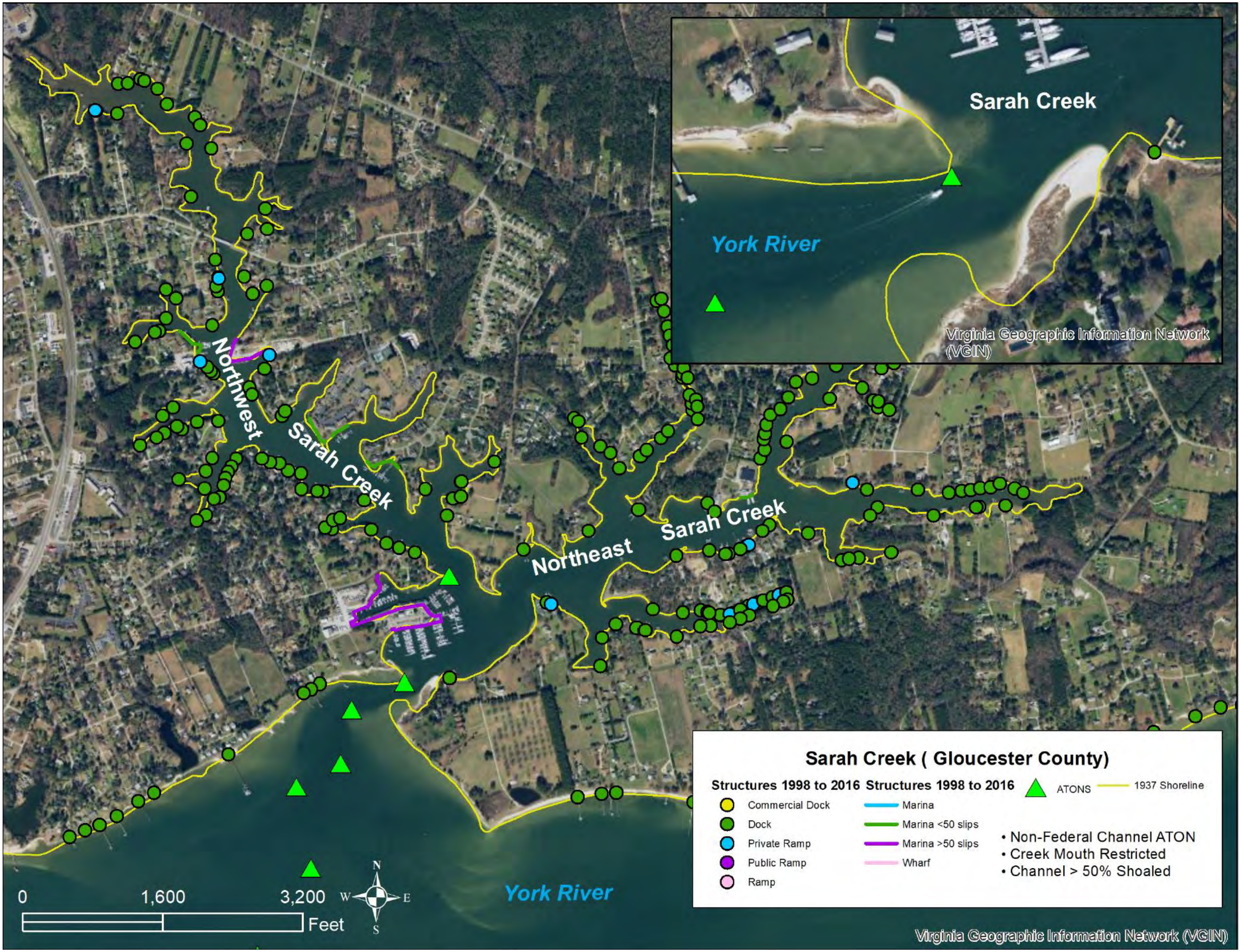
STUDY AREA

Sarah Creek is located on the York River in Gloucester County, Virginia. The creek mouth is restricted and greater than 50 percent of the channel is shoaled. The average depth of the creek mouth is -7.3 feet and the maximum depth of the creek mouth is -13.2 feet. The water surface area is 287 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The dredging of Sarah Creek is necessary to establish navigable depths sufficient to provide safe navigation for vessels utilizing the creek for commercial and recreational activities. Creating a defined channel by way of dredging which provides for safe access is needed. Sarah Creek has 213 piers, 8 marinas, and 11 boat ramps.

[13] VIMS Study Information: Creek ID Number: 106 Locality: Gloucester Water Body: York River Channel Type: Non-Federal ATON Latitude: 37.2542 Longitude: -76.4815 Number of Marinas: 8 Number of Boat Ramps: 11 Number of Piers: 213 Creek Mouth Morphology: Restricted %Shoaling of Creek: >50% of channel Tide Range (ft): 2.5 Creek Area (acres): 287 Average Depth of Creek Mouth (ft): -7.3 Maximum Depth of Creek Mouth (ft): -13.2



Sarah Creek
York River
Virginia Geographic Information Network (VGIN)
Northwest
Sarah Creek
Northeast
Sarah Creek
York River
0
1,600
3,200
Feet
N
S
E
W
Sarah Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Restricted
• Channel > 50% Shoaled
Virginia Geographic Information Network (VGIN)

Perrin River[14]

INTRODUCTION

Perrin River is located in Gloucester County, Virginia. The creek has no federal authorization and has never been dredged. The mean range of tide is 2.50 feet.

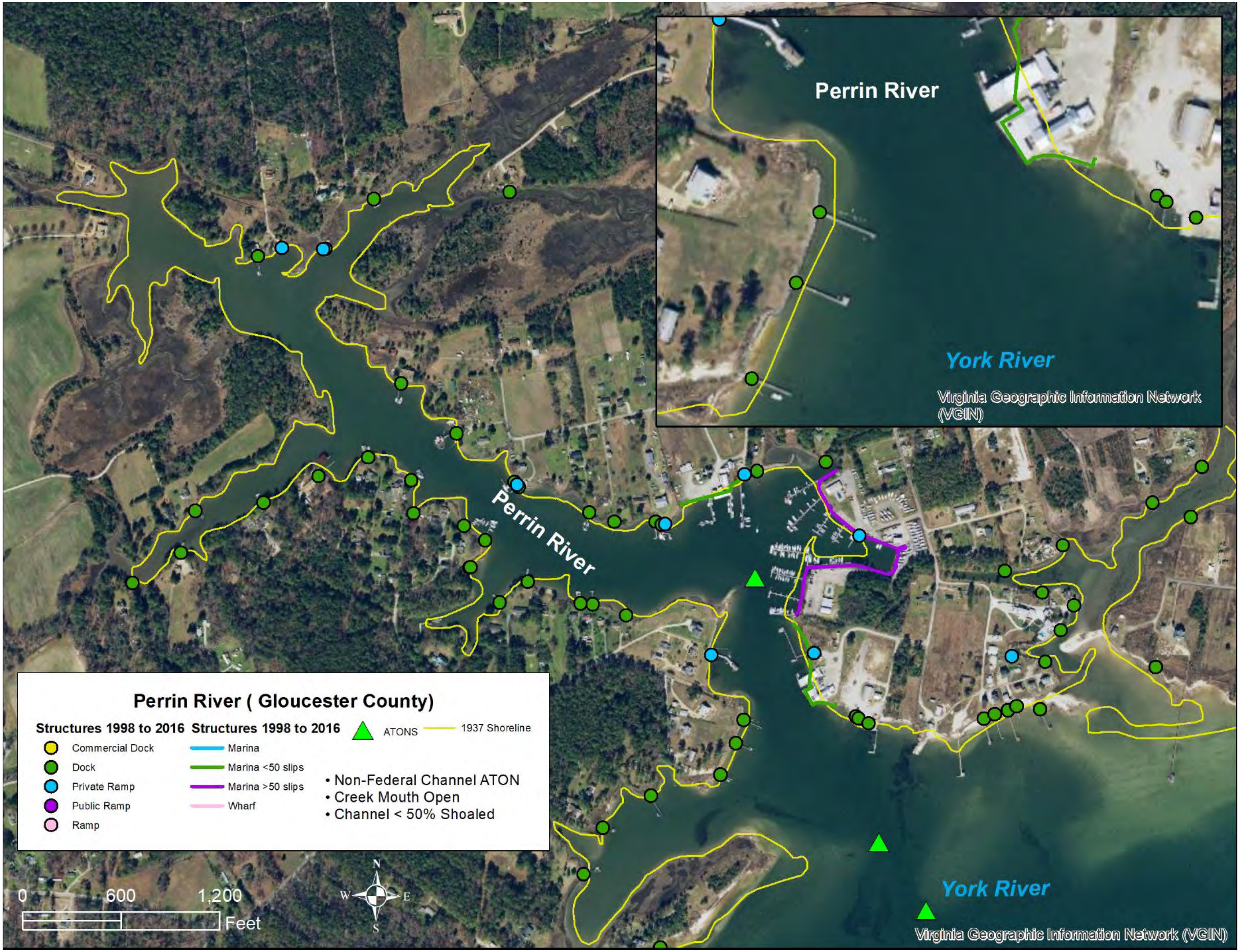
STUDY AREA

Perrin River is located on the York River in Gloucester County, Virginia. The creek mouth is open and less than 50 percent of the channel is shoaled. The average depth of the creek mouth is -5.0 feet and the maximum depth of the creek mouth is -7.7 feet. The water surface area is 94 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The dredging of Perrin River is necessary to establish navigable depths sufficient to provide safe navigation for vessels utilizing the creek for commercial and recreational activities. The creek contains working waterfront infrastructure. Creating a defined channel by way of dredging which provides for safe access is needed. Perrin River has 30 piers, 3 marinas, and 9 boat ramps. Of particular import, one of the boat ramps on the eastern branch of the Perrin River is owned and maintained by the Middle Peninsula Public Access Authority, providing public access to the river.

[14] VIMS Study Information: Creek ID Number: 105 Locality: Gloucester Water Body: York River Channel Type: Non-Federal ATON Latitude: 37.2641 Longitude: -76.4234 Number of Marinas: 3 Number of Boat Ramps: 9 Number of Piers: 30 Creek Mouth Morphology: Open %Shoaling of Creek: <50% of channel Tide Range (ft): 2.5 Creek Area (acres): 94 Average Depth of Creek Mouth (ft): -5.0 Maximum Depth of Creek Mouth (ft): -7.7



Perrin River
York River
Virginia Geographic Information Network (VGIN)
Perrin River
Perrin River (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Open
• Channel < 50% Shoaled
0
600
1,200
Feet
N
S
E
W
York River
Virginia Geographic Information Network (VGIN)

Free School Creek[15]

INTRODUCTION

Free School Creek is located in Gloucester County, Virginia. The creek has no federal authorization and has never been dredged. The US Coast Guard does not maintain aids to navigation on this creek. The mean range of tide is 2.67 feet.

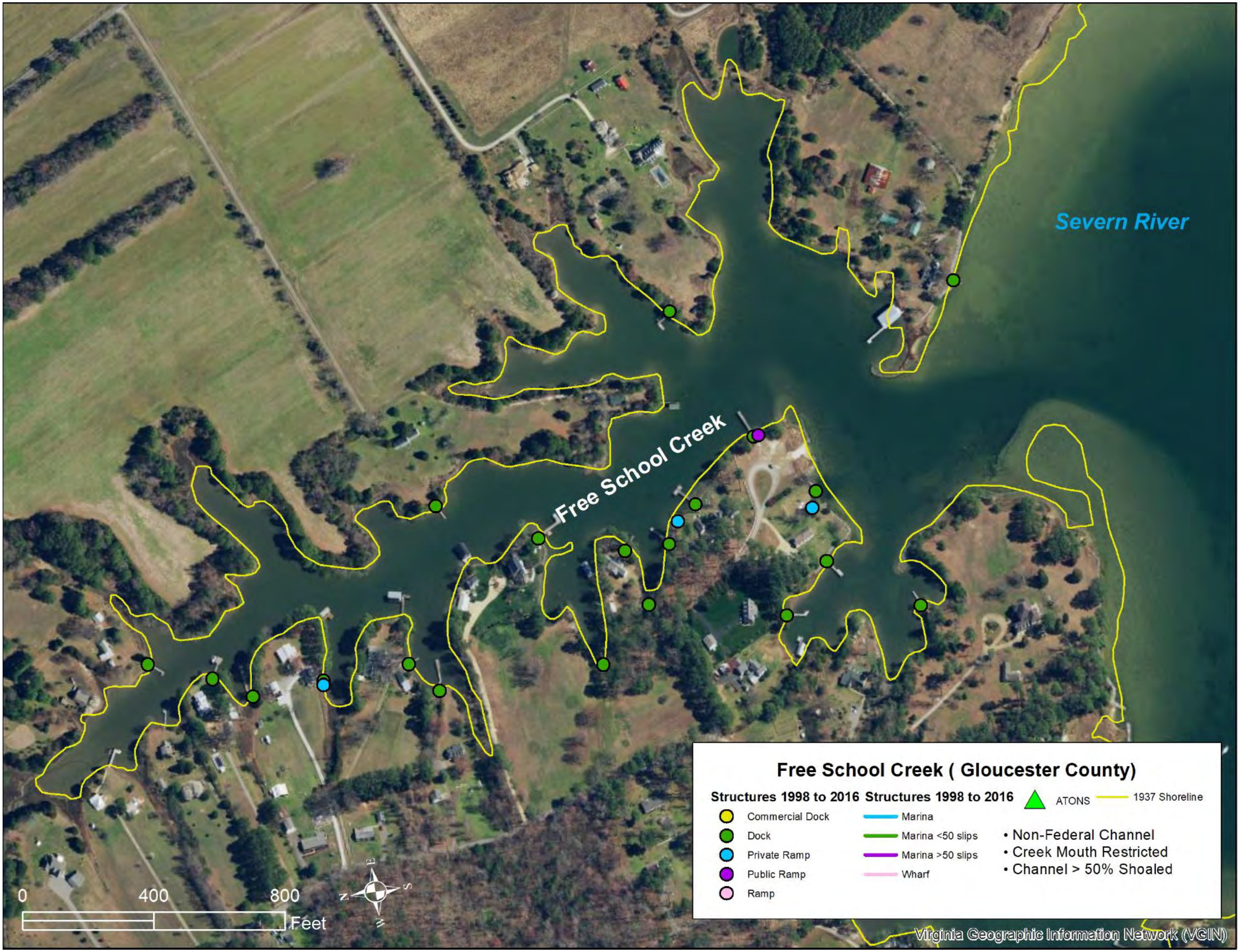
STUDY AREA

Free School Creek is located on the Severn River in Gloucester County, Virginia. The creek mouth is restricted and greater than 50 percent of the channel is shoaled. The average depth of the creek mouth is -4.5 feet and the maximum depth of the creek mouth is -6.2 feet. The water surface area is 38 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The dredging of Free School Creek is necessary to establish navigable depths sufficient to provide safe navigation for vessels utilizing the creek for commercial and recreational activities. Creating a defined channel by way of dredging which provides for safe access is needed. Free School Creek has 19 piers and 4 boat ramps.

[15] VIMS Study Information: Creek ID Number: 87 Locality: Gloucester Water Body: Severn River Channel Type: Non-Federal Latitude: 37.3308 Longitude: -76.4449 Number of Marinas: 0 Number of Boat Ramps: 4 Number of Piers: 19 Creek Mouth Morphology: Restricted %Shoaling of Creek: >50% of channel Tide Range (ft): 2.7 Creek Area (acres): 38 Average Depth of Creek Mouth (ft): -4.5 Maximum Depth of Creek Mouth (ft): -6.2



Severn River
Free School Creek
Free School Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
400
800
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Whittaker Creek[16]

INTRODUCTION

Whittaker Creek is located in Gloucester County, Virginia. The creek has no federal authorization and has never been dredged. The US Coast Guard does not maintain aids to navigation on this creek. The mean range of tide is 2.67 feet.

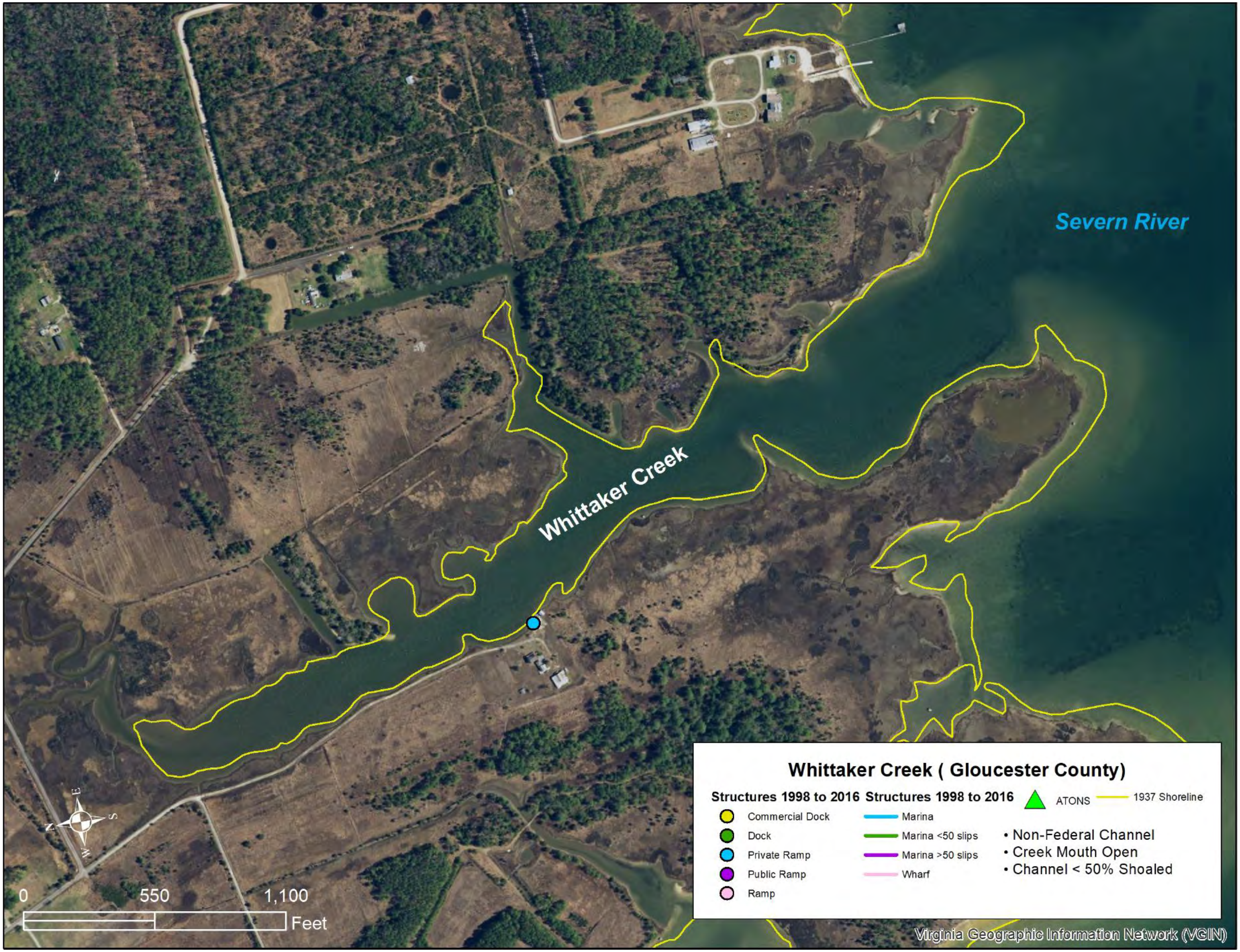
STUDY AREA

Whittaker Creek is located on the Severn River in Gloucester County, Virginia. The creek mouth is open and less than 50 percent of the channel is shoaled. The average depth of the creek mouth is -2.6 feet and the maximum depth of the creek mouth is -5.9 feet. The water surface area is 45 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The dredging of Whittaker Creek is necessary to establish navigable depths sufficient to provide safe navigation for vessels utilizing the creek for commercial and recreational activities. Creating a defined channel by way of dredging which provides for safe access is needed. Whittaker Creek has a pier and a boat ramp. Dredging is needed along the northern branch of Whittaker Creek to the main channel to provide boat access to the MPCBPAA owned and operated boat ramp.

[16] VIMS Study Information: Creek ID Number: 86 Locality: Gloucester Water Body: Severn River Channel Type: Non-Federal Latitude: 37.3234 Longitude: -76.4313 Number of Marinas: 0 Number of Boat Ramps: 1 Number of Piers: 1 Creek Mouth Morphology: Open %Shoaling of Creek: <50% of channel Tide Range (ft): 2.7 Creek Area (acres): 45 Average Depth of Creek Mouth (ft): -2.6 Maximum Depth of Creek Mouth (ft): -5.9


Severn River
Whittaker Creek
Whittaker Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
550
1,100
Feet
Virginia Geographic Information Network (VGIN)

Mill Creek 2[17]

INTRODUCTION

Mill Creek 2 is located in Mathews County, Virginia. It is named “Mill Creek 2” for the purposes of this study as there is another Mill Creek located in Middlesex County. The creek has no federal authorization and has never been dredged. The US Coast Guard does not maintain aids to navigation on this creek. The mean range of tide is 2.67 feet.

STUDY AREA

Mill Creek 2 is a tributary of the East River in Mathews County, Virginia. The creek mouth is morphology is an inlet and less than 50 percent of the channel is shoaled. The average depth of the creek mouth is -0.7 feet and the maximum depth of the creek mouth is -1.0 foot. The water surface area is 14 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

The dredging of Mill Creek 2 is necessary to establish navigable depths sufficient to provide safe navigation for vessels utilizing the creek for commercial and recreational activities. Creating a defined channel by way of dredging which provides for safe access is needed. Mill Creek 2 has 8 piers, 8 marinas, 2 boat ramps, and 1 wharf.

[17] VIMS Study Information: Creek ID Number: 63 Locality: Mathews Water Body: East River Channel Type: Non-Federal Latitude: 37.4006 Longitude: -76.3522 Number of Marinas: 0 Number of Boat Ramps: 2 Number of Piers: 8 Creek Mouth Morphology: Inlet %Shoaling of Creek: <50% of channel Tide Range (ft): 2.7 Creek Area (acres): 14 Average Depth of Creek Mouth (ft): -0.7 Maximum Depth of Creek Mouth (ft): -1.0


Mill Creek 2
East River
Virginia Geographic Information Network (VGIN)
Mill Creek 2
East River
Mill Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Channel < 50% Shoaled
N
W
E
S
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Put In Creek[18]

INTRODUCTION

Put In Creek is located entirely within Mathews County, Virginia. Mathews County is located on the Middle Peninsula of the Tidewater area in the Commonwealth of Virginia. Mathews County is bordered by Middlesex County to the north, the Piankatank River and Gloucester County to the west, and the Mobjack Bay to the south. Mathews County is about 250 square miles, of which approximately 85 square miles is land and 165 square miles is water. The study area consists of predominantly flat, low-lying terrain with many small tidal creeks and wetland areas.

This area has historically provided significant water-related economic activity associated with shipbuilding; in the early 19th century, there were at least three shipyards in Mathews County, one of which was located on Put In Creek. Due to a change in the environmental conditions associated with the decline in shipbuilding activities and other development, the creek began to silt in, which restricted locations suitable for shipbuilding. Shipbuilding is no longer an industry in the study area, but due to its close proximity to the productive fishing grounds in the Chesapeake Bay, commercial fishing and charter boat operations have continued to utilize the waterways in and around Mathews County. Recreational boaters also regularly navigate in the study area, as most of the waterways are protected.

In the New Deal era following the great depression, a channel was constructed at Put In Creek by the Civil Works Administration (CWA). In 1934, a channel 30 feet wide and seven feet deep was completed from a point near the Methodist parsonage at the terminus to the deeper waters of the Put In Creek channel. Due to the high cost of building projects such as Put In Creek, the CWA program only lasted five months before ending. Because no additional funding was allocated for projects under construction by the CWA after the program ended, very little has been done to maintain a channel at Put In Creek since the initial project was constructed in 1934. The mean range of tide is 2.7 feet.

STUDY AREA

Put In Creek lies approximately 80 miles east of Richmond and 155 miles southeast of Washington, DC. Put In Creek is a tributary of the East River, which flows into the Mobjack Bay, a tributary of the Chesapeake Bay. The Creek is 2 miles long with depths ranging from 10 feet mean lower low water (MLLW) at the downstream end near the East River to less than 1foot (MLLW) at the upstream terminus near the County's courthouse and public dock. Starting at the mouth where it meets the East River, the lower half of Put In Creek has controlling depth ranging from 10 to 5 feet (MLLW), but the controlling depth rapidly declines upstream from that point. The creek mouth is open and there is no visible shoaling. The average depth of the creek mouth is -6.3 feet and the maximum depth of the creek mouth is -11.9 feet. The water surface area is 130 acres.

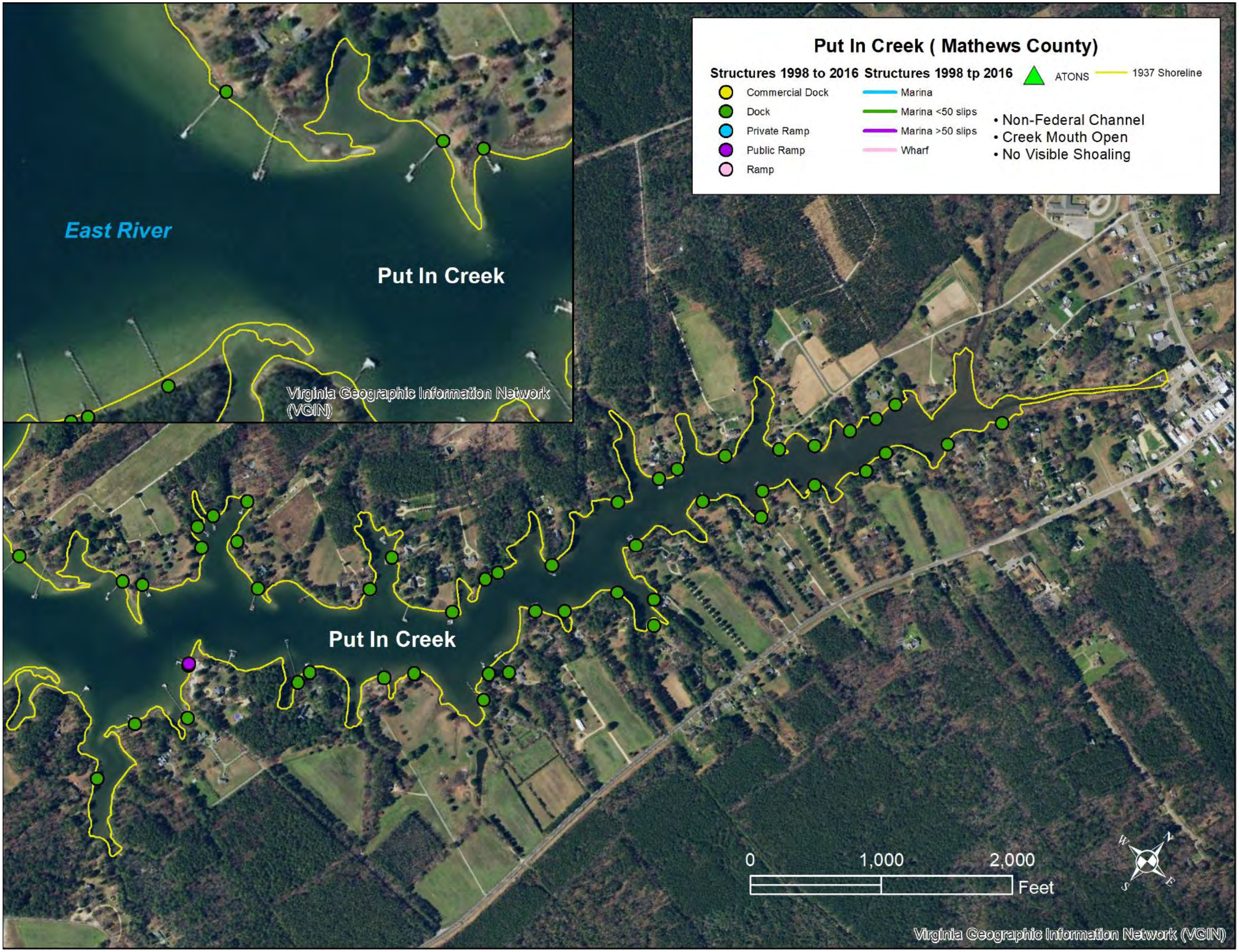
PROBLEMS, NEEDS, AND OPPORTUNITIES

The mouth of Put In Creek opens into the East River which flows into the Mobjack Bay, which then flows into the Chesapeake Bay, a preferred fishing and crabbing area of Virginia. Locals report year-round catch in this location consisting of a variety of finfish and shellfish species. Because a channel

[18] VIMS Study Information: Creek ID Number: 60 Locality: Mathews Water Body: East River Channel Type: Non-Federal Latitude: 37.4140 Longitude: -76.3412 Number of Marinas: 0 Number of Boat Ramps: 1 Number of Piers: 48 Creek Mouth Morphology: Open %Shoaling of Creek: No Visible Shoaling Tide Range (ft): 2.7 Creek Area (acres): 130 Average Depth of Creek Mouth (ft): -6.3 Maximum Depth of Creek Mouth (ft): -11.9

has not been maintained at Put In Creek for approximately 87 years, commercial watermen and recreational boaters are no longer able to freely access the channel. Shoaling has seriously limited existing operations and restricted the commercial fishing industry and recreational boating. The existing commercial vessels and pleasure boats are experiencing difficulty navigating the natural watercourse.

There are not any fish houses, harbors, or marine suppliers located on Put In Creek, so most commercial fishermen offload/sell their catch and dock their boats in shore facilities located on other waterways near the study area. VDGIF maintains a public boat ramp in the East River directly adjacent to the mouth of Put In Creek. Both recreational and small commercial boats utilize the ramp. At the end of Put In Creek, where the historic downtown portion of Mathews County is located, there is a small, wooden public dock. Put In Creek has 48 piers and 1 boat ramp.



Put In Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
East River
Put In Creek
Virginia Geographic Information Network (VGIN)
Put In Creek
0
1,000
2,000
Feet
Virginia Geographic Information Network (VGIN)

Davis Creek[19]

INTRODUCTION

Davis Creek is an existing federal navigation channel which was constructed under authority of the River and Harbor Act of 17 May 1950, as amended. The existing authorized federal project consists of a channel 10 feet deep and 80 feet wide, extending from the 10-foot contour in Mobjack Bay into the western arm of Davis Creek to a point near the existing public landing, a distance of approximately 4,130 feet, and an anchorage and turning basin opposite the public landing 10 feet deep, 165 feet to 230 feet wide and 720 feet long. The channel, anchorage, and turning basin were last dredged by USACE in 1971. The mean range of tide is 2.34 feet.

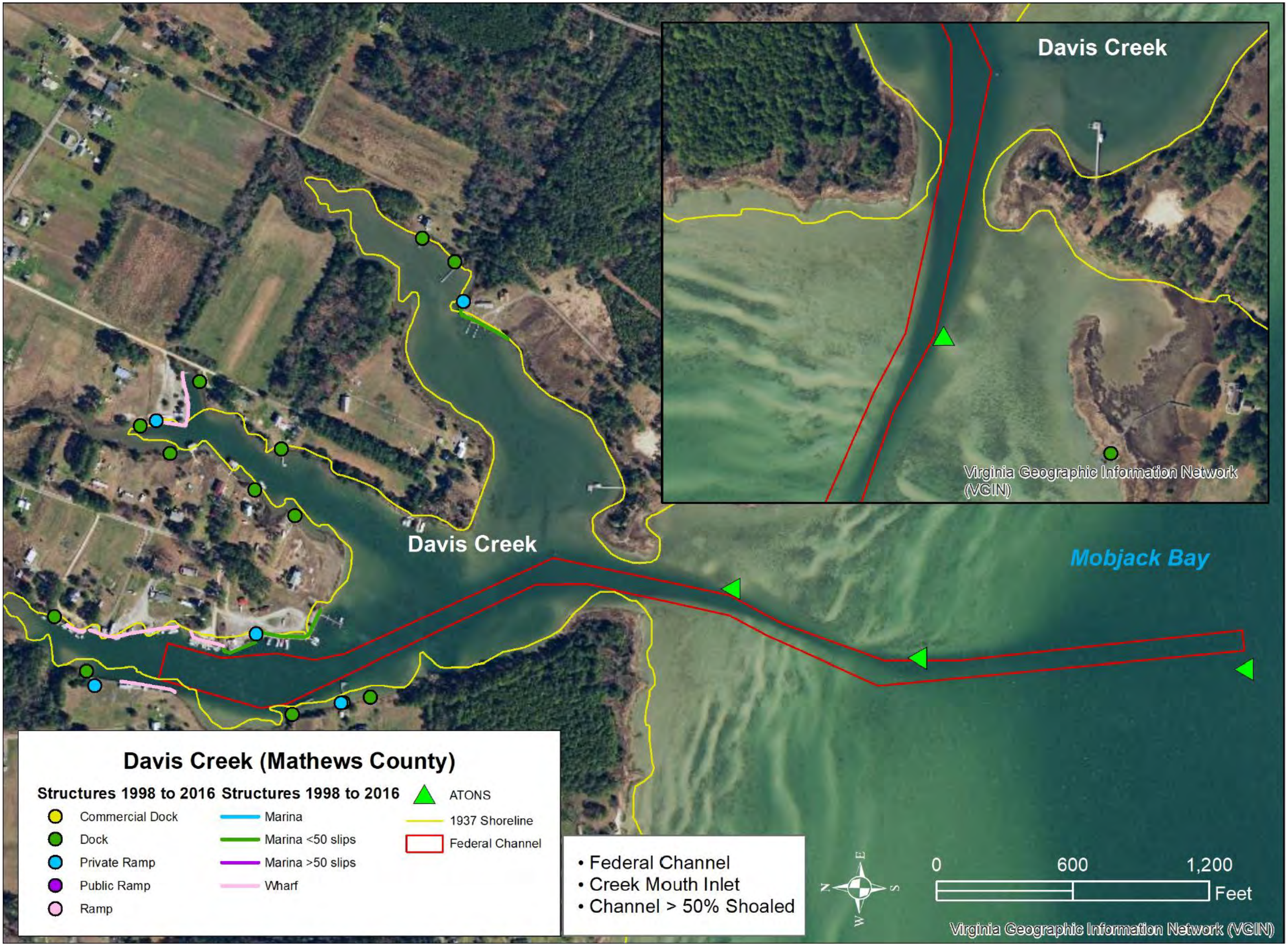
STUDY AREA

Davis Creek is located in Mathews County, Virginia and empties into Mobjack Bay, a small bay in the lower Chesapeake Bay. The creek has a narrow mouth that splits into three prongs. The eastern prong is shortest at 2,200 ft from the mouth, and the western prong is the longest extending about 3,000 ft from the mouth. The Marina on Davis Creek occurs on this prong. Land use adjacent to the creek is mostly residential with some agriculture and wooded properties. The headwaters do not have extensive marsh. Instead the creek terminates soon after the channel narrows at the headwaters. The creek mouth morphology contains an inlet and greater than 50 percent of the channel is shoaled. The average depth of the creek mouth is -2.6 feet and the maximum depth of the creek mouth is -3.6 feet. The water surface area is 49 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Today, the nearshore has sand shoals and submerged aquatic vegetation. A flood shoal occurs just inside the creek. The narrow mouth, though, has widened over time. In 1937, the mouth was 147 ft wide, but in 2017, it was 255 ft wide. East of the creek, where the material was placed in the nearshore along the adjacent shoreline in 1956, new land has been created. The 2017 shoreline was about 900 ft in front of the 1937 shoreline. The center part of the disposal site is relatively high and several houses have since been constructed on it. On either end, extensive marshes have been created. However, the natural trend along this shoreline is very low to low erosion (0 to -2 ft/yr). Davis Creek has 13 piers, 2 marinas, 5 boat ramps, and 5 wharves.

[19] VIMS Study Information: Creek ID Number: 52 Locality: Mathews Water Body: Mobjack Bay Channel Type: Federal Latitude: 37.3276 Longitude: -76.2985 Number of Marinas: 2 Number of Boat Ramps: 5 Number of Piers: 13 Creek Mouth Morphology: Inlet %Shoaling of Creek: >50% of channel Tide Range (ft): 2.3 Creek Area (acres): 49 Average Depth of Creek Mouth (ft): -2.6 Maximum Depth of Creek Mouth (ft): -3.6



Davis Creek
Davis Creek
Mobjack Bay
Virginia Geographic Information Network (VGIN)
Davis Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Inlet
• Channel > 50% Shoaled
N
E
S
W
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Horn Harbor[20]

INTRODUCTION

Horn Harbor is an existing federal navigation channel which was constructed under authority of the River and Harbor Act of July 3, 1930 as modified by the River and Harbor Act of 1935. The authorized channel is 7 feet deep at mean low water and 100 feet wide across the entrance bar. The channel was last dredged by the USACE in 2003. The mean range of tide is 1.84 feet.

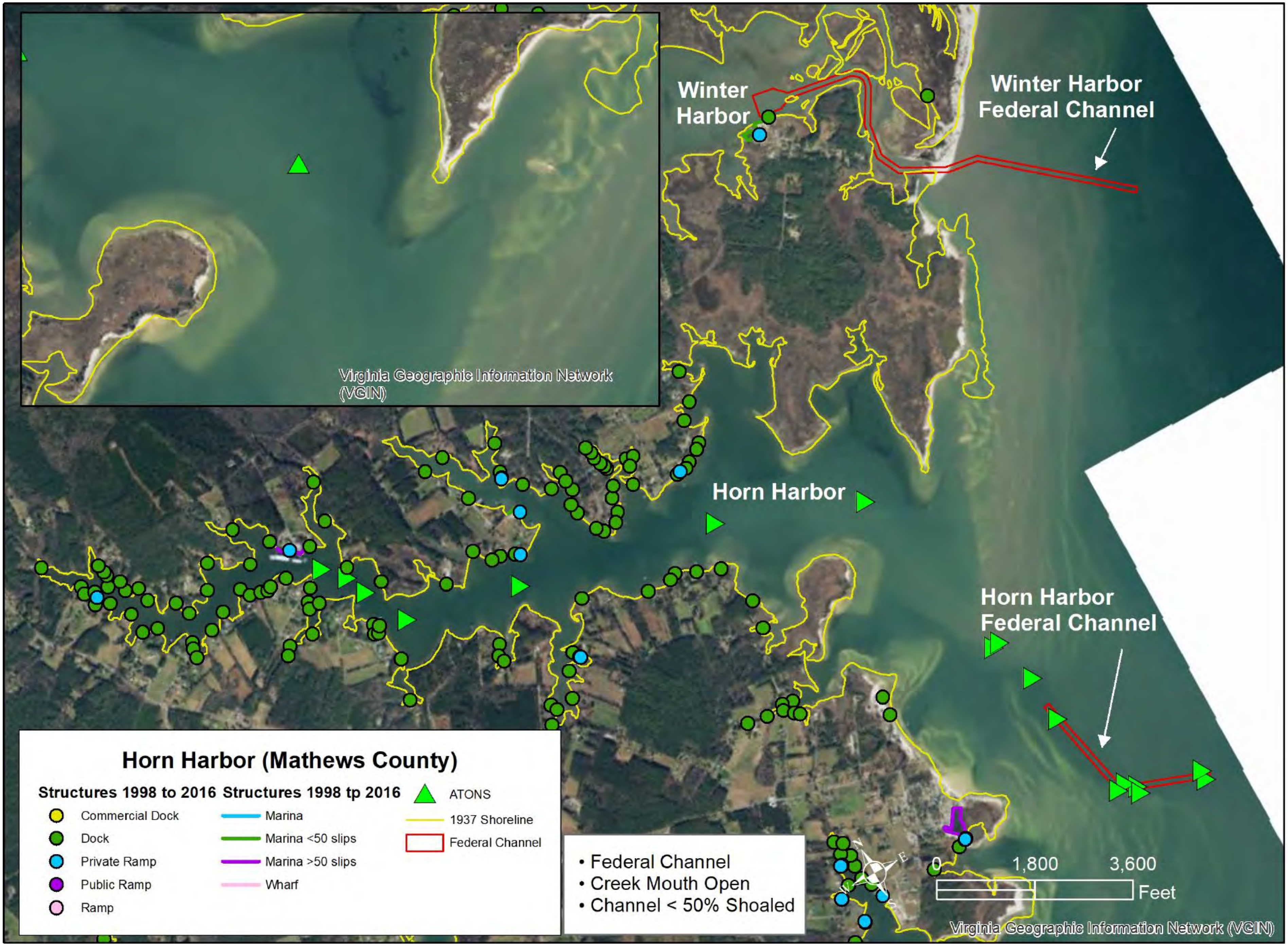
STUDY AREA

Horn Harbor is a tributary of Ingram Bay in Mathews County, Virginia. The creek mouth is open and less than 50 percent of the channel is shoaled. The average depth of the creek mouth is -5.2 feet and the maximum depth of the creek mouth is -8.2 feet. The water surface area is 745 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Maintenance dredging of Horn Harbor is necessary to re-establish the authorized navigable depths to provide safe navigation for vessels utilizing the working waterfront located on the creek. Horn Harbor has 113 piers, 3 marinas, and 7 boat ramps.

[20] VIMS Study Information: Creek ID Number: 49 Locality: Mathews Water Body: Chesapeake Bay Channel Type: Federal Latitude: 37.3486 Longitude: -76.2671 Number of Marinas: 3 Number of Boat Ramps: 7 Number of Piers: 113 Creek Mouth Morphology: Open %Shoaling of Creek: <50% of channel Tide Range (ft): 1.8 Creek Area (acres): 745 Average Depth of Creek Mouth (ft): -5.2 Maximum Depth of Creek Mouth (ft): -8.2



Winter Harbor
Winter Harbor Federal Channel
Horn Harbor
Horn Harbor Federal Channel
Virginia Geographic Information Network (VGIN)
Horn Harbor (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
1,800
3,600
Feet
Virginia Geographic Information Network (VGIN)

Winter Harbor[21]

INTRODUCTION

Winter Harbor is an existing federal navigation channel which was constructed under authority of the River and Harbor Act of May 17, 1950, as amended. The authorized channel is 12 feet deep and 100 feet wide, extending from the 12-foot contour in the Chesapeake Bay into Winter Harbor to a point just east of the public landing area, a distance of approximately 7,600 feet and a mooring and turning basin opposite the public landing 12 feet deep and 440 feet square, with a flare entrance 300 feet long. The channel and mooring/turning basin were last dredged by the USACE in 2009-2010. The mean range of tide is 1.70 feet.

STUDY AREA

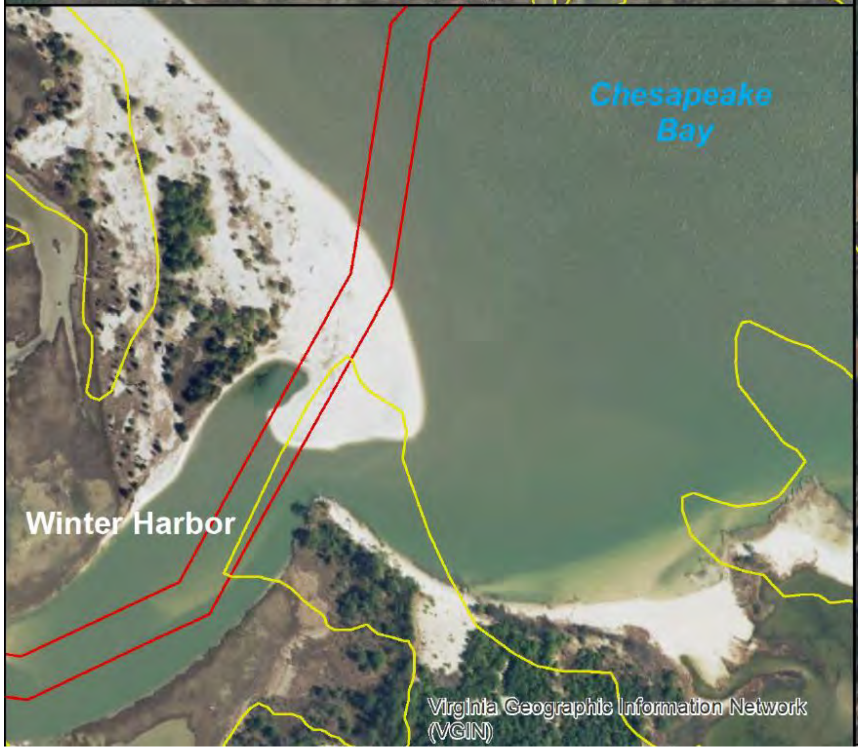
Winter Harbor is a tributary of the Chesapeake Bay in Mathews County, Virginia. The creek mouth morphology is an inlet and greater than 50 percent of the channel is shoaled. The maximum depth of the creek mouth is -2.1 feet. The water surface area is 916 acres.

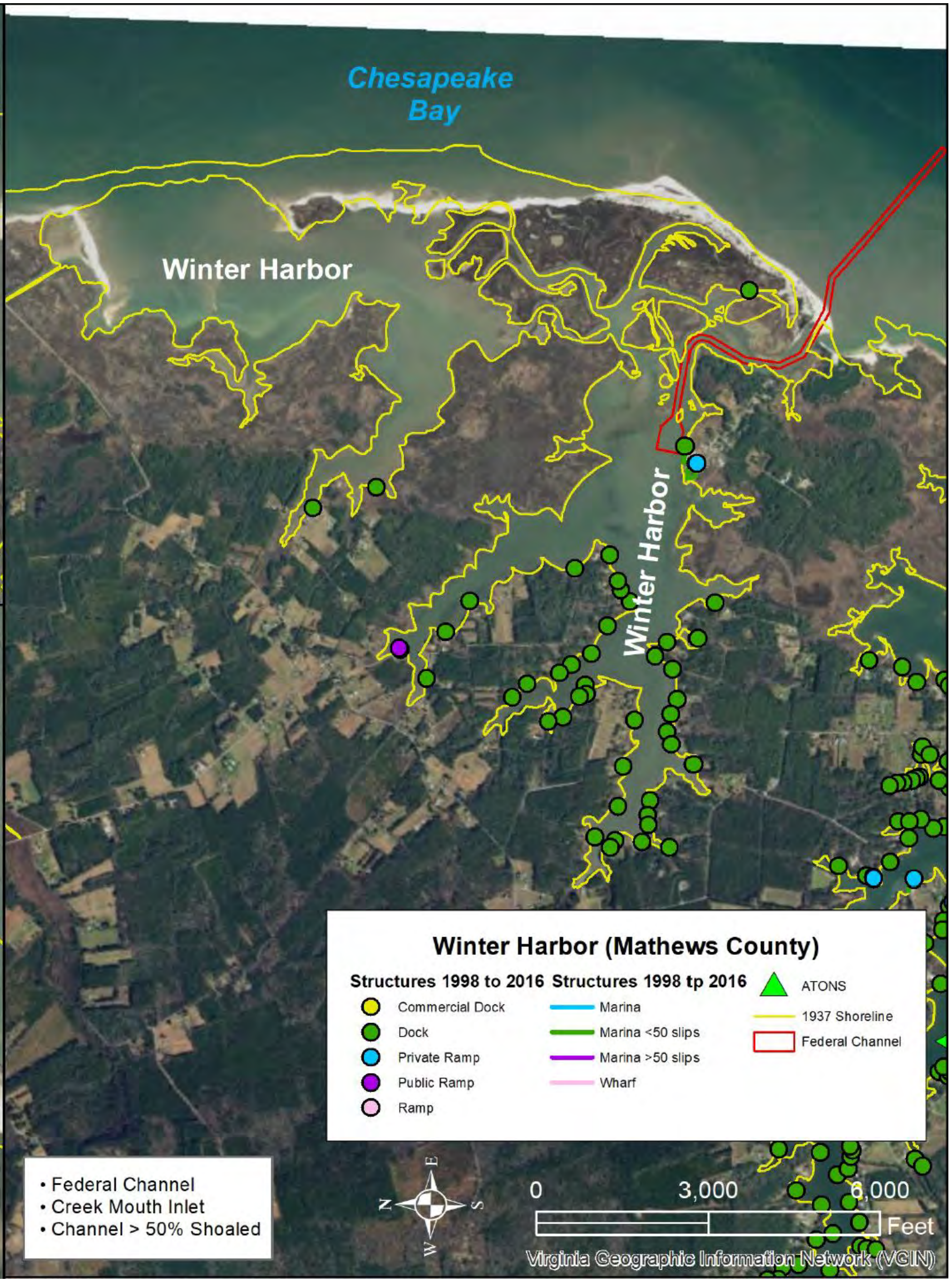
PROBLEMS, NEEDS, AND OPPORTUNITIES

Maintenance dredging of Winter Harbor is necessary to re-establish the authorized navigable depths to provide safe navigation for vessels utilizing the working waterfront located on the creek. Winter Harbor has 44 piers, 1 marina, and 2 boat ramps.

[21] VIMS Study Information: Creek ID Number: 48 Locality: Mathews Water Body: Chesapkeake Bay Channel Type: Federal Latitude: 37.3707 Longitude: -76.2559 Number of Marinas: 2 Number of Boat Ramps: 2 Number of Piers: 42 Creek Mouth Morphology: Inlet %Shoaling of Creek: >50% of channel Tide Range (ft): 1.7 Creek Area (acres): 0 Average Depth of Creek Mouth (ft): N/A Maximum Depth of Creek Mouth (ft): -2.1


Chesapeake Bay
Winter Harbor
Virginia Geographic Information Network (VGIN)


Chesapeake Bay
Winter Harbor
Virginia Geographic Information Network (VGIN)


Chesapeake Bay
Winter Harbor
Winter Harbor
Winter Harbor (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Inlet
• Channel > 50% Shoaled
0
3,000
6,000
Feet
Virginia Geographic Information Network (VGIN)

Hole in the Wall[22]

INTRODUCTION

Hole in the Wall once provided easy access to the Chesapeake Bay for commercial fishing vessels as well as for recreation. In addition, the U.S. Coast Guard Station at Milford Haven uses this open channel to reach calls or conduct maintenance out of Gwynn Island more easily and quickly. The creek has no federal authorization and has never been dredged. The mean range of tide is 1.10 feet.

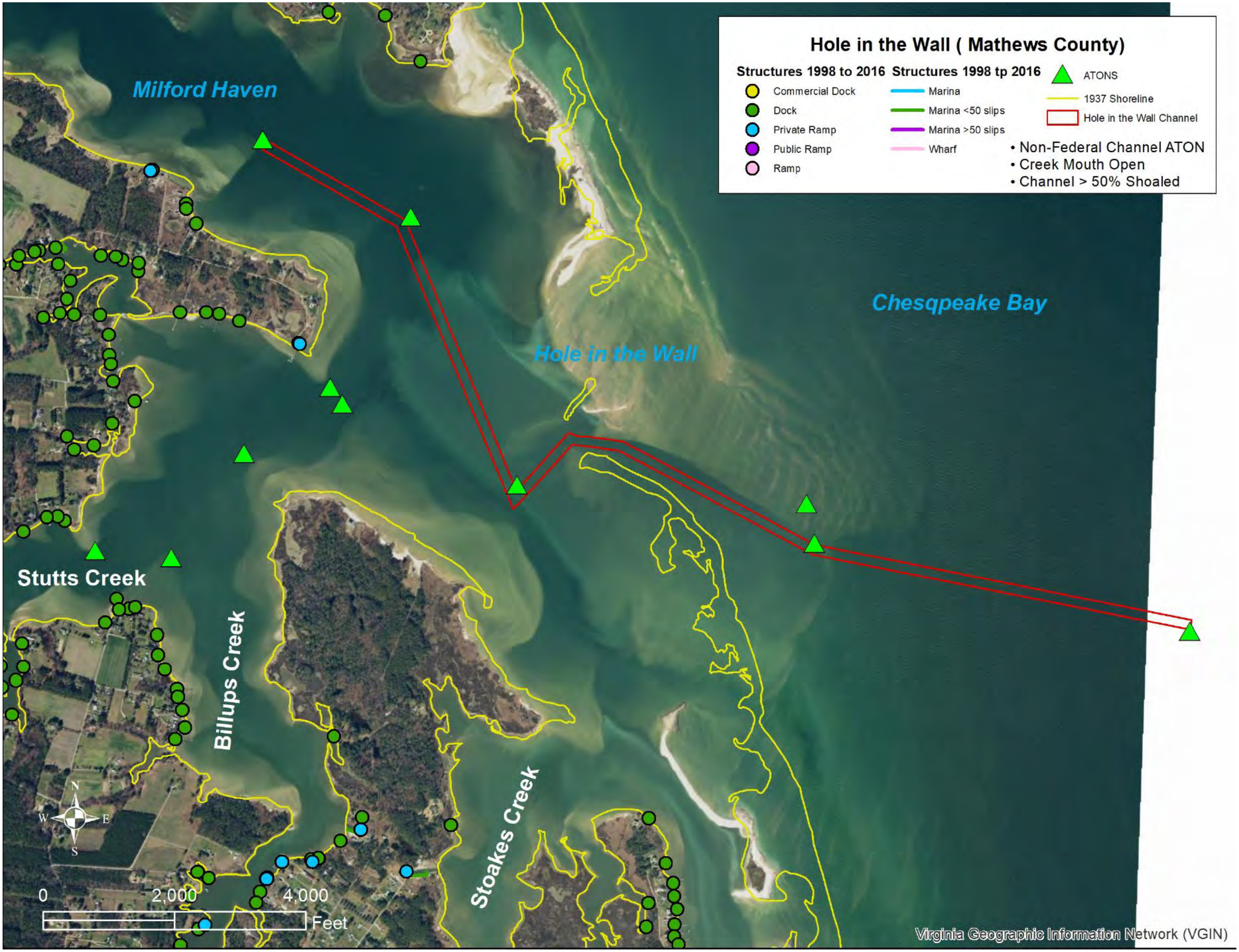
STUDY AREA

Hole in the Wall is a tributary of the Chesapeake Bay in Mathews County, Virginia. It is located between the fetch-limited barrier islands that provide access from the Chesapeake Bay to Milford Haven and Gwynn Island a natural channel. Today, Milford Haven is known for having significant working waterfront facilities and infrastructure, and as mentioned earlier contains the U.S. Coast Guard Station. It is not a federal navigation channel and has never been dredged but it is marked with aids to navigation. The creek mouth is open and greater than 50 percent of the channel is shoaling.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Hole in the Wall is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Narrowing of the channel in some sections makes it difficult for ingress and egress of vessels to Milford Haven through the Hole in the Wall.

[22] VIMS Study Information: Creek ID Number: 43 Locality: Mathews Water Body: Chesapeake Bay/Milford Haven Channel Type: Non-Federal ATON Latitude: 37.4681 Longitude: -76.2648 Number of Marinas: 0 Number of Boat Ramps: 0 Number of Piers: 0 Creek Mouth Morphology: Open %Shoaling of Creek: >50% of channel Tide Range (ft): 1.1 Creek Area (acres): 0 Average Depth of Creek Mouth (ft): N/A Maximum Depth of Creek Mouth (ft): N/A


Hole in the Wall (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Hole in the Wall Channel
• Non-Federal Channel ATON
• Creek Mouth Open
• Channel > 50% Shoaled
Milford Haven
Chesqpeake Bay
Hole in the Wall
Stutts Creek
Billups Creek
Stoakes Creek
N
S
W
E
0
2,000
4,000
Feet
Virginia Geographic Information Network (VGIN)

Queens Creek[23]

INTRODUCTION

Queens Creek is an existing federal navigation channel which was constructed under authority of Section 107 of the River and Harbor Act of 1960, as amended. The authorized channel is 6 feet deep, 60 feet wide and 4,100 feet long extending from that depth in Hills Bay to Queens Creek to a turning basin of the same depth 200 feet wide and 400 feet long. The channel was last dredged by the USACE in 2019. The mean range of tide is 1.34 feet.

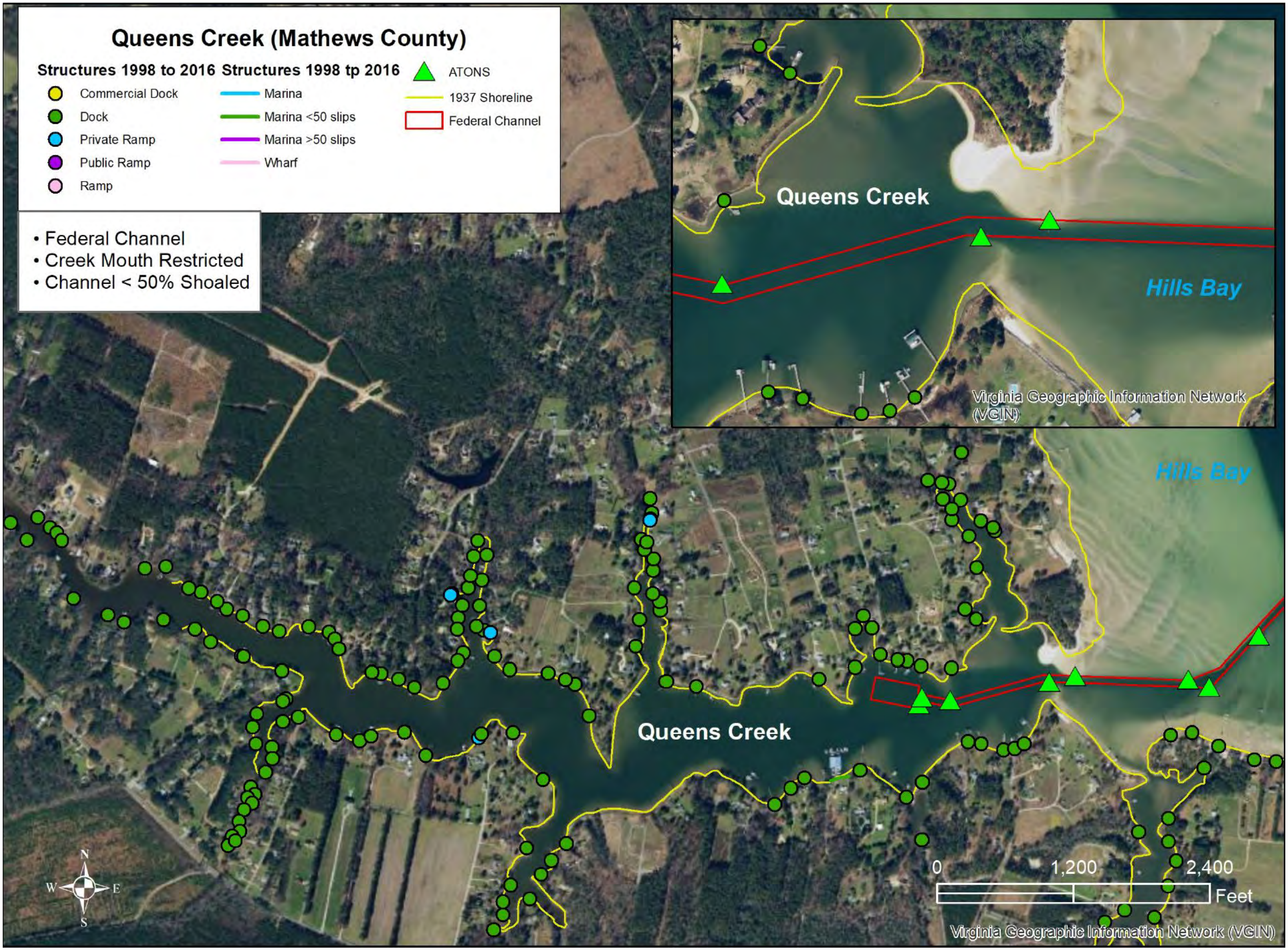
STUDY AREA

Queens Creek is a tributary of the Chesapeake Bay in Mathews County, Virginia. The creek mouth is restricted and less than 50 percent of the channel is shoaled. The average depth of the creek mouth is -6.3 feet and the maximum depth of the creek mouth is -9.9 feet. The water surface area is 188 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Queens Creek is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Queens Creek has 145 piers, 1 marina, and 4 boat ramps.

[23] VIMS Study Information: Creek ID Number: 34 Locality: Mathews Water Body: Piankatank River Channel Type: Federal Latitude: 37.4873 Longitude: -76.3289 Number of Marinas: 1 Number of Boat Ramps: 4 Number of Piers: 145 Creek Mouth Morphology: Restricted %Shoaling of Creek: <50% of channel Tide Range (ft): 1.3 Creek Area (acres): 188 Average Depth of Creek Mouth (ft): -6.3 Maximum Depth of Creek Mouth (ft): -9.9


Queens Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
Queens Creek
Hills Bay
Virginia Geographic Information Network (VGIN)
Queens Creek
Hills Bay
0
1,200
2,400
Feet
Virginia Geographic Information Network (VGIN)
N
S
E
W

Milford Haven[24]

INTRODUCTION

Milford Haven is an existing federal navigation channel which was constructed under authority of the River and Harbor Act of March 3, 1899, as amended by the River and Harbor Act of June 6, 1900. The authorized channel is 10 feet deep and 200 feet wide from the Piankatank River through the northwest entrance and between Cricket Hill and Callis Wharf with construction of a stone jetty 1,183 feet long at the northwest entrance. The channel was last dredged by the USACE in 1936. The mean range of tide is 1.34 feet.

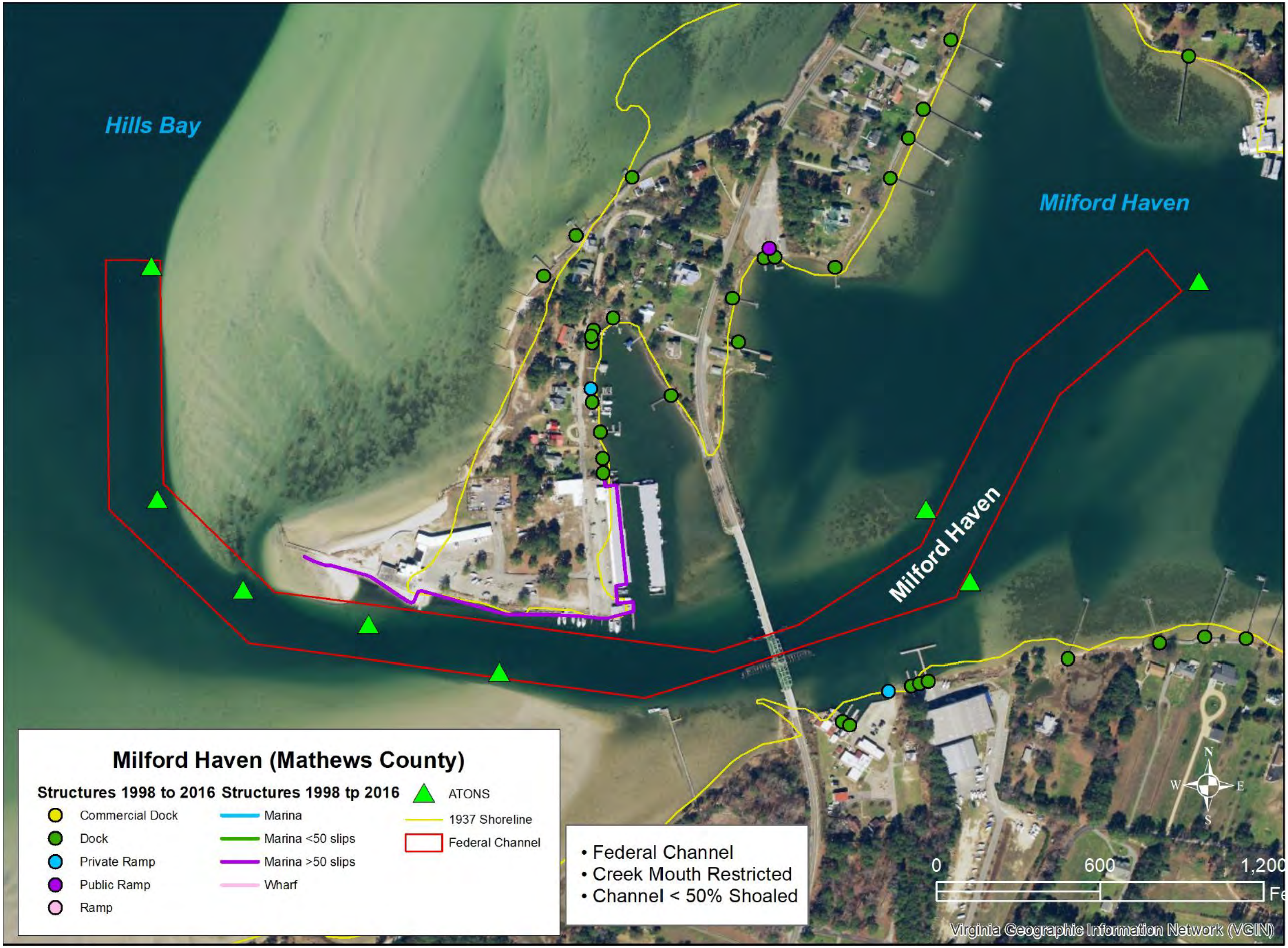
STUDY AREA

Milford Haven is a tributary of the Chesapeake Bay in Mathews County, Virginia. The creek mouth is restricted and less than 50 percent of the channel is shoaled. The water surface area is 23 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Milford Haven is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Milford Haven has a marina and many piers.

[24] VIMS Study Information: Creek ID Number: 36 Locality: Mathews Water Body: Piankatank River/Milford Haven Channel Type: Federal Latitude: 37.4884 Longitude: -76.3117 Number of Marinas: 1 Number of Boat Ramps: 0 Number of Piers: 0 Creek Mouth Morphology: Restricted %Shoaling of Creek: <50% of channel Tide Range (ft): 1.3 Creek Area (acres): 23 Average Depth of Creek Mouth (ft): N/A Maximum Depth of Creek Mouth (ft): N/A


Hills Bay
Milford Haven
Milford Haven
Milford Haven (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
600
1,200
N
W
E
S
Virginia Geographic Information Network (VGIN)

Broad Creek[25]

INTRODUCTION

Broad Creek is an existing federal navigation channel which was constructed under authority of the River and Harbor Act of March 2, 1945, as amended. The channel is authorized 7 feet deep and 100 feet wide from deep water in the Rappahannock River to deep water in Broad Creek, a distance of 4,100 feet. The channel was last dredged by the USACE in 2010. The mean range of tide is 1.34 feet.

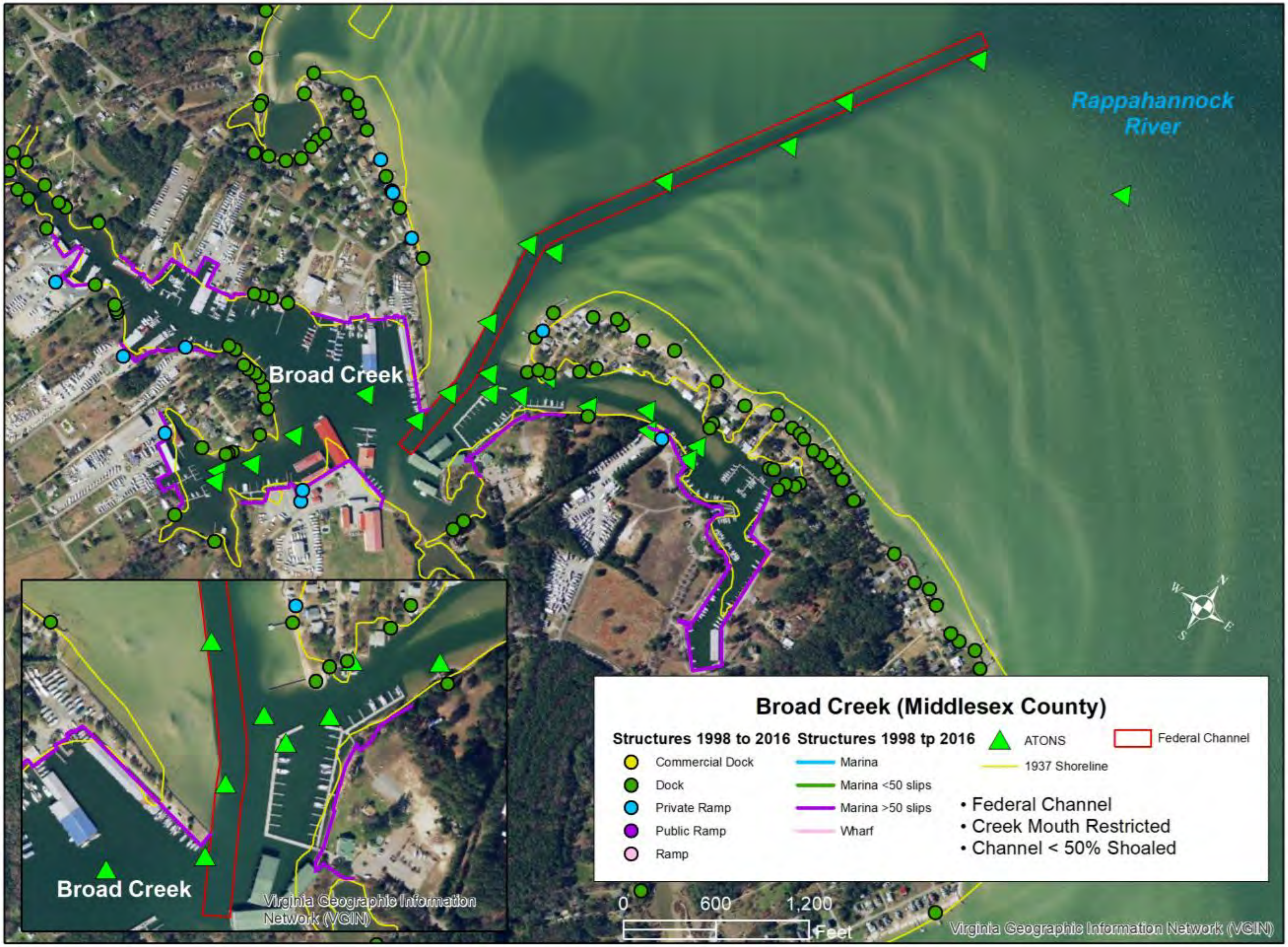
STUDY AREA

Broad Creek is a tributary of the Chesapeake Bay in Middlesex County, Virginia. The creek mouth is restricted and less than 50 percent of the channel is shoaled. The average depth of the creek mouth is -6.2 feet and the maximum depth of the creek mouth is -7.9 feet. The water surface area is 79 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Broad Creek is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Broad Creek has 50 piers, 8 marinas, and 7 boat ramps.

[25] VIMS Study Information: Creek ID Number: 21 Locality: Middlesex Water Body: Rappahannock River Channel Type: Federal Latitude: 37.5604 Longitude: -76.3134 Number of Marinas: 8 Number of Boat Ramps: 7 Number of Piers: 50 Creek Mouth Morphology: Restricted %Shoaling of Creek: <50% of channel Tide Range (ft): 1.3 Creek Area (acres): 79 Average Depth of Creek Mouth (ft): -6.2 Maximum Depth of Creek Mouth (ft): -7.9


Rappahannock River
Broad Creek
Broad Creek
Virginia Geographic Information Network (VGIN)
Broad Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
Federal Channel
1937 Shoreline
• Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Bush Park Creek[26]

INTRODUCTION

Bush Park Creek is located in Middlesex County, Virginia. The creek has no federal authorization, but according to USACE data 1,400-2,000 cubic yards from the creek mouth may have been dredged according to Section 10 and Section 404 authority RP-2 and RP-19 permits issued in 2016. More complete data is required to determine historical dredging efforts. The mean range of tide is 1.34 feet. The US Coast Guard does not maintain aids to navigation on this creek.

STUDY AREA

Bush Park Creek is a tributary of the Chesapeake Bay in Middlesex County, Virginia. The creek mouth is an inlet and the channel is completely shoaled. The average depth of the creek mouth is -0.3 feet and the maximum depth of the creek mouth is -0.3 feet. The water surface area is 77 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Bush Park Creek is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Creating a defined channel by way of dredging which provides for safe access is needed. Bush Park Creek has 38 piers, 5 marinas, and 4 boat ramps.

[26] VIMS Study Information: Creek ID Number: 17 Locality: Middlesex Water Body: Rappahannock River Channel Type: Non-Federal Latitude: 37.5734 Longitude: -76.3849 Number of Marinas: 5 Number of Boat Ramps: 4 Number of Piers: 38 Creek Mouth Morphology: Inlet %Shoaling of Creek: Completely shoaled Tide Range (ft): 1.3 Creek Area (acres): 77 Average Depth of Creek Mouth (ft): -0.3 Maximum Depth of Creek Mouth (ft): -0.3


Rappahannock River
Bush Park Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Bush Park Creek
Bush Park Creek (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Inlet
• Channel Completely Shoaled
0
700
1,400
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Mill Creek[27]

INTRODUCTION

Mill Creek is an existing federal navigation channel which was constructed under authority of the River and Harbor Act of August 30, 1935, as amended. The channel is authorized 8 feet deep, 80 feet wide and 2,200 feet long from the 8 foot contour in the Chesapeake Bay straight through the mouth to a 120-foot wide turning basin inside the creek. The channel and turning basin were last dredged by the USACE in 1936. The mean range of tide is 1.34 feet.

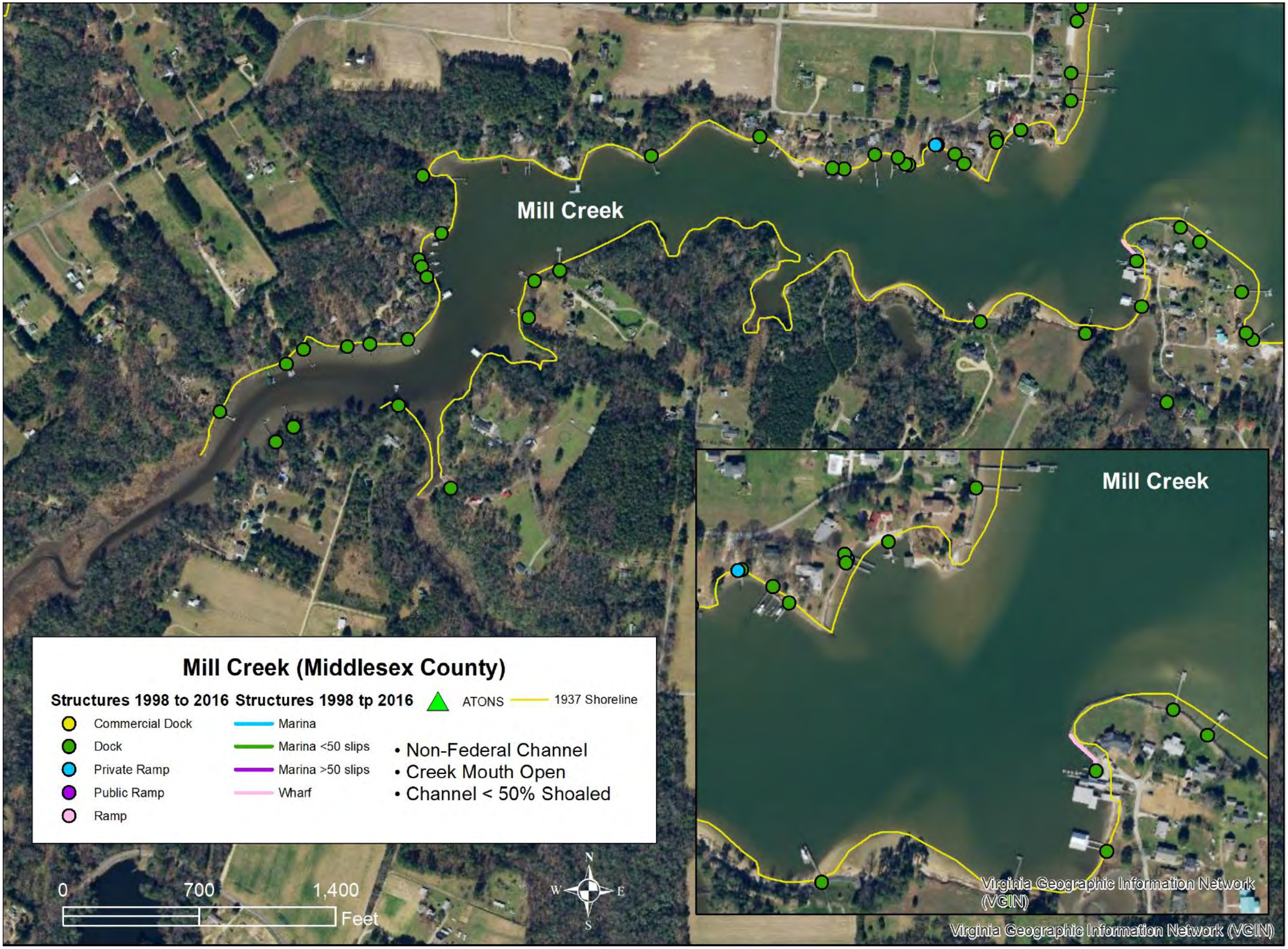
STUDY AREA

Mill Creek is a tributary of the Chesapeake Bay in Middlesex County, Virginia. The creek mouth is open and less than 50 percent of the channel is shoaled. The average depth of the creek mouth is -2.7 feet and the maximum depth of the creek mouth is -4.8 feet. The water surface area is 75 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Mill Creek is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Mill Creek has 37 piers, 2 boat ramps, and a wharf.

[27] VIMS Study Information: Creek ID Number: 16 Locality: Middlesex Water Body: Rappahannock River Channel Type: Non-Federal Latitude: 37.5863 Longitude: -76.4280 Number of Marinas: 0 Number of Boat Ramps: 2 Number of Piers: 37 Creek Mouth Morphology: Open %Shoaling of Creek: <50% of channel Tide Range (ft): 1.3 Creek Area (acres): 75 Average Depth of Creek Mouth (ft): -2.7 Maximum Depth of Creek Mouth (ft): -4.8


Mill Creek
Mill Creek
Mill Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
700
1,400
Feet
N
S
W
E
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Whiting Creek[28]

INTRODUCTION

Whiting Creek is an existing federal navigation channel which was constructed under authority of the River and Harbor Act of March 2, 1945, as amended. The authorized channel is 4 feet deep and 70 feet wide between the 4 foot contour in the Rappahannock River and the 4 foot depth in Whiting Creek. The channel was last dredged by the USACE in 2003. The mean range of tide is 1.5 feet.

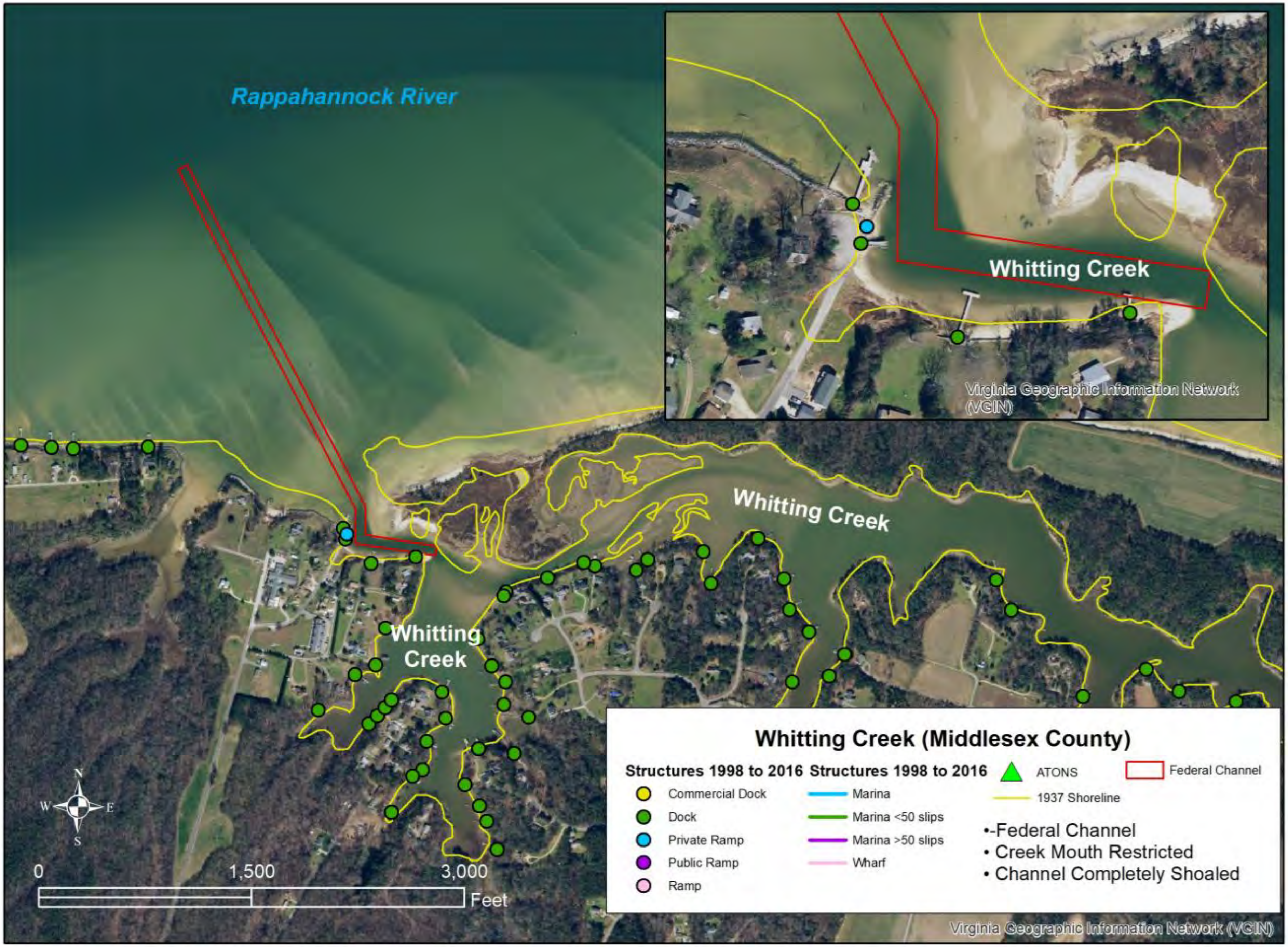
STUDY AREA

Whiting Creek is a tributary of the Rappahannock River in Middlesex County, Virginia. The creek mouth is restricted and the creek is completely shoaled. The average depth of the creek mouth is -1.3 feet and the maximum depth of the creek mouth is -2.2 feet. The water surface area is 132 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Whiting Creek is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Whiting Creek has 59 piers and a boat ramp.

[28] VIMS Study Information: Creek ID Number: 10 Locality: Middlesex Water Body: Rappahannock River Channel Type: Federal Latitude: 37.6103 Longitude: -76.5058 Number of Marinas: 0 Number of Boat Ramps: 1 Number of Piers: 59 Creek Mouth Morphology: Restricted %Shoaling of Creek: Completely shoaled Tide Range (ft): 1.5 Creek Area (acres): 132 Average Depth of Creek Mouth (ft): -1.3 Maximum Depth of Creek Mouth (ft): -2.2


Rappahannock River
Whitting Creek
Whitting Creek
Whitting Creek
Virginia Geographic Information Network (VGIN)
Whitting Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
Federal Channel
1937 Shoreline
•-Federal Channel
• Creek Mouth Restricted
• Channel Completely Shoaled
N
W
E
S
0
1,500
3,000
Feet
Virginia Geographic Information Network (VGIN)

Robinson Creek[29]

INTRODUCTION

Robinson Creek is located in Middlesex County, Virginia. The creek has no federal authorization and has never been dredged. The mean range of tide is 1.5 feet.

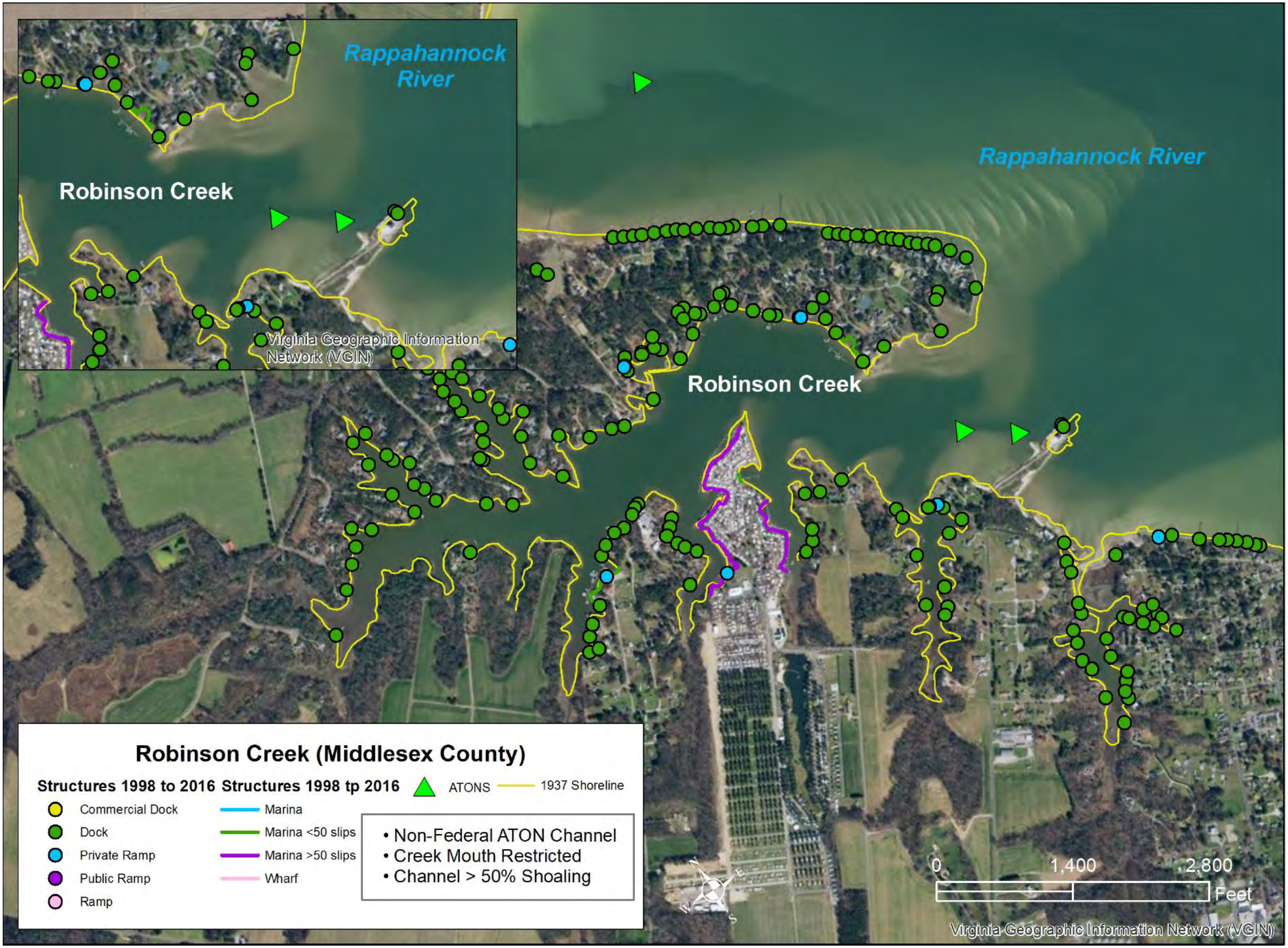
STUDY AREA

Robinson Creek is a tributary of the Rappahannock River in Middlesex County, Virginia. The creek mouth is restricted and greater than 50 percent of the channel is shoaled. The average depth of the creek mouth is -0.5 feet and the maximum depth of the creek mouth is -1.4 feet. The water surface area is 241 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Robinson Creek is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Robinson Creek has 111 piers, 5 marinas, and 5 boat ramps.

[29] VIMS Study Information: Creek ID Number: 8 Locality: Middlesex Water Body: Rappahannock River Channel Type: Non-Federal ATON Latitude: 37.6525 Longitude: -76.5765 Number of Marinas: 5 Number of Boat Ramps: 5 Number of Piers: 111 Creek Mouth Morphology: Restricted %Shoaling of Creek: >50% of channel Tide Range (ft): 1.5 Creek Area (acres): 241 Average Depth of Creek Mouth (ft): -0.5 Maximum Depth of Creek Mouth (ft): -1.4


Rappahannock River
Robinson Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Robinson Creek
Robinson Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal ATON Channel
• Creek Mouth Restricted
• Channel > 50% Shoaling
0
1,400
2,800
Feet
Virginia Geographic Information Network (VGIN)

Parrotts Creek[30]

INTRODUCTION

Parrotts Creek is an existing federal navigation channel which was constructed under authority of the River and Harbor Act of September 1954, as amended. The channel is authorized 6 feet deep, 60 feet wide and 4,800 feet wide from deep water in the Rappahannock River through the entrance to Parrotts Creek, suitably widened at bends with a turning basin of the same depth 120 feet square at the public landing. The channel was last dredged by the USACE in 1956. The mean range of tide is 1.7 feet.

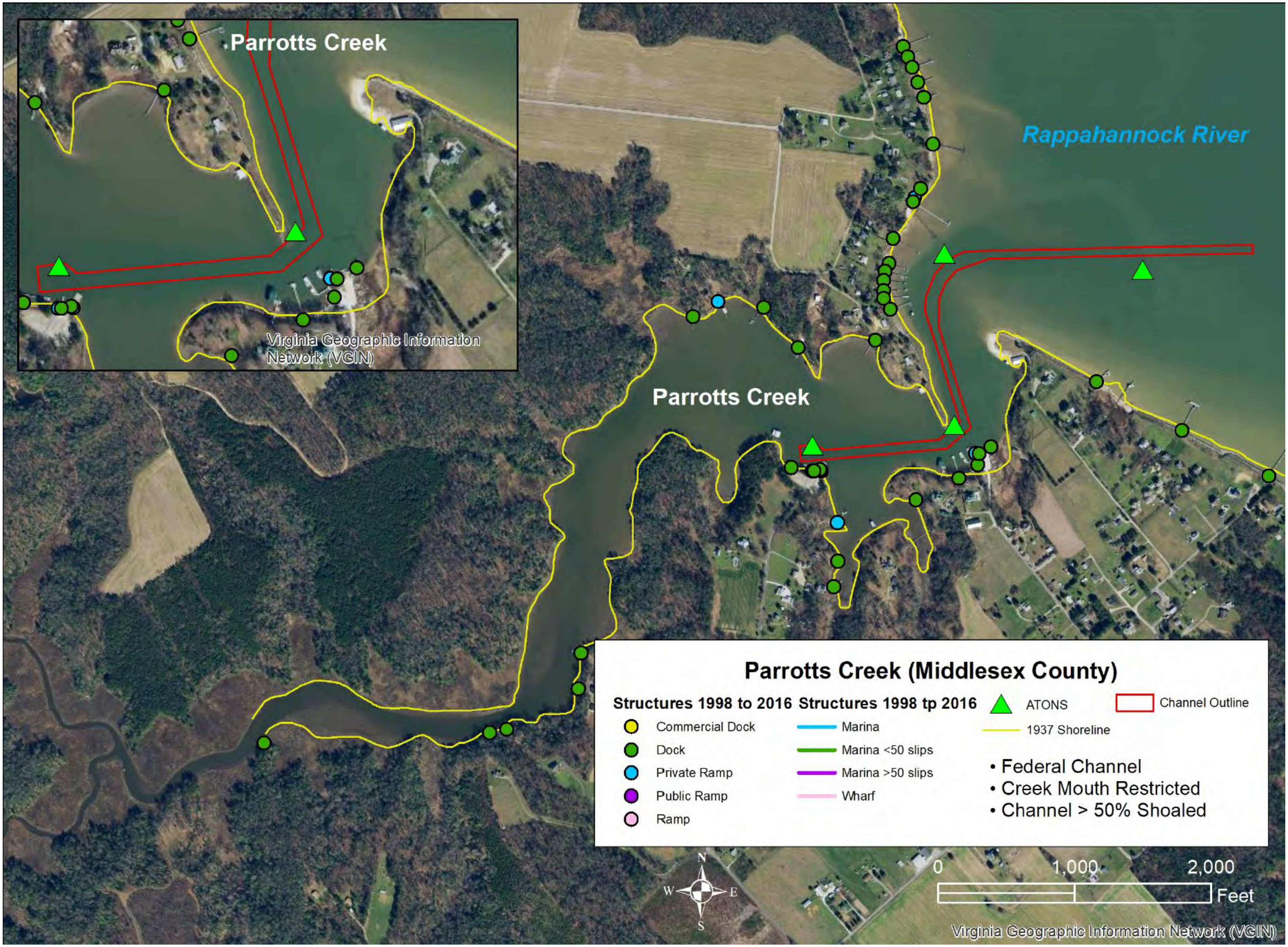
STUDY AREA

Parrotts Creek is a tributary to the Rappahannock River in Middlesex County, Virginia. The creek mouth is restricted and more than 50 percent of the channel is shoaled. The average depth of the creek mouth is -2.7 feet and the maximum depth of the creek mouth is -4.1 feet. The water surface area is 115 acres.

PROBLEMS, NEEDS, AND OPPORTUNITIES

Dredging of Parrotts Creek is necessary to establish navigable depths to provide safe navigation for commercial and recreational vessels. Parrotts Creek has 19 piers and 4 boat ramps.

[30] VIMS Study Information: Creek ID Number: 4 Locality: Middlesex Water Body: Rappahannock River Channel Type: Federal Latitude: 37.7290 Longitude: -76.6183 Number of Marinas: 0 Number of Boat Ramps: 4 Number of Piers: 19 Creek Mouth Morphology: Restricted %Shoaling of Creek: >50% of channel Tide Range (ft): 1.7 Creek Area (acres): 115 Average Depth of Creek Mouth (ft): -2.7 Maximum Depth of Creek Mouth (ft): -4.1


Parrotts Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Parrotts Creek
Parrotts Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
Channel Outline
1937 Shoreline
• Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
N
W
E
S
0
1,000
2,000
Feet
Virginia Geographic Information Network (VGIN)

Overview of Shallow Channel Dredging

Introduction

In order to understand the equipment and staffing requirements for a dredging and dredged material disposal (placement) program, an understanding of the recent past and current practices is useful. The period of 1990 through 2020 was selected based on an evaluation of dredging records to include government estimates and bid abstracts for shallow draft dredging in the region. In addition dredging records from current comparable projects in North Carolina and Florida were researched and personal interviews were conducted with dredging industry companies, dredging equipment manufacturers and resale companies, and officials at all levels of government.

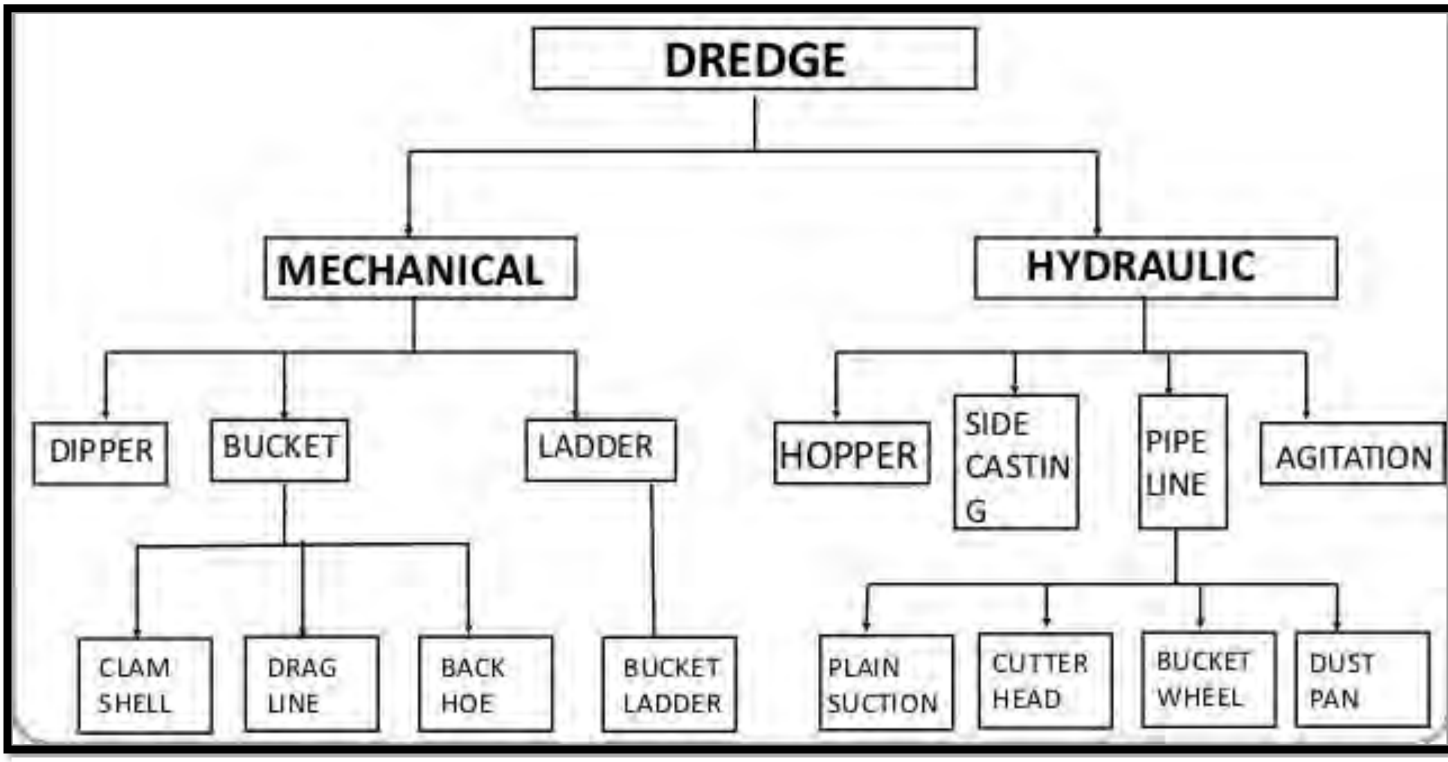
Dredging and Disposal (Placement) Equipment

In general, dredging projects can range in size from a few hundred cubic yards to well over one million cubic yards. Specific to the Middle Peninsula, the largest dredging project over the past 30 years was at Winter Harbor in 2009-2010 when over 87,000 cubic yards of material was dredged. Smaller sized dredging jobs are those requiring less than 25,000 cubic yards (examples include Horn Harbor, Queens Creek, and Whiting Creek), medium sized dredging jobs generally range from 25,000 cubic yards to less than 50,000 cubic yards (an example is Broad Creek) and larger sized dredging jobs are those requiring the removal of greater than 50,000 cubic yards of dredged material (such as Winter Harbor, mentioned previously). Within those sizes of dredging projects, dredging production is measured as cubic yards of material removed over a specified time period and historically has run from 50 to 250 cubic yards per day if removed via upland platform dredging to upwards of 1,000 cubic yards per day if removed via water-based dredging equipment. As noted in Table 4, dredging over the recent period of record has been performed by hydraulic dredging methods.

Table 4. Dredging Type and Job Size for Federal Navigation Channels (1990-2020)

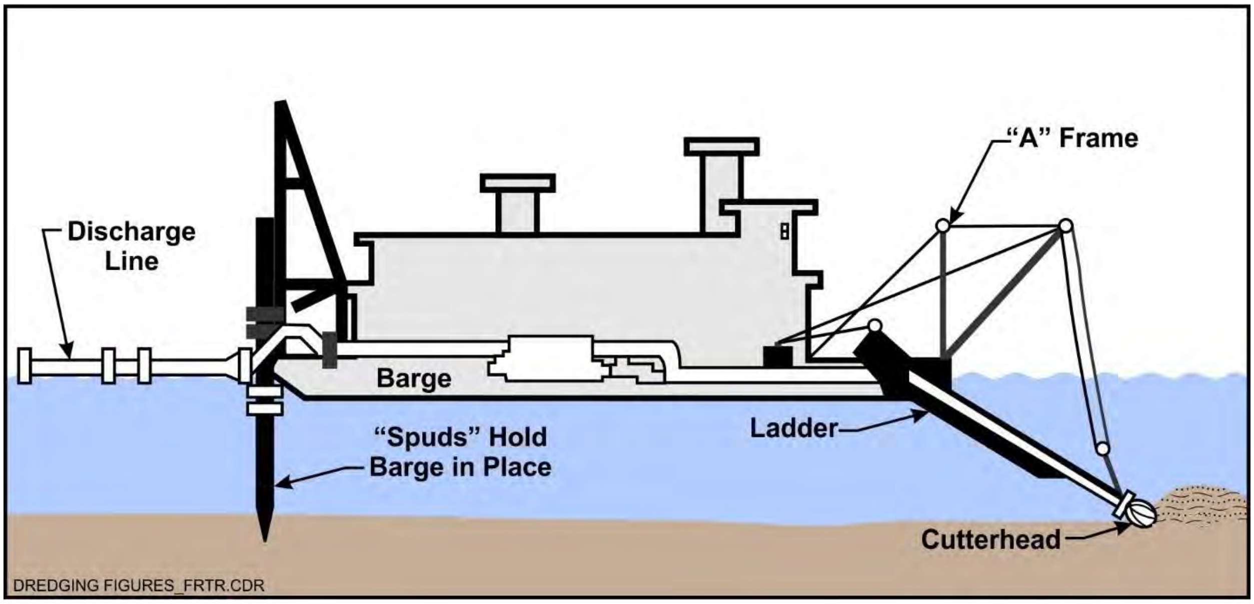
Federal Channel Name	County Identifier	Date Last Dredged	Last Volume Dredged (cy)	Dredge Type Used for Most Recent Dredging	Relative Project Size
Horn Harbor	Mathews	Combined with Whiting Creek in 2003	4,096	Hydraulic	Small
Whiting Creek	Middlesex	Combined with Horn Harbor in 2003	13,285	Hydraulic	Small
Winter Harbor	Mathews	2009-10	87,090	Hydraulic	Medium/Large
Broad Creek	Middlesex	2010	38,491	Hydraulic	Medium
Queens Creek	Mathews	2019	20,220	Hydraulic	Small
TOTALS			**163,182**		
AVERAGE			**32,636**		

Dredging equipment can generally be classified as either mechanical or hydraulic. Schematic 1 below presents an array of various types of mechanical and hydraulic dredging equipment.



Schematic 1. Mechanical and Hydraulic Dredging Equipment Types. Source Credit: USACE

As Table 4 shows, the predominant dredge plant utilized on Middle Peninsula dredging projects over the recent past has been the hydraulic cutterhead dredge with pipeline or barge placement of dredge material either along beach shorelines, overboard, or into upland placement sites. Hydraulic dredges add water to sediment to create a slurry that can be pumped by pipeline to the disposal site. There are several types of hydraulic dredges that use different methods to loosen sediment and guide the material into a suction pipe. Used most often, a cutter head dredge has a rotating head that cuts into the sediment. Some hydraulic dredges do not use any cutting device and rely only on suction to remove the sediment. In order to create a slurry and remove sediment, a large amount of water must be added. Typically, the volume of water added is 5 to 10 times the in-place volume of sediment removed. Schematic 2 provides a view of a standard hydraulic cutterhead suction dredge.



Schematic 2: Standard Hydraulic Cutterhead Suction Dredge. Source: Federal Remediation Technologies Roundtable.

The following provides a description of how hydraulic dredges have typically worked in waters of the Middle Peninsula. Consider a hydraulic dredging operation where the dredging site is at point A and the disposal site is point B. At point A, the following operations occur: the dredge uses a suction arm to remove material from the channel bottom which is then transported via a pipeline to a disposal site point B. The pipelines can be assisted by a booster pump. Pipelines can cross water and/or land areas to reach point B. At point B the dredge material is then placed and spread by a dozer or bobcat. From a relative cost standpoint hydraulic dredging methods may be more expensive than other dredging methods if there is a significant amount of incremental cost involved with dredge material disposal. Similarly, if an upland placement site is not available then the options for the use of a hydraulic dredge are limited. In addition, the operational distance for pumping dredge material is generally limited to less than two miles. The following photos show the dredge equipment utilized for the most recent dredging projects in the region.

(Above) Photo 1: 2020 Hydraulic Dredge Plant, Oyster Channel, VA. Source Credits: USACE and Dredgit Corp.

(Below) Photo 2: 2020 Hydraulic Dredge Plant, Bradford Bay, VA. Source Credits: USACE and SumCo Eco-Contracting

(Above) Photo 3: 2019 Floating Dredge Plant, Queens Creek, VA. Source Credits: USACE and Edwin S. and John O. Crandell, Inc.

(Below) Photo 4: 2019 Hydraulic Dredge Plant, Chincoteague Inlet, VA. Source Credits: USACE and Dredgit Corp.

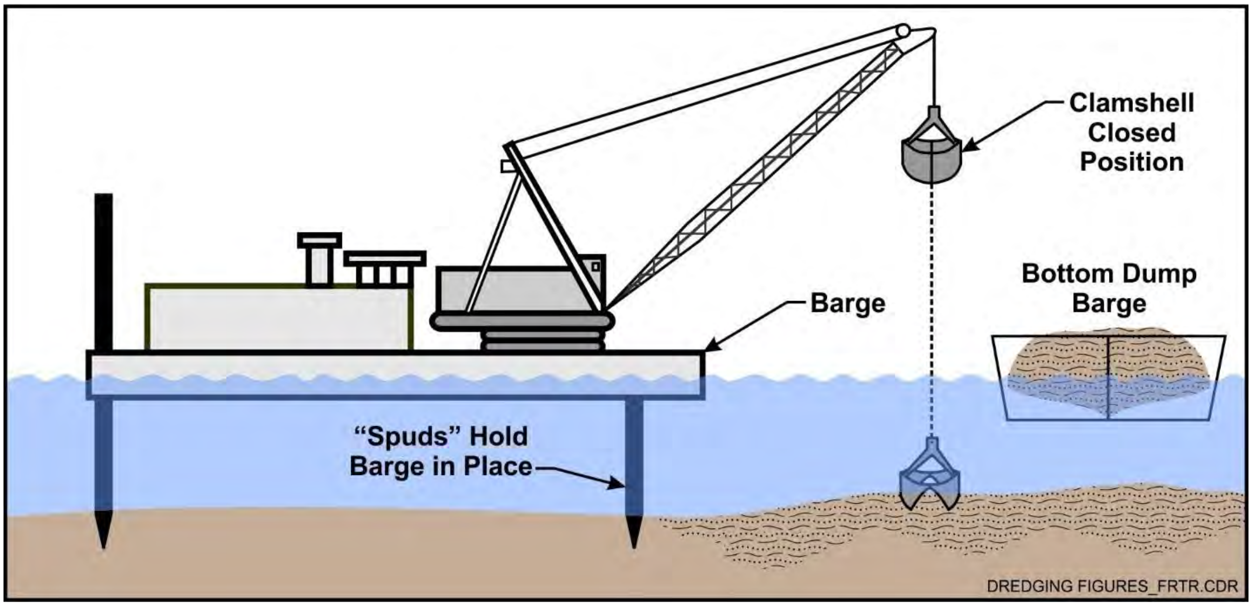
Photo 5: 2009 Hydraulic Dredge Plant, Winter Harbor, VA. Source Credits: USACE and Southwind Construction Corp.

Mechanical dredges use digging buckets such as a clamshell suspended by a cable from a crane, an excavator on a fixed arm, or dragline buckets suspended by a cable from a crane. Mechanical dredges remove sediment with a similar density and water content as the in-place material. Some water is added to the sediment because the clamshell and bucket are not always completely full of sediment.

Consider a mechanical dredging operation where the dredging site is point A and the disposal site is point B. At point A, the following operations occur: a dredge removes the dredge material by way of a mechanical bucket and deposits the material into a (containment) barge where it is then transported to Point B. At point B, the following operations occur: the material is offloaded from the barge into the disposal area either directly via bucket or via a short pipeline to the disposal site and a person manning a dozer or bobcat spreads the material within the disposal site. Everything else being equal, for medium to large size dredging jobs this type of operation is typically more expensive than hydraulic dredging but does allow for longer distance transport of dredge material.

In certain cases a modified mechanical dredging operation may include a dredge transfer station where dredge material may be moved via dump trucks to the dredge disposal site. This option can be used in cases where upland disposal sites are located a significant distance from the transfer point.

Schematic 3 shows the configuration of a standard mechanical dredge. Photos 6, 7, and 8 show examples of a standard mechanical dredging project utilizing barges with a transfer station and upland disposal site.



Schematic 3: Standard Mechanical Dredge. Source: Federal Remediation Technologies Roundtable.

Photos 6, 7, and 8 show examples of a standard mechanical dredging project utilizing barges with a transfer station and upland disposal site.


Photo 6: 2021 Mechanical Dredge Plant, Shallowbag Bay, NC. Source Credit: Dare County Grants and Waterways.

(Above) Photo 7: 2021 Mechanical Dredge Transfer Station, Shallowbag Bay, NC. Source Credit: Dare County Grants and Waterways

(Below) Photo 8: 2021 Mechanical Dredge Placement Site, Shallowbag Bay, NC. Source Credit: Dare County Grants and Waterways

As the availability of suitable upland placement areas has declined and the costs for limited, larger-acreage placement sites has grown, different types of technologies are being explored. One such advance in technology is the use of hydraulic dredges which pump material into barges which can then transit to longer distance disposal sites. Consider a modified hydraulic dredging operation where the dredging site is point A, the barge mooring area is point B, and the disposal site is point C. At point A, the following operations occur: a hydraulic dredge removes dredge material from the channel bottom and places the material in a containment barge assisted by a tug or pusher barge. The containment barge is transported to the barge mooring area, point B by way of a tug or pusher barge. The barge mooring area point B may be directly at a disposal site point C (such as where overboard placement might occur) or in close proximity to a disposal site point C (such as adjacent to an upland placement site where it is either direct pumped or pumped within the site via pipelines). In either case, the dredge material is then placed and spread within the disposal site point C. Everything else being equal, this type of operation may be less expensive than the operations described earlier for the more traditional hydraulic and mechanical dredging. This type of operation allows for longer distance transport of dredge material than does traditional hydraulic dredging. One such application of this technology was used to dredge the Wormley Creek federal navigation channel in 2017. This unique project required removal of both silty and sandy material via hydraulic methods due to an unusually narrow navigable channel width of 30′. Sandy material was pumped via conventional methods to a beach placement area on USCG property on the bank of the York River. Material deemed too silty for beach placement was pumped into a scow and was transported to the Wolftrap Offshore Disposal site once material had sufficiently settled out of suspension. The following photo shows the dredge equipment used at Wormley Creek.

Photo 9: 2017 Hydraulic Dredge with Scow, Wormley Creek, Yorktown, VA. Source Credits: USACE and Burnham Associates, Inc.

Case Studies

To determine the current state of the dredging industry and to discover how localities across the country deal with their regional dredging needs, case studies and interviews were conducted with dredging contractors, the US Army Corps of Engineers, and cities and counties that own and operate their own dredging programs.

Hillsboro Inlet District, Broward County, Florida[31]

David Tolces, as general legal counsel, was not privy to the more technical information related to the dredging programs of Hillsboro Inlet, but provided the following information:

- Hillsboro Inlet District does not own property; instead, they lease space from the US Coast Guard to park equipment.
- Dredged sand is used to replenish the adjacent beach.
- Hillsboro Inlet largely avoids grants from FIND and the federal government because they come with strings attached.
- The dredging crew conducts all maintenance work on equipment. Dredging is needed mostly in the fall, though dredging and maintenance are a full-time job.
- Commissioners meet once a month at a facility owned by one of the localities.

David Tolces forwarded the organization's website which contained several reports, the District's Charter and Charter Amendments, budgets, and other technical information. A summary of these items are found below. David Tolces also offered to connect the project team with Captain Draughon, the District's Dredge Captain.

Notes from website/reports:[32]
The Hillsboro Inlet District was established in 1957 to provide for the maintenance of the Hillsboro Inlet, located in Broward County, Florida. The Hillsboro Inlet District is governed by an eight-member Board of Commissioners from the eight local governments comprising the district. The District provides for sand bypassing around the Hillsboro Inlet, maintenance of the Hillsboro Inlet, and provides important drainage after storm/flooding events for the communities to the west.

The District's source of revenue is predominately ad valorem taxes levied on real property within the District. The District's budget consists of two major components: the recurring expenses and funding for special projects.

Recurring expenses are the day-to-day expenses to operate and maintain the dredging equipment to dredge the channel and bypass sand to the south. These expenses are labor costs for crew of five, fuel, supplies, insurance, legal, accounting, etc. The day-by-day operation of the crew is supervised

[31] Based on a December 28, 2020 conference call with David Tolces, General Counsel for the Hillsboro Inlet District, handling administration.
[32] More information at https://hillsboroinletdistrict.org/.

by the Dredge Captain and the Assistant Captain. The overall management strategy of the operation is provided by the District's eight commissioners that are volunteers with no direct compensation.

Special projects are mainly capital equipment purchases and improvements to the inlet. Channel improvements were cost shared with FDEP and FIND. For these special projects, a reserve is set up and funds are accrued (mostly over several years) before committing to the project. The District's special project outlay occurs in the year of the construction and/or the purchase of the capital equipment. The District does not carry any debt.

The District's dredging equipment consists of a hydraulic sand pumping dredge, two support workboats, an elbow barge and a yard crane.

In 2008, the District replaced the dredge with a new dredge built to better withstand the harsh salt environment. The new dredge is an Ellicott Dragon Series 1070 14/12 Dredge purchased at a cost of $1.8 M. With an expected life of at least 30 years. The amortized cost of the dredge is about $60,000 per year which is 6% of the annual operating budget.

The current millage rate for the Hillsboro Inlet District is .0860 mills and is imposed pursuant to the authority of the District Charter.

5 years of monthly dredging volumes are included in the table below:[33]

Bypass Volumes in Cubic Yards													
Year	**Total**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
16	168,753	11,250	11,925	22,725	23,063	4,388	16,313	6,638	3,263	2,588	14,175	30,150	22,275
17	97,088	16,425	3,825	15,975	0	22,838	2,250	0	0	0	10,125	11,700	13,950
18	89,076	8,188	17,438	25,200	18,675	8,100	0	0	3,600	0	1,800	0	6,075
19	87,863	6,075	6,075	10,463	22,050	5,400	2,700	0	0	0	6,750	28,350	0
20	103,050	2,700	25,875	33,750	2,700	15,975	9,225	0	3,600	2,250	6,975	-	-

[33] More information can be found at: https://hillsboroinletdistrict.org/wp-content/uploads/2020/11/HID-Dredging-Volumes-2020-10.pdf

Boca Raton, Florida[34]

The Boca Raton Inlet continually shoals and creates hazardous navigation conditions for boaters. The City of Boca Raton conducts continuous interior inlet maintenance dredging to transfer sand past the inlet and to maintain the inlet for navigation purposes. The dredging is conducted by a City-owned dredge and crew. The material dredged from the inlet is placed above the mean high-water line of the beaches 500 feet south of the southern jetty of the inlet.[35]

- While dredging operation is ongoing the dredge will display day marks as required by the U.S. Coast Guard for a "R.A.M." Vessel (Vessel Restricted in Ability to Maneuver).
- The dredge and the discharge pipe including the support vessel (Tug) may temporarily impede and block the flow of traffic in the Inlet Channel.
- The normal dredge operation occurs during the week, Tuesday through Friday during daylight hours only.
- The dredge, when not pumping, is anchored in the inlet just south of the Inlet Bridge.
- The dredge tug is docked at Silver Palm Park when not in use.

Dredging can be locally unpopular for many reasons. Some citizens may think that dredging does more harm than good and could impact public and political support for dredging projects. Below is a response letter to a concerned citizen regarding Boca Raton's dredging spoils placement, which contains useful information:[36]

> "I wanted to first provide you with a brief history of the City of Boca Raton's beach renourishment program. The City of Boca Raton has been constructing beach renourishment projects throughout the City since the mid 1980's and conducting environmental and physical monitoring before, during and after construction of each project to ensure there are no negative impacts to the environment. These monitoring events are required by both the Florida Department of Environmental Protection (FDEP) and the United States Army Corps of Engineers (USACE) and the City provides both agencies with monitoring reports on a yearly basis.
>
> The City conducts physical monitoring surveys yearly of the beach renourishment project areas to monitor the movement of the sand placed after a beach renourishment project, which in turn determines the timeframe for the next beach renourishment project. The City has been successful in overall maintaining an 8-10yr nourishment cycle for each of the project areas within Boca Raton while maintaining enough storm protection and sea turtle nesting habitat along the shorelines.
>
> Prior to the construction commencement of the current Central Boca Raton Beach Renourishment Project, the City was required to obtain permits from both the FDEP and USACE and within both of these permits are strict environmental and physical monitoring guidelines and protocols that must be followed before, during and after construction. These protection measures include:

[34] Based on a January 11, 2021 conference call with Jennifer Bistyga, Coastal Program Manager, Boca Raton, FL.
[35] Further background information can be found at: https://www.myboca.us/371/Dredging
[36] Source: https://www.4boca.com/the-reality-and-the-theory-of-dredging/

- benthic community monitoring
- sedimentation monitoring
- sea turtle protection guidelines
- turbidity monitoring
- beach performance

Additionally, all the data collected before, during and after construction is provided to both the FDEP and USACE for review and concurrence with the monitoring program.

In response to your concerns regarding the Boca Raton Inlet, as you stated the natural drift of sand is from North to South and material does get "trapped" within the mouth of the inlet and within the interior of the inlet. Because the inlet impedes the natural flow of sand from North to South, the City is required by the FDEP to dredge this material from the interior of the inlet and place the material south, which the City accomplishes with the City's dredge crew. Then every 6-8 years, the City hires a dredge contractor to remove approximately 150,000-200,000 cubic yards of sand from the mouth of the inlet and place this material along the entire length of beach from the inlet to the Boca Raton/City of Deerfield line.

Because of the natural and artificial reefs located offshore of the South Boca Raton Beach Renourishment Project Area, the City is limited on the amount of sand that can be dredged from the mouth of the inlet and placed on the beaches south of the inlet within the FDEP and USACE permitted design template. The City has investigated the potential of purchasing a larger dredge that could remove and place a larger quantity of sand yearly on the beaches south of the inlet, however with a fixed beach design template the ability to place more sand than the current placement schedule is very limited as the City does not want to have any adverse impact to the reef system.

The City will continue to research the different dredging mechanisms available for when it comes time to replace our existing City-owned dredge equipment."

Additional Call Notes:

- Boca Raton has been dredging since 1972, but only in the inlet, not on the coast.
- They own their dredge and tug. They recently purchased a new custom-built dredge at $1.2M. The custom-built dredge is intended for their narrow inlet.
- They decided to buy the dredge to have control over staff and dredge material on demand, rather than contract dredging services out. They will contract out services if needed.
- There is a 4-member crew: the captain, dredge operator, and 2 deckhands. The crew works collaboratively due to the tightness of the dredge. The crew works 10-hour shifts, Tuesday through Friday.
- The crew dredges an average of 4-5 days a month, up to 10-12 times a month. The other days are spent doing maintenance of the dredging equipment, or vacation/sick days. The crew minimum requirement is three (3).
- If there is light work, the crew will be reassigned to other projects in the department.
- Hiring new staff to operate the dredge is difficult as the required qualifications are hard to come by. Deck hands have high turnover rate due to low comparable pay to the private sector. Necessary skills include welding, SCUBA diving, and other specialized skills.

- The operating costs of the dredging program are $400,000 annually for the 4-man crew, operating, maintenance, and insurance costs. These costs are covered by the city's general fund, although some funding comes from the Florida Department of Environmental Protection in the form of reimbursements. FIND provided $60,000 for the purchase of the dredge as a cost share agreement.
- Boca Raton dredges 50,000-80,000 cubic yards per year. Their permit requires a fixed discharge hose to pump onto the beach south of the inlet. The material is left there for natural settlement; no manual movement of material is used.
- They considered partnering with Hillsboro Inlet to share a dredge for regional services, but ultimately went with their own dredge.
- Starting new, Jennifer recommends hiring a contractor for continuing services to dredge 5-10 times per year.
- Jennifer suggested reaching out to big companies, like Marinex construction, Great Lakes, and Weeks Marine, about the industry and options for smaller companies. She recommended contacting Marinex first, as they are headquartered in North Carolina.

Dare County, North Carolina

The primary purpose of Dare County's dredging program is for navigation. Suitable material resulting from the dredging operations is used beneficially. They manage the dredging of coastal inlets (to include Oregon Inlet and accesses to ferry terminals, as well as dredging of interior areas such as Shallowbag Bay in Manteo which is a current project). To facilitate their program, they have established a Grants and Waterways Commission (DCGWC). The DCGWC has multiple responsibilities including staffing, facilitating special grant projects, and overseeing mitigation grants. The commission was created by the Dare County Board of Commissioners in January 1983.

Dare County has a Memorandum of Agreement (MOA) with the USACE which outlines the roles and responsibilities of each party. The DCGWC owns limited dredging equipment and contracts with private industry for smaller-sized non-federal dredging projects, and partners with the USACE for the dredging of federally authorized navigation channels. Most of the dredged material is disposed of overboard, in most cases ocean disposal, utilizing funding from the USACE or via grants from the state of North Carolina. Dare County is a tier two county and as such receives funding from the North Carolina Department of Environmental Quality, principally via fishing license fees. In cases where USACE obtained permits have expired, or new permits are required, DCGWC coordinates the development of the permit application. They are planning for material disposal facilities over 20 years at 400,000 cy every five years and are in the process of acquiring a hopper dredge.

The new dredge is a private-public partnership arrangement. One of the conditions of the contract to build the dredge is that the contractor is required to ensure that all USCG certifications and licensing requirements are met. Dare County works closely with the USCG on many maritime matters related to dredging. Dare County's new dredge, "Miss Katie," will be a split hulled hopper which will be nearly identical to the Corps owned dredge "Murden".[37] Dare County expects to take delivery of the Miss Katie in January 2022, and after several months of testing and certification of staff and equipment by the USCG, it is scheduled to be operational in May 2022. Dare County has not yet decided if their staffing will be W-2 or 1099 based.

The availability of areas for upland disposal are very limited, although an upland site is currently being used for the Shallowbag Bay project. The authorized depth of the federal channel is -12 ft. MLLW. The project consisted of the removal of an estimated 40,632 cubic yards of material within a 50-ft wide channel to a required depth of -9 feet MLLW with 3H:1V side slopes within Ranges 1-5 of the Manteo (Shallowbag Bay) Federal Navigation Project, as well as a connector channel dredged to the berth of the vessel "Elizabeth II" located at Festival Park on Roanoke Island.[38]

A modified mechanical dredge was used for this job, with ancillary requirements including staff to man the dredge, associated transport barges, a dredged material transfer station (from floating barge to shore), and the disposal (placement) site. Dump trucks were used to transport the dredged material from the transfer station to the disposal site.

Below is a description of how the Shallowbag Bay dredging project was accomplished:

[37] A description of Miss Katie can be found at: https://www.dredgingtoday.com/2021/03/17/the-new-dredge-miss-katie-video/

[38] Source: https://www.obxtoday.com/top-stories/long-awaited-shallowbag-bay-dredging-to-begin-around-the-end-of-the-month/

Consider the dredging site as point A, the dredge material transfer site as point B, and the disposal site as point C. At point A, the following occurs: a dredging barge manned by a dredging bucket operator dredges material from the channel bottom and places the material in a barge and tug manned by a tug captain and deck hand. The receiving barge is taken by tug to the transfer station, point B. At point B, the following occurs: the material is offloaded from the barge via land based excavator manned by an excavator operator who offloads the material and loads it on to individual dump trucks for transfer to the disposal area, point C. Up to 10 individual dump trucks (one driver per truck) transfer the material. At point C, the following occurs: the dump trucks empty the material into the disposal site and a person manning a bobcat spreads the material around in the disposal site. The bobcat operator also keeps the entrance street to the disposal site maintained (due to dump truck traffic). The typical work day is from 7 am to 5 pm and the work continues for 6 days per week at points A, B, and C.

The Shallowbag Bay project was successfully completed earlier this year and funded via a $1.9 million allotment from the North Carolina General Assembly. The Town of Manteo provided an additional $170,000.

Merrimack Valley Planning Commission, Massachusetts

In 2019, the Merrimack Valley Planning Commission (MVPC) contracted the Woods Hole Group, Inc. to conduct the "Upper North Shore Dredge Purchase Feasibility Study" in order to determine whether MVPC and its 10 coastal member localities should purchase and operate a dredge to handle 9 Federal Navigation Projects and other shoaling waterways that are no longer receiving funding.[39] The study took into account channels that required maintenance dredging, those that had never been dredged, and potential disposal methods for dredge spoils of each channel. They also conducted their own case studies on municipalities that operate dredging programs in the region.

The study considered 3 different alternatives: owning a hydraulic cutter dredge, owning a hopper dredge, and retaining private contracting services. The 30-year lifetime costs are summarized below:

Alternative:	1	2	3	4
Description:	Hydraulic Cutterhead Suction Dredge	Hopper Dredge	Contracting at $10/cy	Contracting at $40/cy
30 Year Lifetime Cost:	$28,343,072	$48,999,518	$15,749,640	$47,338,560

From their analysis, contracting services would be the cheapest option only if costs were kept to $10/cy, which is not a very conservative estimate. They note that some of the positive aspects of a municipality owning their own dredge are:

- Being able to control dredging resources, schedules, and project selection,
- Dredging at below-market rates, and
- Having autonomy over how to dispose of or reuse dredged materials.

They mention some negative aspects as being:

- The significant long-term investment, which would require dedicated annual funding,
- Risk and liability issues, and
- The political task of distributing dredging projects equitably.

Ultimately, they recommend setting up an Advisory Committee to choose among alternatives and, going forward, to help deal with ensuring equitable access to dredging resources.

[39] The July 2019 draft of this report can be found at: https://www.townofnewbury.org/sites/g/files/vyhlif951/f/uploads/mvpc_north_shore_dredge_report_draft_7_8_2019.pdf

The Costs of Dredging

Introduction

Implementation costs are based on the 3 major phases of a dredging project: pre-construction, construction, and post construction. Each phase is comprised of the major components necessary for a successful project. In this connection, it is important to note that the life cycle of a dredging project begins with initial construction and then at periodic intervals maintenance of the dredging project is necessary to ensure that proper dimensions (length, width, and depth when measured at mean lower low water) are being provided for the navigation user (commercial and recreational) boating traffic. Horizontal and vertical datums were established for each project using mean lower low water (MLLW) as a basis for establishing the channel depths for initial dredging and subsequent maintenance dredging. Dredging frequencies (cycles) were also estimated by the VIMS Shoreline Studies Program for each project using bathymetric data where available and through analysis of historic satellite imagery. The dredging depths established by Congress were used for Federal channels. For non Federal channels with USCG-maintained aids to navigation, a dredging depth of six feet was used since this is the draft depth needed for USCG vessels to access the aids. For non Federal channels lacking USCG-maintained aids to navigation, general research was done regarding the current type and intensity of vessel usage. It is anticipated that any locality designing a dredging project on any of the non Federal creeks lacking aids to navigation will conduct further examination of needed depths and based on available resources, determine the ultimate dredge depth accordingly. One foot of over-depth dredging was added for each project. Table 5 provides a listing of the navigation channels as well as their respective dredging depths and dredging frequencies.[40]

[40] For an overview of each channel and their costs, see Appendix B.

Table 5. Navigation Channels and Associated Maintenance Dredging Frequencies

Navigation Project	County	Dredging Depth (MLLW)[41]	Estimated Maintenance Frequency (Years)
Mattaponi River	Multiple	--[42]	--[42]
Aberdeen Creek	Gloucester	-6	5-10
Cedarbush Creek	Gloucester	-6	10-20
Timberneck Creek	Gloucester	-6	5-10
Sarah Creek	Gloucester	-6	5-10
Perrin River	Gloucester	-6	10-20
Free School Creek	Gloucester	-4	10-20
Whittaker Creek	Gloucester	-4	5-10
Mill Creek 2	Mathews	-4	10-20
Put In Creek	Mathews	-4	5-10
Davis Creek	Mathews	-7	5-10
Horn Harbor	Mathews	-7	10-20
Winter Harbor	Mathews	-6	5-10
Hole In The Wall	Mathews	-6	5-10
Queens Creek	Mathews	-6	5-10
Milford Haven	Mathews	-10	10-20
Broad Creek	Middlesex	-7	5-10
Bush Park Creek	Middlesex	-4	<5
Mill Creek	Middlesex	-4	10-20
Whiting Creek	Middlesex	-6	5-10
Robinson Creek	Middlesex	-6	5-10
Parrotts Creek	Middlesex	-6	10-20

Estimated Dredging Volumes for Initial Construction and Subsequent Maintenance Dredging

Channel condition surveys were performed for each of the waterways in order to determine the existing depths necessary to develop estimates of the volume of dredge material to be removed. Utilizing that information and the dredging depths and frequencies listed in Table 5, Table 6 displays the volumes of material estimated to be dredged from each of the waterways. Prior to subsequent maintenance dredging efforts, a project condition survey will be performed to better define the need, timing and volumes of material to be removed.

[41] An additional 1 foot of over-depth dredging is also anticipated.
[42] Channel condition survey indicates sufficient channel depth currently exists.

Table 6. Estimated Dredging Volumes for Initial Construction and Maintenance

Navigation Project	Initial Construction Dredging Volume (Cubic Yards)[43]	Subsequent Maintenance Dredging Cycle Volumes (Cubic Yards)
Mattaponi River	--[44]	--[44]
Aberdeen Creek	59,250	59,250
Cedarbush Creek	89,506	89,506
Timberneck Creek	46,300	46,300
Sarah Creek	9,549	9,549
Perrin River	14,593	14,593
Free School Creek	222	222
Whittaker Creek	8,953	8,953
Mill Creek 2	1,127	1,127
Put In Creek	5,370	5,370
Davis Creek	32,900	32,900
Horn Harbor	82,233	82,233
Winter Harbor	106,861	106,861
Hole In The Wall	40,000	40,000
Queens Creek	971[45]	23,000
Milford Haven	11,043	11,043
Broad Creek	7,136	7,136
Bush Park Creek	2,568	2,568
Mill Creek	483	483
Whiting Creek	31,644	31,644
Robinson Creek	4,372	4,372
Parrotts Creek	20,265	20,265

In order to better inform in terms of identifying the size of dredging jobs that exist in the Middle Peninsula the dredging jobs from Table 6 were aggregated into ranges of dredging material (50,000 cubic yards and greater, 25,000 cubic yards to 50,000 cubic yards, and less than 25,000 cubic yards) to be dredged associated with the channel depth to be provided by dredging efforts (-4, -6, -7, and -10 feet when measured at MLLW) during initial construction and subsequent maintenance dredging cycles. The following table provides the number of projects by dredging volume and channel depth.

[43] Initial and subsequent maintenance dredging volumes assumed to be equal and could vary based on individual project channel shoaling rates over time.
[44] Channel condition survey indicates sufficient channel depths currently exist.
[45] Navigation channel recently dredged. Long term dredging records indicate that the average dredging volume equals approximately 23,000 cubic yards per cycle.

Table 7. Number of Projects by Dredging Volume and Channel Depth

Dredging Volume Range (Cubic Yards)	Dredging Depth in Feet MLLW[46] -4	-6	-7	-10	Total
50,000 and greater	-	3	1	-	4
25,000 to 50,000	-	3	1	-	4
Less than 25,000	6	6	-	1	13
Total:	6	12	2	1	**21**

Estimated Disposal (Placement) of Dredged Material

The Virginia Institute of Marine Science Shoreline Studies Program collected sediment samples and performed physical and chemical analysis of the sediments at each site in order to classify the material to be dredged and disposed of. That information was used to determine whether dredge material would be placed beneficially (shoreline nourishment) or at upland containment sites. Table 8 displays the type of placement for dredge material from each of the channels.

Table 8. Type of Placement for Dredged Material

Navigation Project	Initial Placement of Dredge Material	Subsequent Maintenance Dredging Cycles
Mattaponi River	--[47]	--[47]
Aberdeen Creek	Upland	Upland
Cedarbush Creek	Upland	Upland
Timberneck Creek	Upland	Upland
Sarah Creek	Upland	Upland
Perrin River	Upland	Upland
Free School Creek	Upland	Upland
Whittaker Creek	Upland	Upland
Mill Creek 2	Beneficial Use	Beneficial Use
Put In Creek	Upland	Upland
Davis Creek	Upland	Upland
Horn Harbor	Beneficial Use	Beneficial Use
Winter Harbor	Beneficial Use and Upland	Beneficial Use and Upland
Hole In The Wall	Beneficial Use	Beneficial Use
Queens Creek	Beneficial Use	Beneficial Use
Milford Haven	Beneficial Use	Beneficial Use
Broad Creek	Beneficial Use and Upland	Beneficial Use and Upland
Bush Park Creek	Beneficial Use	Beneficial Use

[46] An additional 1 foot of over-depth dredging is also anticipated.
[47] Channel condition survey indicates sufficient channel depth currently exists.

Navigation Project	**Initial Placement of Dredge Material**	**Subsequent Maintenance Dredging Cycles**
Mill Creek	Beneficial Use	Beneficial Use
Whiting Creek	Beneficial Use	Beneficial Use
Robinson Creek	Beneficial Use	Beneficial Use
Parrotts Creek	Upland	Upland

In order to determine a pairing of dredging volumes with dredging disposal (placement) sites an assessment was made of the composition of dredge material at each site (silts, clays, and/or sands). Material consisting primarily of silts and clays was considered for placement in upland areas (group 1). The use of geotubes was considered as a potential means of minimizing the size (acreage) of required upland disposal areas. Primarily beach quality sandy material was considered for beneficial use/reuse placement along shorelines within a reasonable pumping distance (group two) and material identified as having mixtures of groups 1 and 2 were identified as group 3. The specifics for each project are contained in the appendices developed by the Virginia Institute of Marine Science.

An evaluation was made for the potential combinations of dredging projects with similar characteristics and location proximity of dredging and/or disposal areas. This evaluation identified 3 types of cost savings: a reduction in overall mobilization and demobilization costs, the creation of additional upland disposal capacity and the beneficial use of dredge material on adjacent shorelines. Table 9 provides a listing of the potential combination projects evaluated for initial construction. Given the uncertainty for the timing overlap of future maintenance dredging of combination projects, no attempt was made to estimate the specific timelines for the maintenance dredging of combination projects. Those evaluations could occur at a later date closer to the identification of the need for maintenance dredging.

Table 9. Potential Combination Projects for Initial Construction

Potential Combination Project	Potential Cost Savings from a Combination of Projects: Mobilization and Demobilization Costs	Creation of Future Upland Dredge Material Disposal Capacity	Beneficial Reuse of Dredged Material
Aberdeen, Cedarbush, and Timberneck Creeks	✓	✓	
Sarah Creek and Perrin River	✓	✓	
Free School and Whittaker Creeks	✓	✓	
Mill Creek 2 and Put In Creek	✓	✓	✓
Horn Harbor and Winter Harbor	✓	✓	✓
Queens Creek and Milford Haven	✓		✓

Factors and General Assumptions Used in Developing Implementation Costs for Dredging and Disposal (Placement) of Dredged Material

The pre-construction phase for each project consists of the following components:

- Preliminary engineering and design for dredging and disposal activities (including joint permit application) costs are generally $50,000 and $30,000 each for dredging and disposal for initial construction and each subsequent maintenance cycle, respectively,
- Grant and loan applications costs are generally $10,000 each for initial construction and each subsequent maintenance cycle, community engagement costs are generally $6,000 and $3,000 each for initial construction and each subsequent maintenance cycle, respectively,
- Environmental assessment costs are generally $30,000 for initial construction and for each subsequent maintenance cycle, federal/state/local permits costs are generally $25,000 for initial construction and for each subsequent maintenance cycle,
- Legal coordination costs are generally $10,000 for initial construction and $0 for each subsequent maintenance cycle, respectively,
- Financial coordination costs which are generally $25,000 and $10,000 each for initial construction and each subsequent maintenance cycle, respectively, and
- Dredge material disposal (placement) site acquisition costs vary depending upon the type (upland or beneficial placement) and size (acres) of the disposal site.

To date, the principal pre-construction activities accomplished have consisted of preliminary engineering and design efforts for dredging and disposal sites provided by the Virginia Institute of Marine Science Shoreline Studies Program, to include:

- Channel condition assessments (channel condition surveys and base mapping),
- Physical and chemical sediment sampling,
- A benthic and fisheries assessment, channel design and disposal strategies, as well as
- A useful life (dredging cycle) for each project site.

Each of these work products can be accessed in Appendix G. Contingencies of 10 percent are included for each project generally in accordance with the degree of prior information and experience with each project. Combination projects follow the same assumption and in cases where one or more federal projects are included, a contingency of 10 percent is used for the combined project. In cases where conditions warrant the use of different assumptions than stated above, project specific assumptions are included in individual project narratives provided later in this evaluation.

The construction phase for each project will consist of the following components:

- Final engineering and design/plans and specifications for dredging and disposal activities (generally $25,000 and $15,000 each for dredging and disposal for initial construction and each subsequent maintenance cycle, respectively),
- Bonds and insurance costs are estimated at 3 percent of the dredging and disposal costs for initial construction and for each subsequent dredging cycle,
- Mobilization and demobilization of dredging and disposal site equipment costs are generally $700,000 for initial construction and for each subsequent maintenance dredging cycle and $980,000 for combination projects,
- Dredge material site preparation costs vary depending upon type (upland or beneficial use), size (acres) and location distance of the disposal site from the dredging location,
- Dredging and disposal (placement of dredged material) costs are generally estimated at $8.50 to $10 per cubic yard and spreading costs for material placed on beneficial use sites is generally estimated at $1.50 per cubic yard, as well as
- Supervision and administration costs (generally $35,000 and $21,000 each for dredging and disposal activities for initial construction and each subsequent maintenance cycle, respectively), for the above referenced construction phase activities.

Upland disposal sites are assumed to either be in place or can be acquired at a location within a 2-mile distance of the dredging site and that necessary real estate interests can be acquired to receive dredged material. The use of geotubes is assumed to be used at all upland sites and cost estimates for each project are included. Beneficial use sites are assumed to be in place or can be acquired along the shoreline adjacent to the dredging sites. Beneficial use sites are not engineered beaches/shorelines but rather a site to be used to receive the estimated dredging volumes shown in the plan. Contingencies of either 15 percent or 25 percent are included for each project generally in accordance with the degree of prior information and experience with each project. In that connection, the 11 federal navigation channels each have an assigned contingency of 15 percent and the 11 non federal navigation channels each have an assigned contingency of 25 percent. Combination projects follow the same assumption and in cases where one or more federal projects are included, a contingency of 15 percent is used for the combined project. In cases where conditions warrant the use of different assumptions than stated above, project specific assumptions are included in individual project narratives provided later in this evaluation.

The post construction phase for each project will consist of the following components:

- Monitoring and/or mitigation activities and a project condition survey. Monitoring and/or mitigation costs are estimated at 10 percent of dredging and disposal contract costs for initial construction and each subsequent maintenance dredging cycle.
- Costs for a project conditions survey are estimated at $25,000 for initial construction and for each subsequent maintenance dredging cycle.
- Contingencies of either 15 percent or 25 percent are included for each project generally in accordance with the degree of prior information and experience with each project. To that end, the 11 federal navigation channels each have an assigned contingency of 15 percent and the 11 non federal navigation channels each have an assigned contingency of 25 percent. Combination projects follow the same assumption and in cases where one or more federal projects are included, a contingency of 15 percent is used for the combined project.

In cases where conditions warrant the use of different assumptions than stated above, project specific assumptions are included in individual project narratives provided later in this evaluation.

Obstacles or Barriers

At this point, the dredging and disposal (placement) of dredge material from the channels evaluated in this implementation plan have not identified any contaminated creeks based on samples, surveys, and sediment analysis performed by the Virginia Institute of Marine Science Shoreline Studies Program. Although dredging and disposal (placement) activities can impact the benthic environment, it may also allow for an improvement in water circulation and water quality. In general, these projects are not expected to cause long-term adverse effects on the surrounding ecosystems. Any effects on the environment should be minimal and be offset by the project benefits of providing safe navigation and opportunities for the more efficient movement of waterborne commerce. Short-term impacts associated with the projects may include destruction of the non-motile benthic community and temporary changes in water quality, air, and noise emissions. Short-term impacts would cease with the completion of construction. Long-term impacts to soils and bathymetry, typical of a dredging project, would be expected as a result of these projects. Nevertheless, impacts will be identified and addressed in a joint permit application for individual projects as appropriate.

Areas that typically can pose as obstacles or barriers to dredging and disposal (placement) include the existence of utilities and biological resource impacts (to include essential fish habitats, submerged aquatic vegetation, and public and private shellfish grounds) which are being identified as part of the aforementioned joint permit application process. As part of the dredging and disposal (placement) process, active engagement with stakeholders via public outreach to impacted stakeholders and the public in general will help to ensure early and often communication.

The costs of dredging and disposal/placement are both variable and increasing. Similarly, the historical cost of real estate necessary for project construction and maintenance in a coastal riverine environment has been variable and can be expected to be so in the future. Perhaps the biggest obstacle in previous dredging projects has been the availability of appropriately located and sized compatible disposal areas. This implementation plan assumes that to be the case both now and in the future. Future sections of this plan will identify innovative techniques such as the use of geotubes designed to decrease the horizontal footprint of disposal (placement) areas which are generally to be located within 2 miles of the dredging sites. The dredging and placement of dredged material is a dynamic process. For example, as technologies are identified and refined, additional disposal options may become available thus providing additional opportunities such as thin layering, island restoration/creation, and combination dredge material placement facilities. Such technologies may be applied to future maintenance dredging efforts to ensure continued compatibility within the broadest range of resiliency strategies.

Finally, the US Army Corps of Engineers Norfolk District authorized a Categorical Permission (CP) letter for seventeen federal navigation channels located in the study area. The CP was prepared in response to Section 14 of the Rivers and Harbors Act of 1899, which has since been amended several times and is codified at 33 USC 408 (Section 408). Section 408 provides that USACE may grant permission for another party to alter a Civil Works project upon a determination that the alteration proposed will not be injurious to the public interest and will not impair the usefulness of the Civil Works project. The CP creates an opportunity for non federal entities to conduct dredging activities within the federal navigation channels without required and often lengthy federal review and approval processes.

Equipment and Staffing

Based on the dredging volumes identified in recently completed surveys and data analysis by the VIMS Shoreline Studies Program, it appears that the wide array of small to large sized dredging projects will necessitate a combination of dredging strategies which take advantage of combinations of dredging equipment previously presented. In areas with a combination of sufficient dredge volumes and the availability of disposal or beneficial reuse sites within reasonable pumping distances (such as Aberdeen, Cedarbush, and Timberneck Creeks), hydraulic pipeline dredging may be considered. A second dredging strategy may consist of a continuation of the beneficial placement of beach quality dredge material on nearby beaches (for example Hole in the Wall). A third dredging strategy may include mechanical dredging (examples may include Bush Park and Mill Creeks). A fourth dredging strategy may involve smaller land based platform dredging operations (examples may include Free School Creek, Mill Creek, and Mill Creek 2). In addition, combinations of the above strategies are envisioned.

Each type of dredging operation utilizes specific types of equipment. For instance, a hydraulic cutter dredge requires several thousand feet of flexible pipeline that connects directly to an onboard pump, whereas floating mechanical clamshell dredges typically require an ancillary spider barge to collect and transport dredged material. Table 10 below describes some costs necessary for a hydraulic cutter dredge operation and preparation and maintenance of upland disposal and beneficial reuse sites, as well as the annualized costs over 10 years for the dredge (the largest single-item cost) and 6 years for other costs. The interest rate is assumed to be 3%.

Table 10. Typical Dredging and Disposal (Placement) Site Equipment Costs[48]

Equipment Type & Description	Proposed Budget Item	Annual Finance Cost	Loan Term - years
Dredge			
Ellicott Dragon 670 (12", 620HP)	$1,800,000		
Subtotal	**$1,800,000**	**$204,868.85**	10
Marine Support Craft & Equipment			
Primary Push Boat	$250,000		
Support Boat 1	$75,000		
Support Skiff	$20,000		
Booster Pump	$350,000		
Dredge Pipe (11,000 ft @ 12-14")	$418,000		
Barge/Scow	$300,000		
Subtotal	**$1,413,000**	**$253,239.10**	6
Land-based Support Craft & Equipment			
GMC Sierra 2500HD Duramax Pickup Truck (x3)	$180,000		
Heavy-duty Equipment Trailer	$7,500		
CAT 928 Wheeled Loader	$125,000		
Loader Attachments	$10,000		
Subtotal	**$322,500**	**$57,798.73**	6
Total:	**$3,535,500**	**$515,907**	

[48] Some equipment cost estimates in this section derived from the MVPC study; see Case Studies.

Each type of dredging operation, whether hydraulic or mechanical, typically employs a full-time crew complement of 3-5 or 4-7 employees (respectively). The number of people required is highly variable on the specific conditions at the job being done, as well as whether or not crewmembers are flexible within their job descriptions. For example, a deckhand may be required to both help on board the barge or tugboat and be responsible for assisting in disposal site activities (if not handled entirely by another party).

Table 11 below lists the names of typical positions aboard different dredges and salary estimates based on industry data, case studies, and online job postings. Total personnel costs include payroll taxes, workman's compensation, health and life insurance, and training costs.

Table 11. Typical Dredging and Disposal (Placement) Positions and Salaries

Position Name	Low Estimate	High Estimate
Dredge Superintendent	$ 100,000	
Dredge Captain/Tug Operator	$ 47,881	$ 76,432
Assistant Captain	$ 31,715	--
Dredge Maintenance Engineer	$ 36,997	$ 65,000
Dredge Leverman	$ 36,720	$ 51,000
Dredge First Deckhand	$ 28,560	$ 44,533
Dredge Second Deckhand	$ 28,560	$ 44,533
Welder	$ 32,640	$ 36,720
Cook	$ 40,800	$ 51,000
Truck Driver	$ 32,640	$ 41,000
Transfer Point Attendant[49]	--	--

Between equipment and staffing, there are numerous ancillary costs to consider. Dredge hoses and moorings, fuels and lubricants, storage rentals for equipment, repairs for both the dredge and the workboats, general maintenance supplies, and liability insurance all add to operating costs. Payroll taxes, retirement contributions, workman's compensation, health insurance, life insurance, and various trainings and certifications all add to personnel costs.[50] There may also be contributions to a replacement costs fund.

In addition to equipment and staffing, there are engineering services and administrative costs related to running a dredging operation. Even if every project were contracted out, a general administrator would be required to coordinate projects. Table 12 lists some of the costs of such an operation.

[49] Some dredging operations may require a full-time attendant at the disposal site to manage the ingress of barges and coordination of dredged material disposal; salaries for this position are likely highly variable.

[50] For a complete breakdown of these costs, see Owning and Operating a Regional Dredging Program.

Table 12. Administrative and Engineering Costs

Office Expense	Administration	Engineering Services
Office and Facilities	$3,600	
Equipment	$3,000	
Utilities		
Electric	$3,000	
Telephone	$3,600	
Water and Sewer	$2,400	
Internet	$1,200	
Subtotal	**$16,800**	
Consultants		
Accounting and Audit	$25,000	
Preliminary Engineering and Design - Future Projects	$300,000	
Preliminary Engineering and Design - 3 Projects		$120,000
Environmental Assessment	$30,000	
Legal	$20,000	
Financial	$20,000	
Other - Grant/Loan Applications	$15,000	
Condition Survey - 3		$75,000
Monitoring and Mitigation - $50,000 X 3		$150,000
Subtotal	**$410,000**	**$345,000**
Bonds		**$8,000**
Permit Fees and Environmental Compliance		$75,000
Environmental Support Services		$75,000
Subtotal		**$150,000**
Administrative		
Travel	$4,000	
Office Supplies and Postage	$1,200	
Administrative Expenses and dues	$2,000	
Bank Fees and Finance Charges	$600	
Bank Interest Charges	$15,000	
Subtotal	**$22,800**	
Total(s):	**$449,600**	**$503,000**
Combined Total:		**$952,600**

Developing a Base Dredging Schedule

In order to develop a dredging schedule a number of criteria were developed and assessed according to the criteria. Three basic schedules were assessed; two based on geographic proximity and one based on a combination of geographic proximity with dredging projects where data assessments have been completed.

Alternative One is Gloucester County projects followed by Mathews County projects followed by Middlesex County projects. **Alternative Two** is Middlesex County projects followed by Mathews County projects followed by Gloucester County projects. **Alternative Three** is Davis Creek, Aberdeen Creek, Timberneck Creek, Cedarbush Creek, and Hole In The Wall, followed in geographic order by projects in Gloucester County, then Mathews County, then Middlesex County.

For each alternative, the analysis assumes that:

- Downtime for non working days (holidays and equipment repairs) is set at 10%.
- Delays beyond set aside maintenance periods would result in the dredging schedule for each ensuing project to be delayed accordingly, and
- All Pre-Construction activities have been completed and disposal area (beneficial and/or upland) has been acquired and prepared for dredging activities to begin.

The table below lists the criteria used to assess the three alternative base dredging schedules:

Criteria	Alternative One	Alternative Two	Alternative Three
Minimizes travel time for moving dredging equipment from site to site	Yes	Yes	Yes
Minimizes travel cost for moving equipment from site to site	Yes	Yes	Yes
Facilitates daily dredging production rate of 750 cubic yards per day	Yes	Yes	Yes
Facilitates weekday work schedule	Yes	Yes	Yes
Facilitates requirements for dredge equipment maintenance based on normal usage	Yes	Yes	Yes
Generally consistent in meeting annual dredging program dredging target totals (within 120,000 cubic yards)	Yes	Yes	Yes
Produces the shortest dredging program cycle time	**No**	**No**	Yes

All three alternatives meet almost all of the established criteria, but Alternative Three is also able to accomplish all of the dredging projects in the shortest period of time, such that a second round of dredging could occur for those projects most in need of maintenance dredging.

Table 13 below lays out the resultant base dredging schedule for each of the projects. Such a schedule would allow for completion of the first complete cycle of dredging in December 2027. Thereafter it is envisioned that over the 10-year period of analysis the maintenance dredging program will routinely respond to dredging needs within the 3 county area based on timely preparation of project condition surveys. Deviations to the base dredging schedule may occur for a number of reasons to include, but not limited to, delays in the provisions of adequate disposal (placement) areas, delays in preparing the dredging and/or disposal (placement) sites, permitting delays, and equipment downtime. In such instances the base schedule will need to be revised to meet dredging program realities.

Several assumptions go into the creation of the base schedule, including:

- The dredging year starts on November 1 in the first year of the program based on program startup considerations and on April 1 thereafter with an overall goal of 100,000 to 120,000 cubic yards of dredging per year.
- In the years that multiple projects are dredged, this base schedule is designed to reduce travel costs.
- The schedule is based on a production rate of 750 cubic yards per day.
- The schedule is based on a Monday through Friday working week.
- Downtime for non-working days (holidays and equipment repairs) is set at 10%.
- Delays beyond set aside maintenance periods would result in the dredging schedule for each ensuing project to be delayed accordingly.
- All Pre-Construction activities have been completed and disposal area (beneficial and/or upland) has been acquired and prepared for dredging activities to begin.

Table 13. Base Dredging Schedule

Navigation Project	Dredging Program Year Number	Dredging	Total Period of Performance	Begin Date For Mobilization	End Date for Demobilization	Days of Equipment Usage Accumulated[51]	Accumulated Dredging Volume
Davis Creek	1	44	59	10/01/22	12/22/22	44	32,900
Aberdeen Creek	2	79	98	04/01/23	08/15/23	79	59,250
Timberneck Creek	2	62	79	08/16/23	12/04/23	141	105,550
Cedarbush Creek	3	119	142	04/01/24	10/16/24	119	89,506
Hole In The Wall	3	53	70	10/17/24	01/22/25	173	129,506
Sarah Creek	4	13	25	04/01/25	05/06/25	13	9,549
Perrin River	4	19	32	05/07/25	06/20/25	32	24,142
Free School Creek	4	1	12	06/21/25	07/08/25	33	24,364
Whittaker Creek	4	12	24	07/09/25	08/12/25	45	33,317
Mill Creek 2	4	2	13	08/13/25	08/29/25	47	34,444
Put In Creek	4	7	19	08/30/25	09/24/25	54	39,814
Horn Harbor	4	110	132	09/25/25	03/27/26	163	122,047
Winter Harbor	5	142	168	04/01/26	11/20/26	142	106,861
Queens Creek	5	31	45	11/21/26	01/21/27	173	129,861
Milford Haven	6	15	27	04/01/27	05/10/27	15	11,043
Broad Creek	6	10	21	05/11/27	06/09/27	24	18,179
Bush Park Creek	6	3	15	06/10/27	06/30/27	28	20,747
Mill Creek	6	1	12	07/01/27	07/16/27	28	21,230
Whiting Creek	6	42	57	07/17/27	10/05/27	70	52,874
Robinson Creek	6	6	17	10/06/27	10/29/27	76	57,246
Parrotts Creek	6	27	41	10/30/27	12/24/27	103	77,511

[51] Mobilization and demobilization days are not included as the equipment would not be in a non production status during those periods.

The Cost of Dredging – Channels Summary

Here, the particular costs of each of the 21 channels are explored (in order of which county they are located in).[52] Separate consideration is given to the costs of combined channel projects. There are several assumptions inherent in this cost analysis:

- The information below is based on January 2021 price levels and an interest rate of 3 per cent. The fiscal year used is July 1 through June 30. The base year is the year assumed for project construction and for subsequent maintenance dredging cycles based on a 5–10-year dredging frequency. Placement of beach quality dredge material is assumed to be used to nourish shorelines and the placement of non-beach quality dredge material is assumed to be placed in upland sites facilitated via the use of geotubes.
- Regarding assumptions for subsequent dredging cycles, the costs associated with further disposal site preparation will be decided at that time.
- The costs for aids to navigation, if any, will be determined closer to project construction.

The costs for each channel are derived from line items in the Pre-Construction, Construction, and Post-Construction phases.

The Pre-Construction phase consists of components necessary to prepare the project for the actual dredging effort. The major components of the Pre-Construction phase are preliminary engineering and design activities to include a joint permit application, grant and loan applications, community engagement, an environmental assessment, federal, state, and local permits, legal coordination, and financial coordination. The timeline for the Pre-Construction phase would typically range up to 18 months.

The Construction phase consists of activities necessary to dredge the project and place dredged material at an appropriate placement site. The major components of the Construction phase are final engineering designs/plans and specifications, bonds and insurance, mobilization and demobilization of equipment, disposal/placement site preparation, dredging and disposal placement costs, supervision and administration costs for the dredging and disposal/placement activities. Construction times vary depending upon the size and complexity of the job. For each channel, mobilization includes the costs of operations accomplished prior to commencement of dredging operations, and demobilization includes costs for the general preparation for transfer of the plant to its home base, removal of pipelines, cleanup of site of work areas, and the actual transfer of the plant to its home base. The timeline for the Construction phase varies depending upon the complexity of the job.

The Post-Construction phase consists of activities to close out the project to include mitigation, and/or monitoring and the conduct of a project condition survey. Typically, the timeline to close out the fiscal and physical activities can range up to 2 months and the timeline to provide appropriate mitigation and/or monitoring is dependent upon the degree of dredging and disposal/placement impacts.

[52] Detailed project-by-project cost estimates for each individual channel and the project combinations are available in Appendix B.

Contingency costs may vary up or down as more is known about the project and its impacts. Likewise, the costs of dredging and disposal/placement are both variable and increasing. Similarly, the historical cost of real estate necessary for project construction and maintenance in a coastal riverine environment has historically been variable and can be expected to be so in the future.

The evaluation of initial dredging costs for each project began with the determination of an appropriate depth (to include 1 foot of over depth dredging for each project), an associated dredging volume and the type of disposal (placement) for dredge material. Estimates were developed for single effort projects (Twenty-two projects minus Mattaponi River equals twenty-one single effort dredging projects) as well as combination dredging projects. Table 14 provides this information for each project as well as the associated maintenance dredging frequency in years. Cost estimates are based on the assumption of projects being competitively bid to private sector contractors.

Table 14. Summary of Project Dredging Depths, Disposal (Placement) Types, Dredging Volumes, and Dredging Frequencies

Navigation Project	Dredging Depth (Ft.)	Assessment of Type of Disposal (Placement)	Total Volume	Dredging Frequency (Years)
Mattaponi River[53]	No Dredging	No Dredging	No Dredging	No Dredging
Aberdeen Creek	-(6+1)	Upland	59,250	5-10
Cedarbush Creek	-(6+1)	Upland	89,506	10-20
Timberneck Creek	-(6+1)	Upland	46,300	5-10
Aberdeen/Cedarbush/Timberneck Creeks Combination	-(6+1)	Upland	195,056	--
Sarah Creek	-(6+1)	Upland	9,549	5-10
Perrin River	-(6+1)	Upland	14,593	10-20
Sarah Creek/Perrin River Combination	-(6+1)	Upland	24,142	--
Free School Creek	-(4+1)	Upland	222	10-20
Whittaker Creek	-(4+1)	Upland	8,953	5-10
Free School Creek/Whittaker Creek Combination	-(4+1)	Upland	9,175	--
Mill Creek 2	-(4+1)	Beneficial Use	1,127	10-20
Put In Creek	-(4+1)	Upland	5,370	5-10
Mill Creek 2/Put In Creek Combination	-(4+1)	Upland	6,497	--
Davis Creek	-(7+1)	Upland	32,900	5-10
Horn Harbor	-(7+1)	Beneficial Use	82,233	10-20
Winter Harbor	-(6+1)	Beneficial Use and Upland	106,861	5-10
Horn Harbor/Winter Harbor Combination	-(7+1) | -(6+1)	Beneficial Use and Upland	189,094	--
Hole In The Wall	-(6+1)	Beneficial Use	40,000	5-10
Queens Creek[54]	-(6+1)	Beneficial Use	971/23,000	5-10
Milford Haven	-(10+1)	Beneficial Use	11,043	10-20
Milford Haven/Queens Creek Combination	-(6+1) | -(10+1)	Beneficial Use	34,043	--
Broad Creek	-(7+1)	Beneficial Use and Upland	7,136	5-10
Bush Park Creek	-(4+1)	Beneficial Use	2,568	<5
Mill Creek	-(4+1)	Beneficial Use	483	10-20
Whiting Creek	-(6+1)	Beneficial Use	31,644	5-10
Robinson Creek	-(6+1)	Beneficial Use	4,372	5-10
Parrotts Creek	-(6+1)	Upland	20,265	10-20
		Total:	**597,375**	

[53] VIMS Shoreline Studies Program channel condition survey indicated that dredging was not required.
[54] Dredging last occurred in 2019, with 2020 VIMS survey showing 971 cubic yards required to bring full project depth; long term dredging records indicate an average of 23,000 cubic yards required for removal each cycle.

The total cost of initial dredging is expected to be $36,702,083 inclusive of all Pre-Construction, Construction, and Post-Construction activities. In certain cases, it is more economical to combine dredging efforts as this results in a lower cost when projects can be combined as part of a single effort. Those potential six combination projects are as follows:

- Aberdeen/Cedarbush/Timberneck Creeks (Gloucester County)
- Sarah Creek/Perrin River (Gloucester County)
- Free School Creek/Whittaker Creek (Gloucester County)
- Mill Creek 2/Put In Creek (Mathews County)
- Horn Harbor/Winter Harbor (Mathews County)
- Queens Creek/Milford Haven (Mathews County)

When assessing the cost of the combination projects together with the remaining eight single effort dredging projects the total cost is reduced to $30,074,672. Table 15 provides the estimated cost for each single and combination dredging project.

Table 15. Summary of Project Dredge Type and Initial Dredging Costs

Navigation Project	Type of Dredge	Initial Cost of Construction	Cost Per Cubic Yard of Initial Construction
Mattaponi River	No Dredging	No Dredging	No Dredging
Aberdeen Creek	Hydraulic	$2,416,043	$41
Cedarbush Creek	Hydraulic	$3,201,088	$36
Timberneck Creek	Hydraulic	$2,841,833	$61
Aberdeen/Cedarbush/Timberneck Creeks Combination	Hydraulic	$4,700,927	$24
Sarah Creek	Hydraulic	$1,679,282	$176
Perrin River	Hydraulic	$1,878,608	$129
Sarah Creek/Perrin River Combination	Hydraulic	$2,514,523	$104
Free School Creek	Upland Platform or Hydraulic	$337,178	$1,519
Whittaker Creek	Hydraulic	$1,650,126	$184
Free School Creek/Whittaker Creek Combination	Hydraulic	$2,008,969	$219
Mill Creek 2	Upland Platform, Hydraulic or Mechanical	$379,538	$337
Put In Creek	Hydraulic	$1,634,444	$304
Mill Creek 2/Put In Creek Combination	Hydraulic	$2,008,475	$309
Davis Creek	Hydraulic	$2,182,320	$66
Horn Harbor	Hydraulic	$2,291,117	$28
Winter Harbor	Hydraulic	$3,093,480	$29
Horn Harbor/Winter Harbor Combination	Hydraulic	$4,493,758	$24
Hole In The Wall	Hydraulic	$1,951,350	$49
Queens Creek	Hydraulic	$1,562,250	$68
Milford Haven	Hydraulic or Mechanical	$1,385,624	$125
Milford Haven/Queens Creek Combination	Hydraulic	$1,996,548	$59
Broad Creek	Hydraulic	$1,529,468	$214
Bush Park Creek	Mechanical	$1,350,332	$526
Mill Creek	Upland Platform or Mechanical	$339,571	$703
Whiting Creek	Hydraulic	$1,689,937	$53
Robinson Creek	Hydraulic	$1,379,297	$315
Parrotts Creek	Hydraulic or Mechanical	$1,929,197	$95
	Total, Single Projects:	**$36,702,083**	**$61**
	Total, with Combinations:	**$30,058,514**	**$50**

Of the six potential combination projects examined, two (Free School Creek/Whittaker Creek and Mill Creek 2/Put In Creek) would not result in a direct savings. However, there is a potential for a savings to be gained by using shared disposal sites as noted in Table 16 below. Those two combination projects may see a reduction in mobilization and demobilization costs (although the project costs already reflect this savings for upland platform dredging projects vs. traditional water based dredging methods). The following table provides a listing of potential savings for each combination project.

Table 16. Implementation Cost Savings for Combination Projects

Combination Dredging Project	County Identifier	Costs of Each Single Project	Costs for One Combined Project	Potential Cost Savings
Aberdeen/Cedarbush/Timberneck Creeks Combination	Gloucester	$8,458,964	$4,700,927	$3,758,037
Sarah Creek/Perrin River Combination	Gloucester	$3,557,890	$2,514,523	$1,043,367
Free School Creek/Whittaker Creek Combination	Gloucester	$2,008,969	$2,008,969	$0[55]
Mill Creek 2/Put In Creek Combination	Mathews	$2,008,475	$2,008,475	$0[56]
Horn Harbor/Winter Harbor Combination	Mathews	$5,384,597	$4,493,758	$890,839
Milford Haven/Queens Creek Combination	Mathews	$2,947,874	$1,996,548	$951,326
Total:		$24,366,769	$17,723,200	$6,643,569

It is noted that a number of variables drive the opportunities for any dredging cost savings in the out years (defined as the years where subsequent maintenance dredging would need to occur). The principal variables considered include the length of dredging cycles and the availability of long-term disposal sites, each of which vary by project alternative. As an example, the dredging cycles for the Aberdeen/Cedarbush/Timberneck Creeks combination project are 5-10 years, 10-20 years, and 5-10 years, respectively. For these reasons, subsequent maintenance dredging costs for the out years were not included in this table although savings will likely occur when dredging cycles (the need for subsequent maintenance dredging) and long-term disposal sites align. The additional savings would be identified starting with the conduct of project condition surveys at that time.

Detailed project-by-project cost estimates for each individual channel and the project combinations are available in Appendix B.

[55] Athough there would be no savings from combining the projects, there would be a savings to Free School Creek via the use of an upland platform dredging method vs. a traditional water-based dredging method (and the associated savings in mobilization and demobilization costs) and potential savings from a shared disposal site with Whittaker Creek.

[56] Athough there would be no savings from combining the projects, there would be a savings to Mill Creek 2 via the use of an upland platform dredging method vs. a traditional water-based dredging method (and the associated savings in mobilization and demobilization costs) and potential savings from a shared disposal site with Put In Creek.

Owning and Operating a Regional Dredging Program

Introduction

If a regional dredging program is to be undertaken by the Middle Peninsula local governments to address the continuing need for shallow channel dredging, it is essential to be able to project the annual costs for operating the dredging program along with the administrative structure required to implement the program. This analysis builds upon the work of Shore Consulting Group LLC and the Berkley Group in the estimation of equipment, staffing and operational costs. The analysis develops an annual operating budget for the regional dredging program and projects the costs on a monthly basis over a three-year period.

The analysis also compared the cost of operating a regional dredging program vs. contracting with the private sector to perform the dredging projects.

Proposed Annual Budget

This analysis developed annual budget and revenue structure to support a regionally operated dredging program. The expenditures are based on the proposed equipment list, staffing and operational costs that were developed by Shore Consulting Group and the Berkley Group. In addition to these costs the proposed budget includes those costs associated with the administration of the regional dredging program and related costs of financing. The equipment costs were annualized based upon the term of the equipment financing. The budget is presented to reflect the costs of the administration of the regional dredging program as well as the direct costs of dredging. The total annual budget of a regionally operated dredging program is estimated at $2.6M with $856,000 associated with administration and $1.7M with direct dredging activity. The proposed annual budget is shown in Table 17.

Table 17. Potential Annual Budget – 4 Dredging Projects per Year (on Average)[57]

Item	Description	Cost - Administration	Cost - Dredging and Disposal
Personnel			
	Director/Dredge Superintendent	$100,000	
	Dredge Captain/Tug Operator		$75,000
	Dredge Maintenance Engineer		$65,000
	Dredge Leverman		$65,000
	Dredge First Deckhand		$65,000
	Dredge Second Deckhand		$50,000
	Total Wages	**$100,000**	**$320,000**
	Payroll Taxes - Social Security	$7,500	$24,000
	Retirement	$5,000	$16,000

[57] According to the hypothetical dredging schedule, which spreads dredging the 21 channels over 5 years.

Item	Description	Cost - Administration	Cost - Dredging and Disposal
	Workman's Comp.	$120	$3,840
	Health Insurance	$15,400	$49,280
	Life Insurance	$10	$32
	Training and Certification	$2,000	$8,000
	Total Personnel	**$130,030**	**$421,152**
	Dredging Equipment Maintenance and Supplies		
	Dredge Hose and Mooring		$25,000
	Fuel and Lubricants		$37,000
	Miscellaneous Expenses		$15,000
	Storage Rent		$3,600
	Repairs and Materials - Dredge		$25,000
	Repairs and Materials - Workboats		$5,000
	General Maintenance Supplies		$30,000
	Rental Equipment		$75,000
	Subtotal		**$215,600**
	Insurance		
	Liability		$25,000
	Hull and Equipment		$40,000
	Other	$6,000	
	Subtotal	**$6,000**	**$65,000**
	Office Expense		
	Office and Facilities	$3,600	
	Equipment	$3,000	
	Utilities		
	Electric	$3,000	
	Telephone	$3,600	
	Water and Sewer	$2,400	
	Internet	$1,200	
	Subtotal	**$16,800**	
	Consultants		
	Accounting and Audit	$25,000	
	Preliminary Engineering and Design - Future Projects	$300,000	
	Preliminary Engineering and Design - 3 Projects		$120,000
	Environmental Assessment	$30,000	
	Legal	$20,000	
	Financial	$20,000	
	Other - Grant/Loan Applications	$15,000	
	Condition Survey – 3 Projects		$75,000

Item	Description	Cost - Administration	Cost - Dredging and Disposal
	Monitoring and Mitigation - $50,000 X 3		$150,000
	Subtotal	**$410,000**	**$345,000**
Bonds			**$8,000**
Permit Fees and Environmental Compliance			$75,000
	Environmental Support Services		$75,000
	Subtotal		**$150,000**
Administrative			
	Travel	$4,000	
	Office Supplies and Postage	$1,200	
	Administrative Expenses and dues	$2,000	
	Bank Fees and Finance Charges	$600	
	Bank Interest Charges	$15,000	
	Subtotal	**$22,800**	
Debt Payments			**$521,597**
Replacement Reserves		**$250,000**	
Other and Miscellaneous		**$20,000**	**$40,000**
Total		**$855,630**	**$1,726,349**
Grand Total		**$2,581,979**	

There is the potential to reduce the annual operating cost of the regionally operated dredging program above by securing a grant(s) to cover the cost of the equipment, $3.6M. If grant funding was successful to cover the full cost of the equipment it would save the program $521,597 annually in debt service costs. A grant to cover the cost of half the equipment would result in a reduction of the operating cost by $260,789. The Virginia Department of Housing and Community Development's GO Virginia and the Virginia Port Authority's Waterway Maintenance Fund programs are potential grant sources.

The pro forma that is discussed in the next section indicates that a fee to the counties of $27 per cubic yard (cu. yd.) is required to cover operating costs of the regional dredging program. If grant funding were available this would result in a lowered fee to $24.30 per cu. yd. with a 50% equipment grant and $21.50 per cu. yd. for a 100% equipment grant. There would be a commensurate reduction in local real estate tax rates necessary to support the regionally operated dredging program. Table 18 illustrates the results of this analysis:

Table 18. Impact of Grants on Real Estate Tax Rates for a Regionally Operated Program

Regionally Operated Program	Annual Operating Costs	Fee per Cubic Yard	
No Grant	$2,581,979	$27.00	
50% Equipment Grant	$2,321,180	$24.30	
100% Equipment Grant	$2,060,382	$21.50	
Total Project Costs	**Gloucester**	**Mathews**	**Middlesex**
No Grant	$8,478,571	$9,818,908	$3,040,177
50% Equipment Grant	$7,861,967	$9,061,545	$2,860,713
100% Equipment Grant	$7,222,525	$8,276,131	$2,674,603
Tax Rate Increase			
No Grant	$0.021	$0.061	$0.017
50% Equipment Grant	$0.019	$0.056	$0.016
100% Equipment Grant	$0.018	$0.051	$0.015

Three-Year Pro Forma

The revenue forecast for the first three years of the regional dredging program operation was based upon a dredging fee to the localities of $27/cy of material dredged. The annual revenues were projected based upon an annual dredging production rate of 120,000 cubic yards. It was assumed that no dredging would be conducted during the months of December through February due to holidays and winter weather conditions. Equipment maintenance, staff training, and vacations would be conducted during these months. Revenues were calculated for the months that dredging is actually performed, March through November.

Dredging is projected to begin on the 1st of October of the first year. This allows three months to purchase and assemble equipment, hire and train staff, and establish the program administration. The debt service payments on the equipment are projected to begin the month following the delivery of the equipment. The administrative staff would start on July 1st and the remainder of the staff starting on September 15.

It is projected that personnel and operating expenses would increase at a rate of 3% per year. A working capital line of credit (LOC) will be necessary to cover start-up costs and cash flow over the three years. It was assumed that the LOC interest rate would be 6% of the LOC balance. The full pro forma is presented in Appendix C. Table 19 below provides a summary of the 3-year financial pro forma.

Table 19. Three Year Pro Forma Summary

Revenues	Year 1	Year 2	Year 3
County Contributions	$1,800,000	$3,240,000	$3,240,000
Total Revenues	**$1,800,000**	**$3,240,000**	**$3,240,000**
Expenditures			
Personnel	$428,346	$567,718	$624,489
Operating	$1,078,300	$1,322,726	$1,362,408
Replacement Reserve	$250,000	$250,000	$250,000
Debt Service	$434,664	$521,597	$521,597
Total Expenditures	**$2,191,310**	**$2,662,041**	**$2,758,495**
Financing			
Line of Credit Interest	$27,750	$19,250	$8,500
Line of Credit Repayment	$200,000	$450,000	$300,000
Total Financing	**$227,750**	**$469,250**	**$308,500**
Revenue Over Expenditures	**-$619,060**	**$108,709**	**$173,005**
End of year LOC Balance	**$550,000**	**$250,000**	**$100,000**
Replacement Reserve Balance	**$250,000**	**$500,000**	**$750,000**
End of Year Cash on Hand	**$290,940**	**$99,649**	**$122,654**

Conclusions - Pro Forma

The following summarizes the main conclusions from the pro forma:

1st Year:

- Expenditures exceeded revenues by $619,060 – Revenues, $1,800,000 – Expenditures, $2,419,060.
- The program start-up time and the down time during the winter months cause a cash flow and first year deficit.
- A $650,000 working capital LOC is required to offset the cash flow issues during this first year.
- A fee structure of $27/cy is required to ensure break even in following years.
- $250,000 was added to the replacement reserve and there was a cash balance of $290,940 at the end of the fiscal year.

2nd Year:

- Revenues exceeded expenditures by $108,709 – Revenues of $3,240,000 and expenditures of $3,331,291.
- The LOC can be reduced to $250,000 at the end of the year.
- The replacement reserve grows to $500,000 with the cash balance $99,649 at the end of the year.

3rd Year:

- Revenues exceeded expenditures by $173,005 – Revenues of $3,240,000 and Expenditures of $3,066, 995.
- The LOC can be further reduced to $100,000 at the end of the year.
- The replacement reserve grows to $750,000 and the cash balance of $122,654 at the end of the year.

Regionally Operated Dredging Program vs. Private Sector Cost Comparison

It is useful to compare what it costs to implement the proposed dredging projects either through contracts with private sector companies or through a regionally operated dredging program. This analysis considered the combined costs of pre-construction, dredging and post-dredging costs for a regionally operated dredging program versus those same costs if they are contracted out to private sector companies. The costs of acquisition of dredge material disposal sites and the preparation of those sites are equivalent for both a regionally operated dredging program and a private sector contracted program. Both the cost of dredging and the cost of dredging and disposal were evaluated. For purposes of this analysis, a regionally operated dredging program was calculated at $27 per cubic yard and uniformly applied to each project.

The following Table 20 illustrates the costs of dredging each of the projects and combination projects for the 21 channel dredging projects under study.

Table 20. Regional Program vs. Private Sector Cost Comparison

Dredging Project	Regional Dredging Program: Dredging Cost at $27/cy	Regional Dredging Program: Total Dredging and Disposal Cost	Private Sector: Dredging Cost	Private Sector: Total Dredging and Disposal Cost
Aberdeen Creek	$1,599,750	$2,192,128	$1,823,662	$2,416,043
Cedarbush Creek	$2,416,635	$3,215,709	$2,174,160	$3,201,088
Timberneck Creek	$1,250,100	$2,191,618	$1,697,529	$2,841,833
Aberdeen, Cedarbush, Timberneck Combination Project	$5,266,485	$6,298,820	$3,668,588	$4,700,927
Sarah Creek	$257,823	$691,552	$1,355,549	$1,679,282
Perrin River	$394,011	$1,073,106	$1,419,510	$1,878,608
Sarah, Perrin River Combination Project	$651,834	$1,630,297	$1,898,059	$2,514,523
Free School Creek	$5,994	$307,723	$728,567	$1,545,299
Free School Creek[58]	--	--	--	$337,178
Whittaker Creek	$241,731	$543,460	$1,348,393	$1,650,126
Freeschool, Whittaker Combination Project	$247,725	$549,454	$1,707,237	$2,008,969
Gloucester Total[59]	$6,166,044	**$8,478,571**	$7,273,884	**$9,224,419**
Mill Creek 2[58]	$30,429	$65,197	$344,766	$379,538
Mill Creek 2	--	--	--	$1,325,018
Put In Creek	$144,990	$556,064	$1,206,356	$1,634,444
Mill Creek 2, Put In Creek Combination Project	$175,419	$601,404	$1,679,406	$2,013,982
Davis Creek	$888,300	$1,536,341	$1,534,276	$2,182,320
Horn Harbor	$2,220,291	$2,431,139	$2,226,373	$2,291,117
Winter Harbor	$2,885,247	$3,611,623	$2,784,938	$3,093,480
Horn & Winter Harbors Combination Project	$5,105,538	$5,980,498	$3,857,776	$4,493,758
Hole In The Wall	$1,080,000	$1,229,996	$1,801,350	$1,951,350
Queens Creek	$26,217	$134,889	$1,453,575	$1,562,250
Milford Haven	$298,161	$386,207	$1,297,575	$1,385,624
Queens Creek, Milford Haven Combination Project	$324,378	$470,669	$1,929,310	$1,996,548

[58] Using an on-land platform mechanical dredging method (as opposed to hydraulic cutterhead suction).
[59] The cost if all cost-saving combination projects are implemented.

Table 20. Regional Program vs. Private Sector Cost Comparison (Continued)

	Regional Dredging Program		Private Sector	
Dredging Project	**Dredging Cost at $27/cy**	**Total Dredging and Disposal Cost**	**Dredging Cost**	**Total Dredging and Disposal Cost**
Mathews Total[60]	$7,573,635	**$9,818,908**	$10,802,118	**$12,632,451**
Broad Creek	$192,672	$387,423	$1,243,050	$1,529,468
Bush Park Creek	$69,336	$149,147	$1,270,517	$1,350,332
Mill Creek[61]	$13,041	$43,176	$309,432	$339,571
Mill Creek	--	--	--	$1,229,634
Whiting Creek	$854,388	$977,970	$1,566,351	$1,689,937
Robinson Creek	$118,044	$201,238	$1,296,100	$1,379,297
Parrotts Creek	$547,155	$1,281,223	$1,391,314	$1,929,197
Middlesex Total[60]	$1,794,636	**$3,040,178**	$7,076,764	**$8,217,802**
Total All Projects	$15,534,315	**$21,337,657**	$25,152,766	**$30,074,672**
Average	$1,109,594	**$1,557,738**	$1,932,202	**$2,211,151**

The impact of the cost savings of a regionally operated program is reflected in a lesser increase in the real estate tax rate necessary to support the dredging program. Since the savings of operating a regional dredging program are different for each of the three counties and the real estate tax base varies by county, the real estate tax rate necessary to cover the costs of the dredging projects also varies from county to county. Table 21 summarizes the cost savings for each county of operating a regional dredging program and the lower tax rate that would be required to support the regionally operated dredging program.

Operating a dredging program regionally versus contracting the dredging projects to private contractors is less costly for each county (Gloucester - $745,848, Mathews - $2,813,543 and Middlesex – $5,177,625) with an overall estimated savings of $8,737,016. The impact upon the local real estate tax base is also lower. The increase in the real estate tax rate required to support the regional dredging program is lower by $.003 in Gloucester County, $.02 in Mathews County and $.029 in Middlesex County when compared to contracting the dredging projects to private contractors.

[60] The cost if all cost-saving combination projects are implemented.
[61] Using an on-land platform mechanical dredging method (as opposed to hydraulic cutterhead suction).

Table 21. Impact of Private Sector Contracting vs. a Regionally Operating Program on Real Estate Tax Rates by County

Total Cost of Dredging

County	Private Sector Contracting	Regionally Operated Program	Difference
Gloucester	$9,224,419	$8,478,571	$745,848
Mathews	$12,632,451	$9,818,908	$2,813,543
Middlesex	$8,217,802	$3,040,177	$5,177,625
Total	$30,074,672	$21,337,656	$8,737,016

Tax Rate Increase

County	Private Sector Contracting	Regionally Operated Program	Difference
Gloucester	$0.024	$0.021	$0.003
Mathews	$0.080	$0.061	$0.020
Middlesex	$0.046	$0.017	$0.029

Conclusions - Comparison of Regionally Operated Dredging Program vs. Private Sector Costs

Table 22 below illustrates the cost per cubic yard of each of the projects by contracting the dredging projects to private companies vs. implementing those same projects through a regional dredging program at $27/cy. The dredging costs in Table 22 do not include the costs of acquisition and preparation of the sites for disposal of the dredge material since these costs are not reflected in the $27/cy cost of operating the regional dredging program.

The estimated cost per cubic yard to dredge the various projects through private contractors ranges from a low of $18.81/cy for the combined Aberdeen, Cedarbush, and Timberneck Creeks project to a high of $3,282/cy for Freeschool Creek. **The cost per cubic yard of all of the projects is $43.72 if implemented through private sector contractors vs. $27 for the regionally operated program.**

A main conclusion from this analysis is that small to medium sized dredging projects are more economical to implement through a regionally operated dredging program than contracting with private sector companies. Only four projects, all over 85,000 cy, are more economical to implement through contracts with private companies than through a regionally operated program. The mobilization and demobilization costs for a private contractor using a hydraulic dredge typically run about $700,000/per project. If the project is small to medium size, between a 1,000 cy and 80,000 cy, the cost per cubic yard escalates quickly. Having the regional hydraulic dredge close to the dredge site provides significant cost advantage for a regionally operated dredging program.

Very small projects, less than 1,000 cy, are likely to be more expensive using the hydraulic dredging equipment of the regional dredging program or private sector than using a modified mechanical dredging system offered by some private sector contractors. There are three projects, Free School Creek, Mill Creek and Mill Creek 2 that would lend them to this modified mechanical dredging process. Queens Creek was dredged in 2019 and by the time it will require dredging again it should be more in the range of 20,000 cy dredge volume.

Table 22. Regional Dredging Program vs. Private Sector Cost per Cubic Yard[62]

	Cost/Cubic Yard	
Cost of Authority-Owned Regional Dredging Program:	**$27.00**	
Dredging Project	**Private Sector**	**Dredging Volume**
Aberdeen Creek	$30.78	59,250
Cedarbush Creek	$24.29	89,505
Timberneck Creek	$36.66	46,300
Aberdeen/Cedarbush/Timberneck Combination Project	$18.81	195,055
Sarah Creek	$141.96	9,549
Perrin River	$97.27	14,593
Sarah Creek/Perrin River Combination Project	$78.62	24,142
Free School Creek	$3,281.83	222
Whittaker Creek	$150.61	8,953
Free School/Whittaker Creeks Combination Project	$186.07	9,175
Gloucester Total	$31.85	228,372
Mill Creek 2	$305.91	1,127
Put In Creek	$224.65	5,370
Mill Creek 2/Put In Creek Combination Project	$258.49	6,497
Davis Creek	$46.63	32,900
Horn Harbor	$27.07	82,233
Winter Harbor	$26.06	106,861
Horn/Winter Harbor Combination Project	$20.40	189,094
Hole In The Wall	$45.03	40,000
Queens Creek	$1,496.99	971
Milford Haven	$117.50	11,043
Queens Creek/Milford Haven Combination Project	$160.59	12,014
Mathews Total	$38.51	280,505
Broad Creek	$174.19	7,136
Bush Park Creek	$494.75	2,568
Mill Creek	$640.65	483
Whiting Creek	$49.50	31,644
Robinson Creek	$296.45	4,372
Parrots Creek	$68.66	20,265
Middlesex Total	$106.47	66,468
Total All Projects	**$43.72**	**575,345**
Average All Projects	**$47.02**	**41,096**

[62] Red text indicates a project for which private contracting would be cheaper than the $27 per cubic yard achieved by a regional dredging program.

Options for Covering the Costs of Dredging

Background

The USACE historically carried out dredging of shallow draft navigation projects in the Middle Peninsula. However, recent funding levels have not provided funding to sustain any maintenance dredging for the 17 Federal Navigation Channels on Virginia's Middle Peninsula. Further, the Commonwealth of Virginia has neglected funding for maintenance dredging of non-Federal channels until the Virginia General Assembly established the Virginia Waterway Maintenance Fund in 2018. For the past decade, the Middle Peninsula Chesapeake Bay Public Access Authority (MPCBPAA), the Middle Peninsula Planning District Commission (MPPDC) and its member jurisdictions (Essex, Gloucester, King and Queen, King William, Mathews and Middlesex Counties), with the support of the Virginia Institute of Marine Science (VIMS) Shoreline Studies Program have led the way in advancing local solutions and alternatives to address dredging needs in the Commonwealth.

Despite these efforts, funding levels and financing strategies are inadequate for addressing the critical navigation channel maintenance needs on the Middle Peninsula in a cost- and time-effective manner. After two years, the Virginia Waterway Maintenance Fund will have successfully led to "shovel-ready" designs of 7 dredging projects on the Middle Peninsula. The current and projected level of funding is insufficient to implement these projects. Based upon these realities, it is imperative that alternative methods of financing be evaluated to fund these and other dredging projects that are in the pipeline. It is important to maximize the resources available from federal and state sources in order to reduce the financial burden on the Middle Peninsula local governments to pay for current and future dredging projects.

Following is a review of an array of grants from federal and state sources that may be used to cover a portion of the costs of the proposed dredging projects. Each of the grant programs have specific requirements and regulations that may make them more or less applicable to individual projects. Each grant program will be discussed as to its potential application to dredging activity.

After, various potential sources of debt that can be used to finance the dredging activity are reviewed.

The characteristics of potential grant and loan financing options are analyzed, and insights into how applicable each may be to the Middle Peninsula dredging projects are provided.

Grant Programs

When evaluating the feasibility of dredging any channel, one of the first considerations is "what grant funds are available to offset the costs of dredging?" This section provided insight into that question. Seven grant programs administered by Virginia state agencies were reviewed along with eight grant programs available from federal agencies to determine what grants might be available to support the dredging projects in the Middle Peninsula. Each of these programs has their own unique purposes, requirements, and funding levels. Some grant programs will fund dredging as a "stand-alone" activity, other programs will only fund dredging as a component of a larger project serving another objective, while other programs only cover the cost of beneficial disposal of the dredge material. To further complicate the analysis some programs are specifically designed to support the planning of the dredging project (pre-dredging activities).

Three programs can provide grant support dredging as a “stand-alone” activity:

1. Virginia Port Authority, Waterway maintenance Fund,
2. US Army Corps of Engineers, Continuing Authorities Program, Section 107–Navigation, and
3. USDA Rural Development Community Facilities Direct Loan and Grant Program.

The limited appropriations from the Virginia General Assembly for the Waterway Maintenance Fund will only allow a very select few projects to be supported annually. If projects can support debt financing these funds could be spread across additional projects. With only $1.35M available in 2020, the Middle Peninsula should only project no more than about $600,000 annually to go into the dredging program. The VPA should be encouraged to consider a multi-year commitment to dredging projects to help facilitate the completion of pre-dredging activities and the coordination with other grant programs. The future commitment of funding from VPA would be critical in providing the matching resources necessary to gain access to other funding sources.

The US Army Corps of Engineers, Continuing Authorities Program, Section 107–Navigation program has had very limited funding over the past several years, with no projects undertaken in the Middle Peninsula in over 20 years. The Middle Peninsula should not expect funding from this program because of the long timeframe for the Corps of Engineers to plan and fund dredging projects. The criteria for grant funding from the USDA Rural Development Community Facilities Direct Loan and Grant Program targets projects with service areas that contain a predominance of lower-income households. Since waterfront residential properties tend to be higher valued and occupied by higher-income individuals, the likelihood of grant funding from this source is limited. USDA Rural Development may be willing to provide loans and loan guarantees supporting dredging projects.

Eight programs could support dredging if it is a component of a larger project:

1. Virginia Port Authority, Aid to Grants Local Ports,
2. DHCD, GO Virginia Implementation Grants,
3. DHCD, CDBG Community Economic Development Grants,
4. EDA, Public Works Grants,
5. EDA, Economic Adjustment Grants,
6. EDA, Disaster Supplemental Assistance,
7. US Army Corps of Engineers, Chesapeake Bay Environmental Restoration and Protection, Section 510, and
8. US Army Corps of Engineers, Project Modifications to Improve the Environment, Section 1135.

Several grant programs may be available to support dredging if the project is tied to the development of a working waterfront that will expand the local economy:

1. VPA, Aid to Local Ports Grants,
2. DHCD, GO Virginia Implementation Grants,
3. DHCD, CDBG Community Economic Development Grants,
4. EDA, Public Works Grants,
5. EDA, Economic Adjustment Grants, and
6. EDA, Disaster Supplemental Assistance.

Extensive redevelopment planning efforts will be required to determine both the eligibility for these grant programs and an expected timeline for implementation through the coordination of multiple funding sources.

Three programs are directed at the "beneficial disposal of dredge material:

1. US Army Corps of Engineers, Continuing Authorities Program, Section 204–Beneficial Use of Dredge Material,
2. US Army Corps of Engineers, Project Modifications to Improve the Environment, Section 1135, and
3. US Army Corps of Engineers, Chesapeake Bay Environmental Restoration and Protection, Section 510.

Like other programs covered by the US Army Corps of Engineers, Continuing Authorities Program, Section 204–Beneficial Use of Dredge Material program has had very limited funding over the past several years with no projects undertaken in the Middle Peninsula. The Middle Peninsula should not expect funding from this Section 204 program because of the long timeframe for the Corps of Engineers to plan and fund these projects. It appears that the US Army Corps of Engineers, Chesapeake Bay Environmental Restoration and Protection, Section 510 program will have funding over the next several years that will be able to support dredging that is tied to implementation of the Chesapeake Bay Program. Application of this program to dredging will likely require additional matching funding from other sources to cover dredging activities that do not directly contribute to Chesapeake Bay restoration. For example, the Section 510 program would cover the costs associated with the beneficial disposal of dredge material to enhance the wetlands, but not cover the costs of the actual dredging of the channels.

Funding to cover the costs of the pre-dredging activities are eligible under ten different programs:

1. Virginia Port Authority, Waterway Maintenance Fund,
2. DHCD, GO Virginia, Enhanced Capacity Building,
3. DHCD, CDBG, Project Planning Grants,
4. US Army Corps of Engineers, Continuing Authorities Program, Section 107–Navigation
5. US Army Corps of Engineers, Continuing Authorities Program, Section 204,
6. US Army Corps of Engineers, Chesapeake Bay Environmental Restoration and Protection, Section 510,

7. US Army Corps of Engineers, Project Modifications to Improve the Environment, Section 1135,
8. EDA, Public Works Grants,
9. EDA, Economic Adjustment Grants, and
10. EDA, Disaster Supplemental Assistance program.

The MPPDC and MPCBPAA have utilized the Virginia Port Authority's Waterway Maintenance Fund to cover pre-dredging activities on seven dredging projects already. These projects will be "shovel ready" for implementation funding in 2021. The MPPDC and MPCBPAA, working with member localities, may wish to identify several working waterfront communities for intense planning work that would include dredging of the harbor that supports that working waterfront.

There are five potential grant programs that could support the planning of these working waterfront redevelopment projects:

1. DHCD, GO Virginia, Enhanced Capacity Building,
2. DHCD, CDBG, Project Planning Grants,
3. EDA, Public Works Grants,
4. EDA, Economic Adjustment Grants, and
5. EDA, Disaster Supplemental Assistance program.

The Corps of Engineers has the ability to conduct pre-dredging activities with their own resources related to the Continuing Authorities Program, Section 107–Navigation, Continuing Authorities Program, Section 204, and the Chesapeake Bay Environmental Restoration and Protection, Section510.

The MPPDC and MPCBPAA should establish a working relationship with the Corps that facilitates the Corps conducting pre-development activities on priority channels meeting both the priorities of the Corps and the MPPDC and MPCBPAA.

The recently announced Virginia Community Flood Preparedness Fund (CFPF) for 2021 administered by the Virginia Department of Conservation and Recreation (DCR) is not included in the above review since the program guidelines were just released in June of 2021. The CFPF holds significant promise in its possible support of dredging activities that would reduce future flooding of low-lying areas. The use of dredge material in a flood reduction strategy could potentially qualify for CFPF grants. The recent grant application announcement is for the allocation of $18M with more funding rounds anticipated in early 2022 that would total approximately $60M. A brief summary of the Virginia Community Flood Preparedness Fund (CFPF) can be found in Appendix E.

Grants Summary and Analysis

Highlights:

- The Virginia Port Authority (VPA) Waterway Maintenance Fund is the single best grant program for supporting dredging activities but annual allocation funds limit its utilization. VPA should be encouraged to consider a multi-year commitment to dredging projects to help facilitate the completion of pre-dredging activities and the coordination with other financing programs for the implementation of the dredging projects.
- The utilization of the USDA Community Facilities Direct Loan and Grant Program may have limited applicability to the Middle Peninsula localities since dredging projects tend to benefit higher valued waterfront residential properties occupied by higher-income individuals.
- Several grant programs may be available to support dredging if the project is tied to working waterfront redevelopment that results in expanded local economic activity: VPA, Aid to Local Ports Grants; DHCD, GO Virginia Implementation Grants; DHCD, CDBG Community Economic Development Grants; EDA, Public Works Grants; EDA, Economic Adjustment Grants, and EDA, Disaster Supplemental Assistance. Extensive waterfront redevelopment planning efforts should be undertaken to determine the eligibility for these grant programs and coordination with other funding sources.
- There are five potential grant programs that could support the planning of these working waterfront redevelopment projects; the DHCD, GO Virginia, Enhanced Capacity Building; the DHCD, CDBG, Project Planning Grants; the EDA, Public Works Grants, the EDA, Economic Adjustment Grants, and the EDA, Disaster Supplemental Assistance program.

The Corps of Engineers has the ability to conduct pre-dredging and dredging activities with their own resources related to the Continuing Authorities Program, Section 107–Navigation, Continuing Authorities Program, Section 204, and the Chesapeake Bay Environmental Restoration and Protection, Section 510.

The MPPDC and MPCBPAA should establish a strong working relationship with the Corps that facilitates the Corps conducting pre-dredging and dredging activities on priority channels meeting both the priorities of the Corps and the MPPDC and MPCBPAA. Unlike the Section 107 and 204 programs, it appears that the Chesapeake Bay Environmental Restoration and Protection, Section 510 program will have funding over the next several years that could support dredging that is tied to implementation of the Chesapeake Bay Program.

The following table summarizes the key provisions of each of the grant programs analyzed.

Table 23. Summary of Potential Grant Programs Supporting Dredging

Agency	Grant Program	Purpose	Maximum Grant	Total Match	Local Match	Unique Provisions	Pre-Dredging Activity	Dredging Activity	Application Date
VA Port Authority									
	Waterway Maintenance Fund	Shallow draft dredging	NA	0%	0%	%1.35MM annually	X	X	1-Mar
	Aid to Local Ports	Improvement of local public-owned ports	75% of project costs	25%	25%	$1MM annually	Not eligible	As related to the port development	1-Mar
VA Department of Housing and Community Development									
	GO Virginia								
	Enhanced Capacity Building	Regional project that creates higher paying jobs and expands marine industry	$100,000	50%	0%	Both regional and state approval - numerous funding criteria	X	Not eligible	Rolling
	Implementation Funds		$1,000,000	1 to 1	10%, $50,000 minimum		Not eligible	Component of a larger project	
	Community Development Block Grants								
	Project Planning		$35,000	0%	0%		X	Not eligible	
	Competitive Grants	Benefit to low-to-moderate income individuals	$800,000 to $1,000,000	Match $ are a funding criterion		Planning grant prior to full application - numerous funding criteria	Not eligible	Component of a larger project	March/April
	Community Economic Development		$700,000 to $1,000,000	Scale based upon economic distress			Not eligible		Rolling
Army Corps of Engineers									
	Continuing Authorities Program								

Agency	Grant Program	Purpose	Maximum Grant	Total Match	Local Match	Unique Provisions	Pre-Dredging Activity	Dredging Activity	Application Date
	Section 107 - Navigation	Improve federal navigation channels	90% of project costs	10% non-federal		Corps administers project - long time frame	X	X	Rolling
	Section 204 - Beneficial Use of Dreding Material	Funding for the beneficial use of dredging materials	65% of project costs	35% non-federal		Corps administers project - long time frame	X	X	Rolling
	Chesapeake Bay Environmental Restoration and Protection - 510	Fund projects furthering the Chesapeake Bay Program	75% of project costs	25% non-federal		Corps administers project - long time frame	X	X	Rolling
Department of Commerce - Economic Development Administration									
	Public Works	Generate private sector jobs and investment in distressed communities	50% of the project	50%		Degree of economic distress	X	X	Rolling
	Economic Adjustment	Respond to sudden economic shock	50% of the project	50%		Response to economic shock	X	X	Rolling
	Disaster Supplemental Assistance	Economic resilience after national disaster	80% of the project	20%			X	X	Rolling
Department of Agriculture - Rural Development									
	Community Facilities Direct Loan and Grant Program	Develop essential community facilities	55% of the project	Scale based upon population & economic distress		Combined loan, grant and loan guarantee approval	Not eligible	X	Rolling
	Community Facilities Technical Assistance and Training	Plan essential community facilities	$150,000	Match $ are a funding criteria			X	Not eligible	Annual

Loan Programs

Overview

Local governments borrow money in a number of different ways. These various mechanisms for borrowing are either long-term or short-term, and they can be repaid through tax revenues, user fees, or special assessments. Short-term debt can be used to cover a temporary cash flow deficit or provide for an interim method of financing until long-term borrowing has been secured.

The traditional way that counties finance capital improvements is through normal annual budgeting processes where projects are prioritized in Capital Improvements Programs (CIPs). Larger capital improvements typically require that the locality finance capital improvements through long-term debt, loans, or bonds issued by the locality or an authority. Issuing debt increases the total cost of the asset through the payment of interest, but it also allows local governments to acquire or build capital assets sooner by borrowing up front for assets that they could not otherwise fund from existing cash resources. By spreading out the debt payments over many years, local governments can also smooth out their expenses and create a more predictable cash flow.

Special Authorities established by a locality(s) are legally authorized to issue long-term debt for projects that serve the locality. Authorities are not required to have voter approval through a referendum prior to issuance of the debt, which is a significant logistical advantage to the locality. In cases where the project does not generate sufficient revenues to retire the debt, the lender or bond documents will normally require an assurance that the locality will back the debt payments of the Authority. This assurance is called a "moral obligation" resolution passed by the county. The "moral obligation" resolution commits the locality to include the annual debt service payment of the Authority in its annual budget. For some projects, the lender may require additional credit enhancement to secure the debt. Credit enhancements may be in the form of a loan guarantee issued by a federal or state agency, loan insurance, or a loan loss reserve.

Long-term debt is a legal obligation that typically does not mature for more than a decade and may have a maturity of 30 - 40 years depending upon the debt type. The funding mechanism used by local government to finance long-term debt can vary widely depending upon the capital project but there are three distinct types of long-term debt that can be issued by local government:

- **General obligation (GO) debt** is secured by the full faith and credit of the local government issuing the debt. The municipality pledges its tax revenues unconditionally to pay the interest and principal on the debt as it matures. If the debt is in the form of a bond, the bond owners have a legal claim on all the general income of the jurisdiction if a default occurs.
- **Revenue debt** is guaranteed by the specific revenues generated by the project. For example, water authorities can issue revenue debt with the revenues from customers' water bills guaranteeing the repayment of the debt.
- **Special assessment debt** is debt repaid from assessments against those who directly benefit from the project the funds have been used to finance. For example, if a special assessment bond is issued to pay for road improvements that benefit a specific subset of the population, the local government will develop an assessment roll for those properties benefitting from the improvement to repay the bond or create a tax district with a boundary that contains the properties.

General obligation bonds issued by local governments are secured by a pledge of the localities general tax revenues. General obligation bonds have been the traditional form of financing for capital projects such as land acquisition, park development, and municipal office development that are owned and operated by government. Virginia's Constitution and the Public Finance Act require that counties must first receive approval of the voters in a referendum prior to issuance of debt that is supported by general tax revenues.

Revenue bonds may be issued to finance projects for any enterprise that is self-supporting. Revenue bonds are generally used to finance water and wastewater projects, airports, and stormwater systems. Payment for debt service on revenue bonds comes from user fees generated by the capital facility that is being built. The local entity is then responsible for establishing and collecting sufficient revenue (through rates) to retire the debt.

Revenue bonds are not backed by the full faith and credit of the locality, and therefore investors consider them somewhat less secure than general obligation bonds. As a result, the interest rate that bond buyers demand may be higher than those on general obligation bonds.

Revenue bonds are not subject to either statutory or constitutional debt limits. However, the bond market does provide an effective limit to the amount of bonds and/or debt issued. If investors do not believe that the project will generate enough revenue to make the bond payments, they will not purchase the bonds, or they may require bond covenants to meet lending requirements. A covenant is a local government's promise to do or refrain from doing something that would jeopardize the entity's ability to repay the loan.

There is a hybrid type of bond that combines revenue bonds and GO bonds called "double barrel" or "flip bonds". These bonds are issued based on the revenues generated from the project's finances, but, if the revenues are insufficient to retire the debt, the general tax revenues of the locality are pledged to make up the shortfall in revenues. Double barrel bonds do require the approval of voters at a referendum since there is the pledge of general tax revenues.

Improvement District Bonds are issued when a capital project is going to primarily or wholly benefit only a subset of the citizenry and a **local improvement district (LID**) is formed to cover the project area. LIDs are commonly used for projects such as street improvements, streetlights, sidewalks, water and sewer systems, and undergrounding power lines that serve a defined project, neighborhood, or development. Service Districts (SD), Community Development Authorities (CDA), and Tax Increment Financing (TIF) districts are all forms of local improvement districts.[63]

Table 24 below provides yield rates for AAA, AA, and A rated municipal bonds in 10, 20 and 30-year maturity ranges. These rates reflect the approximate yield to maturity that an investor can earn in today's tax-free municipal bond market as of December 27th, 2020.

[63] For a more complete description of the requirements for formation and the types of revenues that can be generated from SD, CDA, and TIF districts, see "Analysis of Local Revenue-Generating Structures."

Table 24. Sample Yields for AAA, AA, and A Rated Municipal Bonds

AAA RATED MUNI BONDS

ISSUE	Maturity Range	Today	Last Week
National	**10 Year**	0.65	0.7
National	**20 Year**	1.15	1.2
National	**30 Year**	1.35	1.4

AA RATED MUNI BONDS

ISSUE	Maturity Range	Today	Last Week
National	**10 Year**	0.85	0.9
National	**20 Year**	1.3	1.4
National	**30 Year**	1.55	1.6

A RATED MUNI BONDS

ISSUE	Maturity Range	Today	Last Week
National	**10 Year**	1	1.1
National	**20 Year**	1.55	1.65
National	**30 Year**	1.75	1.9

In addition to bond issues, local governments may raise funds for specific projects by negotiating with private lending institutions for a "bank loan". These bank loans are a catch-all term that refer to direct commercial loans, private placements, and other alternative private financing methods.

Private placements are particularly useful for projects of smaller size (less than $1MM), where the bond issuance costs become a major factor in the transaction. Private placements have lower issuance costs, but lenders charge higher interest rates than public offerings, ranging from .25% to 1%. Private placement issuance costs are consistently about one-third of the issuance costs for public offerings. The following are seen as advantages of private placements:

- Fewer disclosure requirement,
- Fewer issuance costs,
- Faster execution process,
- Competitive interest rates.

Private placements and direct loans have been appealing to banks for the following reasons:

- Higher profits when banks loan to municipal governments,
- Less risk,
- Regulatory changes that encourage banks to invest in municipal debt,
- Ease at converting existing letters of credit to bank loans.

Government loans are another important source of funds for financing capital projects. State and federal agencies offer loans to localities and political subdivisions for capital projects.

The following section provides an overview of debt financing options for financing dredging projects in the Middle Peninsula and reviews three loan programs:

1. Virginia Resources - Virginia Pooled Financing Program ("VPFP"),
2. USDA Community Facilities Direct Loan and Grant Program, and
3. USDA Rural Development, Community Facilities Loan Guarantee program.

Virginia Resources Authority (VRA)
Virginia Pooled Financing Program ("VPFP")

Any county may borrow funds from VRA through the VPFP for dredging projects.

VRA issues VPFP bonds in the public debt markets each spring and fall. Dredging projects would be included in VPFP's "junior lien" State Moral Obligation Bonds. All of the State Moral Obligation Bonds are supported by the moral obligation of the Commonwealth of Virginia, whereby the Commonwealth pledges to cover bond payments through the Capital Reserve Fund.

An internal credit committee of VRA meets weekly to discuss and authorize loan requests made by borrowers. The local loan request is supported by local bonds issued and secured as general obligation bonds, revenue bonds, or double barrel local bonds (consisting of a revenue pledge, supplemented by an additional general or moral obligation pledge of a borrower/locality). VPFP borrowers share the costs of bond issuance, including bond counsel fees, financial advisor fees, printing of the final official statement, electronic posting of official statements, rating agency fees, trustee and trustee counsel fees, and verification agent fees.

Project financing is available for up to 30 years based on the useful life of the project at fixed interest rates set at the time of bond issuance, plus an on-going annual administration fee of 0.125% of the outstanding loan balance. VPFP State Moral Obligation Bonds are rated "Aa1" by Moody's and "AA" by Standard & Poor's. VRA charges an upfront fee, payable at closing, equal to 0.125% of the par amount of the loan. There is no maximum loan amount provided the borrower's debt exposure does not impact on VRA's program ratings or impair the VRA's moral obligation debt capacity. Due to the costs associated with issuing bonds in the public debt markets, VPFP loans of less than $750,000 are not the most cost-effective means of financing.

The VPFP application deadline for the spring pooled transaction is typically the first Friday in February, and the application deadline for the fall pooled transaction is typically the first Friday in August. Applications are typically accepted through May 1st when VRA offers a summer transaction.

Upon receipt of a VPFP application, VRA coordinates a due diligence conference call or meeting with the borrower's financing team (i.e. local bond counsel, local financial advisor, etc.). The due diligence conference call will discuss the project and VRA's financing schedule for the transaction. VRA staff will then complete the credit analysis related to the borrower's loan request and make a security recommendation to VRA's credit committee. Subject to loan approval by VRA's credit committee, a term sheet will be provided to the borrower related to the funding request. The borrower's local bond counsel will draft a resolution or ordinance, authorizing the borrower to participate in the VPFP financing. Upon approval of the authorizing resolution/ordinance by the borrower's governing body, the borrower will enter into the primary financing document related to the VPFP loan (typically in the form of a Local Bond Sale and Financing Agreement or Local Lease Acquisition Agreement and Financing Lease). VRA sells the VPFP bond issue in the public bond markets and allocates the proceeds of the bond issue to the local participants within the loan pool. Interest rates are fixed through the final maturity once the bond sale is completed. VRA staff and its financing team coordinate the VRA and local loan closings within two to four weeks of bond pricing. Loan proceeds are available for disbursement to localities as of the VPFP closing date.

US Department of Agriculture – Rural Development
Community Facility Direct Loan and Grant Program

The Community Facilities Direct Loan and Grant Program can be used to purchase, construct, and/or improve essential community facilities, purchase equipment and pay related project expenses including transportation facilities, streets, roads, and bridges. Rural Development can make a combination of low interest direct loans, grants and loan guarantees to support the financing of a project. These may be combined with commercial financing to finance one project if all eligibility and feasibility requirements are met.

Priority is given to localities that have populations of 5,500 or less and communities having a median household income below 80% of the state non-metropolitan median household income.

Direct Loans are provided through a competitive process. Loan repayment terms may not be longer than the useful life of the facility with a maximum of 40 years. The interest rate is set by Rural Development for the entire term of the loan and is determined by the median household income of the service area and population of the community. The interest rate is set at the time of loan approval, which was around 3% in December of 2019.

Applicants must be unable to finance the project from their own resources and/or through commercial credit at reasonable rates and terms. The project must serve the rural area where it is located and must have substantial community support.

US Department of Agriculture – Rural Development
Community Facilities Guaranteed Loan Program

The Community Facilities Guaranteed Loan Program provides 80% loan guarantees to eligible lenders in the United States to finance essential community facilities, including water infrastructure facilities such as levees, dams, reservoirs, inland waterways, canals, dredging, and irrigation systems in rural areas with populations of 50,000 residents or less. Each year funds are reserved for projects in rural areas with populations less than 20,000.

The maximum amount of a guaranteed loan is $100 million. The lender establishes the loan term based on the useful economic life of the project (not to exceed 40 years), the collateral, and the borrower's repayment ability. Interest rates are negotiated between the lender and borrower with rates being fixed or variable. There is an initial guarantee fee of 1.5 percent of the guaranteed amount and an annual guarantee retention fee of 0.5 percent of the outstanding principal balance. In addition, there is an Issuance of Loan Note Guarantee Prior to Construction fee of 0.5 percent. Reasonable and customary fees for loan origination are negotiated between the borrower and lender.

The lender conducts a credit evaluation using credit documentation procedures and underwriting processes. The lender is responsible for obtaining and maintaining proper and adequate collateral for the guaranteed loan.

Applicants must be unable to finance the project from their own resources or through commercial credit at reasonable rates and terms and the project must have significant community support.

Table 25. Potential Loan Programs Supporting Dredging

Loan Agency	Program	Loan Size	Max Term	Interest Rate	Fees and Charges	Unique provisions	Pre-dredging	Dredging	Application
Virginia Resource Authority									
	Virginia Pooled Finance Program	Greater than $750K	30 yr./useful life	0.75% to 1.75% - set at closing	0.125% of loan amount - issuance costs	Aa1 and AA rated bonds	NA	X	1st Friday in Feb. & August
USDA Rural Development									
	Community Facilities Direct Loan and Grant Program	NA	40 yr./useful life	3%	NA	Lower-income rural community priority	NA	X	Rolling
	Community Facilities Guarantee Loan Program	$100M max	40 yr./useful life	Lender rate	1.5% of guaranteed amount	80% guarantee	NA	X	Rolling
Private Municipal Finance									
	Municipal Bonds	$3M min	30 yr./useful life	0.75% to 3% - set at closing	NA	High issuance costs - rating required	NA	X	Rolling
	Private Placement	NA	30 yr./useful life	Lender rate	Lender rate	Lower issuance costs	X	X	Rolling

Loans Summary and Analysis

Long-term debt will likely be required to support the financing of the proposed dredging projects for the Middle Peninsula localities. If the localities can pool several dredging projects resulting in a single bond issue, greater than $1MM, the Virginia Resources Authority's Pooled Finance Program provides an affordable and efficient method to provide the necessary debt financing.

If the coordination of the pre-dredging activities among several dredging projects is not possible, the localities should look to commercial lending institutions that provide long-term loans to localities and political subdivisions. In particular those lending institutions that accept USDA Rural Development, Community Facilities Loan Guarantees should be given preference. Working through commercial lenders reduces the cost of issuance, provides greater flexibility in the structure of the debt, and can be completed in a timeframe to meet dredging schedules. Another advantage of a commercial lender is their ability to provide short-term debt in support of pre-dredging activities and the possibility of converting that debt into long-term debt. Debt from commercial lenders will typically result in higher interest rates and require greater loan security.

The priority for loans to lower-income communities by USDA Rural Development may limit the applicability of Community Facilities Direct Loans for dredging projects.

The high cost of issuance of municipal bonds requires a fairly large bond issue to be able to provide affordable financing for dredging projects. If the Middle Peninsula localities could coordinate numerous dredging projects into a single bond (over $3 million) then a publicly issued bond might be a possibility.

- If the localities wish to actively pursue debt financing for one or more dredging projects, the engagement of a financial advisor and bond counsel will be necessary to properly evaluate the best finance structure for dredging projects over time. Since there have been few locality sponsored, shallow-channel dredging projects supported by long-term debt in Virginia, it may take a considerable time to develop the appropriate financing structure that will satisfy either a public or private lender.
- The ability of the localities in the Middle Peninsula to "pool" dredging projects into a single financing package will determine the potential debt funding available. Virginia Resources Authority Pooled Finance Program and publicly issued municipal bonds will require multiple dredging projects to justify the associated bond issuance costs.
- Private commercial lenders that provide long-term loans to localities and political subdivisions and accept USDA Rural Development, Community Facilities Loan Guarantees may be the best option for debt financing for individual dredging projects. Private placements with commercial lenders reduce the cost of issuance, provide greater flexibility in the structure of the debt, and can be completed in a timeframe to meet dredging schedules. Higher interest rates and greater loan security will typically be required from commercial lenders.
- Since there have been few locality sponsored, shallow-channel dredging projects supported by long-term debt in Virginia, it may take a considerable time to develop the appropriate financing structure that will satisfy either a public or private lender

Applying the Cost of Dredging to the Regional Tax Base

Introduction

The purpose of conducting a financial evaluation of the 21 potential dredging projects in the Middle Peninsula is to answer the basic question for local elected leader: "How much will the dredging projects cost and how much will the taxes in the locality have to be raised to pay for the dredging?" To begin to address that question, an Analysis of Local Revenue-Generating Structures was completed (and a report issued in the Fall of 2020). This analysis reviewed the authority in state law to establish special tax districts to raise annual revenue to pay debt service that support the financing of the dredging project. After that analysis was complete, an Analysis of Grant and Loan Financing Options was conducted to determine the potential for various grants and loans that could be available to finance the dredging projects (completed in Fall 2020). Given this background information, a "Dredging Evaluation Model" was developed that estimates what the annual cost to the taxpayer will be based upon estimates and assumptions as to:

1. The cost of the project and its components,
2. The type and amount of grant funds available, and
3. The source and type of debt financing that would be available.

Price levels used in the evaluation were from January 2021. The model estimates the net annual cost of the dredging project to the locality and estimates the increase in real estate tax rate necessary to cover the annual costs. The model can be applied to all of the locality's real estate tax base or to just a portion of the tax base that would represent a special tax district.

This analysis applies the "Dredging Evaluation Model" to 21 channel dredging projects under consideration. The Mattaponi dredging project was not included in the evaluation since the channel condition survey conducted by the VIMS Shoreline Studies Program indicated that no dredging was needed. It is hoped that the analysis provides the information needed by elected officials to address the central question of necessary additional tax burden.

Assumptions

There are literally thousands of combinations of alternatives that can go into estimating what the cost may be to the taxpayer in increased real estate taxes. In order to simplify the analysis, the following assumptions and data sources were used in the application of the evaluation model to each dredging project:

Cost Estimates

Shore Consulting Group provided detailed cost estimates for each dredging project, with the costs broken down into pre-construction, construction, and post-construction phases. Within each of these phases the cost estimates were further broken down into specific line items. The specific line items were based upon:

- Information provided from the VIMS Shoreline Studies Program and Waterways Surveys and Engineering, Ltd. for seven of the projects,
- Historical experience of Shore Consulting Group related to similar projects,

- Experience of the USACE related to similar projects,
- Data collected from recent and current dredging projects along the Atlantic and Gulf Coasts, and
- Data provided by dredging contractors.

The analysis assumes that the dredging projects will be competitively bid to private contractors. For some of the dredging projects cost estimates were developed using different methods of dredging and placement of dredge material. In addition, costs were estimated for the disposal of dredge material at either upland or beneficial use sites. Dredging frequencies were also estimated within ranges of years to reflect the need to keep the channels open and available to commercial and recreational boaters. In these instances, the lowest cost option was used.

Combination Projects

During the development of the cost estimates by the VIMS Shoreline Studies Program on the seven projects that they worked on, it became evident that there are considerable cost savings if projects can be combined, carried out at the same time, and/or use the same disposal sites. In addition to evaluating each individual project as a "stand-alone" project, several projects were combined, and cost estimates developed for these combined projects. These combined projects were then evaluated using the Financial Evaluation Model.

Grants

The analysis of potential grants yielded distinct categories of grants that may be applicable in support of the dredging projects; 1) grants that may cover the pre-construction costs, 2) grants that could cover a portion of the dredging costs and 3) grants that would cover a portion of the costs for the disposal of the dredge material. While Virginia Port Authority's Waterway Improvement Grants could potentially cover the total cost of a project the limitations of annual appropriations make that source unlikely for most of the projects.

The Financial Evaluation Model was applied to four different assumptions of grant assistance:

1. No grant assistance – the locality assumes all costs of the project,
2. A grant that covers the pre-construction costs but not any land acquisition costs for a disposal site,
3. A grant that would cover 50% of the dredging cost, and
4. A grant that covers 50% of the cost of disposal of the dredge material.

Debt Finance

- **Source of Finance:**
    - Due to the limitations on local governments for the issuance of long-term debt, it is assumed that a locally created authority would issue the debt that would be backed by the locality. The Middle Peninsula Chesapeake Bay Public Access Authority would be a likely candidate for the debt issuance authority.
    - There are several sources of loans that could be accessed in support of the dredging project. Each loan program has its own underwriting criteria, interest rate, fees, and terms. For this analysis it assumed that a private lender specializing in local government finance would be used to finance the projects, normally referred to as a "private placement". Private lenders

offer greater flexibility in how they can structure the loans to meet the conditions of a project but may have slightly higher interest rates.

- **Term of Loan:**
  - The term of the loan is normally established as the useful life of the project. For dredging projects that would be the time interval between dredging cycles. The VIMS Shoreline Studies Program has provided an estimated range for future dredging cycles for each project. If the range was less than 5 years, the useful life was assumed to be 5 years. For projects with a dredging frequency of 5 to 10 years, the useful life was assumed to be 7 years, and for projects with a 10-to-20-year dredging frequency the useful life was assumed to be 15 years.
- **Interest Rate:**
  - It was assumed that the interest rate on the loans would be 3%.
- **Fees:**
  - There was assumed to be a loan origination fee of .125% of loan amount and an annual administration fee of .125% would be applied to each loan. These fees vary greatly among lenders and programs.

Real Estate Valuation

The total real estate assessment values for each county and the waterfront properties of each water body served by the dredging project were used to determine the increase in the real estate property rate that would be required to provide sufficient revenues to pay the total annual debt service payment. Each county's geographic information staff were able to provide the maps of all the properties fronting the water bodies and provide the total assessments of those properties. The Timmons Group was able to provide a historical analysis of land improvement values for the waterfront properties for each water body area. There was not an easy way to calculate the valuation for the Hole In The Wall water body, thus for the purposes of this analysis the real estate valuation figures for Milford Haven were used. The assessed values are based on reassessments that were done in 2020 for Gloucester County, and 2017 for Mathews and Middlesex Counties. These are the most recent reassessments.

Findings

The analysis was conducted using the estimated costs associated with dredging the channels through contracting with private sector dredging contractors. This analysis provides insights for board of supervisors on the impact of the cost of dredging on the real estate tax rates.

The following Table 26 lists the costs of each project in the analysis. The costs were broken down by project category: pre-construction, dredging, disposal and post construction. For Mill Creek in Mathews County and Mill Creek in Middlesex County, cost estimates were developed for two different dredging methods. The financial evaluation model was applied to the lowest cost option. Cost estimates were developed for conducting/combining the dredging of two or more channels under a single contract. The potential of cost savings, primarily for mobilization/demobilization, are significant, and thus were analyzed separately. Three combination projects were evaluated in Gloucester County: Aberdeen, Cedarbush and Timberneck Creeks; Sarah Creek and Perrin River; and Free School and Whittaker Creeks. Three combination projects were also evaluated in Mathews

County: Mill Creek 2 and Put In Creek; Horn Harbor and Winter harbor; and Milford Haven and Queens Creek.

For each county, grants that reduce the cost of a project are reflected in reduced annual debt service, thus a smaller increase in the real estate tax rate required to pay off the debt. Typically, a 50% grant for either the dredging or the disposal of dredge material will reduce annual debt service between 20% and 40%.

Table 26. Dredging Cost Summary by Project

Gloucester County

Cost Phase	Aberdeen	Cedarbush	Timberneck	Aberdeen/ Cedarbush/ Timberneck	Sarah	Perrin	Sarah/ Perrin River	Free School	Whittaker	Freeschool/Whittaker
Pre-Construction	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600
Dredging	$1,510,395	$1,821,211	$1,390,486	$3,222,573	$1,087,554	$1,146,155	$1,614,558	$470,481	$1,081,031	$1,440,021
Disposal	$592,378	$799,074	$941,518	$1,032,335	$433,729	$679,095	$978,463	$301,729	$301,729	$301,729
Post-Construction	$86,667	$126,349	$80,443	$219,416	$41,395	$46,755	$56,901	$31,486	$40,762	$40,616
Total Project	$2,416,043	$3,201,088	$2,841,833	$4,700,927	$1,789,282	$2,098,608	$2,822,524	$1,030,299	$1,650,126	$2,008,969

Mathews County

Cost Phase	Mill 2[64]	Put In Cr.	Mill 2/ Put In	Davis	Horn Harbor	Winter Habor	Horn Harbor/ Winter Harbor	Hole In Wall	Milford Haven	Queens	Milford Haven/ Queens
Pre-Construction	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600
Dredging	$990,823	$942,800	$1,414,653	$1,246,767	$1,876,455	$2,415,915	$3,394,189	$1,493,500	$1,029,526	$1,171,775	$1,634,811
Disposal	$77,109	$411,074	$425,985	$648,041	$210,848	$726,376	$874,960	$149,996	$88,046	$108,672	$146,291
Post-Construction	$32,658	$36,955	$38,153	$60,909	$123,318	$142,422	$236,987	$81,250	$41,449	$55,200	$67,899
Total Project	$1,327,195	$1,716,452	$2,090,483	$2,182,321	$2,437,225	$3,511,317	$4,726,008	$1,951,350	$1,385,624	$1,562,250	$2,057,034

Middlesex County

Cost Phase	Broad	Bush Park	Mill	Mill (b)	Whiting	Robinson	Parrotts
Pre-Construction	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600	$226,600
Dredging	$980,109	$1,009,457	$903,896	$52,416	$1,274,611	$1,032,785	$1,116,156
Disposal	$194,751	$79,811	$69,830	$30,135	$123,582	$83,194	$734,068
Post-Construction	$36,341	$34,460	$29,305	$30,416	$65,140	$36,715	$48,559
Total Project	$1,437,805	$1,350,332	$1,229,634	$339,571	$1,689,937	$1,379,297	$2,125,384

[64] Reflects the costs of using a hydraulic cutter dredge method. If using an on-land mechanical dredge, dredging costs are reduced to $82,690, disposal costs are reduced to $34,768, and post-construction costs increase slightly to $35,476, for a total project cost of $379,538.

The impact on the real estate tax base is heavily dependent upon the useful life of the dredging project that is reflected in the term of the debt. The shorter the useful life of the project the higher the annual debt service, thus a greater impact on the real estate tax rate necessary to retire the debt. The VIMS Shoreline Studies Program estimated the longest useful life of any dredging project was 10 to 20 years. For those projects, a 15-year loan term was used. For projects with a 5-to-10-year dredging cycle a 7-year loan term was used.

In addition, the analysis also evaluated the potential impact on the real estate tax rate of the waterfront properties on the watershed served by the dredging project. The local counties' staffs provided the total real estate valuation for the waterfront properties in each watershed served by the dredging projects. Because the total real estate valuation in the watersheds is significantly less than the real estate valuation for the County, the impact of the cost of the dredging project on the watershed properties is multiple times greater than the impact on the County real estate tax rate.

Gloucester County

The dredging projects in Gloucester County range in cost from $1,545,296 for the smallest project, Free School Creek, to the largest, Cedarbush Creek, at $3,201,088. There is significant cost savings when combining dredging projects into a single project/contract. The Aberdeen/Cedarbush/Timberneck combined project total cost is $4,700,927 as compared to $8,458.964 when conducted separately. Similarly, the costs of the combined projects of Sarah Creek/Perrin River and Free School/Whittaker Creeks are $2,822,524 and $2,008,969 respectively as compared to costs of $3,887,890 and $3,195,425 if done separately. While it may be feasible to combine dredging projects initially, the creeks have varying maintenance cycles which adds another level of complexity in determining when projects may line up for maintenance dredging efforts in the out years. The total estimated cost of all of the combined projects is $9.5M.

The impact on the County's real estate tax rate for individual projects ranged from a high of $.008 for Aberdeen Creek and a low of $.003 for Free School Creek assuming no grants were received, and all of the debt service would be borne by the real estate tax. When you combine two or more dredging projects with a 10-year loan term the impact is $.012 for Aberdeen/Cedarbush/Timberneck Creeks, $.007 for Sarah Creek/Perrin River and a low of $.005 for Free School/Whittaker Creeks.

If you apply the cost of the dredging project to just the waterfront properties within the watershed, the increase in real estate rates is a high of $19.16 in Whittaker Creek and a low of $.19 in Sarah Creek. Those creeks that have larger and higher valued waterfront properties have a lower increase in real estate tax necessary to pay the annual debt service. The increase in real estate tax rates on all of the watersheds except Sarah Creek would require waterfront increases ranging from a doubling of the tax rate to a tax rate that would be 20 times the County rate. Those watersheds where the increased tax rate is more than 50% of the County real estate tax rate may make it politically impractical to pass along the cost of the dredging project to just the waterfront properties within the watershed.

The increased real estate tax rates on the waterfront properties for the combined projects are $.81 for Aberdeen/Cedarbush/Timberneck Creeks, $.19 for Sarah Creek/Perrin River and $1.73 for Free School/Whittaker Creeks. If you finance all of the projects at once and apply the cost to the waterfront properties for all of the watersheds the increase in real estate rates would be $.44 for the waterfront properties.

Table 27. Gloucester County Real Estate Tax Analysis

Creek	Aberdeen	Cedarbush	Timberneck	Aberdeen/ Cedarbush/ Timberneck	Sarah	Perrin River	Sarah/ Perrin River	Freeschool	Whitaker	Freeschool/ Whitaker	Total of Combination Projects
Total Project Cost	$2,416,043	$3,201,088	$2,841,833	$4,706,803	$1,789,278	$2,098,605	$2,822,524	$1,545,296	$1,650,122	$2,008,969	$9,538,296
Loan Term - Years	7	15	15	10	7	15	10	15	7	10	10
Annual Finacing Cost	$379,990	$264,666	$234,963	$541,593	$281,414	$173,513	$325,183	$127,765	$259,527	$231,453	$1,098,229
Gloucester County Real Estate Tax Rate - $.69/$100											
Real Estate Tax Rate Increase/$100											
Countywide											
Grants:											
None	$0.00815	$0.00568	$0.00504	$0.01162	$0.00604	$0.00372	$0.00698	$0.00274	$0.00557	$0.00497	$0.02357
Pre-Construction - 100%	$0.00739	$0.00528	$0.00464	$0.01106	$0.00527	$0.00332	$0.00642	$0.00234	$0.00480	$0.00441	$0.02189
Dredging - 50%	$0.00561	$0.00406	$0.00381	$0.00764	$0.00420	$0.00271	$0.00498	$0.00187	$0.00375	$0.00319	$0.01581
Disposal - 50%	$0.00715	$0.00497	$0.00421	$0.01035	$0.00531	$0.00312	$0.00577	$0.00247	$0.00506	$0.00459	$0.02071
Watershed Only											
Grants:											
None	$2.18	$1.72	$0.70	$0.81	$0.19	$0.79	$0.19	$1.11	$14.16	$1.73	$0.44
Pre-Construction - 100%	$1.97	$1.60	$0.64	$0.78	$0.17	$0.70	$0.18	$0.95	$12.21	$1.54	$0.41
Dredging - 50%	$1.50	$1.23	$0.53	$0.54	$0.13	$0.57	$0.14	$0.76	$9.52	$1.11	$0.30
Disposal - 50%	$1.91	$1.51	$0.58	$0.73	$0.17	$0.66	$0.16	$1.00	$12.86	$1.60	$0.39

Mathews County

The dredging projects in Mathews County range in cost from $379,534 for the smallest project, Mill Creek 2, to the largest, Winter Harbor, at $3,093,480. There is significant cost savings when combining dredging projects into a single project/contract. The Horn Harbor/Winter Harbor combined total project cost is $4,726,008 as compared to $5,948,534 when conducted separately. Similarly, the cost of the combined project of Milford Haven/Queens Creek and is $2,057,034 as compared to a cost of $2,947,868 if done separately. Combining the Mill Creek 2 project and the Put In Creek project does not yield any cost savings since there is a difference in the least cost method of dredging for each creek. While it may be feasible to combine dredging projects initially, the creeks have varying maintenance cycles which adds another level of complexity in determining when projects may line up for maintenance dredging efforts in the out years. The total estimated cost of the three combined dredging projects and Davis Creek and Hole In The Wall stand-alone projects is $13M.

The impact on the County's real estate tax rate for individual projects ranged from a high of $.03 for Winter Harbor to a low of $.002 for Mill Creek 2 assuming no grants were received, and all of the debt service would be borne by the real estate tax. When you combine the Horn Harbor and Winter Harbor dredging projects with a 10-year loan term the increase in the real estate tax rate is $.029. For the Milford Haven and Queens Creek combined project the increase in the real estate tax rate is $.013.

If you apply the cost of the dredging project to just those waterfront properties within the watershed the increase in real estate rates is a high of $5.01 in Davis Creek and a low of $.13 in Hole In The Wall. Those creeks that have larger and higher valued waterfront properties require a lower increase in real estate tax necessary to pay the annual debt service. Where the increased tax rate is over 50% of the County real estate tax rate may make it politically impractical to pass along the cost of the dredging project to waterfront properties.

The increase in real estate tax rates on waterfront properties to cover the cost of the combined projects are $.57 for Mill Creek/Put In Creek, $.55 for Horn Harbor/Winter Harbor and $.07 for Queens Creek/Milford Haven.

If you finance all of the projects at once and apply the cost to the waterfront properties for all of the watersheds the increase in real estate tax rate required would be $.21.

Table 28. Mathews County Real Estate Tax Analysis

Creek	Mill/East River	Put In Creek	Mill 2/ Put In	Davis	Horn Harbor	Winter Harbor	Horn Harbor/ Winter Harbor	Hole in Wall	Milford Haven	Queens	Millford Haven /Queens	Total Combination and Individual Projects
Total Project Cost	$379,534	$1,617,429	$2,090,483	$2,182,317	$2,437,221	$3,093,480	$4,493,758	$1,951,346	$1,385,621	$1,562,247	$2,057,034	$12,774,938
Loan Term - Years	15	7	10	7	15	7	10	7	15	7	10	10
Annual Finacing Cost	$31,380	$254,386	$240,844	$343,230	$60,029	$486,536	$517,725	$306,903	$114,563	$245,707	$236,991	$1,645,693
Real Estate Rate Increase/$100												
Countywide												
Grants												
None	$0.00168	$0.01365	$0.01293	$0.01842	$0.00310	$0.02611	$0.02779	$0.01647	$0.00615	$0.01319	$0.01272	$0.08043
Pre-Construction	$0.00068	$0.01174	$0.01153	$0.01651	$0.00250	$0.02420	$0.02639	$0.01456	$0.00514	$0.01127	$0.01132	$0.07342
Dredging - 50%	$0.00150	$0.00967	$0.00855	$0.01316	$0.00250	$0.01731	$0.01731	$0.01017	$0.00386	$0.00824	$0.00767	$0.05204
Disposal - 50%	$0.00161	$0.01192	$0.01161	$0.01569	$0.00260	$0.02340	$0.02580	$0.01584	$0.00595	$0.01273	$0.01227	$0.07349
Watershed Only												
Grants												
None	$1.11	$0.65	$0.57	$5.01	$2.02	$1.62	$0.53	$0.13	$0.05	$0.30	$0.07	$0.21
Pre-Construction	$0.45	$0.56	$0.51	$4.49	$1.62	$1.50	$0.50	$0.11	$0.04	$0.25	$0.07	$0.19
Dredging - 50%	$0.99	$0.46	$0.38	$3.58	$1.62	$1.07	$0.33	$0.08	$0.03	$0.18	$0.04	$0.14
Disposal - 50%	$1.06	$0.57	$0.51	$4.26	$1.72	$1.45	$0.49	$0.12	$0.05	$0.29	$0.07	$0.19

Middlesex County
The dredging projects in Middlesex County range in cost from $339,571 for the smallest project, Mill Creek, to the largest, Parrots Creek, at $2,125,383. There can be significant cost savings in combining dredging projects into a single project/contract. Because of the distance between dredging projects, the costs of combining dredging projects were not calculated.

For projects with a less than 5-year dredging cycle a 7-year loan term was used. The impact on the County's real estate tax rate for individual projects ranged from a high of $.014 for Bush Park Creek to a low of $.0013 for Mill Creek assuming no grants were received, and all of the debt service would be borne by the real estate tax.

If you apply the cost of the dredging project to just those waterfront properties within the watershed the increase in real estate rates is a high of $1.00 in Bush Park Creek watershed to a low of $.09 in the Mill Creek watershed. Those Creeks that have larger watershed area and higher valued waterfront properties have lower increase in real estate tax necessary to pay the annual debt service. An increase in real estate tax rates of over 50% of the County real estate tax rate may make it politically impractical to impose the tax increase on just the waterfront properties.

If you were to finance all of the projects at once and apply the cost to the waterfront properties for all of the watersheds the increase in real estate tax rate would be $.41.

Table 29. Middlesex County Real Estate Tax Analysis

Creek	Broad	Bush Park	Mill	Whitings	Robinson	Parrots	Total All Creeks
Total Project Cost	$1,437,801	$1,350,328	$339,567	$1,689,933	$1,379,294	$2,125,383	$8,322,306
Loan Term - Years	7	5	15	7	7	15	10
Annual Finacing Cost	$226,134	$288,310	$28,075	$265,789	$216,932	$175,727	$958,812
Middlesex County Real Estate Tax Rate - $.62/$100							
Real Estate Tax Rate Increase/$100							
Countywide							
Grants							
None	$0.01089	$0.01388	$0.00135	$0.01279	$0.01044	$0.00846	$0.04615
Pre-Construction - 100%	$0.00917	$0.01388	$0.00045	$0.01108	$0.00873	$0.00756	$0.03861
Dredging - 50%	$0.00718	$0.00869	$0.00125	$0.00797	$0.00653	$0.00624	$0.03100
Disposal - 50%	$0.01015	$0.01347	$0.00129	$0.01233	$0.01013	$0.00700	$0.04270
Watershed Only							
Grants							
None	$0.52	$1.00	$0.09	$0.84	$0.28	$0.79	$0.41
Pre-Construction - 100%	$0.44	$0.83	$0.03	$0.73	$0.23	$0.70	$0.34
Dredging - 50%	$0.35	$0.63	$0.08	$0.52	$0.17	$0.58	$0.27
Disposal - 50%	$0.49	$0.97	$0.08	$0.81	$0.27	$0.65	$0.38

Historical Analysis of Mathews County Land Values

The staff of Mathews County was able to provide the historical assessment values for the waterfront properties of each dredging project watershed for the assessment years of 2005, 2011 and 2017. This data indicates that the land values within each watershed increased between 2005 and 2011 but decreased between 2011 and 2017. The increase in property values for all watersheds was 31% between 2005 and 2011 and a loss of property value of 10% between 2011 and 2017. Mathews County Board of Supervisors increased the real estate tax rate after the 2017 assessment to make up for the declining revenues due to the reduction in property values.

All of the factors that resulted in the decline of the land values between 2011 and 2017 are unknown but reduced boating access due to channel shoaling of the various creeks and threats from rising sea levels definitely contributed to the decline in real estate values during this period. While the exact impact that the dredging of a channel may have on waterfront property values is unknown, it can be assumed the impact will be positive.

Table 30. Mathews County Historic Land Value Change

Waterbody	Total Land Value 2005	Total Land Value 2011	Total Land Value 2017
Davis Creek	$3,269,300.00	$4,784,500.00	$4,310,300.00
Horn Harbor	$28,178,200.00	$40,879,900.00	$31,750,300.00
Milford Haven	$102,331,600.00	$127,785,100.00	$119,048,200.00
Queens Creek	$25,902,000.00	$38,641,300.00	$36,565,600.00
Winter Harbor	$15,319,900.00	$19,915,500.00	$16,841,000.00
Mill Creek	$1,453,700.00	$1,835,900.00	$1,480,700.00
Put In Creek	$16,331,600.00	$19,644,400.00	$19,129,200.00
Total of Waterbodies	**$192,786,300.00**	**$253,486,600.00**	**$229,125,300.00**

Waterbody	Land Value Change 2005-2011	Land Value Change 2011-2017
Davis Creek	$1,515,200.00	-$474,200.00
Horn Harbor	$12,701,700.00	-$9,129,600.00
Milford Haven	$25,453,500.00	-$8,736,900.00
Queens Creek	$12,739,300.00	-$2,075,700.00
Winter Harbor	$4,595,600.00	-$3,074,500.00
Mill Creek	$382,200.00	-$355,200.00
Put In Creek	$3,312,800.00	-$515,200.00
Total of Waterbodies	**$60,700,300.00**	**-$24,361,300.00**

Waterbody	Land Value % Change 2005-2011	Land Value % Change 2011-2017
Davis Creek	46%	-10%
Horn Harbor	45%	-22%
Milford Haven	25%	-7%
Queens Creek	49%	-5%
Winter Harbor	30%	-15%
Mill Creek	26%	-19%
Put In Creek	20%	-3%
Total of Waterbodies	**31%**	**-10%**

When trying to estimate what the fiscal impact to the County of not addressing the resiliency of our waterways and threats to the waterfront properties are, two central questions need to be asked: "What was the loss in revenues as a result of the decline in property values from 2011 to 2017?" and "What might the tax gain be going forward into the next reassessment cycle if property values increase at historic rates for?"

Lost revenues for the watersheds served by the dredging projects for 2017 to 2023 were estimated and are shown in Table 31. This addresses the first question: "What was the loss in revenues as a result of the decline in property values from 2011 to 2017?" If the property values remained constant at 2005 levels for each watershed for the next reassessment cycle (2017 through 2023) and the tax rate remained at the $.645/$100, the County would have gained $942,782 in taxes.

Table 31. Mathews County Revenue Lost 2017-2023

Waterbody	Lost Revenue 2017 - 2023
Davis Creek	-$18,351.54
Horn Harbor	-$353,315.52
Milford Haven	-$338,118.03
Queens Creek	-$80,329.59
Winter Harbor	-$118,983.15
Mill Creek	-$13,746.24
Put In Creek	-$19,938.24
Total of Waterbodies	**-$942,782.31**

In addressing the second question regarding tax gains going forward, the increase in property values (gain is real estate tax revenues) are projected to be the same as property value increases as seen in the 2005 to 2011 time period. These increases are applied to the 2017 property values for an estimate of future values. This assumes that the real estate conditions present in the 2005 to 2011 time period are replicated between at the time of the 2023 reassessment. These hypothetical projects yielded a $73,212,689 increase in property value and an annual real estate tax gain of $72,222 with a cumulative real estate tax gain of $2,833,331 for the next reassessment cycle.

Table 32. Mathews County Projected Land Value Increases and Revenues

Waterbody	Projected Land Value Increase 2023	Revenue Gain/Yr. - 2023	Revenue Gain 2023-2029
Davis Creek	$1,982,738.00	$12,788.66	$76,731.96
Horn Harbor	$14,287,635.00	$92,155.25	$552,931.47
Milford Haven	$29,762,050.00	$191,965.22	$1,151,791.34
Queens Creek	$17,917,144.00	$115,565.58	$693,393.47
Winter Harbor	$5,052,300.00	$32,587.34	$195,524.01
Mill Creek	$384,982.00	$2,483.13	$14,898.80
Put In Creek	$3,825,840.00	$24,676.67	$148,060.01
Total of Waterbodies	**$73,212,689.00**	**$472,221.84**	**$2,833,331.06**

While this methodology has many assumptions and is speculative in nature, it illustrates that for Mathews County's fiscal health is directly tied to taking measures to maintain and increase the value of waterfront properties throughout the County. Historical land values for Gloucester and Middlesex counties were not available for analysis. Maintaining the navigability of the channels and increasing the resiliency of the shoreline are critical to maintaining and increasing the value of waterfront properties. While the threats to waterfront properties in Mathews County may be more severe than in Gloucester and Middlesex Counties, the same principles apply. The continued increase in the value of the waterfront properties in all three localities are critical to the foundation of their economies and the fiscal health of the local government.

Conclusions

The analysis yielded several conclusions that may be useful for County policy makers:

- The individual dredging projects range in cost from a low of $339,571 for Mill Creek to a high of $3,093,480 for Winter Harbor.
- The cost savings are VERY significant and will greatly reduce the real estate tax rate necessary to pay the debt service when projects can be combined under a single contract.
- Without grant funding the total cost of the dredging projects for each County are: Gloucester - $9.2M, Mathews - $12.6M, and Middlesex - $8.2M.
- Any grant funding that can be secured to reduce costs is directly reflected in a reduction real estate tax increases necessary to pay the annual debt service.
- Longer useful life of the dredging projects results in decreases in the annual debt service payments, and thus decreases the burden on the real estate tax base.
- If you apply the cost of all of the dredging projects across the tax base of each County the increase in real estate taxes range from $.024/$100 for Gloucester to $.08/$100 in Mathews County.
- If you apply the costs of dredging projects only to the waterfront properties of the watershed served the real estate tax increases necessary are typically more than the real estate tax rate of the County.
- The creation of special tax districts appears to be politically infeasible due to the high real estate tax rates on the waterfront property owners required to cover the cost of dredging projects.
- The experience of Mathews County's recent land assessment values over the last three assessments cycles (2005, 2011, and 2017) indicates that loss of property value can be attributed, in part, to lack of water access and to increased costs/risks of waterfront living (i.e. increased cost of flood insurance, cost of hazard mitigation, impact of sea level rise).
- While hard to quantify, the inaction of political leaders to address the dredging needs of creeks of the County will likely have a direct and significant reduction in future waterfront land values, and thus a commensurate reduction in real estate tax revenues to the County.

Summary of Findings, Conclusions, and Recommendations

The Dredging Problem
The analysis contained in this Plan and the research supporting the Plan provided the following findings and conclusion related to the extent of the problems related to the shoaling of the shallow draft channels in the Middle Peninsula:

- Of the120 shallow draft channels in the region, 55 (46%) are restricted or semi-restricted and 39 (32%) are completely shoaled or have shoaling greater than 50% of the channel according to the Virginia Institute of Marine Science (VIMS) Shoreline Studies Program's April 2021 report, *Dredging Implementation Prioritization and Management for Middle Peninsula Shallow Draft Channels*.
- Dredging projects in the Middle Peninsula have historically been conducted by the US Army Corps of Engineers (USACE) but due to the reduction in shallow draft navigation funding and other higher priorities the USACE has only completed five dredging projects within the region over the period 1990-2020.
- As the federal budget for dredging projects has declined it has become apparent that a different approach is required to fund channel dredging in the future.
- The recently enacted Virginia Port Authority's Waterways Maintenance Fund provides annual funding of $1.35 M as of 2020 for shallow draft channel dredging throughout the Commonwealth. This level of funding will only allow a very select few projects to be dredged annually, nowhere near addressing the dredging needs in the Middle Peninsula or the Commonwealth.
- Without continual maintenance of the navigable waterways in the Middle Peninsula, marine traffic will have to be diverted, boating safety will be jeopardized, and recreational and economic activity curtailed. The impact will result in reduced economic activity, reduced shoreline property values, and fewer real estate taxes flowing to local governments.

The Cost of Dredging
The costs of dredging the 21 channels were estimated based upon the traditional method of contracting with private companies that specialize in dredging and estimating the cost of establishing a regionally operated dredging program. A comparison of the cost of both methods was performed. The following are the findings and conclusions from that analysis.

Private Sector Contracting

- The costs for dredging the individual projects ranged from a low of $337,178 for Free School Creek Mill Creek to a high of $3,201,088 for Cedarbush Creek. If you combine dredging projects under a single contract the Aberdeen/Cedarbush/Timberneck Creeks project would be the most expensive at $4,700,927.
- Combining projects under a single construction contract yields very significant cost savings since the mobilization/demobilization costs would be spread across several projects. Typically, the mobilization/demobilization costs are $700,000 per project.

- Without grant funding the total cost of all of the dredging projects is $30M. The cost of the dredging projects in each County are: Gloucester - $9.2M, Mathews - $12.6M, and Middlesex - $8.2M.
- The increase in County real estate taxes necessary to fund the dredging projects without any grant funding is projected to be: $.024/$100 for Gloucester County to $.08/$100 in Mathews County to $.046/$100 in Middlesex County. If projects are undertaken individually the increase in the real estate tax for each project would be less than $.02/$100 on the tax rate.

Regionally Operated Dredging Program

The cost of operating a regional dredging program was estimated using a hydraulic cutter head dredge operated with a staff of 5 members.

- A regionally operated dredging program would have an annual budget of $2,581,979 – Administration $855,630 including a Replacement Reserve of $250,000/yr., and Dredging - $1,766,349 including Debt Service on Equipment of $521,597.
- This regionally operated dredging program would be able to dredge approximately 750 cu. yd. per day or about 120,000 cu. yd. per year. At this rate, the regional program would be able to complete around 3 to 4 dredging projects per year depending upon the sizes of the projects. At that rate, one round of dredging for the portfolio would take approximately 5 years to complete.
- The number of shallow draft channels needing dredging across the region and the projected frequency of maintenance dredging would require full-time operation of the regional dredging program for the foreseeable future.
- A $27/cy fee structure is required to support the regionally operated dredging program.
- The cost to complete all projects within each of the Counties at the rate of $27/cu. yd. would be: Gloucester - $8.5M, Mathews – $9.8M, and Middlesex - $3M for a total cost of $21.3M.
- Lowered costs are achieved as a result of being able to plan and move dredging operations sequentially from one site to the next in a logical geographic order and having much lower mobilization/demobilization costs.
- The increase in County real estate taxes necessary to fund the dredging projects without any grant funding is projected to be: $.021/$100 for Gloucester County, $.061/$100 in Mathews County and $.017/$100 in Middlesex County.
- If grant funding were available for the dredging equipment ($3.6M) the dredging fee charged the counties could be lowered from $27/cu. yd. to $21.50. If 50% of the equipment costs could be covered the fee would be $24.30/cu. yd. The DHCD's GO Virginia and the VPA's Waterway Maintenance Fund programs are potential grant sources.
- The pro forma of the regionally operated dredging program indicates that the start-up time and the down time during the winter months cause a cash flow and first year deficit (Expenditures exceed revenues by $619,060) requiring a $650,000 working capital line of credit (LOC) to offset these cash flow issues.
- During the second year of operation the pro forma projects the regional dredging program revenues will exceed expenditures by $108,709 reducing the LOC to $250,000 at the end of the 2nd year. During the third-year revenues again exceed expenditures by $173,005 further reducing the LOC to $100,000 at the end of the year. At the end of three years of operation of the regional dredging program, the replacement reserve is projected to grow to $750,000 and there would be cash balance of $122,654 at the end of the third year.

Regionally Operated Dredging Program vs. Private Sector Contracting

The costs of contracting the various dredging projects were compared to the costs of carrying out the dredging program through a regionally operated dredging program. The following is a summary of the findings of that analysis:

- It is 29% less costly to dredge the channels through a regionally operated program than through contracting with private sector dredging contractors.
- Dredging all of the channels through contracting with the private contractors is estimated at $30M versus $21.3M if dredged through the regionally operated dredging program. The savings for each locality are estimated to be: Gloucester - $.7M, Mathews - $2.8, and Middlesex - $5.2M.
- The cost savings of a regionally administered and operated dredging program results in less of an impact on the real estate tax rate: $.003 – Gloucester County, $.02 – Mathews County, and $.029 in Middlesex County.
- Small to medium sized dredging projects, 1,000 to 85,000 cu. yd., are more economical to implement through a regionally operated dredging program.
- Larger dredging projects, greater than 85,000 cu. yd., are less costly when undertaken with a private sector contractor than a regionally operated dredging program.
- Very small dredging projects, less than 1,000 cu. yd. using an upland platform method of dredging, are less costly when undertaken with private contractor.
- The regionally operated dredging program would likely contract with the private sector for some projects, particularly the smaller projects, to achieve cost efficiencies and reduce overall cost to the localities.

Options for Financing Dredging

The possible grants to reduce the overall costs of the dredging projects and the potential for debt capital to provide long-term financing for the net cost of the projects were also evaluated. In addition, various methods of raising revenues were evaluated to determine the most feasible options for paying the annual cost of the dredging projects. Lastly, the implications of not taking any action were analyzed based upon the recent real estate assessment experience of Mathews County for the years 2005, 2011, and 2017. The following are the findings and conclusions related to each area of analysis.

Grant Options

The cost of channel dredging can be reduced through grants or contributions to the projects. A variety of grants options were reviewed and evaluated for their application to the dredging projects proposed. The following is a summary of the findings related to that analysis.

- There are four general categories of grants that can be applied to dredging projects: 1) grants that can cover most of the overall cost of a dredging project, 2) grants that would support the economic expansion of the harbor served by the channel, 3) grants that improve the environment, typically related to beneficial use of the dredge material and 4) grants that may be available to reduce the planning and predevelopment costs of the dredging projects.
- Three programs can provide grant support for most of the individual dredging projects: Virginia Port Authority Waterway Maintenance Fund; US Army Corps of Engineers, Continuing

Authorities Program, Section 107 – Navigation; and the USDA Rural Development Community Facilities Direct Loan and Grant Program.

- The Virginia Port Authority (VPA) Waterway Maintenance Fund is the single best grant program for supporting the regional dredging projects but annual allocation funds limit its utilization to one or two projects a year, which is insufficient to address the need for dredging in the region.
- There are six grant programs which could support dredging if it is a component of a larger project that increases economic activity related to a working waterfront or harbor: 1) VPA - Aid to Local Ports, 2) DHCD, Go Virginia Implementation Grants, 3) DHCD, CDBG Community Economic Development Grants, 4) EDA, Public Works Grants, 5) EDA, Economic Adjustment Grants, and 6) EDA, Disaster Supplemental Assistance.
- Four programs are directed at the "beneficial disposal of dredge material":
    - US Army Corps of Engineers, Continuing Authorities Program, Section 204 – Beneficial Use of Dredge Material,
    - US Army Corps of Engineers, Chesapeake Bay Environmental Restoration and Protection, Section 510,
    - US Army Corps of Engineers, Project Modifications to Improve the Environment - Section 1135 and
    - Virginia Department of Conservation and Recreation - Virginia Community Flood Preparedness Fund (CFPF).
- Given the amount of funding that is projected to be available in the Virginia Community Flood Preparedness Fund (CFPF), there is a significant potential for grants that would cover a portion of several dredging projects.
- Funding to cover a portion of the costs of the pre-dredging activities are eligible under eleven different programs: 1) Virginia Port Authority, Waterway Maintenance Fund, 2) DHCD, Go Virginia, Enhanced Capacity Building, 3) DHCD, CDBG, Project Planning Grants, 4) US Army Corps of Engineers, Continuing Authorities Program, Section 107 – Navigation, 5) US Army Corps of Engineers, Continuing Authorities Program, Section 204, 6) US Army Corps of Engineers, Project Modifications to Improve the Environment, Section 1135, 7) US Army Corps of Engineers, Chesapeake Bay Environmental Restoration and Protection, Section 510, 8) EDA, Public Works Grants, 9) EDA, Economic Adjustment Grants, 10) EDA, Disaster Supplemental Assistance program, and 11) VDCR, Virginia Community Flood Preparedness Fund (CFPF).
- It appears that the US Army Corps of Engineers, Chesapeake Bay Environmental Restoration and Protection, Section 510 program will have funding available over the next several years that will be able to support dredging that is tied to implementation of the Chesapeake Bay Program.
- If the counties choose to operate a regional dredging program through the Middle Peninsula Chesapeake Bay Public Access Authority by purchasing a dredge and related equipment, the VPA - Waterway Maintenance Fund and the DHCD – GO Virginia grant programs are potential opportunities for grants to cover all or a portion of the cost of that dredging equipment, $3.6M.

Loan Options

Covering the cost of channel dredging will likely require loans to be able to spread the costs of the projects over their useful life. A variety of methods of providing debt financing were evaluated and the following is a summary of the findings related to that analysis.

- Long-term debt will almost certainly be required to support the financing of the proposed dredging projects for the Middle Peninsula counties because of the size of the projects. It is highly unlikely that grants will be available in sufficient number and quantity to support the full dredging program proposed.
- The counties may wish to issue debt through the Middle Peninsula Chesapeake Bay Public Access Authority (MPCBPAA) to avoid having to have a referendum approved by the voters of each participating county. The MPCBPAA is authorized to issue debt for dredging activities and to operate a channel-dredging program within its boundaries.
- If the counties choose to issue debt through the MPCBPAA or other authority it will require, at a minimum, a "moral obligation" resolution from the locality and additional collateral may be needed to satisfy the lender.
- The engagement of a financial advisor and bond counsel will be necessary to properly evaluate the best financial structure(s) for the dredging projects.
- The ability of the localities in the Middle Peninsula to "pool" dredging projects into a single financing package will determine the potential debt funding options available. Virginia Resources Authority Pooled Finance Program and publicly issued municipal bonds will require multiple dredging projects to justify the associated bond issuance costs.
- The Virginia Resources Authority's Pooled Finance Program provides an affordable and efficient method to provide the necessary debt financing if several dredging projects can "pooled" into a single bond issue, greater than $1MM.
- Commercial lending institutions accustomed to providing long-term loans to localities and political subdivisions, particularly those that participate in the USDA Rural Development - Community Facilities Loan Guarantee Program, appears to be a viable option for financing the regional dredging program. Working through commercial lenders reduces the cost of issuance, provides greater flexibility in the structure of the debt, and can be completed in a timeframe to meet dredging schedules. Another advantage of a commercial lender is their ability to provide short-term debt in support of pre-dredging activities and the possibility of converting that debt into long-term debt. Debt from commercial lenders will typically result in higher interest rates and require greater loan security.
- Since there have been few locality sponsored, shallow-channel dredging projects supported by long-term debt in Virginia, it may take a considerable time to develop the appropriate financing structure that will satisfy either a public or private lender.

Options for Raising Annual Revenues to Cover the Costs of the Dredging Program

A central question that the Counties will ask is: "How much will a dredging program cost the taxpayers and how can we pay for it?" In order to answer that question, the cost of each dredging project was annualized assuming that it would be financed for the useful life of the dredging project and the impact on the real estate tax rate calculated. This same procedure was conducted for all of the projects identified for each county. Four different levels of grant funding were assumed and applied to each project analysis. In addition, an analysis was conducted applying the cost of the dredging project to the tax base of the waterfront properties served by the dredging project. The findings and conclusions from that analysis is presented below:

- Any grant funding that can be secured to reduce costs is directly reflected in a reduction real estate tax increases necessary to pay the annual debt service. Typically, a 50% grant for either the dredging or the disposal of dredge material will reduce annual debt service between 20% and 40%.

- Longer useful life of the dredging projects results in decreases in the annual debt service payments thus decreases the burden on the real estate tax base. The useful life of a dredging project is typically between 5 and 20 years.
- If you apply the cost of private sector contracting of the dredging projects across the tax base of each County the impact on real estate taxes necessary to pay the annual debt service is $.024/$100 for Gloucester to $.08/$100 in Mathews County and $.046 in Middlesex County. If grant funding is awarded to any of the projects the tax rate would be reduced accordingly.
- If you apply the cost of dredging the projects through a regionally operated dredging program across the tax base of each County the impact on real estate taxes necessary to pay the annual debt drops to $.021/$100 for Gloucester to $.061/$100 in Mathews County and $.017 in Middlesex County. If grant funding is awarded to any of the projects or the dredging equipment the tax rate would be reduced even further.
- If you apply the costs of dredging projects only to the waterfront properties of the watershed served by the dredging project, the real estate tax increases necessary are typically more than the County's real estate tax rate.
- Special tax districts covering the watersheds appear to be politically infeasible because of the high increases in the real estate tax rates necessary to cover the dredging project costs.
- Applying the costs of dredging to the watersheds served by that project results in the high value real estate watersheds paying much lower taxes than low value watersheds. This leads to wide differences in tax rates across the county.

Do Nothing Option

What is the likely impact on the real estate tax base by not addressing the dredging needs of throughout the region? This question is hard to answer but an analysis of the Mathews County land assessments over the last three assessments cycles, 2005, 2011 and 2017 was undertaken for the watershed properties served by the proposed dredging projects to provide some insight into what the impact might be. The following is the findings and conclusions of that analysis:

- Land values in these watersheds increased between 2007 and 2011 by 31% ($60,700,300) but declined between 2011 and 2017 by 10% ($24,361,300).
- If the property values had remained constant in these watersheds at the 2005 levels through the next reassessment cycle (2017 through 2023) and the tax rate remained at the $.645/$100, the County would have gained an additional $942,782 in taxes.
- Projecting the increase in property values at the 2005 to 2011 rate for the watersheds into next reassessment cycle, 2023 reassessment, yields a $73,212,689 increase in property value and an annual real estate tax gain of $72,222 with a cumulative real estate tax gain of $2,833,331 for the 2023 - 2029 reassessment cycle.
- Recent land assessment experience in Mathews County over the last three assessments cycles, 2005, 2011 and 2017, indicates that loss of property values can be attributed, in part, to lack of water access and to increased costs/risks of waterfront living (i.e. increased cost of flood insurance, cost of hazard mitigation, impact of sea-level rise).

- While hard to quantify, the inaction of political leaders to address the dredging needs of creeks of the County will likely have a direct and significant reduction in future waterfront land values thus a commensurate reduction in real estate tax revenues to the County.

Recommendations
Based on the analysis, findings, and conclusions of this Plan it is recommended that:

- The Middle Peninsula counties join together through the auspices of the Middle Peninsula Chesapeake Bay Public Access Authority (MPCBPAA) to purchase and operate their own medium-sized hydraulic cutter dredge to carry out dredging projects throughout the region. This approach is the most cost-effective course of action for dredging the shallow draft channels in the Middle Peninsula.
- The Middle Peninsula counties formally request the MPCBPAA to develop a plan for managing a regionally operated dredging program with a detailed financing plan to support the program.
- The MPCBPAA engage a financial advisor and bond counsel to evaluate the best finance structure for funding the dredging projects over time. Since there have been few locality-sponsored shallow-channel dredging projects supported by long-term debt in Virginia, it may take a considerable time to develop the appropriate financing structure that will satisfy either a public or private lender.
- The Middle Peninsula counties, based on the approval of the "regional dredging management plan", adopt the appropriate resolutions to provide the appropriate assurances that the localities will provide the revenues necessary to cover the costs of the regionally operated dredging program.
- The Middle Peninsula counties encourage the Virginia Port Authority to adopt a multi-year commitment to dredging projects in the Middle Peninsula based on the MPCBPAA management plan. Such action will help facilitate the completion of pre-dredging activities, support a comprehensive approach to dredging shallow draft channels, reduce costs and improve the coordination with other potential grant programs.
- The MPPDC and MPCBPAA, in partnership with member localities, identify several working waterfront communities for intense planning that would support the development of the working waterfronts leading to grant funding supporting the working waterfront development and channel dredging. There are six potential grant programs that could support these planning efforts of working waterfront redevelopment projects:
    1. DHCD, GO Virginia, Enhanced Capacity Building,
    2. DHCD, CDBG, Project Planning Grants,
    3. EDA, Public Works Grants,
    4. EDA, Economic Adjustment Grants,
    5. EDA, Disaster Supplemental Assistance program, and
    6. DCR, Virginia Community Flood Preparedness Fund (CFPF).
- The MPPDC and MPCBPAA, in partnership with member localities, continue and expand its planning efforts to determine the eligibility for grant funding for the beneficial use of the dredge spoil and how the dredging program coordinates with other environmental initiatives, particularly the improvement of the Chesapeake Bay and resiliency from flooding. There are two potential grant programs have the potential of supporting these planning efforts:

1. DCR, Virginia Community Flood Preparedness Fund (CFPF),
2. US Army Corps of Engineers, Chesapeake Bay Environmental Restoration and Protection, Section 510 program.

- The Middle Peninsula localities should partner with the USACE, when federal funding becomes available, to expedite dredging projects and reduce costs. This includes pre-construction, construction, and post construction activities.
- The Middle Peninsula localities utilize the USACE pre-construction planning and other work products to facilitate the dredging of federal navigation channels.

Appendix A: Glossary of Key Terms and Concepts

Aids to Navigation: Buoys, beacons, fog signals, radio beacons, range markers, and generally any charted or published information serving the interest of safe navigation.

Allowable Over-depth: Additional depths below the required section specified in a dredging contract. This additional depth is generally permitted (but not required) because of inaccuracies in the dredging process.

Applicant: According to the Virginia Port Authority Policy on Grants to Local Governments for Financial Assistance for Dredging Activities, an applicant refers to the political subdivision and governing bodies of Virginia localities.

Bathymetry: The study of the "beds" or "floors" of water bodies, including the ocean, rivers, streams, and lakes. Bathymetry map of East Flower Garden Bank. The term "bathymetry" originally referred to the ocean's depth relative to sea level, although it has come to mean "submarine topography," or the depths and shapes of underwater terrain.

Beneficial Use (Reuse): According to the Virginia Port Authority Policy on Grants to Local Governments for Financial Assistance for Dredging Activities, refers to innovative uses and placement alternatives for dredge materials that produce public, economic, or environmental benefits.

Authorized Dimensions: Length, width, and depth dimensions of a navigation project as specified in the authorizing document (in the case of federal projects the authorized dimensions are established by the US Army Corps of Engineers (USACE).

Channel: Part of a body of water deep enough to be used for navigation. Channels can be either natural or artificial waterways.

Carryover Funds: According to the Virginia Port Authority Policy on Grants to Local Governments for Financial Assistance for Dredging Activities, refers to unused funds for awarded projects. Funds must be reapplied for each year.

Categorical (Dredging) Permissions (also see Section 408 below): The USACE has the ability to create a "categorical permission" in order to expedite and streamline the review and decisions of Section 408 requests that are similar in nature and that have similar impacts to the USACE project and environment. An assessment of impacts to the usefulness of the USACE project, environmental compliance, and a public interest determination is conducted ahead of time for a common category of activities. For those individual Section 408 requests that are consistent with the terms and conditions of an established categorical permission, the Section 408 request can be granted with a simplified validation process.

Commercial Craft: Non-recreational vessels used for commercial activity.

Continuing Authorities Program: The USACE Continuing Authorities Program (CAP) is a group of nine legislative authorities under which the USACE can plan, design, and implement certain types of water resources projects without additional project specific congressional authorization. The purpose of the CAP is to plan and implement projects of limited size, cost, scope and complexity.

All projects in this program include a feasibility phase and an implementation phase. Planning activities, such as development of alternative plans to achieve the project goals, initial design and cost estimating, environmental analyses, and real estate evaluations, are performed during the feasibility phase, to develop enough information to decide whether to implement the project. The feasibility phase is initially Federally funded up to $100,000. Any remaining feasibility phase costs are shared 50/50 with the non-Federal sponsor after executing a feasibility cost sharing agreement (FCSA). The final design, preparation of contract plans and specifications, permitting, real estate acquisition, project contracting and construction, and any other activities required to construct or implement the approved project are completed during the implementation phase. The USACE and the non-federal sponsor sign a project partnership agreement (PPA) near the beginning of the implementation phase. Costs beyond the feasibility phase are shared as specified in the authorizing legislation for that section. The table below lists the CAP authorities and their project purposes.

AUTHORITY	PROJECT PURPOSE
Section 14, Flood Control Act of 1946, as amended	Streambank and shoreline erosion protection of public works and non-profit public services
Section 103, River and Harbor Act of 1962, as amended (amends Public Law 79-727)	Beach erosion and hurricane and storm damage reduction
Section 107, River and Harbor Act of 1960, as amended	Navigation improvements
Section 111, River and Harbor Act of 1968, as amended	Shore damage prevention or mitigation caused by Federal navigation projects
Section 204, Water Resources Development Act of 1992, as amended	Beneficial uses of dredged material
Section 205, Flood Control Act of 1948, as amended	Flood control
Section 206, Water Resources Development Act of 1996, as amended	Aquatic ecosystem restoration
Section 208, Flood Control Act of 1954, as amended (amends Section 2, Flood Control Act of August 28, 1937)	Removal of obstructions, clearing channels for flood control
Section 1135, Water Resources Development Act of 1986, as amended	Project modifications for improvement of the environment

Cross-Section: A view of the channel bottom and side slopes normal to the channel alignment.

Datum: A coordinate system with a reference surface (such as sea level) that serves to provide known locations to begin surveys and create maps. Datums provide reference points requiring accurate coordinates that are consistent with one another. A sample datum used for the most recent Hoskins Creek dredging project follows:

— QUANTITY ESTIMATE —			
STATION TO STATION	TO 10 FT (REQUIRED)	1' OVERDEPTH (ALLOWABLE)	TOTAL
	CY	CY	CY
1+00 TO 10+00 (FULL WIDTH)	600	1,900	2,500
12+50 TO 61+00 (FULL WIDTH)	27,700	20,000	47,700
ESTIMATED ACCRETION TO JUNE 2015	900	300	1,200
TOTAL	29,200	22,200	51,400

LEGEND:

- EXISTING CONTOUR MINOR
- EXISTING CONTOUR MAJOR
- EXISTING STORM PIPE
- U.S. GOVERNMENT PROPERTY EASEMENT
- SF — SILT FENCE
- TREELINE
- DREDGE PIPELINE ROUTE
- 33.4 — GROUND SPOT
- LIMITS OF CHANNEL
- DREDGING AREA

SURVEY NOTES:

PROJECT DIMENSIONS: A channel 10 feet deep from the Rappahannock River to the Route 17 Bridge, 100 feet wide in the entrance channel, 80 feet wide within the creek with a turning basin 250 feet long and 200 feet wide at the public wharf.

MEAN LOWER LOW WATER (MLLW), National Tidal Datum Epoch (NTDE) of 1983–2001, was determined by the National Ocean Service (NOS) at Tappahannock is 1.09 feet below the North American Vertical Datum (NAVD) of 1988.

SOUNDINGS are in feet referred to NOS MLLW and were taken on 2 and 8 October 2013. ELEVATIONS are in feet referred to North American Vertical Datum of 1988 (NAVD 1988) and were taken on 21 thru 31 July 2014.

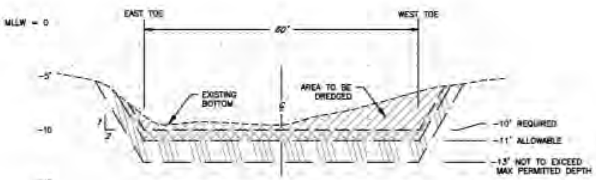
UPLAND PLACEMENT SITE EXISTING SURVEY was originally preformed by Waterways Surveys & Engineering, LTD and provided to the US Corps of Engineers in digital (AutoCAD) format.

MEAN RANGE OF TIDE is 1.74 feet at Tappahannock, Rappahannock River, and the Mean Low Water (MLW) and MLLW separation is 0.13 feet at Wares Wharf based on NOS observations.

COORDINATES are referred to the Virginia State Plane Coordinate System, South Zone, in U.S. survey feet, and are based on the North American Datum of 1983.

PLANIMETRIC FEATURES were developed by stereo-photogrammetric methods from aerial photos flown on 28 December 1994 by Photo Science. Portions of the planimetric data to the South East of Hoskins Creek were added using a Google Earth overlay.

LAST DREDGED by Southwind Construction Corporation during the period 5 October 2009 through 17 November 2009 under Contract No. W91236-09-C-0065 dated 29 July 2009



TYPICAL SECTION SHOWING SIDESLOPES AND OVERDEPTH (NOT TO SCALE)

ABBREVIATIONS

LOC LIMITS OF CONSTRUCTION
INV INVERT ELEVATION
CMP CORRUGATED METAL PIPE
FES FLARED END SECTION
FT FEET

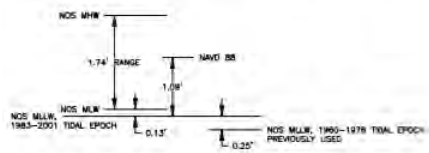
COORDINATES OF CENTERLINE STATIONS		
STATION	EAST (X)	NORTH (Y)
0+00.0	11,956,313.55	3,861,740.59
6+00.0	11,956,887.15	3,861,916.63
8+50.0	11,957,079.55	3,862,076.26
9+70.0	11,957,127.00	3,862,186.48
12+50.0	11,957,065.84	3,862,459.72
17+19.0	11,956,911.88	3,862,902.73
19+59.0	11,956,859.48	3,863,136.93
21+22.0	11,956,910.82	3,863,291.63
28+12.0	11,957,403.71	3,863,774.49
29+62.0	11,957,549.00	3,863,811.78
30+67.0	11,957,653.82	3,863,805.64
32+47.0	11,957,805.54	3,863,708.78
34+82.0	11,957,905.43	3,863,498.06
36+61.7	11,958,048.51	3,863,367.35
38+68.1	11,958,254.89	3,863,392.36
64+00.0	11,960,326.39	3,864,848.11

GOVERNMENT EASEMENT BOUNDARY COORDINATES					
EASEMENT POINTS	X	Y	EASEMENT POINTS	X	Y
EP-1	11,951,889.79	3,857,732.07	EP-39	11,951,762.23	3,859,266.46
EP-2	11,950,695.40	3,856,559.69	EP-40	11,951,792.90	3,859,274.71
EP-3	11,950,365.20	3,856,894.06	EP-41	11,951,916.08	3,859,236.19
EP-4	11,950,226.45	3,856,879.01	EP-42	11,951,909.06	3,859,094.62
EP-5	11,950,163.79	3,856,944.36	EP-43	11,951,910.84	3,858,936.82
EP-6	11,949,969.44	3,857,504.49	EP-44	11,951,909.06	3,858,834.51
EP-7	11,949,973.97	3,857,553.66	EP-45	11,950,731.35	3,856,594.97
EP-8	11,949,984.67	3,857,581.53	EP-46	11,951,008.04	3,856,373.20
EP-9	11,949,992.82	3,857,581.05	EP-47	11,951,056.05	3,856,097.20
EP-10	11,949,987.56	3,857,673.84	EP-48	11,951,207.54	3,855,707.78
EP-11	11,949,994.76	3,857,672.52	EP-49	11,951,231.12	3,855,647.18
EP-12	11,950,078.82	3,857,706.01	EP-50	11,951,122.33	3,855,515.72
EP-13	11,950,141.49	3,857,737.81	EP-51	11,951,082.78	3,855,546.29
EP-14	11,950,205.60	3,857,775.87	EP-52	11,951,035.18	3,855,566.48
EP-15	11,950,261.63	3,857,804.01	EP-53	11,951,150.70	3,855,715.99
EP-16	11,950,287.98	3,857,836.53	EP-54	11,951,007.64	3,856,083.71
EP-17	11,950,302.95	3,857,845.63	EP-55	11,950,962.01	3,856,346.01
EP-18	11,950,322.85	3,857,864.14	EP-56	11,955,118.13	3,861,709.19
EP-19	11,950,346.33	3,857,891.32	EP-57	11,955,123.57	3,861,595.89
EP-20	11,950,429.67	3,858,080.40	EP-58	11,954,998.54	3,861,766.02
EP-21	11,950,429.79	3,858,075.30	EP-59	11,954,959.22	3,861,674.48
EP-22	11,950,389.04	3,858,283.55	EP-60	11,954,942.63	3,861,644.28
EP-23	11,950,272.06	3,858,393.15	EP-61	11,954,766.85	3,861,694.94
EP-24	11,949,946.95	3,858,621.59	EP-62	11,954,741.14	3,861,582.45
EP-25	11,950,007.05	3,858,651.37	EP-63	11,954,413.42	3,861,026.84
EP-26	11,950,259.17	3,858,652.08	EP-64	11,954,394.02	3,860,928.06
EP-27	11,950,550.33	3,858,657.03	EP-65	11,954,211.93	3,860,848.78
EP-28	11,950,743.75	3,858,743.67	EP-66	11,954,237.05	3,860,632.12
EP-29	11,950,893.66	3,859,108.16	EP-67	11,953,809.35	3,859,909.78
EP-30	11,950,978.12	3,859,199.94	EP-68	11,953,509.87	3,859,899.66
EP-31	11,951,141.12	3,859,024.62	EP-69	11,953,343.30	3,859,868.64
EP-32	11,951,288.06	3,858,931.17	EP-70	11,953,350.26	3,859,592.02
EP-33	11,951,356.41	3,858,887.01	EP-71	11,953,180.75	3,859,384.14
EP-34	11,951,387.99	3,858,891.74	EP-72	11,953,200.60	3,859,361.00
EP-35	11,951,532.88	3,858,959.90	EP-73	11,952,494.66	3,858,926.74
EP-36	11,951,548.77	3,858,981.22	EP-74	11,952,506.41	3,858,869.61
EP-37	11,951,699.46	3,859,224.36	EP-75	11,952,457.37	3,858,859.86
EP-38	11,951,706.05	3,859,245.49	EP-76	11,952,360.92	3,858,924.32
			EP-77	11,952,351.59	3,859,024.43

BENCHMARKS	
BENCHMARK	ELEVATION
CE "HC-1, 1978"	+3.22'
CE "HC-GADE, 2004"	+15.31'
CE "DILLARD, 2004"	+9.44'
Elevations are relative to NOS MLLW, 1983–2001 NTDE	

SURVEY CONTROL TABLE			
DESCRIPTION	NORTHING	EASTING	ELEVATION
CE "KINS, 2003"	3,856,641.316	11,950,731.131	43.18'
CE "HOS, 2003" (NOT FOUND)	-----	-----	-----
CE "WOOD, 2003"	3,856,603.79	11,950,747.28	41.65'
CE "WARD, 2003"	3,856,424.64	11,950,873.42	43.58'
CE "RED OAK, 1995"	3,857,412.69	11,950,013.03	39.39'
CE "PINE, 1995"	3,856,951.82	11,950,171.70	46.15'

NOTE: CORPS OF ENGINEERS DISK'S "RED OAK, 1995" & "PINE, 1995" VALUES WERE OBTAINED BY TOTAL STATION TIES PERFORMED DURING THIS SURVEY. ALL OTHER CONTROL DATA IN TABLE WERE PROVIDED BY USACE.



D A T U M   D I A G R A M
(SCALE 1" = 1')

US Army Corps of Engineers Norfolk District

REV	DATE	DESCRIPTION	BY	APP

NORFOLK DISTRICT CORPS OF ENGINEERS NORFOLK, VIRGINIA

DESIGNED: | CHECKED: M.L.A. | DATE: 31 JULY 14
DRAWN: H.A.F. | SUBMITTED: K.L.G. | SCALE: AS SHOWN
NORFOLK DISTRICT FILE NO.: CPM 2014-10-02.PS
DRAWING NO.:
SURVEYED BY: WATERWAY SURVEYS & ENGINEERING, LTD.

HOSKINS CREEK PLANS FOR DREDGING AND PLACEMENT AREA REFURBISHMENT
SURVEY OF OCTOBER 2013
ESSEX COUNTY, VIRGINIA
LEGEND AND GENERAL NOTES

SHEET 3 OF 16

Discount Rate: The interest rate used in calculating present and annualized values of expected yearly benefits and costs of projects.

Disposal Area: An area designated for the placement of dredged material. A disposal area may be either upland, on a beach or shoreline, or for overboard placement.

Draft: The depth of water displaced by a vessel.

Dredging: The practice of excavating and removing material from underwater locations, either by mechanical or hydraulic means. Furthermore, according to the Virginia Port Authority Policy on Grants to Local Governments for Financial Assistance for Dredging Activities, dredging refers to the removal of sediments and debris from the bottom of lakes, rivers, harbors, and other water bodies.

Dredging Cycle: The period of time (years) between dredging events. Also referred to as dredging frequency.

Dredging Template: A cross-sectional view of the channel showing project depth, width, and side slopes.

Geosynthetic Tube: A disposal area dewatering technology fabricated from a specially engineered textile which provides confinement of the fine solids inside the container, while allowing water to permeate through the engineered textile. As water drains, the solids continue to densify and consolidate over time. Once the solids are fully consolidated or have met minimum requirements for transport, several options are available for disposal of the dewatered material (Source: TenCate Geotube®).

Hydraulic Dredging: Dredging performed by a hydraulic dredge, which generally moves bottom material via a centrifugal pump and pipeline or hopper directly toward a dredged material placement area.

Items of Local Cooperation: According to the Virginia Port Authority Policy on Grants to Local Governments for Financial Assistance for Dredging Activities, includes specific requirements on the applicant for implementation of a federal, state, or local project. Such items include but are not limited to lands, easements, rights-of-way, relocations, dredge material disposal sites, and cash contributions.

Local Sponsor: A local, regional, or state entity which has the authority to provide all items of local cooperation including but not limited to lands, easements, rights-of-way, relocations, dredge material disposal sites, and cash contributions. They must be financially able to meet obligations under Project Cooperation Agreements. Cities, Counties, Towns, States, and Port Authorities all serve as local sponsors.

Maintenance Dredging: The removal of shoal material from a constructed project.

Mean Lower Low Water (MLLW): A tidal datum established by the National Ocean Service. The average height of all lower low waters recorded over a specific 19-year period called the National Tidal Datum Epoch. It is the reference datum used for Federal navigation projects.

Mechanical Dredging: Dredging performed with a mechanical dredge, which normally lifts the dredged material above the waterline by means of buckets or scoops of various designs and deposits it in a barge or similar conveyance for transport and placement at a disposal site.

Monitoring: Requirements associated dredging and disposal activities to ensure that the project fully addresses conditions of environmental permits. Monitoring can occur during and/or after dredging and disposal activities are completed and typically follows a written monitoring plan.

Navigation Channel: A project feature with project limits/dimensions which are designed, constructed, and maintained for use by commercial and/or recreational navigation traffic. This definition includes appropriate harbors, canals, turning basins, anchorages/mooring areas and/or waterways.

Notice to Proceed: A term used when the government notifies a dredging contractor to proceed with dredging and disposal placement activities. The notice is typically provided in writing along with the provision of key elements of the contract to include dredging restrictions such as environmental windows and monitoring efforts.

Period of Performance: The period of time to perform a dredging project beginning with a notice to proceed and ending with the demobilization of dredging equipment.

Recreational Craft: Non-commercial vessels used for recreation activity.

River and Harbor Act: Typically, a Congressional authorization for construction of specific Federal navigation projects to include shallow-draft channels and turning basins.

Section 408: Through the Civil Works program, the USACE serves the public by providing the Nation with quality and responsive management of the Nation's water resources. As a result, USACE, in partnership with stakeholders, has constructed many Civil Works projects across the Nation's landscape. Given the widespread locations of these projects, many embedded within communities, over time there may be a need for others outside of USACE to alter or occupy these projects and their associated lands. Reasons for alterations could include improvements to the projects; relocation of part of the project; or installing utilities or other non-project features. In order to ensure that these projects continue to provide their intended benefits to the public, Congress mandated that any use or alteration of a Civil Works project by another party is subject to the approval of USACE. This requirement was established in Section 14 of the Rivers and Harbors Act of 1899, which has since been amended several times and is codified at 33 USC 408 (Section 408). Section 408 provides that USACE may grant permission for another party to alter a Civil Works project upon a determination that the alteration proposed will not be injurious to the public interest and will not impair the usefulness of the Civil Works project. A link providing specific approval procedures follows:

https://www.publications.usace.army.mil/Portals/76/Publications/EngineerCirculars/EC_1165-2-220.pdf?ver=2018-09-07-115729-890

See Appendix E of the 408 regulation for specific coverage of "categorical permissions".

Section 510: Develops a comprehensive strategy to guide USACE and Chesapeake Bay stakeholders in the identification and implementation of projects under Section 510 of the Water Resources Development Act (WRDA) of 1996, as amended, Chesapeake Bay Environmental Restoration and Protection Program.

Shallow Draft Navigation: Those navigation channels and turning basins with a depth of less than 15 feet for navigation and 20 feet for project cost sharing when measured at mean low water (reference: USACE Coastal Engineering Technical Note I-63, page 3, March 1999). Furthermore, according to the Virginia Port Authority Policy on Grants to Local Governments for Financial Assistance for Dredging Activities, refers to rural coastal waterways that have recognized and established navigable channels that are pivotal to the use and enjoyment of docks, marinas, boat yards and working waterfronts. Shallow draft dredging areas can be categorized as primary or secondary (including smaller tributaries and marked and unmarked channels) having a water depth of 14 feet or less.

Shoaling Rate: This is the rate at which sediment fills a navigation channel or feature, usually measured in terms of cubic yards per year.

Study: According to the Virginia Port Authority Policy on Grants to Local Governments for Financial Assistance for Dredging Activities, refers to feasibility and cost evaluations, pre-project engineering studies, and project permitting and contracting costs for a waterway project conducted by a political subdivision of the Commonwealth.

Turning Basin: A general navigation feature which allows commercial and recreational vessels to make a U-turn and leave a channel the way that they entered. They eliminate the need for long backing-out movements.

USACE: United States Army Corps of Engineers.

USCG: United States Coast Guard.

Vessels: Towboats, barges, and other waterborne craft.

VIMS: Virginia Institute of Marine Science.

VPA: Virginia Port Authority.

Waterway: Any body of water wide enough and deep enough to accommodate the passage of watercraft, particularly commercial and recreational vessels.

Water Resources Development Act: Water Resources Development Act (WRDA), is a reference to public laws enacted by Congress to address various aspects of water resources needs: environmental, structural, navigational, flood protection, hydrology, etc. Typically, the USACE administers the bulk of the Act's requirements. There have been a series of WRDAs which can be accessed via:

Water Resources Development Act - Wikipedia
(https://en.wikipedia.org/wiki/Water_Resources_Development_Act)

The most recent version of WRDA was signed into law on December 27, 2020, a summary of which can be obtained via: (https://crsreports.congress.gov/product/pdf/IF/IF11700)

Appendix B: Individual Channel Costs

Here, the particular costs of each of the 21 channels are explored (in order of which county they are located in). Separate consideration is given to the costs of combined channel projects and disposal. There are several assumptions inherent in this cost analysis:

The information below is based on January 2021 price levels and an interest rate of 3 per cent. The fiscal year used is July 1 through June 30. The base year is the year assumed for project construction and for subsequent maintenance dredging cycles based on a 5–20-year dredging frequency. Placement of beach quality dredge material is assumed to be used to nourish shorelines and the placement of non-beach quality dredge material is assumed to be placed in upland sites facilitated via the use of geotubes. The following paragraphs present the components in each of the project phases (Pre-Construction, Construction, and Post Construction) along with costs and associated time frames.

For assumptions for subsequent dredging cycles, the costs associated with further disposal site preparation will be decided at that time. The costs of disposal are included in the construction costs. For the final costs for each creek, the costs for aids to navigation, if any, will be determined closer to project construction.

The US Army Corps of Engineers Norfolk District authorized a Categorical Permission (CP) letter for seventeen federal navigation channels located in the study area. The CP was prepared in response to Section 14 of the Rivers and Harbors Act of 1899, which has since been amended several times and is codified at 33 USC 408 (Section 408). Section 408 provides that USACE may grant permission for another party to alter a Civil Works project upon a determination that the alteration proposed will not be injurious to the public interest and will not impair the usefulness of the Civil Works project. The CP creates an opportunity for non federal entities to conduct dredging activities within the federal navigation channels without required and often lengthy federal review and approval processes.

The costs for each channel are broken down into pre-construction, construction, and post-construction phases.

The Pre-Construction phase consists of components necessary to prepare the project for the actual dredging effort. The major components of the Pre-Construction phase are preliminary engineering and design activities to include a joint permit application, grant and loan applications, community engagement, an environmental assessment, federal, state, and local permits, legal coordination, and financial coordination. For each channel's pre-construction costs, a separate line item for contingencies is included. The timeline for the Pre-Construction phase would typically range up to 18 months.

The Construction phase consists of activities necessary to dredge the project and place dredged material at an appropriate placement site. The major components of the Construction phase are final engineering designs/plans and specifications, bonds and insurance, mobilization and demobilization of equipment, disposal/placement site preparation, dredging and disposal placement costs, supervision and administration costs for the dredging and disposal/placement activities. For each channel's construction costs, a separate line item for contingencies is included. Construction times vary depending upon the size and complexity of the job. For each channel, mobilization includes the costs of operations accomplished prior to commencement of dredging operations, and demobilization includes costs for the general preparation for transfer of the plant to its home base, removal of pipelines, cleanup of site or work areas, and the actual transfer of the plant to its home base.

The Post Construction phase consists of activities to close out the project to include mitigation, and/or monitoring and the conduct of a project condition survey. For each channel's post-construction costs, a separate line item for contingencies is included. Typically, the timeline to close out the fiscal and physical activities can range up to 2 months and the timeline to provide appropriate mitigation and/or monitoring is dependent upon the degree of dredging and disposal/placement impacts.

The amount of contingencies shown may vary up or down as more is known about the project and its impacts. Likewise, the costs of dredging and disposal/placement are both variable and increasing. Similarly, the historical cost of real estate necessary for project construction and maintenance in a coastal riverine environment has historically been variable and can be expected to be so in the future.

Aberdeen Creek

The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $2,416,043 and $1,746,960, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 5.7 acres is assumed to be required for the deposition of 59,250 cubic yards of dredge material. As shown in Table 33, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 33, costs for the Construction phase initial construction are $2,102,776 and costs for each period dredging cycle are $1,508,494. The timeline for the Construction phase, including mobilization and demobilization is 89 days with an additional 9 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 33, costs for the Post Construction phase initial construction are $86,666 and costs for each subsequent dredging cycle are $86,666.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	59,250
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 33. Implementation Costs for Aberdeen Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[65]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$49,762	$36,109
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$455,114	
Dredging	$503,625	$503,625
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,828,501	$1,311,734
Contingencies (15% of Construction Phase Costs)	$274,275	$196,760
TOTAL CONSTRUCTION PHASE COSTS	$2,102,776	$1,508,494
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$50,363	$50,363
Project Condition Survey	$25,000	$25,000
Subtotal	$75,363	$75,363
Contingencies (15% of Post Construction Phase Costs)	$11,304	$11,304
TOTAL POST CONSTRUCTION PHASE COSTS	$86,667	$86,667
TOTAL COST ALL PHASES	$2,416,043	$1,746,961

[65] Assumes the use of an upland disposal site which is in public control.

Cedarbush Creek

The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $3,201,088 and $2,248,919, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 10 acres is assumed to be required for the deposition of 89,505 cubic yards of dredge material. As shown in Table 34, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 34, costs for the Construction phase initial construction are $2,848,140 and costs for each period dredging cycle are $1,970,770. The timeline for the Construction phase, including mobilization and demobilization is 129 days with an additional 13 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 34, costs for the Post Construction phase initial construction are $126,349 and costs for each subsequent dredging cycle are $126,349.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	89,505
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	10-20
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 34. Implementation Costs for Cedarbush Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[66]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$62,869	$43,824
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$634,850	
Dredging	$760,793	$760,793
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$2,278,512	$1,576,616
Contingencies (25% of Construction Phase Costs)	$569,628	$394,154
TOTAL CONSTRUCTION PHASE COSTS	$2,848,140	$1,970,770
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$76,079	$76,079
Project Condition Survey	$25,000	$25,000
Subtotal	$101,079	$101,079
Contingencies (25% of Post Construction Phase Costs)	$25,270	$25,270
TOTAL POST CONSTRUCTION PHASE COSTS	$126,349	$126,349
TOTAL COST ALL PHASES	$3,201,089	$2,248,919

[66] Assumes the use of an upland disposal site which is in public control.

Timberneck Creek

The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $2,841,833 and $1,730,189, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 5.5 acres is assumed to be required for the deposition of 46,300 cubic yards of dredge material. As shown in Table 35, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 35, costs for the Construction phase initial construction are $2,534,790 and costs for each period dredging cycle are $1,497,945. The timeline for the Construction phase, including mobilization and demobilization is 72 days with an additional 7 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 35, costs for the Post Construction phase initial construction are $80,443 and costs for each subsequent dredging cycle are $80,443.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	46,300
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 35. Implementation Costs for Timberneck Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[67]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$55,568	$32,807
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$758,714	
Dredging	$393,550	$393,550
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$2,027,832	$1,198,357
Contingencies (25% of Construction Phase Costs)	$506,958	$299,589
TOTAL CONSTRUCTION PHASE COSTS	$2,534,790	$1,497,946
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$39,355	$39,355
Project Condition Survey	$25,000	$25,000
Subtotal	$64,355	$64,355
Contingencies (25% of Post Construction Phase Costs)	$16,089	$16,089
TOTAL POST CONSTRUCTION PHASE COSTS	$80,444	$80,444
TOTAL COST ALL PHASES	$2,841,834	$1,730,189

[67] Assumes the use of an upland disposal site which is in public control.

Combination Project: Aberdeen, Cedarbush, and Timberneck Creeks

The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $4,700,927 and $4,360,458, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 18 acres is assumed to be required for the deposition of 195,055 cubic yards of dredge material. As shown in Table 36, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 36, costs for the Construction phase initial construction are $4,254,911 and costs for each period dredging cycle are $3,989,242. The timeline for the Construction phase was previously provided for each of the 3 creeks in their individual write-ups.

POST CONSTRUCTION PHASE

As shown in Table 36, costs for the Post Construction phase initial construction are $219,416 and costs for each subsequent dredging cycle are $219,416.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	195,055[68]
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10/10-20[69]
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

[68] Assumption that dredging of these creeks would occur consecutively while dredging equipment was mobilized in the area.

[69] 5–10-year frequency for Aberdeen and Timberneck Creeks and 10-20 year frequency for Cedarbush Creek.

Table 36. Implementation Costs for Aberdeen, Cedarbush, and Timberneck Combination

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[70]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$104,270	$98,939
Mobilization/Demobilization	$980,000	$980,000
Dredge Material Placement Site Preparation	$837,686	$660,000
Dredging	$1,657,968	$1,657,968
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$3,699,923	$3,468,907
Contingencies (15% of Construction Phase Costs)	$554,988	$520,336
TOTAL CONSTRUCTION PHASE COSTS	$4,254,912	$3,989,243
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$165,797	$165,797
Project Condition Survey	$25,000	$25,000
Subtotal	$190,797	$190,797
Contingencies (15% of Post Construction Phase Costs)	$28,620	$28,620
TOTAL POST CONSTRUCTION PHASE COSTS	$219,416	$219,416
TOTAL COST ALL PHASES	$4,700,928	$4,360,459

[70] Assumes the use of an upland disposal site which is in public control.

Sarah Creek

The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,679,282 and $1,493,644, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 1 acre is assumed to be required for the deposition of 9,549 cubic yards of dredge material. As shown in Table 37, costs for the Pre-Construction phase initial construction are $248,600 and costs for each period dredging cycle are $173,800.

CONSTRUCTION PHASE

As shown in Table 37, costs for the Construction phase initial construction are $1,389,286 and costs for each period dredging cycle are $1,278,448. The timeline for the Construction, including mobilization and demobilization is 23 days with an additional 2 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 37, costs for the Post Construction phase initial construction are $41,395 and costs for each subsequent dredging cycle are $41,395.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	9,549
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 37. Implementation Costs for Sarah Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition	$20,000	$20,000
Subtotal	$226,000	$158,000
Contingencies (10% of Pre-Construction Phase Costs)	$22,600	$15,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$248,600	$173,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$28,877	$27,692
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$181,386	$141,900
Dredging	$81,167	$81,167
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,111,429	$1,022,758
Contingencies (25% of Construction Phase Costs)	$277,857	$255,690
TOTAL CONSTRUCTION PHASE COSTS	$1,389,286	$1,278,448
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$8,117	$8,117
Project Condition Survey	$25,000	$25,000
Subtotal	$33,117	$33,117
Contingencies (25% of Post Construction Phase Costs)	$8,279	$8,279
TOTAL POST CONSTRUCTION PHASE COSTS	$41,396	$41,396
TOTAL COST ALL PHASES	$1,679,282	$1,493,644

Perrin River

Placement of dredge material is assumed to be in an upland site via geotubes. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,878,608 and $1,667,551, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 2 acres is assumed to be required for the deposition of 14,593 cubic yards of dredge material. As shown in Table 38, costs for the Pre-Construction phase initial construction are $270,600 and costs for each period dredging cycle are $195,800.

CONSTRUCTION PHASE

As shown in Table 38, costs for the Construction phase initial construction are $1,561,254 and costs for each period dredging cycle are $1,424,996. The timeline for the Construction phase, including mobilization and demobilization is 29 days with an additional 3 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 38, costs for the Post Construction phase initial construction are $46,755 and costs for each subsequent dredging cycle are $46,755.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	14,593
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	10-20
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 38. Implementation Costs for Perrin River

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition	$40,000	$40,000
Subtotal	$246,000	$178,000
Contingencies (10% of Pre-Construction Phase Costs)	$24,600	$17,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$270,600	$195,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$32,884	$31,107
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$272,079	$212,850
Dredging	$124,041	$124,041
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,249,003	$1,139,997
Contingencies (25% of Construction Phase Costs)	$312,251	$284,999
TOTAL CONSTRUCTION PHASE COSTS	$1,561,254	$1,424,997
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$12,404	$12,404
Project Condition Survey	$25,000	$25,000
Subtotal	$37,404	$37,404
Contingencies (25% of Post Construction Phase Costs)	$9,351	$9,351
TOTAL POST CONSTRUCTION PHASE COSTS	$46,755	$46,755
TOTAL COST ALL PHASES	$1,878,609	$1,667,552

Combination Project: Sarah Creek and Perrin River

Placement of dredge material is assumed to be in an upland site via geotubes. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $2,514,523 and $2,278,047, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 4 acres is assumed to be required for the deposition of 24,142 cubic yards of dredge material. As shown in Table 39, costs for the Pre-Construction phase initial construction are $314,600 and costs for each period dredging cycle are $239,800.

CONSTRUCTION PHASE

As shown in Table 39, costs for the Construction phase initial construction are $2,143,023 and costs for each period dredging cycle are $1,981,346. The timeline for the Construction phase was previously provided for the individual projects.

POST CONSTRUCTION PHASE

As shown in Table 39, costs for the Post Construction phase initial construction are $56,901 and costs for each subsequent dredging cycle are $56,901.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	24,142
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10/10-20[71]
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs
Project Condition Survey	Used to determine when maintenance dredging is needed
Base Year	MPPDC
Price Level Year	01/01/21
Interest/Discount Rate	3%

[71] 5-10 year frequency for Sarah Creek and 10-20 year frequency for Perrin River.

Table 39. Implementation Costs for Sarah Creek and Perrin River Combination

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition	$80,000	$80,000
Subtotal	$286,000	$218,000
Contingencies (10% of Pre-Construction Phase Costs)	$28,600	$21,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$314,600	$239,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$46,439	$44,070
Mobilization/Demobilization	$980,000	$980,000
Dredge Material Placement Site Preparation	$362,772	$283,800
Dredging	$205,207	$205,207
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,714,418	$1,585,077
Contingencies (25% of Construction Phase Costs)	$428,605	$396,269
TOTAL CONSTRUCTION PHASE COSTS	$2,143,023	$1,981,347
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$20,521	$20,521
Project Condition Survey	$25,000	$25,000
Subtotal	$45,521	$45,521
Contingencies (25% of Post Construction Phase Costs)	$11,380	$11,380
TOTAL POST CONSTRUCTION PHASE COSTS	$56,901	$56,901
TOTAL COST ALL PHASES	$2,514,524	$2,278,047

Free School Creek

Placement of dredge material is assumed to be in an upland site. If dredging occurs via an upland dredging platform the initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $337,178 and $237,378, respectively, and are described by phase below. If dredged via a traditional hydraulic dredge the costs are estimated at $1,545,299 for initial construction and $1,359,661 for each subsequent maintenance cycle.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of <1 acre is assumed to be required for the deposition of 222 cubic yards of dredge material. As shown in Table 40, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 40, costs for the Construction phase initial construction are $32,082 and costs for each period dredging cycle are $32,082. The timeline for the Construction phase, including mobilization and demobilization is 11 days with an additional day allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 40, costs for the Post Construction phase initial construction are $31,485 and costs for each subsequent dredging cycle are $31,485.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-4 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	222
Dredging Method(s)	Upland Platform
Dredging Cycle (Years)	10-20
Disposal Type	Upland
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 40. Implementation Costs for Free School Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[72]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$360	$360
Mobilization/Demobilization	$5,000	$5,000
Dredge Material Placement Site Preparation	$333	$333
Dredging	$6,660	$6,660
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$222	$222
Supervision and Administration for Disposal (Placement) Oversight	$222	$222
Subtotal	$62,797	$42,797
Contingencies (25% of Construction Phase Costs)	$15,699	$10,699
TOTAL CONSTRUCTION PHASE COSTS	$78,496	$53,496
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$666	$666
Project Condition Survey	$25,000	$25,000
Subtotal	$25,666	$25,666
Contingencies (25% of Post Construction Phase Costs)	$6,417	$6,417
TOTAL POST CONSTRUCTION PHASE COSTS	$32,083	$32,083
TOTAL COST ALL PHASES	$337,178	$237,378

[72] Given the small volume it is assumed that the material would be truck hauled to an existing upland site.

Whittaker Creek

Placement of dredge material is assumed to be in an upland site via geotubes. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,650,126 and $1,464,488, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 1 acre is assumed to be required for the deposition of 8,953 cubic yards of dredge material. As shown in Table 41, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 41, costs for the Construction phase initial construction are $1,382,764 and costs for each period dredging cycle are $1,271,925. The timeline for the Construction phase, including mobilization and demobilization is 22 days with an additional 2 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 41, costs for the Post Construction phase initial construction are $40,762 and costs for each subsequent dredging cycle are $40,762.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-4 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	8,953
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 41. Implementation Costs for Whittaker Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[73]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$28,725	$27,540
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$181,386	$141,900
Dredging	$76,101	$76,101
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,106,211	$1,017,541
Contingencies (25% of Construction Phase Costs)	$276,553	$254,385
TOTAL CONSTRUCTION PHASE COSTS	$1,382,764	$1,271,926
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$7,610	$7,610
Project Condition Survey	$25,000	$25,000
Subtotal	$32,610	$32,610
Contingencies (25% of Post Construction Phase Costs)	$8,153	$8,153
TOTAL POST CONSTRUCTION PHASE COSTS	$40,763	$40,763
TOTAL COST ALL PHASES	$1,650,126	$1,464,488

[73] Assumes the use of an upland disposal site which is in public control.

Combination Project: Free School Creek and Whittaker Creek

Placement of dredge material is assumed to be in an upland site via geotubes. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $2,008,969 and $1,823,331, respectively, and are described by phase below. It is noted that the dredging of Free School Creek may also be accomplished via an upland platform dredge.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 1 acre is assumed to be required for the deposition of 9,175 cubic yards of dredge material. As shown in Table 42, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 42, costs for the Construction phase initial construction are $1,741,753 and costs for each period dredging cycle are $1,630,915. The timeline for the Construction phase was previously provided for the individual projects.

POST CONSTRUCTION PHASE

As shown in Table 42, costs for the Post Construction phase initial construction are $40,615 and costs for each subsequent dredging cycle are $40,615.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-4 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	9,175
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10/10-20[74]
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

[74] 5-10 year frequency for Whittaker Creek and 10-20 year frequency for Free School Creek.

Table 42. Implementation Costs for Free School Creek and Whittaker Creek Combination

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[75]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$37,089	$35,905
Mobilization/Demobilization	$980,000	$980,000
Dredge Material Placement Site Preparation	$181,386	$141,900
Dredging	$74,928	$74,928
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,393,403	$1,304,732
Contingencies (25% of Construction Phase Costs)	$348,351	$326,183
TOTAL CONSTRUCTION PHASE COSTS	$1,741,754	$1,630,915
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$7,493	$7,493
Project Condition Survey	$25,000	$25,000
Subtotal	$32,493	$32,493
Contingencies (25% of Post Construction Phase Costs)	$8,123	$8,123
TOTAL POST CONSTRUCTION PHASE COSTS	$40,616	$40,616
TOTAL COST ALL PHASES	$2,008,970	$1,823,331

75 Assumes the use of an upland disposal site which is in public control.

Mill Creek 2

Placement of dredge material is assumed to be for beneficial use at a shoreline site. If dredging occurs via an upland dredging platform the initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $379,538 and $279,738, respectively, and are described by phase below. If dredged via a traditional water based dredging equipment the costs are estimated at $1,325,018 for initial construction and $1,190,218 for each subsequent maintenance cycle.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 1,127 cubic yards of dredge material with dredging accomplished via upland platform method. As shown in Table 43, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 43, costs for the Construction phase initial construction are $117,462 and costs for each period dredging cycle are $92,462. The timeline for the Construction phase, including mobilization and demobilization is 12 days with an additional day allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 43, costs for the Post Construction phase initial construction are $35,476 and costs for each subsequent dredging cycle are $35,476.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-4 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	1,127
Dredging Method(s)	Upland Platform
Dredging Cycle (Years)	10-20
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 43. Implementation Costs for Mill Creek 2

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[76]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$1,215	$1,215
Mobilization/Demobilization	$5,000	$5,000
Dredge Material Placement Site Preparation	$1,691	$1,691
Dredging	$33,810	$33,810
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$1,127	$1,127
Supervision and Administration for Disposal (Placement) Oversight	$1,127	$1,127
Subtotal	$93,970	$73,970
Contingencies (25% of Construction Phase Costs)	$23,492	$18,492
TOTAL CONSTRUCTION PHASE COSTS	$117,462	$92,462
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$3,381	$3,381
Project Condition Survey	$25,000	$25,000
Subtotal	$28,381	$28,381
Contingencies (25% of Post Construction Phase Costs)	$7,095	$7,095
TOTAL POST CONSTRUCTION PHASE COSTS	$35,476	$35,476
TOTAL COST ALL PHASES	$379,538	$279,738

[76] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Put In Creek

Placement of dredge material is assumed to be in an upland site via geotubes. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,634,444 and $1,448,805, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 1 acre is assumed to be required for the deposition of 5,370 cubic yards of dredge material. As shown in Table 44, costs for the Pre-Construction phase initial construction are $253,936 and costs for each period dredging cycle are $179,136.

CONSTRUCTION PHASE

As shown in Table 44, costs for the Construction phase initial construction are $1,343,552 and costs for each period dredging cycle are $1,232,714. The timeline for the Construction phase, including mobilization and demobilization is 17 days with an additional 2 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 44, costs for the Post Construction phase initial construction are $36,955 and costs for each subsequent dredging cycle are $36,955.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-4 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	5,370
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 44. Implementation Costs for Put In Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition	$24,851	$24,851
Subtotal	$230,851	$162,851
Contingencies (10% of Pre-Construction Phase Costs)	$23,085	$16,285
TOTAL PRE-CONSTRUCTION PHASE COSTS	$253,936	$179,136
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$27,811	$26,626
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$181,386	$141,900
Dredging	$45,645	$45,645
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,074,842	$986,171
Contingencies (25% of Construction Phase Costs)	$268,710	$246,543
TOTAL CONSTRUCTION PHASE COSTS	$1,343,552	$1,232,714
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$4,565	$4,565
Project Condition Survey	$25,000	$25,000
Subtotal	$29,565	$29,565
Contingencies (25% of Post Construction Phase Costs)	$7,391	$7,391
TOTAL POST CONSTRUCTION PHASE COSTS	$36,956	$36,956
TOTAL COST ALL PHASES	$1,634,444	$1,448,806

Combination Project: Mill Creek 2 and Put In Creek

Placement of dredge material is assumed to be in an upland site via geotubes and beneficial use along an adjacent shoreline. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $2,013,982 and $1,822,836, respectively, and are described by phase below. It is noted that the dredging of Mill Creek 2 may also be accomplished via an upland platform dredge.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 1 acre is assumed to be required for the deposition of 5,370 cubic yards of dredge material with additional placement of 1,127 cubic yards of suitable material on an adjacent shoreline. As shown in Table 45, costs for the Pre-Construction phase initial construction are $253,936 and costs for each period dredging cycle are $179,136.

CONSTRUCTION PHASE

As shown in Table 45, costs for the Construction phase initial construction are $1,716,386 and costs for each period dredging cycle are $1,605,548. The timeline for the Construction phase was previously provided for the individual projects.

POST CONSTRUCTION PHASE

As shown in Table 45, costs for the Post Construction phase initial construction are $38,153 and costs for each subsequent dredging cycle are $38,153.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-4 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	6,497
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10/10-20[77]
Disposal Type	Upland via Enhanced Geotubes and Beneficial Use
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

[77] 5-10 year frequency for Put In Creek and 10-20 year frequency for Mill Creek 2.

Table 45. Implementation Costs for Mill Creek 2 and Put In Creek Combination

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition	$24,851	$24,851
Subtotal	$230,851	$162,851
Contingencies (10% of Pre-Construction Phase Costs)	$23,085	$16,285
TOTAL PRE-CONSTRUCTION PHASE COSTS	$253,936	$179,136
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$36,498	$35,314
Mobilization/Demobilization	$980,000	$980,000
Dredge Material Placement Site Preparation	$181,386	$141,900
Dredging	$55,225	$55,225
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,373,109	$1,284,438
Contingencies (25% of Construction Phase Costs)	$343,277	$321,110
TOTAL CONSTRUCTION PHASE COSTS	$1,716,386	$1,605,548
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$5,522	$5,522
Project Condition Survey	$25,000	$25,000
Subtotal	$30,522	$30,522
Contingencies (25% of Post Construction Phase Costs)	$7,631	$7,631
TOTAL POST CONSTRUCTION PHASE COSTS	$38,153	$38,153
TOTAL COST ALL PHASES	$2,013,982	$1,822,837

Davis Creek

Placement of dredge material is assumed to be in an upland site at Dutchman's Point via geotubes. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $2,182,320 and $1,455,904, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site is assumed to be required for the deposition of 32,900 cubic yards of dredge material. As shown in Table 46, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 46, costs for the Construction phase initial construction are $1,894,811 and costs for each period dredging cycle are $1,243,195. The timeline for the Construction phase, including mobilization and demobilization is 54 days with an additional 5 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 46, costs for the Post Construction phase initial construction are $60,909 and costs for each subsequent dredging cycle are $60,909.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-7 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	32,900
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 46. Implementation Costs for Davis Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[78]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$44,495	$29,390
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$503,517	
Dredging	$279,650	$279,650
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,647,662	$1,081,040
Contingencies (15% of Construction Phase Costs)	$247,149	$162,156
TOTAL CONSTRUCTION PHASE COSTS	$1,894,811	$1,243,195
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$27,965	$27,965
Project Condition Survey	$25,000	$25,000
Subtotal	$52,965	$52,965
Contingencies (15% of Post Construction Phase Costs)	$7,945	$7,945
TOTAL POST CONSTRUCTION PHASE COSTS	$60,910	$60,910
TOTAL COST ALL PHASES	$2,182,321	$1,455,905

[78] Assumes the use of an upland disposal site which is in public control.

Horn Harbor

Placement of dredge material is assumed to be for beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $2,291,117 and $2,161,117, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 82,233 cubic yards of dredge material. As shown in Table 47, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 47, costs for the Construction phase initial construction are $1,941,200 and costs for each period dredging cycle are $1,886,000. The timeline for the Construction phase, including mobilization and demobilization is 120 days with an additional 12 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 47, costs for the Post Construction phase initial construction are $123,318 and costs for each subsequent dredging cycle are $123,318.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-7 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	82,233
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	10-20
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 47. Implementation Costs for Horn Harbor

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[79]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$45,670	$45,670
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$0	$0
Dredging	$822,330	$822,330
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,688,000	$1,640,000
Contingencies (15% of Construction Phase Costs)	$253,200	$246,000
TOTAL CONSTRUCTION PHASE COSTS	$1,941,200	$1,886,000
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$82,233	$82,233
Project Condition Survey	$25,000	$25,000
Subtotal	$107,233	$107,233
Contingencies (15% of Post Construction Phase Costs)	$16,085	$16,085
TOTAL POST CONSTRUCTION PHASE COSTS	$123,318	$123,318
TOTAL COST ALL PHASES	$2,291,118	$2,161,118

[79] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Winter Harbor

Placement of dredge material is assumed to be upland and beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $3,093,480 and $2,846,553, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 106,861 cubic yards of dredge material. As shown in Table 48, costs for the Pre-Construction phase initial construction are $275,942 and costs for each period dredging cycle are $201,142.

CONSTRUCTION PHASE

As shown in Table 48, costs for the Construction phase initial construction are $2,675,115 and costs for each period dredging cycle are $2,502,988. The timeline for the Construction phase, including mobilization and demobilization is 152 days with an additional 16 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 48, costs for the Post Construction phase initial construction are $142,423 and costs for each subsequent dredging cycle are $142,423.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	106,861
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Beneficial Use (Shoreline Placement) and Upland Placement
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 48. Implementation Costs for Winter Harbor

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[80]	$44,856	$44,856
Subtotal	$250,856	$182,856
Contingencies (10% of Pre-Construction Phase Costs)	$25,086	$18,286
TOTAL PRE-CONSTRUCTION PHASE COSTS	$275,942	$201,142
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$64,258	$61,296
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation (Beneficial Use Site Component)	$0	$0
Dredge Material Placement Site Preparation (Upland Site Component)	$453,464	$354,750
Dredging (Beach Compatible Material)	$534,310	$534,310
Dredging (Non Beach Compatible Material)	$454,155	$454,155
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$2,326,187	$2,176,511
Contingencies (15% of Construction Phase Costs)	$348,928	$326,477
TOTAL CONSTRUCTION PHASE COSTS	$2,675,115	$2,502,988
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$98,847	$98,847
Project Condition Survey	$25,000	$25,000
Subtotal	$123,847	$123,847
Contingencies (15% of Post Construction Phase Costs)	$18,577	$18,577
TOTAL POST CONSTRUCTION PHASE COSTS	$142,423	$142,423
TOTAL COST ALL PHASES	$3,093,480	$2,846,553

[80] Assumption that 50% of the dredge material from Winter Harbor is for beneficial use, and that the property will either be in public control or can be acquired at no cost. Assumption that the remaining will not be suitable for beneficial use and will be placed in an upland site. Cost shown is for the upland site.

Combination Project: Horn Harbor and Winter Harbor

Placement of dredge material is assumed to be in an upland site via geotubes and beneficial use shoreline sites. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $4,493,758 and $4,246,831, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 6 acres is assumed to be required for the deposition of 53,430 cubic yards of dredge material shoreline placement sites would be required for the deposit of 135,664 cubic yards of suitable material. As shown in Table 49, costs for the Pre-Construction phase initial construction are $275,942 and costs for each period dredging cycle are $201,142.

CONSTRUCTION PHASE

As shown in Table 49, costs for the Construction phase initial construction are $3,980,825 and costs for each period dredging cycle are $3,808,698. The timeline for the Construction phase was previously provided for the individual projects.

POST CONSTRUCTION PHASE

As shown in Table 49, costs for the Post Construction phase initial construction are $236,991 and costs for each subsequent dredging cycle are $236,991.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet/-7 feet[81]
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	189,094
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10/10-20[82]
Disposal Type	Beneficial Use (Shoreline Placement) and Upland Placement
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

[81] -6 feet for Winter Harbor and -7 feet for Horn Harbor.

[82] 5-10 year frequency for Winter Harbor and 10-20 year frequency for Horn Harbor.

Table 49. Implementation Costs for Horn Harbor and Winter Harbor Combination

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[83]	$44,856	$44,856
Subtotal	$250,856	$182,856
Contingencies (10% of Pre-Construction Phase Costs)	$25,086	$18,286
TOTAL PRE-CONSTRUCTION PHASE COSTS	$275,942	$201,142
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$97,328	$94,366
Mobilization/Demobilization	$980,000	$980,000
Dredge Material Placement Site Preparation (Beneficial Use Site Component)	$0	$0
Dredge Material Placement Site Preparation (Upland Site Component)	$453,464	$354,750
Dredging (Beach Compatible Material)	$1,356,640	$1,356,640
Dredging (Non Beach Compatible Material)	$454,155	$454,155
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$3,461,587	$3,311,911
Contingencies (15% of Construction Phase Costs)	$519,238	$496,787
TOTAL CONSTRUCTION PHASE COSTS	$3,980,825	$3,808,698
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$181,080	$181,080
Project Condition Survey	$25,000	$25,000
Subtotal	$206,080	$206,080
Contingencies (15% of Post Construction Phase Costs)	$30,912	$30,912
TOTAL POST CONSTRUCTION PHASE COSTS	$236,991	$236,991
TOTAL COST ALL PHASES	$4,493,758	$4,246,831

[83] Assumption that 50% of the dredge material from Winter Harbor is for beneficial use, Horn Harbor is beneficial use, and that the property can be acquired at no cost. Assumption that the remaining will not be suitable for beneficial use and will be placed in an upland site. Cost shown is for the upland site.

Hole In The Wall

Placement of dredge material is assumed to be for beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,951,350 and $1,816,550, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 40,000 cubic yards of dredge material. As shown in Table 50, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 50, costs for the Construction phase initial construction are $1,643,500 and costs for each period dredging cycle are $1,583,500. The timeline for the Construction phase, including mobilization and demobilization is 63 days and an additional 7 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 50, costs for the Post Construction phase initial construction are $81,250 and costs for each subsequent dredging cycle are $81,250.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	40,000
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 50. Implementation Costs for Hole In The Wall

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[84]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$34,800	$34,800
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$60,000	$60,000
Dredging	$400,000	$400,000
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,314,800	$1,266,800
Contingencies (25% of Construction Phase Costs)	$328,700	$316,700
TOTAL CONSTRUCTION PHASE COSTS	$1,643,500	$1,583,500
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$40,000	$40,000
Project Condition Survey	$25,000	$25,000
Subtotal	$65,000	$65,000
Contingencies (25% of Post Construction Phase Costs)	$16,250	$16,250
TOTAL POST CONSTRUCTION PHASE COSTS	$81,250	$81,250
TOTAL COST ALL PHASES	$1,951,350	$1,816,550

[84] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Queens Creek

Placement of dredge material is assumed to be for beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,562,250 and $1,432,250, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 23,000 cubic yards of dredge material. As shown in Table 51, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 51, costs for the Construction phase initial construction are $1,280,450 and costs for each period dredging cycle are $1,225,250. The timeline for the Construction phase is 41 days with an additional 4 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 51, costs for the Post Construction phase initial construction are $55,200 and costs for each subsequent dredging cycle are $55,200.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	23,000
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 51. Implementation Costs for Queens Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[85]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$28,935	$28,935
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$34,500	$34,500
Dredging	$230,000	$230,000
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,113,435	$1,065,435
Contingencies (15% of Construction Phase Costs)	$167,015	$159,815
TOTAL CONSTRUCTION PHASE COSTS	$1,280,450	$1,225,250
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$23,000	$23,000
Project Condition Survey	$25,000	$25,000
Subtotal	$48,000	$48,000
Contingencies (15% of Post Construction Phase Costs)	$7,200	$7,200
TOTAL POST CONSTRUCTION PHASE COSTS	$55,200	$55,200
TOTAL COST ALL PHASES	$1,562,250	$1,432,250

85 Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Milford Haven

Placement of dredge material is assumed to be for beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,385,624 and $1,255,624, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 11,043 cubic yards of dredge material. As shown in Table 52, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 52, costs for the Construction phase initial construction are $1,175,575 and costs for each period dredging cycle are $1,062,375. The timeline for the Construction phase is 25 months with an additional 2 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 52, costs for the Post Construction phase initial construction are $41,449 and costs for each subsequent dredging cycle are $41,449.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-10 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	11,043
Dredging Method(s)	Hydraulic or Mechanical
Dredging Cycle (Years)	10-20
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 52. Implementation Costs for Milford Haven

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[86]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$24,810	$24,810
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$16,565	$16,565
Dredging	$110,430	$110,430
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$971,804	$923,804
Contingencies (15% of Construction Phase Costs)	$145,771	$138,571
TOTAL CONSTRUCTION PHASE COSTS	$1,117,575	$1,062,375
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$11,043	$11,043
Project Condition Survey	$25,000	$25,000
Subtotal	$36,043	$36,043
Contingencies (15% of Post Construction Phase Costs)	$5,406	$5,406
TOTAL POST CONSTRUCTION PHASE COSTS	$41,449	$41,449
TOTAL COST ALL PHASES	$1,385,624	$1,255,624

[86] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Combination Project: Queens Creek and Milford Haven

Placement of dredge material is assumed to be beneficial use shoreline sites. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,996,548 and $1,866,548, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

The deposition of 34,043 cubic yards of suitable dredge material on shoreline placement sites would be required. As shown in Table 53, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 53, costs for the Construction phase initial construction are $1,702,049 and costs for each period dredging cycle are $1,646,849. The timeline for the Construction phase was previously provided for the individual projects.

POST CONSTRUCTION PHASE

As shown in Table 53, costs for the Post Construction phase initial construction are $67,899 and costs for each subsequent dredging cycle are $67,899.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet/-10 feet[87]
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	34,043
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10/10-20[88]
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

[87] Queens Creek is -6 feet and Milford Haven is -10 feet.
[88] 5–10-year frequency for Queens Creek and 10-20 year frequency for Milford Haven.

Table 53. Implementation Costs for Queens Creek and Milford Haven Combination

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[89]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$39,613	$39,613
Mobilization/Demobilization	$980,000	$980,000
Dredge Material Placement Site Preparation	$0	$0
Dredging	$340,430	$340,430
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,480,043	$1,432,043
Contingencies (15% of Construction Phase Costs)	$222,006	$214,806
TOTAL CONSTRUCTION PHASE COSTS	$1,702,049	$1,646,849
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$34,043	$34,043
Project Condition Survey	$25,000	$25,000
Subtotal	$59,043	$59,043
Contingencies (15% of Post Construction Phase Costs)	$8,856	$8,856
TOTAL POST CONSTRUCTION PHASE COSTS	$67,899	$67,899
TOTAL COST ALL PHASES	$1,996,549	$1,866,549

[89] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Broad Creek

Placement of dredge material is assumed to be upland and for beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,529,468 and $1,352,697, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

Upland and beneficial use shoreline sites are assumed to be required for the deposition of 7,136 cubic yards of dredge material. As shown in Table 54, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 54, costs for the Construction phase initial construction are $1,266,527 and costs for each period dredging cycle are $1,164,556. The timeline for the Construction phase is 20 days with an additional day allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 54, costs for the Post Construction phase initial construction are $36,341 and costs for each subsequent dredging cycle are $36,341.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	7,136
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Beneficial Use (Shoreline Placement) and Upland Placement
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 54. Implementation Costs for Broad Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[90]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$28,582	$27,398
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation (Beneficial Use Site Component)	$5,352	$5,352
Dredge Material Placement Site Preparation (Upland Site Component)	$181,386	$141,900
Dredging (Beach Compatible Material)	$35,680	$35,680
Dredging (Non Beach Compatible Material)	$30,328	$30,328
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,101,328	$1,012,658
Contingencies (15% of Construction Phase Costs)	$165,199	$151,899
TOTAL CONSTRUCTION PHASE COSTS	$1,266,528	$1,164,556
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$6,601	$6,601
Project Condition Survey	$25,000	$25,000
Subtotal	$31,601	$31,601
Contingencies (15% of Post Construction Phase Costs)	$4,740	$4,740
TOTAL POST CONSTRUCTION PHASE COSTS	$36,341	$36,341
TOTAL COST ALL PHASES	$1,529,469	$1,352,697

[90] Assumption that 50% of the dredge material is for beneficial use, and that the property will either be in public control or can be acquired at no cost. Assumption that the remaining will not be suitable for beneficial use and will be placed in an upland site.

Bush Park Creek

Placement of dredge material is assumed to be for beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,350,332 and $1,215,532, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 2,568 cubic yards of dredge material. As shown in Table 55, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 55, costs for the Construction phase initial construction are $1,089,272 and costs for each period dredging cycle are $1,029,272. The timeline for the Construction phase is 13 days with an additional 2 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 55, costs for the Post Construction phase initial construction are $34,460 and costs for each subsequent dredging cycle are $34,460.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-4 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	2,568
Dredging Method(s)	Mechanical
Dredging Cycle (Years)	<5
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 55. Implementation Costs for Bush Park Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[91]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$21,886	$21,886
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$3,852	$3,852
Dredging	$25,680	$25,680
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$871,418	$823,418
Contingencies (25% of Construction Phase Costs)	$217,854	$205,854
TOTAL CONSTRUCTION PHASE COSTS	$1,089,272	$1,029,272
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$2,568	$2,568
Project Condition Survey	$25,000	$25,000
Subtotal	$27,568	$27,568
Contingencies (25% of Post Construction Phase Costs)	$6,892	$6,892
TOTAL POST CONSTRUCTION PHASE COSTS	$34,460	$34,460
TOTAL COST ALL PHASES	$1,350,332	$1,215,532

[91] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Mill Creek

Placement of dredge material is assumed to be for beneficial use at a shoreline site. If dredging occurs via an upland dredging platform the initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $339,571 and 241,771, respectively, and are described by phase below. If dredged via a traditional hydraulic dredge the costs are estimated at $1,229,634 for initial construction and $1,099,634 for each subsequent maintenance cycle.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 483 cubic yards of dredge material. As shown in Table 56, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 56, costs for the Construction phase initial construction are $82,555 and costs for each period dredging cycle are $59,555. The timeline for the Construction phase is 11 days with an additional day allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 56, costs for the Post Construction phase initial construction are $30,416 and costs for each subsequent dredging cycle are $30,416.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-4 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	483
Dredging Method(s)	Upland Platform
Dredging Cycle (Years)	10-20
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 56. Implementation Costs for Mill Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[92]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$606	$606
Mobilization/Demobilization	$5,000	$5,000
Dredge Material Placement Site Preparation	$725	$725
Dredging	$14,490	$14,490
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$483	$483
Supervision and Administration for Disposal (Placement) Oversight	$483	$483
Subtotal	$71,787	$51,787
Contingencies (15% of Construction Phase Costs)	$10,768	$7,768
TOTAL CONSTRUCTION PHASE COSTS	$82,555	$59,555
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$1,449	$1,449
Project Condition Survey	$25,000	$25,000
Subtotal	$26,449	$26,449
Contingencies (15% of Post Construction Phase Costs)	$3,967	$3,967
TOTAL POST CONSTRUCTION PHASE COSTS	$30,416	$30,416
TOTAL COST ALL PHASES	$339,571	$241,771

[92] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Whiting Creek

Placement of dredge material is assumed to be for beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,689,937 and $1,559,937, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 31,644 cubic yards of dredge material. As shown in Table 57, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 57, costs for the Construction phase initial construction are $1,398,197 and costs for each period dredging cycle are $1,342,997. The timeline for the Construction phase is 52 days with an additional 5 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 57, costs for the Post Construction phase initial construction are $65,140 and costs for each subsequent dredging cycle are $65,140.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	31,644
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 57. Implementation Costs for Whiting Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[93]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$31,917	$31,917
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$47,466	$47,466
Dredging	$316,440	$316,440
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,215,823	$1,167,823
Contingencies (15% of Construction Phase Costs)	$182,373	$175,173
TOTAL CONSTRUCTION PHASE COSTS	$1,398,197	$1,342,997
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$31,644	$31,644
Project Condition Survey	$25,000	$25,000
Subtotal	$56,644	$56,644
Contingencies (15% of Post Construction Phase Costs)	$8,497	$8,497
TOTAL POST CONSTRUCTION PHASE COSTS	$65,141	$65,141
TOTAL COST ALL PHASES	$1,689,937	$1,559,937

[93] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Robinson Creek

Placement of dredge material is assumed to be for beneficial use at a shoreline site. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,379,297 and $1,244,497, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

A beneficial use shoreline site is assumed to be required for the deposition of 4,372 cubic yards of dredge material. As shown in Table 58, costs for the Pre-Construction phase initial construction are $226,600 and costs for each period dredging cycle are $151,800.

CONSTRUCTION PHASE

As shown in Table 58, costs for the Construction phase initial construction are $1,379,297 and costs for each period dredging cycle are $1,244,497. The timeline for the Construction phase is 16 days with an additional day allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 58, costs for the Post Construction phase initial construction are $36,715 and costs for each subsequent dredging cycle are $36,715.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	4,372
Dredging Method(s)	Hydraulic
Dredging Cycle (Years)	5-10
Disposal Type	Beneficial Use (Shoreline Placement)
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 58. Implementation Costs for Robinson Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition[94]	$0	$0
Subtotal	$206,000	$138,000
Contingencies (10% of Pre-Construction Phase Costs)	$20,600	$13,800
TOTAL PRE-CONSTRUCTION PHASE COSTS	$226,600	$151,800
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$22,508	$22,508
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$6,558	$6,558
Dredging	$43,720	$43,720
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$892,786	$844,786
Contingencies (25% of Construction Phase Costs)	$223,197	$211,197
TOTAL CONSTRUCTION PHASE COSTS	$1,115,983	$1,055,983
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$4,372	$4,372
Project Condition Survey	$25,000	$25,000
Subtotal	$29,372	$29,372
Contingencies (25% of Post Construction Phase Costs)	$7,343	$7,343
TOTAL POST CONSTRUCTION PHASE COSTS	$36,715	$36,715
TOTAL COST ALL PHASES	$1,379,298	$1,244,498

[94] Assumes that there is no acquisition cost since a property sufficient in size will be available which will either be in public control or that the required real estate interests can be acquired with no cost.

Parrotts Creek

Placement of dredge material is assumed to be in an upland site via geotubes. The initial costs for the 3 phases of initial construction and subsequent maintenance dredging per cycle are $1,929,197 and $1,705,655, respectively, and are described by phase below.

PRE-CONSTRUCTION PHASE

An existing upland disposal (placement) site of 4 acres is assumed to be required for the deposition of 20,265 cubic yards of dredge material. As shown in Table 59, costs for the Pre-Construction phase initial construction are $279,752 and costs for each period dredging cycle are $204,952.

CONSTRUCTION PHASE

As shown in Table 59, costs for the Construction phase initial construction are $1,600,866 and costs for each period dredging cycle are $1,452,144. The timeline for the Construction phase is 37 days with an additional 4 days allowed for potential downtime.

POST CONSTRUCTION PHASE

As shown in Table 59, costs for the Post Construction phase initial construction are $48,559 and costs for each subsequent dredging cycle are $48,559.

PROJECT DESCRIPTION:

Dredging Depth (Referenced to MLLW)	-6 feet
Overdepth Dredging (Number of Feet)	1
Dredging Volume (Cubic Yards Inclusive of Overdepth Dredging)	20,265
Dredging Method(s)	Hydraulic or Mechanical
Dredging Cycle (Years)	10-20
Disposal Type	Upland via Enhanced Geotubes
Monitoring and/or Mitigation	10% of Dredging and Disposal Costs

Table 59. Implementation Costs for Parrotts Creek

PHASE AND COST COMPONENT	COSTS FOR INITIAL PROJECT	COSTS FOR EACH SUBSEQUENT DREDGING CYCLE
PRE-CONSTRUCTION PHASE:		
Preliminary Engineering & Design for Dredging Activities (Including Joint Permit Application)	$50,000	$30,000
Preliminary Engineering & Design for Disposal Activities Not Included in Dredging Activities Above (Including Joint Permit Application)	$50,000	$30,000
Grant and Loan Applications	$10,000	$10,000
Community Engagement	$6,000	$3,000
Environmental Assessment	$30,000	$30,000
Federal, State, and Local Permits	$25,000	$25,000
Legal Coordination	$10,000	$0
Financial Coordination	$25,000	$10,000
Dredge Material Placement Site Acquisition	$48,320	$48,320
Subtotal	$254,320	$186,320
Contingencies (10% of Pre-Construction Phase Costs)	$25,432	$18,632
TOTAL PRE-CONSTRUCTION PHASE COSTS	$279,752	$204,952
CONSTRUCTION PHASE:		
Final Engineering and Design/Plans and Specifications for Dredging Activities	$25,000	$15,000
Final Engineering and Design/Plans and Specifications for Disposal Activities Not Included in Dredging Activities Above	$25,000	$15,000
Bonds and Insurance	$37,051	$34,682
Mobilization/Demobilization	$700,000	$700,000
Dredge Material Placement Site Preparation	$362,772	$283,800
Dredging	$172,253	$172,253
Disposal (Placement) of Dredge Material	- -	- -
Supervision and Administration for Dredging Oversight	$35,000	$21,000
Supervision and Administration for Disposal (Placement) Oversight	$35,000	$21,000
Subtotal	$1,392,075	$1,262,734
Contingencies (15% of Construction Phase Costs)	$208,811	$189,410
TOTAL CONSTRUCTION PHASE COSTS	$1,600,887	$1,452,144
POST CONSTRUCTION PHASE:		
Monitoring and/or Mitigation	$17,225	$17,225
Project Condition Survey	$25,000	$25,000
Subtotal	$42,225	$42,225
Contingencies (15% of Post Construction Phase Costs)	$6,334	$6,334
TOTAL POST CONSTRUCTION PHASE COSTS	$48,559	$48,559
TOTAL COST ALL PHASES	$1,929,198	$1,705,655

Appendix C: Three Year Pro Forma

This appendix contains the 3-year pro forma, which describes revenues, costs, and cash flows by month. The revenues are projected at \$27/cy for 120,000cy/yr. The revenues would accrue on a monthly basis 30 days after work commences. It is not anticipated that dredging will be conducted during the months of December through February. Revenues will be calculated for the months that dredging actually accrues, April through November.

The dredging is projected to start on the 1st of October of the first year. This allows three months to purchase and assemble equipment, hire, and train staff and establish the program administration.

Debt service payments are projected to start on the month after the delivery of the equipment.

The administrative staff would start on July 1st and the remainder of the staff coming on board on September 15.

Any line of credit interest rate is assumed to be 6%.

For revenues, this analysis only considers county contributions, and does not take into account **grants, contract services,** or **other sources of revenue** that may be available once the project is underway.

Year 1

	Month												
Revenues	July	August	September	October	November	December	January	February	March	April	May	June	**Year 1**
County Contributions				$360,000	$360,000	$0	$0	$0	$360,000	$360,000	$360,000	$360,000	$1,800,000
Total Revenues	$0	$0	$0	$360,000	$360,000	$0	$0	$0	$360,000	$360,000	$360,000	$360,000	**$1,800,000**
Expenditures													
Personnel	$10,836	$10,836	$10,836	$28,384	$45,932	$45,932	$45,932	$45,932	$45,932	$45,932	$45,932	$45,932	$428,346
Operating	$38,383	$38,383	$38,383	$107,017	$107,017	$107,017	$107,017	$107,017	$107,017	$107,017	$107,017	$107,017	$1,078,300
Replacement Reserve												$250,000	$250,000
Debt Service	$0	$0	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$434,664
Total Expenditures	$49,219	$49,219	$92,685	$178,867	$196,415	$196,415	$196,415	$196,415	$196,415	$196,415	$196,415	$446,415	**$2,191,310**
Financing													
Line of Credit Interest	$1,250	$1,250	$2,500	$2,000	$2,000	$2,000	$2,500	$3,250	$2,750	$2,750	$2,750	$2,750	$27,750
Line of Credit Repayment				$100,000					$100,000				$200,000
Sub Total	$50,469	$50,469	$95,185	$280,867	$198,415	$198,415	$198,915	$199,665	$299,165	$199,165	$199,165	$449,165	**$2,419,060**
Monthly Cash Flow	-$50,469	-$50,469	-$95,185	$79,133	$161,585	-$198,415	-$198,915	-$199,665	$60,835	$160,835	$160,835	-$89,165	
Cumulative Cash Flow		-$100,938	-$196,124	-$116,991	$44,594	-$153,821	-$352,735	-$552,400	-$491,565	-$330,730	-$169,895	-$259,060	
Line of Credit Draw	$250,000	$250,000	$500,000	$400,000	$400,000	$400,000	$500,000	$650,000	$550,000	$550,000	$550,000	$550,000	
Cash on Hand	$300,469	$149,062	$303,877	$283,009	$444,594	$246,179	$147,265	$97,600	$58,435	$219,270	$380,105	$290,940	

Year 2

Revenues	Month July	August	September	October	November	December	January	February	March	April	May	June	**Year 2**
County Contributions	$360,000	$360,000	$360,000	$360,000	$360,000	$0	$0	$0	$360,000	$360,000	$360,000	$360,000	$3,240,000
Total Revenues	$360,000	$360,000	$360,000	$360,000	$360,000	$0	$0	$0	$360,000	$360,000	$360,000	$360,000	**$3,240,000**
Expenditures													
Personnel	$47,310	$47,310	$47,310	$47,310	$47,310	$47,310	$47,310	$47,310	$47,310	$47,310	$47,310	$47,310	$567,718
Operating	$110,227	$110,227	$110,227	$110,227	$110,227	$110,227	$110,227	$110,227	$110,227	$110,227	$110,227	$110,227	$1,322,726
Replacement Reserve												$250,000	$250,000
Debt Service	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$43,466	$521,597
Total Expenditures	$201,003	$201,003	$201,003	$201,003	$201,003	$201,003	$201,003	$201,003	$201,003	$201,003	$201,003	$451,004	**$2,662,041**
Financing													
Line of Credit Interest	$2,000	$2,500	$1,250	$1,250	$1,250	$1,250	$1,250	$2,000	$2,000	$2,000	$1,250	$1,250	$19,250
Line of Credit Repayment	$150,000		$150,000								$150,000		$450,000
Sub Total	$353,003	$203,503	$352,253	$202,253	$202,253	$202,253	$202,253	$203,003	$203,003	$203,003	$352,253	$452,254	**$3,131,291**
Monthly Cash Flow	$6,997	$156,497	$7,747	$157,747	$157,747	-$202,253	-$202,253	-$203,003	$156,997	$156,997	$7,747	-$92,254	
Cumulative Cash Flow	-$252,064	-$95,567	-$87,821	$69,926	$227,673	$25,419	-$176,834	-$379,838	-$222,841	-$65,844	-$58,098	-$150,351	
Line of Credit Draw	$400,000	$500,000	$250,000	$250,000	$250,000	$250,000	$250,000	$400,000	$400,000	$400,000	$250,000	$250,000	
Cash on Hand	$147,936	$404,433	$162,179	$319,926	$477,673	$275,419	$73,166	$20,162	$177,159	$334,156	$191,902	$99,649	

Year 3

Month	July	August	September	October	November	December	January	February	March	April	May	June	**Year 3**
Revenues													
County Contributions	$360,000	$360,000	$360,000	$360,000	$360,000	$0	$0	$0	$360,000	$360,000	$360,000	$360,000	$3,240,000
Total Revenues	$360,000	$360,000	$360,000	$360,000	$360,000	$0	$0	$0	$360,000	$360,000	$360,000	$360,000	**$3,240,000**
Expenditures													
Personnel	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$275,000	$275,000	$550,000
Operating	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$537,245	$1,029,720
Replacement Reserve												$250,000	$250,000
Debt Service	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Expenditures	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$44,770	$319,770	$1,062,245	**$1,829,720**
Financing													
Line of Credit Interest	$1,000	$1,000	$500	$500	$500	$500	$500	$1,250	$1,250	$500	$500	$500	$8,500
Line of Credit Repayment	$50,000		$100,000							$150,000			$300,000
Sub Total	$95,770	$45,770	$145,270	$45,270	$45,270	$45,270	$45,270	$46,020	$46,020	$195,270	$320,270	$1,062,745	**$2,138,220**
Monthly Cash Flow	$264,230	$314,230	$214,730	$314,730	$314,730	-$45,270	-$45,270	-$46,020	$313,980	$164,730	$39,730	-$702,745	
Cumlative Cash Flow	$264,230	$578,459	$793,189	$1,107,918	$1,422,648	$1,377,377	$1,332,107	$1,286,086	$1,600,066	$1,764,796	$1,804,525	$1,101,780	
Line of Credit Draw	$200,000	$200,000	$100,000	$100,000	$100,000	$100,000	$100,000	$250,000	$250,000	$100,000	$100,000	$100,000	
Cash on Hand	$464,230	$778,459	$893,189	$1,207,918	$1,522,648	$1,477,377	$1,432,107	$1,536,086	$1,850,066	$1,864,796	$1,904,525	$1,201,780	

Appendix D: Example of a Special Service District (SSD)

Norfolk Special Service District Policy for Flood Protection
In June 2019, the Norfolk City Council adopted a policy authorizing the creation of Special Service Districts (SSD) to support implementation of local flood risk reduction and water quality improvement projects in the City of Norfolk, Virginia. SSDs enable a group of residents to agree to pay a tax to finance additional services in a particular neighborhood. The Norfolk policy allows SSD funding to be used to pay for flood mitigation, dredging, water quality improvements, and coastal protection projects. To initiate a project, residents must work with the City government to determine feasibility, boundary, and cost; the SSD plan must be developed with engineering, costs, and a timeline; 75 percent of parcel owners representing 50 percent of the property value in the area must agree to the project; and the City Council must approve construction of the project. SSDs present a useful tool for helping local governments finance projects to adapt to sea-level rise and other impacts of climate change by enabling residents to contribute to paying the costs to construct resilience projects. This can help cities to finance adaptation projects, while maintaining budgets to pay for ongoing services and other priority projects.

The Norfolk policy lays out the following process for financing a project through an SSD:

- To initiate a project, residents must work with the City's Department of Neighborhood Development and Public Works to assess the project's boundary and feasibility.
- To initiate further study of a project, 30 percent of parcel owners in the area to be benefited by the project must sign a petition supporting development of an SSD plan.
- The Department of Public Works and Office of Budget and Strategic Planning then develop an SSD plan analyzing engineering and cost for the project. The SSD plan must include the name of the project and its boundaries, a description of the proposed services provided by the project and the SSD, the purpose for the SSD, a budget for the services provided, a detailed implementation plan, a timeline for project start and end date, and a contingency plan identifying areas of major risk (e.g., cost overruns, inability to get permits).
- To approve construction, at least 75 percent of parcel owners representing at least 50 percent of the property value of the benefited area must agree to the SSD plan and the tax to support implementation.
- Finally, the City Council must formally approve the project and its implementation to finance the project and to ensure that the project will not require the city to exceed debt limits.
- Once a project is approved, City departments oversee procurement and construction.

Appendix D.1: Tax Increment Financing Regulations

58.1-3245. Definitions.

As used in this article, unless the context clearly shows otherwise, the term or phrase:

"Base assessed value" means the assessed value of real estate within a development project area as shown upon the land book records of the local assessing officer on January 1 of the year preceding the effective date of the ordinance creating the development project area.

"Blighted area" means any area within the borders of a development project area which impairs economic values and tax revenues, causes an increase in and spread of disease and crime, and is a menace to the health, safety, morals and welfare of the citizens of the Commonwealth; or any area which endangers the public health, safety and welfare because commercial, industrial and residential structures are subject to dilapidation, deterioration, obsolescence, inadequate ventilation, inadequate public utilities and violations of minimum health and safety standards; or any area previously designated as a blighted area pursuant to § 36-48; or any area adjacent to or in the immediate vicinity thereof which may be improved or enhanced in value by the placement of a proposed highway construction project.

"Current assessed value" means the annual assessed value of real estate in a development project area as recorded on the land book records of the local assessing officer.

"Development project area" means any area designated for development or redevelopment, including any area designated for a dredging project other than a dredging project for or by the Virginia Port Authority, unless the Virginia Port Authority has an agreement with a local governing body for local financial participation in such a project, in an ordinance passed by the local governing body.

"Development project cost" has the same meaning as the term "cost" in the Public Finance Act (§ 15.2-2600 et seq.) and, in the case of blighted areas, includes amounts paid to carry out the purposes described in § 144(c)(3) of the Internal Revenue Code of 1986, as amended.

"Development project cost commitment" means a determination by the local governing body of payment of a sum specific of development project costs from the tax increment and other available funds in a development area.

"Governing body" means the board of supervisors, council or other legislative body of any county, city or town.

"Obligations" means bonds, general obligation bonds and revenue bonds as defined in § 15.2-2602 of the Public Finance Act (§ 15.2-2600 et seq.), and any other form of indebtedness which the county, city or town may incur.

"Tax increment" means the amount by which the current assessed value of real estate exceeds the base assessed value.

58.1-3245.1. Blighted areas constitute public danger.

It is hereby found and declared that blighted areas exist in the Commonwealth, and these areas impair and endanger the health, safety, morals, and welfare of the citizens because commercial, residential and industrial structures or improvements are subject to dilapidation, deterioration, inadequate ventilation, and inadequate public utilities. It is a public purpose to provide public facilities including, but not limited to, roads, water, sewers, parks, and real estate devoted to open-space use as that term is defined in § 58.1-3230 within redevelopment and conservation areas to encourage the private development in such areas in order to eliminate blighted conditions. It is essential to the public interest that governing bodies have authority to finance development project costs by using real estate tax increments to encourage private investment in development project areas.

58.1-3245.2. Tax increment financing.

A. The governing body of any county, city or town may adopt tax increment financing by passing an ordinance designating a development project area and providing that real estate taxes in the development project area shall be assessed, collected and allocated in the following manner for so long as any obligations or development project cost commitments secured by the Tax Increment Financing Fund, hereinafter authorized, are outstanding and unpaid.

1. The local assessing officer shall record in the land book both the base assessed value and the current assessed value of the real estate in the development project area.

2. Real estate taxes attributable to the lower of the current assessed value or base assessed value of real estate located in a development project area shall be allocated by the treasurer or director of finance pursuant to the provisions of this chapter.

3. Real estate taxes attributable to the increased value between the current assessed value of any parcel of real estate and the base assessed value of such real estate shall be allocated by the treasurer or director of finance and paid into a special fund entitled the "Tax Increment Financing Fund" to pay the principal and interest on obligations issued or development project cost commitments entered into to finance the development project costs.

B. The governing body shall hold a public hearing on the need for tax increment financing in the county, city or town prior to adopting a tax increment financing ordinance. Notice of the public hearing shall be published once each week for three consecutive weeks immediately preceding the public hearing in each newspaper of general circulation in such county, city or town. The notice shall include the time, place and purpose of the public hearing, define tax increment financing, indicate the proposed boundaries of the development project area, and propose obligations to be issued to finance the development project area costs.

58.1-3245.3. Copies of tax increment financing ordinance to local assessing officer and treasurer or director of finance.

The governing body shall transmit to the local assessing officer and treasurer or director of finance a copy of the tax increment financing ordinance, a description of all real estate located within the development project area, a map indicating the boundaries of the development project area and the manner of collecting and allocating real estate taxes pursuant to this article.

58.1-3245.4. Issuance of obligations for project costs.

Any county, city or town which adopts tax increment financing may issue obligations and may make development project cost commitments secured by the Tax Increment Financing Fund established in § 58.1-3245.2 to finance the development project costs. All obligations issued pursuant to this section shall be subject to the requirements and limitations of the Public Finance Act (Chapter 26, § 15.2-2600 et seq., of Title 15.2) and the charter provisions of each county, city or town. The ordinance authorizing the issuance of obligations may pledge all or any part of the funds deposited in the Tax Increment Financing Fund for the payment of the development project costs and any obligations to be issued to finance them. Any revenues in the Tax Increment Financing Fund which are not pledged as security for the obligations issued or allocated for development project cost commitments shall be deemed "surplus funds." At the end of the tax year, all surplus funds may be paid into the general fund of the county, city or town in which the development project area is located. The local governing body may agree, in writing, to pay all or a portion of any project development cost in annual installments from the tax increment and other available funds.

A county, city or town may also pledge any part or combination of the following revenues for a period not to exceed the term of the obligations:

1. Net revenues of all or part of any development project;

2. All real estate and tangible personal property taxes;

3. The full faith and credit of the locality;

4. Any other taxes or anticipated revenues that the county, city or town may lawfully pledge.

58.1-3245.4:1. No annual debt limits for certain cities.

The Cities of Chesapeake and Virginia Beach, when issuing debt obligations pursuant to § 58.1-3245.4 shall not be subject to any annual debt limitations set forth in the charter provisions of such city.

58.1-3245.5. Dissolving the Tax Increment Financing Fund.

The governing body may pass an ordinance to dissolve the Tax Increment Financing Fund, and to terminate the existence of a development project area, upon the payment or defeasance of all obligations secured by the Tax Increment Financing Fund and payment or provision for payment of all development project cost commitments. When the Tax Increment Financing Fund is dissolved, any revenue remaining in the Fund after payment or provision for payment of all such obligations and commitments shall be paid into the general fund of the county, city or town.

Upon dissolving the Tax Increment Financing Fund, the real estate shall be assessed and taxes collected in the same manner as applicable in the year preceding the adoption of the tax increment financing ordinance, and pursuant to this chapter.

Appendix D.2: Service District Regulations

15.2-2400. Creation of service districts.

Any locality may by ordinance, or any two or more localities may by concurrent ordinances, create service districts within the locality or localities in accordance with the provisions of this article. Service districts may be created to provide additional, more complete or more timely services of government than are desired in the locality or localities as a whole.

Any locality seeking to create a service district shall have a public hearing prior to the creation of the service district. Notice of such hearing shall be published once a week for three consecutive weeks in a newspaper of general circulation within the locality, and the hearing shall be held no sooner than ten days after the date the second notice appears in the newspaper.

15.2-2402. Description of proposed service district.

Any ordinance or petition to create a service district shall:

1. Set forth the name and describe the boundaries of the proposed district and specify any areas within the district that are to be excluded;

2. Describe the purposes of the district and the facilities and services proposed within the district;

3. Describe a proposed plan for providing such facilities and services within the district; and

4. Describe the benefits which can be expected from the provision of such facilities and services within the district.

15.2-2402.1. Change to service district boundaries.

Any locality, by majority vote of the governing body, may amend the boundaries of an established service district that lies wholly within that locality's boundaries. If more than one locality is involved in an established service district and those localities desire to amend that service district, a majority vote of the governing body of each locality affected by the amendment is required. Any locality or localities seeking to amend such service district boundaries shall follow the notice and public hearing requirements set out in § 15.2-2400.

15.2-2403. Powers of service districts.

After adoption of an ordinance or ordinances or the entry of an order creating a service district, the governing body or bodies shall have the following powers with respect to the service districts:

1. To construct, maintain, and operate such facilities and equipment as may be necessary or desirable to provide additional, more complete, or more timely governmental services within a service district, including but not limited to general government facilities; water supply, dams, sewerage, garbage removal and disposal, heat, light, fire-fighting equipment and power and gas systems and sidewalks; economic development services; promotion of business and retail development services; beautification and landscaping; beach and shoreline management and restoration; dredging of creeks and rivers to maintain existing uses; control of infestations of insects that may carry a disease that is dangerous to humans, gypsy moths, cankerworms or other pests identified by the Commissioner of the Department of Agriculture and Consumer Services in accordance with the Virginia Pest Law (§ 3.2-700 et seq.); public parking; extra security, street cleaning, snow removal and refuse collection services; sponsorship and promotion of recreational and cultural activities; upon petition of over 50 percent of the property owners who own not less than 50 percent of the property to be served,

construction, maintenance, and general upkeep of streets and roads; construction, maintenance, and general upkeep of streets and roads through creation of urban transportation service districts pursuant to § 15.2-2403.1; and other services, events, or activities that will enhance the public use and enjoyment of and the public safety, public convenience, and public well-being within a service district. Such services, events, or activities shall not be undertaken for the sole or dominant benefit of any particular individual, business or other private entity. Any transportation service, system, facility, roadway, or roadway appurtenance established under this subdivision that will be operated or maintained by the Virginia Department of Transportation shall be established with the involvement of the governing body of the locality and meet the appropriate requirements of the Department.

2. Notwithstanding the provisions of § 33.2-326, to provide, in addition to services authorized by subdivision 1, transportation and transportation services within a service district, regardless of whether the facilities subject to the services are or will be operated or maintained by the Virginia Department of Transportation, including, but not limited to: public transportation systems serving the district; transportation management services; road construction, including any new roads or improvements to existing roads; rehabilitation and replacement of existing transportation facilities or systems; and sound walls or sound barriers. However, any transportation service, system, facility, roadway, or roadway appurtenance established under this subdivision that will be operated or maintained by the Virginia Department of Transportation shall be established with the involvement of the governing body of the locality and meet the appropriate requirements of the Department. The proceeds from any annual tax or portion thereof collected for road construction pursuant to subdivision 6 may be accumulated and set aside for such reasonable period of time as is necessary to finance such construction; however, the governing body or bodies shall make available an annual disclosure statement, which shall contain the amount of any such proceeds accumulated and set aside to finance such road construction.

3. To acquire in accordance with § 15.2-1800, any such facilities and equipment and rights, title, interest or easements therefore in and to real estate in such district and maintain and operate the same as may be necessary and desirable to provide the governmental services authorized by subdivisions 1 and 2.

4. To contract with any person, municipality or state agency to provide the governmental services authorized by subdivisions 1 and 2 and to construct, establish, maintain, and operate any such facilities and equipment as may be necessary and desirable in connection therewith.

5. To require owners or tenants of any property in the district to connect with any such system or systems, and to contract with the owners or tenants for such connections. The owners or tenants shall have the right of appeal to the circuit court within 10 days from action by the governing body.

6. To levy and collect an annual tax upon any property in such service district subject to local taxation to pay, either in whole or in part, the expenses and charges for providing the governmental services authorized by subdivisions 1, 2 and 11 and for constructing, maintaining, and operating such facilities and equipment as may be necessary and desirable in connection therewith; however, such annual tax shall not be levied for or used to pay for schools, police, or general government services not authorized by this section, and the proceeds from such annual tax shall be so segregated as to enable the same to be expended in the district in which raised. Such tax may be levied on taxable real estate zoned for residential, commercial, industrial or other uses, or any combination of such use classification, within the geographic boundaries of the service district; however, such tax shall only be levied upon the specific classification of real estate that the local governing body deems the provided governmental services to benefit. In addition to the tax on property authorized herein, in the City of Virginia Beach, the city council shall have the power to impose a tax on the base transient

room rentals, excluding hotels, motels, and travel campgrounds, within such service district at a rate or percentage not higher than five percent which is in addition to any other transient room rental tax imposed by the city. The proceeds from such additional transient room rental tax shall be deposited in a special fund to be used only for the purpose of beach and shoreline management and restoration. Any locality imposing a tax pursuant to this subdivision may base the tax on the full assessed value of the taxable property within the service district, notwithstanding any special use value assessment of property within the service district for land preservation pursuant to Article 4 (§ 58.1-3229 et seq.) of Chapter 32 of Title 58.1, provided the owner of such property has given written consent. In addition to the taxes and assessments described herein, a locality creating a service district may contribute from its general fund any amount of funds it deems appropriate to pay for the governmental services authorized by subdivisions 1, 2, and 11 of this section.

7. To accept the allocation, contribution or funds of, or to reimburse from, any available source, including, but not limited to, any person, authority, transportation district, locality, or state or federal agency for either the whole or any part of the costs, expenses and charges incident to the acquisition, construction, reconstruction, maintenance, alteration, improvement, expansion, and the operation or maintenance of any facilities and services in the district.

8. To employ and fix the compensation of any technical, clerical, or other force and help which from time to time, in their judgment may be necessary or desirable to provide the governmental services authorized by subdivisions 1, 2 and 11 or for the construction, operation, or maintenance of any such facilities and equipment as may be necessary or desirable in connection therewith.

9. To create and terminate a development board or other body to which shall be granted and assigned such powers and responsibilities with respect to a special service district as are delegated to it by ordinance adopted by the governing body of such locality or localities. Any such board or alternative body created shall be responsible for control and management of funds appropriated for its use by the governing body or bodies, and such funds may be used to employ or contract with, on such terms and conditions as the board or other body shall determine, persons, municipal or other governmental entities or such other entities as the development board or alternative body deems necessary to accomplish the purposes for which the development board or alternative body has been created. If the district was created by court order, the ordinance creating the development board or alternative body may provide that the members appointed to the board or alternative body shall consist of a majority of the landowners who petitioned for the creation of the district, or their designees or nominees.

10. To negotiate and contract with any person or municipality with regard to the connections of any such system or systems with any other system or systems now in operation or hereafter established, and with regard to any other matter necessary and proper for the construction or operation and maintenance of any such system within the district.

11. To acquire by purchase, gift, devise, bequest, grant, or otherwise title to or any interests or rights of not less than five years' duration in real property that will provide a means for the preservation or provision of open-space land as provided for in the Open-Space Land Act (§ 10.1-1700 et seq.). Notwithstanding the provisions of subdivision 3, the governing body shall not use the power of condemnation to acquire any interest in land for the purposes of this subdivision.

12. To contract with any state agency or state or local authority for services within the power of the agency or authority related to the financing, construction, or operation of the facilities and services to be provided within the district; however, nothing in this subdivision shall authorize a locality to obligate its general tax revenues, or to pledge its full faith and credit.

13. In the Town of Front Royal, to construct, maintain, and operate facilities, equipment, and programs as may be necessary or desirable to control, eradicate, and prevent the infestation of rats and removal of skunks and the conditions that harbor them.

14. In Accomack County, to construct, maintain, and operate in the Wallops Research Park, consistent with all applicable federal, state, and local laws and regulations, such infrastructure, services, or amenities as may be necessary or desirable to provide access for aerospace-related economic development to the NASA/Wallops Flight Facility runway and related facilities, and to create and terminate a Wallops Research Park Partnership body, which shall consist of one representative of the NASA/Wallops Research Flight Facility, one representative of the U.S. Navy Surface Combat Systems Center, one representative of the Marine Science Consortium, one representative of the Accomack County government, the Chancellor of the Virginia Community College System, and one representative of the Virginia Economic Development Partnership. The Partnership body shall have all of the powers enumerated in § 15.2-2403. Federal appointees to the Partnership body shall maintain their absolute duties of loyalty to the U.S. government.

15. To contract with a nongovernmental broadband service provider who will construct, maintain, and own communications facilities and equipment required to facilitate delivery of last-mile broadband services to unserved areas of the service district, provided that the locality documents that less than 10 percent of residential and commercial units within the project area are capable of receiving broadband service at the time the construction project is approved by the locality.

As used in this subdivision:

"Area unserved by broadband" means a designated area in which less than 10 percent of residential and commercial units are capable of receiving broadband service, provided that the Department of Housing and Community Development for its Virginia Telecommunication Initiative may by guidelines modify such percentage from time to time.

"Broadband" means Internet access at speeds greater than 10 Mbps download speed and one Mbps upload speed, provided that the Department of Housing and Community Development for its Virginia Telecommunication Initiative may by guidelines modify such speeds from time to time.

Appendix D.3: Community Improvement District Regulations

15.2-2403.4. Community Improvement Districts.

A. Any locality may by ordinance, or any two or more localities may by concurrent ordinances, create community improvement districts within the locality or localities by the method prescribed in § 15.2-2400. Any ordinance to create such a district shall include the words "Community Improvement District" in the name of the district. After adoption of an ordinance or ordinances creating a community improvement district, the governing body or bodies shall have all powers with respect to the community improvement district that they possess with respect to service districts.

B. To the extent the governing body of a locality contracts for the provision to a community improvement district of any of the governmental services authorized by subdivisions 1 and 2 of § 15.2-2403, such governing body shall contract with a nonprofit corporation, a majority of whose board members own property in the community improvement district, to provide such service.

Appendix D.4: Community Development Authority Regulations

§ 15.2-5103. Ordinance, agreement or resolution creating authority to include articles of incorporation.

A. The ordinance, agreement or resolution creating an authority shall include articles of incorporation which shall set forth:

1. The name of the authority and address of its principal office.

2. The name of each participating locality and the names, addresses and terms of office of the first members of the board of the authority.

3. The purposes for which the authority is being created and, to the extent that the governing body of the locality determines to be practicable, preliminary estimates of capital costs, proposals for any specific projects to be undertaken by the authority, and preliminary estimates of initial rates for services of such projects as certified by responsible engineers.

4. If there is more than one participating locality, the number of board members who shall exercise the powers of the authority and the number from each participating locality.

B. Any such ordinance, agreement or resolution that does not set forth the information required in subdivision 3 of subsection A regarding capital cost estimates, project proposals and project service rate estimates shall set forth a finding by the governing body that inclusion of such information is impracticable.

C. Any ordinance, agreement or resolution adopted pursuant to §§ 15.2-5152 through 15.2-5157 shall provide that any bonds issued by the community development authority shall be a debt of the authority, not the local government. Unless otherwise provided in the ordinance which establishes the authority, the local government shall not retire any part of the bonds or pay any debt service of an authority out of revenues or funds derived from sources other than those set out in § 15.2-5158, except that, where the authority finances improvements not contemplated by the original ordinance, the local government may, by ordinance or resolution, make such provisions for repayment as are otherwise permitted under general law. This subsection shall have no effect upon authorities formed pursuant to § 15.2-5102.

§ 15.2-5111. Specification of projects.

If they have specified the initial purpose or purposes of the authority and insofar as practicable, any project or projects to be undertaken by the authority, the governing bodies of any of the localities organizing an authority may, at any time by ordinance or resolution, after a public hearing, and with or without a referendum, specify further projects to be undertaken by the authority. No other projects shall be undertaken by the authority than those so specified. If the governing bodies of the localities organizing the authority fail to specify any project or projects to be undertaken, then the authority shall be deemed to have all the powers granted by this chapter.

15.2-5152. Localities may consider petitions for creation of authority.

A. Any city may consider petitions for the creation of community development authorities in accordance with this article.

B. Any town may by ordinance elect to assume the power to consider petitions for the creation of community development authorities in accordance with this article. A public hearing shall be held on such ordinance.

C. Any county may by ordinance elect to assume the power to consider petitions for the creation of community development authorities in accordance with this article. A public hearing shall be held on such ordinance.

D. Notwithstanding any other provision of law, community development authorities shall be created pursuant to this Article and the provisions of §§ 15.2-5103 and 15.2-5107 through 15.2-5111.

§ 15.2-5153. Landowners may petition localities.

The owner or owners of at least 51 percent of the land area or assessed value of land in any tract or tracts of land in any locality or localities may petition the locality or localities in which the tract or tracts are located for the creation of a community development authority, provided that before the creation of a community development authority in any town or county, the town or county has elected to consider petitions to create community development authorities pursuant to the applicable provisions of § 15.2-5152. Any petition for the creation of a community development authority in multiple tracts which are not contiguous shall be signed by the owner or owners of at least 51 percent of the land area or assessed value of land in each such non-contiguous tract.

§ 15.2-5154. Contents of petition.

A petition for the creation of a community development authority shall:

1. Set forth the name and describe the boundaries of the proposed district, including any provisions for adjusting the community development authority district boundaries pursuant to subsection A of § 15.2-5155;

2. Describe the services and facilities proposed to be undertaken by the community development authority within the district;

3. Describe a proposed plan for providing and financing such services and facilities within the district;

4. Describe the benefits which can be expected from the provision of such services and facilities by the community development authority;

5. Provide that the board members of the community development authority shall be selected under the applicable provisions of § 15.2-5113; and

6. Request the local governing body to establish the proposed community development authority for the purposes set forth in the petition.

Such petition may provide that the board members of the community development authority appointed pursuant to § 15.2-5113 shall consist of a majority of the petitioning landowners or their designees or nominees.

§ 15.2-5155. Ordinance or resolution creating authority.

A. Any locality authorized to consider petitions under this article may, by ordinance or resolution not inconsistent with the petition proposing the creation of the authority, create a community development authority, a public body politic and corporate and political subdivision of the Commonwealth. Community development authorities proposed for districts that are within any two or more localities may be formed by concurrent ordinances of each locality, and such localities may contract with one another for administration of the authority. If the boundaries of the proposed community development authority district are located wholly in a town, the owner or owners shall petition the town and need not petition the county and the town may create the authority without action by the county. If the petition for the creation of a community development authority so provides, the ordinance or resolution creating the community development authority may provide for the locality at any time after the creation of the community development authority to adjust the boundaries of the community development authority district to exclude certain land as long as the owners of at least 51 percent of the land area or assessed value of land remaining in the community development authority district after the adjustment petitioned for the creation of the community development authority.

B. An ordinance or resolution creating a community development authority shall not permit the community development authority to provide services which are provided by, or are obligated to be provided by, any authority already in existence whose charter requires or permits service within the proposed community development district, unless the existing authority first certifies to the governing body that the services provided by the proposed community development authority will not have a negative impact upon the existing authority's operational or financial condition. Such certification shall not be unreasonably withheld by the existing authority.

§ 15.2-5156. Hearing; notice.

A. An ordinance or resolution creating a community development authority shall not be adopted or approved until a public hearing has been held by the governing body on the question of its adoption or approval. Notice of the public hearing shall be published once a week for three successive weeks in a newspaper of general circulation within the locality. The petitioning landowners shall bear the expense of publishing the notice. The hearing shall not be held sooner than ten days after completion of publication of the notice.

B. After the public hearing and before adoption of the ordinance or resolution, the local governing body shall mail a true copy of its proposed ordinance or resolution creating the development authority to the petitioning landowners or their attorney in fact. Unless waived in writing, any petitioning landowner shall have thirty days from mailing of the proposed ordinance or resolution in which to withdraw his signature from the petition in writing prior to the vote of the local governing body on such ordinance or resolution. If any signatures on the petition are so withdrawn, the local governing body may pass the proposed ordinance or resolution only upon certification by the petitioners that the petition continues to meet the requirements of § 15.2-5152. If all petitioning landowners waive the right to withdraw their signatures from the petition, the local governing body may adopt the ordinance or resolution upon compliance with the provisions of subsection A and any other applicable provisions of law.

§ 15.2-5157. Recording in land records.

The local governing body, upon approving the resolution or ordinance creating the district, shall direct that a copy of the resolution or ordinance be recorded in the land records of the circuit court for the locality in which the district is located for each parcel included in the district and be noted on the land books of the locality. For the purposes of this section, "parcel" is defined as tax map parcel.

§ 15.2-5158. Additional powers of community development authorities.

A. Each community development authority created under this article, in addition to the powers provided in Article 3 (§ 15.2-5110 et seq.) of Chapter 51 of this title, may:

1. Subject to any statutory or regulatory jurisdiction and permitting authority of all applicable governmental bodies and agencies having authority with respect to any area included therein,

finance, fund, plan, establish, acquire, construct or reconstruct, enlarge, extend, equip, operate, and maintain the infrastructure improvements enumerated in the ordinance or resolution establishing the district, as necessary or desirable for development or redevelopment within or affecting the district or to meet the increased demands placed upon the locality as a result of development or redevelopment within or affecting the district, including, but not limited to:

a. Roads, bridges, parking facilities, curbs, gutters, sidewalks, traffic signals, storm water management and retention systems, gas and electric lines and street lights within or serving the district which meet or exceed the specifications of the locality in which the roads are located.

b. Parks and facilities for indoor and outdoor recreational, cultural and educational uses; entrance areas; security facilities; fencing and landscaping improvements throughout the district.

c. Fire prevention and control systems, including fire stations, water mains and plugs, fire trucks, rescue vehicles and other vehicles and equipment.

d. School buildings and related structures, which may be leased, sold or donated to the school district, for use in the educational system when authorized by the local governing body and the school board.

e. Infrastructure and recreational facilities for age-restricted active adult communities, and any other necessary infrastructure improvements as provided above, with a minimum population approved under local zoning laws of 1,000 residents. Such development may include security facilities and systems or measures which control or restrict access to such community and its improvements.

2. Issue revenue bonds of the development authority as provided in § 15.2-5125, including but not limited to refunding bonds, subject to such limitation in amount, and terms and conditions regarding capitalized interest, reserve funds, contingent funds, and investment restrictions, as may be established in the ordinance or resolution establishing the district, for all costs associated with the improvements enumerated in subdivision 1 of this subsection. Such revenue bonds shall be payable solely from revenues received by the development authority. The revenue bonds issued by a development authority shall not require the consent of the locality, except where consent is specifically required by the provisions of the resolution authorizing the collection of revenues and/or the trust agreement securing the same, and shall not be deemed to constitute a debt, liability, or obligation of any other political subdivision, and shall not impact upon the debt capacity of any other political subdivision.

3. Request annually that the locality levy and collect a special tax on taxable real property within the development authority's jurisdiction to finance the services and facilities provided by the authority. Notwithstanding the provisions of Article 4 (§ 58.1-3229 et seq.) of Chapter 32 of Title 58.1, any such special tax imposed by the locality shall be levied upon the assessed fair market value of the taxable real property. Unless requested by every property owner within the proposed district, the rate of the special tax shall not be more than $.25 per $100 of the assessed fair market value of any taxable real estate or the assessable value of taxable leasehold property as specified by § 58.1-3203. The proceeds of the special taxes collected shall be kept in a separate account and be used only for the purposes provided in this chapter. All revenues received by the locality from such special tax shall be paid over to the development authority for its use pursuant to this chapter subject to annual appropriation. No other funds of the locality shall be loaned or paid to the development authority without the prior approval of the local governing body.

4. Provide special services, including: garbage and trash removal and disposal, street cleaning, snow removal, extra security personnel and equipment, recreational management and supervision, and grounds keeping.

5. Finance the services and facilities it provides to abutting property within the district by special assessment thereon imposed by the local governing body. All assessments pursuant to this section shall be subject to the laws pertaining to assessments under Article 2 (§ 15.2-2404 et seq.) of Chapter 24; provided that any other provision of law notwithstanding, (i) the taxes or assessments shall not exceed the full cost of the improvements, including without limitation the legal, financial and other directly attributable costs of creating the district and the planning, designing, operating and financing of the improvements which include administration of the collection and payment of the assessments and reserve funds permitted by applicable law; (ii) the taxes or assessments may be imposed upon abutting land which is later subdivided in accordance with the terms of the ordinance forming the district, in amounts which do not exceed the peculiar benefits of the improvements to the abutting land as subdivided; and (iii) the taxes or assessments may be made subject to installment payments for up to 40 years in an amount calculated to cover principal, interest and administrative costs in connection with any financing by the authority, without a penalty for prepayment. Notwithstanding any other provision of law, any assessments made pursuant to this section may be made effective as a lien upon a specified date, by ordinance, but such assessments may not thereafter be modified in a manner inconsistent with the terms of the debt instruments financing the improvements. All assessments pursuant to this section may also be made subject to installment payments and other provisions allowed for local assessments under this section or under Article 2 of Chapter 24. All revenues received by the locality pursuant to any such special assessments which the locality elects to impose upon request of the development authority shall be paid over to the development authority for its use under this chapter, subject to annual appropriation, and may be used for no other purposes.

6. Fix, charge, and collect rates, fees, and charges for the use of, or the benefit derived from, the services and/or facilities provided, owned, operated, or financed by the authority benefiting property within the district. Such rates, fees, and charges may be charged to and collected by such persons and in such manner as the authority may determine from (i) any person contracting for the services or using the facilities and/or (ii) the owners, tenants, or customers of the real estate and improvements that are served by, or benefit from the use of, any such services or facilities, in such manner as shall be authorized by the authority in connection with the provision of such services or facilities.

7. Purchase development rights that will be dedicated as easements for conservation, open space or other purposes pursuant to the Open-Space Land Act (§ 10.1-1700 et seq.). For purposes of this subdivision, "development rights" means the level and quantity of development permitted by the zoning ordinance expressed in terms of housing units per acre, floor area ratio or equivalent local measure. An authority shall not use the power of condemnation to acquire development rights.

8. Subject to any statutory or regulatory jurisdiction and permitting authority of all applicable governmental bodies and agencies having authority with respect to any area included therein, finance and fund the acquisition of land within the district. All financing authority and methods provided by subsections 2, 3, 4, 5, 6, and 7 shall be permitted for the acquisition of land as provided herein.

9. Any special tax levied pursuant to subdivision 3 and any special assessment imposed pursuant to subdivision 5, whether previously or hereafter levied or imposed, constitute a lien on real estate ranking on parity with real estate taxes, and any such delinquent special tax or delinquent special assessment may be collected in accordance with the procedures set forth in Article 4 (§ 58.1-3965 et seq.) of Chapter 39 of Title 58.1, provided that the enforcement of the lien for any special assessment under subdivision 5 made subject to installment payments shall be limited to the installment payments due or past due at the time the lien is enforced through sale in accordance with Article 4 (§ 58.1-3965 et seq.) of Chapter 39 of Title 58.1, and any sale to enforce payment of any delinquent taxes, assessments, or other levies shall not extinguish installment payments that are not yet due.

B. Nothing contained in this chapter shall relieve the local governing body of its general obligations to provide services and facilities to the district to the same extent as would otherwise be provided were the district not formed.

§ 15.2-5159. Validation of creation of authorities; bonds issued.

All proceedings heretofore taken with respect to the creation of a community development authority by any locality pursuant to this chapter are hereby presumed to be valid and all such authorities are presumed to be legally created. All proceedings heretofore taken by any community development authority with respect to the authorization, issuance, sale, execution, delivery, and repayment of bonds by any community development authority are presumed to be valid, and any such bonds so issued are presumed valid and legal obligations of such community development authority, enforceable in accordance with law.

Appendix D.5: Joint Exercise of Powers Regulations

§ 15.2-1300. Joint exercise of powers by political subdivisions.

A. Any power, privilege or authority exercised or capable of exercise by any political subdivision of this Commonwealth may be exercised and enjoyed jointly with any other political subdivision of this Commonwealth having a similar power, privilege or authority except where an express statutory procedure is otherwise provided for the joint exercise.

B. Any two or more political subdivisions may enter into agreements with one another for joint action pursuant to the provisions of this section. The participating political subdivisions shall approve such agreement before the agreement may enter into force. Localities shall approve such agreements by ordinance. Other political subdivisions shall approve such agreements by resolution.

C. The agreement shall specify the following:

1. Its duration.

2. Its purpose or purposes.

3. The manner of financing the joint undertaking and of establishing and maintaining a budget therefore.

4. The permissible method or methods to be employed in accomplishing the partial or complete termination of the agreement and for disposing of property upon such partial or complete termination.

5. All other necessary and proper matters.

D. The agreement, in addition to the items enumerated in subsection C hereof, may contain the following:

1. Provision for an administrator or a joint board responsible for administering the undertaking. The precise organization, composition, term, powers and duties of any administrator or joint board shall be specified.

2. The manner of acquiring, holding (including how title to such property shall be held) and disposing of real and personal property used in the undertaking.

3. How issues of liability will be dealt with and the types, amounts and coverages of insurance.

E. No agreement made pursuant to this section shall relieve any political subdivision of any obligation or responsibility imposed upon it by law except that to the extent of actual and timely performance thereof by an administrator or joint board created by an agreement made hereunder, such performance may be offered in satisfaction of the obligation or responsibility.

F. Any political subdivision entering into an agreement pursuant to this section may appropriate funds and may sell, lease, give, or otherwise supply the administrator or joint board created to operate the undertaking with such property, personnel or services therefore as may be within its legal power to furnish.

G. Any power, privilege or authority exercised or capable of exercise by any political subdivision of this Commonwealth may be exercised and enjoyed jointly with any political subdivision of any other state or the District of Columbia subject to the provisions of subsections A, B, C, D, E and F above, which shall apply mutatis mutandis.

Appendix E: Grant Program Descriptions

This appendix reviews eight state grant programs: two administered by the Virginia Port Authority (Virginia Waterway Maintenance Fund and Aid to Local Ports), five administered by the Department of housing and Community Development (GO Virginia and Community Development Block Grants), and a newly funded grant administered by the Department of Conservation and Recreation (Community Flood Preparedness Fund). In addition to those seven State programs, eight federal grant programs are reviewed: two administered by USDA Rural Development (Community Facilities Loans and Grants and Community Facilities Technical Assistance and Training), three administered by US Department of Commerce Economic Development Administration (Public Works, Economic Adjustment and Disaster Supplemental Assistance) and three administered by the US Army Corps of Engineers.

Virginia Port Authority (VPA)
Virginia Waterway Maintenance Fund (VWMF)

VPA administers the Virginia Waterway Maintenance Fund (VWMF) established in May 2018 by the Virginia General Assembly. The purpose of VWMF is to support shallow-draft dredging projects throughout the Commonwealth.

VWMF grants can be used for:

1. Feasibility and cost evaluations, pre-project engineering studies, and project permitting and contracting costs for a waterway project;
2. The state portion of a nonfederal sponsor funding requirement for a federal project, which may include the beneficial use of dredged materials that are not covered by federal funding;
3. The maintenance of shallow-draft navigable waterway channel maintenance dredging and the construction and management of areas for the placement of dredged material; and

There is no financial contribution or matching requirement for the VWMF grants. Grant applications are due to the VPA by March 1 of each year with a decision made at the May VPA Board of Commissioners meeting. Special consideration will be given to any project applications that support waterway enhancement in rural coastal Virginia where evidence is provided that the dredging project benefits working waterfront businesses, commercial fishing, or seafood business.

The VWMF has been funded at a level of $1.35 Million for FY 2019 and 2020. The limited amount of funding available will not provide sufficient funding for the dredging of all of the current projects that have had design work completed or in progress.

The VWMF is the most mission-aligned grant program with the proposed dredging program in the Middle Peninsula. If the Middle Peninsula localities wish to pursue a multi-project dredging program, VWMF should be able to support most of the pre-dredging costs of the projects with the possibility of some cost sharing of the dredging.

In May 2018, the Virginia General Assembly established the Virginia Waterway Maintenance Fund for the purpose of supporting shallow-draft dredging projects throughout the Commonwealth. The source of the grant funds shall be the Virginia Waterway Maintenance Grant Fund. The Virginia Port Authority finds it necessary and in the public body interest, and pursuant to its statutory responsibility, to establish the Virginia Waterway Maintenance Grant Program Guidelines.

Application Deadline: March 1

This policy shall be as follows:

I. DEFINITIONS

A. Applicant – refers to the political subdivision and the governing bodies of Virginia localities.
B. Study – refers to feasibility and cost evaluations, pre-project engineering studies, and project permitting and contracting costs for a waterway project conducted by a political subdivision of the Commonwealth.
C. Carryover Funds – refers to unused funds for awarded projects. Funds must be reapplied for each year.
D. Dredging – refers to the removal of sediments and debris from the bottom of lakes, rivers, harbors, and other water bodies.
E. Items of Local Cooperation – include specific requirements on the applicant for implementation of a federal, state or local project. Such items include but are not limited to lands, easements, rights-of-way, relocations, dredge material disposal sites, and cash contributions.
F. Beneficial Use – refers to innovative uses and placement alternatives for dredge materials that produce public, economic or environmental benefits.
G. Shallow draft dredging – refers to rural coastal waterways that have recognized and established navigable channels that are pivotal to the use and enjoyment of docks, marinas, boat yards and working waterfronts. Shallow draft dredge areas can be categorized as primary, secondary (including smaller tributaries and marked and unmarked channels) having a water depth of 14' or less.

II. ADMINISTRATION

The following elements will guide the application, allocation, and distribution of the Virginia Waterway Maintenance Grant Fund:

A. FOR ALL PROJECTS FOR WHICH VIRGINIA WATERWAY MAINTENANCE GRANT FUNDS ARE REQUESTED.

1) The Virginia Port Authority will serve as the responsible agency for administering the Virginia Waterway Maintenance Grant Fund.
2) Funds will be used to support:
    1. feasibility and cost evaluations, pre-project engineering studies, and project permitting and contracting costs for a waterway project conducted by a political subdivision of the Commonwealth;
    2. the state portion of a nonfederal sponsor funding requirement for a federal project, which may include the beneficial use of dredged materials that are not covered by federal funding;

3. the Commonwealths' maintenance of shallow-draft navigable waterway channel maintenance dredging and the construction and management of areas for the placement of dredged material; and
4. the beneficial use, for environmental restoration and the mitigation of coastal erosion or flooding, of dredged materials from waterway projects conducted by a political subdivision of the Commonwealth.

3) For a project to be eligible for funds, VPA, in its sole discretion, must determine that the proposed project is economically feasible based on preplanning study or current level of business, will not directly competitively disadvantage existing publicly-owned port facilities, and will further the interests of the Commonwealth of Virginia. Development and presentation of the information needed to determine project eligibility will be the responsibility of the applicant.
4) Requests for funding and their disposition shall be as follows: Requests for funding shall be made by March 1st. Applicants may be required to make oral presentation of the requests to the VPA. Funds will be allocated by VPA at its May Board of Commissioners meeting and available for successful applicants by July 1st of that year.
5) Application Guidelines: The applicant shall submit a completed application to the VPA that contains the following information: statement of need and urgency, total project cost, timeline and phases of project, feasibility of the proposed planning and/or dredging project, status of any necessary permits, the adequacy of the applicant's project management, the potential beneficial use of dredged materials for the purpose of mitigation of coastal erosion, flooding or other purposes, potential beneficial impact to the community, and total amount of funding being requested.
6) Prior to the receipt of a grant, the applicant shall enter into a memorandum of understanding with the VPA establishing the requirements for the use of grant funds.
7) Disbursements: The applicant shall submit a requisition to the VPA for payment. The requisition shall be accompanied by supporting invoices or other documentation as well as a certification of the applicant that the work has been performed or that payment is otherwise properly due. The requisition shall further set forth the name of the person or entity to whom payment is to be made, the amount of payment, and the project for which the payment is to be made. Requisitions may be submitted quarterly or at the completion of the project. When the project is completed, the applicant shall certify its completion date to the VPA.
8) Requests not made within the schedule of Paragraph 4 above, shall be considered only when accompanied by a statement declaring the need for funds an emergency, with consequences of non-funding clearly specified, or a statement explaining why the schedule in Paragraph 4 above could not be met. Requests must be received no later than three weeks prior to the next regular Board of Commissioners meeting to be considered at that meeting.
9) VPA will allocate an amount appropriated by the General Assembly for projects which are judged to meet the criteria above.
10) VPA, in its sole discretion, may allocate the total amount requested to an applicant, any portion thereof, or may decline to allocate funds for the project. These funds may not be used for any dredging project for a solely privately owned marina or dock. Additionally, special consideration will be given in the first year to applicants who can provide a 3 to 1 match for requested funds.

B. ADDITIONALLY, FOR PROJECTS WITH POTENTIAL FEDERAL INTEREST

1) Applicant must have made previous, or must make simultaneous, "application" for federal funds.

2) VPA recognizes that local sponsors for federal projects must agree to share with the federal government in the cost of studies and construction as a condition necessary for the initiation of federal study of the project. VPA agreement to provide support necessary to allow for the initiation of any project is conditional upon the later determination of VPA that the standards in II.A.3 above are met and that funds are available.
3) VPA shall be given the opportunity to review and comment on all cost sharing agreements between the local sponsor and federal government prior to releasing any funds.
4) If undertaken prior to the receipt of federal funds, but for which federal funds are committed, projects must be completed within the time frame determined reasonable by the Corps of Engineers in project studies.

C. ADDITIONALLY, FOR NONFEDERALLY FUNDED PROJECTS:

1) There will be no financial contribution requirement for the applicant.

Special consideration will be given to any project application that supports waterway enhancement in rural coastal Virginia as defined by §15.2-7600. Localities as defined by §15.2-7600 will provide evidence of working waterfront businesses or commercial fishing or seafood business and the need for dredging project.

Virginia Port Authority (VPA)
Aid to Local Ports (ALP)

The Commonwealth Port Fund established in 1986 provides funding to the Aid to Local Ports (ALP) program. The purpose of ALP is to support the capital needs and the preservation of existing publicly-owned ocean, river, or tributary ports to foster and stimulate the flow of commerce through the ports of Virginia. Currently the Aid to Local Ports Fund appropriation is $1,000,000.

ALP grants support the capital needs of publicly-owned ocean, river, and tributary ports and their marine facilities whose primary purpose is the flow-through of goods for consumption. Marine facilities include both main and access channels, berthing areas, piers and landside facilities necessary for handling and storing waterborne commerce. No APL funds can be used for studies to determine project feasibility.

The local applicant is responsible for 25% of total project costs.

ALP funding is a potential source to cover a portion of a dredging projects cost when the project includes improvements to a local publicly-owned port facility. Since ALP funding cannot support the pre-dredging activities, ALP funds can be applicable to that portion of the dredging that serves a local port facility.

The Aid to Local Ports program is a result of the Virginia General Assembly's 1986 legislation establishing a Commonwealth Port Fund. The purpose of the fund is to support port capital needs and the preservation of existing capital needs of all ocean, river, or tributary ports within the Commonwealth. In the interest of the public body and pursuant to its statutory responsibility to foster and stimulate the flow of commerce through the ports of Virginia, the policy on grants to local governments was established and adopted on July 28, 1987. The purpose of the program is for local governments to make application for a portion of the Commonwealth Port Fund that is set aside each year for this purpose. The Aid to Local Ports Fund appropriation is $1,000,000.

Application Deadline: March 1

I. DEFINITIONS

A. Marine Facilities—include main and access channels, berthing areas, piers and landside facilities necessary for handling and storing waterborne commerce.
B. Items of Local Cooperation—include specific requirements on the applicant for implementation of a Federal project. Such items include but are not limited to lands, easements, rights-of way, relocations, disposal areas, and cash contributions.
C. Project—shall mean a capital expenditure proposal.
D. Applicant—refers to the public body that is pursuing the implementation of a project.
E. Study—refers to any preconstruction planning investigation.
F. Carryover Funds—refers to unused funds for awarded projects. Funds must be reapplied for each year.

II. ADMINISTRATION

The following elements will guide the application, allocation, and distribution of the Commonwealth Port Fund:

A. FOR ALL PROJECTS FOR WHICH COMMONWEALTH PORT FUNDS ARE

REQUESTED.

1. The Virginia Port Authority (VPA) will serve as the responsible agency for administering the Commonwealth Port Fund.
2. Funds will be used to support capital needs of publicly-owned ocean, river, and tributary ports and their marine facilities within the Commonwealth whose primary purpose is the flow-through of goods for consumption.
3. For a project to be eligible for funds, VPA, in its sole discretion, must determine that the proposed project is economically feasible based on preplanning study or current level of business, will not directly competitively disadvantage existing publicly-owned port facilities, and will further the interests of the Commonwealth of Virginia. Development and presentation of information needed to determine project feasibility will be the responsibility of the applicant.
4. Requests for funding and their disposition shall be as follows:
   Requests for funding shall be made by March 1. Applicants may be required to make oral presentation of the requests to VPA. Funds will be allocated by VPA at its May Board of Commissioners meeting and available for successful applicants July 1 of that year.
5. Application Guidelines: The applicant shall submit an application to the VPA that contains the following information: statement of need and urgency, total project cost, timeline and phases of project, rendering or picture of proposed improvements, potential impact to the community, total amount of funding being requested, and all other pertinent information. Additionally, a formal application for carryover funds must be submitted. The carryover application must contain a project update and specify what project the funds will be used for. If carryover funds are to be used for a new project, the applicant must state this as well.
6. Disbursements: The applicant shall submit a requisition to VPA for payment. The requisition shall be accompanied by supporting invoices or other documentation as well as a certification of the applicant that the work has been performed or that payment is otherwise properly due. The requisition shall further set forth the name of person or entity to whom payment is to be made, the amount of payment, and the project for which the payment is to be made. Requisitions may be submitted periodically or at the completion of the project. The applicant must show that local

share requirements have been met. When the project is completed, the applicant shall certify its completion date to VPA.

7. Request not made within the schedule of Paragraph 4 above, shall be considered only when accompanied by a statement declaring the need for funds an emergency, with consequences of non-funding clearly specified, or a statement explaining why the schedule in Paragraph 4 above could not be met.

   Requests must be received no later than three weeks prior to the next regular Board of Commissioners meeting to be considered at that meeting. Paragraph 4 below applies to the Board's decision.
8. VPA will allocate an amount appropriated by the General Assembly for projects which are adjudged to meet the criteria above.
9. VPA, in its sole discretion, may allocate the total amount requested to an applicant, any portion thereof, or may decline to allocate funds for the project.
10. No Commonwealth Port Funds monies shall be used to fund studies to determine project feasibility, except as herein below provided.
11. VPA will establish priorities of funding for projects based on importance of the projects toward promoting the interests of the Commonwealth of Virginia and financing needs of the applicant both in terms of amount of the request and ability to pay.
12. Local share of project costs shall be reduced by an amount equal to the costs incurred by successful applicants to fund studies to determine project feasibility. Local shares of project costs may also be reduced by up to 50% by contributions of real or personal property necessary for development of the project, as well as any out-of-pocket costs for technical evaluation, survey, and engineering, among others. The value of, and extent to allow, such contributions shall be determined solely by VPA.
13. Local share requirements must be met with an applicant's locally generated funds excluding state and federal grants. This requirement is imposed to insure that an applicant has carefully considered whether or not a proposed project will justify the investment of funds from the Commonwealth Port Fund.

B. ADDITIONALLY, FOR PROJECTS WITH POTENTIAL FEDERAL INTEREST:

1. Applicant must have made previous, or must make simultaneous, "application" for federal funds.
2. VPA recognizes that local sponsors for federal projects must agree to share with the federal government in the cost of studies and construction as a condition necessary for the initiation of federal study of the project. VPA agreement to provide support necessary to allow for the initiation of any project is conditional upon the later determination of VPA that the standards in II.A.3 above are met and that funds are available.
3. At the completion of the federal reconnaissance study of the project, applicant may make application to VPA for funding of further studies for project implementation. Similarly, upon federal approval of construction of the project, applicant may request construction funds.
4. VPA shall be given the opportunity to review and comment on all cost sharing agreements between the local sponsor and federal government prior to releasing any funds.
5. If undertaken prior to the receipt of federal funds, but for which federal funds are committed, projects must be completed within the time frame determined reasonable by the Corps of Engineers in project studies.
6. Local interests must pay 25% of the costs of the total non-federal share of the project, to include items of local cooperation.
7. Maintenance dredging projects are not eligible for funding.

C. ADDITIONALLY, FOR NONFEDERALLY-FUNDED PROJECTS:

1. Local interests must pay:
    a. 25 % of total project costs

Department of Housing and Community Development (DHCD)
GO Virginia

The purpose of GO Virginia is to "create **more higher paying jobs** through incentivized collaboration, primarily through **out-of-state revenue**, which diversifies and strengthens the economy in every region." The program is administered through a statewide GO Virginia Board and nine regional councils with representation from regional business leadership, economic development and workforce professionals, educators, and local government officials. The Mary Ball Washington Regional Council (Region 6) covers the George Washington Regional Commission, the Northern Neck Planning District Commission, and the Middle Peninsula Planning District Commission. Regional opportunities and priorities are laid out in the Growth and Diversification plan.

GO Virginia has three funding streams that can support local projects:

1. **Enhanced Capacity Building**: These grants are planning grants i.e. Feasibility Studies, Pre-Development Activities, Plans, and Capacity Building Activities.
2. **Per Capita Implementation Funds**: Funds are used to fund project implementation. Each year Region 6 receives about $1 million in project funds. Applicants may ask up to $1 million for these types of projects, depending on fund availability.
3. **Statewide Competitive Funds**: These funds are for multi-region projects. These funds are separate from the regional allocation and are up to the discretion of the State Board to approve.

Projects must further the growth of the target industry sectors identified in the Growth and Diversification Plan. The Region 6 Plan identifies Aquaculture, Seafood, Commercial Fishing and Marine Industries as a target industry cluster that would be most aligned with dredging activity. Funding is further limited to: 1) site development, 2) workforce development, 3) entrepreneurship and 4) target industry cluster scale-up activities. Each project must demonstrate meaningful regional collaboration between two or more local governments and show how the project will lead to the creation of "higher-paying" jobs in the region.

Dredging related activities may be eligible for GO Virginia funding if the dredging activities are a component part of a larger project that would expand the Aquaculture, Seafood, Commercial Fishing and Marine Industries industry cluster. A regional working waterfront revitalization project that has dredging as a central component may be a type of project that could fit all of the constraints of the GO Virginia program and address the need for channel dredging. Given the unique and innovative nature of regional dredging activities, it may be difficult to coordinate all of the GO Virginia constraints with the requirements of other funding programs necessary to support a more comprehensive project with dredging as a component of that project.

Department of Housing and Community Development (DHCD)
Community Development Block Grants (CDBG)

DHCD administers the "Non-Entitlement" portion of the federal Community Development Block Grant Program that was established to provided benefit to Low- to moderate-income persons, eliminate slums or blight or address an emergency situation. Each year DHCD adopts a Program Design for the CDBG program that outlines the methods and policies that will be utilized to distribute and manage the CDBG funds.

CDBG funds could be eligible to support dredging when the beneficiaries of the dredging project will be individuals of low to moderate income (LMI). A project that supports the expansion of employment opportunities for LMI individuals could be an eligible CDBG project. Dredging would likely be a component of a larger project like harbor improvements that supports commercial fishing operations where the fishermen are primarily LMI. Historically, CDBG funding has been used to revitalize commercial several harbors on Virginia's Eastern Shore. In these projects the planning of the project included documentation from the watermen that they would expand their businesses as a result of the harbor improvements.

Potential CDBG projects are strongly encouraged to apply for a "CDBG Project Planning Grant" to ensure that the project addresses a priority community need and that the project will be designed to accomplish one of the three CDBG national objectives: 1) benefit low to moderate income individuals, 2) elimination of slums and blight, or 3) address an emergency situation.

Eligible activities of Project Planning Grants include:

- Community assessments, needs analyses, and need prioritization,
- Activation and organization of target area residents and stakeholders,
- Surveys of residents, users, customers, and potential beneficiaries,
- Obtaining easements and user agreements,
- Development of cost estimates and Preliminary Engineering Reports (PERs), and
- Completion of market studies.

CDBG Project Planning Grants CDBG Project Planning Grants of up to $35,000 ($45,000 for Comprehensive Community Development) are available for needs analysis and prioritization, preliminary design, and strategy development activities in preparation for a future Community Improvement Grant Application.

Once the appropriate project planning is completed, a Community Improvement Grant application would be expected within a year. Community Improvement Grants can be for Community Service Facilities or Community Facilities or Community Economic Development Fund (CED). The maximum amount of funding varies by grant category; $800,000 for Community Service Facilities, $1,000,000 for Community Facilities, $700,000 for Community Economic Development serving one locality and $1,200,000 for Community Economic Development serving a region.

Community Economic Development Fund (CED) grants would be the most likely category of CDBG grants to financially support a dredging project. In order to be eligible for a CED grant the dredging project would need to be component part of a broader working waterfront redevelopment project that creates or retains jobs for LMI individuals.

CED projects are submitted on a rolling basis during the year. Projects that meet specific threshold criteria based upon the economic stress of the applicant locality (s) are funded if sufficient funds are available.

Virginia's Community Development Block Grant (CDBG) Planning Grant program is designed to aid in developing clearly articulated strategies for addressing communities' greatest community development needs following meaningful citizen participation. Planning Grant Funding totaling $1,000,000 is available on an open basis from January 6, 2020, until September 30, 2020; or until all of the funding is committed, whichever comes first.

Submission Requirements

A locality interested in obtaining Planning Grant assistance must submit a completed Application through the Virginia Department of Housing and Community Development's (DHCD) Centralized Application and Management System (CAMS).

Applications are due on the 15th of each month. Upon the successful review by DHCD of the pre-application, if no additional information is required, Initial Activities must be completed within 120 days of the DHCD correspondence in order for Planning Grants Funds to be awarded. Upon completion of the Initial Activities, the locality will upload the documentation as an attachment in their original application and resubmit. Although there is no requirement for local match, Planning Grants may or may not cover the full cost of all planning activities for future projects. Localities should expect to contribute resources to the planning process in order to develop a successful project.

Categories

There are two (2) categories of Planning Grants. 1. Pre-Project Planning Grants 2. Project Planning Grants.

PRE-PROJECT PLANNING GRANTS Organizing Planning Grants of up to $10,000 are available for activation and organization of community residents to develop strategies for future social and physical improvements.

Eligible activities include:

- Conducting assessments of community strengths, weaknesses, opportunities, and threats,
- Establishing goals and objectives, and
- Developing work plans and implementation strategies.

Citizen participation is the central purpose of these Planning Grants and should result in an organized, informed community which has reached consensus on a practical vision of the future and has the capacity and options available for future community improvement. The locality's highest community development needs should be prioritized after gathering input from citizens and other stakeholders. In addition to ranking these needs, the options available to address these needs should be evaluated. The capacity of the locality to undertake project planning efforts should be evaluated in a Community Organizing Planning Grant.

This evaluation should consider the following areas:

- Leadership,

- Technical skills,
- Available staff time,
- Management and fiscal systems,
- Consultants needed,
- Partnerships needed, and
- Additional funds and other resources needed for project planning and future implementation.

Of the $1,000,000 available for Planning Grants, no more than $60,000 will be targeted for Community Organizing Planning Grants. This amount is a maximum, not a reservation of funds.

Community Needs Assessment/Economic Assessment Planning Grants Community or Economic Assessment Planning Grants of up to $15,000 are available for a locality to conduct a single objective needs analysis or to prioritize community or economic conditions for future direction. One example of this category is a locality-wide assessment of housing conditions used to prioritize the selection of future project areas. Completion of an Opportunity Zone prospectus is also an eligible activity.

A Community Improvement Grant application is not required following all Needs / Economic Assessment Planning Grant; however, it is expected that the assessment will lead to at least one Project Planning Grant.

PROJECT PLANNING GRANTS

Eligible activities of Project Planning Grants include:

- Community assessments, needs analyses, and need prioritization,
- Activation and organization of target area residents and stakeholders,
- Surveys of residents, users, customers, and potential beneficiaries,
- Obtaining easements and user agreements,
- Development of cost estimates and Preliminary Engineering Reports (PERs), and
- Completion of market studies.

CDBG Project Planning Grants CDBG Project Planning Grants of up to $35,000 ($45,000 for Comprehensive Community Development) are available for needs analysis and prioritization, preliminary design, and strategy development activities in preparation for a future Community Improvement Grant Application.

DHCD reserves the option of awarding additional Planning Grant Funding in excess of this limit for projects which are particularly innovative, challenging, or costly. All Project Planning Grant Activities must be conducted with maximum participation of residents, potential beneficiaries, stakeholders, and local leaders. At a minimum, this participation must be carried out in accordance with the Virginia Community Development Block Grant Citizen Participation Plan for Local Government Applicants which is included as APPENDIX B of the 2020 CDBG Program Design.

All Project Planning Grant recipients must submit complete Community Improvement Grant Applications following completion of all planning activities unless otherwise negotiated with DHCD.

Types of Project Planning Grants

- Housing Rehabilitation
- Comprehensive Community Development (CCD)
- Community Service Facility (CSF)
- Business District Revitalization (BDR)
- Telecommunication/Broadband Business District Revitalization Planning Grants Business District Revitalization (BDR)

Planning Grants are intended to assist appropriate localities in undertaking activities that are designed to identify opportunities to improve the economic and physical conditions within the community. Up to a maximum of $35,000 will be available for each Business District Revitalization Planning Grant. The development of an Economic Restructuring Plan will identify the means by which the locality can implement Economic Improvement Strategies that will help ensure the long-term sustainability of the community, particularly the Downtown Business District.

Applicants must provide:

- An explanation of why Business District Revitalization is the highest community development need,
- Detail on other community development efforts that have been completed,
- A housing analysis to determine if there is a sufficient level of physical and/or economic blight present (At a minimum, target project areas must exhibit at least a 25 percent level of physical blight or at least a 50 percent vacancy rate). A locality is required to become a Main Street affiliate if not already one. Specific guidance on completing a Downtown Market Analysis is available in the Center for Community and Economic Development's Downtown Market Analysis page online at: http://fyi.uwex.edu/downtown-market-analysis/
- Funding related to physical design will be the last approved activity, based on satisfactory completion of all other Planning Grant activities.

Telecommunications Planning Grants

Telecommunication planning grants are available for future system development and support or implementation efforts.

Funds may be utilized to:

- Assist in promoting awareness of potential CDBG eligible activities and gauging stakeholder interest,
- Creating a management team of potential user groups to oversee the creation of a Telecommunications Plan,
- Conduct surveying efforts to document the eligibility of future telecommunication planning and implementation efforts for CDBG funding,
- Conduct informational and training programs, and

- Identify and procure professional assistance as necessary. In order to access CDBG funds for telecommunication implementation, a locality must have completed a community-based telecommunications plan.

Up to $40,000 per project is available for Telecommunications Planning Grants. DHCD's experience is that the maximum available amount for Telecommunications Planning Grants is not sufficient to complete the activities required to create a Community Telecommunications Study.

Applicants are expected to show if additional funding is available and committed to the project prior to receiving a Planning Grant offer. Regional Project Planning Grants Project Planning Grants of up to $50,000 are available for a regional effort of more than one locality for needs analysis and strategy development.

Eligible activities include:

- Community assessments, needs analyses, and need prioritization,
- Activation and organization of target area residents and stakeholders,
- Surveys of residents, users, customers, and potential beneficiaries,
- Obtaining easements and user agreements,
- Development of cost estimates and Preliminary Engineering Reports (PERs), and
- Completion of market studies.

Proposal Evaluation

Is there a clear indication of community development needs? Proposals must demonstrate some local knowledge of the scope and scale of the community development needs in the proposed project area. Certainly, the Planning Grant investment is provided to fully assess the scope and scale of such needs, but there has to be some evidence that funding will be properly applied in a particular area because there is some good knowledge that needs exist. There must be evidence that the needs are known among potential beneficiaries and local officials. Are there potential benefits? The needs identified must generally be eligible targets for future CDBG investments. One test of eligibility is whether the need can be addressed under at least one of the three CDBG national objectives, particularly of benefit to low to moderate income (LMI) persons. Another test is whether the need can be addressed through a CDBG funding option, including Competitive Grants, the Community Development Innovation Fund, and the Community Economic Development Fund.

There must also be evidence of participation by potential beneficiaries to the extent that needs and demand can be fully assessed. Is there adequate local readiness? There must be evidence that local officials and stakeholders alike are committed to fully identifying and addressing local needs.

A management team must exist which is comprised of stakeholders and local officials. This team must agree to meet regularly to actively address issues that arise during the planning process. The locality must show a willingness to remove any barriers to addressing the identified needs, particularly those which are controlled locally. The locality must also commit financial resources to fill gaps not covered by Planning Grant assistance.

Is there adequate local capacity?

There must be evidence that the locality and management team have the time, funding, and expertise to follow through with the planning process. If local expertise is lacking, the locality must procure professional assistance. If funding is lacking, the locality must identify other sources of funding. Time cannot be lacking.

Is there a need for Planning Grant funding?

For localities that have participated extensively in the CDBG program, Planning Grant assistance should be targeted for projects which are innovative and/or unlike anything the locality has undertaken before or for components of typical projects which the locality cannot undertake with its own resources. For localities which have not participated extensively in the CDBG program, Planning Grant assistance can be targeted to a range of costs associated with obtaining community input and contracting for professional assistance. It is the locality's responsibility to adequately state its case for Planning Grant funding in its proposal.

Contract Limit Applicants must complete the initial activities of a planning grant to be under contract by August 1, 2020, in order to ensure a schedule that will prepare them for a March application date. While DHCD will work with planning grant applicants who do not meet this target date, staff are not in a position to accelerate the timeframe of the planning grant process to meet the application deadline.

SUBMISSION

Please note that planning grant applications are accepted electronically through the Agency's Centralized Application and Management System (CAMS).

CDBG Competitive Grants – Community Service Facility

COMMUNITY SERVICE FACILITY

CDBG assistance is available up to $800,000 for Community Service Facilities that are physical facilities targeting the provision of important services to low- and moderate-income persons and the greater community. CDBG funds are not to be used to construct office and/or service delivery space for local or state operated entities (like DSS, VDH, etc.). Generic "community centers", such as facilities that offer recreation and general community meeting space, are a low priority for Virginia's CDBG Program. While eligible, these types of projects usually do not rank well in our competitive evaluation process. Projects must provide targeted, directed services and programs, for which there is documented need and demand, to predominately low- and moderate-income persons. If scattered programs are being consolidated or if existing programs are seeing demand beyond that which they can fulfill and the project will address this, then the applicant should clearly describe how this project will help resolve the need.

We look for these types of projects and the services they provide to deliver palpable, measurable, positive change in the lives of the participants.

CDBG Competitive Grants – Community Facility

Community facilities include water services and wastewater services. CDBG assistance under this option is generally targeted to projects involving water and wastewater improvements, particularly those involving new services to low- and moderate-income persons. Community Facility projects are eligible for up to $1,000,000 of CDBG funding. Applications under the Comprehensive Community Development project type and which include water or sewer improvements must also complete this section. Applicants which include water and/or sewer service activities in the design of a project, regardless of the project type, must meet the following requirements:

- Service must be made available to any house within the project area that is occupied by an LMI household located within 200 feet of the distribution (water) or collector (sewer) line provided the cost of installing said connection line does not exceed $3,500. This service must be made available to said LMI household without cost to the household. This requirement does not apply to the monthly user fees based on the rates applicable to all customers.
- Water meters are required for each customer that connects to the CDBG supported utility line (mobile home park owners are considered a single customer);
- The CDBG investment per utility connection may not exceed an average of $15,000 for water service or $18,000 for sewer service.
- LMI persons cannot be charged an access fee for facilities developed using CDBG funding and neither are these fees CDBG-eligible expenses. The actual physical costs of connections will be eligible for CDBG funding.

CDBG - Open Submission Grants - COMMUNITY ECONOMIC DEVELOPMENT FUND GRANTS

The Community Economic Development Fund (CED) is designed to support economic development activities, particularly those creating employment opportunities for low- and moderate-income persons, in CDBG-eligible localities up to $700,000 will be available per project. Community Economic Development projects that are non-industrial and will have a regional impact are eligible for up to $1,200,000 in CDBG assistance. Projects assisting businesses which cannot commit to providing a post-probationary wage of at least 1.5 times the minimum wage to 90 % of all employees hired as a result of the CDBG investment may be eligible for CDBG funding limited to 50 percent of project costs up to $350,000.

For all CED's an irrevocable Letter of Credit, bond, or other guaranteed form of security will be required in the amount of the CED grant. This security must remain in place until all program requirements are satisfactorily met.

JOB CREATION AND RETENTION

The Job Creation and Retention targets projects with job creation resulting from commercial enterprises, sheltered workshops, or other non-basic industries, or projects with job retention by basic and non-basic industries. CDBG assistance under Job Creation and Retention is available for on-site or off-site assistance. Applicants must prove a clear need for the off-site improvements and show justification for their scope and scale through Preliminary Engineering Reports and other analyses.

SITE REDEVELOPMENT

This project category targets sites which have been rendered unmarketable or unusable by previous uses and which have conditions having an impact beyond the boundaries of the site. CDBG assistance may be utilized to correct identified conditions, provided they are justified as blight in accordance with earlier guidance. Applicants must detail the conditions and demonstrate local consensus that the conditions, real or perceived, exist and that addressing these conditions is a local priority. Treatment of these conditions must result in increased potential for investment on and surrounding the site. Applicants must show the difference in the property value, before and after the project, with pre and post appraisals, unless an alternative method is negotiated with and approved by DHCD. In the event the post appraisal does not support the increase in value of the property, DHCD reserves the right to request other measures of the values, including, but not limited to, the sales price, additional appraisals, etc., in order to determine if undue or inappropriate benefit of public funds is likely to accrue to a private, for-profit entity. All CDBG funding spent on these projects, save for administrative costs, and must be recovered upon sale or long-term lease of the site or building to a private sector entity which will create the required jobs. Full recovery of the funds must occur within one year of the completion of construction activities. Activities may include:

- Modification to or demolition of structures existing on these sites;
- Targeting more than one site under a single project if it can be demonstrated that the accumulation of these sites has a single identity and/or each individual site has conditions which impact beyond its boundaries. Site conditions and corrections for these conditions should be determined through stakeholder participation. Eligible activities beyond elimination of blighting conditions may include:
- Real property acquisition;
- Future use planning

DEVELOPMENT READINESS

This category allows for the completion of improvements which will result in the creation of businesses and job opportunities providing primary benefit to low- and moderate-income persons. The focus of this category is on removing barriers to economic investment, particularly in areas of distress. Two such barriers are as follows: 1) The existence of previously used sites and structures for which reuse for economically beneficial activities is not cost effective in comparison to development or construction on a new site. 1) The lack of building space to accommodate business location or expansion and the prohibitive cost of constructing or adaptively reusing space, especially for small businesses.

This category seeks to address these barriers directly by making resources available for site redevelopment and for commercial building development. In instances where the proposed site or building is publicly owned, eligible activities include:

- Acquisition,
- Site preparation,
- On-site and incidental off-site infrastructure,
- Architectural and engineering costs,
- Building rehabilitation or construction, and
- Administration.

All CDBG funding spent on these projects, save for administrative costs, and must be recovered upon sale or long-term lease of the site or building to a private sector entity which will create the required jobs. Full recovery of the funds must occur within one year of the completion of construction activities. Failure to secure a private sector entity to purchase or lease the improvements within the required time period will result in the administrative and construction costs being repaid by the locality. Recovered funds will be regarded as disallowed costs and will be subject to the Program Income policy.

The availability and amount of CDBG funding will depend upon the number of jobs projected to be created and the economic strength of applicant localities.

Applicants seeking to apply for funding under the Local Diversification criteria must contact DHCD prior to the submission of a request for funding. Only CDBG-eligible localities may secure funding for development readiness activities. These localities may implement these activities directly using available funding or may lend these funds to a local or regional non-profit economic development entity which will implement the activities. Such an entity must have the capacity to borrow and administer Federal funds for economic development purposes.

Requests for CDBG funding should be accompanied by a comprehensive marketing strategy for growing and/or attracting businesses and creating employment, primarily through basic industries. The strategy must identify one or more sectors or industries at which marketing efforts will be aimed. The CDBG assisted site or building should have a prominent position in the strategy. The strategy must be supported by a marketing program and an organization that is financially and technically capable of conducting the marketing.

Applicants for development readiness assistance must demonstrate that public benefit will result from the CDBG investment and that there is a clear relationship between the proposed site or building improvements and existing economic development strategies. Only under the Development Readiness category are somewhat speculative physical improvements permitted since these improvements are treated as loans to the locality. All Development Readiness projects must have an irrevocable Letter of Credit, bond, or other guaranteed form of security will be required in the amount of the CDBG grant. This security must remain in place until all program requirements are satisfactorily met. Physical improvements under all other economic development categories must be consistent in scope and scale with the underlying needs identified.

Applications will be received on an open basis from January 1, 2020, through September 30, 2020. Assistance is limited to projects involving employment creation by private, for-profit basic industries. Assistance may include off-site improvements such as water lines, sewer lines, roads, and drainage. On-site assistance may be eligible in some projects, but these projects are subject to underwriting.

Categories and Thresholds

The nature of the financial assistance available under the CED Fund varies depending on the economic strength of the applicant localities. CDBG-eligible localities, excluding Towns, are placed in one of three categories: Distressed Transitional, and Competitive. Towns which are fully contained within a county are in the same category as the surrounding county. Towns which are divided among two counties are in the same category as the county with the least economic strength. Localities were placed in a category based on the relative position of local statistics to statewide statistics for each of three economic factors. The factor titles, sources of factor data, and delineations within each factor are as follows: Localities receive two points for each factor in which they met distressed levels, one point for each factor at Transitional levels, and no points for each factor at Competitive levels. A table of locality statistics and scores is included as APPENDIX C.

Localities with 5 or more points are distressed. Localities with 2 to 4 points are Transitional. Localities with 1 point or less are Competitive.

THRESHOLDS

The thresholds for CDBG assistance in distressed localities are as follows:

- The subject business must create at least 10 full-time positions,
- The subject business must make a private investment of at least $100,000, and
- The subject business must provide a post-probationary wage of at least 1.5 times the minimum wage for 90% of all new employees and provide an employment benefits package that includes, at a minimum, basic medical coverage, and insurance. The post-probationary period must not exceed six months.

ASSISTANCE FOR BUSINESSES

Unless the assisted business will be diversifying the local economy the following conditions apply:

- CDBG assistance for site improvements is eligible for no more than 80 percent of the total project costs,
- Local financial participation must total at least 25 percent of the CDBG eligible costs. Administrative costs may not be included as part of the local financial participation, and
- CDBG assistance is available at up to $25,000 per job created.

ASSISTANCE FOR LOCAL ECONOMIC DIVERSIFICATION

If the assisted business is involved in the value-added manufacturing or re-manufacturing and reuse of indigenous raw materials (from the region and/or Virginia), the provision of goods or services not previously available locally, and/or the provision of goods or services that are divergent from the local norm, the following conditions apply:

- CDBG assistance for site improvements is eligible for up to 100 percent of total project costs. The locality is still required to provide local financial participation in the project equivalent to at least 25 percent of the CDBG funds,
- Local financial participation must total at least 25 percent of the CDBG eligible costs. Administrative costs may not be included as part of the local financial participation,
- CDBG assistance is available at up to $25,000 per job to be created.
- Applicants seeking to apply for funding under the Local Diversification criteria must contact DHCD prior to the submission of a request for funding.

US Army Corp of Engineers
Continuing Authorities Program

The Corps' Continuing Authorities Program (CAP) is a group of nine legislative authorities under which the Corps of Engineers can plan, design, and implement certain types of water resources projects without additional project specific congressional authorization. The purpose of the CAP is to plan and implement projects of limited size, cost, scope, and complexity. The table below lists the CAP authorities and their project purposes.

All projects in this program include a feasibility phase and an implementation phase. Planning activities, such as development of alternative plans to achieve the project goals, initial design and cost estimating, environmental analyses, and real estate evaluations, are performed during the feasibility phase, to develop enough information to decide whether to implement the project. The feasibility phase is initially Federally funded up to $100,000. Any remaining feasibility phase costs are shared 50/50 with the non-Federal sponsor after executing a feasibility cost sharing agreement (FCSA). The final design, preparation of contract plans and specifications, permitting, real estate acquisition, project contracting and construction, and any other activities required to construct or implement the approved project are completed during the implementation phase. The Corps and the non-federal sponsor sign a project partnership agreement (PPA) near the beginning of the implementation phase. Costs beyond the feasibility phase are shared as specified in the authorizing legislation for that section.

AUTHORITY	PROJECT PURPOSE
Section 14, Flood Control Act of 1946, as amended	Streambank and shoreline erosion protection of public works and non-profit public services
Section 103, River and Harbor Act of 1962, as amended (amends Public Law 79-727)	Beach erosion and hurricane and storm damage reduction
Section 107, River and Harbor Act of 1960, as amended	Navigation improvements
Section 111, River and Harbor Act of 1968, as amended	Shore damage prevention or mitigation caused by Federal navigation projects
Section 204, Water Resources Development Act of 1992, as amended	Beneficial uses of dredged material
Section 205, Flood Control Act of 1948, as amended	Flood control
Section 206, Water Resources Development Act of 1996, as amended	Aquatic ecosystem restoration
Section 208, Flood Control Act of 1954, as amended (amends Section 2, Flood Control Act of August 28, 1937)	Removal of obstructions, clearing channels for flood control
Section 1135, Water Resources Development Act of 1986, as amended	Project modifications for improvement of the environment

An example of CAP program in Virginia is the construction of the Tangier Jetty Project, approximately 685-foot-long stone jetty at the entrance of the Tangier Island Federal Navigation Channel, located on the western side of the Tangier Island. This is a Continuing Authorities Project under Section 107, which is designated for Navigation Improvement projects. The project is cost shared 90/10 between the federal government and a local sponsor, the Virginia Marine Resources Commission. The Norfolk District, U.S. Army Corps of Engineers awarded a contract for more than $2.9 million to Gloucester-based Coastal Design & Construction Inc.

Another example of the CAP program in Virginia is the Cedar Island beneficial use of dredge material project on the Eastern Shore. This is a Continuing Authorities Project Continuing under Section 204 of the Water Resources Development Act provides for the beneficial use of dredged material from an authorized federal navigation channel for the protection, restoration, and creation of aquatic and related habitats. The project will enhance, expand, and protect the Cedar Island back-barrier shoreline wetlands and marsh islands by:

- Reducing the current rate of tidal wetland shoreline and marsh island degradation and loss,
- Expanding and enhancing the existing wetlands and marsh islands to enhance fish habitat, fishery resources, and wildlife habitat,
- Increasing the area of intertidal mudflat habitat to provide increased foraging opportunities for avian fauna,
- Creating long-term, sustainable solutions to reduce tidal wetland erosion rates, increase sediment accretion rates, and increase shoreline protection,
- Enhancing existing shoreline protection to the town of Wachapreague through wetland marsh island creation, enhancement and protection, and
- Adaptively manage dredged material placement sites in response to the constantly fluxing ecosystem under the continual threats of such erosion, subsidence and sea-level rise.

The Corps of Engineers funding of this $11.2 M project represents 65% of the cost, $7.3M. With the remaining no-federal share being provided by the Virginia Marine Resources Commission.

US Army Corp of Engineers
Chesapeake Bay Environmental Restoration and Protection Program (Section 510)

AUTHORIZATION: Section 510 of Water Resources Development Act (WRDA) 1996, as amended by Section 5020 of WRDA 2007 and Section 4010(a) of WRRDA 2014.

TYPE OF PROGRAM: Environmental (Ecosystem Restoration and Protection)

CONTRIBUTION TO CHESAPEAKE BAY: Directly contributes to achieving protection and restoration goals established by the 2009 Executive Order 13508 and the 2014 Chesapeake Bay Program Agreement by restoring clean water, recovering habitat, and sustaining fish and wildlife.

BACKGROUND: This program authorizes the Corps to design and construct water-related resource protection and restoration projects within the Chesapeake Bay watershed. Project types include projects for sediment and erosion control; protection of eroding shorelines; ecosystem restoration, including restoration of submerged aquatic vegetation; protection of essential public works; beneficial uses of dredged material; and other related projects that may enhance the living resources of the estuary.

Costs are shared 75 percent federal and 25 percent non-federal. The cost of operation, maintenance, repair, replacements and rehabilitation is 100 percent non-federal.

The Corps' Dec. 8, 2015, implementation guidance for Section 1040(a) of WRDA 2014 limits the total cost of a project to $10M and aligns implementation with guidance used for projects under the Continuing Authorities Program (i.e., conduct of a feasibility level analysis to recommend project implementation under a cost-shared design and construction Project Partnership Agreement).

US Army Corps of Engineers
Project Modifications to Improve the Environment (Section 1135)

Section 1135 of the Water Resources Development Act of 1986, as amended, provides the authority to modify existing Corps projects to restore the environment and construct new projects to restore areas degraded by Corps projects.

The maximum federal expenditure per project is $5 million, which includes both planning and construction costs. Projects exceeding $5 million must be specifically authorized by Congress. Project costs are shared 75% federal, 25% nonfederal. Costs of lands, easements, and rights-of-way are non-federal and are creditable towards the 25% non-federal cost share. Section 1135 also allows credit for certain works in-kind, including provision of materials and construction activities. Contributions, such as volunteer labor, can also be accepted to reduce the overall project cost. The non-federal sponsor must assume responsibility for operation and maintenance of the project upon completion.

The Corps does environmental restoration in areas that require modification to the hydrologic regime, in other words, areas of water, such as rivers, lakes, and wetlands. The Corps evaluates projects that benefit the environment through restoring, improving, or protecting habitat for plants, fish and wildlife.

After an eligible non-federal sponsor requests assistance, the Corps will conduct a preliminary study to determine if the problem may have a federal interest. If the Corps' headquarters office approves this effort, a feasibility study begins at federal expense. In the feasibility study the problem is defined, potential solutions are identified, the costs, benefits, and environmental impacts of the alternatives are analyzed, and a plan is chosen. In addition to the study, a project cooperation agreement (PCA) is drawn up by which the federal government and the sponsor agree to share project costs. No more than 2 years should pass between the start of the study and the time the project is ready for construction. Projects with an estimated federal cost of $1,000,000 or less may be expedited allowing for a project to be completed in 18 months or less.

Sponsors include public agencies such as cities, local improvement districts, and watershed groups, private interests if no future operation and maintenance is required, and large national nonprofit organizations if they can commit to future operation and maintenance. The non-federal sponsor must have the legal and financial capability to fulfill the requirements of cost sharing and local cooperation.

The sponsor generally must agree to the following:

- Provide all lands, easements, rights-of-way, relocations, and dredged material disposal areas.
- Provide any additional cash contributions needed to make the local sponsor's share of the cost 25 percent.
- Hold and save the United States free from damages due to the construction and maintenance of the project, except damages due to fault or negligence of the United States or its contractors;
- Provide all access routes and relocations of utilities necessary for project construction and subsequent operation and maintenance;
- Comply with provisions of pertinent federal acts in carrying out the specified nonfederal responsibilities of the project;
- Contribute in cash the local share of project planning and construction cost;
- Maintain and operate all the non-federal works after completion in accordance with regulations prescribed by the Secretary of the Army.

US Department of Commerce – Economic Development Administration (EDA)
Public Works and Economic Adjustment Assistance (EAA) Programs

EDA's Public Works and Economic Adjustment Assistance (EAA) programs provide economically distressed communities and regions with comprehensive and flexible resources to address a wide variety of economic needs. Projects funded by these programs will support work in Opportunity Zones and will support the mission of the Department by, among other things, leading to the creation and retention of jobs and increased private investment, advancing innovation, enhancing the manufacturing capacities of regions, providing workforce development opportunities, and growing ecosystems that attract foreign direct investment.

EDA solicits applications from applicants in order to provide investments that support construction, non-construction, planning, technical assistance, and revolving loan fund projects under EDA's Public Works program and EAA programs. Grants and cooperative agreements made under these programs are designed to leverage existing regional assets and support the implementation of economic development strategies that advance new ideas and creative approaches to advance economic prosperity in distressed communities.

Economic Development Administration (EDA)
Public Works Program

The Public Works funding from EDA empowers distressed communities to revitalize, expand, and upgrade their physical infrastructure to attract new industry, encourage business expansion, diversify local economies, and generate or retain long-term, private sector jobs and investment.

What does the Public Works program do?

EDA's Public Works program helps distressed communities revitalize, expand, and upgrade their physical infrastructure. This program enables communities to attract new industry; encourage business expansion; diversify local economies; and generate or retain long-term, private-sector jobs and investment through the acquisition or development of land infrastructure improvements needed for the successful establishment or expansion of industrial or commercial enterprises.

What kind of public works projects does EDA fund?

EDA Public Works program investments help facilitate the transition of communities from being distressed to becoming competitive by developing key public infrastructure, such as technology-based facilities that utilize distance learning networks, smart rooms, and smart buildings; multitenant manufacturing and other facilities; business and industrial parks with fiber optic cable; and telecommunications and development facilities. In addition, EDA invests in traditional public works projects, including water and sewer systems improvements, industrial parks, business incubator facilities, expansion of port and harbor facilities, skill-training facilities, and brownfields redevelopment.

What criteria are used in determining which projects receive planning grants?

- The project's demonstrated alignment with at least one of EDA's current investment priorities; 1) Recovery & Resilience: Projects that assist with economic resilience (including business continuity and preparedness) and long-term recovery from natural disasters and economic shocks to ensure U.S. communities are globally competitive. 2) Critical Infrastructure: Projects that establish the fundamental building blocks of a prosperous and innovation-centric economy and a secure platform for American business, including physical (e.g., broadband, energy, roads, water, sewer) and other economic infrastructure. 3) Workforce Development & Manufacturing: Projects that support the planning and implementation of infrastructure for skills-training centers and related facilities that address the hiring needs of the business community -- particularly in the manufacturing sector -- with a specific emphasis on the expansion of apprenticeships and work-and-learn training models. Also includes projects that encourage job creation and business expansion in manufacturing, including infrastructure-related efforts that focus on advanced manufacturing of innovative, high-value products and enhancing manufacturing supply chains. 4) Exports & FDI: Primarily infrastructure projects that enhance community assets (e.g., port facilities) to support growth in U.S. exports and increased foreign direct investment—and ultimately the return of jobs to the United States. 5) Opportunity Zones: Planning and implementation projects aimed at attracting private investment – including from Opportunity Funds – to grow businesses and create jobs in Census tracts that have been designated as Opportunity Zones. This includes targeted projects located within an Opportunity Zone; projects that, while not located within an Opportunity Zone, have a clear intent of benefitting nearby Opportunity Zone(s); and regional projects that encompass an area containing at least one Opportunity Zone with a clear intent of benefitting that Opportunity Zone. Opportunity Zones are designed to spur economic development by providing tax benefits to investors.
- The project's potential to increase the capacity of the community or region to promote job creation and private investment in the regional economy,
- The likelihood that the project will achieve its projected outcomes,
- Ability of the applicant to successfully implement the proposed project, including the applicant's financial and management capacity and the applicant's capacity to secure the support of key public and private sector stakeholders.

Economic Development Administration (EDA)
Economic Adjustment Assistance (EAA)

Assists state and local interests in designing and implementing strategies to adjust or bring about change to an economy. The program focuses on areas that have experienced or are under threat of serious structural damage to the underlying economic base. Under Economic Adjustment, EDA administers its Revolving Loan Fund (RLF) Program, which supplies small businesses and entrepreneurs with the gap financing needed to start or expand their business.

What does the Economic Adjustment Assistance (EAA) program do?

The EAA program provides a wide range of technical, planning, and public works and infrastructure assistance in regions experiencing adverse economic changes that may occur suddenly or over time. These adverse economic impacts may result from a steep decline in manufacturing employment following a plant closure, changing trade patterns, catastrophic natural disaster, a military base closure, or environmental changes and regulations.

Who may benefit from EAA and what will such funding do to promote economic development?

The EAA program can assist state and local entities in responding to a wide range of economic challenges through:

- Strategy Grants to support the development, updating or refinement of a Comprehensive Economic Development Strategy (CEDS),
- Implementation Grants to support the execution of activities identified in a CEDS, such as infrastructure improvements, including site acquisition, site preparation, construction, rehabilitation and equipping of facilities.

Specific activities may be funded as separate investments or as multiple elements of a single investment.

Why is it advantageous to apply for EAA funding?

The EAA program is EDA's most flexible program. Under the EAA program, EDA can fund market and environmental studies, planning or construction grants, and capitalize or recapitalize revolving loan funds (RLFs) to help provide small businesses with the capital they need to grow.

What criteria are used in determining which projects receive EAA grants?

- The ability of the proposed project to realistically achieve the desired results and catalyze additional resources;
- The ability of a project to start quickly and create jobs faster;
- The extent to which the project will enable the community/region to become more diversified and more economically prosperous;
- The relative economic distress of the region;
- The applicant's performance under previous Federal financial assistance awards, including whether the grantee submitted required performance reports and data;
- The comparative feasibility of the applicant to achieve the outcomes identified in the application;

Economic Development Administration (EDA)
2018 and 2019 Disaster Supplemental Assistance

The Economic Development Administration (EDA) has made $587 million available each year to eligible grantees in communities impacted by natural disasters in 2017 and 2018 and Floods.

This investment assistance will help communities and regions devise and implement long-term economic recovery strategies through a variety of non-construction and construction projects, as appropriate, to address economic challenges in areas where a Presidential declaration of a major disaster was issued "as a result of Hurricanes Florence, Michael, and Lane...". To be competitive, applications must clearly incorporate principles for enhancing the resilience of the relevant community/region or demonstrate the integration of resilience principles into the investment project itself. Resilience is an essential component of any strategy for mitigating the potential for future disaster-related losses and adverse economic impacts for communities. Therefore, inclusion of resilience principles in the project is a necessary step to improve the capacity of the region to recover more quickly from future disaster events. Applicants must include a narrative attachment as a part of their application materials, describing in detail the nexus between their proposed project scope of work and disaster recovery and resilience efforts. The strength of the nexus to the disaster is drawn from the consequences of the relevant disaster(s) and the intended project outcomes that fulfill the community's specific post-disaster needs.

USDA – Rural Development
Community Facilities Direct Loan & Grant Program

What does this program do?

This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial, or business undertakings.

What is an eligible area?

Rural areas including cities, villages, townships, and towns including Federally Recognized Tribal Lands with no more than 20,000 residents according to the latest U.S. Census Data are eligible for this program.

How may funds be used?

Funds can be used to purchase, construct, and / or improve essential community facilities, purchase equipment and pay related project expenses.

Examples of essential community facilities include:

- Community support services such as childcare centers, community centers, fairgrounds or transitional housing
- Public safety services such as fire departments, police stations, prisons, police vehicles, fire trucks, public works vehicles or equipment
- Educational services such as museums, libraries, or private schools
- Utility services such as telemedicine or distance learning equipment

For a complete list see Code of Federal Regulations 7 CFR, Part 1942.17(d) for loans; 7 CFR, Part 3570.62 for grants.

What kinds of funding are available?

- Low interest direct loans
- Grants
- A combination of the two above, as well as our loan guarantee program. These may be combined with commercial financing to finance one project if all eligibility and feasibility requirements are met.

What are the funding priorities?

- Priority point system based on population, median household income
  - Small communities with a population of 5,500 or less
  - Low-income communities having a median household income below 80% of the state nonmetropolitan median household income.

What are the terms?

Funding is provided through a competitive process.

Direct Loan:

- Loan repayment terms may not be longer than the useful life of the facility, state statutes, the applicant's authority, or a maximum of 40 years, whichever is less.
- Interest rates are set by Rural Development, contact us for details and current rates.
- Once the loan is approved, the interest rate is fixed for the entire term of the loan, and is determined by the median household income of the service area and population of the community.
- There are no pre-payment penalties.

Grant Approval:

Applicant must be eligible for grant assistance, which is provided on a graduated scale with smaller communities with the lowest median household income being eligible for projects with a higher proportion of grant funds. Grant assistance is limited to the following percentages of eligible project costs: Maximum of 75 percent when the proposed project is:

- Located in a rural community having a population of 5,000 or fewer; and
- The median household income of the proposed service area is below the higher of the poverty line or 60 percent of the State nonmetropolitan median household income.

Maximum of 55 percent when the proposed project is:

- Located in a rural community having a population of 12,000 or fewer; and
- The median household income of the proposed service area is below the higher of the poverty line or 70 percent of the State nonmetropolitan median household income.

Maximum of 35 percent when the proposed project is:

- Located in a rural community having a population of 20,000 or fewer; and
- The median household income of the proposed service area is below the higher of the poverty line or 80 percent of the State nonmetropolitan median household income.

Maximum of 15 percent when the proposed project is:

- Located in a rural community having a population of 20,000 or fewer; and
- The median household income of the proposed service area is below the higher of the poverty line or 90 percent of the State nonmetropolitan median household income. The proposed project must meet both percentage criteria. Grants are further limited.
- Grant funds must be available.

Are there additional requirements?

- Applicants must have legal authority to borrow money, obtain security, repay loans, construct, operate, and maintain the proposed facilities
- Applicants must be unable to finance the project from their own resources and/or through commercial credit at reasonable rates and terms
- Facilities must serve rural area where they are/will be located
- Project must demonstrate substantial community support
- Environmental review must be completed/acceptable

US Department of Agriculture – Rural Development
Community Facility Direct Loan and Grant Program

What does this program do?

The Agency will make grants to public bodies and private nonprofit corporations, (such as States, counties, cities, townships, and incorporated towns and villages, boroughs, authorities, districts, and Indian tribes on Federal and State reservations) to provide associations Technical Assistance and/or training with respect to essential community facilities programs. The Technical Assistance and/or training will assist communities, Indian Tribes, and Nonprofit Corporations to identify and plan for community facility needs that exist in their area. Once those needs have been identified, the Grantee can assist in identifying public and private resources to finance those identified community facility needs.

Who may apply for this program?

- Public bodies

What is an eligible area?

Rural areas including cities, villages, townships, towns, and Federally Recognized Tribal Lands outside the boundaries of a city of 20,000 or more.

How may funds be used?

- Assist communities in identifying and planning for community facility needs;
- Identify resources to finance community facility needs from public and private sources;
- Prepare reports and surveys necessary to request financial assistance to develop community facilities;
- Prepare applications for Agency financial assistance;
- Improve the management, including financial management, related to the operation of community facilities; or
- Assist with other areas of need identified by the Secretary.

What kind of funding is available?

- Maximum grant award is $150,000.
- Grant funds are limited and are awarded through a competitive process

Are matching funds required?

- Matching funds are not required but preference is giving to applications with cash matching funds.
- In-kind contributions cannot be used as matching funds
- Partnerships with other federal, state, local, private and nonprofit entities are encouraged

How do we get started?

- Applications are accepted on an annual basis through a Notice of Funding Availability (NOFA) in the Federal Register
- Program Resources are available online (includes forms needed, guidance, certifications etc.)

US Department of Agriculture – Rural Development
Community Facilities Technical Assistance and Training Grant

The Technical Assistance and/or training grant assists localities to identify and plan for essential community facility needs that exist in their community. The grants can be used to:

- Identify resources to finance community facility needs from public and private sources;
- Prepare reports and surveys necessary to request financial assistance to develop community facilities;
- Prepare applications for Agency financial assistance;
- Improve the management, including financial management, related to the operation of community facilities; or

- Assist with other areas of need.

Grant funds are awarded through a competitive process with the maximum grant award of $150,000. Cash match is not required but preference is giving to applications have cash match.

Applications are accepted annually.

Department of Conservation and Recreation (DCR)
Virginia Community Flood Preparedness Fund (CFPF)

Virginia Community Flood Preparedness Fund to local governments per §10.1-603.25 et seq. of the Code of Virginia and as required by the Clean Energy and Community Flood Preparedness Act (the Act) authorizes loans but the first grant round will be for grants only. The manual describes three categories that are eligible to receive grant funds. The three grant categories are: Capacity Building and Planning, Projects, and Studies. The initial grant round makes $18M available with two additional funding rounds anticipated before February 2022 totaling approximately $40M.

The Fund was established to provide support for regions and localities across Virginia to reduce the impacts of flooding, including flooding driven by climate change. The Fund will prioritize projects that are in concert with local, state, and federal floodplain management standards, local resilience plans, and the Virginia Coastal Resilience Master Plan. The Fund will empower communities to complete vulnerability assessments and develop and implement action-oriented approaches to bolster flood preparedness and resilience. The following conditions shall apply to the use of moneys allocated from the Fund:

1. Localities shall use moneys in the Fund primarily for the purpose of implementing flood prevention and protection projects and studies in areas that are subject to recurrent flooding as confirmed by a locality-certified floodplain manager.
2. Moneys in the Fund may be used to mitigate future flood damage and to assist inland and coastal communities across the Commonwealth that are subject to recurrent or repetitive flooding.
3. No less than 25 percent of the moneys disbursed from the Fund each year shall be used for projects in low-income geographic areas (80% of median household income).
4. Priority shall be given to projects that implement community-scale hazard mitigation activities that use nature-based solutions to reduce flood risk.

Applications will be accepted beginning (06/04/2021) and ending at 4:00 p.m. on (09/03/2021) for the first round of funding.

Appendix F: Loan Program Descriptions

Virginia Resources Authority
Virginia Pooled Financing Program ("VPFP")

Frequently Asked Questions

1. Who is eligible to borrow through the VPFP?

Pursuant to Section 62.1-197 et seq. of the Code of Virginia of 1950, as amended (the "VRA Act"), any county, city, town, municipal corporation, authority, district, commission, or political subdivision created by the General Assembly or pursuant to the Constitution and laws of the Commonwealth of Virginia can borrow funds from VRA through the VPFP.

2. What are the benefits of borrowing through the VPFP?

There are many value-added benefits to borrowing through the VPFP, including: "AAA/AA" interest rates, reliable and consistent capital market access, custom-tailored loan structures, economies of scale through shared issuance costs, loan terms up to 30 years, a straightforward and administratively easy loan process, and a highly customer service-oriented VRA staff to assist you from loan application through loan closing.

3. What types of projects are eligible for financing through the VPFP?

Under the VRA Act, the General Assembly has authorized VRA to finance capital projects in 18 different areas: public safety, transportation, wastewater, flood prevention and dam safety, solid waste, water, former federal facility development, brownfield remediation, airports, land conservation and recreation, broadband, parks and recreation, local government buildings, energy, site acquisition and development for economic and community development, administrative and operations systems, oyster restoration, defective drywall correction and restoration, and dredging. Loan authorization is subject to credit approval by VRA. Project eligibility is subject to approval by VRA, with the advice of VRA's bond counsel, and VRA may recommend different financing programs for certain types of projects.

4. Is capitalized interest available?

Yes, subject to certain limitations under the VRA Act and IRS regulations.

5. What is the maximum loan term?

Project financing is available for up to 30 years through the VPFP, based on the useful life of the asset(s) being financed.

6. Can a borrower refinance existing debt?

Yes, if the existing debt financed a qualified project under the VRA Act. See question 3 for a list of eligible projects.

7. When are loan funds available?

Loan funds are available for disbursement on and after the closing date of the VPFP bond issuance, upon completion and submission of a loan requisition and supporting invoice documentation. VPFP bonds are issued, at a minimum, each spring and fall with funds available typically in late May and mid-November.

8. How are VPFP loans funded?

VRA obtains funds for borrowers through the issuance and sale of VPFP bonds in the public debt markets. VRA issues bonds, at a minimum, each spring and fall using a senior and junior lien structure under the VPFP master indenture of trust. VRA issues two types of bonds under the VPFP: Infrastructure Revenue Bonds (senior lien) and State Moral Obligation Bonds (junior lien).

The senior-lien Infrastructure Revenue Bonds represent approximately 70% of the total bonds issued in each VPFP bond transaction and have a first lien on 100% of the borrower loan repayments. This structure provides approximately 1.43x coverage for all of the Infrastructure Revenue Bonds.

The junior-lien State Moral Obligation Revenue Bonds represent approximately 30% of the bonds issued in each VPFP bond transaction and have a legal claim to the remaining loan repayments, after payment of the VPFP Infrastructure Revenue Bonds. This structure generates 1.00x coverage for all of the State.

Moral Obligation Bonds. In addition, all of the State Moral Obligation Bonds are supported by the moral obligation of the Commonwealth of Virginia, whereby the Commonwealth has pledged to refill any draws on the Capital Reserve Fund established under the master indenture of trust. The Capital Reserve Fund is pledged only to support the State Moral Obligation Bonds.

9. Where are loan proceeds invested during the construction / drawdown period?

While not mandatory, VPFP loan proceeds are typically invested in the Virginia State Non-Arbitrage Program ("SNAP") during the project construction period.

Please visit: https://www.vasnap.com/ for more information on SNAP. VPFP borrowers have the ultimate determination on the investment of loan proceeds during the construction / drawdown period, subject to IRS regulations, as applicable.

10. What costs are associated with borrowing through the VPFP?

Fees associated with borrowing through the VPFP include: (1) an upfront fee, payable at closing and equal to 0.125% of the par amount of the loan, and (2) an on-going annual administration fee of 0.125% based on the outstanding loan balance and payable semi-annually. VRA does not assess an upfront fee when refunding existing VRA debt obligations for debt service savings.

VPFP borrowers share the costs of issuance related to the bond issue and include: VRA bond counsel fees, VRA financial advisor fees, printing of the final official statement, electronic posting of the preliminary and final official statement, rating agency fees, trustee and trustee counsel fees, and verification agent fees, if applicable.

After loan closing, VPFP borrowers are assessed annual trustee fees and arbitrage rebate calculation fees, if applicable.

11. How are interest rates set for VPFP loans?

When VRA issues VPFP bonds, the interest rates obtained based on the program's "AAA/AA" ratings are passed through to the underlying borrower loans, plus VRA's on-going annual administration fee of 0.125% of the outstanding loan balance.

12. Are interest rates fixed for the life of the loan?

Yes, interest rates on VPFP loans are fixed for the life of the loan.

13. What are the payment dates for VPFP loans?

Local loan payments are made 30 days in advance of VRA VPFP payments, which are made each May 1st and November 1st. VPFP local loan principal is paid annually on each October 1st and interest is paid semi-annually on each April 1st and October 1st

14. How are credit decisions made with respect to the VPFP?

VRA has an internal credit committee, which meets weekly to discuss and authorize loan requests made by borrowers. The credit committee reviews the in-depth credit analysis completed by VRA staff regarding the loan request within the context of loan underwriting guidelines, which have been approved by VRA's Portfolio Risk Management Committee of the Board of Directors and the VRA Board of Directors. A complete list of VRA's loan underwriting guidelines can be found by visiting: https://www.virginiaresources.gov/page/policies-&-procedures/

15. What are the security options for VPFP loans?

VPFP loans are secured through local obligations, which are typically evidenced by local bonds or financing leases. Local bonds are typically issued and secured as general obligation local bonds, revenue local bonds, or double barrel local bonds (consisting of a revenue pledge, supplemented by an additional general or moral obligation pledge of a borrower).

Financing leases include real estate or equipment collateral.

All local obligations are subject to review and approval of VRA and its bond counsel.

16. Can loans be prepaid or redeemed?

VPFP bonds are typically issued with an optional redemption provision beginning ten years after issuance. VPFP borrower loans carry the same redemption provisions as the corresponding VPFP bonds. VRA does research on an on-going basis to determine if any of the various outstanding VRA bond issues are showing savings. When we find that one or more bond maturities are showing savings, we offer the ability to refund / defease VPFP local loans, subject to IRS regulations as applicable.

17. Does a borrower have to be rated by one of the major rating agencies to participate in the VPFP?

Borrowers are not required to have public debt ratings as a prerequisite to borrow from the VPFP; however, where the participation of an unrated borrower has the potential to impact the existing public debt rating of the VPFP due to loan size or certain other conditions, VRA reserves the right to require that a borrower obtain a rating from Moody's and/or Standard & Poor's as a condition of loan approval.

18. Is continuing disclosure required of VPFP borrowers?

VRA requires annual submission of certain borrower documents for loan monitoring purposes, such as comprehensive annual financial reports and insurance certificates among others; however, continuing disclosure is only required if a borrower's aggregate outstanding debt in the VPFP is equal to or greater than 15% of the total loan obligations outstanding in the program, resulting in the borrower being considered a "material obligor" under the master indenture of trust. There are currently no "material obligors" in the VPFP.

19. What are the current VPFP ratings?

VPFP Infrastructure Revenue Bonds are rated "Aaa" by Moody's and "AAA" by Standard & Poor's. VPFP State Moral Obligation Bonds are rated "Aa1" by Moody's and "AA" by Standard & Poor's.

20. Are VPFP official statements and continuing disclosure documents available?

VPFP official statements and continuing disclosure documents can be accessed by visiting: https://emma.msrb.org/IssuerHomePage/Issuer?id=24707E02D7364632E053151E6E0ACACC

21. Is there a maximum or minimum amount that can be borrowed?

The authorization of a VPFP loan is primarily driven by a borrower's debt capacity and project affordability. There is no specific loan maximum to the extent a borrower's VPFP debt exposure does not have an impact on VRA's program ratings or significantly impair the moral obligation debt capacity extended to VRA by the Commonwealth of Virginia.

Due to the costs associated with issuing bonds in the public debt markets, VPFP loans of less than $750,000 may not provide the most cost effective means of financing. Please contact VRA about your specific project needs for more details.

22. Where are the applications for the VPFP located?

Online applications and downloadable application materials can be found by visiting

https://www.virginiaresources.gov/page/virginia-pooled-financing-program/ or by contacting Peter D'Alema, Director of Program Management at 804-616-3446 or

pdalema@virginiaresources.org, Kim Adams, Program Manager at 804-616-3449 or kadams@virginiaresources.org, or Jon Farmer, Financial Analyst at 804-616-3447 or jfarmer@virginiaresources.org .

23. What are the application deadlines for VPFP transactions?

Application deadlines for the VPFP can be found by visiting:

https://www.virginiaresources.gov/page/virginia-pooled-financing-program/

The VPFP application deadline for the spring pooled transaction is typically the first Friday in February, and the VPFP application deadline for the fall pooled transaction is typically the first Friday in August. Applications are typically accepted through May 1st when VRA offers a summer transaction.

24. How long is the process between loan application and loan closing?

VPFP loans typically close within 120 days of the application deadline.

25. What is the general process between loan application and loan closing?

The primary activities between VPFP loan application and loan closing typically include:

- Upon receipt of a VPFP application, VRA coordinates a due diligence conference call or meeting with the borrower's financing team (i.e. local bond counsel, local financial advisor, etc.). The due diligence conference call will discuss the project to be financed and VRA's financing schedule for the transaction.
- VRA staff will then complete the credit analysis related to the borrower's loan request and make a security recommendation to VRA's credit committee, and if applicable, VRA's Board of Directors.
- Subject to loan approval by VRA's credit committee, a term sheet will be provided to the borrower related the funding request.
- The borrower's local bond counsel will draft a resolution / ordinance, authorizing the borrower to participate in the VPFP financing.
- Upon approval of the authorizing resolution / ordinance by the borrower's governing body, the borrower will enter into the primary financing document related to the VPFP loan (typically in the form of a Local Bond Sale and Financing Agreement or Local Lease Acquisition Agreement and Financing Lease).
- VRA sells the VPFP bond issue on a negotiated or competitive basis in the public bond markets and allocates the proceeds of the bond issue to the local loan participants within the loan pool. Interest rates are fixed through the final maturity once the bond sale is completed.
- VRA staff and its financing team coordinate the VRA and local loan closings within two to four weeks of bond pricing.
- Loan proceeds are available for disbursement to localities as of the VPFP closing date.

USDA – Rural Development
Community Facilities Direct Loan & Grant Program

What does this program do?

This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings.

What is an eligible area?

Rural areas including cities, villages, townships and towns including Federally Recognized Tribal Lands with no more than 20,000 residents according to the latest U.S. Census Data are eligible for this program.

How may funds be used?

Funds can be used to purchase, construct, and/or improve essential community facilities, purchase equipment and pay related project expenses.

Examples of essential community facilities include:

- Community support services such as child care centers, community centers, fairgrounds or transitional housing
- Public safety services such as fire departments, police stations, prisons, police vehicles, fire trucks, public works vehicles or equipment
- Educational services such as museums, libraries or private schools
- Utility services such as telemedicine or distance learning equipment

For a complete list see Code of Federal Regulations 7 CFR, Part 1942.17(d) for loans; 7 CFR, Part 3570.62 for grants.

What kinds of funding are available?

- Low interest direct loans
- Grants
- A combination of the two above, as well as our loan guarantee program. These may be combined with commercial financing to finance one project if all eligibility and feasibility requirements are met.

What are the funding priorities?

- Priority point system based on population, median household income
    - Small communities with a population of 5,500 or less
    - Low-income communities having a median household income below 80% of the state nonmetropolitan median household income.

What are the terms?

Funding is provided through a competitive process.

Direct Loan:

- Loan repayment terms may not be longer than the useful life of the facility, state statutes, the applicant's authority, or a maximum of 40 years, whichever is less
- Interest rates are set by Rural Development, contact us for details and current rates
- Once the loan is approved, the interest rate is fixed for the entire term of the loan, and is determined by the median household income of the service area and population of the community
- There are no pre-payment penalties

Grant Approval:

1. Applicant must be eligible for grant assistance, which is provided on a graduated scale with smaller communities with the lowest median household income being eligible for projects with a higher proportion of grant funds.

Are there additional requirements?

- Applicants must have legal authority to borrow money, obtain security, repay loans, construct, operate, and maintain the proposed facilities
- Applicants must be unable to finance the project from their own resources and/or through commercial credit at reasonable rates and terms
- Facilities must serve rural area where they are/will be located
- Project must demonstrate substantial community support
- Environmental review must be completed/acceptable

USDA – Rural Development
Community Facilities Guaranteed Loan Program

What does this program do?

This program provides loan guarantees to eligible lenders to develop essential community facilities in rural areas. An essential community facility is defined as a public improvement, operated on a non-profit basis, needed for the orderly development of a rural community where the rural community is a city or town, or its equivalent county or multi-county area. The term "facility" refers to both the physical structure financed, and the resulting service provided to rural residents or rural businesses.

Who may apply for this program?

Lenders who have the legal authority, financial strength and sufficient experience to operate a successful lending program. This includes lenders that are subject to supervision and credit examination by the applicable agency of the United States or a State, including:

- Federal and State chartered banks
- Farm Credit Banks with direct lending authority
- Bank for Cooperatives
- Savings and Loan Associations
- Savings banks
- Mortgage companies that are part of a bank-holding company
- The National Rural Utilities Cooperative Finance Corporation
- Credit unions
- State Bond Banks or State Bond Pools

Other non-regulated lending institutions may also be approved by the Agency under the criteria of the OneRD regulation.

Who may qualify for these loan guarantees?

Eligible borrowers are:

- Public bodies

Additional entities may be eligible for other types of loan guarantees under the OneRD Guarantee Loan Initiative.

What is an eligible area?

- Rural areas with populations of 50,000 residents or less, which excludes certain populations pursuant to 7 U.S.C. 1991(a)(13)(H)*, based on the latest decennial census of the United States and not in the urbanized area contiguous and adjacent to that city or town.
- The lender may be located anywhere in the United States.
- Check an eligible rural area.

How may funds be used?

Each year the Agency will reserve funds for projects located in rural areas with a population of not more than 20,000 inhabitants based on the following reservation of funds schedule:

1. 100% of the first $200,000,000 made available
2. 50% of the next $200,000,000 made available
3. 25% of all amounts exceeding $400,000,000 made available

Funds can be used to construct, enlarge, extend or otherwise improve essential community facilities. Guarantee funds can also be used for refinancing the debt of an essential community facility.

Examples of essential community facilities include:

- Transportation facilities such as streets, bridges, roads, ports, and airports
- Certain utility projects when not eligible for Rural Utilities Service financing, gas distribution systems, recycling and transfer centers or stations
- Water infrastructure facilities such as levees, dams, reservoirs, inland waterways, canals, and irrigation systems

For a complete list see Code of Federal Regulations 7 CFR 5001.103(a) and 5001.121(a).

What may loan guarantee funds NOT be used for?

- Lines of credit
- Owner-occupied and rental housing
- Golf courses or golf course infrastructure
- Racetracks or gambling facilities
- Facilities used for inherently religious activities
- Projects that create, directly or indirectly a conflict of interest
- Inherently commercial enterprises

For a complete list see Code of Federal Regulations 7 CFR 5001.115, 5001.116, and 5001.122.

What Collateral Is Required?

The lender is responsible for obtaining and maintaining proper and adequate collateral for the guaranteed loan. All collateral must secure the guaranteed loan. The lender should discount collateral consistent with sound loan-to-discounted value practices which must be adequate to secure the guaranteed loan. The lender will determine the market value of the collateral with an appraisal.

What is the maximum amount of a loan guarantee?

The loan guarantee percentage is published annually in a Federal Register notice. CF loan guarantees approved in Fiscal Year 2021 will receive an 80 percent guarantee.

What is the maximum loan amount?

The maximum amount of a guaranteed loan is $100 million. The loan amount includes the guaranteed and unguaranteed portion. It also includes the balance of any existing CF guaranteed loans and the new CF guaranteed loan request.

What are the loan terms?

The lender, with Agency concurrence, will establish and justify the guaranteed loan term based on the use of guaranteed loan funds, the useful economic life of the assets being financed and those used as collateral, and the borrower's repayment ability. The loan term will not exceed 40 years.

What are the interest rates?

- Interest rates are negotiated between the lender and borrower.
- Rates may be fixed or variable.
- Variable interest rates may not be adjusted more often than quarterly.

What are the applicable fees?

- There is an initial guarantee fee, currently 1.5 percent of the guaranteed amount.
- There is a guarantee retention fee, currently 0.5 percent of the outstanding principal balance, paid annually
- There is a fee for the Issuance of Loan Note Guarantee Prior to Construction of 0.5 percent.
- Reasonable and customary fees for loan origination are negotiated between the borrower and lender.

What are the underwriting requirements?

- The lender will conduct a credit evaluation using credit documentation procedures and underwriting processes that are consistent with generally accepted prudent lending practices and also consistent with the lender's own policies, procedures and lending practices.
- The lender's evaluation must address any financial or other credit weaknesses of the borrower and project and discuss risk mitigation requirements.
- The lender must analyze all credit factors to determine that the credit factors and guaranteed loan terms and conditions ensure guaranteed loan repayment.

- Credit factors to be analyzed include but are not limited to character, capacity, capital, collateral, and conditions.

Are there additional requirements?

- Applicants must have legal authority to construct, operate, and maintain the proposed facilities and services and to obtain, give security for, and repay the proposed loan
- Applicants must be unable to finance the project from their own resources or through commercial credit at reasonable rates and terms
- Applicants must provide evidence of significant community support
- Tax exempt financing cannot be guaranteed by this program
- Facilities must be for public use and serve the rural area where they are /will be located
- Lender is responsible for becoming familiar and ensuring compliance with Federal Environmental requirements

Who will service the loan?

The lender is responsible for servicing the entire loan and taking all servicing actions that a reasonably prudent lender would perform in servicing its own portfolio of loans that are not guaranteed.

Appendix G: Virginia Institute of Marine Science (VIMS) Shoreline Studies Program Dredging Implementation Prioritization and Management for Middle Peninsula Shallow Draft Channels Report

Attached is the April 2021 Virginia Institute of Marine Science Shoreline Studies Program Report titled *Dredging Implementation Prioritization and Management for Middle Peninsula Shallow Draft Channels*, which includes in-depth data for the creeks mentioned in this report.

Dredging Implementation Prioritization and Management

For Middle Peninsula Shallow Draft Channels

Shoreline Studies Program
Virginia Institute of Marine Science
William & Mary

April 2021

Dredging Implementation Prioritization and Management

For Middle Peninsula Shallow Draft Channels

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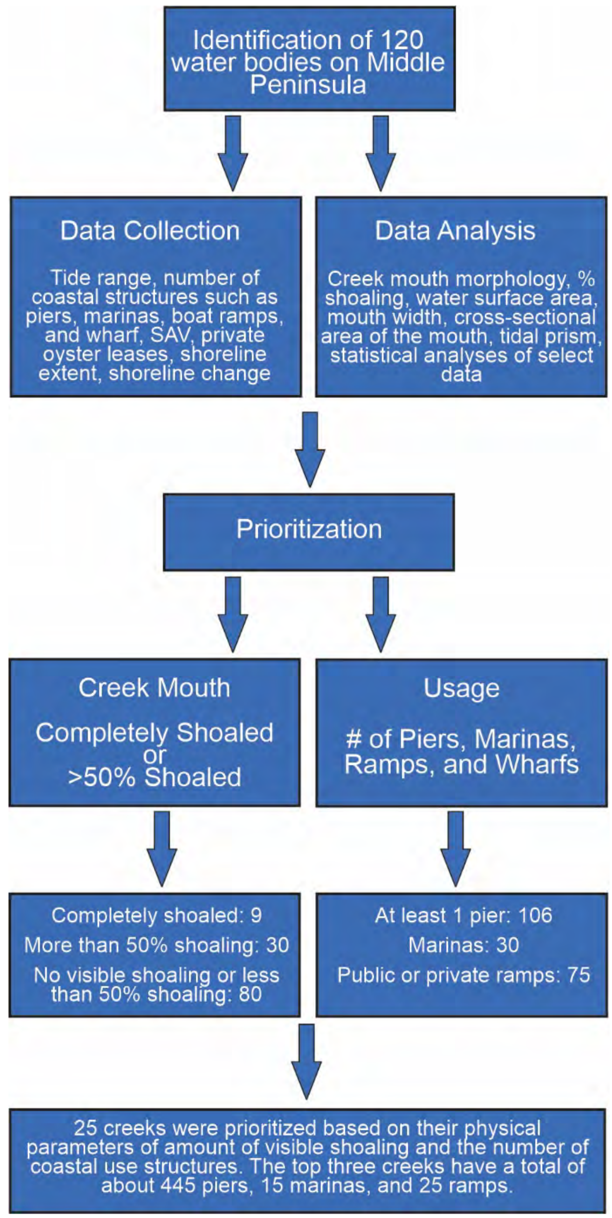
April 2021

Executive Summary

To develop a regional dredging program for the localities of the Middle Peninsula, a database of 120 creeks and rivers was created of its waterbodies from Tappahannock to West Point. Generally, these waterbodies can be categorized into three basic types of shallow draft channels: federally-defined, non-federal with ATONs (aids to Navigation) and non-federal without ATONs. For the Middle Peninsula there are 13 federal channels, 12 non-federal channels in creeks with ATONs, and 94 in creeks without defined channels or ATONs.

Physical parameter data was collected or created for each of these creeks. This data included creek mouth morphology, amount of shoaling in the creek mouth, tide range, number of coastal structures such as piers, marinas, boat ramps, and wharf, the water surface area, mouth width, tidal prism, and cross-sectional area of the mouth (mouth width x average depth). The data collected was used to prioritize dredging needs based on these physical parameters.



Overall, 9 creeks were completely shoaled, and 30 had more than 50% shoaling. Eighty creeks had no visible shoaling or less than 50% shoaling. Fifty creeks had restricted creek mouth morphology. Nearly all the creeks (106) had at least one pier; 30 had marinas; and 75 had public or private boat ramps.

A total of 25 creeks were prioritized based on their physical parameters of amount of visible shoaling and the number of coastal use structures. The top three creeks on the prioritized list are Sarah Creek in Gloucester County, and Robinson Creek and Sturgeon Creek in Middlesex County. These top three prioritized creeks have a total of about 445 piers, 15 marinas, and 25 public or private boat ramps. In addition, most of the prioritized creeks had restricted mouths. This was not a selected feature for prioritization, but these creeks are more likely to be completely or more than 50% shoaled. Also taken into consideration during prioritization was any known local knowledge of the creek.

Utilizing the collected data, the steps that localities need to take for additional data collection to develop a dredging project was outlined, and recommendations were made for additional regional management considerations. Finally, next steps were suggested. These include utilizing the database for additional studies on the morphology and hydrodynamics of the creeks as well as computer modeling of the systems to better understand the systems and further categorize the to enhance future prioritization. In addition, this research could inform adaptive management of the dredge channels in the face of sea-level rise. By creating a regional program for dredging of shallow water, localities can save time, effort, and money. Such a program also provides ways for localities to plan for the utilization of dredge material to combat repetitive flooding and improve coastal resiliency.

Each creek is shown in Appendix A with a creek-specific data table and map. Appendix B shows the Excel table for all the data.

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1 Introduction

1.1 Dredging Background

Channel dredging is usually considered when the safe navigation into and out of a creek, access channel or other shallow navigation waterway is impended. Historically, Federal designated channels were authorized by Congress in the 1950s and 1960s to support the commercial seafood industry, working waterfronts. The natural channels were not sufficient to allow safe passage and channels had to be created by dredging. Each channel is unique in that regard in terms of tidal hydrodynamics and the need for maintenance dredging so their extent and controlling depths vary depending on the nature of boating requirements. Channel lengths were often determined by where an inside bathymetric contour would be "linked" to the same contour on the river or bay side. Controlling depths vary but generally range from 6 to 10 feet MLW. Channel widths vary from 60 to 100 feet depending. These parameters determined the amount of dredging that was required. The consequent disposal of the dredge material also varied from upland to shoreline to offshore sites. Many of these initial disposal sites are no longer available.

Through the Virginia Waterways Management Fund (Senate Bill 693 https://lis.virginia.gov/cgi-bin/legp604.exe?181+cab+SC10122SB0693+BRREF), localities have the opportunity to seek funding for shallow-draft navigable water channel maintenance dredging and the construction and management of areas for the placement of dredged material. To assist localities on the Middle Peninsula with implementation of these types of projects, a regional approach is needed when considering channels for shallow-draft dredging projects. The regional approach will assist localities in implementing the utilization of dredge material from shallow-draft channels to combat repetitive flooding and mitigating coastal erosion through placement along the shoreline at appropriate sites.

1.2 Project Goals

For the localities of the Middle Peninsula (Figure 1), creating a regional program for dredging of shallow water can save time, effort, and money. It also provides a way for localities to plan for the utilization of dredge material to combat repetitive flooding and improve coastal resiliency.

This report provides base data for every creek and channel on the Middle Peninsula. The data collected was used to prioritize dredging needs based on physical parameters. Once the creeks were prioritized, the steps localities need to take for additional data collection to develop a dredging project were outlined. Finally, recommendations were made for additional regional management considerations.

This method can be used for other regions to have them start to look at all of their creeks rather than just the federal channels or those with larger marinas. It allows for the inclusion of other creeks that might otherwise be overlooked.

2 Middle Peninsula Channels

2.1 Creek Morphology

About 15,000 years ago sea level was about 300 feet lower and the ocean coast was about 60 miles to the east. Since then the coastal plain of Virginia has been progressively inundated and the Chesapeake Bay shoreline has receded in response with flooding of the dendritic watershed. As the marshes erode away the exposed interfluves, eroding upland banks, provide sediments to the littoral system creating beaches and spits (Figure 2).

Creeks are the hydrodynamic and hydrologic connection between the uplands and the Bay. Each has its unique setting based on where it sits the antecedent dendritic watershed of Chesapeake Bay (Hardaway & Byrne, 1999). They are typically the lateral drainages into the main rivers and the Bay. The present shoreline and creek settings are a product of the interaction between hydrodynamic forces of the Bay and the material resistance of the underlying geology.

The lateral creeks vary in size and the types of connections to the adjacent rivers and bay. This is related in part to the size of the creek (area), the tidal prism, and the nature of the adjacent river and bay coasts. These may be marsh shoreline and/or eroding upland banks which provide sediments to the littoral system and interact with the creek entrances. Creek entrances vary from open mouths to restricted to tidal inlets. For tidal inlets, the cross-section of the channel at its mouth has a direct relationship to the tidal prism. The tidal prism is the tidal area of a creek times the tide range. This being the volumetric exchange of the creeks tidal water with the adjacent river or Bay.

The creek morphology is a function of where they sit in the landscape as sea level rise transgresses the Virginia coast. We call them lateral creeks because that how they intersect the adjacent water body similar on a large scale as the main tributary estuaries, the James, York, Rappahannock and Potomac Rivers intersect Chesapeake Bay.

Given these elements each creek is in a state of dynamic equilibrium as those force impact and fluctuate over time. Now comes the anthropogenic modifications and the need for navigation access to the creeks and rivers of the Bay. The equilibrium of the channel mouths is often inadequate for navigation needs over the years. Federal channel is usually designated to support commercial fishing interest that wanted to utilize creeks closer the various fishing species, to some extent. Many of the Federal channels were established in the 1950s and 1960s during the height of oyster and rockfish fisheries.

2.2 Regional Creek Descriptions

There are 120 named creeks the Middle Peninsula coast from Tappahannock to West Point. Each creek is shown in Appendix A with a creek-specific data table and map. Appendix B shows the excel table for all the data. Generally, they can be categorized into three basic types of shallow draft channels: federally-defined, non-federal with ATONs (aids to Navigation) and non-federal without ATONs. For the Middle Peninsula there are 13 federal channels, 12 non-federal channels in creeks with ATONs, and 94 in creeks without defined channels or ATONs.

Most of the creeks are in the lower Middle Peninsula. To assess these channels, it is important to place them in their geomorphic/geologic setting. For the purposes of discussion, the coast is divided into reaches. Reach A extends from Tappahannock to Stingray Point along the Rappahannock River (Figure 3). Reach B from Stingray Point to New Point and includes the Piankatank River shoreline as well as Chesapeake Bay. Reach C encompasses Mobjack Bay to the mouth of the York River at Big Island. Reach D extends up the York River coast to West Point and the Mattaponi River.

2.2.1 Reach A

Most of the Reach A coast is eroding high and low banks that vary in composition but generally have a basal clay stratum overlain by various sandy strata. There are 21 named lateral creeks (Appendix A) which are the remaining upland sections of each lateral watershed (Figure 4). There are no significant, named, tidal creeks between Piscataway Creek and Mud Creek, almost 18 miles of shoreline. This is a function of the antecedent geology/geomorphology. The other 19 tidal creeks occur along the remaining 25 miles of the Reach A shoreline in the lower Rappahannock.

There are 6 federal channels, 3 non-federal with ATONs and the remaining 13 non-federal. Locklies Offshore is a federal channel but is not lateral creek. For the other federal channels, Hoskins, Parrots, Urbana, Whiting and Broad Creeks the controlling depths/widths are -10 ft/70-100 ft; -6 ft/60 ft; -10 ft/150-390 ft; -4 ft,70 ft; and -7 ft/100 ft, respectively (Hardaway et al., 2019). When these channels were established by Congress in the 1950s to the 1970s, a local sponsor was required. The need and frequency to dredge varied per creek from industrial situation at Hoskins Creek to smaller vessel size requirements like Whitings Creek. Cost and maintenance are other factors. Currently, the completely shoaled federal channel is Whitings Creek. The remainder are partially shoaled.

Of the 15 non-federal creeks in Reach A, three have ATONs, LaGrange, Robinson Creek, and Locklies North. Langrange and Robinson have restricted mouths while Locklies North is open. Non-federal channels considered completely shoaled are Harry George Creek, Meachim Creek East, Bush Park Creek and Sturgeon Creek. Bushy Park Creek has an extensive trailer park and campground with adequate water inside the creek but with a significantly shoaled inlet channel. The channel has two wood jetties and is frequently dredged, mechanically, with the sandy material placed on the adjacent north coast. With a southerly net littoral drift that material soon returns to the channel but placing the material on the south side would impact the adjacent small creek inlet of Woods Creek* (not in Appendix A). Finally, Broad Creek has some interior shoals but the main channels are relatively open.

2.2.2 Reach B

Reach B extends from Stingray Point to New Point Comfort along the west coast of Chesapeake Bay in Middlesex and Mathews County including the Piankatank River (Figure 5).

The coastal geomorphology is typically lower upland banks that can have more extensive marshy watersheds. The open Chesapeake Bay has a high wind wave climate. Sediment sources from upland erosion sources have been from Stingray Point to Gwynn Island have been reduced by shoreline hardening overtime. There are broad shoals in the nearshore region along most of the Bay coast down to New Point. There are 29 named channels in Reach B (Appendix A). These include 14 creeks in the Piankatank River, 11 in the Milford Haven watershed and 4 along the open bay coast.

There are 5 federal channel, 3 non-federal with ATONs and the 21 non-federal channels. Horn Harbor is a federal channel through a shoal but there is also a non-federal component to it as well which is reflected in Appendix A. For the federal channels, Jackson, Queens, Milford Haven and Horn Harbor, the controlling depths/widths are -8 ft/60-80 ft; -6 ft/60-200 ft; -10 ft/100 ft; -6 ft/100-400 ft; and -7 ft/100 ft. Jackson Creek and Queens Creek have been recently dredged with material going onto adjacent beaches. Milford Haven is naturally deep but has some shoaling along the outbound side. Horn Harbor was dredged in the last ten years and sandy material put on the adjacent campground coast. Winter Harbor is the most significantly shoaled channel with no access even for shallow draft vessels. Previous disposal sites include three upland areas that are now abandoned and more recently the shoreline north of the channel. The problem is the sandy material, once placed, immediately begins infilling the channel. The better option is to put it on the south shoreline.

The non-federal channels with ATONs channel Hole in the Wall is >50% shoaled and needs dredging. The non-federal channels that are completely shoaled include Warehouse Cove, Chappel Creek, and Garden Creek. Garden Creek watershed has been compromised for years because the adjacent bay barrier was breached thereby reducing the tidal prism. Prior to that, two wood jetties helped keep it open but it still infilled quickly.

2.2.3 Reach C

Reach C includes all the named creeks in the Mobjack Bay estuarine system including the East River, North River, Ware River, and Severn River (Figure 6). The coast around the Mobjack Bay watershed is mostly low upland banks and tidal marshes fronting the uplands. As a result, upland bank erosion is intermittent and occurring where the marsh fringes have eroded out. Consequently, the contribution of eroding bank sediments to the littoral system is somewhat less compared to the Rappahannock River coast. Nevertheless, nearshore sands can impact the tidal creeks as evidenced by infilling of the Davis Creek channel over time.

There are 54 named creeks, one, Davis Creek, is federal, three are non-federal with ATONs including Pepper Creek, Greenmasion Creek and Browns Bay. The remaining 50 are non-federal without Coast Guard ATONs (Appendix A). The small lateral tidal creeks either enter Mobjack Bay proper or one on the 4 larger lateral rivers, East River, the North River, the Ware River and the Severn River. The controlling depth/width of Davis Creek is -8 ft/80 ft.

Davis Creek is nearly completely shoaled at the entrance to the federal channel. Put in Creek actually has sufficient water depth up to where the channel narrows and then is completely shoaled for the last 2,000 feet to Mathews Court House. Mill Creek 2 is partially shoaled in the main creek but the adjacent boat ramp is almost completed sanded in. Whittaker Creek is relatively shallow up to and into the dredged canal where it is very shoaled in. Finally, Freeschool Creek has a very narrow entrance channel into the creek and shoals in the nearshore at the public landing.

2.2.4 Reach D

Reach D extends from Big Island at the mouth of the York River upriver to West Point and the entrance to the Mattaponi River, about 32 miles (Figure 7). Big Island is part of an extensive tidal marsh complex including Monday Creek, and the shoreline transitions to very low eroding upland (+5 ft) along the Guinea Neck to the Perrin River. The upland banks increase in elevation slightly up to Sarahs Creek (+10 ft). Most of the shoreline has been developed and hardened. The uplands rise sharply (+30 ft) past Sarahs Creek where the Suffolk Scarp intersects the York River. This coast is also mostly developed and hardened. The high bank coast continues up the north coast of the York River where numerous lateral tidal creeks occur. Old marshy point bar systems occur between creeks including the Catlett Islands, straddled by Timberneck and Cedarbush Creeks. Another marshy point bar coast occurs further upriver between Purtan Creek and the Poropotank River. The low marsh coast continues upriver, transitioning to low eroding uplands back to a low marsh coast that extends into the mouth of the Mattaponi River.

There are 16 named creeks in Reach D. One is federal (Aberdeen Creek), three have ATONs, Perrin River, Sarahs Creek and Timberneck Creek, and the rest are non-federal channels without Coast Guard ATONs. Upriver portions of the Mattaponi River are federal but not the entrance which is the only section included in this project (shown in Appendix A). The controlling depth/width of Aberdeen Creek is -6 ft/80 ft.

The Perrin River, Sarahs Creek, Timberneck Creek, Cedarbush Creek and Aberdeen Creek (Federal) all have some type of working waterfront infrastructure including marinas in the Perrin River and Sarahs Creek. The Perrin River and Sarahs Creek have migrating sandy shoals into the entrance channel. The narrow channel into Aberdeen Creek is also significantly shoaled with sand. The natural channels into Timberneck and Cedarbush have infilled over the years but with muddy material.

3 Methods

3.1 Channel Morphology

For this project, the 120 creeks present on the Middle Peninsula were identified manually from topographic maps in Esri ArcMap. All tidal creeks open to a larger body of water and that could potentially have a navigation channel were included. Though some creeks did not have a name on the chart, one was assigned them either from local knowledge or were named by the researchers after a road or feature near the creek.

Creeks were categorized in several ways. The channel type categories are Federal, which includes those shallow draft creeks that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined creeks that have aids to navigation; and Non-Federal, which includes those creeks that are not federally-defined channels nor do they have aids to navigation.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project that had four categories. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no significant shoals/ land impeding creek flow.

Percent shoaling of a creek was another qualitative assessment used to categorize creeks for this project. It defines the amount of shoaling within the creek, usually at the creek mouth or just outside the creek and is generally related to the need for dredging. The assessment was performed manually using visual inspection of the 2017 VGIN images. The four categories are: No Visible Shoaling; <50% of channel; >50% of channel; Completely shoaled. It must be stressed that this is a qualitative assessment using visual data and only identifies potential shoaling issues.

Where it exists, the submerged aquatic vegetation (SAV) footprint was mapped to show the extent of the grasses between 2015 and 2019 as mapped by the VIMS SAV program (https://www.vims.edu/research/units/programs/sav/access/maps/index.php). Private oyster lease GIS layer was downloaded from the Virginia Marine Resource Commission. Tide range was obtained using NOAA resources, and the existing structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database (data collected between 1998-2016). Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned). However, it should be noted that many errors were found within this dataset and should be used only as a guide. No better dataset existed for most of these small, lateral creeks that have not been surveyed.

Several tidal creek parameters were calculated based on this data. Water surface area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters (Hardaway et al., 2020). Surface area was calculated in GIS. The location of the mouth or inlet was visually-defined on the 2017 VGIN images and its width determined. Determining the position of the creek mouth is somewhat subjective but, in most cases, its intuitively obvious, particularly on creeks with restricted mouths or inlets. Cross-sectional area of the mouth was determined. This was the mouth/inlet width times water depth. In addition, the tidal prism, which is the volume of water in an estuary or inlet between mean high tide and mean low tide, or the volume of water leaving an estuary at ebb tide, was determined by multiplying the average tidal range times the surface area of the basin.

3.2 Prioritizing Channels

The goal of this project was to develop data for a regional dredging plan. Utilizing the collected and analyzed data, channels were prioritized to determining the need for channel dredging. These creeks were both objectively, based on collected data, and subjectively prioritized, based on knowledge of the creek. This will be creek-dependent and involves the creek geomorphology/hydrodynamics as well as the extent of upland development, working waterfront requirements and residential boat activity. The prioritization was based only on physical parameters such as the amount of shoaling that would restrict boating access, the type of creek mouth, and whether marinas, piers, and boat ramps are present. The shoreline structure information was obtained from the VIMS Center for Resources Management shoreline inventory GIS data (https://www.vims.edu/ccrm/research/inventory/index.php). Information obtained for federal channels analyzed for the Hardaway, et al. (2019) report was also included.

4 Regional Dredging

4.1 Regional Prioritization

From the results of this project, Table 1 has a list of 20 channels prioritized by physical parameters for dredging. These creeks were either completely shoaled or were categorized as having >50% shoaling. Most are inlet or restricted creek mouths; although unnamed cove is open, but completely shoaled. Most of the creeks occur in Middlesex and Gloucester counties, although three are in Mathews County. The complete data table is shown in Appendix B. An additional five creeks are listed because they are either completely shoaled or have >50% shoaling and have some piers inside the creek. However, for these five creeks, the number of piers is relatively low.

The top four creeks on the prioritized list are Sarah Creek in Gloucester County, and Robinson Creek, Sturgeon Creek and Whiting Creek in Middlesex County. Sarah Creek is a non-federal channel that has ATONs (Figure 8). It has a restricted mouth that is greater than 50% shoaled. Along its shoreline, over 200 private piers, 8 marinas and 11 boat ramps occur. Having easy access for boats is essential for homeowners and businesses and will boost the economy of Gloucester County through tax revenues. It appears that only the mouth of the creek, where shoaling is occurring due to alongshore transport of material, needs to be dredged. The creek has the 4th largest tidal prism in the dataset (Appendix B). Submerged aquatic vegetation (SAV) will not be an issue for dredging this channel; however private oyster lease owners will need to be addressed. Shoreline adjacent to the creek on the York River could be used as a placement area for sandy dredge material.

Robinson Creek is a non-federal channel that has ATONs (Figure 9). It has a restricted mouth that is greater than 50% shoaled. Along its shoreline, 111 piers, 5 marinas, and 5 boat ramps occur. Aerial photography shows a defined channel that could indicate that the channel is dredged, a review of the VMRC database did not show a permit since 2000. It could be naturally maintained because the creek has the 13th largest tidal prism out of all the 120 creeks. SAV would not be an issue for dredging, and although private oyster leases are close to the channels, they could be avoided. Shoreline downdrift of the creek could be used for placement of sandy dredge material.

Sturgeon Creek does not have a federal channel nor any ATONs (Figure 10). It has a restricted mouth that is completely shoaled, and along its shoreline, 121 piers, 2 marinas, and 9 boat ramps occur. It also has noncommercial and commercial aquaculture. Neither SAV nor private oyster leases will be an issue for dredging. The nearshore along the Rappahannock River at the mouth of Sturgeon appears to be relatively shallow and shoaled offshore. This could be an issue for dredging in that the dredge channel may need to be longer to get to deep water. However, without bathymetry data, this is conjecture.

Whiting Creek is a federal channel that has a restricted mouth and is completely shoaled based on the 2017 VGIN imagery (Figure 11). The Creek has been dredged at least 4 times in

1956, 1962, 1970, and 1998. After 1970, dredging information is based on the VMRC permit database. In 1998, about 80,000 cubic yards (cy) of material was removed. Based on a 2017 survey by the US Army Corps of Engineers, the channel needs dredging again to maintain the channel.

If the physical characteristics of the creeks were disregarded and need was based on economic concerns in terms of the number of access structures, these four creeks are still within the top ten. If the creeks are categorized by the greatest number of piers, marinas, and boat ramps, the top ten includes Sarah, Queens, Sturgeon, Horn Harbor (inside the creek, not the outer federal channel), Robinson, Stutts, Jackson, Meachim, Urbanna, and Whiting.

Table 2 lists the channels that do not appear to need dredging at this time because they showed no visible shoaling. However, this prioritization does not consider local knowledge that may increase or decrease a creek's dredging need. Jackson Creek is a federal channel on this list. However, in 2016, five thousand cy of material was dredged from the channel. Jackson Creek was also dredged in 2001 (15,000 cy) indicating that regular maintenance dredging is needed.

Put in Creek is also on this list. Though the mouth and most of the channel do not need dredging, the upper portion had previously been dredged for boating access to Mathews Courthouse. Over time, the dredge channel filled in and marsh grew. With current environmental regulations, the marsh cannot be removed. However, the small narrow channel immediately adjacent to the courthouse area could be dredged for small skiff and kayak access. Other creeks on Table 2 may also have local issues that would increase their need for dredging.

4.2 Data Needs

Once channels have been prioritized, these are data needs for the next step toward developing a dredging project. The general steps are:

1) Federal versus non-federal channels: Federal channels have pre-defined parameters including dredge channel location, width, and depth, as well as pre-authorized disposal areas. This can make permitting easier.
2) Defining the channel limits: For non-federal channels, actual channel dimensions need to be defined. If ATONs exist, they typically mark the channel and potential shoals and should be used as guidance when determining the channel location. For channels without ATONs, finding the natural channel is necessary. Nearby federal channels can be used to determine needed channel widths and depths. These dimensions are dependent on the type of boat that will be using the channel. The channel should be wide enough to allow for 2-way traffic of the potentially largest boats in the waterway.
3) Determining the amount of material that will be dredged: This is crucial to determining the size of the project and how much area will be needed for disposal of material.
4) Testing dredge material for sediment type: Only sandy material (90-95% sand) can be placed along the shoreline. It also needs to have a median grain size of 0.25 mm. Smaller, muddier material has to be placed in an upland disposal facility.
5) Determine where material will be disposed: based on the type of material, locations need to be found to place the material wither along the shore or in an upland facility. The closer the disposal site is to the dredge channel, the more cost-effective the project.

Once these steps have concluded, a permit application should be submitted and specifications readied for procurement of dredge services. Specific data needs are listed below.

Bathymetric Data

The most important data to collect on a potential dredging site is bathymetry. Knowing the depths is crucial to establishing the need for the project. It also will provide the volume of material that will need to be removed which relates directly to cost. The bathymetry data should be referenced to mean lower low water to define the channel depth. Points should be spaced closely enough accurately represent the bottom depths and cover a large enough area to be able to define all sections of the creek that may need dredged. If ATONs exist in the creek, they should be surveyed in as well.

Channel creation

For non-federal channels, the dredge channels need to be defined. Channel design must balance safety, economic, and sustainability requirements. Channels also must be wide and deep enough to safely accommodate vessel traffic but not so large as to require excessive dredging or habitat modification. However, if a channel is designed deeper than needed at this time, it could offer less habitat impacts in the future if dredging maintenance cycles are reduced. If ATONs exist, they can be located either through a GIS database or a survey. The ATONs generally mark a channel and shoaled areas and can be used as a guide in determining channel location. If no ATONs occur in the creek, locating the natural channel through bathymetric data will help define the channel location. The channel needs to extend far enough into deeper water to match the defined channel depth. Federal channels in the vicinity can be a guide to determining needed channel widths and depths. Once the channel is defined, the volume of material that needs to be dredged can be calculated.

Coring

Sediment cores need to be taken to determine the types of material present in the channel. Because the top layer of material often is different from what material lies below the bottom, the cores need to be deep enough to reach the maximum dredge depth. The cores should be photographed and described to show the depths that have different materials. Sediment samples should be taken and analyzed for composition. Using the bottom depth at the core location, the depth to which the channel will be dredged can be determined on the core. The material type to this length on the core should be mean-weighed by depth to determine the type of material that will be removed from the channel. The disposal site(s) can be defined based on sediment composition.

Determining Resource Impacts

Impacts to biological resources can be large for dredge projects. When this occurs, permitting may be an issue. Determining the impacts before project design and modifying the project as necessary to minimize them is essential. Dredging impacts benthic and fishery habitat and should be assessed. Generally, motile forms of biota should be able to avoid the dredging operation; as such, most fish will not be impacted. The main potential impact is by entrainment of the species in the hydraulic dredging operation itself. Dredging would result in the temporary destruction of marine habitat and the associated benthos in the channel affecting benthic habitat. For oysters, larval stage impacts have been reported. If private oyster leases occur in the channel, the owners of the leases need to be approached for permission. If public oyster leases will be affected, the matter must be considered by VMRC and/or the Virginia General Assembly. SAV may be impacted if it is located in the channel or immediately adjacent to it. After dredging, repopulation of benthic organisms within the dredging will begin quickly (Newell et al., 1998). In estuaries, communities are well adapted to rapid recolonization of deposits because they are typically subject to frequent natural disturbances. Rates of recovery vary from 6-8 months in estuarine muds, possibly 2-3 in sand and gravel habitats.

Sometimes permitting agencies will invoke a time of year (TOY) restriction on dredging when these species are migrating and/or overwintering. In general, small shallow draft dredge projects will not cause long-term adverse effects on the surrounding ecosystem. The goal is to minimize any effects on the environment, and these should be offset by the project benefits of maintaining safe navigation and commerce.

As noted above, private oyster leases are an issue for dredging projects because the lease owner has to approve during the permitting process. Although many leases presently exist, a regional dredging program could address issuance of future private oyster leases. When leases cover an entire creek mouth as occurs at Lagrange Creek (Figure 9), a dredge channel could be difficult to permit. Many private leases also often extend close to the shoreline. This could impact potential disposal sites of sandy material. If dredge channels and potential disposal areas are identified in a regional program, this could influence the issuance of future private leases in the area thereby reducing a future problem.

Chemical Testing

The Evaluation of Dredged Material Proposed for Discharge in the Waters of the U.S. – Testing Manual was developed as a joint effort by the Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (EPA&USACE, 1998) and is referred to as the "Inland Testing Manual (ITM)." The purpose of the manual was to "establish procedures applicable to the evaluation of potential contaminant-related environmental impacts associated with the discharge of dredged materials in inland waters, near coastal waters and surrounding environs." The ITM was primarily developed to establish testing protocols associated with the disposal of dredged material discharges associated with navigation dredging.

The ITM utilizes a tiered approach to determining test requirements for dredged material disposal. There are four tiers: Tier I is an evaluation based on existing information; Tier II includes a chemical evaluation of identified contaminants of concern; Tier III is associated with general toxicity and bioaccumulation tests; and Tier IV provides for project specific toxicity and bioaccumulation tests.

The development of testing requirements always starts with a Tier I evaluation which is an analysis based on existing information. The evaluation can be based on previously collected physical, chemical or biological data; physical sediment characteristics (i.e. is the material comprised of sand, gravel or inert materials); or if the dredged material is associated with known sources of contamination. If there is no available chemical data at the dredging site, but the material is a sandy or inert material or there are no known sources of contamination or contaminant pathways to the dredging site, then there is “no reason to believe” that the disposal of the dredged material would have an adverse impact at the disposal site. Once it has been determined that there is “no reason to believe,” then the dredged material passes the Tier I and no additional evaluation is required. If, however, there is “reason to believe” that there is the potential for contaminants to exist at the dredging site, then a Tier II evaluation would be initiated. The “contaminants of concern” must be identified and a then a sampling plan should be designed to address the concentration of those specific contaminants in the site sediment and water. The results of the Tier II evaluation determine the need for evaluation at higher tiers. If the dredging site passes a Tier I evaluation, the only other time that chemical testing may be required is for disposal of dredged material into a regulated area such as a landfill.

It is unlikely that any contaminated creeks occur on the Middle Peninsula. Data collected at Aberdeen Creek, Cedarbush Creek, and Timberneck Creek in Gloucester; Davis Creek, Hole in the Wall, and Winter Harbor in Mathews; and Parrotts Creek in Middlesex showed no contamination for the following substances (Table 3). Chemical testing only needs to occur if strong reasoning occurs that a creek might be contaminated or if it is a requirement for dredge material disposal particularly if it will eventually be disposed of in a landfill.

Disposal Options

For shallow draft channels in Chesapeake Bay, disposal of dredge material is both a concern and a major component of the dredge planning process. In the past, dredge material was disposed of on the upland, along the shore, or in open-water. However, many previously used upland sites have been filled to capacity, previously-leased shore sites are no longer available, and environmental concerns sometimes limit open-water disposal. As such, new sites must be considered.

Beneficial reuse is the preferred option for dredge disposal. However, material needs to be 90-95% sand with a minimum median grain size (D_{50}) of about 0.25 mm. Smaller, muddier material has to be place in a contained site. For these sandy materials, sites need to be identified downdrift of the dredge channel. Typically, adjacent sites are the most cost effective. Sites within about 1 mile would be most cost-effective, but with booster pumps, material can be dredge farther to ensure the material is disposed where it can be the best use.

Upland sites typically require a containment berm located nearby on property where a lease has been obtained. Confined disposal facilities (CDF) are discussed in Hardaway et al. (2019). In addition to created a berm with on-site material, Geotubes® have been recommended to create the berm to hold material (Hardaway et al., 2020). These tubes are filled with dredge material then stacked around the site to create a basin for additional material. This allows for more material to be stored in a smaller area. Once material in a CDF has dried, it can be disposed of in a land fill or used for other purposes, perhaps fill material or some other technology.

Creating a joint upland disposal site for multiple creeks can create a better cost to benefit ratio. Many of the creeks will have dredge projects with only small amounts of material that will need to be disposed. Identifying public lands close to the site that could be used for disposal would be beneficial for a regional dredge program. Also, creating a site that can be used for multiple dredging cycles would be more cost-effective. The dredging could be grouped to reduce mobilization and demobilization costs.

In some areas of Virginia, modified open water disposal is being used. Geotubes® are filled and placed on the bottom and typically extend above mean high water. Additional dredge material is placed within the tubes. Though it is being used, permitting may be an issue as this method would be covering state bottom.

Coastal wetlands in many areas are deteriorating due, in part, to sediment depletion, subsidence, and sea level rise. Studies of the effects of placing dredged materials on marshes originated with recognition that marshes are adapted to respond to natural processes, such as storms, which deposit wrack and sediments on the marsh surfaces (Ray, 2007). Thin-layering of dredge material has been used in Chesapeake Bay, particularly in Maryland, to recreate marsh habitat. Although the technique is certainly not applicable in all restoration scenarios, it could be targeted toward areas where marsh migration is not possible or where islands are disappearing due to both exterior erosion and internal ponding. It would be a useful tool to help adapt for coastal resiliency. Developing regional thin-layering program would be the cheapest way to dispose of dredge material plus have the additional benefit of helping marshes keep up with sea-level rise. A study by VIMS (2014) looked at the issues and policy considerations of thin-layering.

5 Next Steps

For an efficient regional program, next steps would be to collect data and develop a management structure. The Middle Peninsula Planning District Commission has begun this process by collecting data on 22 creeks, developing dredge plans for 7 of those creeks, and researching how to optimize dredging funds (report in progress). Continuing to collect data and designing projects on prioritized creeks will create a database of information that will be ready as funding becomes available. Of the data that needs to be collected, bathymetry and coring are the most important to determine the need for dredging and what type of disposal site will be needed.

To maximize future planning efforts, further research can be conducted on the morphology and hydrodynamics of the creeks as well as modeling of the systems. This research could inform adaptive management of the dredge channels in the face of sea-level rise. Research has shown that wetland loss inside an estuary increases open water thereby affecting the tidal prism, cross-sectional area of the mouth, and sediment deposition on both flood and ebb tidal shoals such that wetland loss can change regional sediment transport patterns (Sanchez, 2008). The coverage, extent, and density of vegetation associated with estuarine wetlands influence the long-term evolution of estuary morphology and tidal inlets, navigation channels, and the wetlands themselves. Determining the change in wetland coverage for each creek could be translated into predictive morphological tools for management of navigation channels and tidal inlets. In addition, it could provide opportunities for thin-layering. Alternatively, increasing the tidal prism could potentially increase natural flushing and allow the dredge channel to better maintain itself. If tidal prism could be enlarged while simultaneously enhancing wetlands, this would provide habitat benefits while reducing dredging costs.

For this project, physical parameters such as water surface area, inlet cross-sectional area, inlet width, and tidal prism were calculated for the 120 creeks. The data were plotted to look for relationships that could be useful in developing information for the dredge program. Initial results indicate that the variability in creek types effect the outcome of the comparisons. In particular, the tidal prism versus the inlet mouth cross-sectional area should be a linear relationship (Hughes, 2002). However, other variables likely influence the data possibly resulting in several trends that could be fleshed out (Figure 12). Overall, the creek types are too varied and do not provide meaningful data as a group; however, determining parameters to separate data points for statistics may provide meaningful data.

Due to funding constraints, a detailed analysis of this database did not occur. However, data was separated into its creek mouth category and plotted to determine if that simple measure provided information. Only two relationships seemed to have some relationship. For the inlet creek mouth category, plotting water surface area versus creek mouth width provided some relationship (Figure 13). For open creek mouths, plotting water surface area versus creek mouth cross-sectional area resulting in a linear relationship (Figure 14). Additional research into these data could provide tools to better understand the hydrodynamics of each creek and potentially ways to manage them better.

In addition, the effects of sea-level rise on coastal morphology can be difficult to study by field observations alone; hydrodynamic numerical modeling could provide a sophisticated means of analyzing coastal processes over several time-scales and linking processes to long termer term issues.

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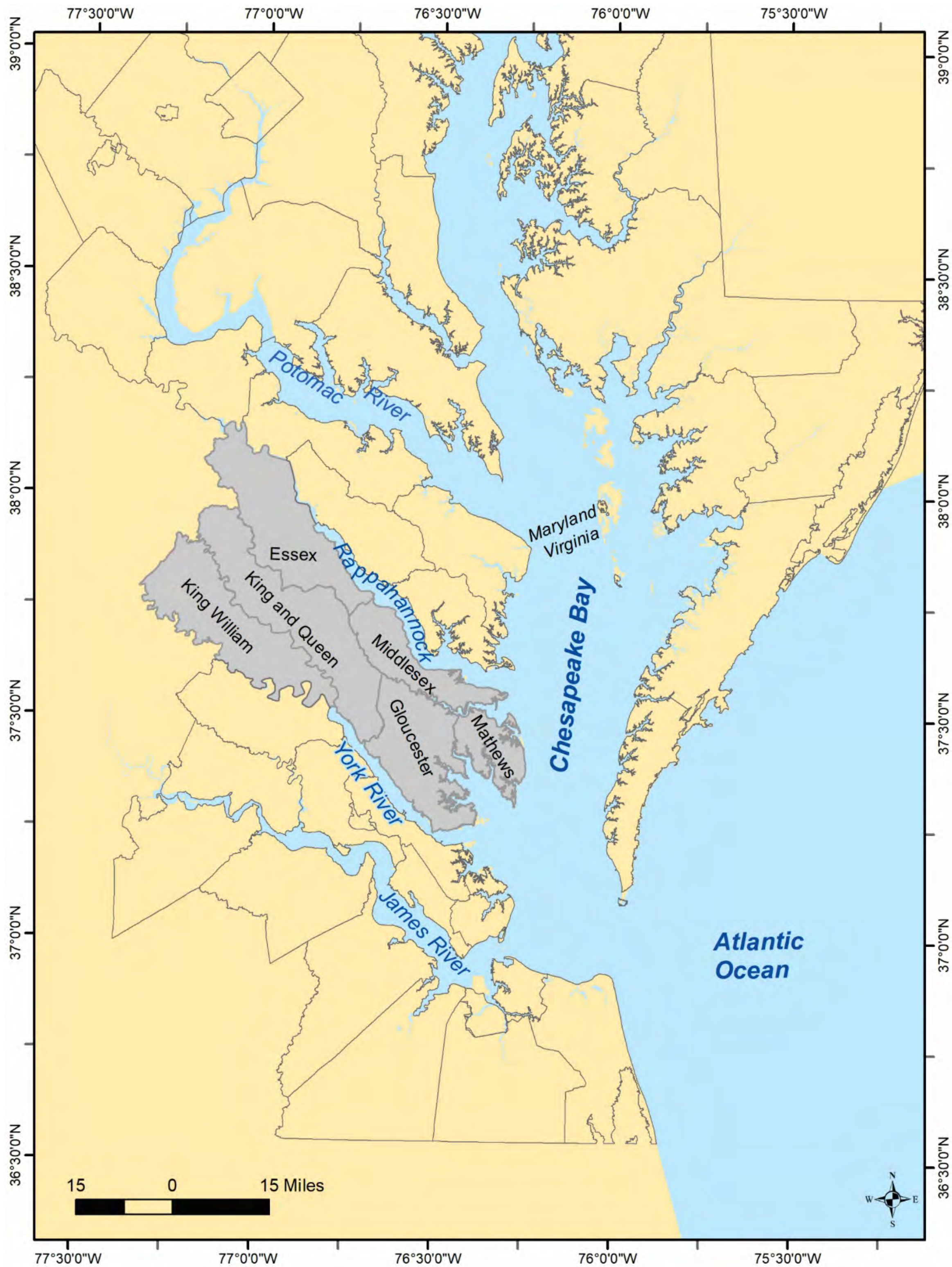


Figure 1. Location of Middle Peninsula counties with the Chesapeake Bay estuarine system.

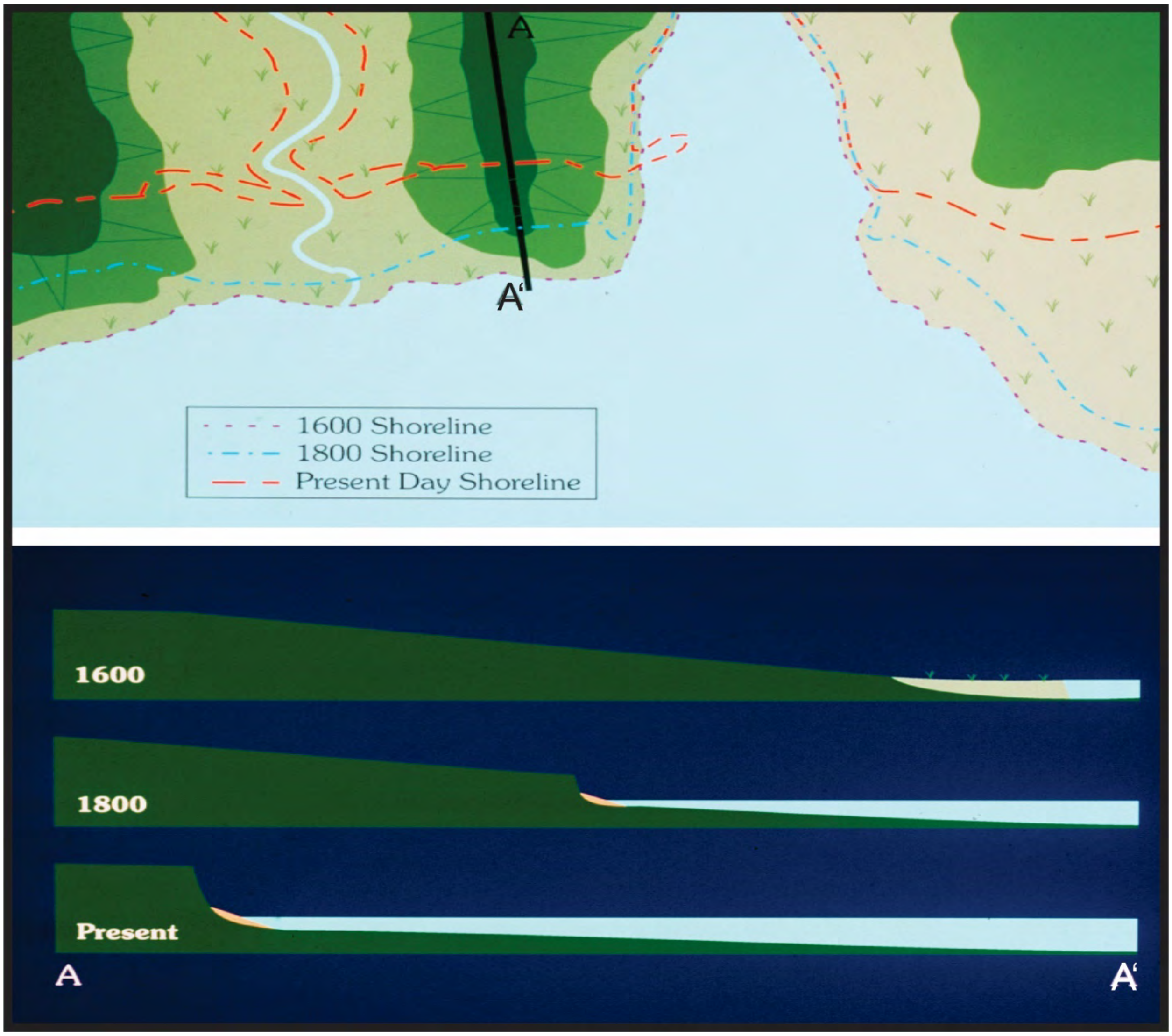


Figure 2. Eroding marshes expose interfluves (eroding upland banks) and provide sediments to the littoral system creating beaches and spits over time. From Hardaway et al. (1999).

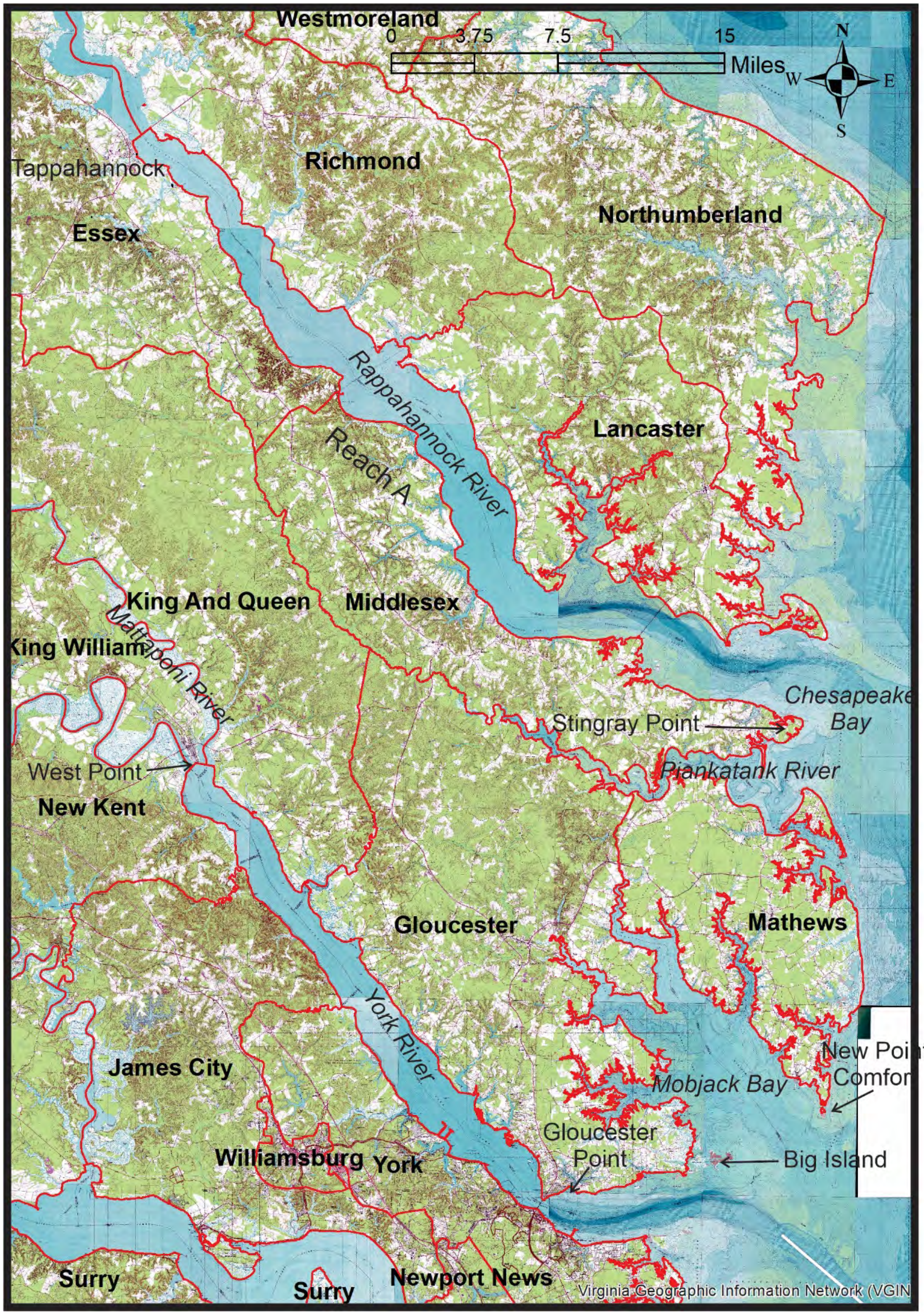


Figure 3. Topographic and bathymetric map of the Middle Peninsula counties.

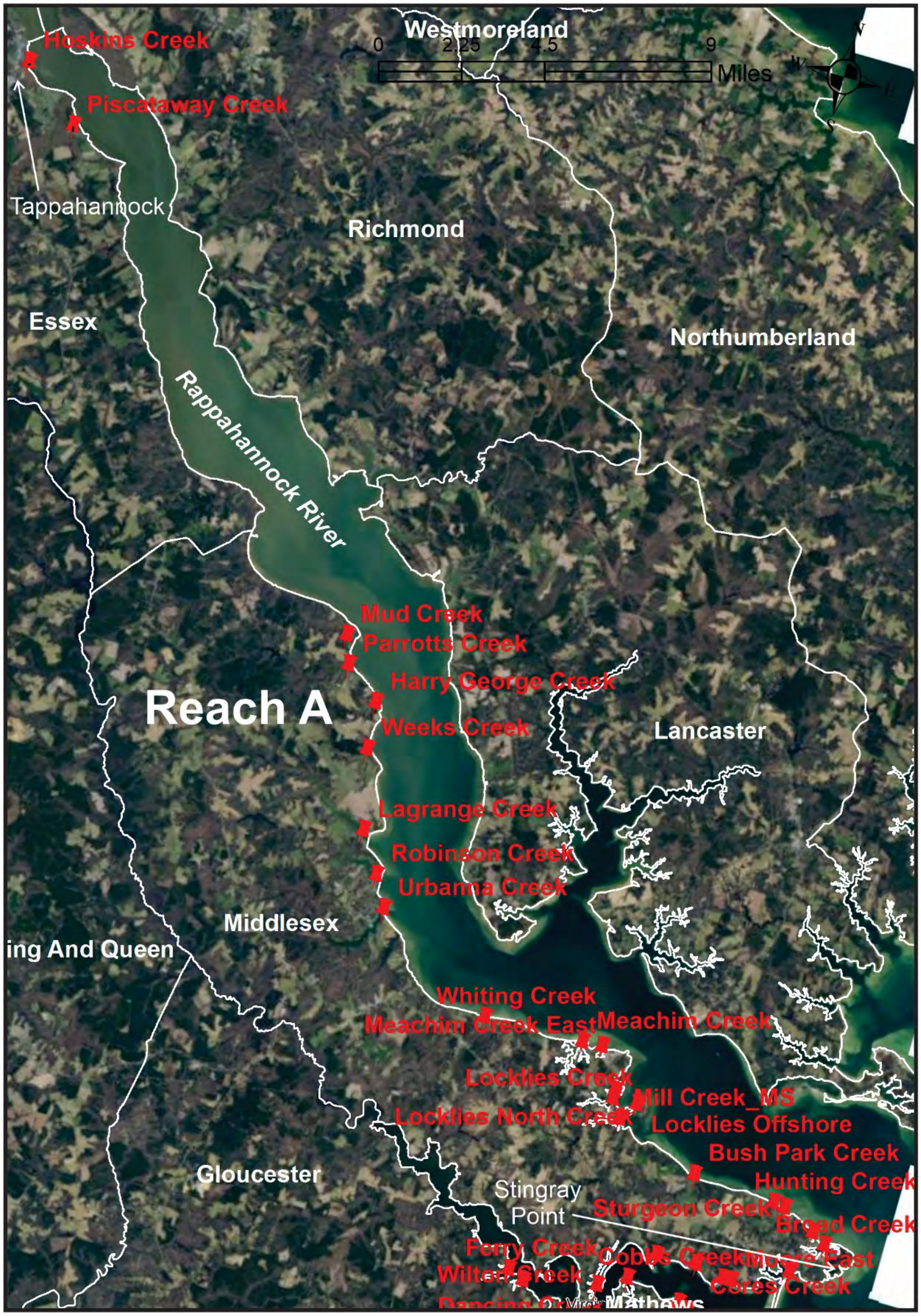


Figure 4. Tidal creeks along the Rappahannock River in Reach A.

Figure 5. Location of tidal creeks along Chesapeake Bay, Milford Haven, and Pianatank River in Reach B.

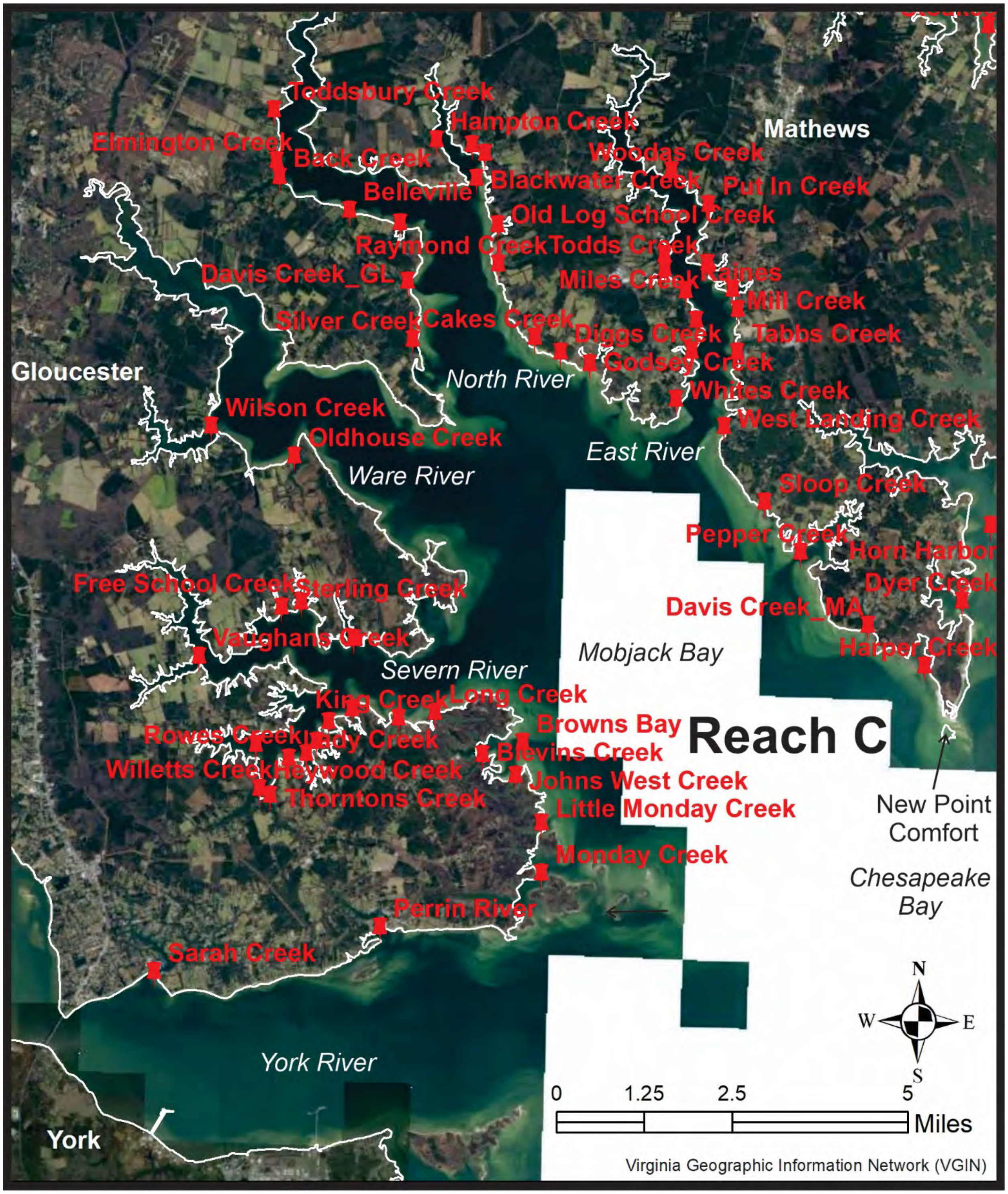


Figure 6. Tidal creeks in Mobjack Bay and associated rivers in Reach C.

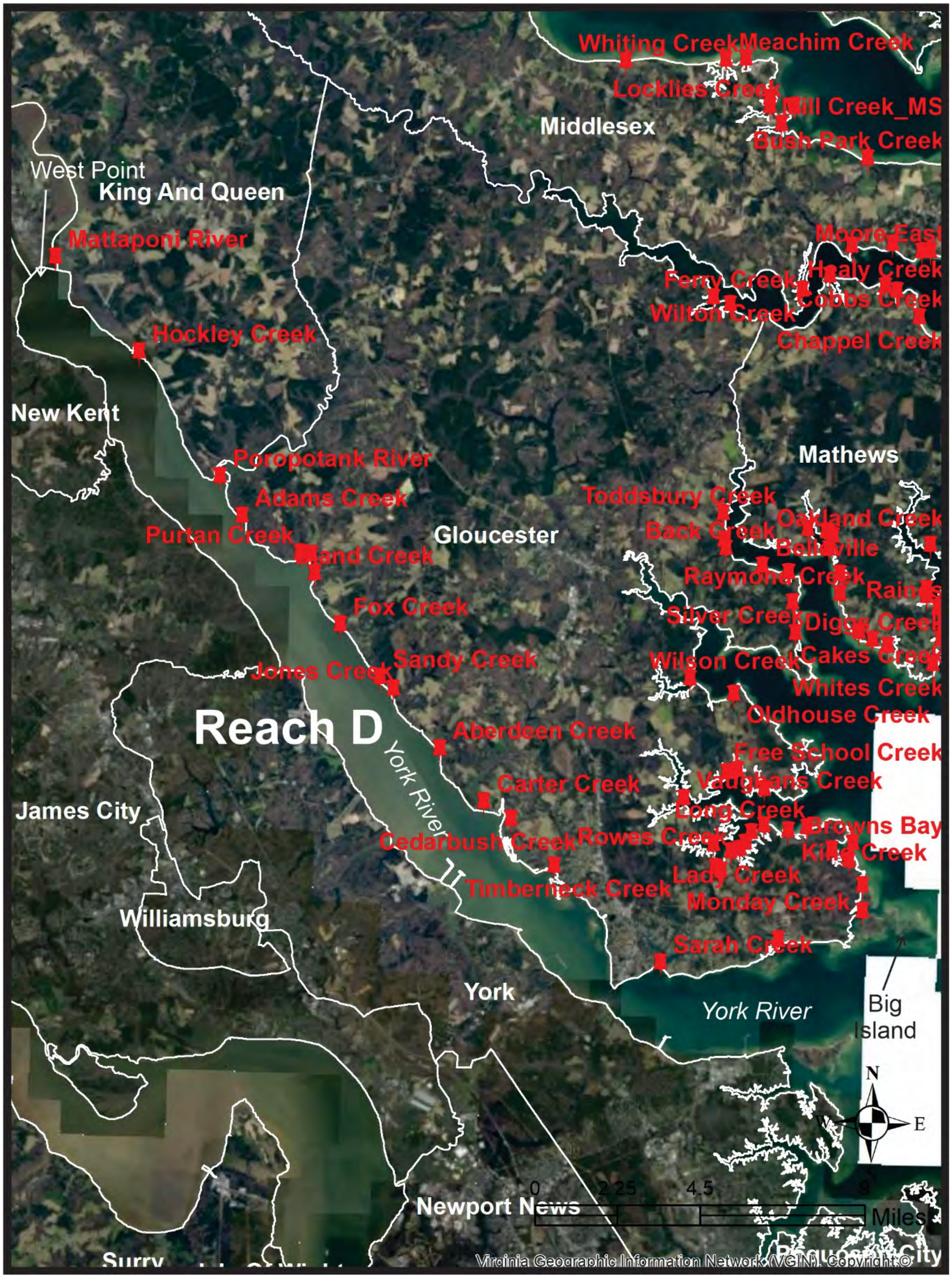


Figure 7. Location of tidal creeks along the York River in Reach D.

Table 1. List of prioritized creeks for dredging based on physical assessment.

Priority Number	Consecutive ID Num	Creek Name	Type	County	Channel Type	Water Body	Creek Mouth	Creek Shoaled	# Piers	# Marina	# Ramps	# Wharf
1	106	Sarah	Creek	Gloucester	Non-Federal ATON	York River	Restricted	>50% of channel	213	8	11	0
2	8	Robinson	Creek	Middlesex	Non-Federal ATON	Rappahannock River	Restricted	>50% of channel	111	5	5	0
3	19	Sturgeon	Creek	Middlesex	Non-Federal	Rappahannock River	Restricted	Completely shoaled	121	2	9	0
5	10	Whiting	Creek	Middlesex	Federal	Rappahannock River	Restricted	Completely shoaled	59	0	1	0
6	17	Bush Park	Creek	Middlesex	Non-Federal	Rappahannock River	Inlet	Completely shoaled	38	5	4	0
7	9	Urbanna	Creek	Middlesex	Federal	Rappahannock River	Restricted	>50% of channel	66	4	6	0
8	52	Davis	Creek	Mathews	Federal	Mobjack Bay	Inlet	>50% of channel	13	2	5	5
9	107	Timberneck	Creek	Gloucester	Non-Federal ATON	York River	Restricted	>50% of channel	27	1	2	0
10	110	Aberdeen	Creek	Gloucester	Federal	York River	Restricted	>50% of channel	22	1	4	0
4	12	Meachim East	Creek	Middlesex	Non-Federal	Rappahannock River	Restricted	Completely shoaled	83	2	3	0
11	11	Meachim	Creek	Middlesex	Non-Federal	Rappahannock River	Restricted	>50% of channel	83	0	1	0
12	48	Winter	Harbor	Mathews	Federal	Chesapkeake Bay	Inlet	>50% of channel	44	1	2	0
13	4	Parrotts	Creek	Middlesex	Federal	Rappahannock River	Restricted	>50% of channel	19	0	4	0
14	87	Free School	Creek	Gloucester	Non-Federal	Severn River	Restricted	>50% of channel	19	0	4	0
15	88	Sterling	Creek	Gloucester	Non-Federal	Severn River	Restricted	>50% of channel	10	0	2	0
16	28	Ferry	Creek	Gloucester	Non-Federal	Piankatank River	Restricted	>50% of channel	17	0	1	0
17	29	Dancing	Creek	Gloucester	Non-Federal	Piankatank River	Restricted	>50% of channel	14	0	1	0
18	20	Unnamed	Cove	Middlesex	Non-Federal	Rappahannock River	Open	Completely shoaled	18	0	0	0
19	68	Godsey	Creek	Mathews	Non-Federal	North River	Restricted	>50% of channel	6	0	1	0
20	85	Oldhouse	Creek	Gloucester	Non-Federal	Ware River	Restricted	>50% of channel	6	0	1	0
21	33	Chappel	Creek	Mathews	Non-Federal	Piankatank River	Inlet	Completely shoaled	8	0	0	0
22	5	Harry George	Creek	Middlesex	Non-Federal	Rappahannock River	Restricted	Completely shoaled	5	0	0	0
23	32	Warehouse	Cove	Mathews	Non-Federal	Piankatank River	Inlet	Completely shoaled	4	0	0	0
24	25	Cores	Creek	Middlesex	Non-Federal	Piankatank River	Inlet	>50% of channel	8	0	0	0
25	35	Winder	Creek	Mathews	Non-Federal	Piankatank River	Inlet	>50% of channel	9	0	0	0

Figure 8. Sarah Creek in Gloucester County showing aids to navigation, private oyster leases, and SAV.

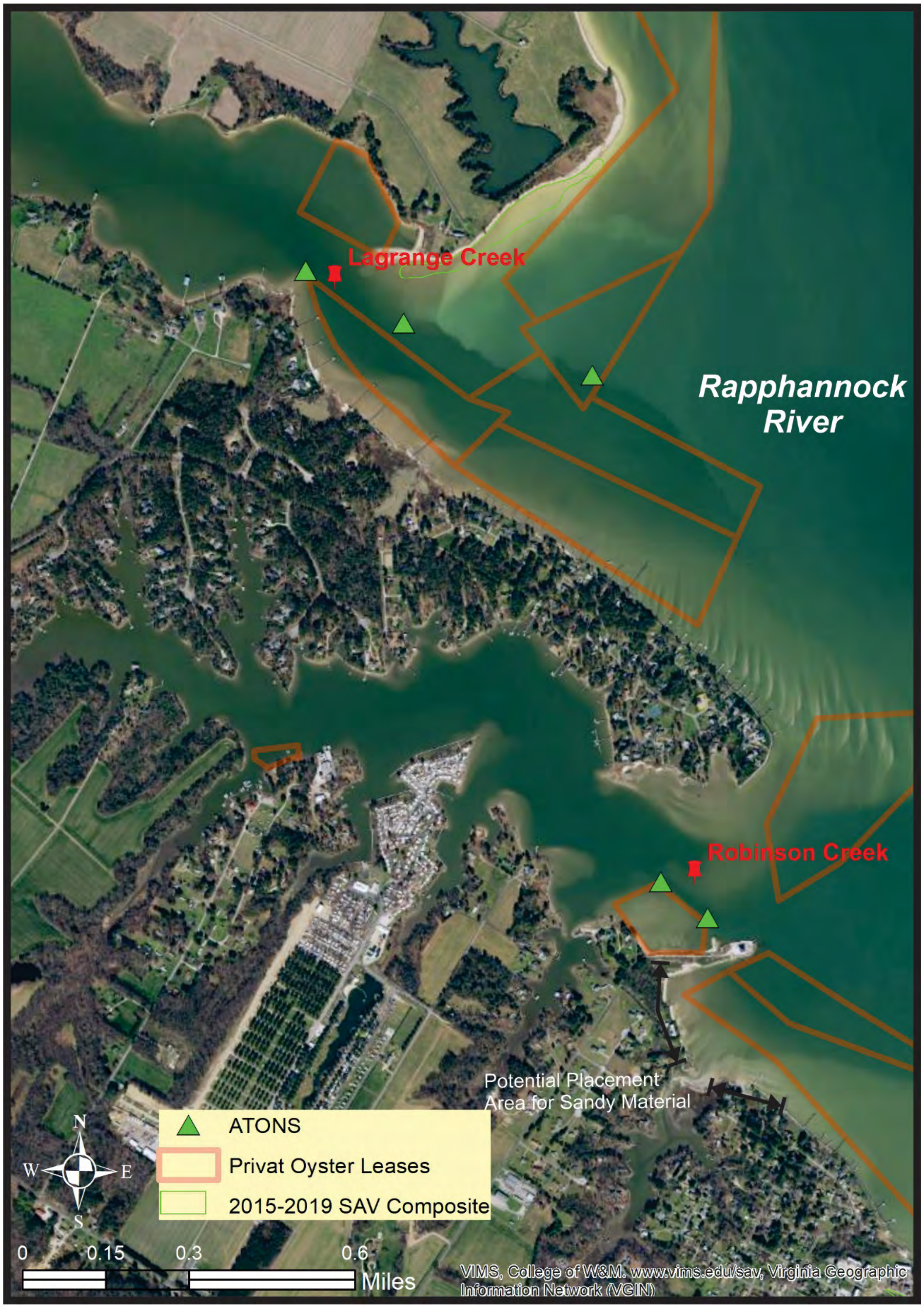


Figure 9. Robinson Creek in Middlesex County showing ATONs and private oyster leases. No SAV occurs in the area of Robinson Creek.

Figure 10. Sturgeon Creek in Middlesex County showing ATONs and private oyster leases. No SAV occurs in the area of Sturgeon Creek.

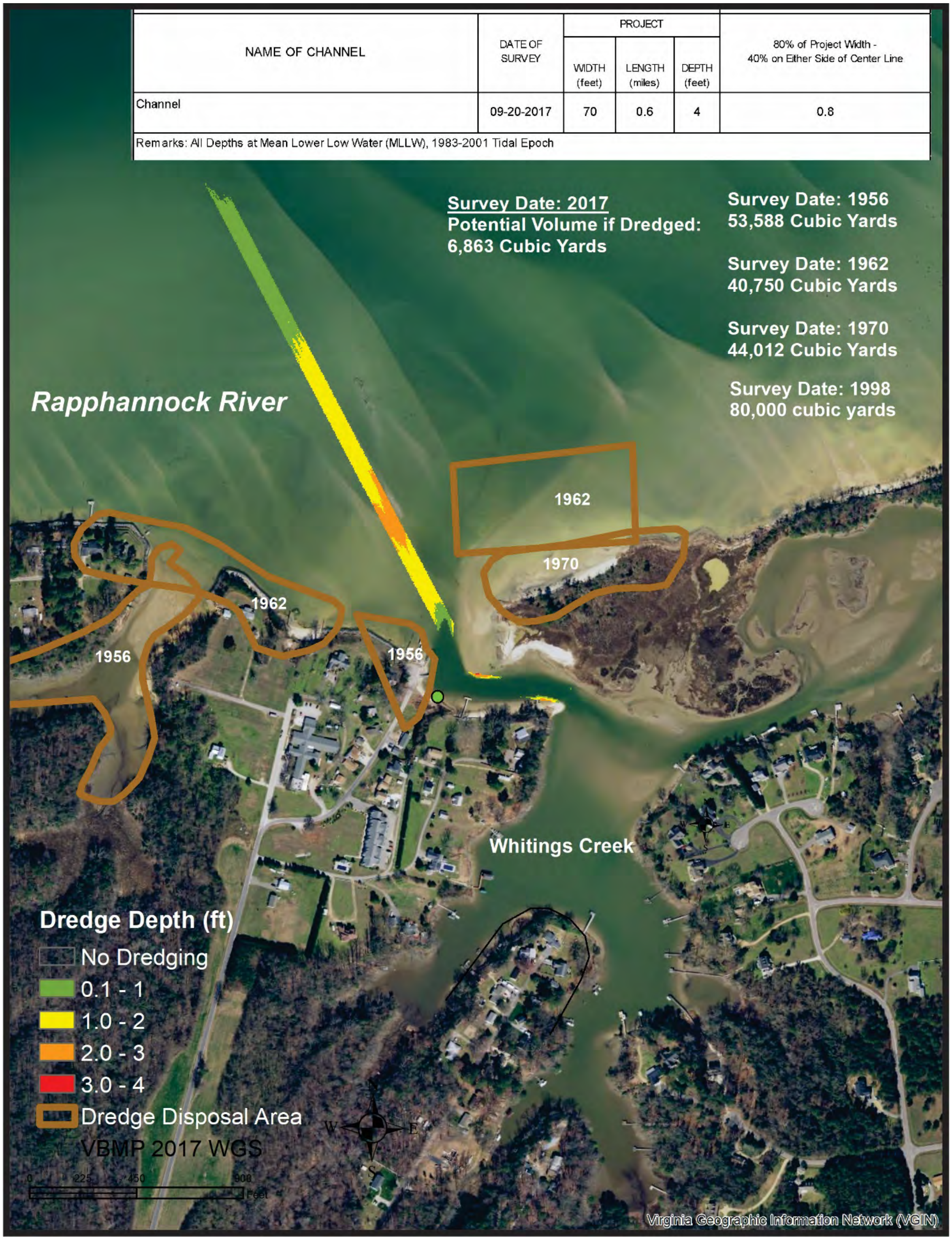


Figure 11. Whiting Creek federal channel in Middlesex County showing the amount of material that needs to be dredged from the channel as well as precious dredge cycles and disposal areas. From Hardaway et al. (2019).

Table 2. List of creeks on the Middle Peninsula that had no visible shoaling identified on the 2017 VGIN aerial image. As such, dredging is likely not needed except in special cases.

Consecutive ID Num	Creek Name	Type	County	Channel Type	Water Body	Creek Mouth	Creek Shoaled	# Piers	# Marina	# Ramps	# Wharf
41	Stutts	Creek	Mathews	Non-Federal ATON	Milford Haven	Open	No Visible Shoaling	108	1	5	0
22	Jackson	Creek	Middlesex	Federal	Piankatank River	Restricted	No Visible Shoaling	103	5	6	0
30	Cobbs	Creek	Mathews	Non-Federal ATON	Piankatank River	Open	No Visible Shoaling	58	3	1	0
75	Blackwater	Creek	Mathews	Non-Federal	North River	Open	No Visible Shoaling	51	1	4	0
27	Wilton	Creek	Middlesex	Non-Federal	Piankatank River	Open	No Visible Shoaling	50	2	1	0
60	Put In	Creek	Mathews	Non-Federal	East River	Open	No Visible Shoaling	48	0	1	0
84	Wilson	Creek	Gloucester	Non-Federal	Ware River	Semi-Restricted	No Visible Shoaling	42	0	5	0
45	Morris	Creek	Mathews	Non-Federal	Stutts Creek/Milford Haven	Open	No Visible Shoaling	37	0	2	0
2	Piscataway	Creek	Essex	Non-Federal	Rappahannock River	Open	No Visible Shoaling	36	0	4	0
39	Barn	Creek	Mathews	Non-Federal	Milford Haven	Open	No Visible Shoaling	32	0	1	0
38	Edwards	Creek	Mathews	Non-Federal	Milford Haven	Open	No Visible Shoaling	29	1	0	0
37	Lanes	Creek	Mathews	Non-Federal	Milford Haven	Open	No Visible Shoaling	26	0	1	0
42	Billups	Creek	Mathews	Non-Federal	Milford Haven	Open	No Visible Shoaling	24	1	5	0
61	Woodas	Creek	Mathews	Non-Federal	East River	Open	No Visible Shoaling	23	0	2	0
89	Vaughans	Creek	Gloucester	Non-Federal	Severn River (Northern Branch)	Open	No Visible Shoaling	21	0	1	0
26	Healy	Creek	Middlesex	Non-Federal	Piankatank River	Open	No Visible Shoaling	21	1	1	0
109	Carter	Creek	Gloucester	Non-Federal	York River	Open	No Visible Shoaling	20	0	0	0
62	Miles	Creek	Mathews	Non-Federal	East River	Open	No Visible Shoaling	19	0	1	0
82	Davis	Creek	Gloucester	Non-Federal	North River	Restricted	No Visible Shoaling	18	0	0	0
80	Belleville	Creek	Gloucester	Non-Federal	North River	Restricted	No Visible Shoaling	17	0	1	0
93	Thorntons	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Open	No Visible Shoaling	16	0	2	0
53	Pepper	Creek	Mathews	Non-Federal ATON	Mobjack Bay	Restricted	No Visible Shoaling	16	0	1	0
50	Dyer	Creek	Mathews	Non-Federal	Chesapeake Bay	Open	No Visible Shoaling	14	0	4	0
59	Todds	Creek	Mathews	Non-Federal	East River	Open	No Visible Shoaling	13	0	0	0
90	Willets	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Open	No Visible Shoaling	12	1	1	0
74	Greenmansion	Cove	Mathews	Non-Federal ATON	North River	Restricted	No Visible Shoaling	10	1	1	0
73	Oakland	Creek	Mathews	Non-Federal	North River	Semi-Restricted	No Visible Shoaling	8	0	1	0
117	Adams	Creek	Gloucester	Non-Federal	York River	Restricted	No Visible Shoaling	8	0	0	1
44	Stoakes	Creek	Mathews	Non-Federal	Milford Haven	Open	No Visible Shoaling	7	1	2	0
114	Bland	Creek	Gloucester	Non-Federal	York River	Restricted	No Visible Shoaling	6	0	0	0
96	Bill Browns	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Open	No Visible Shoaling	5	0	0	0
77	Toddsbury	Creek	Gloucester	Non-Federal	North River	Restricted	No Visible Shoaling	4	0	1	0
113	Fox	creek	Gloucester	Non-Federal	York River	Inlet	No Visible Shoaling	3	0	1	0
6	Weeks	Creek	Middlesex	Non-Federal	Rappahannock River	Open	No Visible Shoaling	2	0	1	0
92	Heywood	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Open	No Visible Shoaling	2	0	0	0
100	Browns	Bay	Gloucester	Non-Federal ATON	Mobjack Bay	Open	No Visible Shoaling	1	0	1	0
99	Long	Creek	Gloucester	Non-Federal	Severn River	Restricted	No Visible Shoaling	0	0	0	0
116	Purtan	Creek	Gloucester	Non-Federal	York River	Open	No Visible Shoaling	0	0	0	0
119	Hockley	Creek	King and Queen	Non-Federal	York River	Open	No Visible Shoaling	0	0	0	0
76	Hampton	Creek	Mathews	Non-Federal	North River	Open	No Visible Shoaling	0	0	0	0
120	Mattaponi Entrance*	River	King and Queen	Non-Federal	Mattaponi River	Open	No Visible Shoaling	15	0	1	0

*Mattaponi River is included, but only the shoreline at the mouth of the river was considered.

Table 3. A list of chemicals and metals tested in samples taken from Middle Peninsula creeks as well as their possible source.

Analysis:	Source:
MTBEX*	fuel component for gasoline engines
TCLP Silver	Industrial use
TCLP Mercury	Industrial use
TCLP Arsenic	Industrial use
TCLP Lead	Industrial use
TCLP Barium	Industrial use
TCLP Selenium	Industrial use
TCLP Cadmium	Industrial use
TCLP Chromium	Industrial use
PCB**	Commercial electrical equipment
TCLP Predetermination SVOC***	Occurs naturally/Industrial use
TCLP Pest	Industrial use
TCLP Herb	Industrial use
Semi-Volatile Hydrocarbons as TPH Diesel Range Organics****	Compounds in diesel fuel
Organochlorine Pesticides and PCB's as Aroclor	Pesticides in agriculture
TCLP Organochlorine Herbicides	Pesticides in agriculture/plant removal
TCLP Organochlorine Pesticides and PCB's	Pesticides in agriculture

Note: TCLP stands for "Toxicity Characteristic Leaching Procedure"
*MTBEX refers to methyl tert-butyl ether (MtBE) which is the analysis of benzene, toluene, ethylbenzene, and xylenes (BTEX)
**PCB refers to polychlorinated biphenyls, a harmful and highly toxic industrial compound
***SVOC refers to Semi Volatile Organic Compounds
****TPH refers to Total Petroleum Hydrocarbons

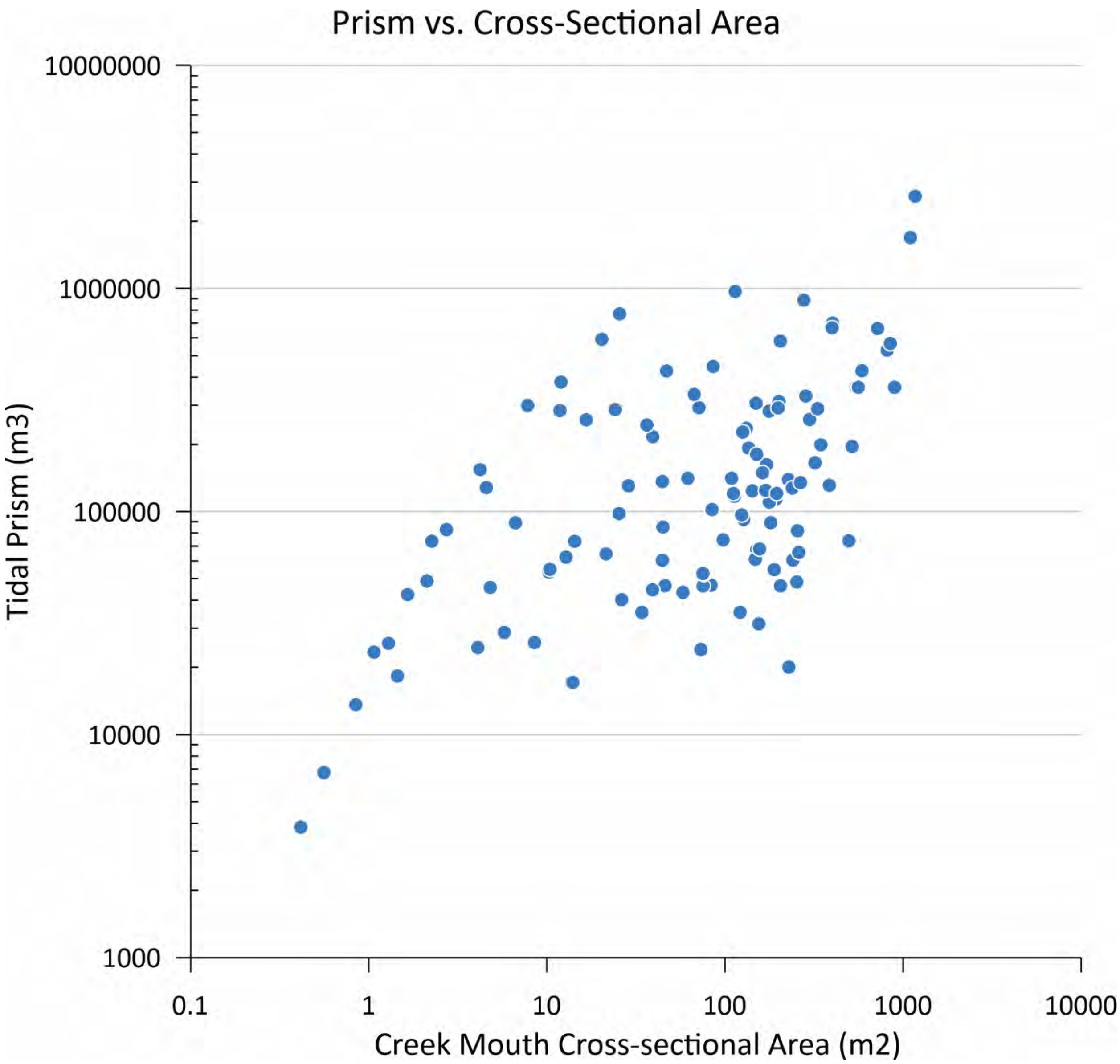


Figure 12. Plot of tidal prism versus creek mouth cross-sectional area for 120 creeks on the Middle Peninsula. No relationship is obvious due to variability in creek types.

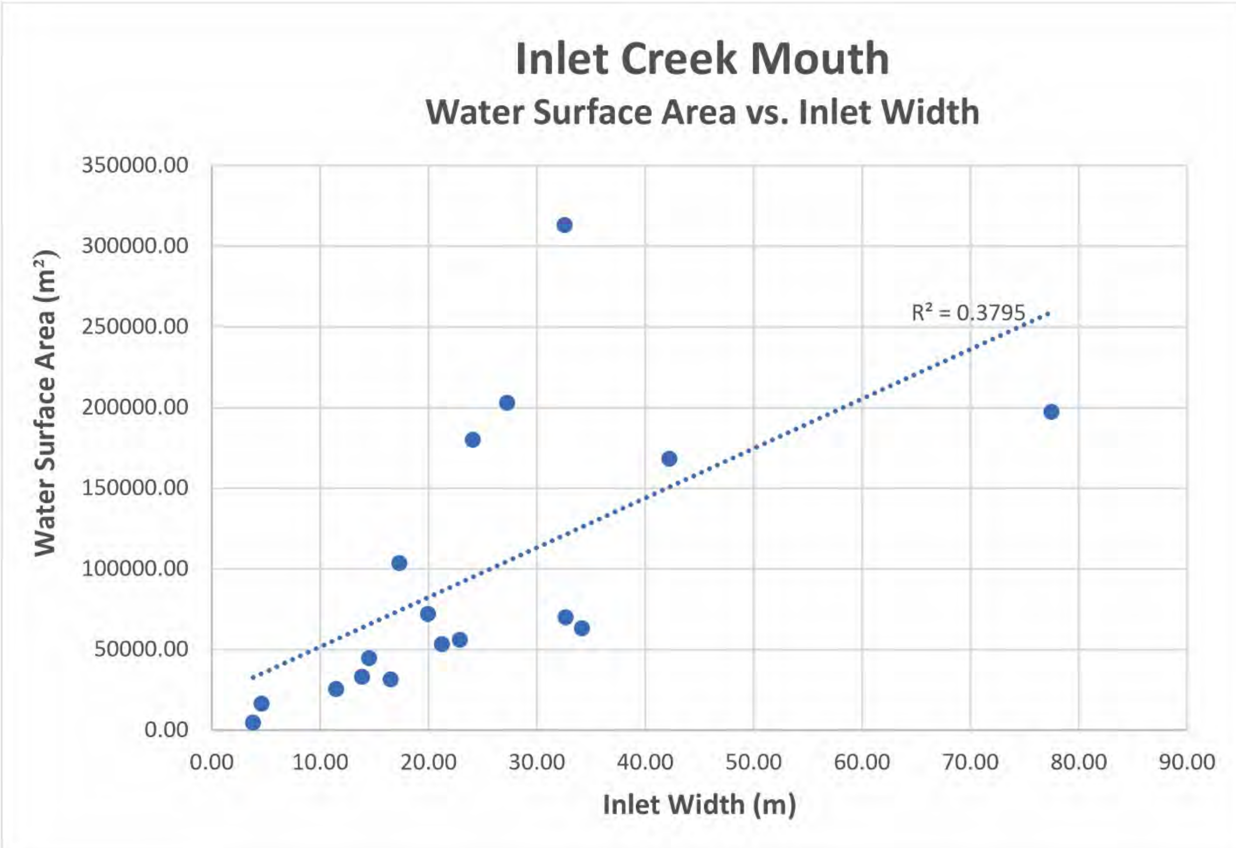


Figure 13. Plot of water surface area versus inlet width for inlet creek mouth categorized creeks on the Middle Peninsula. A slight relationship exists and could be potentially improved if outliers could be disqualified from the analysis.

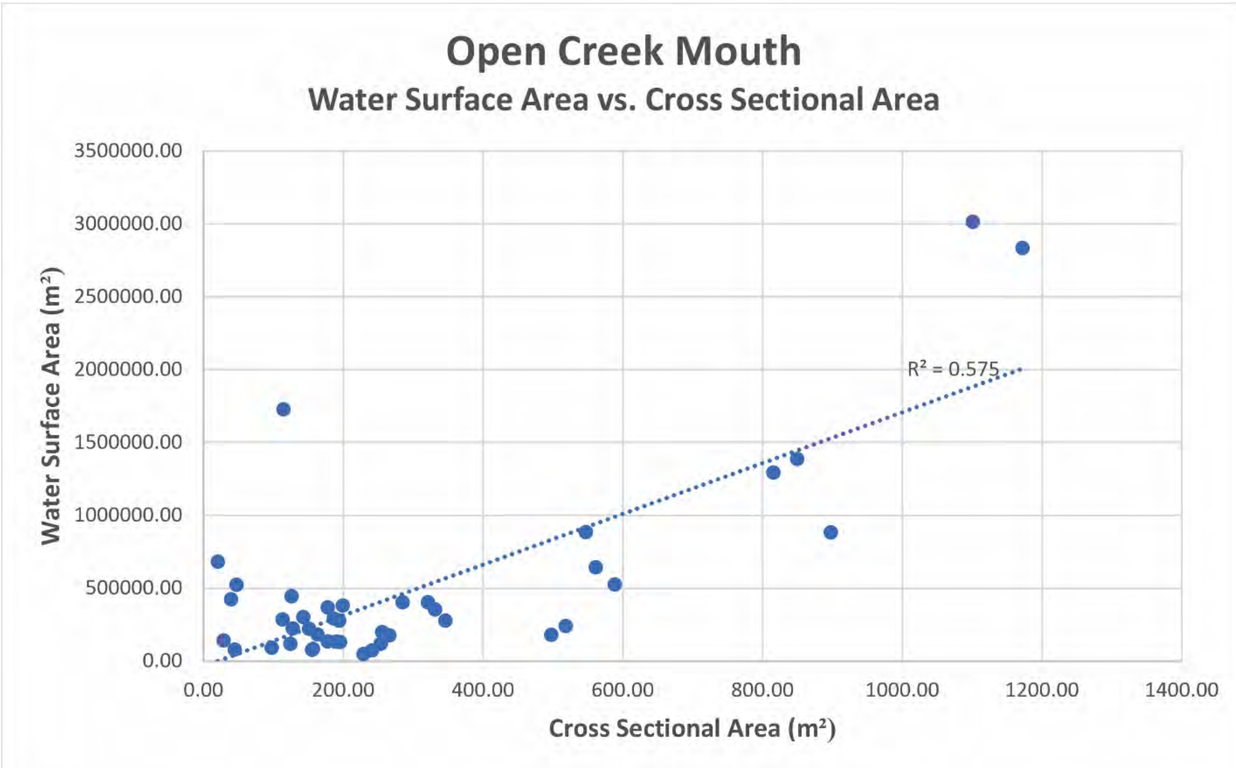


Figure 14. Plot water surface area versus creek mouth cross-sectional area for open creek mouth categorized creeks on the Middle Peninsula. A slight relationship exists and could be potentially improved if outliers could be disqualified from the analysis.

Appendix A

Individual Creek Data and Maps

Data Sheet for Hoskins Creek

Creek ID Number: 1	**Locality:** Essex
Water Body: Rappahannock River	**Channel Type:** Federal
Latitude: 37.9223	**Longitude:** -76.8534
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 18	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.8	**Creek Area (acres):** 132
Average Depth of Creek Mouth (ft): -0.4	**Maximum Depth of Creek Mouth (ft):** -0.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

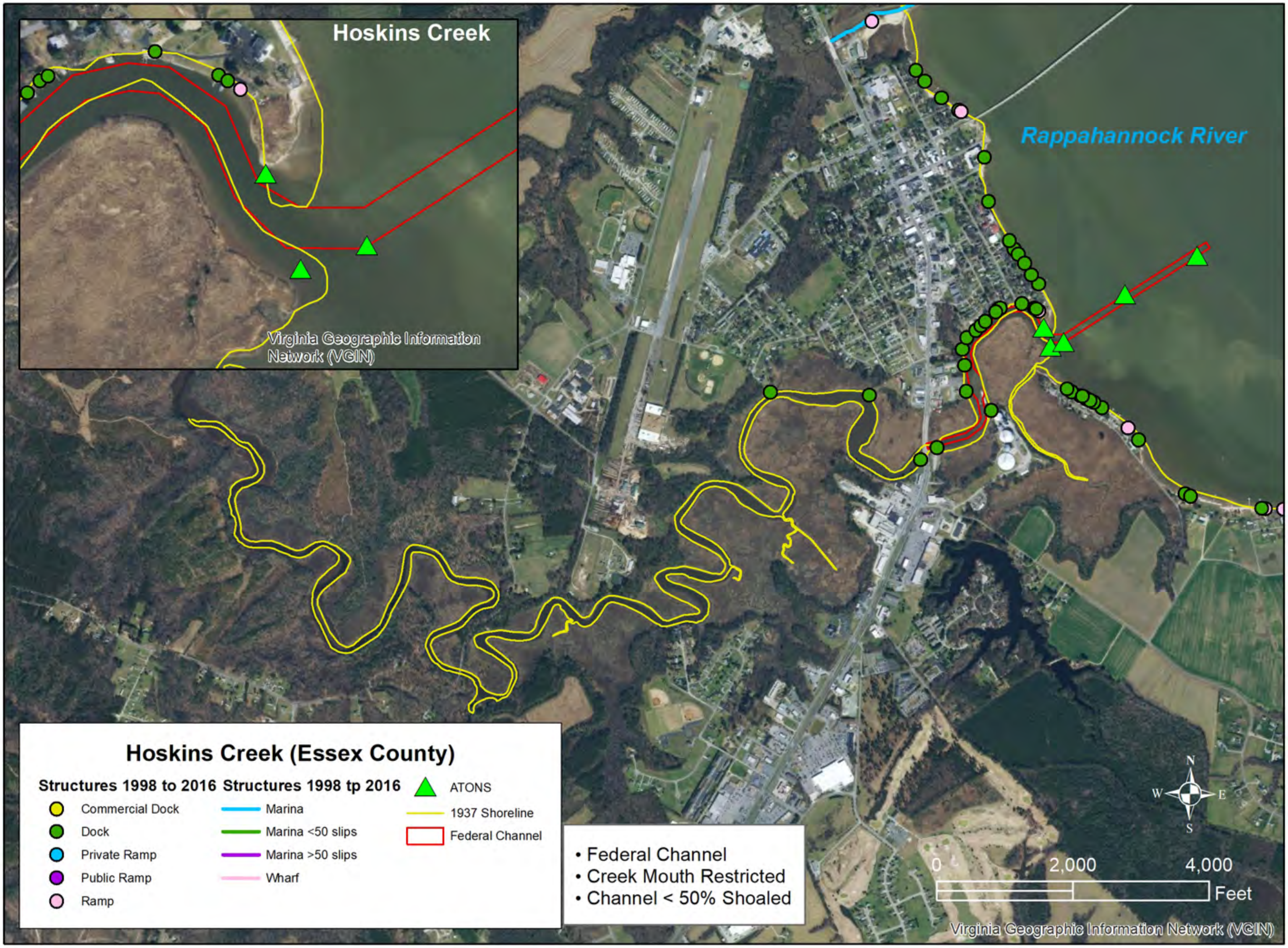
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Hoskins Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Hoskins Creek (Essex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
N
W
E
S
0
2,000
4,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Piscataway Creek

Creek ID Number: 2	**Locality:** Essex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.9028	**Longitude:** -76.8236
Number of Marinas: 0	
Number of Boat Ramps: 4	
Number of Piers: 36	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.8	**Creek Area (acres):** 427
Average Depth of Creek Mouth (ft): -2.2	**Maximum Depth of Creek Mouth (ft):** -2.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

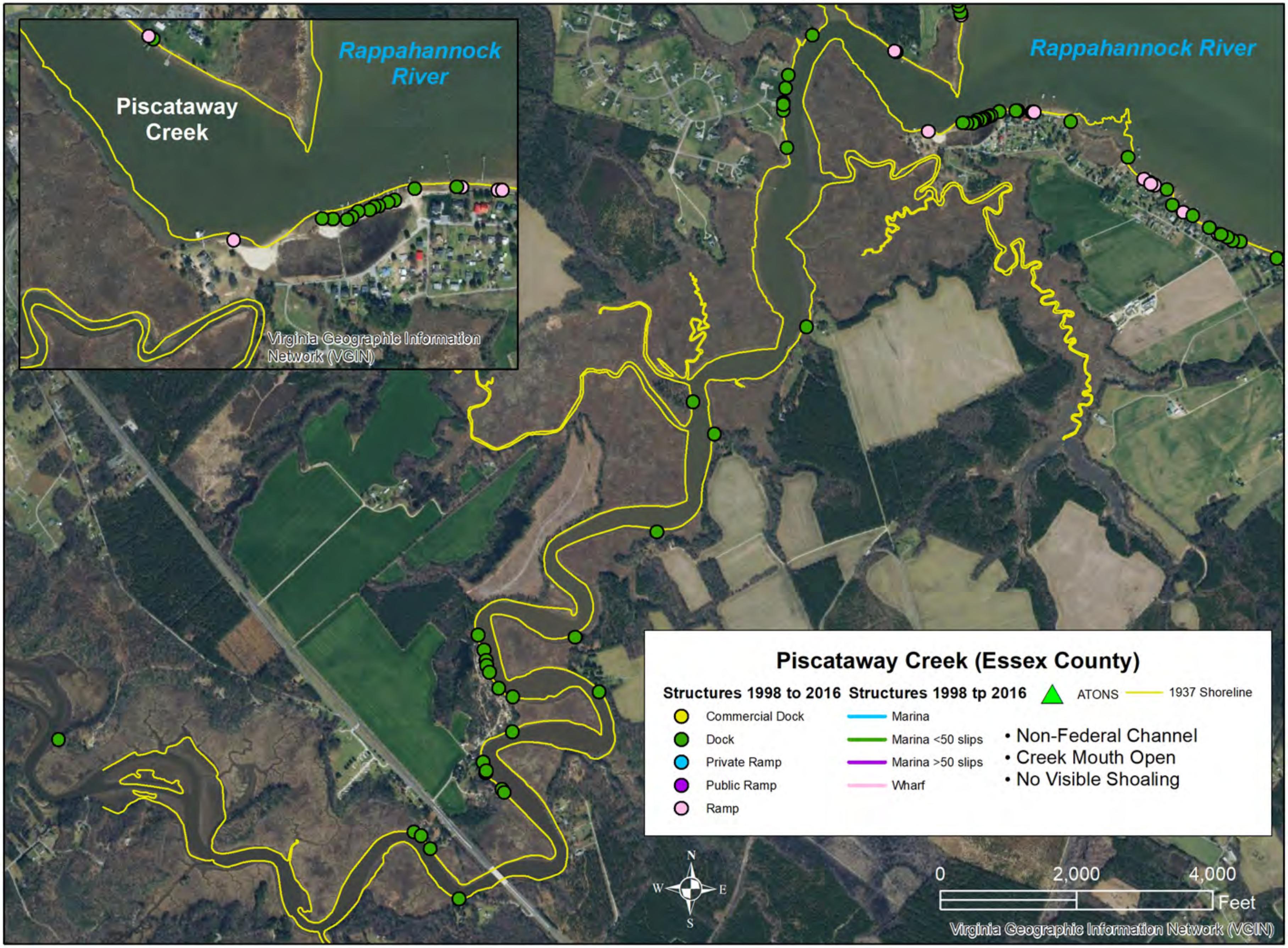
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Piscataway Creek
Rappahannock River
Virginia Geographic Information Network (VGIN)
Rappahannock River
Piscataway Creek (Essex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
N
W
E
S
0
2,000
4,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Mud Creek

Creek ID Number: 3	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.7400	**Longitude:** -76.6233
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 1	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.7	**Creek Area (acres):** 105
Average Depth of Creek Mouth (ft): -1.3	**Maximum Depth of Creek Mouth (ft):** -1.8

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

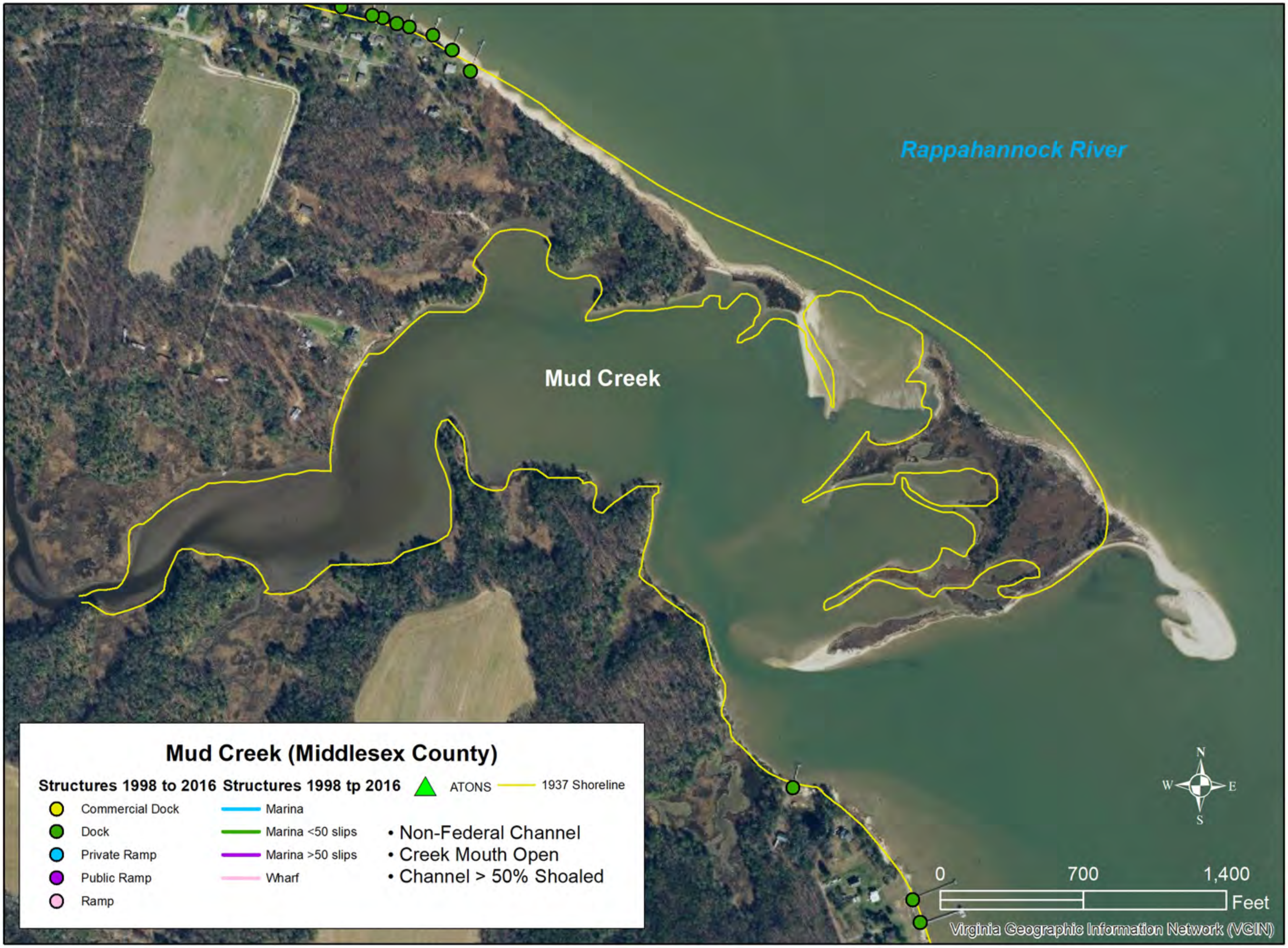
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Rappahannock River
Mud Creek
Mud Creek (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Open
• Channel > 50% Shoaled
N
W
E
S
0
700
1,400
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Parrotts Creek**

Creek ID Number: 4	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Federal
Latitude: 37.7290	**Longitude:** -76.6183
Number of Marinas: 0	
Number of Boat Ramps: 4	
Number of Piers: 19	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.7	**Creek Area (acres):** 115
Average Depth of Creek Mouth (ft): -2.7	**Maximum Depth of Creek Mouth (ft):** -4.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

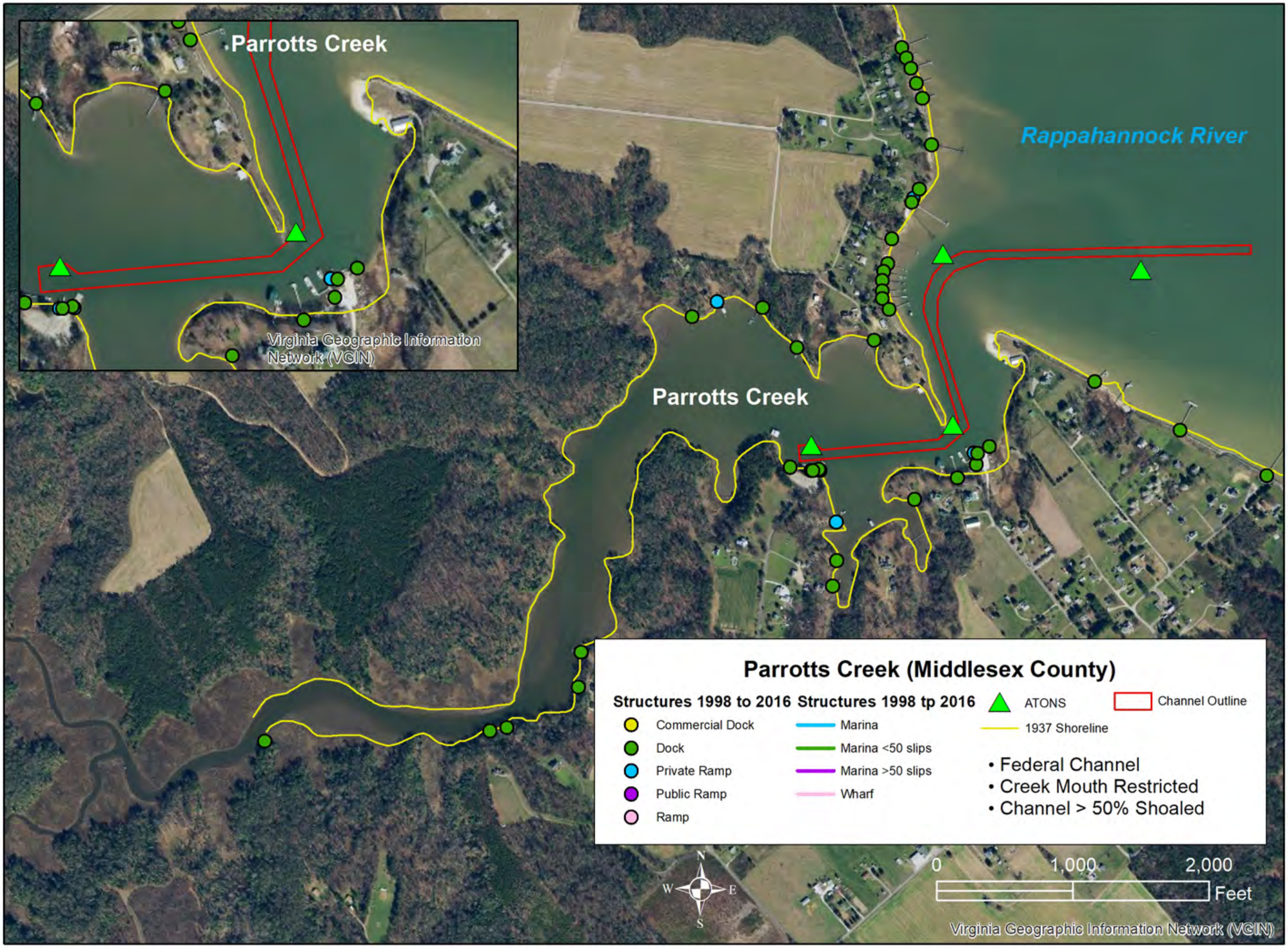
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Parrotts Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Parrotts Creek
Parrotts Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Channel Outline
• Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
N
W
E
S
0
1,000
2,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Harry George Creek

Creek ID Number: 5	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.7177	**Longitude:** -76.6003
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 5	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.7	**Creek Area (acres):** 48
Average Depth of Creek Mouth (ft): -1.0	**Maximum Depth of Creek Mouth (ft):** -1.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

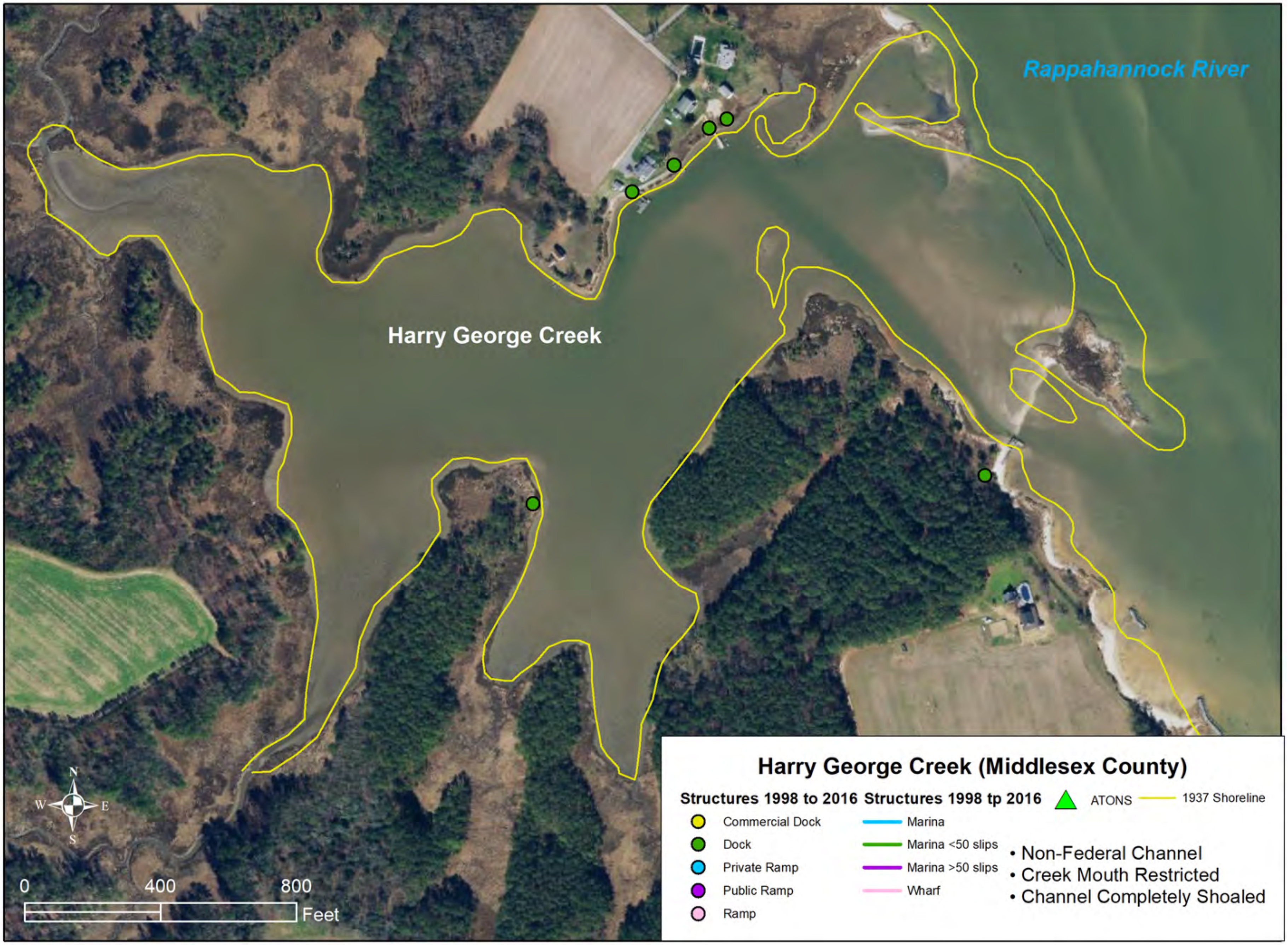
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Rappahannock River
Harry George Creek
Harry George Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel Completely Shoaled
N
W
E
S
0
400
800
Feet

Data Sheet for **Weeks Creek**

Creek ID Number: 6	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.6991	**Longitude:** -76.5982
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 2	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.7	**Creek Area (acres):** 110
Average Depth of Creek Mouth (ft): -2.6	**Maximum Depth of Creek Mouth (ft):** -3.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

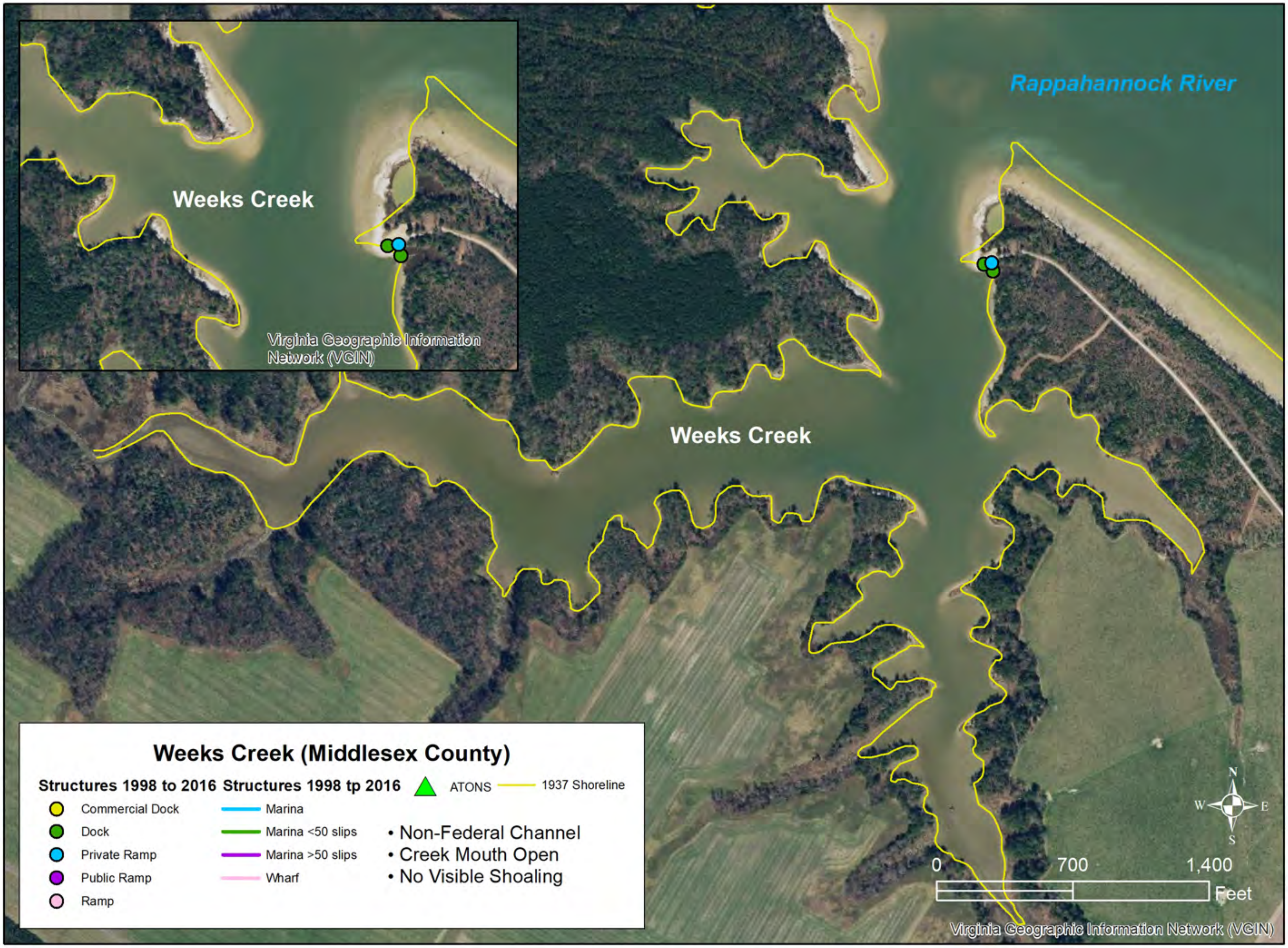
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Rappahannock River
Weeks Creek
Weeks Creek
Virginia Geographic Information Network (VGIN)
Weeks Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
N
W
E
S
0
700
1,400
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Lagrange Creek**

Creek ID Number: 7	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal ATON
Latitude: 37.6679	**Longitude:** -76.5887
Number of Marinas: 1	
Number of Boat Ramps: 6	
Number of Piers: 49	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.5	**Creek Area (acres):** 416
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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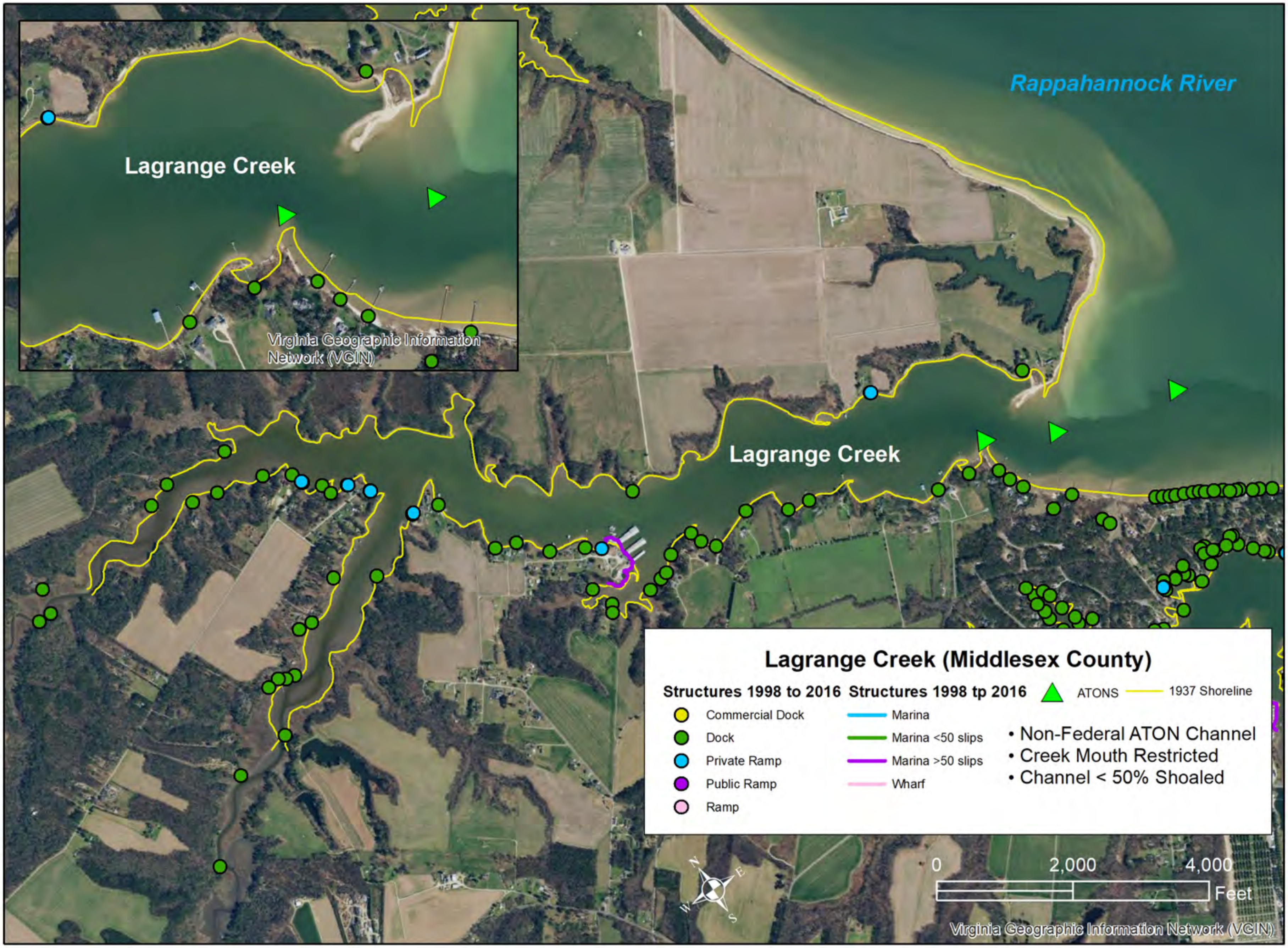
Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Rappahannock River
Lagrange Creek
Lagrange Creek
Virginia Geographic Information Network (VGIN)
Lagrange Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal ATON Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
2,000
4,000
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Robinson Creek

Creek ID Number: 8	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal ATON
Latitude: 37.6525	**Longitude:** -76.5765
Number of Marinas: 5	
Number of Boat Ramps: 5	
Number of Piers: 111	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.5	**Creek Area (acres):** 241
Average Depth of Creek Mouth (ft): -0.5	**Maximum Depth of Creek Mouth (ft):** -1.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

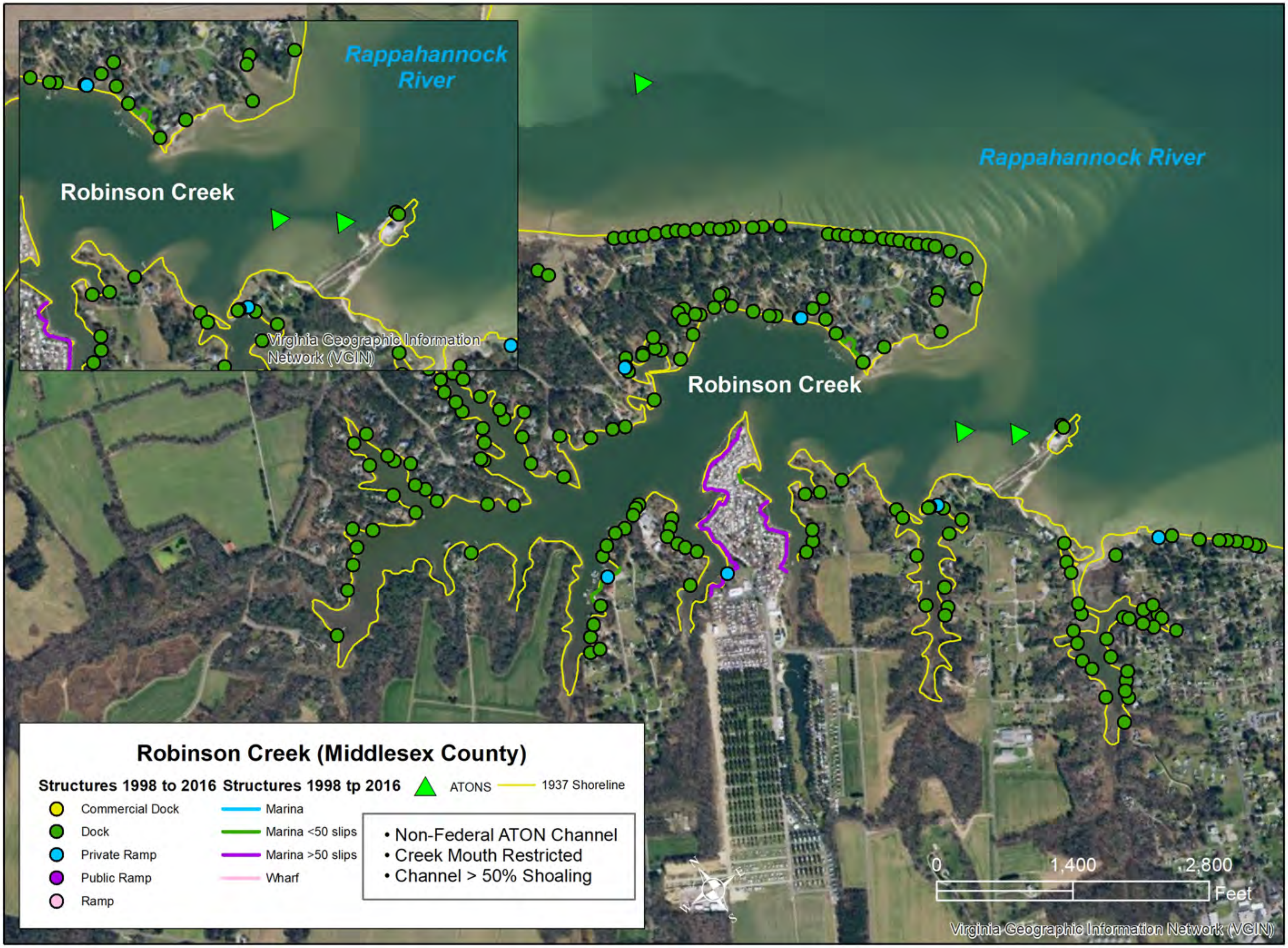
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Rappahannock River
Robinson Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Robinson Creek
Robinson Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal ATON Channel
• Creek Mouth Restricted
• Channel > 50% Shoaling
0
1,400
2,800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Urbanna Creek

Creek ID Number: 9	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Federal
Latitude: 37.6405	**Longitude:** -76.5686
Number of Marinas: 4	
Number of Boat Ramps: 6	
Number of Piers: 66	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.5	**Creek Area (acres):** 314
Average Depth of Creek Mouth (ft): -3.7	**Maximum Depth of Creek Mouth (ft):** -10.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

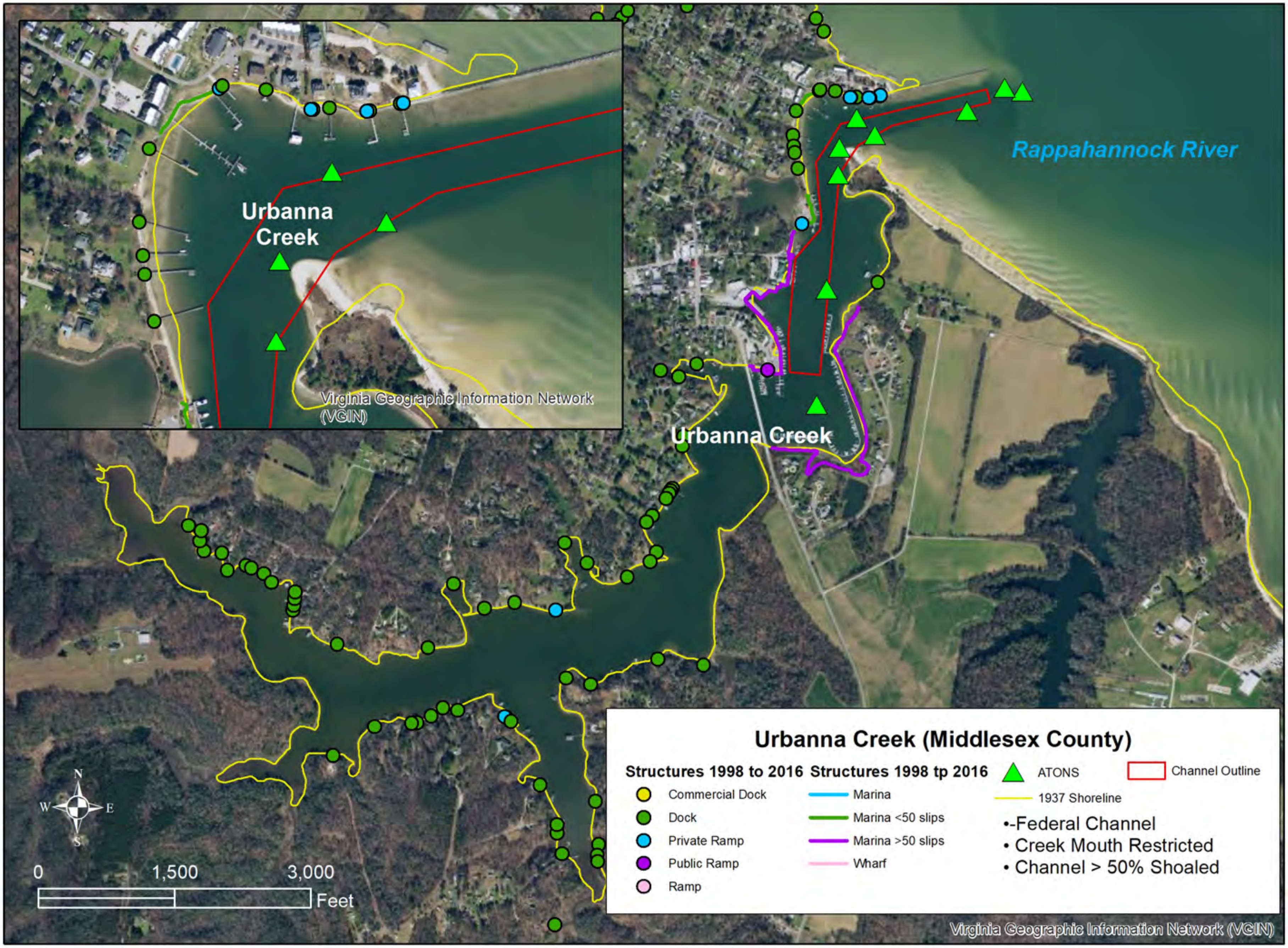
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Urbanna Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Urbanna Creek
Urbanna Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
Channel Outline
1937 Shoreline
•-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
N
W
E
S
0
1,500
3,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Whiting Creek**

Creek ID Number: 10	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Federal
Latitude: 37.6103	**Longitude:** -76.5058
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 59	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.5	**Creek Area (acres):** 132
Average Depth of Creek Mouth (ft): -1.3	**Maximum Depth of Creek Mouth (ft):** -2.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

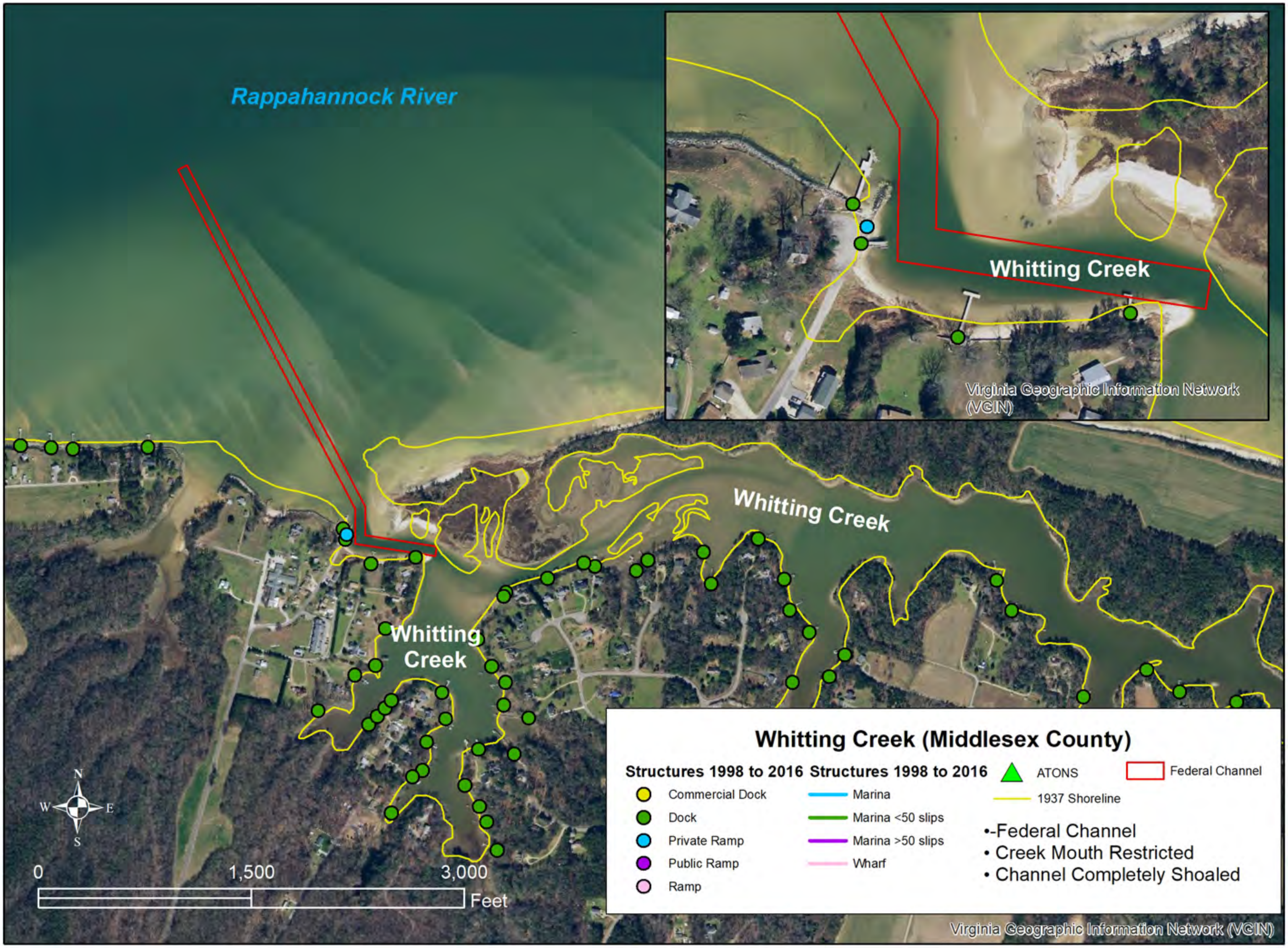
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Rappahannock River
Whitting Creek
Whitting Creek
Whitting Creek
Virginia Geographic Information Network (VGIN)
Whitting Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
Federal Channel
1937 Shoreline
•-Federal Channel
• Creek Mouth Restricted
• Channel Completely Shoaled
N
W
E
S
0
1,500
3,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Meachim Creek

Creek ID Number: 11	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.6115	**Longitude:** -76.4559
Number of Marinas: 0	
Number of Boat Ramps: **2**	
Number of Piers: 83	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.5	**Creek Area (acres):** 158
Average Depth of Creek Mouth (ft): -2.2	**Maximum Depth of Creek Mouth (ft):** -5.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

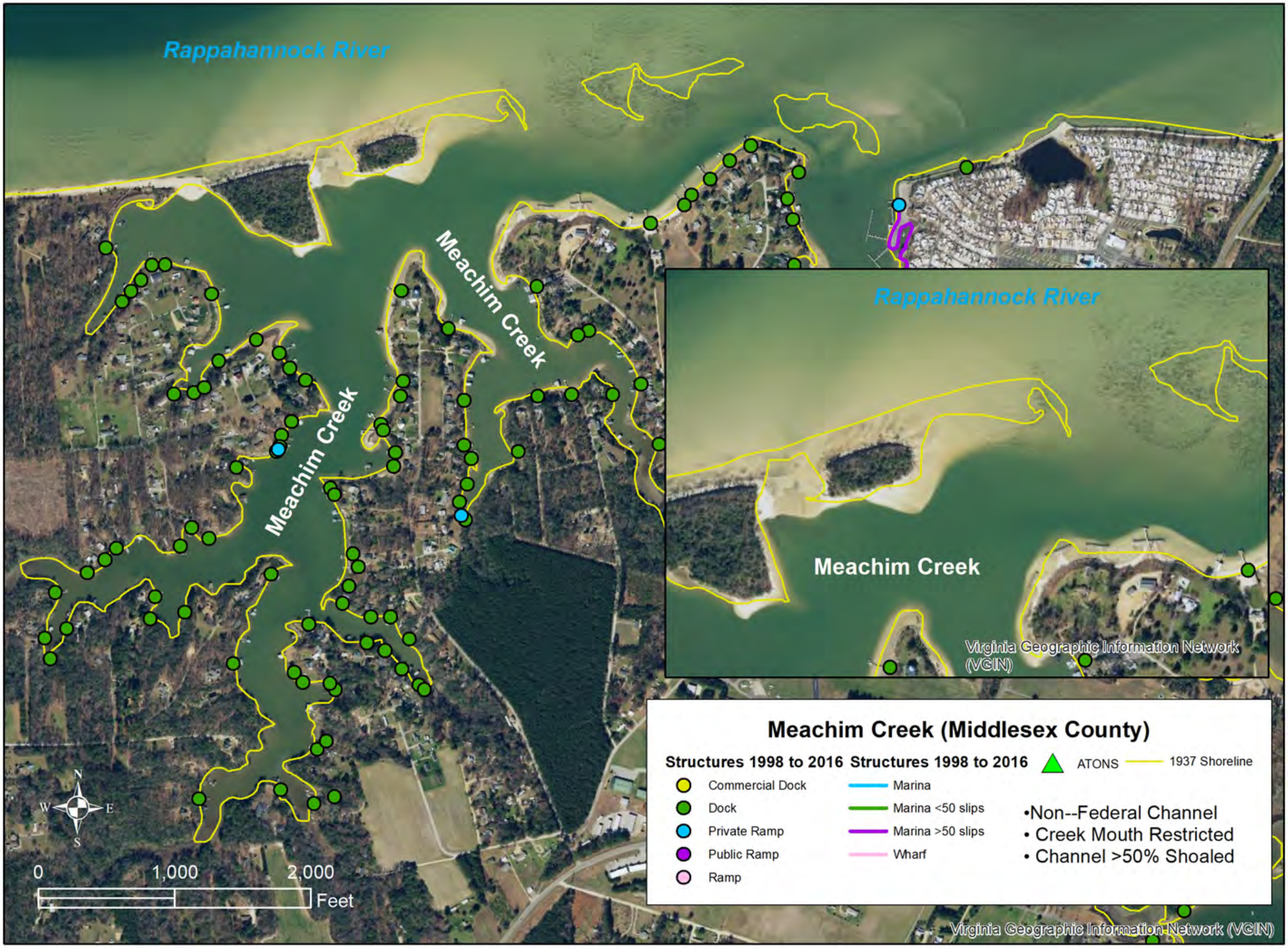
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Rappahannock River
Meachim Creek
Meachim Creek
Rappahannock River
Meachim Creek
Virginia Geographic Information Network (VGIN)
Meachim Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
•Non--Federal Channel
• Creek Mouth Restricted
• Channel >50% Shoaled
0
1,000
2,000
Feet
N
S
E
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Meachim Creek East

Creek ID Number: 12	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.6120	**Longitude:** -76.4459
Number of Marinas: 2	
Number of Boat Ramps: 1	
Number of Piers: 9	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.5	**Creek Area (acres):** 25
Average Depth of Creek Mouth (ft): -3.1	**Maximum Depth of Creek Mouth (ft):** -4.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

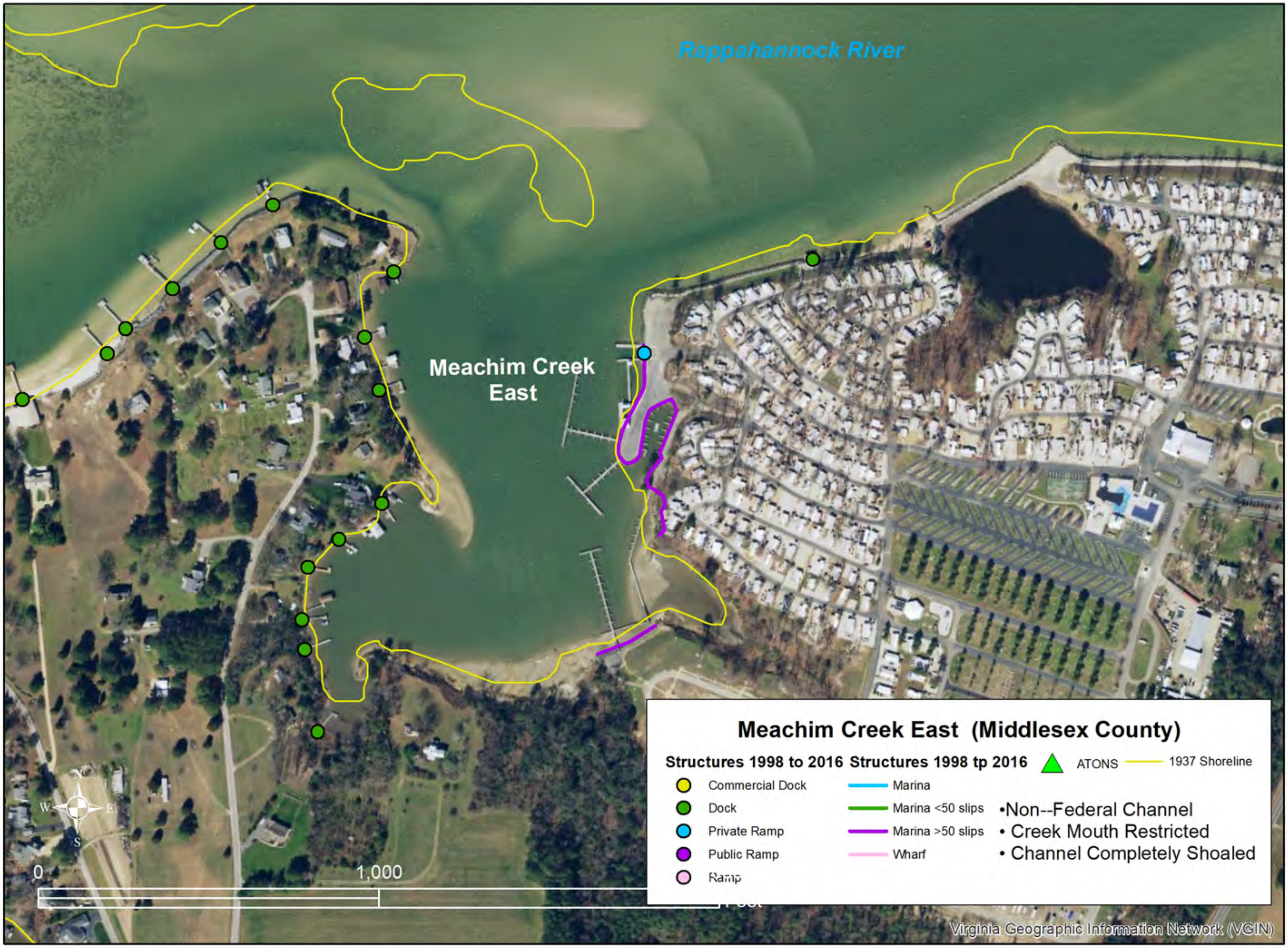
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Rappahannock River
Meachim Creek East
Meachim Creek East (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
•Non--Federal Channel
• Creek Mouth Restricted
• Channel Completely Shoaled
N
W
E
S
0
1,000
Virginia Geographic Information Network (VGIN)

Data Sheet for Locklies North Creek

Creek ID Number: 13	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.5965	**Longitude:** -76.4338
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 11	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 29
Average Depth of Creek Mouth (ft): -3.9	**Maximum Depth of Creek Mouth (ft):** -5.8

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

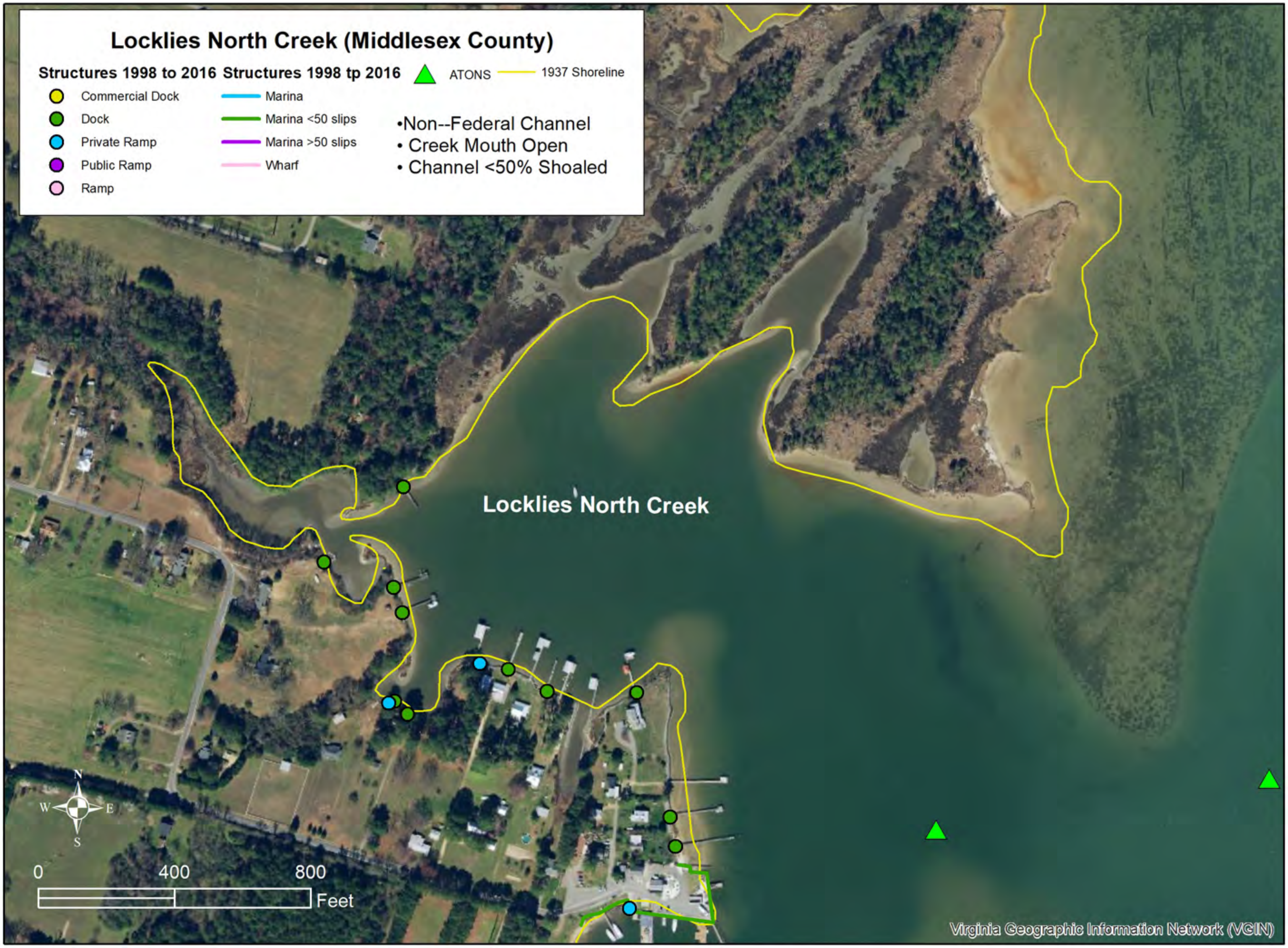
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Locklies North Creek (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
•Non--Federal Channel
• Creek Mouth Open
• Channel <50% Shoaled
Locklies North Creek
N
W
E
S
0
400
800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Locklies Creek**

Creek ID Number: 14	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.5933	**Longitude:** -76.4337
Number of Marinas: 3	
Number of Boat Ramps: 5	
Number of Piers: 32	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 71
Average Depth of Creek Mouth (ft): -2.7	**Maximum Depth of Creek Mouth (ft):** -4.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

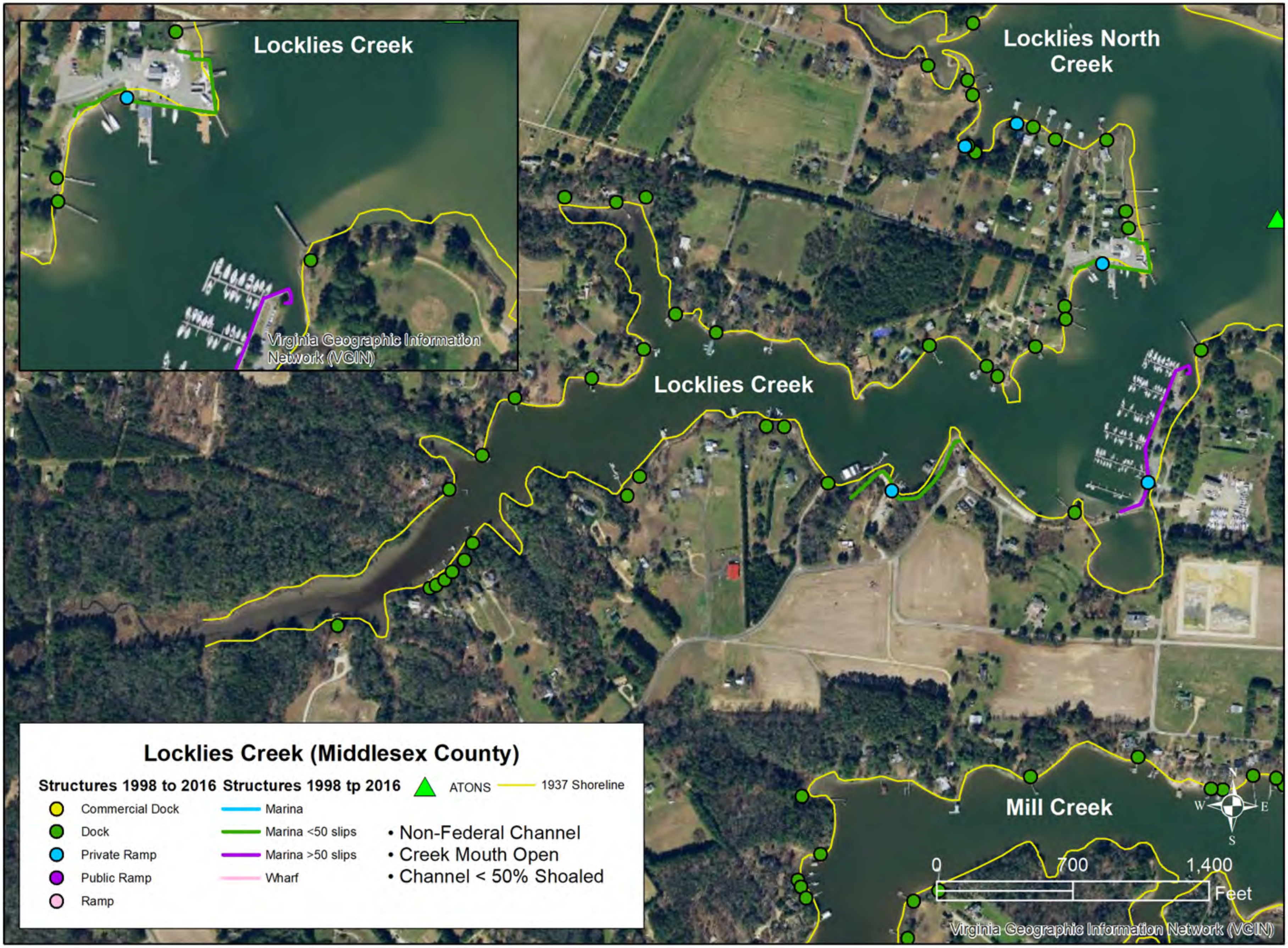
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Locklies Creek
Virginia Geographic Information Network (VGIN)
Locklies North Creek
Locklies Creek
Mill Creek
Locklies Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
700
1,400
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for Locklies Offshore

Creek ID Number: 15	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Federal
Latitude: 37.5936	**Longitude:** -76.4216
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: N/A	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 8
Average Depth of Creek Mouth (ft): N/A	**Maximum Depth of Creek Mouth (ft):** N/A

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Rappahannock River
Parrott Island
Locklies Offshore
Locklies Offshore (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
Federal Channel
1937 Shoreline
• Federal Channel
• Creek Mouth N/A
• Channel < 50% Shoaled
N
W
E
S
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Mill Creek_MS

Creek ID Number: 16	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.5863	**Longitude:** -76.4280
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 37	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 75
Average Depth of Creek Mouth (ft): -2.7	**Maximum Depth of Creek Mouth (ft):** -4.8

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

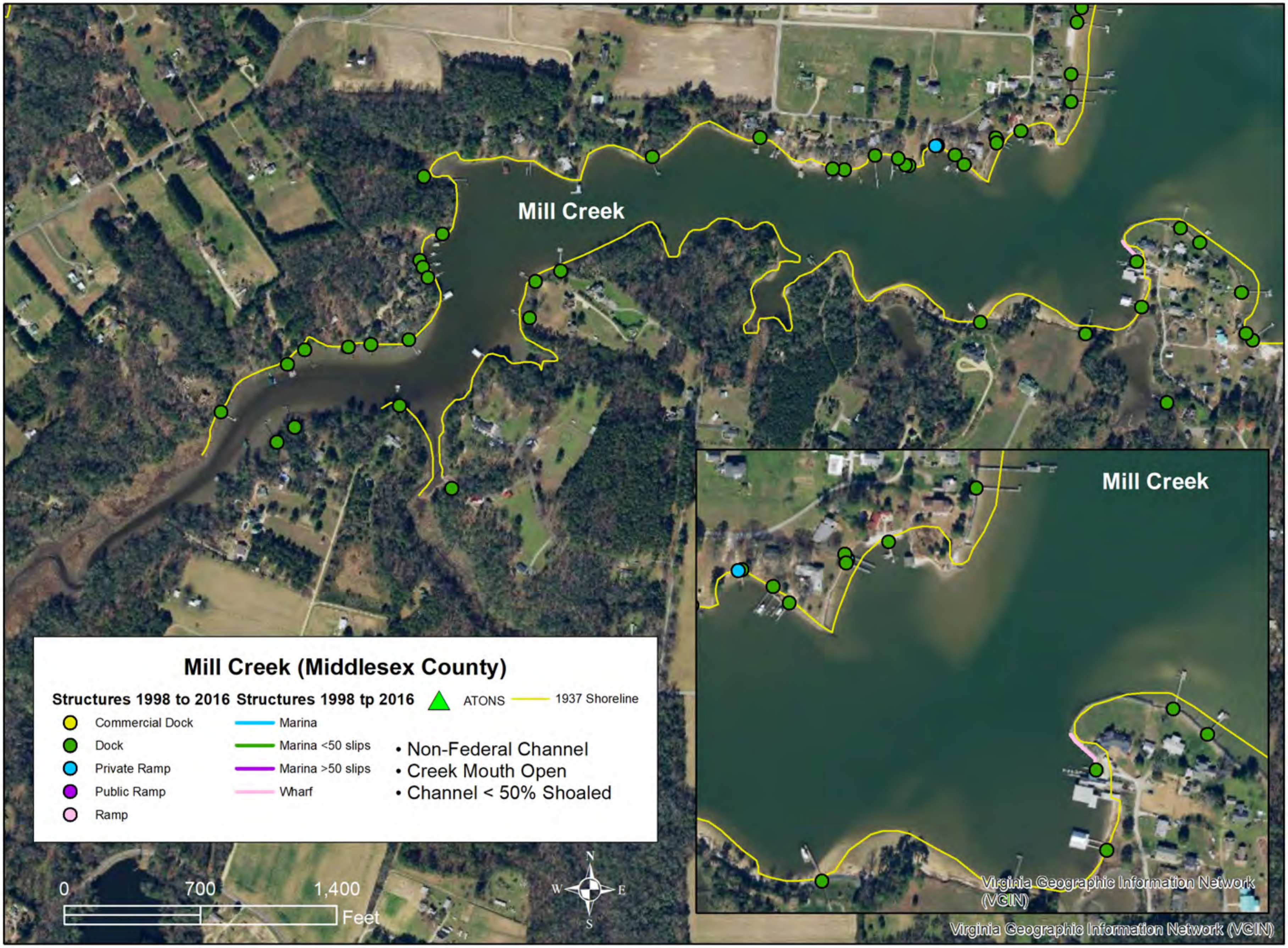
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Mill Creek
Mill Creek
Mill Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
700
1,400
Feet
N
S
W
E
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for **Bush Park Creek**

Creek ID Number: 17	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.5734	**Longitude:** -76.3849
Number of Marinas: 5	
Number of Boat Ramps: 4	
Number of Piers: 38	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.3	**Creek Area (acres):** 77
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

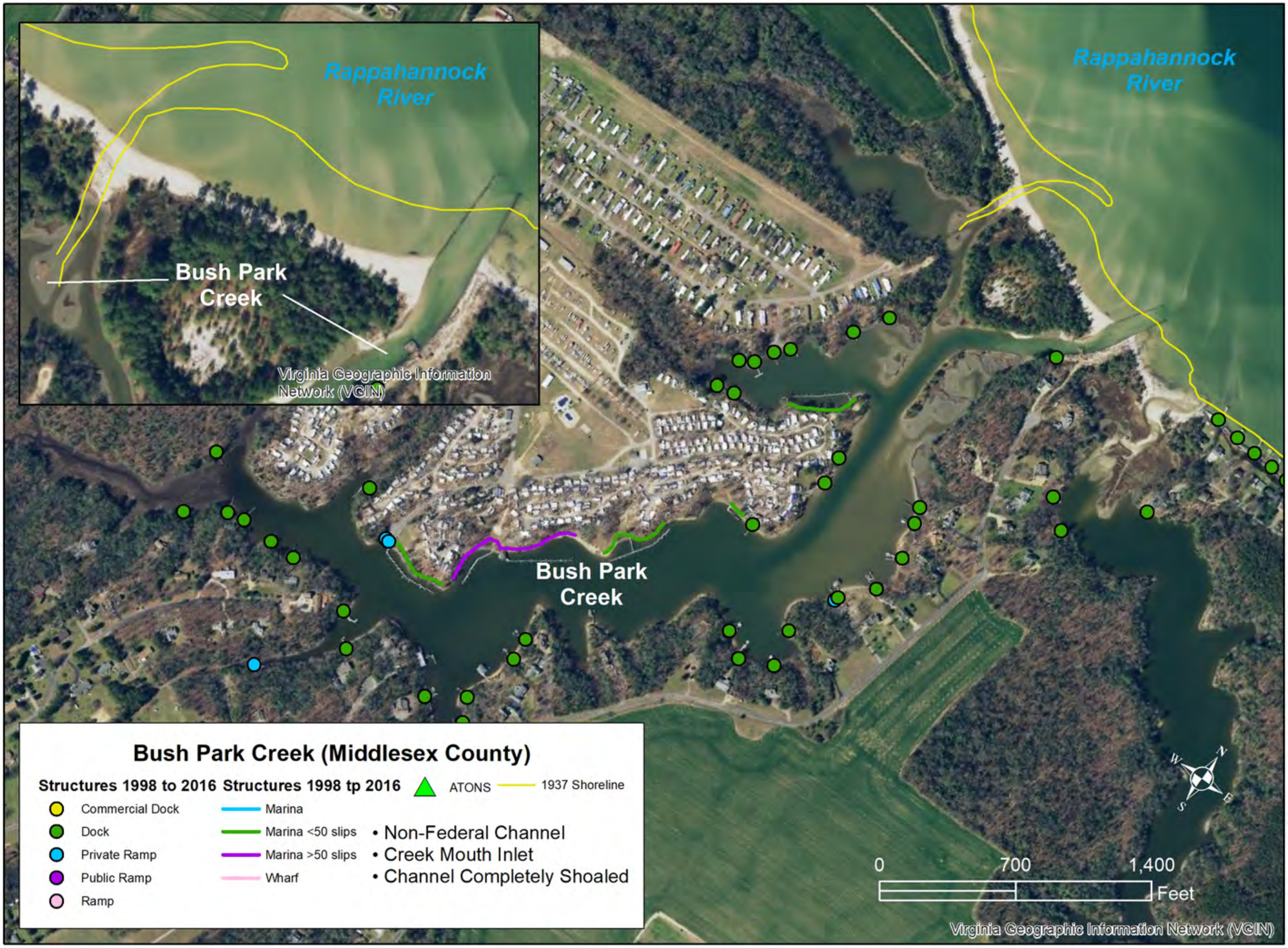
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Rappahannock River
Bush Park Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Bush Park Creek
Bush Park Creek (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Inlet
• Channel Completely Shoaled
0
700
1,400
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for **Hunting Creek**

Creek ID Number: 18	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.5711	**Longitude:** -76.3433
Number of Marinas: 1	
Number of Boat Ramps: 2	
Number of Piers: 35	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 26
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

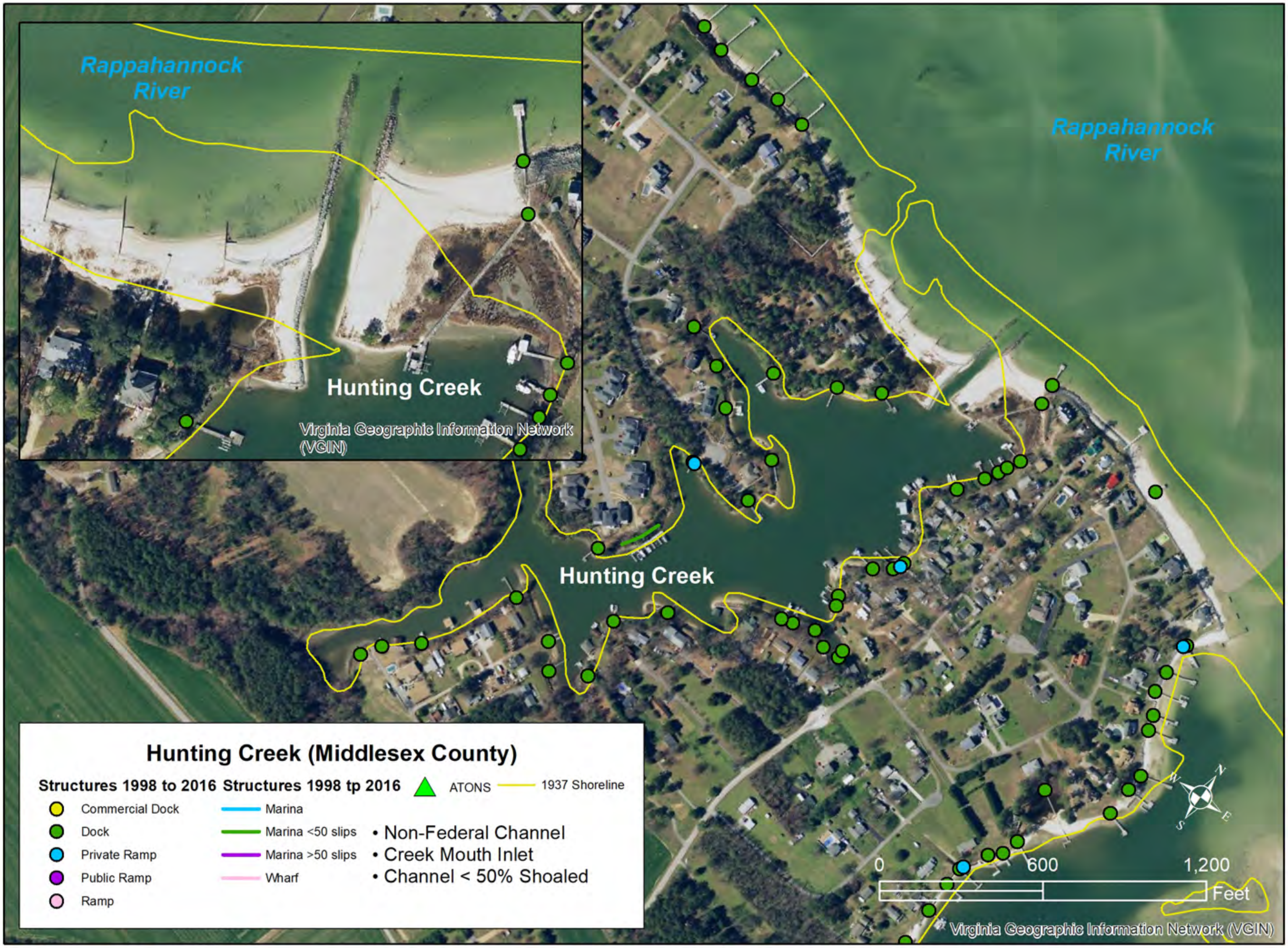
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Rappahannock River
Hunting Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Hunting Creek
Hunting Creek (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Inlet
• Channel < 50% Shoaled
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Sturgeon Creek

Creek ID Number: 19	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.5704	**Longitude:** -76.3375
Number of Marinas: 2	
Number of Boat Ramps: 9	
Number of Piers: 121	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.3	**Creek Area (acres):** 185
Average Depth of Creek Mouth (ft): -1.1	**Maximum Depth of Creek Mouth (ft):** -2.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

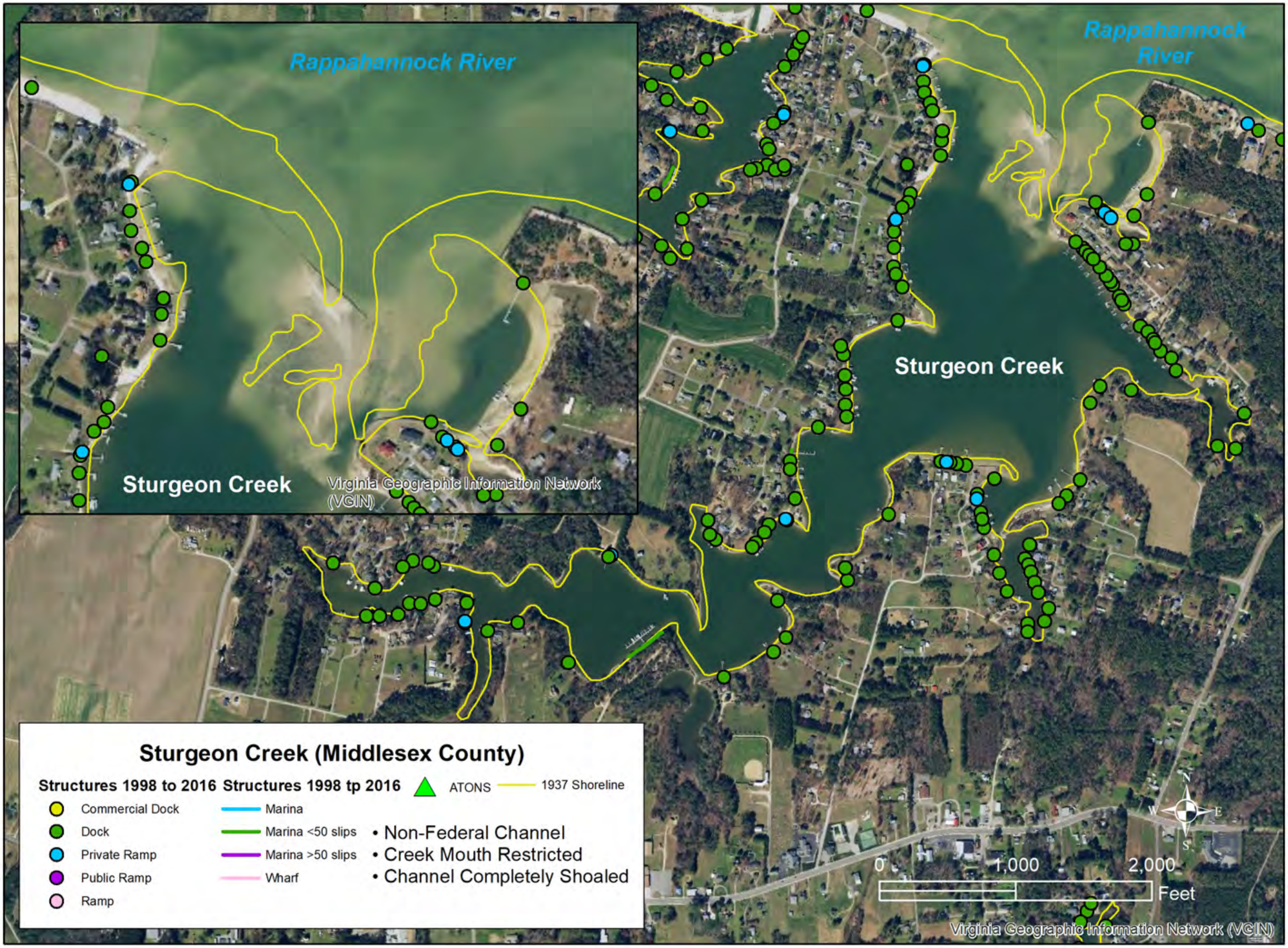
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Rappahannock River
Sturgeon Creek
Virginia Geographic Information Network (VGIN)
Rappahannock River
Sturgeon Creek
Sturgeon Creek (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Restricted
• Channel Completely Shoaled
0
1,000
2,000
Feet
N
S
E
W
Virginia Geographic Information Network (VGIN)

Data Sheet for **Unnamed Cove**

Creek ID Number: 20	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Non-Federal
Latitude: 37.5640	**Longitude:** -76.3206
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 18	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.3	**Creek Area (acres):** 12
Average Depth of Creek Mouth (ft): -3.3	**Maximum Depth of Creek Mouth (ft):** -4.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

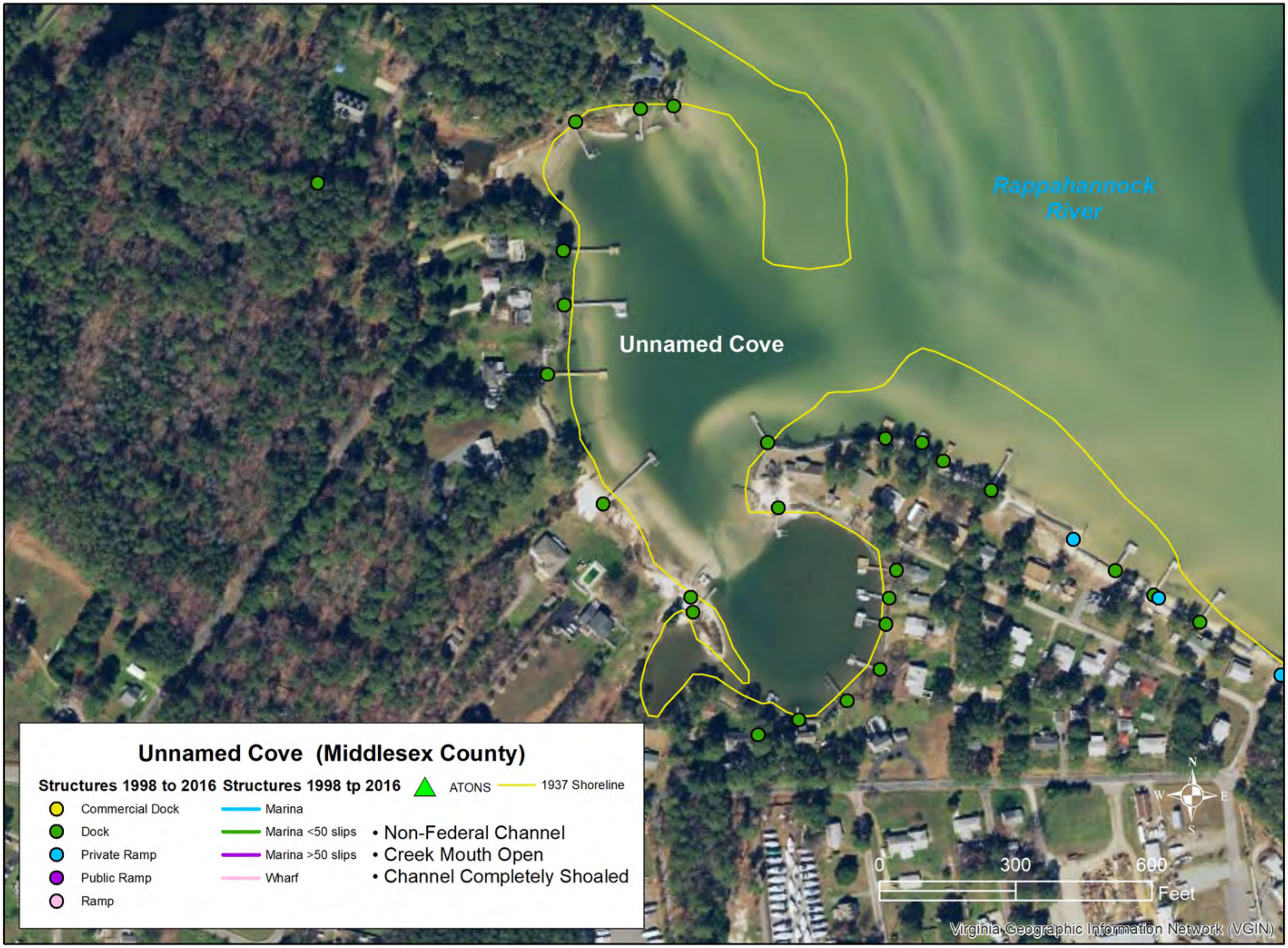
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Rappahannock River
Unnamed Cove
Unnamed Cove (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Open
• Channel Completely Shoaled
0
300
600
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for **Broad Creek**

Creek ID Number: 21	**Locality:** Middlesex
Water Body: Rappahannock River	**Channel Type:** Federal
Latitude: 37.5604	**Longitude:** -76.3134
Number of Marinas: 8	
Number of Boat Ramps: 7	
Number of Piers: 50	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 79
Average Depth of Creek Mouth (ft): -6.2	**Maximum Depth of Creek Mouth (ft):** -7.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

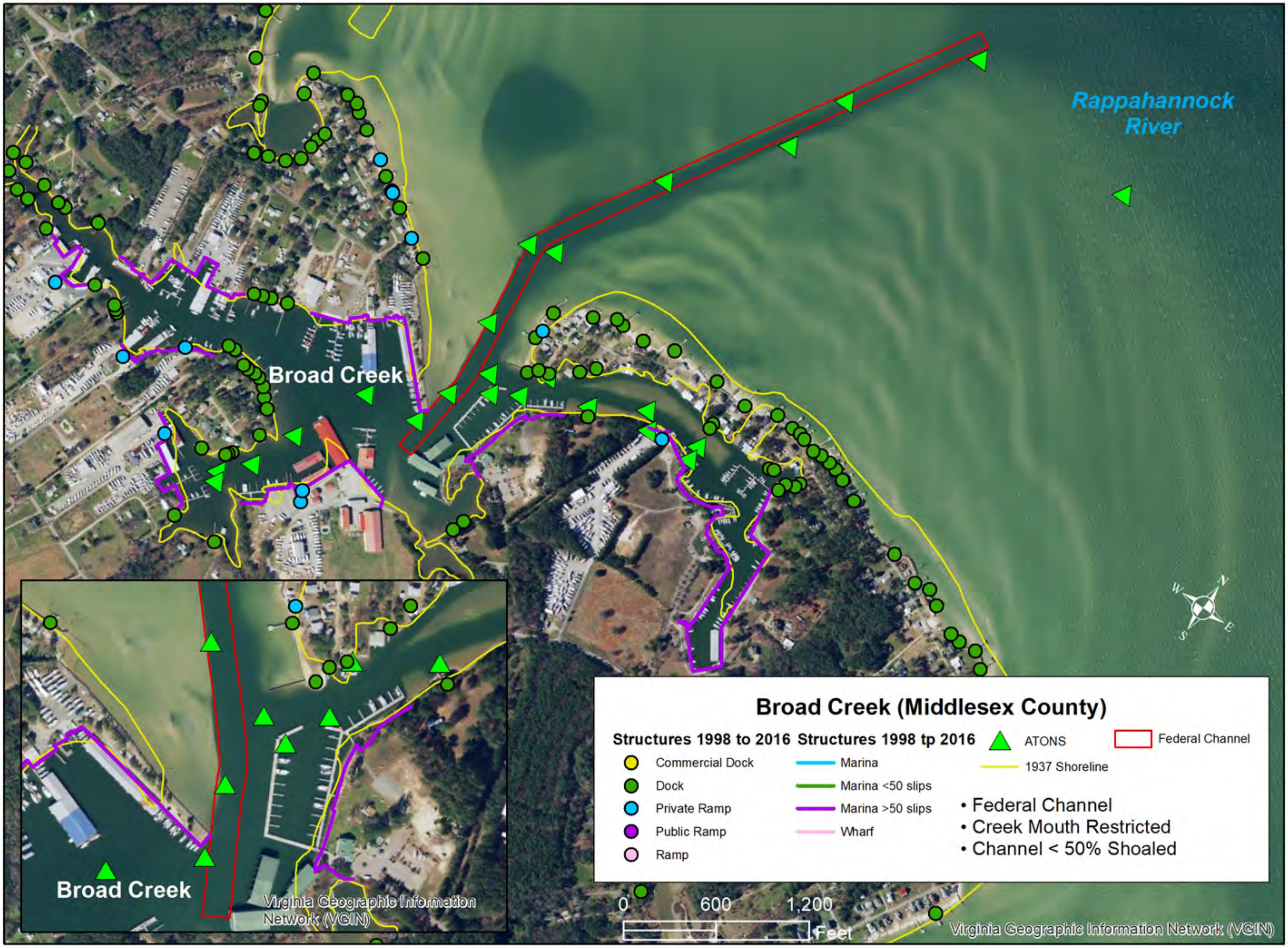
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Rappahannock River
Broad Creek
Broad Creek
Virginia Geographic Information Network (VGIN)
Broad Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
Federal Channel
1937 Shoreline
• Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0 600 1,200 Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Jackson Creek

Creek ID Number: 22	**Locality:** Middlesex
Water Body: Piankatank River	**Channel Type:** Federal
Latitude: 37.5464	**Longitude:** -76.3265
Number of Marinas: 5	
Number of Boat Ramps: 6	
Number of Piers: 103	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 156
Average Depth of Creek Mouth (ft): -2.9	**Maximum Depth of Creek Mouth (ft):** -10.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Jackson Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Restricted
• No Visible Shoaling
Jackson Creek
Piankatank
Virginia Geographic Information Network (VGIN)
Jackson Creek
Piankatank River
0
800
1,600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Moore East**

Creek ID Number: 23	**Locality:** Middlesex
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5371	**Longitude:** -76.3530
Number of Marinas: 1	
Number of Boat Ramps: 1	
Number of Piers: 14	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 11
Average Depth of Creek Mouth (ft): -0.4	**Maximum Depth of Creek Mouth (ft):** -0.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Moore East Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Channel < 50% Shoaled
Moore East Creek
PiankatankRiver
N
W
E
S
0
200
400
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Moore Creek**

Creek ID Number: 24	**Locality:** Middlesex
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5369	**Longitude:** -76.3573
Number of Marinas: 0	
Number of Boat Ramps: 3	
Number of Piers: 53	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 50
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Pinakatank
River
Moore Creek
Virginia Geographic Information Network
(VGIN)
Pianaktank
RIver
Moore Creek
Moore Creek (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Inlet
• Channel < 50% Shoaled
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Cores Creek

Creek ID Number: 25	**Locality:** Middlesex
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5396	**Longitude:** -76.3718
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 8	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 17
Average Depth of Creek Mouth (ft): -0.7	**Maximum Depth of Creek Mouth (ft):** -0.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

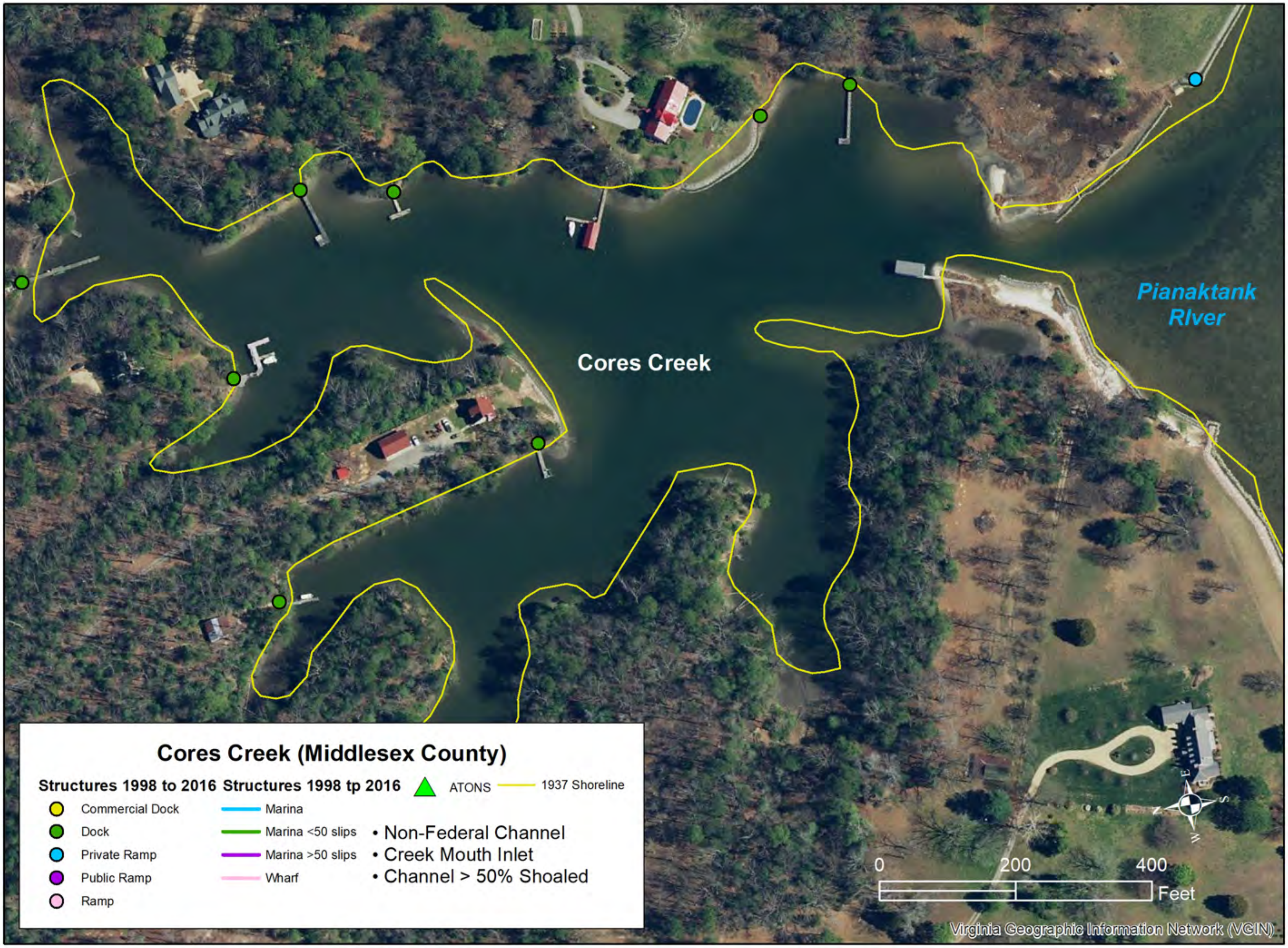
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Pianaktank
RIver
Cores Creek
Cores Creek (Middlesex County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Inlet
• Channel > 50% Shoaled
0
200
400
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Healy Creek

Creek ID Number: 26	**Locality:** Middlesex
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5386	**Longitude:** -76.3922
Number of Marinas: 1	
Number of Boat Ramps: 1	
Number of Piers: 21	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 56
Average Depth of Creek Mouth (ft): -5.4	**Maximum Depth of Creek Mouth (ft):** -9.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Piankatank River
Healy Creek
Virginia Geographic Information Network (VGIN)
Healy Creek
Piankatank River
Healy Creek Middlesex County)
Structures 1998 to 2016 Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
600
1,200
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Wilton Creek

Creek ID Number: 27	**Locality:** Middlesex
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5210	**Longitude:** -76.4162
Number of Marinas: 2	
Number of Boat Ramps: 1	
Number of Piers: 50	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 100
Average Depth of Creek Mouth (ft): -6.6	**Maximum Depth of Creek Mouth (ft):** -10.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

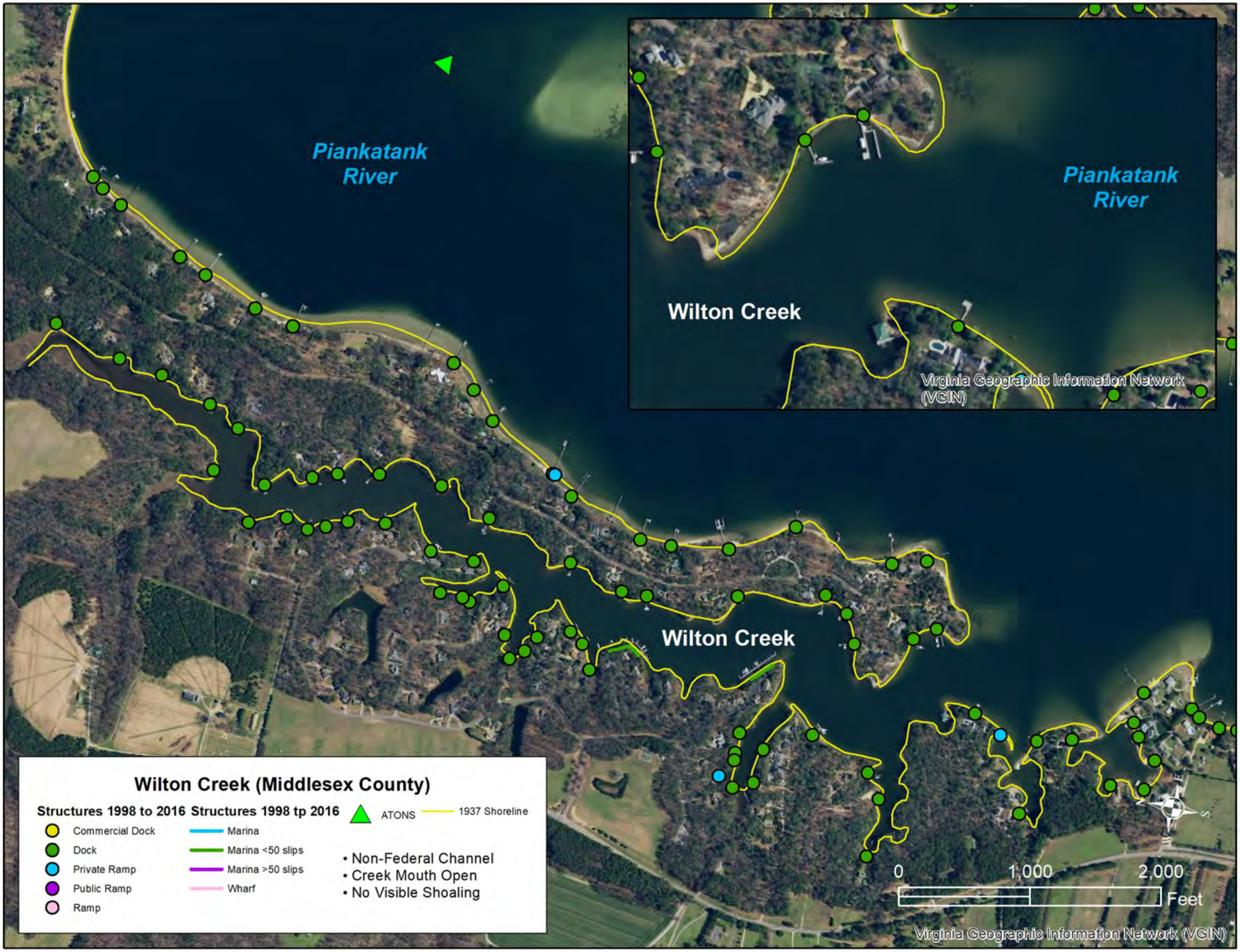
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Piankatank River
Wilton Creek
Piankatank River
Wilton Creek
Virginia Geographic Information Network (VGIN)
Wilton Creek (Middlesex County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
1,000
2,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Ferry Creek

Creek ID Number: 28	**Locality:** Gloucester
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5175	**Longitude:** -76.4602
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 17	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.5	**Creek Area (acres):** 75
Average Depth of Creek Mouth (ft): -4.1	**Maximum Depth of Creek Mouth (ft):** -8.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

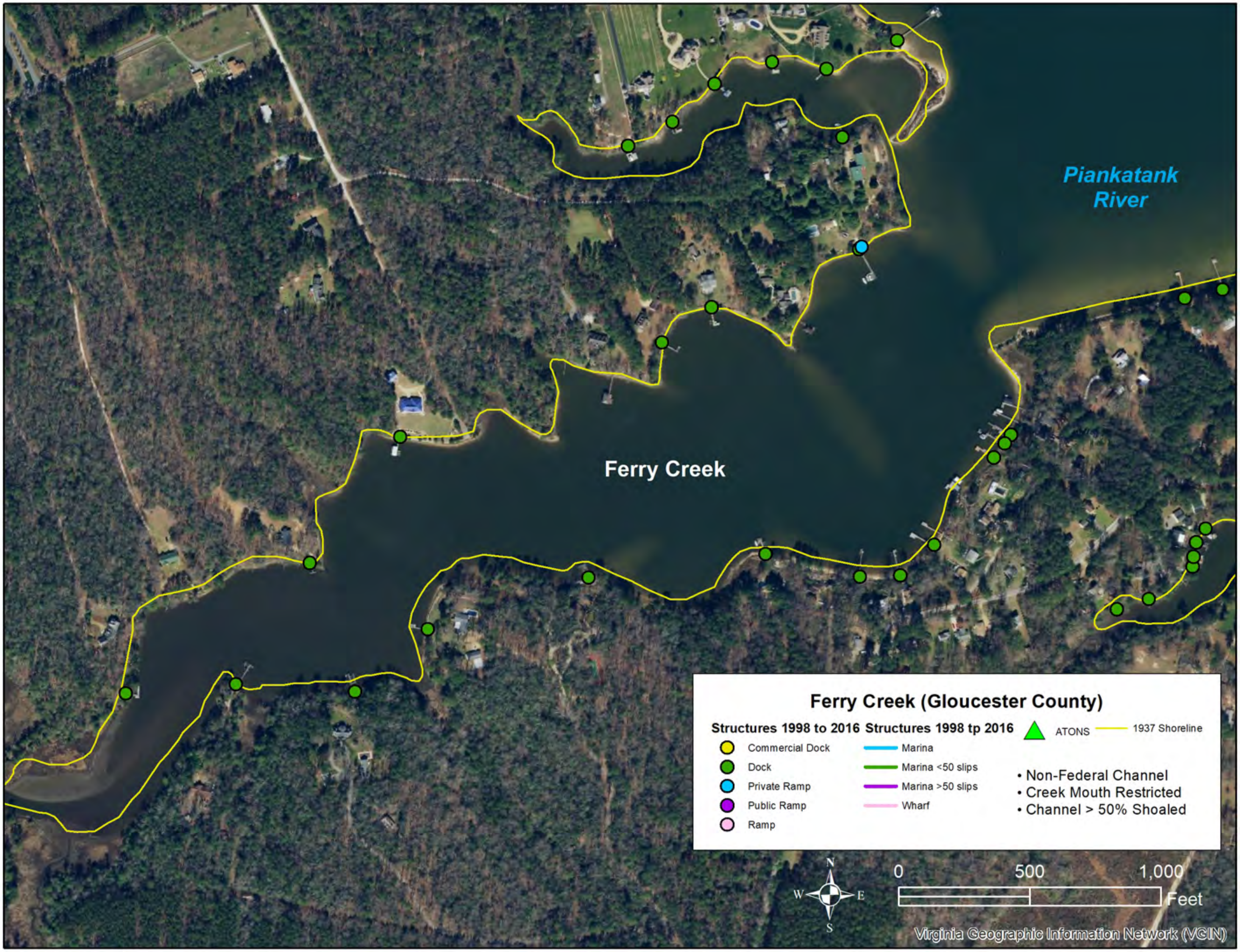
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Piankatank River
Ferry Creek
Ferry Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
N
W
E
S
0
500
1,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Dancing Creek

Creek ID Number: 29	**Locality:** Gloucester
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5149	**Longitude:** -76.4520
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 14	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.5	**Creek Area (acres):** 23
Average Depth of Creek Mouth (ft): -2.2	**Maximum Depth of Creek Mouth (ft):** -5.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Piankatank River
Dancing Creek
Dancing Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
N
W
E
S
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Cobbs Creek**

Creek ID Number: 30	**Locality:** Mathews
Water Body: Piankatank River	**Channel Type:** Non-Federal ATON
Latitude: 37.5268	**Longitude:** -76.4027
Number of Marinas: 3	
Number of Boat Ramps: 1	
Number of Piers: 58	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 69
Average Depth of Creek Mouth (ft): -6.1	**Maximum Depth of Creek Mouth (ft):** -9.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

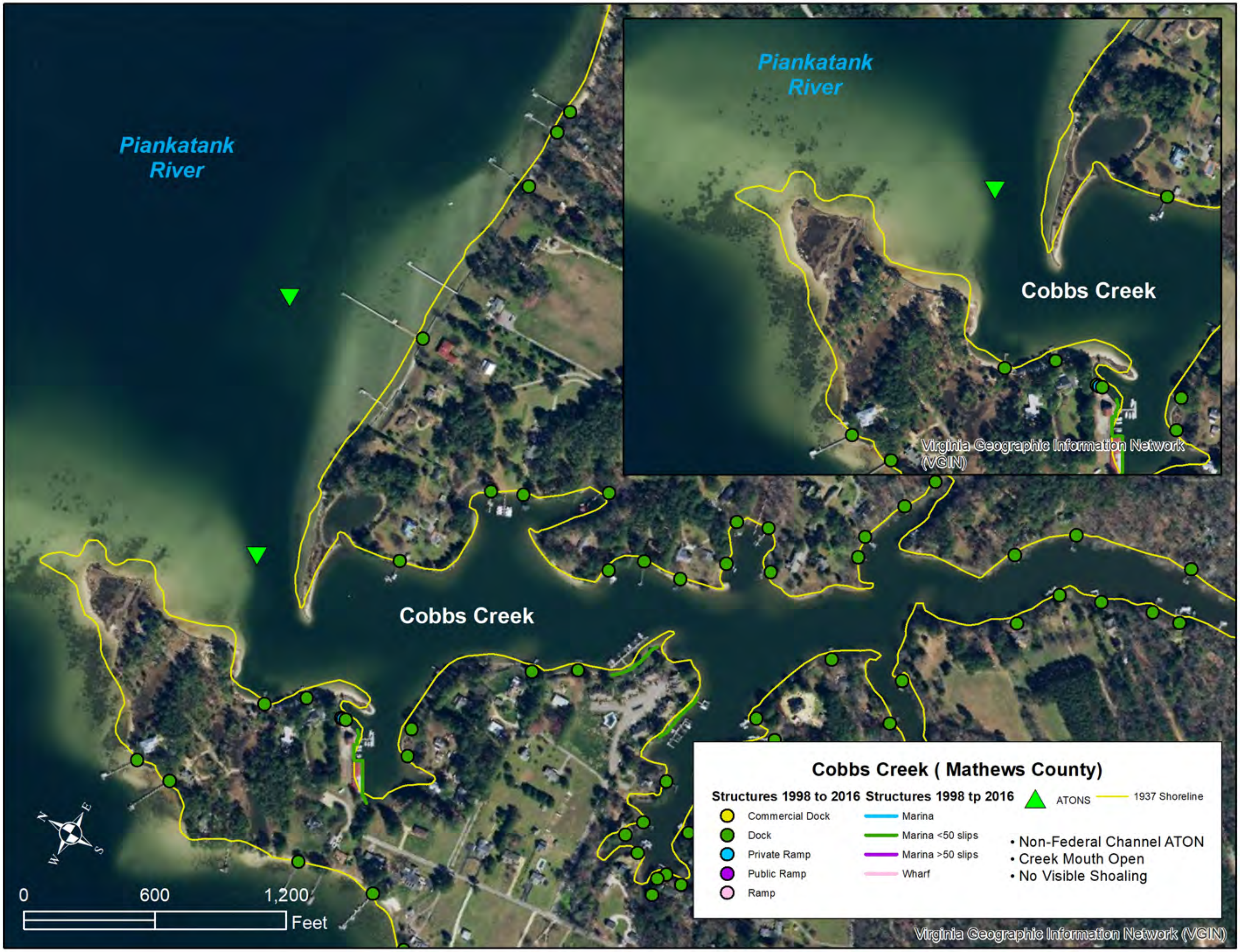
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Piankatank River
Cobbs Creek
Piankatank River
Cobbs Creek
Virginia Geographic Information Network (VGIN)
Cobbs Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Open
• No Visible Shoaling
0
600
1,200
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Roane Point Creek

Creek ID Number: 31	**Locality:** Mathews
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5230	**Longitude:** -76.3750
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 4	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 8
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

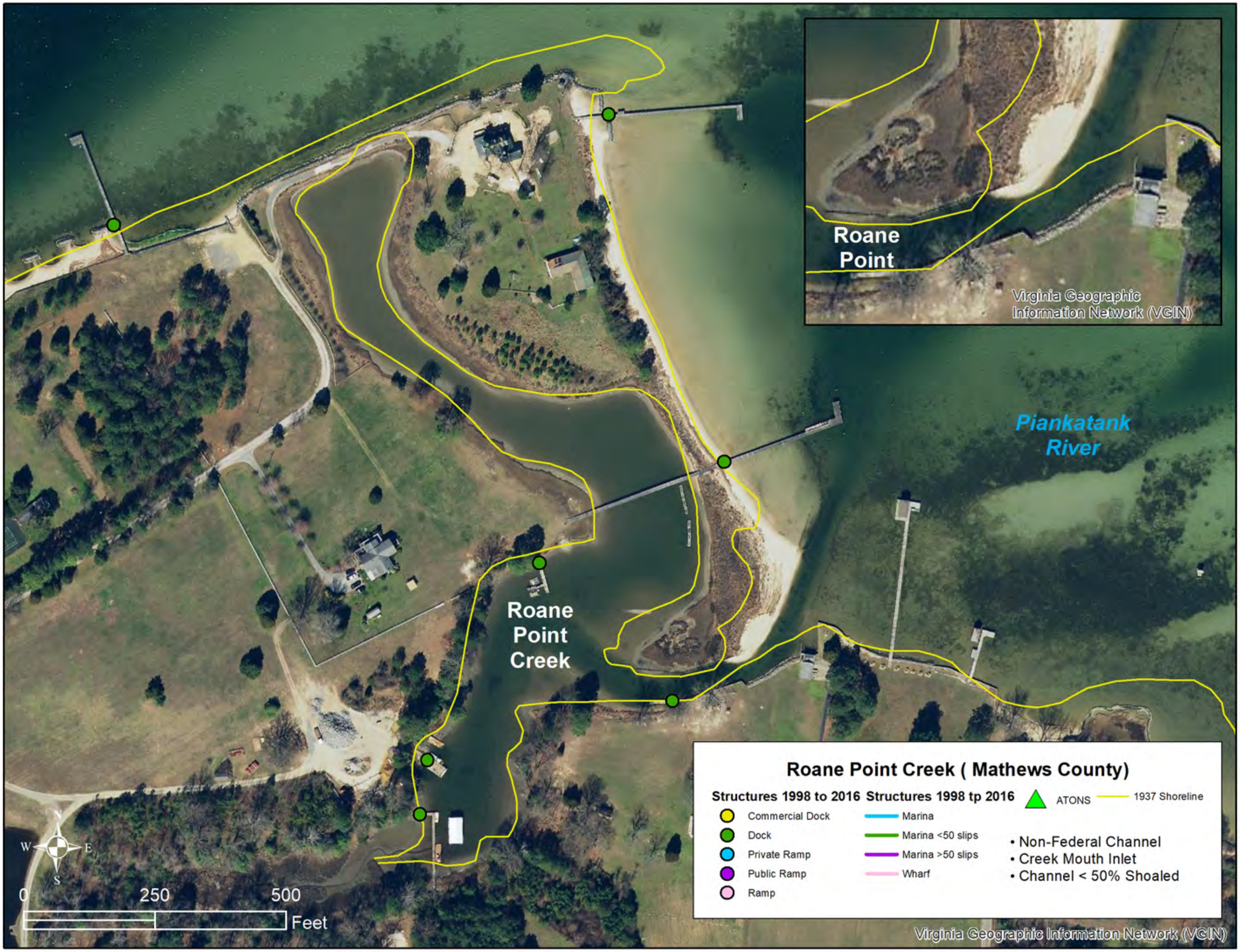
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Roane Point
Virginia Geographic Information Network (VGIN)
Piankatank River
Roane Point Creek
Roane Point Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Channel < 50% Shoaled
N
W
E
S
0
250
500
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Warehouse Cove**

Creek ID Number: 32	**Locality:** Mathews
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5211	**Longitude:** -76.3694
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 4	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.3	**Creek Area (acres):** 4
Average Depth of Creek Mouth (ft): -0.4	**Maximum Depth of Creek Mouth (ft):** -0.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Piankatank River
Warehouse Cove
Warehouse Cove (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Completely Shoaled
0
125
250
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Chappel Creek

Creek ID Number: 33	**Locality:** Mathews
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.5108	**Longitude:** -76.3581
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 8	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.3	**Creek Area (acres):** 44
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

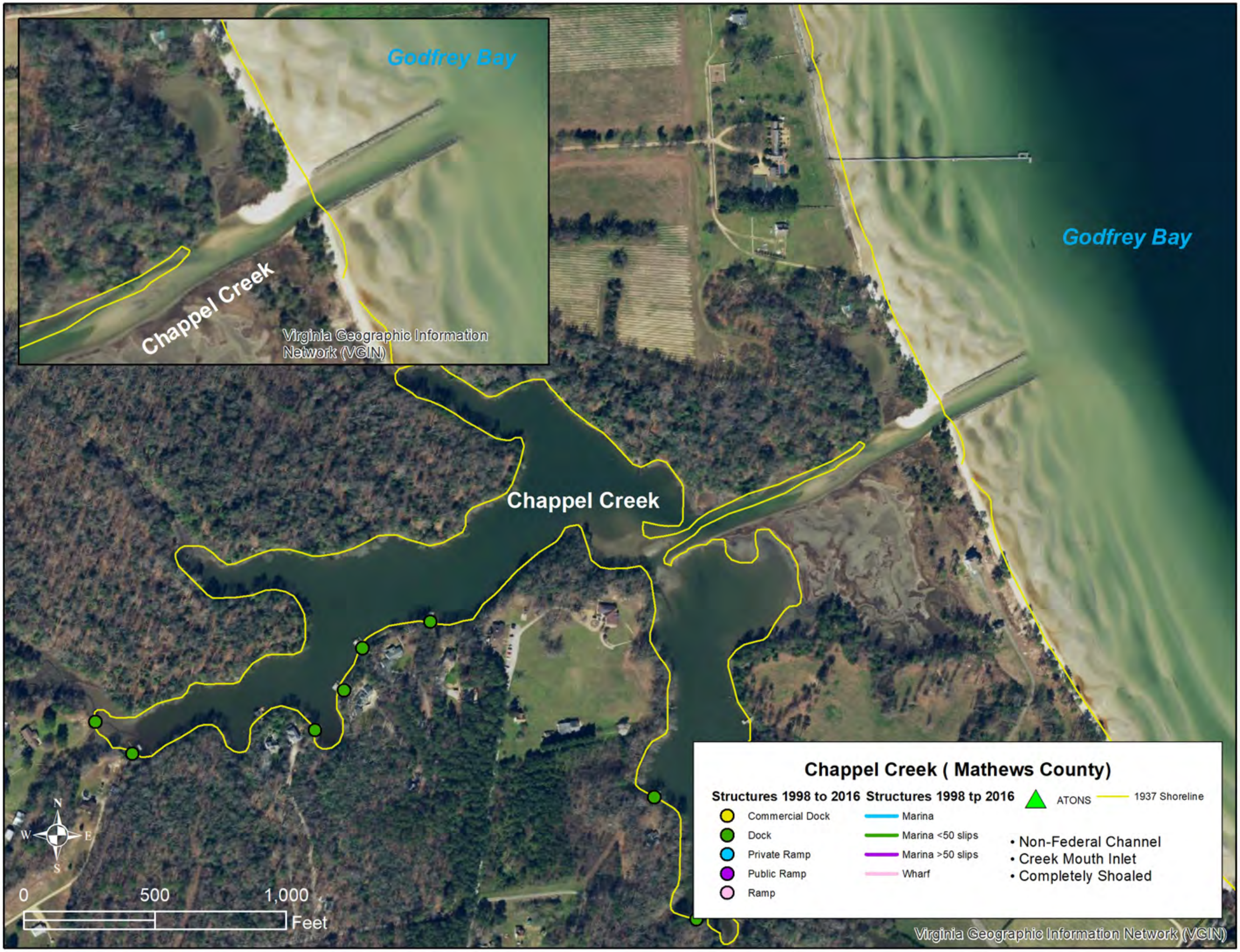
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Godfrey Bay
Chappel Creek
Virginia Geographic Information Network (VGIN)
Godfrey Bay
Chappel Creek
Chappel Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Completely Shoaled
N
W
E
S
0
500
1,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Queens Creek**

Creek ID Number: 34	**Locality:** Mathews
Water Body: Piankatank River	**Channel Type:** Federal
Latitude: 37.4873	**Longitude:** -76.3289
Number of Marinas: 1	
Number of Boat Ramps: 4	
Number of Piers: 145	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 188
Average Depth of Creek Mouth (ft): -6.3	**Maximum Depth of Creek Mouth (ft):** -9.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

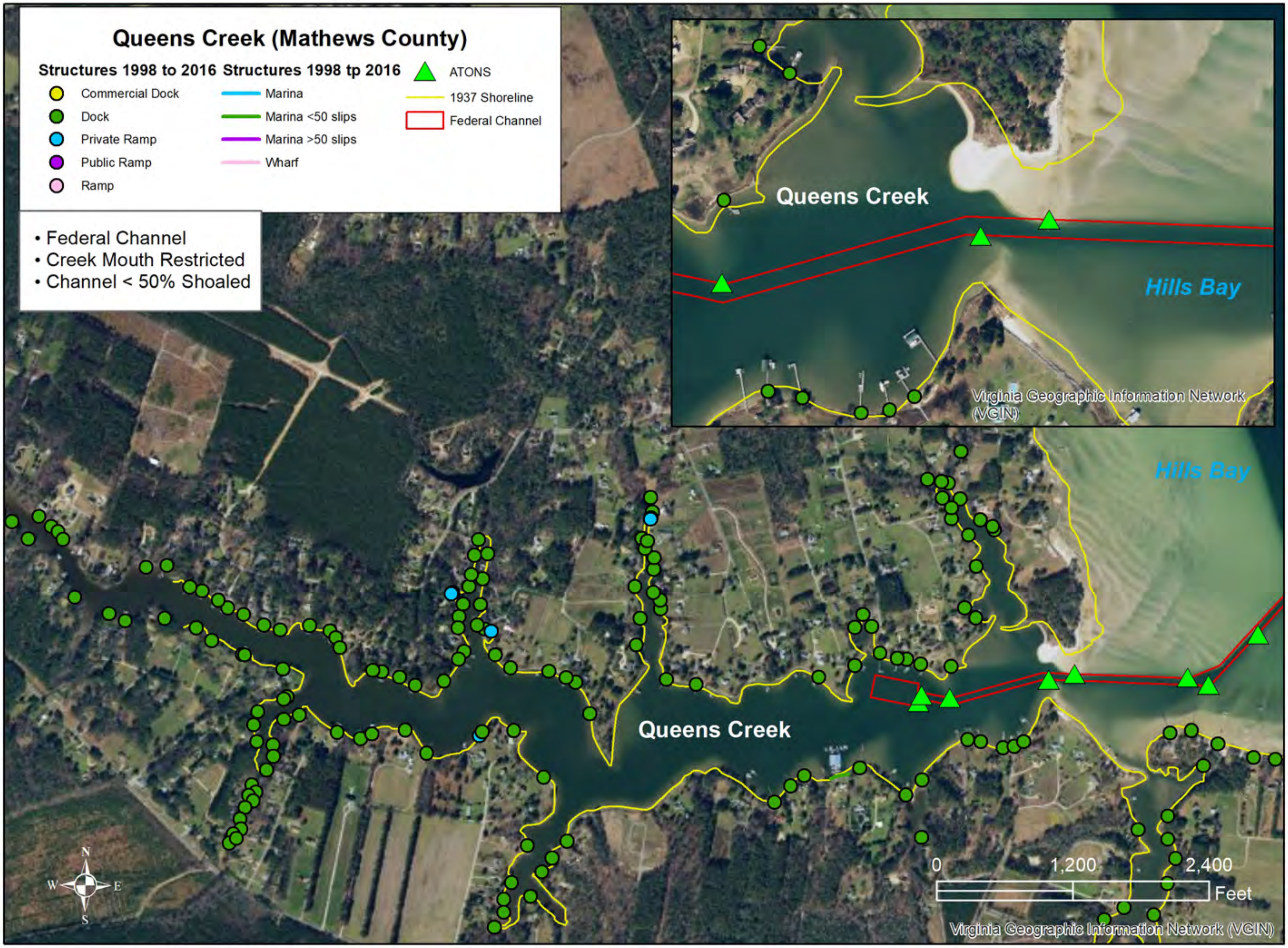
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Queens Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
Queens Creek
Hills Bay
Virginia Geographic Information Network (VGIN)
Queens Creek
Hills Bay
0
1,200
2,400
Feet
N
S
E
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Winder Creek

Creek ID Number: 35	**Locality:** Mathews
Water Body: Piankatank River	**Channel Type:** Non-Federal
Latitude: 37.4851	**Longitude:** -76.3258
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 9	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 16
Average Depth of Creek Mouth (ft): -0.9	**Maximum Depth of Creek Mouth (ft):** -1.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Hills Bay
Winder Creek
Winder Creek
Virginia Geographic Information Network (VGIN)
Winder Creek (Mathews County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Inlet
• Channel > 50% Shoaled
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Milford Haven

Creek ID Number: 36	**Locality:** Mathews
Water Body: Piankatank River/Milford Haven	**Channel Type:** Federal
Latitude: 37.4884	**Longitude:** -76.3117
Number of Marinas: 1	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 23
Average Depth of Creek Mouth (ft): N/A	**Maximum Depth of Creek Mouth (ft):** N/A

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

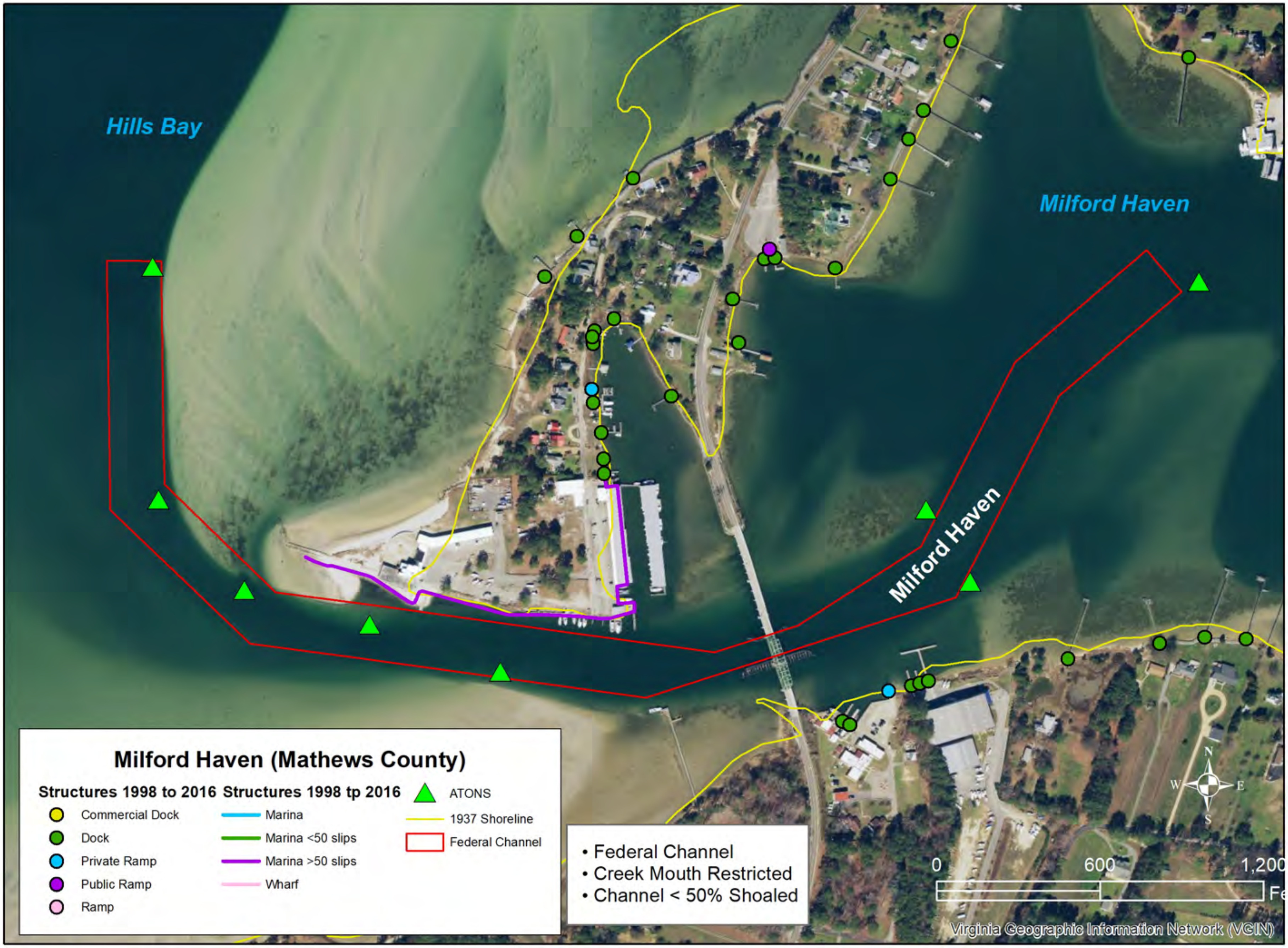
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Hills Bay
Milford Haven
Milford Haven
Milford Haven (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
600
1,200
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for Lanes Creek

Creek ID Number: 37	**Locality:** Mathews
Water Body: Milford Haven	**Channel Type:** Non-Federal
Latitude: 37.4833	**Longitude:** -76.3023
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 26	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 50
Average Depth of Creek Mouth (ft): -4.7	**Maximum Depth of Creek Mouth (ft):** -7.8

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

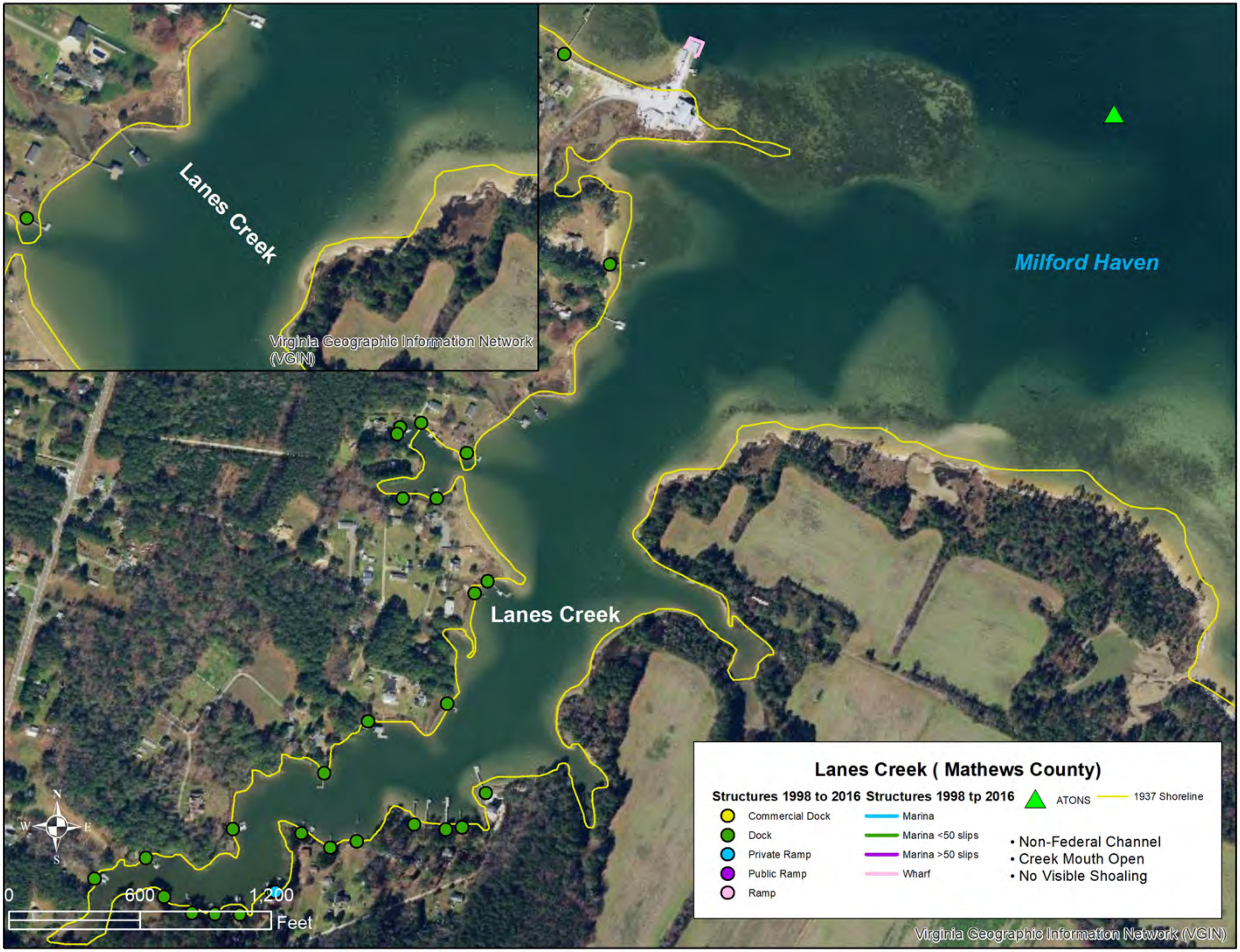
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Lanes Creek
Virginia Geographic Information Network (VGIN)
Milford Haven
Lanes Creek
0
600
1,200
Feet
N
S
E
W
Lanes Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
Virginia Geographic Information Network (VGIN)

Data Sheet for Edwards Creek

Creek ID Number: 38	**Locality:** Mathews
Water Body: Milford Haven	**Channel Type:** Non-Federal
Latitude: 37.4931	**Longitude:** -76.2945
Number of Marinas: 1	
Number of Boat Ramps: 0	
Number of Piers: 29	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 45
Average Depth of Creek Mouth (ft): -6.1	**Maximum Depth of Creek Mouth (ft):** -9.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

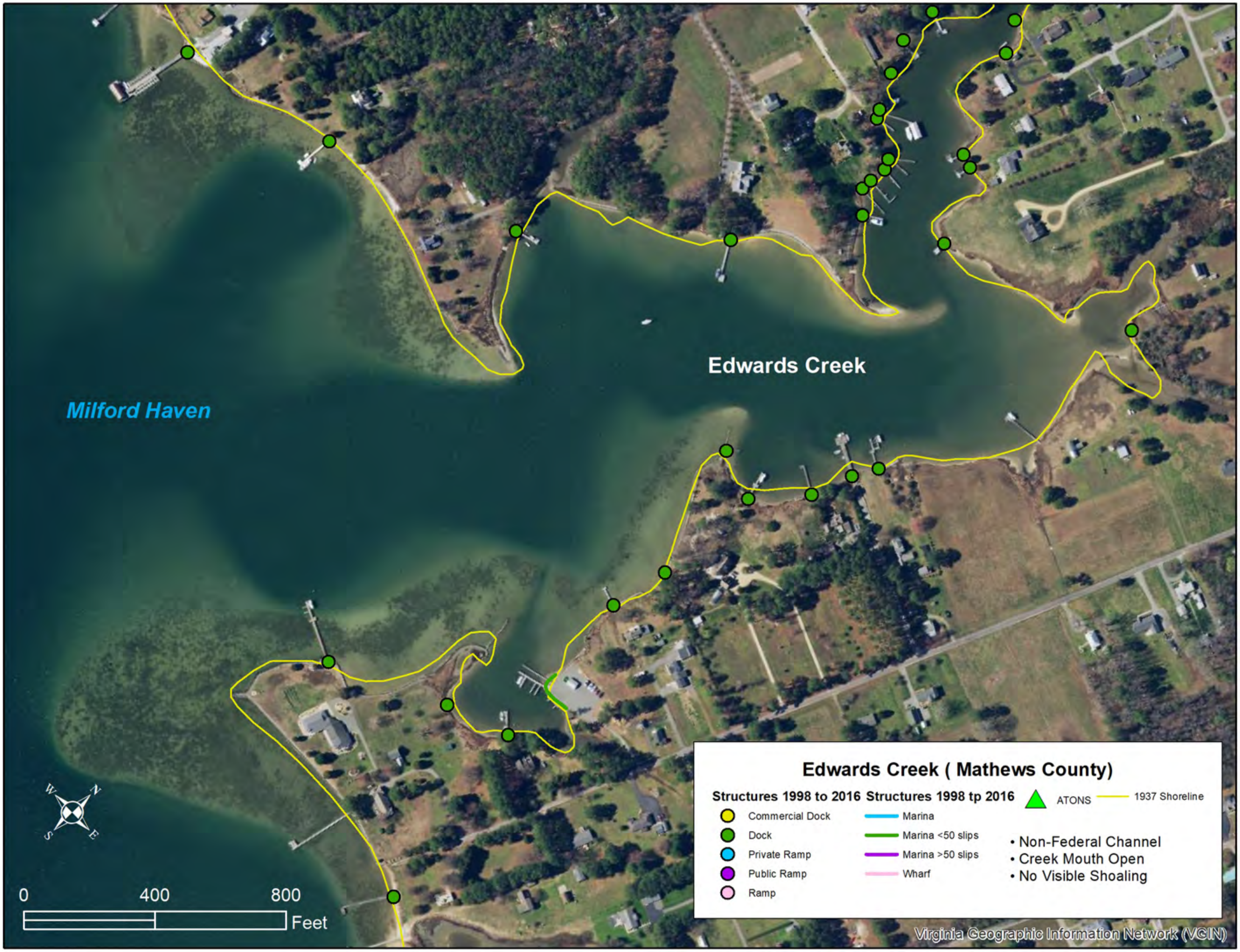
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Edwards Creek
Milford Haven
Edwards Creek (Mathews County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
W
N
S
E
0
400
800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Barn Creek**

Creek ID Number: 39	**Locality:** Mathews
Water Body: Milford Haven	**Channel Type:** Non-Federal
Latitude: 37.4872	**Longitude:** -76.2841
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 32	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 33
Average Depth of Creek Mouth (ft): -3.6	**Maximum Depth of Creek Mouth (ft):** -6.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

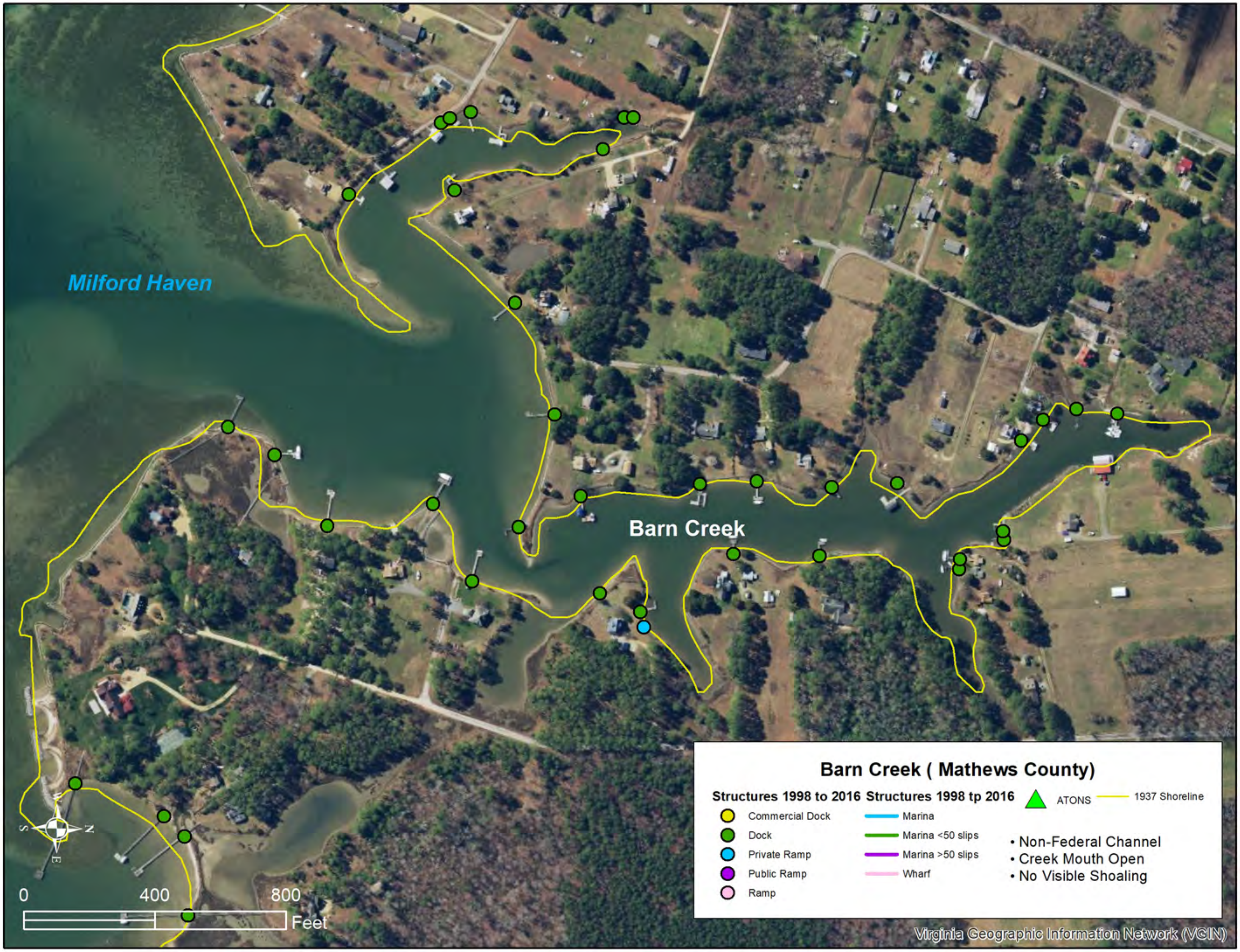
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Milford Haven
Barn Creek
Barn Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
400
800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Whites Creek**

Creek ID Number: 40	**Locality:** Mathews
Water Body: Milford Haven/Chesapeake Bay	**Channel Type:** Non-Federal
Latitude: 37.4532	**Longitude:** -76.2609
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 15	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: #N/A
Tide Range (ft): 1.1	**Creek Area (acres):** 0
Average Depth of Creek Mouth (ft): N/A	**Maximum Depth of Creek Mouth (ft):** N/A

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

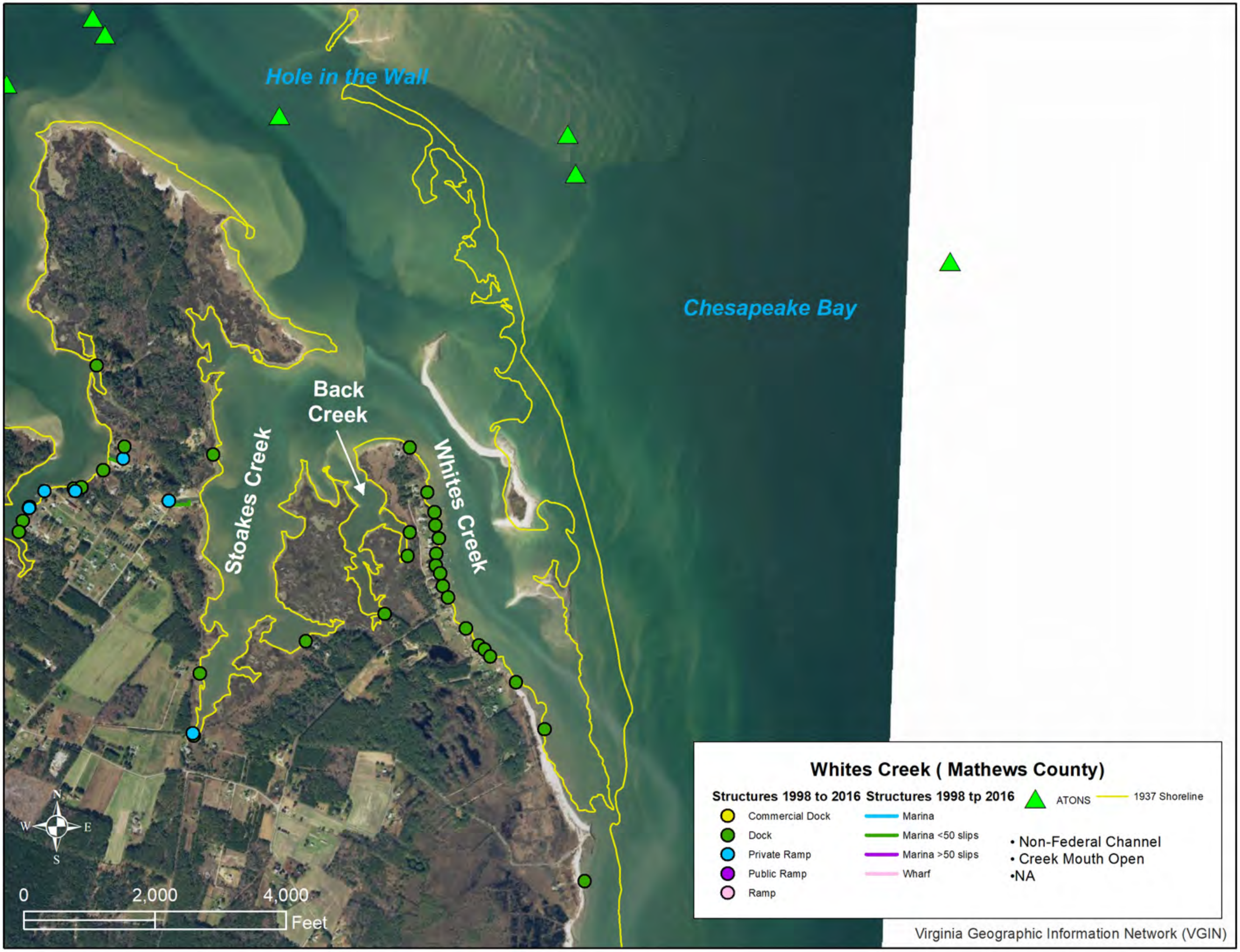
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Hole in the Wall
Chesapeake Bay
Back Creek
Stoakes Creek
Whites Creek
Whites Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
•NA
N
W
E
S
0
2,000
4,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Stutts Creek

Creek ID Number: 41	**Locality:** Mathews
Water Body: Milford Haven	**Channel Type:** Non-Federal ATON
Latitude: 37.4626	**Longitude:** -76.2909
Number of Marinas: 1	
Number of Boat Ramps: 5	
Number of Piers: 108	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 320
Average Depth of Creek Mouth (ft): -7.1	**Maximum Depth of Creek Mouth (ft):** -11.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

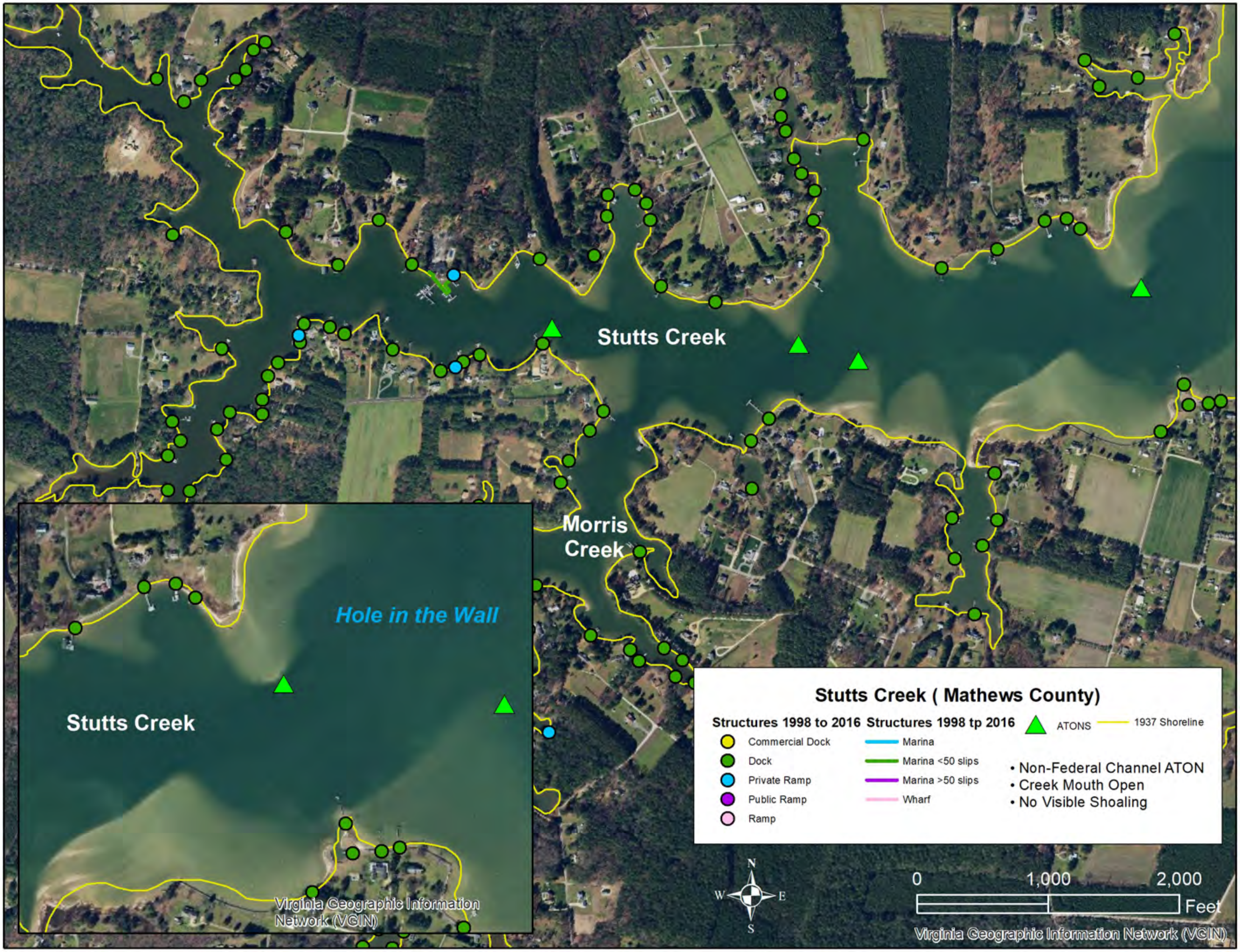
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Stutts Creek
Morris
Creek
Hole in the Wall
Stutts Creek
Virginia Geographic Information Network (VGIN)
Stutts Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Open
• No Visible Shoaling
N
W
E
S
0
1,000
2,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Billups Creek

Creek ID Number: 42	**Locality:** Mathews
Water Body: Milford Haven	**Channel Type:** Non-Federal
Latitude: 37.4615	**Longitude:** -76.2850
Number of Marinas: 1	
Number of Boat Ramps: 5	
Number of Piers: 24	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 218
Average Depth of Creek Mouth (ft): -4.7	**Maximum Depth of Creek Mouth (ft):** -9.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Billups Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
Billups Creek
Stutts Creek
Virginia Geographic Information Network (VGIN)
Billups Creek
Stutts Creek
Stutts Creek
0
1,000
2,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Hole in the Wall

Creek ID Number: 43	**Locality:** Mathews
Water Body: Chesapeake Bay/Milford Haven	**Channel Type:** Non-Federal ATON
Latitude: 37.4681	**Longitude:** -76.2648
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.1	**Creek Area (acres):** 0
Average Depth of Creek Mouth (ft): N/A	**Maximum Depth of Creek Mouth (ft):** N/A

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Hole in the Wall (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Hole in the Wall Channel
• Non-Federal Channel ATON
• Creek Mouth Open
• Channel > 50% Shoaled
Milford Haven
Chesqpeake Bay
Hole in the Wall
Stutts Creek
Billups Creek
Stoakes Creek
0
2,000
4,000
Feet
N
S
E
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Stoakes

Creek ID Number: 44	**Locality:** Mathews
Water Body: Milford Haven	**Channel Type:** Non-Federal
Latitude: 37.4517	**Longitude:** -76.2694
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 6	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 219
Average Depth of Creek Mouth (ft): -3.5	**Maximum Depth of Creek Mouth (ft):** -5.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

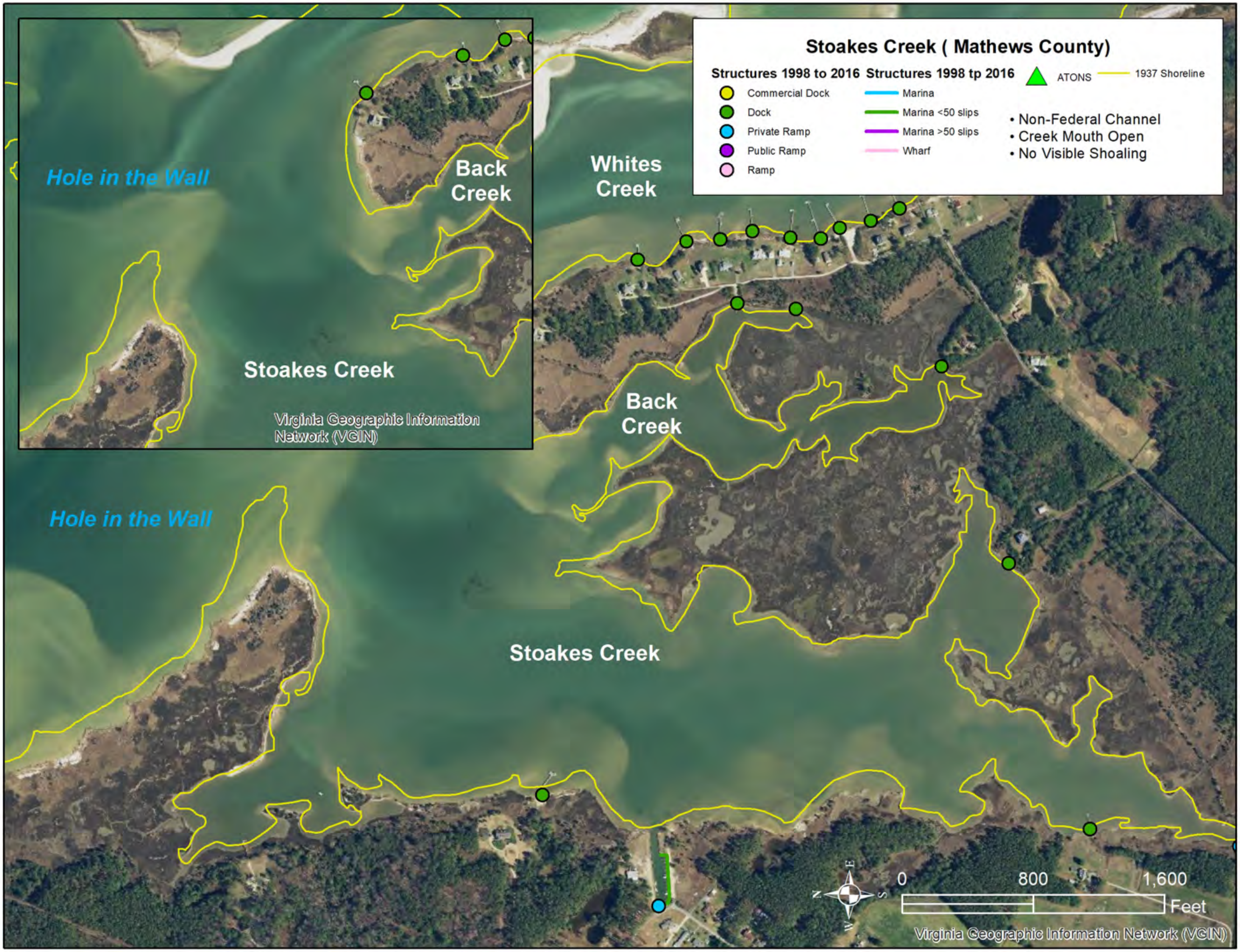
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Stoakes Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
Hole in the Wall
Back Creek
Stoakes Creek
Virginia Geographic Information Network (VGIN)
Whites Creek
Hole in the Wall
Back Creek
Stoakes Creek
0
800
1,600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Morris Creek

Creek ID Number: 45	**Locality:** Mathews
Water Body: Stutts Creek/Milford Haven	**Channel Type:** Non-Federal
Latitude: 37.4603	**Longitude:** -76.3047
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 37	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 72
Average Depth of Creek Mouth (ft): -6.2	**Maximum Depth of Creek Mouth (ft):** -8.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

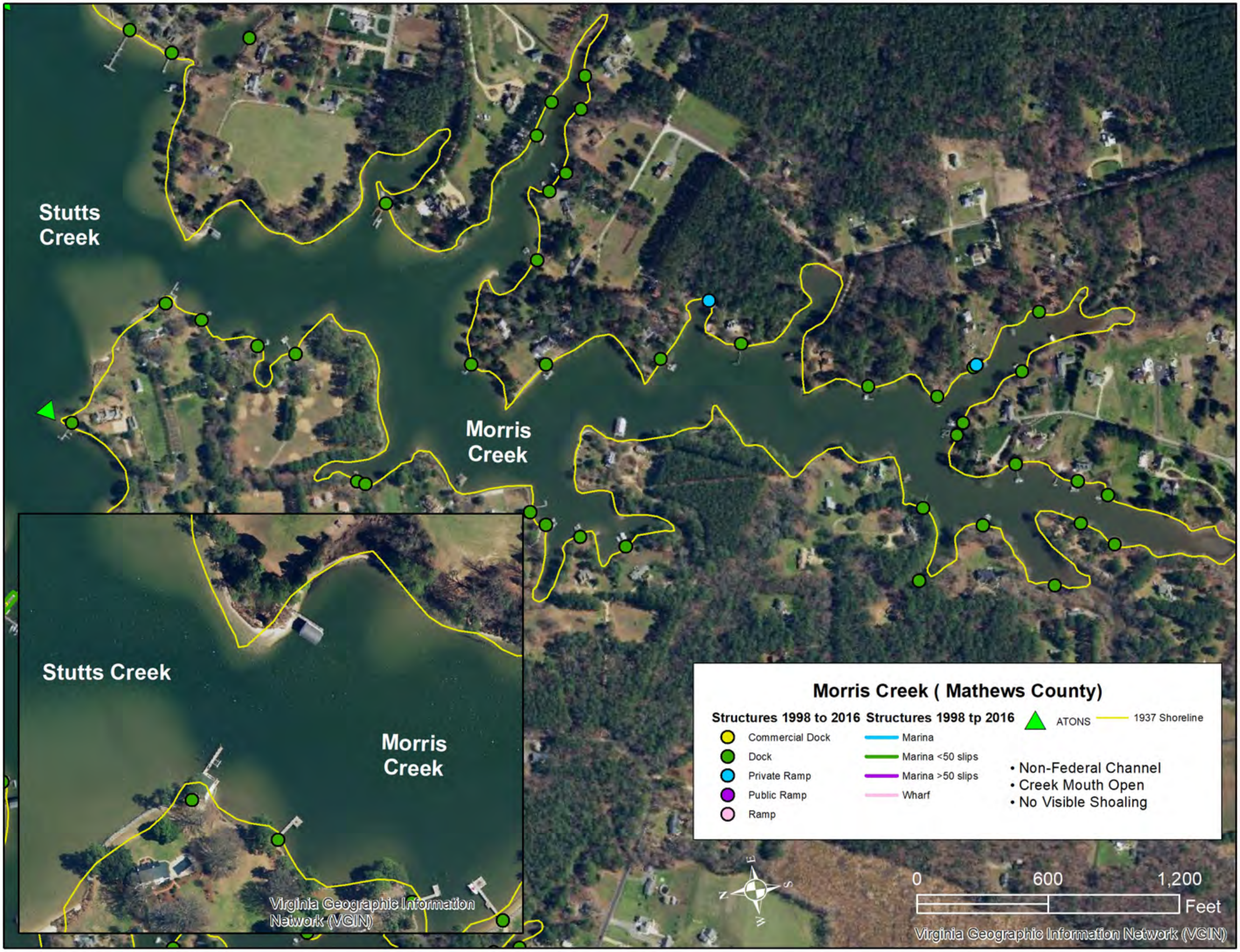
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Stutts Creek
Morris Creek
Stutts Creek
Morris Creek
Virginia Geographic Information Network (VGIN)
Morris Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Hudgins Creek

Creek ID Number: 46	**Locality:** Mathews
Water Body: Stutts Creek/Milford Haven	**Channel Type:** Non-Federal
Latitude: 37.4596	**Longitude:** -76.2958
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 6	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.3	**Creek Area (acres):** 10
Average Depth of Creek Mouth (ft): -1.2	**Maximum Depth of Creek Mouth (ft):** -1.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Hudgins Creek
Stutts Creek
Morris Creek
Stutts Creek
Virginia Geographic Information Network (VGIN)
Hudgins Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
N
E
S
W
0
200
400
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Garden Creek

Creek ID Number: 47	**Locality:** Mathews
Water Body: Chesapeake Bay	**Channel Type:** Non-Federal
Latitude: 37.4230	**Longitude:** -76.2527
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 2	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: Completely shoaled
Tide Range (ft): 1.5	**Creek Area (acres):** 181
Average Depth of Creek Mouth (ft): -1.1	**Maximum Depth of Creek Mouth (ft):** -2.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Winter Harbor
Garden Creek
Virginia Geographic Information Network (VGIN)
Chesapeake Bay
Garden Creek
Virginia Geographic Information Network (VGIN)
Chesapeake Bay
Garden Creek
Winter Harbor
Garden Creek
Garden Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Completely Shoaled
0
2,000
4,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Winter Harbor**

Creek ID Number: 48	**Locality:** Mathews
Water Body: Chesapkeake Bay	**Channel Type:** Federal
Latitude: 37.3707	**Longitude:** -76.2559
Number of Marinas: 2	
Number of Boat Ramps: 2	
Number of Piers: 42	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 1.7	**Creek Area (acres):** 0
Average Depth of Creek Mouth (ft): N/A	**Maximum Depth of Creek Mouth (ft):** -2.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

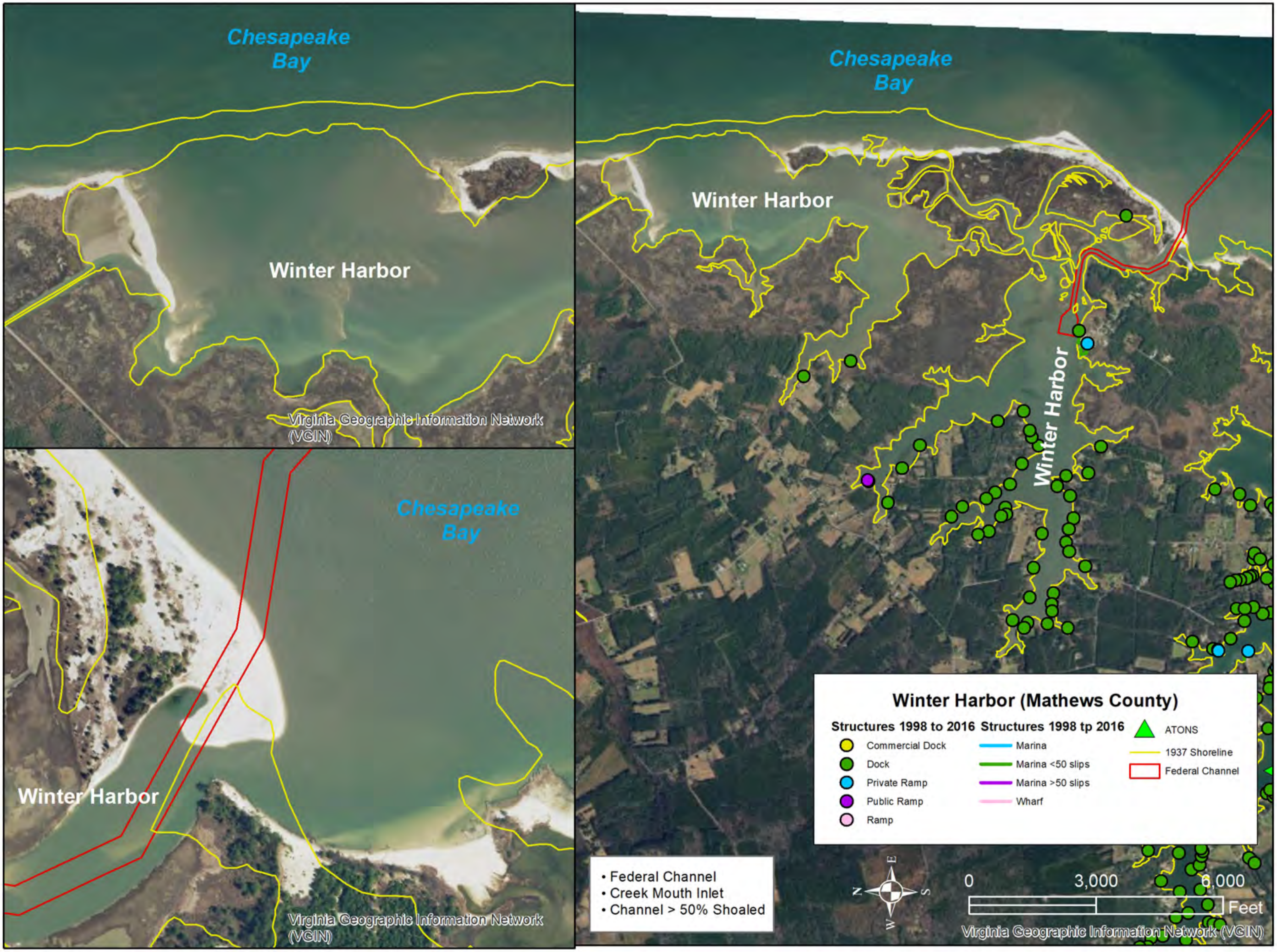
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Chesapeake Bay
Winter Harbor
Virginia Geographic Information Network (VGIN)
Chesapeake Bay
Winter Harbor
Virginia Geographic Information Network (VGIN)
Chesapeake Bay
Winter Harbor
Winter Harbor
Winter Harbor (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Inlet
• Channel > 50% Shoaled
0
3,000
6,000
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Horn Harbor

Creek ID Number: 49	**Locality:** Mathews
Water Body: Chesapeake Bay	**Channel Type:** Federal
Latitude: 37.3486	**Longitude:** -76.2671
Number of Marinas: 3	
Number of Boat Ramps: 7	
Number of Piers: 113	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 1.8	**Creek Area (acres):** 745
Average Depth of Creek Mouth (ft): -5.2	**Maximum Depth of Creek Mouth (ft):** -8.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

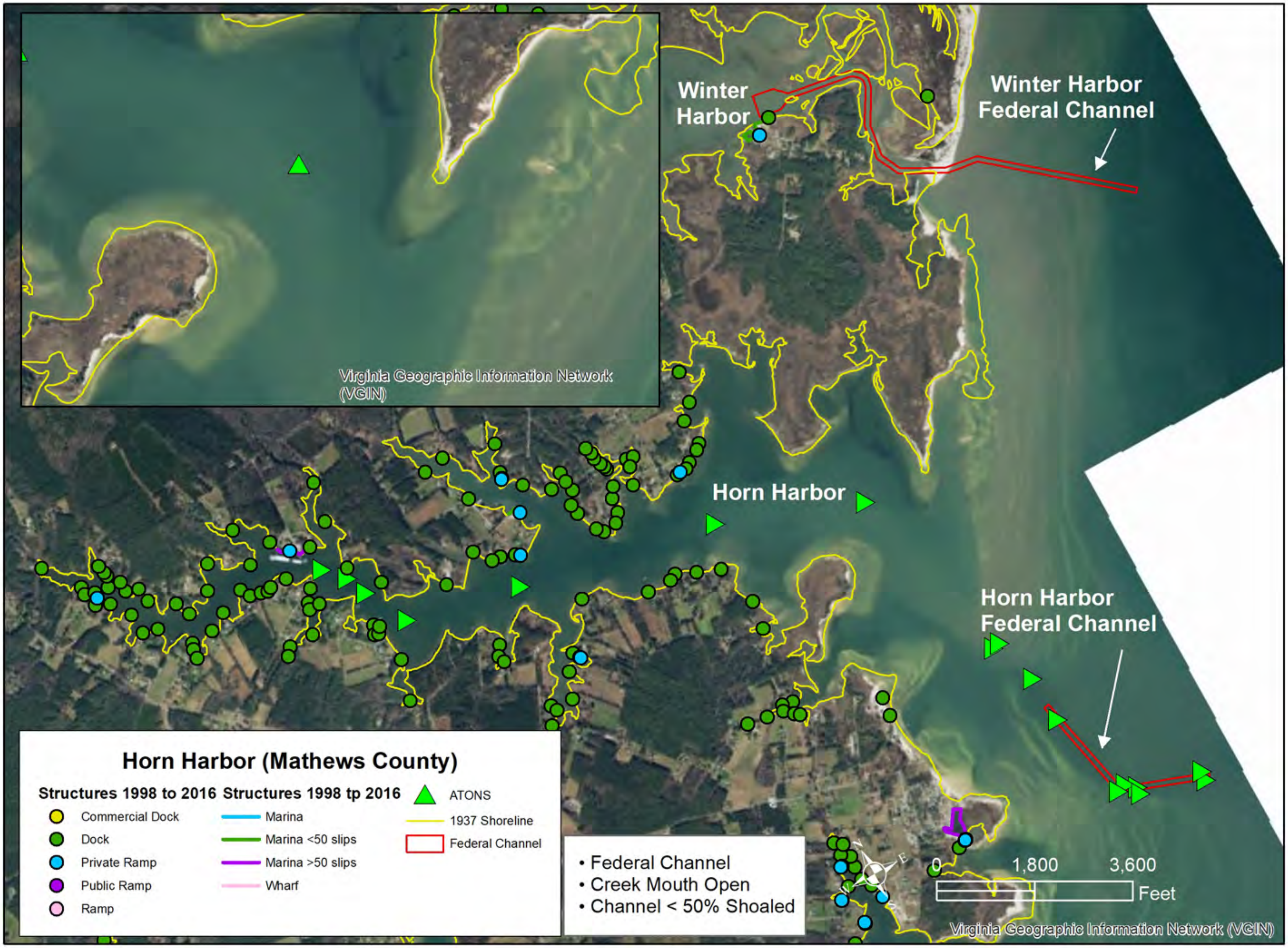
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Winter Harbor
Winter Harbor Federal Channel
Virginia Geographic Information Network (VGIN)
Horn Harbor
Horn Harbor Federal Channel
Horn Harbor (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
1,800
3,600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Dyer Creek**

Creek ID Number: 50	**Locality:** Mathews
Water Body: Chesapeake Bay	**Channel Type:** Non-Federal
Latitude: 37.3330	**Longitude:** -76.2743
Number of Marinas: 0	
Number of Boat Ramps: 4	
Number of Piers: 14	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.8	**Creek Area (acres):** 159
Average Depth of Creek Mouth (ft): -3.7	**Maximum Depth of Creek Mouth (ft):** -6.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

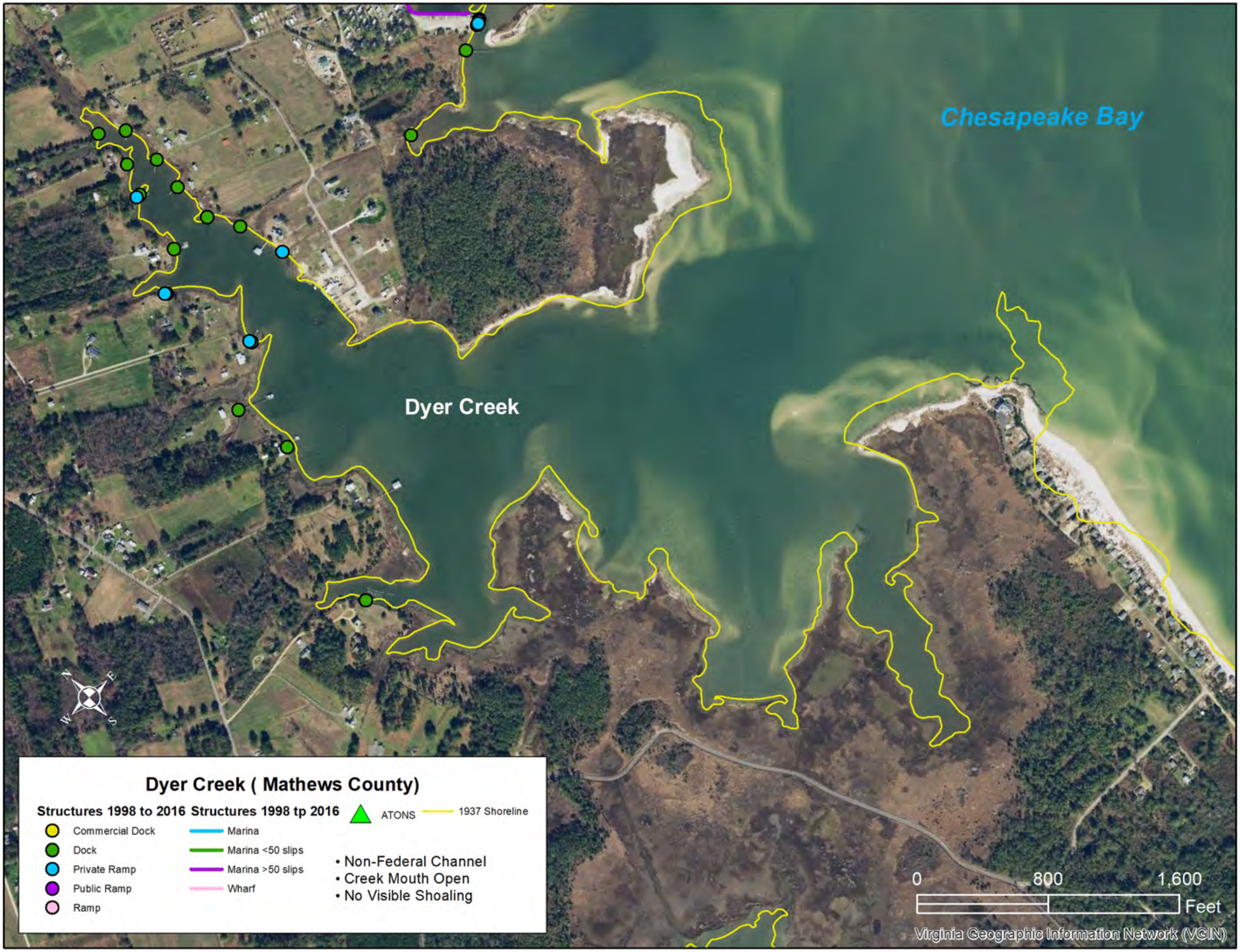
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Chesapeake Bay
Dyer Creek
Dyer Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
800
1,600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Harper Creek

Creek ID Number: 51	**Locality:** Mathews
Water Body: Mobjack Bay	**Channel Type:** Non-Federal
Latitude: 37.3195	**Longitude:** -76.2838
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 2	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.3	**Creek Area (acres):** 69
Average Depth of Creek Mouth (ft): -2.0	**Maximum Depth of Creek Mouth (ft):** -4.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Harper Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel > 50% Shoaled
Harper Creek
Mobjack Bay
N
W
E
S
0
500
1,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Davis Creek_MA**

Creek ID Number: 52	**Locality:** Mathews
Water Body: Mobjack Bay	**Channel Type:** Federal
Latitude: 37.3276	**Longitude:** -76.2985
Number of Marinas: 2	
Number of Boat Ramps: 5	
Number of Piers: 13	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.3	**Creek Area (acres):** 49
Average Depth of Creek Mouth (ft): -2.6	**Maximum Depth of Creek Mouth (ft):** -3.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

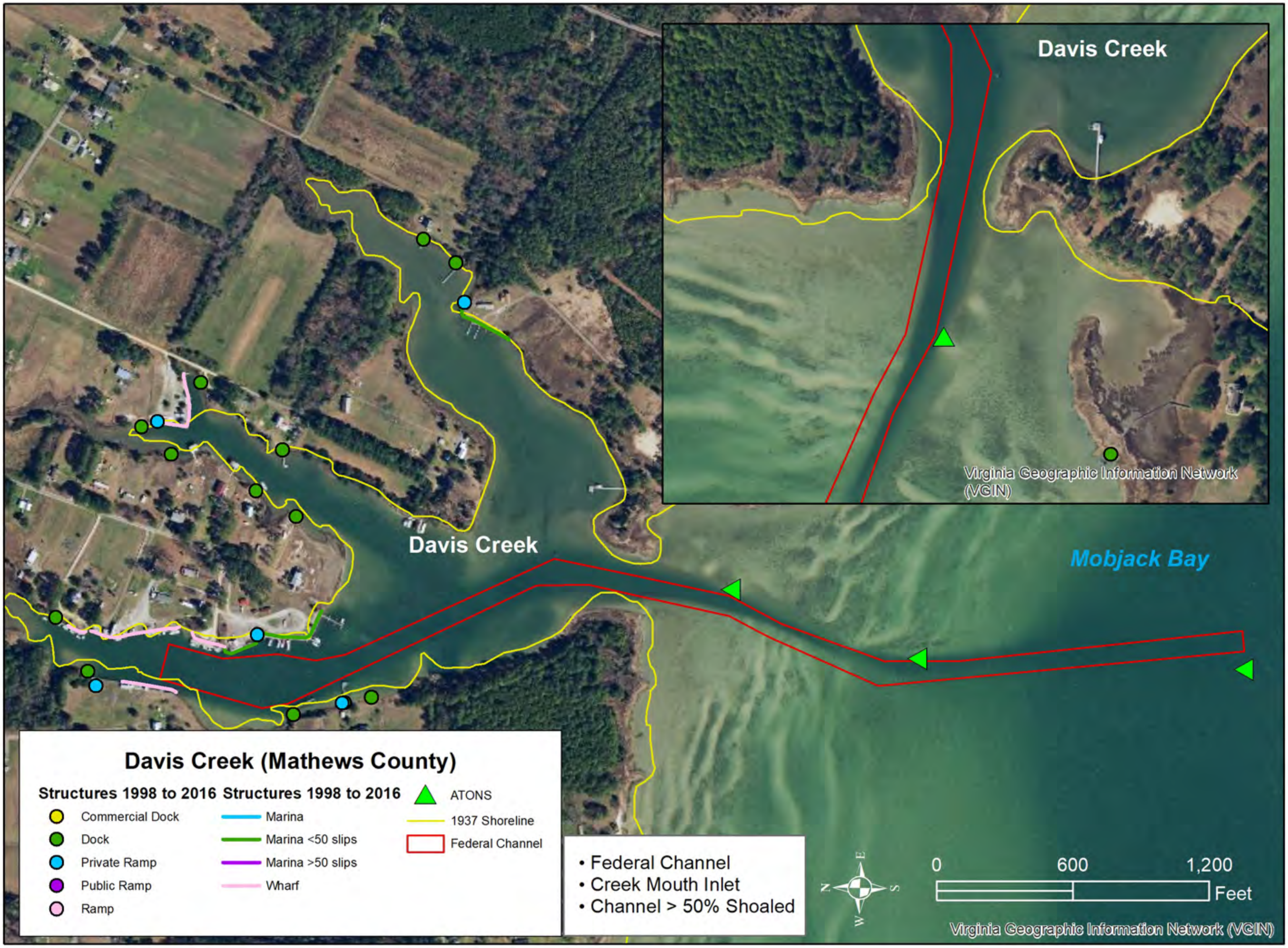
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Davis Creek
Davis Creek
Mobjack Bay
Davis Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Inlet
• Channel > 50% Shoaled
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for **Pepper Creek**

Creek ID Number: 53	**Locality:** Mathews
Water Body: Mobjack Bay	**Channel Type:** Non-Federal ATON
Latitude: 37.3425	**Longitude:** -76.3161
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 16	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.5	**Creek Area (acres):** 214
Average Depth of Creek Mouth (ft): -4.0	**Maximum Depth of Creek Mouth (ft):** -9.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

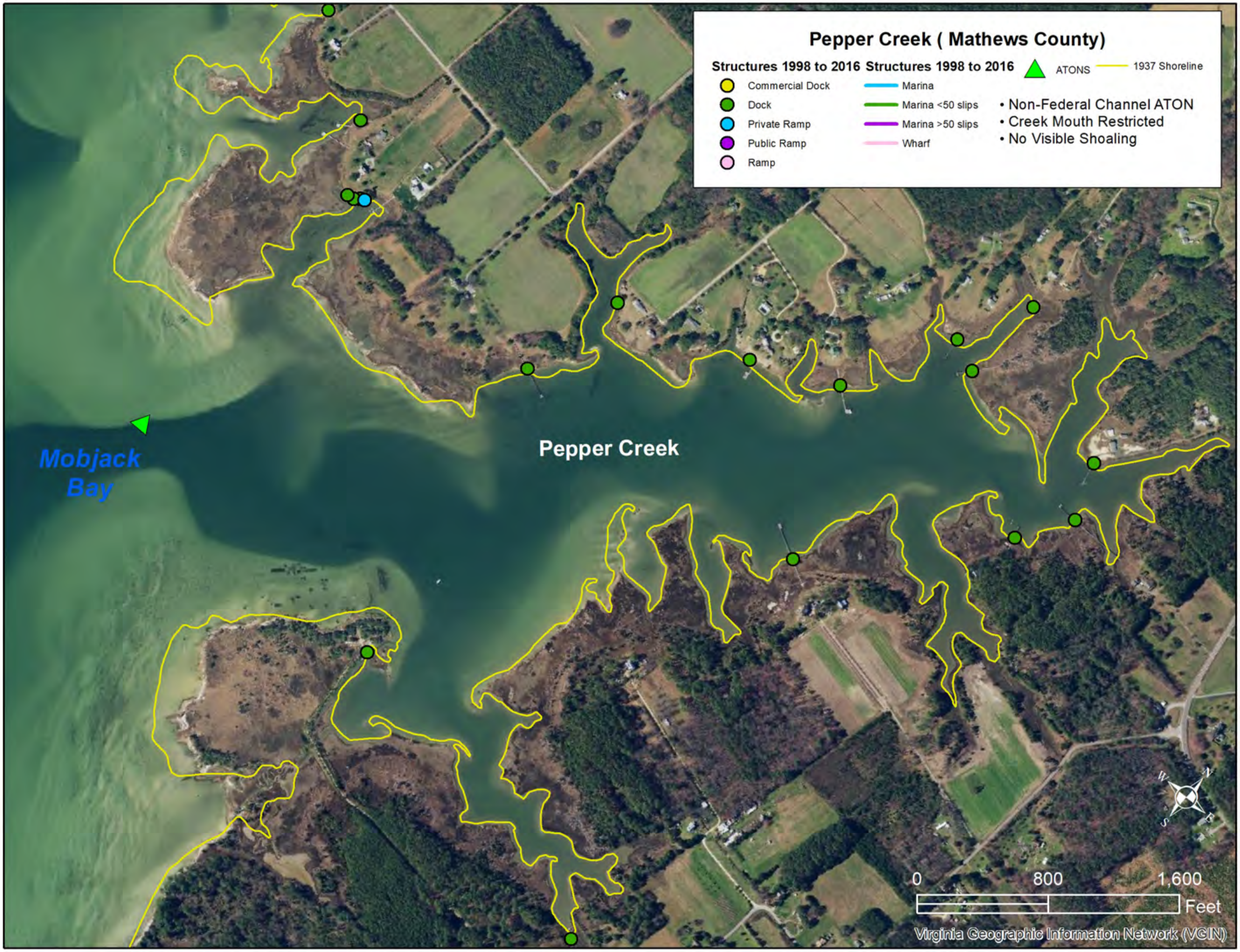
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Pepper Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Restricted
• No Visible Shoaling
Mobjack Bay
Pepper Creek
0
800
1,600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Sloop Creek

Creek ID Number: 54	**Locality:** Mathews
Water Body: Mobjack Bay	**Channel Type:** Non-Federal
Latitude: 37.3528	**Longitude:** -76.3256
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 13	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.5	**Creek Area (acres):** 17
Average Depth of Creek Mouth (ft): -0.7	**Maximum Depth of Creek Mouth (ft):** -1.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Sloop Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
Sloop Creek
Sloop Creek
Mobjack Bay
Mobjack Bay
Virginia Geographic Information Network (VGIN)
0
300
600
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for West Landing Creek

Creek ID Number: 55	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.3683	**Longitude:** -76.3363
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 9	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 20
Average Depth of Creek Mouth (ft): -2.4	**Maximum Depth of Creek Mouth (ft):** -4.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


West Landing Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
West Landing Creek
East River
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Tabbs Creek

Creek ID Number: 56	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.3837	**Longitude:** -76.3332
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 10	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 59
Average Depth of Creek Mouth (ft): -4.7	**Maximum Depth of Creek Mouth (ft):** -8.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Tabbs Creek
East River
Tabbs Creek
Tabbs Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
N
W
E
S
0
500
1,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Weston Creek**

Creek ID Number: 57	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.3924	**Longitude:** -76.3332
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 9	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 23
Average Depth of Creek Mouth (ft): -2.6	**Maximum Depth of Creek Mouth (ft):** -4.7

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

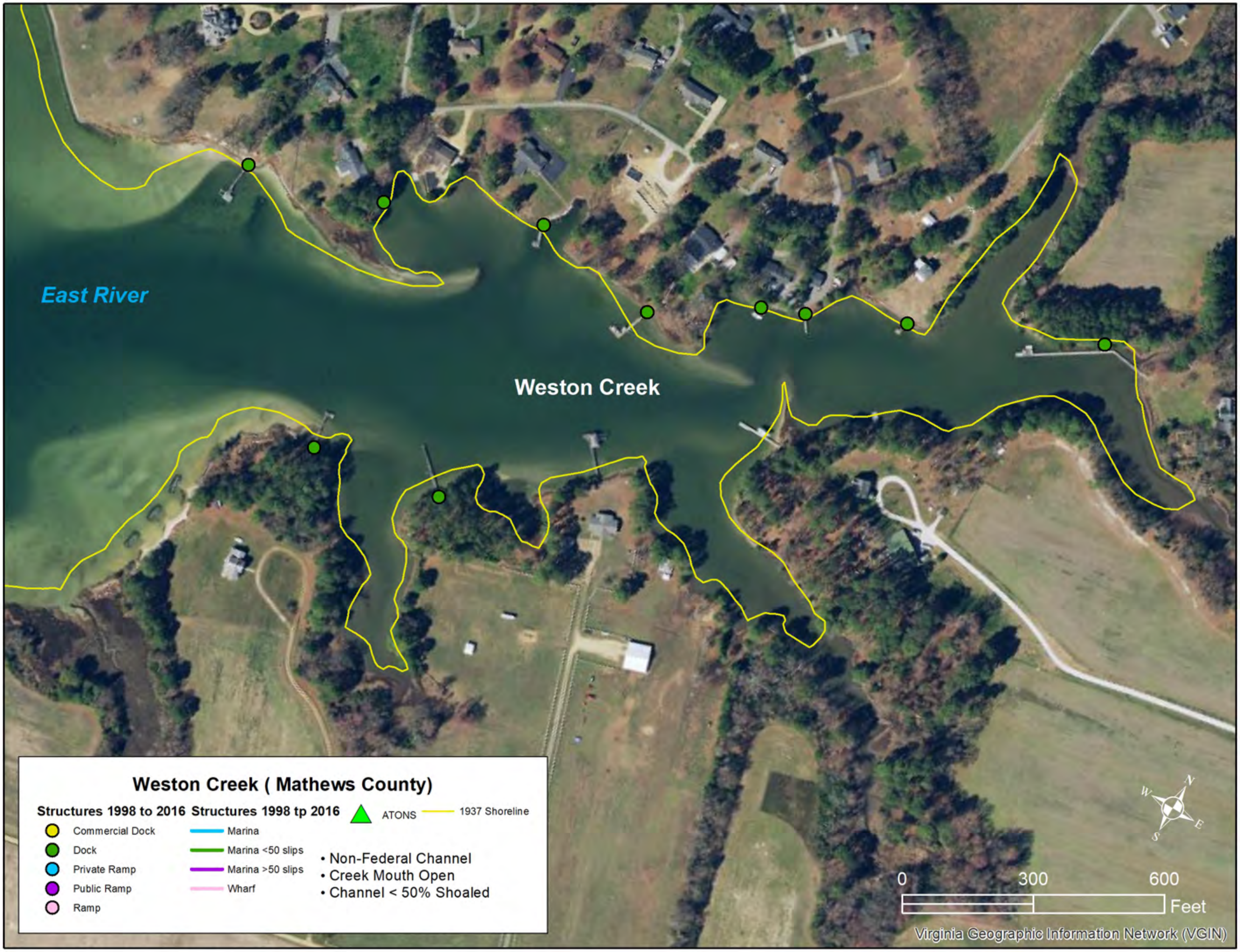
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


East River
Weston Creek
Weston Creek (Mathews County)
Structures 1998 to 2016
Structures 1998 tp 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
300
600
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for **Mill Creek_MA**

Creek ID Number: 58	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.3965	**Longitude:** -76.3346
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 15	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 19
Average Depth of Creek Mouth (ft): -1.0	**Maximum Depth of Creek Mouth (ft):** -1.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

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% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Mill Creek
East River
Mill Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
300
600
Feet
Mill Creek
East River
Virginia Geographic Information Network (VGIN)

Data Sheet for **Todds Creek**

Creek ID Number: 59	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.4018	**Longitude:** -76.3413
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 13	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 18
Average Depth of Creek Mouth (ft): -3.8	**Maximum Depth of Creek Mouth (ft):** -5.8

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

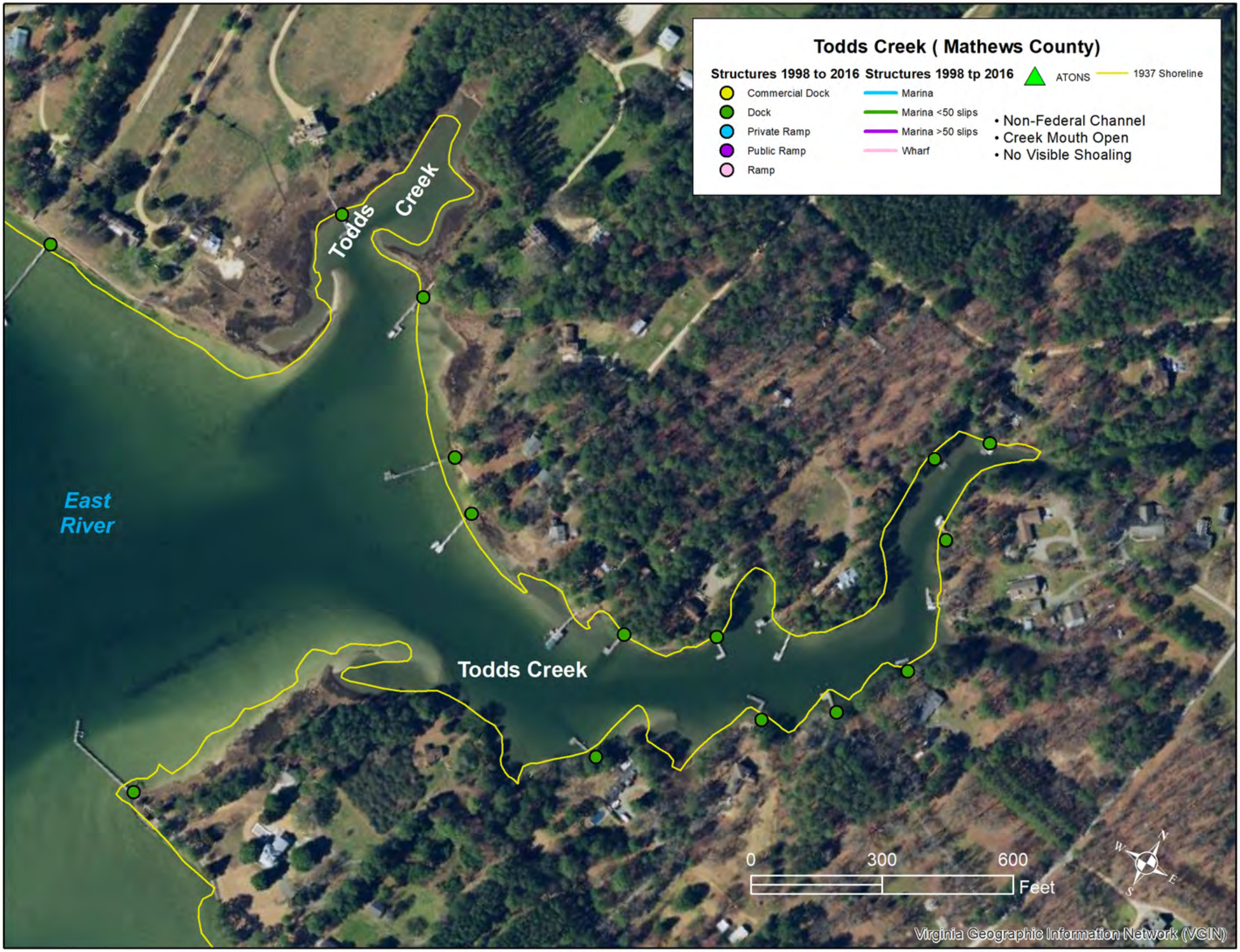
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Todds Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
Todds Creek
East River
Todds Creek
0
300
600
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for **Put In Creek**

Creek ID Number: 60	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.4140	**Longitude:** -76.3412
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 48	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 130
Average Depth of Creek Mouth (ft): -6.3	**Maximum Depth of Creek Mouth (ft):** -11.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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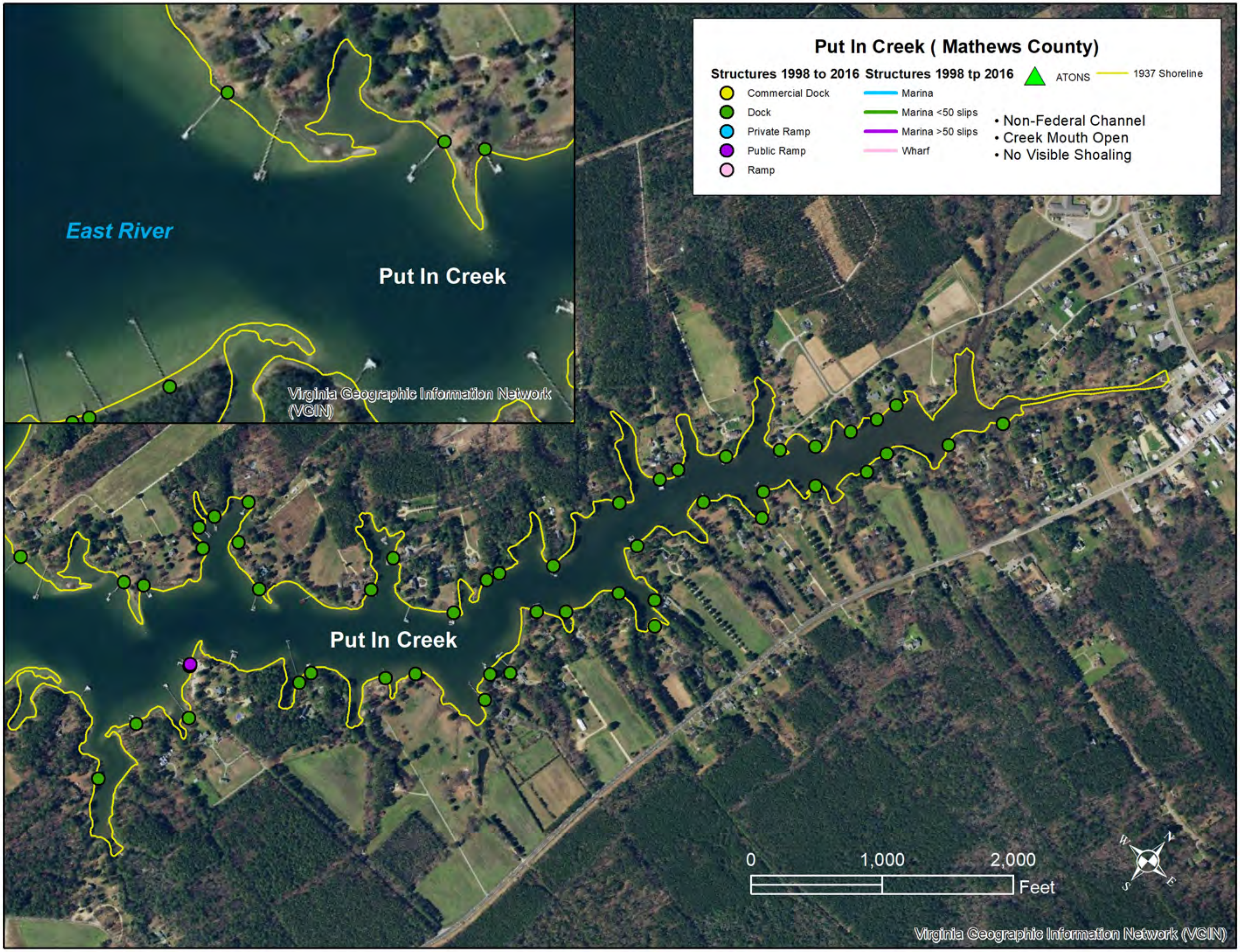
Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Put In Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
East River
Put In Creek
Virginia Geographic Information Network (VGIN)
Put In Creek
0
1,000
2,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Woodas Creek**

Creek ID Number: 61	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.4209	**Longitude:** -76.3509
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 23	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 33
Average Depth of Creek Mouth (ft): -3.1	**Maximum Depth of Creek Mouth (ft):** -6.8

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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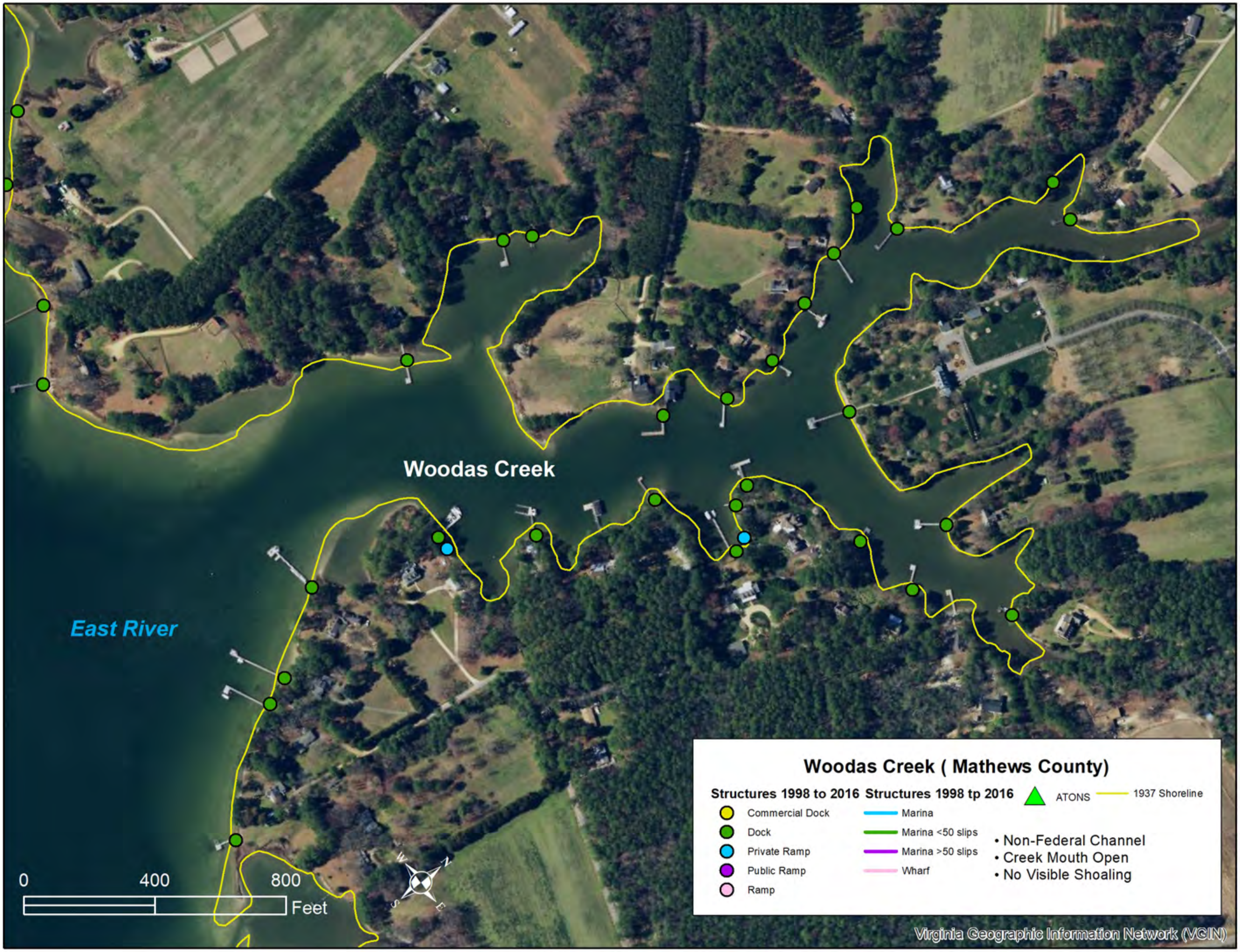
Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Woodas Creek
East River
Woodas Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
400
800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Miles Creek

Creek ID Number: 62	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.4035	**Longitude:** -76.3525
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 19	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 29
Average Depth of Creek Mouth (ft): -4.6	**Maximum Depth of Creek Mouth (ft):** -7.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

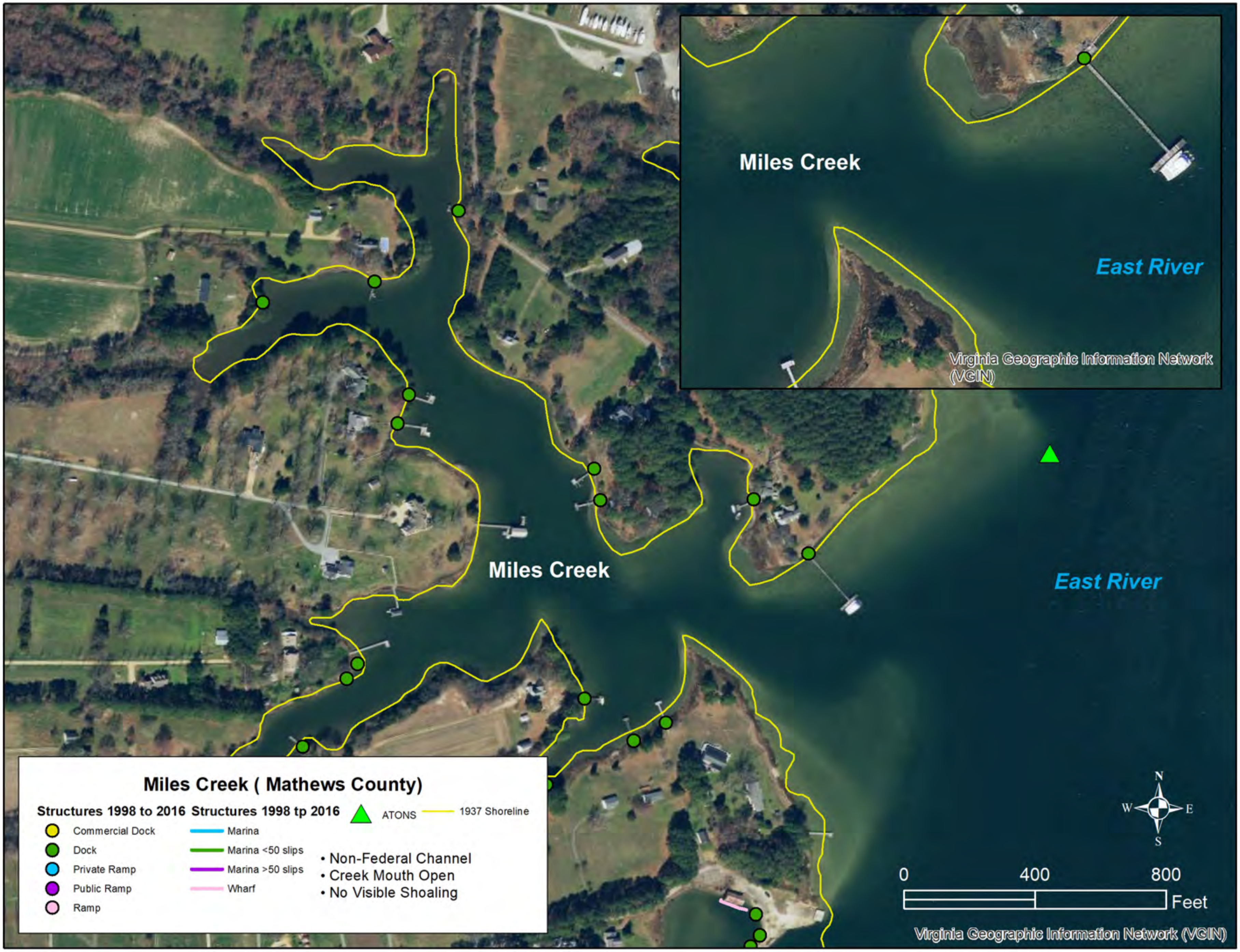
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Miles Creek
East River
Virginia Geographic Information Network (VGIN)
Miles Creek
East River
Miles Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
N
W
E
S
0
400
800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Mill Creek 2

Creek ID Number: 63	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.4006	**Longitude:** -76.3522
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 8	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 14
Average Depth of Creek Mouth (ft): -0.7	**Maximum Depth of Creek Mouth (ft):** -1.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Mill Creek
East River
Virginia Geographic Information Network (VGIN)
Mill Creek
East River
Mill Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Channel < 50% Shoaled
0 300 600
Feet
N
S
E
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Raines

Creek ID Number: 64	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.3961	**Longitude:** -76.3468
Number of Marinas: 0	
Number of Boat Ramps: 3	
Number of Piers: 8	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 20
Average Depth of Creek Mouth (ft): -4.5	**Maximum Depth of Creek Mouth (ft):** -6.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

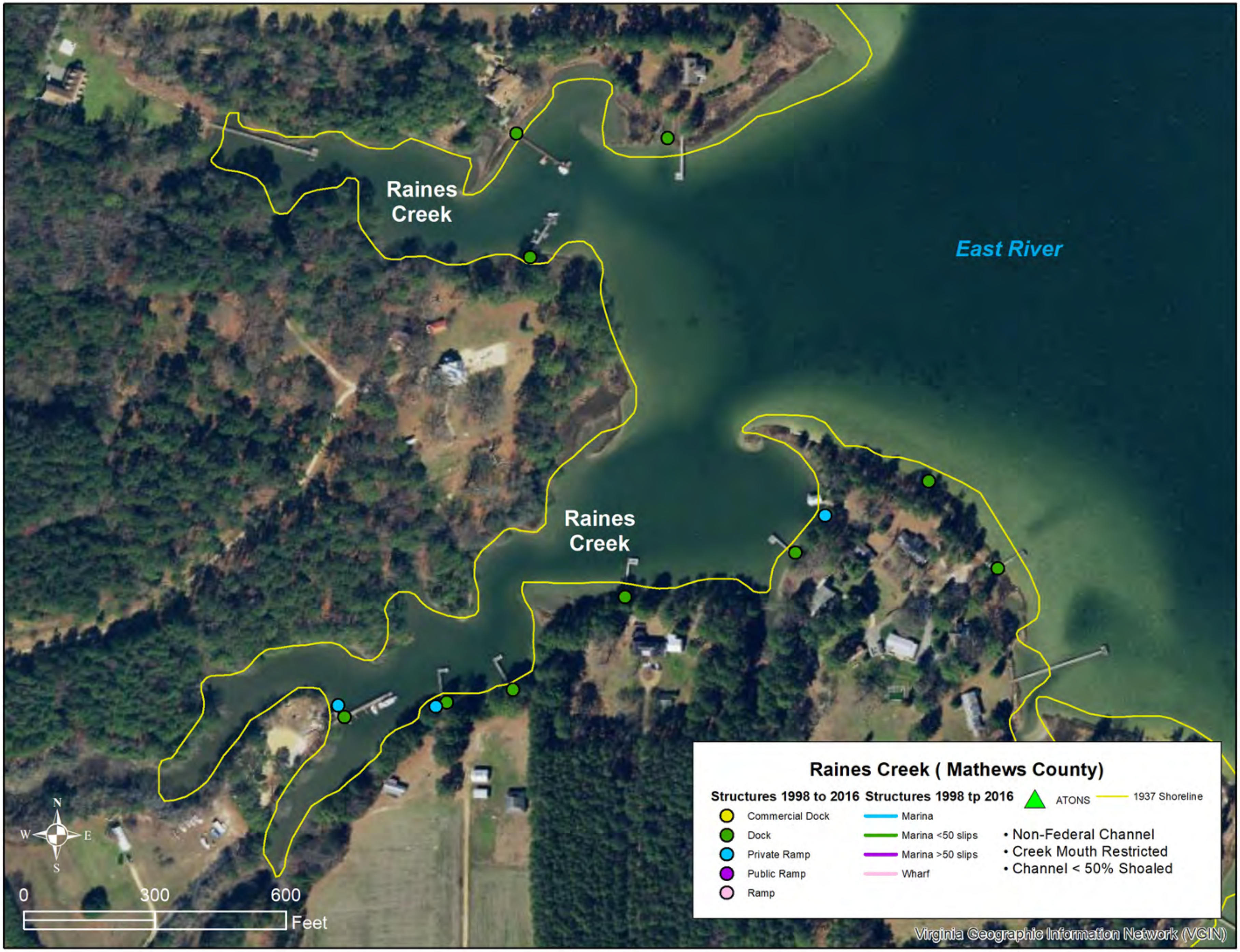
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Raines Creek
Raines Creek
East River
Raines Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
N
S
E
W
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Thomas Creek_MA

Creek ID Number: 65	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.3901	**Longitude:** -76.3440
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 4	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 11
Average Depth of Creek Mouth (ft): -1.8	**Maximum Depth of Creek Mouth (ft):** -2.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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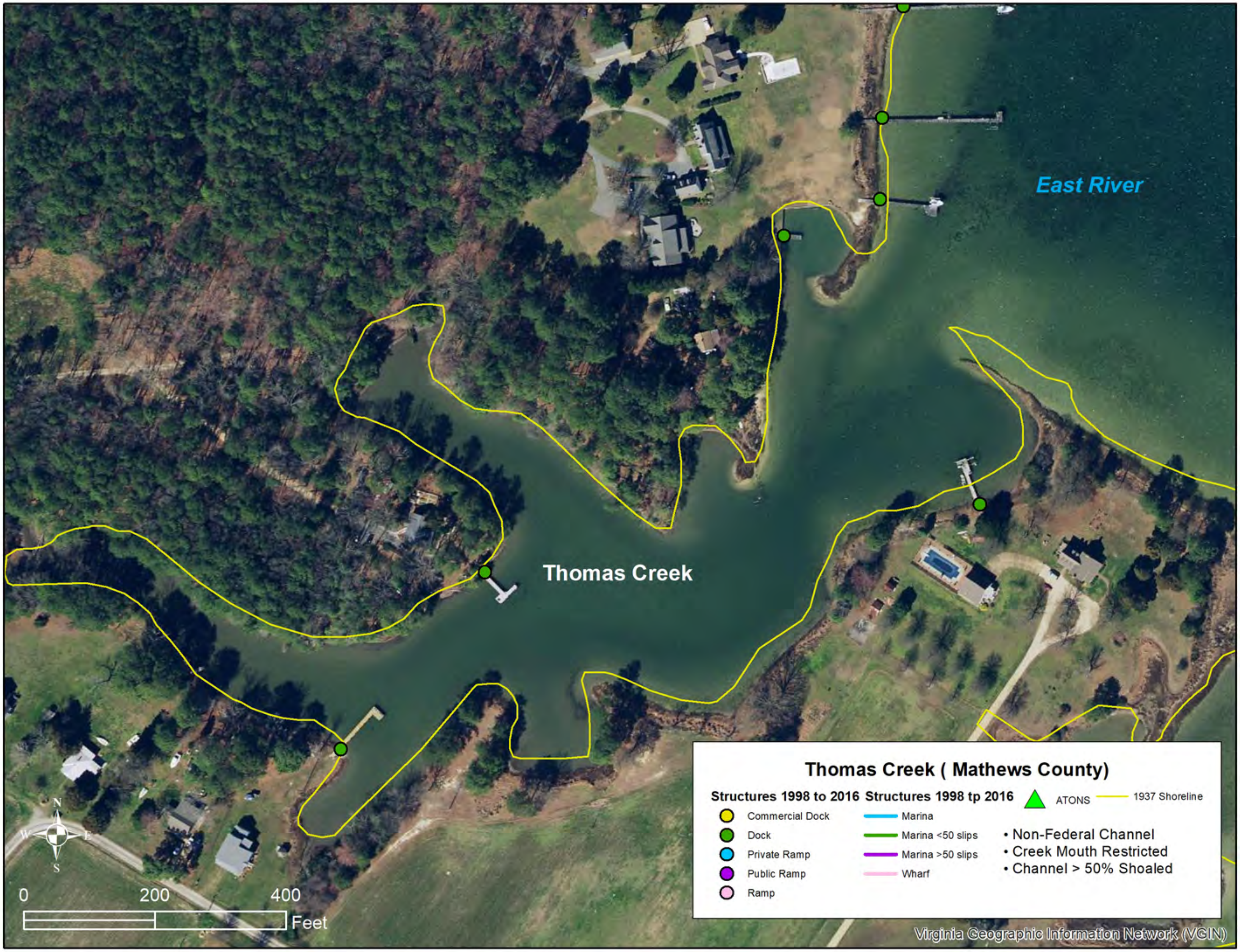
Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



East River
Thomas Creek
Thomas Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
200
400
Feet
N
S
W
E
Virginia Geographic Information Network (VGIN)

Data Sheet for Sharp Point Creek

Creek ID Number: 66	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.3837	**Longitude:** -76.3450
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 2	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 14
Average Depth of Creek Mouth (ft): -2.3	**Maximum Depth of Creek Mouth (ft):** -4.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Sharp Point Creek
East River
Sharp Point Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
200
400
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for **Whites Creek**

Creek ID Number: 67	**Locality:** Mathews
Water Body: East River	**Channel Type:** Non-Federal
Latitude: 37.3738	**Longitude:** -76.3489
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 11	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 12
Average Depth of Creek Mouth (ft): -1.1	**Maximum Depth of Creek Mouth (ft):** -2.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


East River
Whites Creek
Virginia Geographic Information Network (VGIN)
East River
Whites Creek
Whites Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
300
600
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for **Godsey Creek**

Creek ID Number: 68	**Locality:** Mathews
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.3808	**Longitude:** -76.3713
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 6	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 41
Average Depth of Creek Mouth (ft): -1.9	**Maximum Depth of Creek Mouth (ft):** -5.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

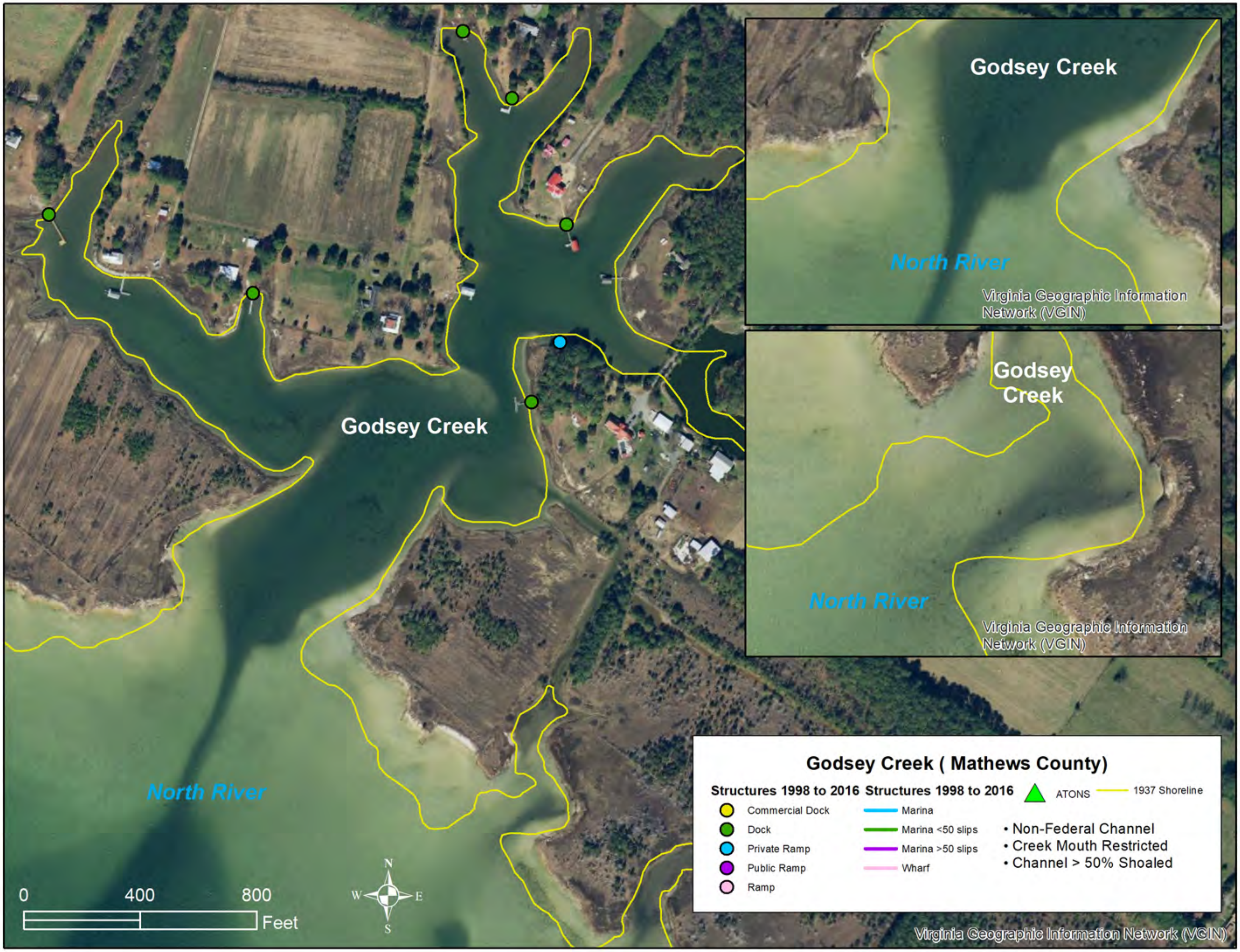
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Godsey Creek
North River
Godsey Creek
North River
Virginia Geographic Information Network (VGIN)
Godsey Creek
North River
Virginia Geographic Information Network (VGIN)
Godsey Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
400
800
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for Diggs Creek

Creek ID Number: 69	**Locality:** Mathews
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.3831	**Longitude:** -76.3790
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 2	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 14
Average Depth of Creek Mouth (ft): -1.2	**Maximum Depth of Creek Mouth (ft):** -1.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

North River
Diggs Creek
North River
Diggs Creek
Virginia Geographic Information Network (VGIN)
Diggs Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
400
800
Feet
W
N
S
E
Virginia Geographic Information Network (VGIN)

Data Sheet for Cakes Creek

Creek ID Number: 70	**Locality:** Mathews
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.3861	**Longitude:** -76.3857
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 2	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 20
Average Depth of Creek Mouth (ft): -0.9	**Maximum Depth of Creek Mouth (ft):** -1.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

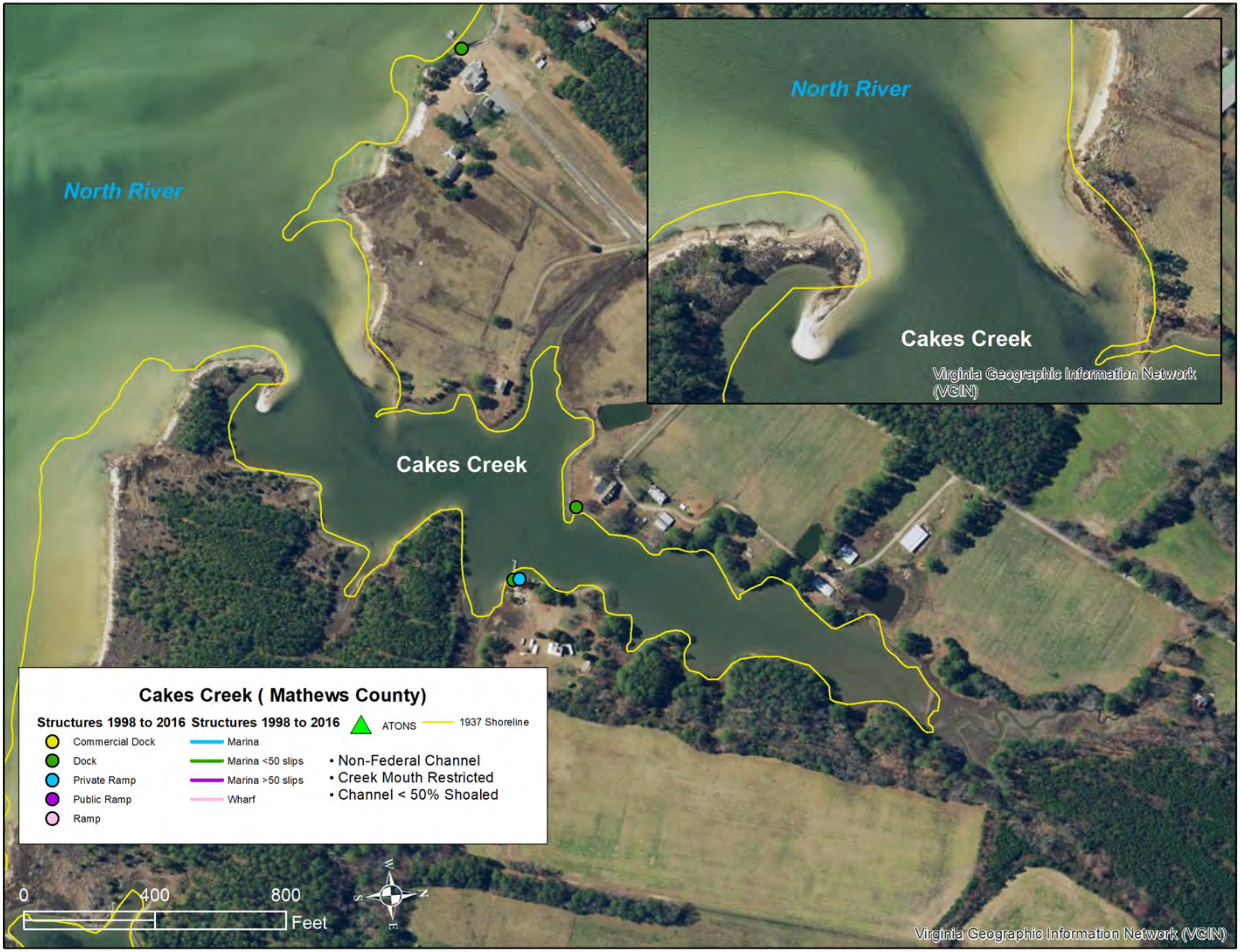
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


North River
Cakes Creek
North River
Cakes Creek
Virginia Geographic Information Network (VGIN)
Cakes Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
400
800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Raymond Creek

Creek ID Number: 71	**Locality:** Mathews
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.4011	**Longitude:** -76.3954
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 1	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 14
Average Depth of Creek Mouth (ft): -1.5	**Maximum Depth of Creek Mouth (ft):** -2.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Raymond Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
North River
Raymond Creek
0
250
500
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Old Log School Creek

Creek ID Number: 72	**Locality:** Mathews
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.4091	**Longitude:** -76.3957
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 3	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 14
Average Depth of Creek Mouth (ft): -2.2	**Maximum Depth of Creek Mouth (ft):** -4.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

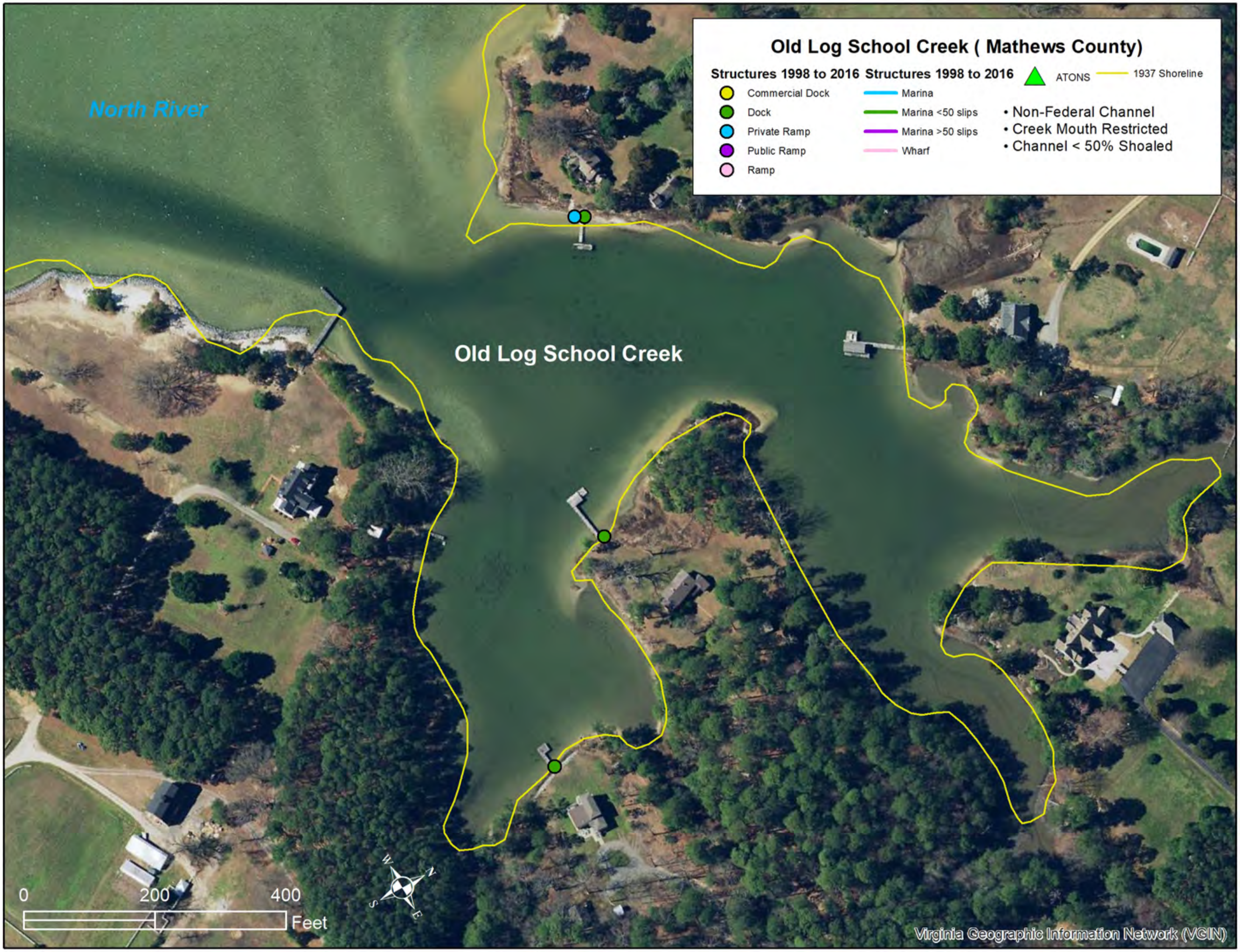
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Old Log School Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
North River
Old Log School Creek
0
200
400
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Oakland Creek**

Creek ID Number: 73	**Locality:** Mathews
Water Body: Blackwater Creek	**Channel Type:** Non-Federal
Latitude: 37.4238	**Longitude:** -76.3991
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 8	
Creek Mouth Morphology: Semi-Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 21
Average Depth of Creek Mouth (ft): -2.7	**Maximum Depth of Creek Mouth (ft):** -5.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

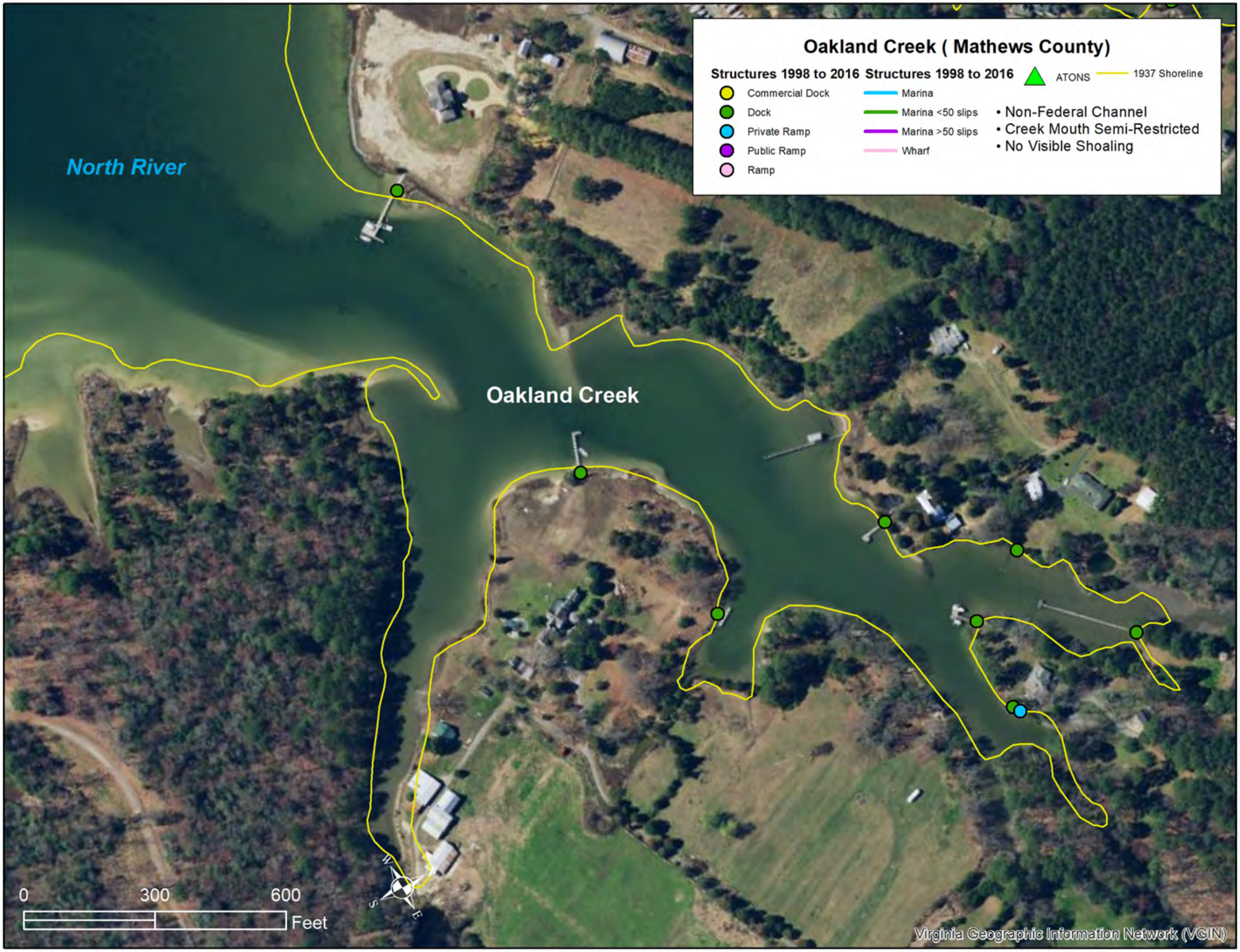
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Oakland Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Semi-Restricted
• No Visible Shoaling
North River
Oakland Creek
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Greenmansion Creek

Creek ID Number: 74	**Locality:** Mathews
Water Body: Blackwater Creek	**Channel Type:** Non-Federal ATON
Latitude: 37.4255	**Longitude:** -76.4026
Number of Marinas: 1	
Number of Boat Ramps: 1	
Number of Piers: 10	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 37
Average Depth of Creek Mouth (ft): -3.9	**Maximum Depth of Creek Mouth (ft):** -7.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

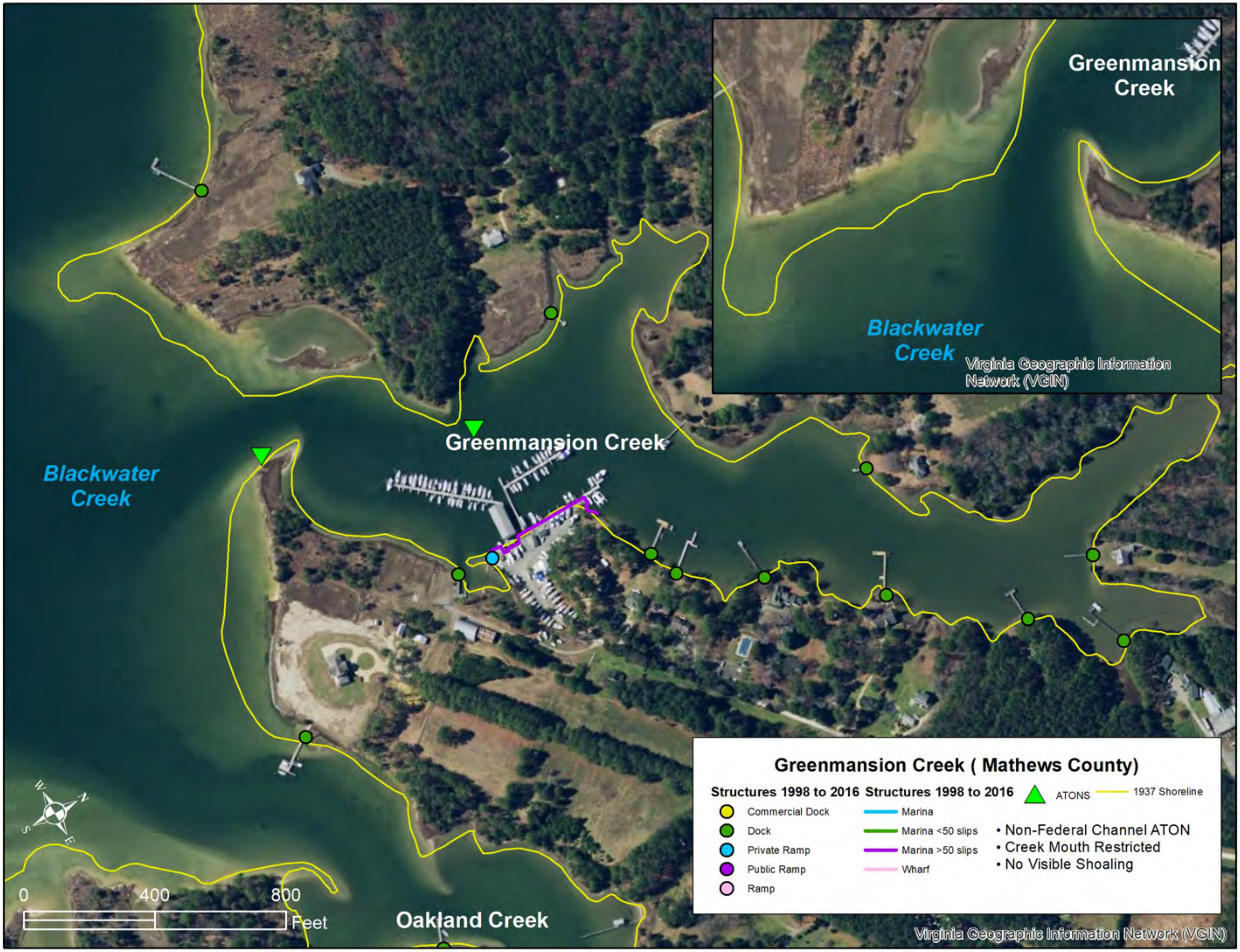
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Greenmansion Creek
Blackwater Creek
Virginia Geographic Information Network (VGIN)
Greenmansion Creek
Blackwater Creek
Oakland Creek
0
400
800
Feet
Greenmansion Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Restricted
• No Visible Shoaling
Virginia Geographic Information Network (VGIN)

Data Sheet for **Blackwater Creek**

Creek ID Number: 75	**Locality:** Mathews
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.4187	**Longitude:** -76.4013
Number of Marinas: 1	
Number of Boat Ramps: 4	
Number of Piers: 51	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 343
Average Depth of Creek Mouth (ft): -6.9	**Maximum Depth of Creek Mouth (ft):** -16.7

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

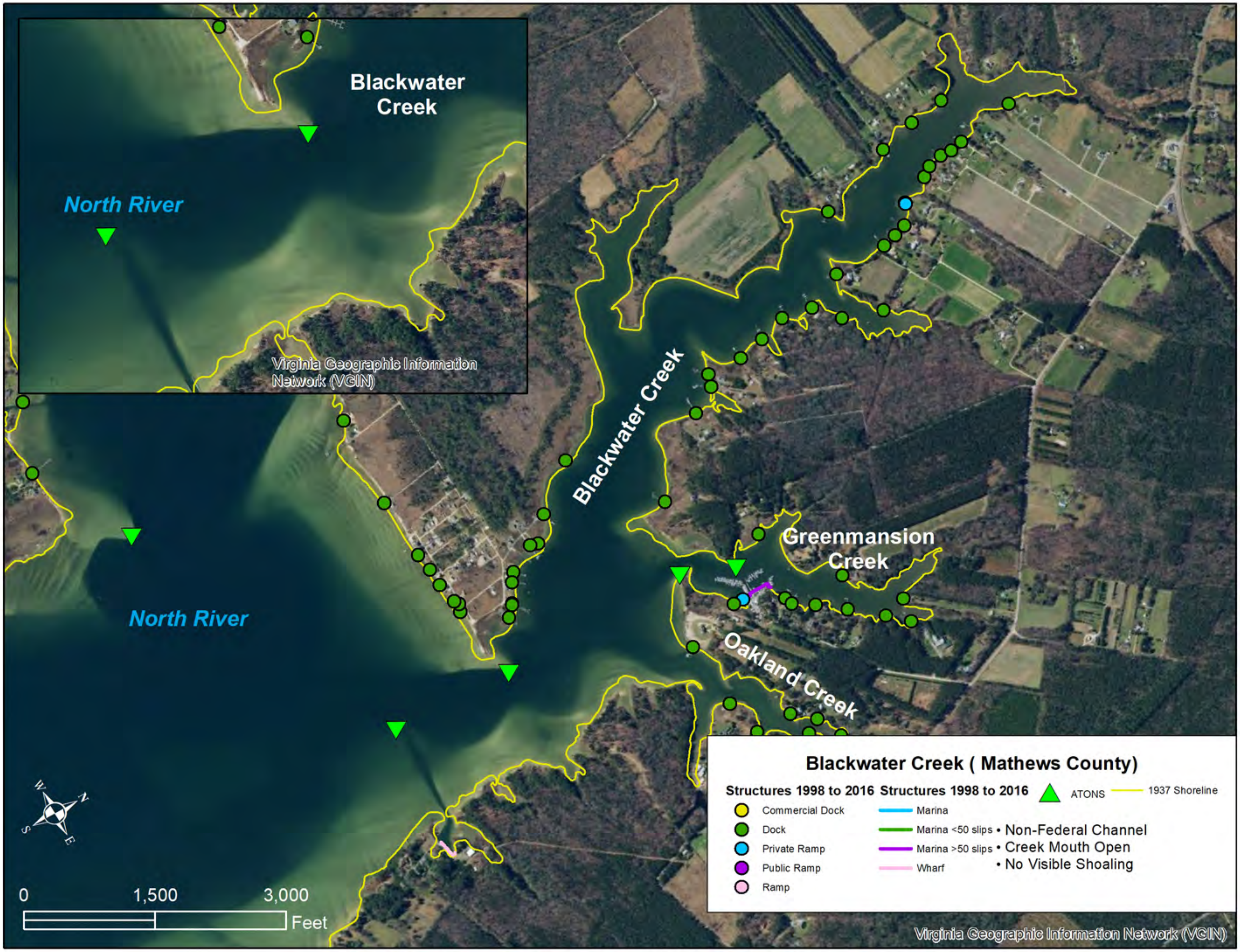
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Blackwater Creek
North River
Virginia Geographic Information Network (VGIN)
Blackwater Creek
North River
Greenmansion Creek
Oakland Creek
Blackwater Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
1,500
3,000
Feet
W
N
S
E
Virginia Geographic Information Network (VGIN)

Data Sheet for Hampton Creek

Creek ID Number: 76	**Locality:** Mathews
Water Body: Blackwater Creek	**Channel Type:** Non-Federal
Latitude: 37.4265	**Longitude:** -76.4118
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 1.3	**Creek Area (acres):** 19
Average Depth of Creek Mouth (ft): -3.2	**Maximum Depth of Creek Mouth (ft):** -5.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

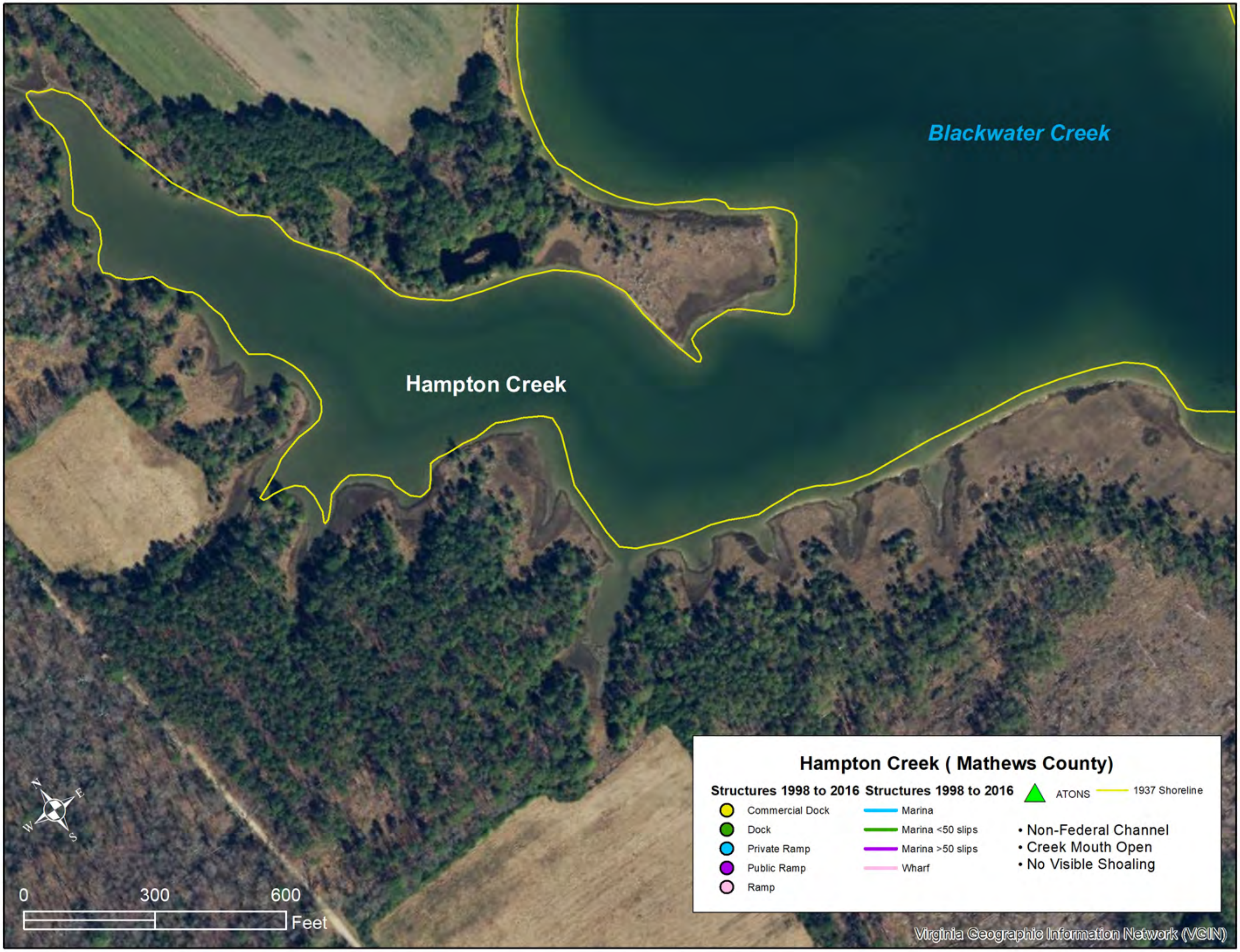
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Blackwater Creek
Hampton Creek
Hampton Creek (Mathews County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
N
E
W
S
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Toddsbury Creek**

Creek ID Number: 77	**Locality:** Gloucester
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.4321	**Longitude:** -76.4540
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 4	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 14
Average Depth of Creek Mouth (ft): -2.0	**Maximum Depth of Creek Mouth (ft):** -2.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


North River
Toddsbury Creek
Toddsbury Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• No Visible Shoaling
N
E
S
W
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Elmington Creek

Creek ID Number: 78	**Locality:** Gloucester
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.4217	**Longitude:** -76.4532
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 8	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 22
Average Depth of Creek Mouth (ft): -0.4	**Maximum Depth of Creek Mouth (ft):** -0.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

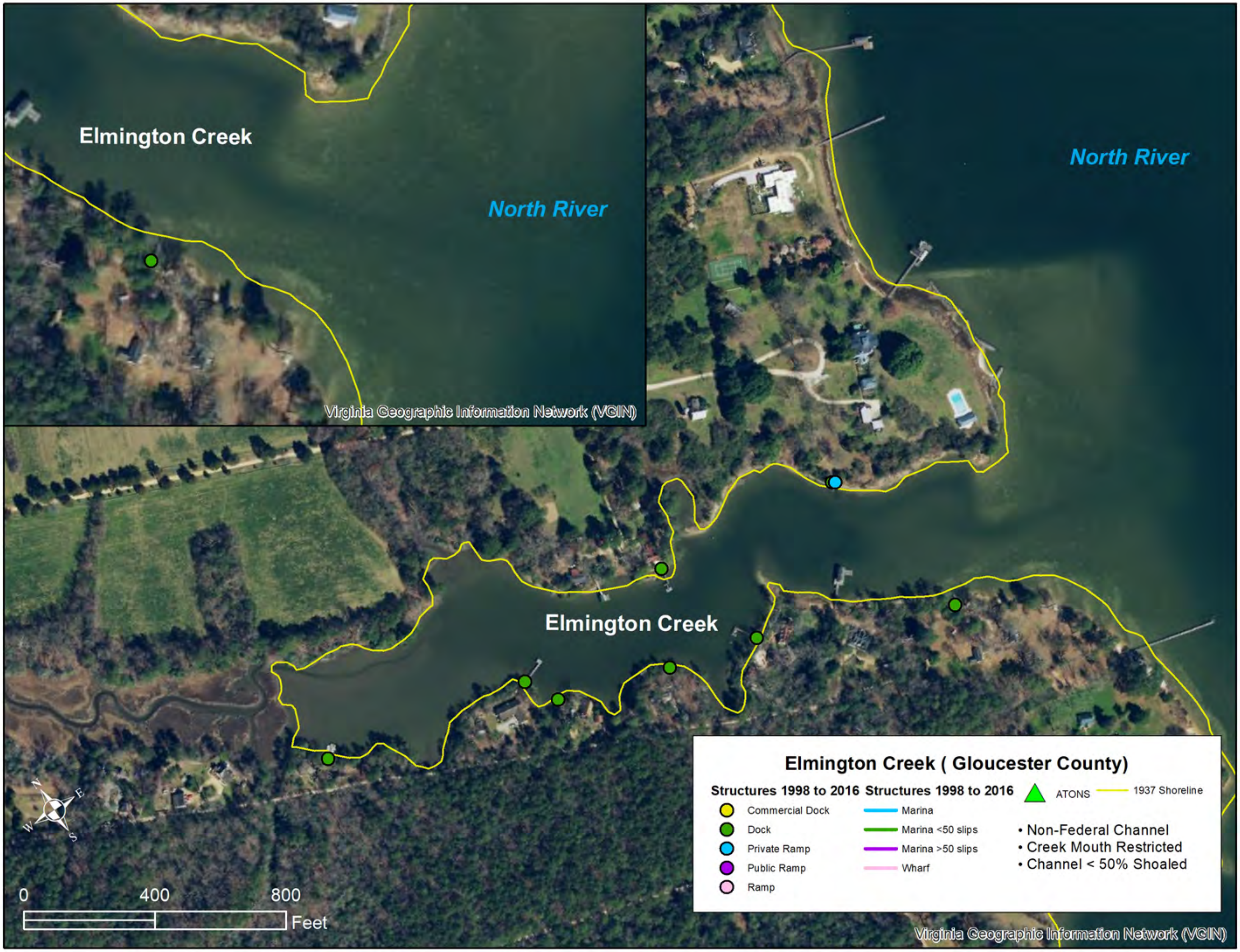
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Elmington Creek
North River
Virginia Geographic Information Network (VGIN)
North River
Elmington Creek
Elmington Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
400
800
Feet
N
E
S
W
Virginia Geographic Information Network (VGIN)

Data Sheet for **Back Creek**

Creek ID Number: 79	**Locality:** Gloucester
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.4184	**Longitude:** -76.4523
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 22	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 58
Average Depth of Creek Mouth (ft): -3.3	**Maximum Depth of Creek Mouth (ft):** -6.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

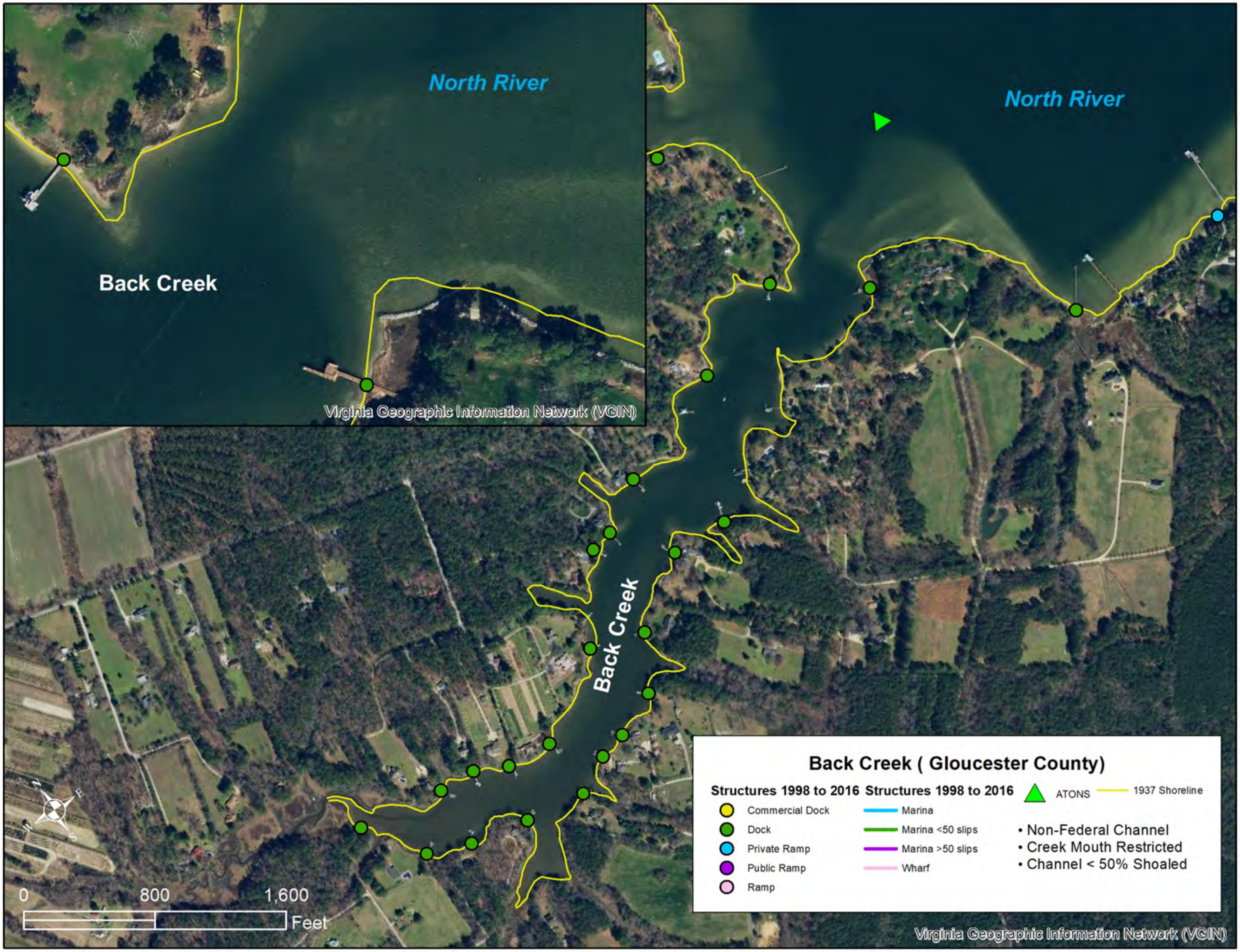
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


North River
Back Creek
Virginia Geographic Information Network (VGIN)
North River
Back Creek
Back Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
800
1,600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Belleville

Creek ID Number: 80	**Locality:** Gloucester
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.4118	**Longitude:** -76.4341
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 17	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 37
Average Depth of Creek Mouth (ft): -3.6	**Maximum Depth of Creek Mouth (ft):** -6.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

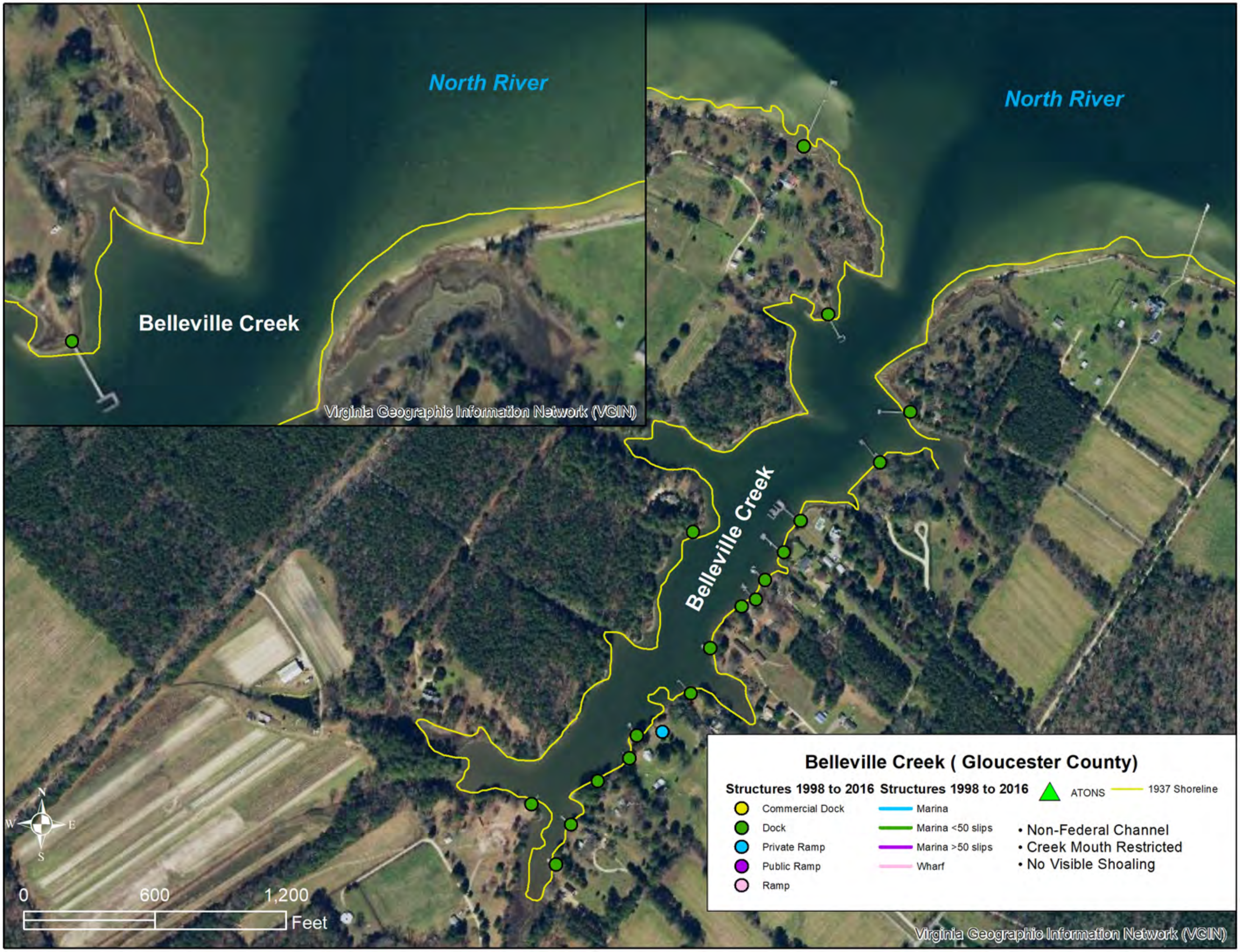
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


North River
Belleville Creek
Virginia Geographic Information Network (VGIN)
North River
Belleville Creek
Belleville Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• No Visible Shoaling
N
W
E
S
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Anchorage Creek

Creek ID Number: 81	**Locality:** Gloucester
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.4093	**Longitude:** -76.4209
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 3	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 8
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

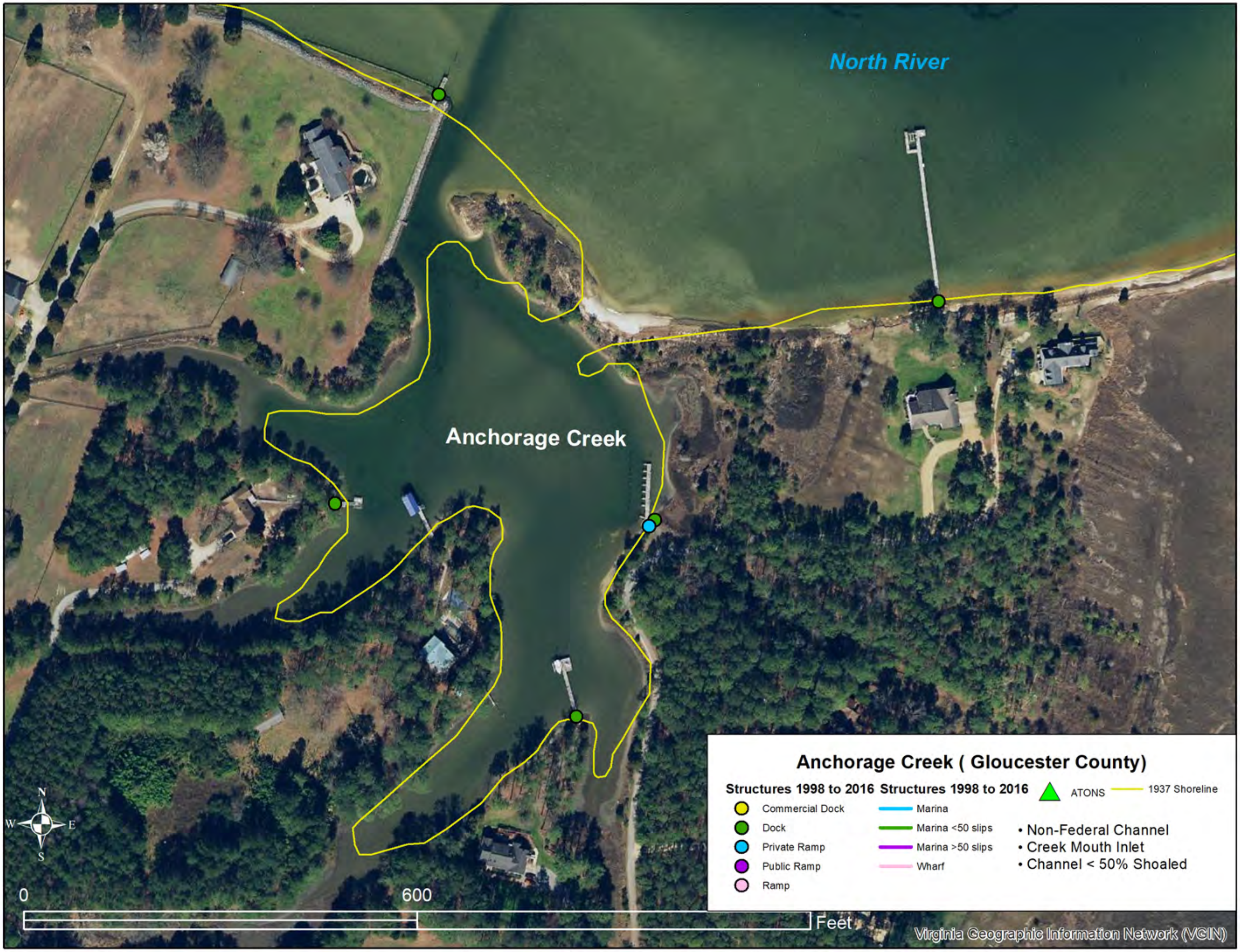
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



North River
Anchorage Creek
Anchorage Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Channel < 50% Shoaled
N
W
E
S
0
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Davis Creek_GL

Creek ID Number: 82	**Locality:** Gloucester
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.3973	**Longitude:** -76.4187
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 18	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 49
Average Depth of Creek Mouth (ft): -6.0	**Maximum Depth of Creek Mouth (ft):** -6.7

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

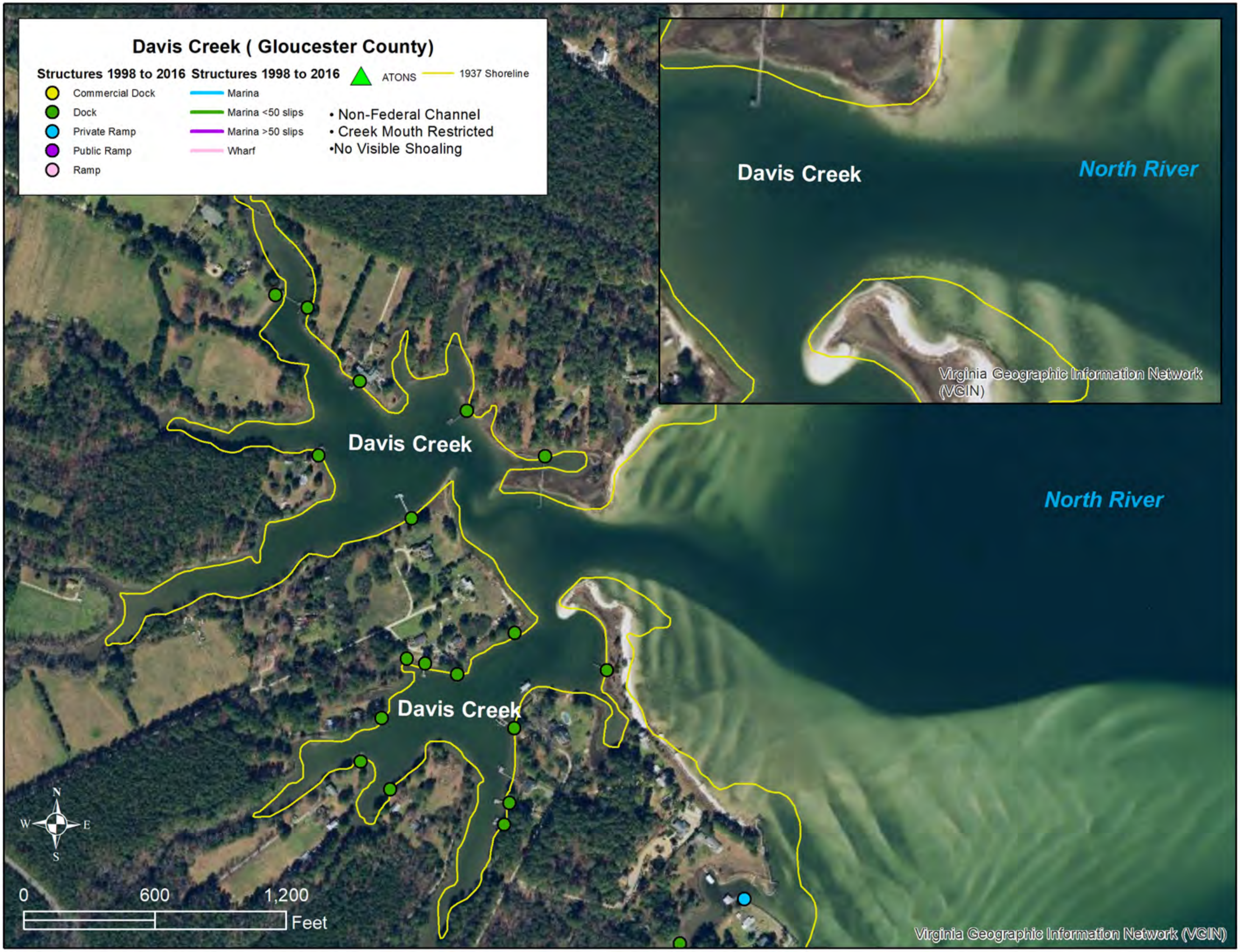
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Davis Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
•No Visible Shoaling
Davis Creek
North River
Virginia Geographic Information Network (VGIN)
Davis Creek
Davis Creek
North River
N
W
E
S
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Silver Creek

Creek ID Number: 83	**Locality:** Gloucester
Water Body: North River	**Channel Type:** Non-Federal
Latitude: 37.3853	**Longitude:** -76.4172
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 1	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 1
Average Depth of Creek Mouth (ft): -0.4	**Maximum Depth of Creek Mouth (ft):** -0.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Silver Creek
North River
Silver Creek (Gloucester County)
Structures 1998 to 2016
Structures 1998 to 2016
ATONS
1937 Shoreline
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Marina
Marina <50 slips
Marina >50 slips
Wharf
• Non-Federal Channel
• Creek Mouth Inlet
•Channel < 50% Shoaled
0
100
200
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for **Wilson Creek**

Creek ID Number: 84	**Locality:** Gloucester
Water Body: Ware River	**Channel Type:** Non-Federal
Latitude: 37.3668	**Longitude:** -76.4689
Number of Marinas: 0	
Number of Boat Ramps: 5	
Number of Piers: 42	
Creek Mouth Morphology: Semi-Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 213
Average Depth of Creek Mouth (ft): -5.7	**Maximum Depth of Creek Mouth (ft):** -10.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

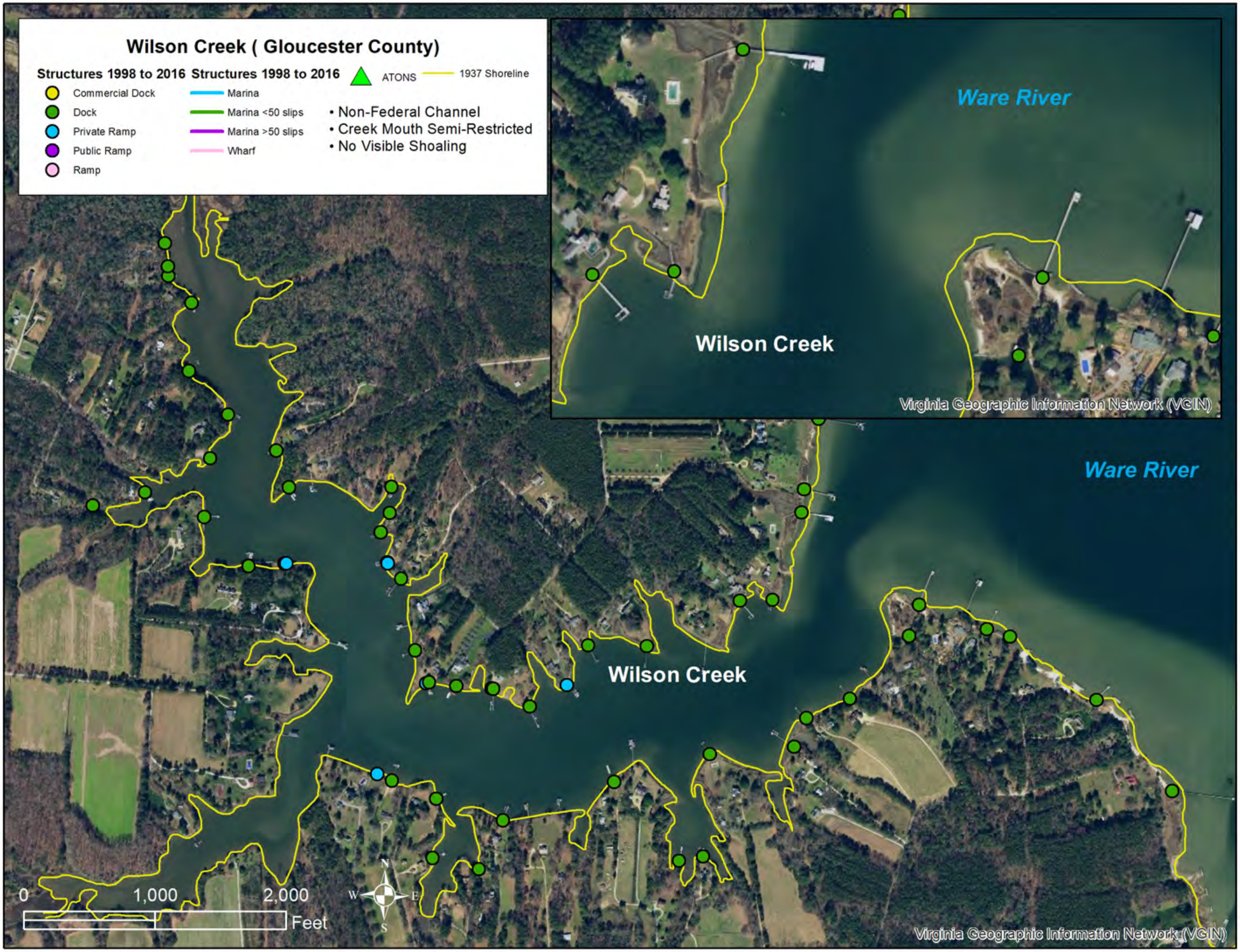
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Wilson Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Semi-Restricted
• No Visible Shoaling
Ware River
Wilson Creek
Virginia Geographic Information Network (VGIN)
Ware River
Wilson Creek
0
1,000
2,000
Feet
N
S
E
W
Virginia Geographic Information Network (VGIN)

Data Sheet for Oldhouse Creek

Creek ID Number: 85	**Locality:** Gloucester
Water Body: Ware River	**Channel Type:** Non-Federal
Latitude: 37.3609	**Longitude:** -76.4473
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 6	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 78
Average Depth of Creek Mouth (ft): -2.0	**Maximum Depth of Creek Mouth (ft):** -4.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

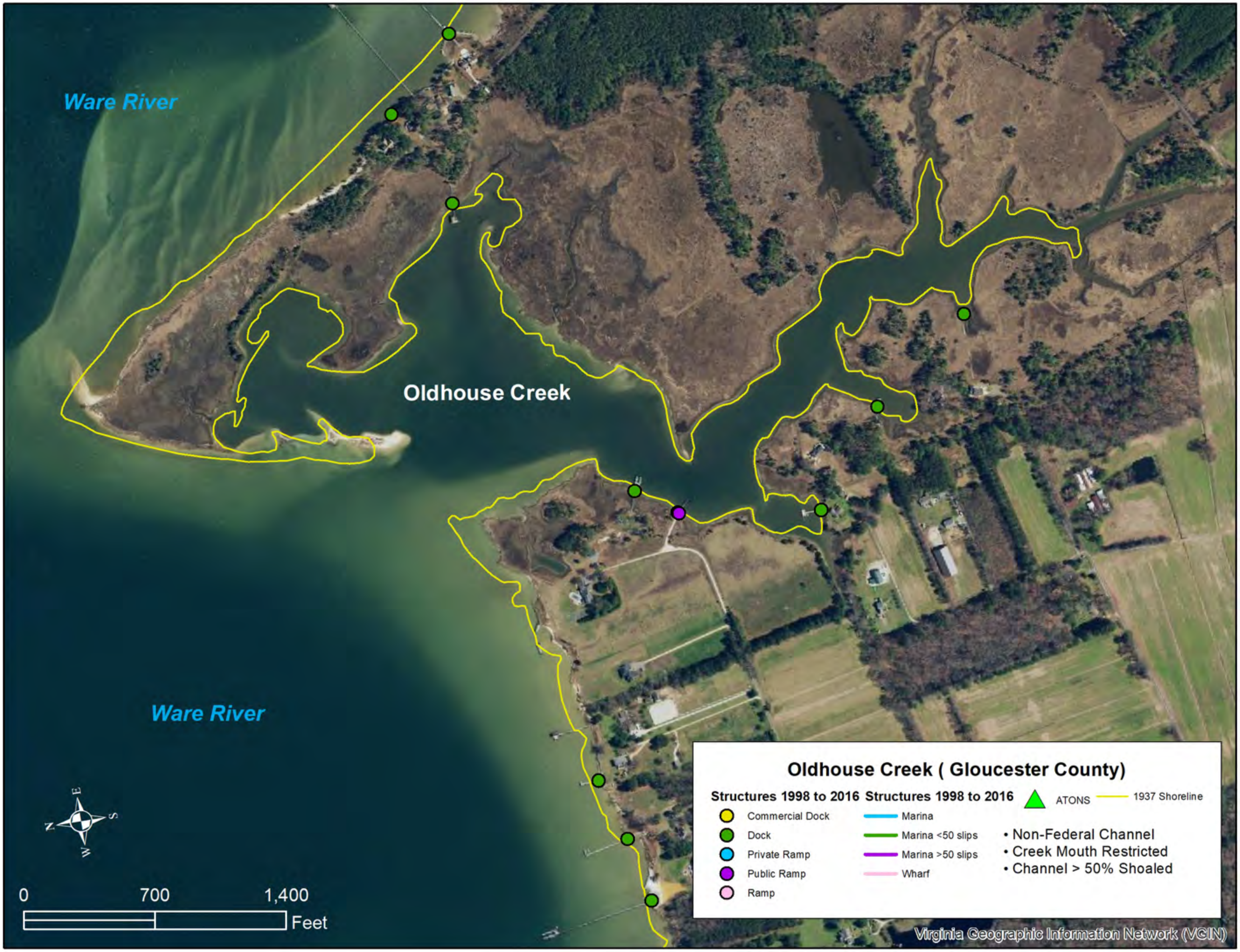
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Ware River
Oldhouse Creek
Ware River
Oldhouse Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
700
1,400
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Whittaker Creek**

Creek ID Number: 86	**Locality:** Gloucester
Water Body: Severn River	**Channel Type:** Non-Federal
Latitude: 37.3234	**Longitude:** -76.4313
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 1	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 45
Average Depth of Creek Mouth (ft): -2.6	**Maximum Depth of Creek Mouth (ft):** -5.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

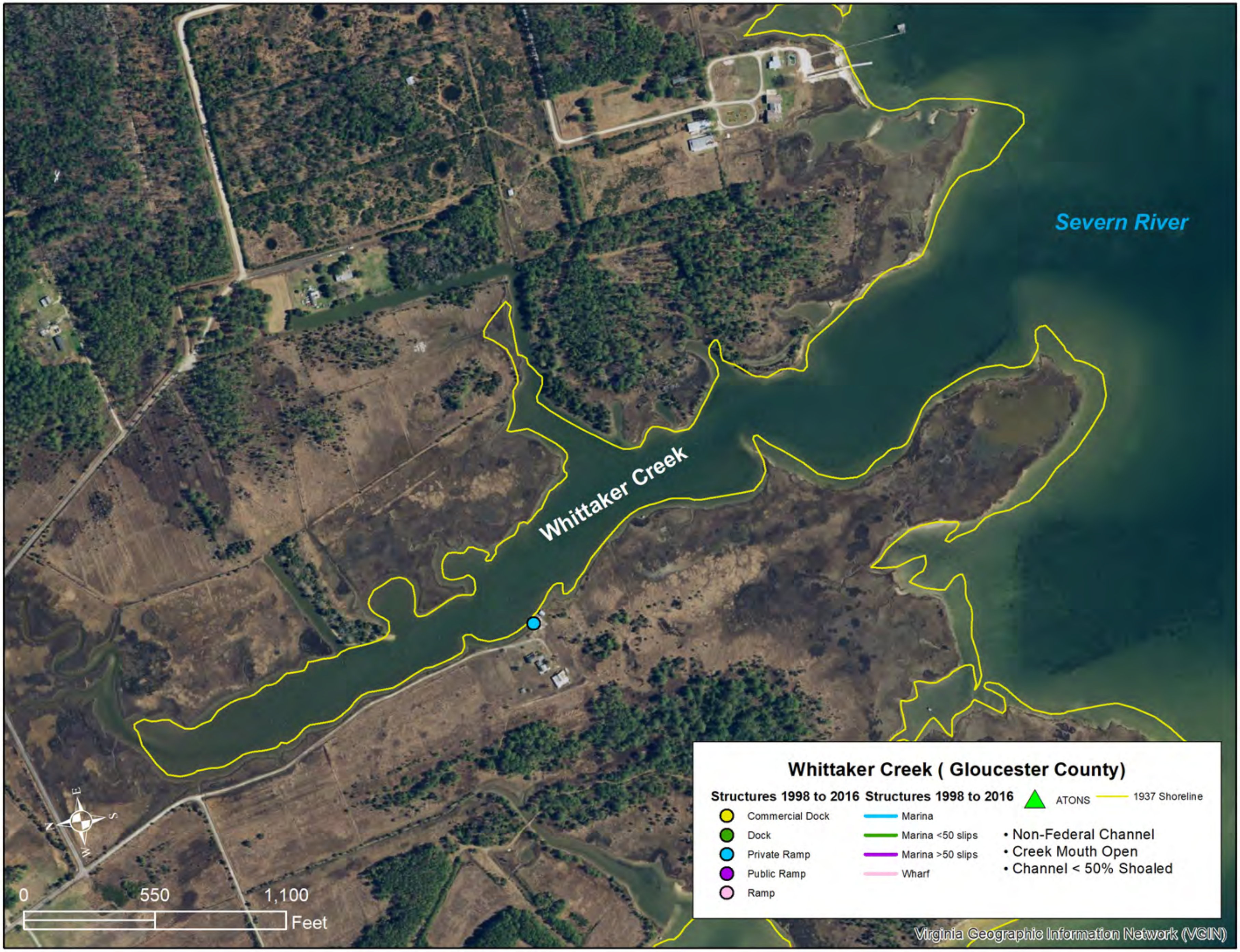
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Severn River
Whittaker Creek
Whittaker Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
550
1,100
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Free School Creek**

Creek ID Number: 87	**Locality:** Gloucester
Water Body: Severn River	**Channel Type:** Non-Federal
Latitude: 37.3308	**Longitude:** -76.4449
Number of Marinas: 0	
Number of Boat Ramps: 4	
Number of Piers: 19	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 38
Average Depth of Creek Mouth (ft): -4.5	**Maximum Depth of Creek Mouth (ft):** -6.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

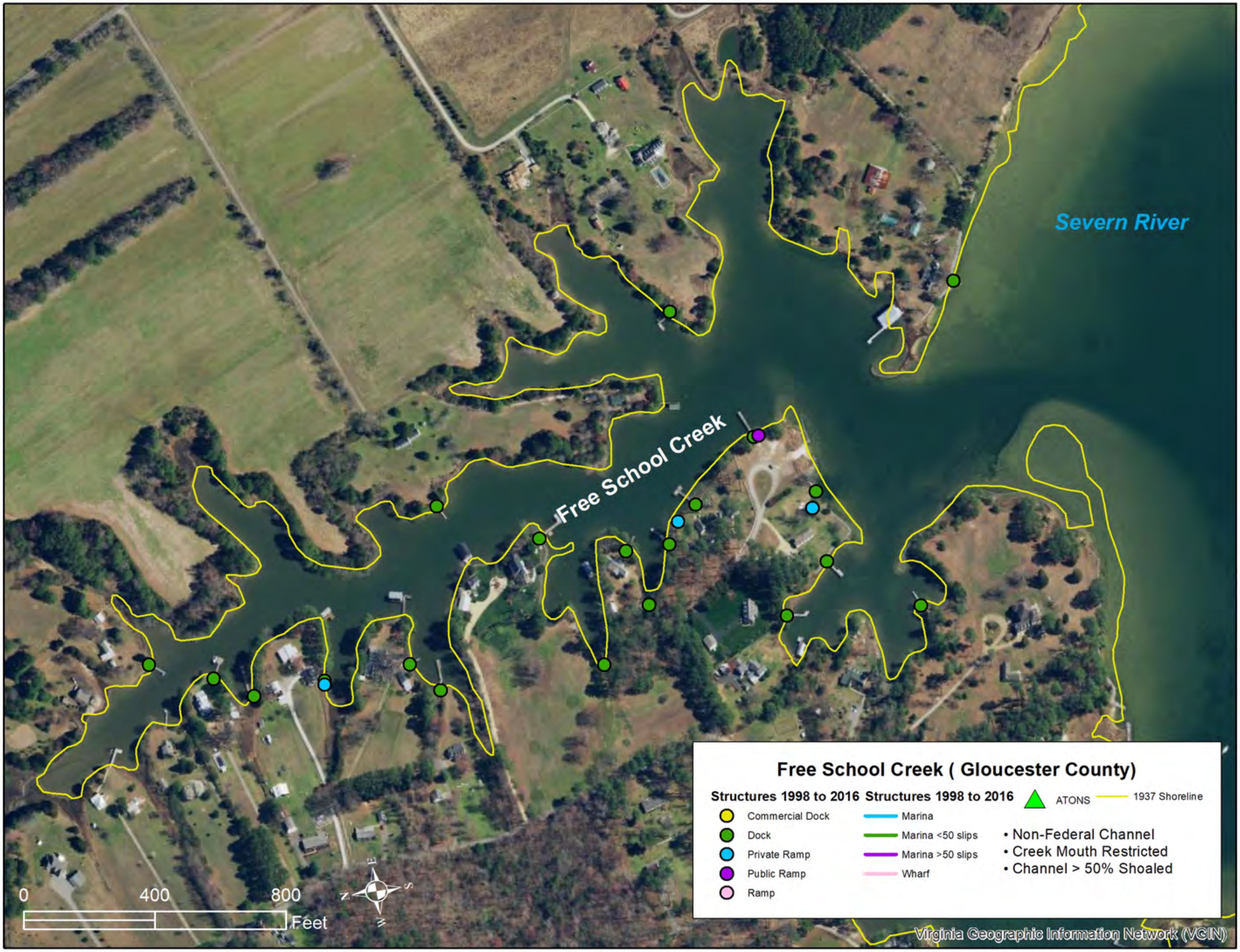
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Severn River
Free School Creek
Free School Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
400
800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Sterling Creek**

Creek ID Number: 88	**Locality:** Gloucester
Water Body: Severn River	**Channel Type:** Non-Federal
Latitude: 37.3297	**Longitude:** -76.4501
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 10	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 16
Average Depth of Creek Mouth (ft): -3.2	**Maximum Depth of Creek Mouth (ft):** -4.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

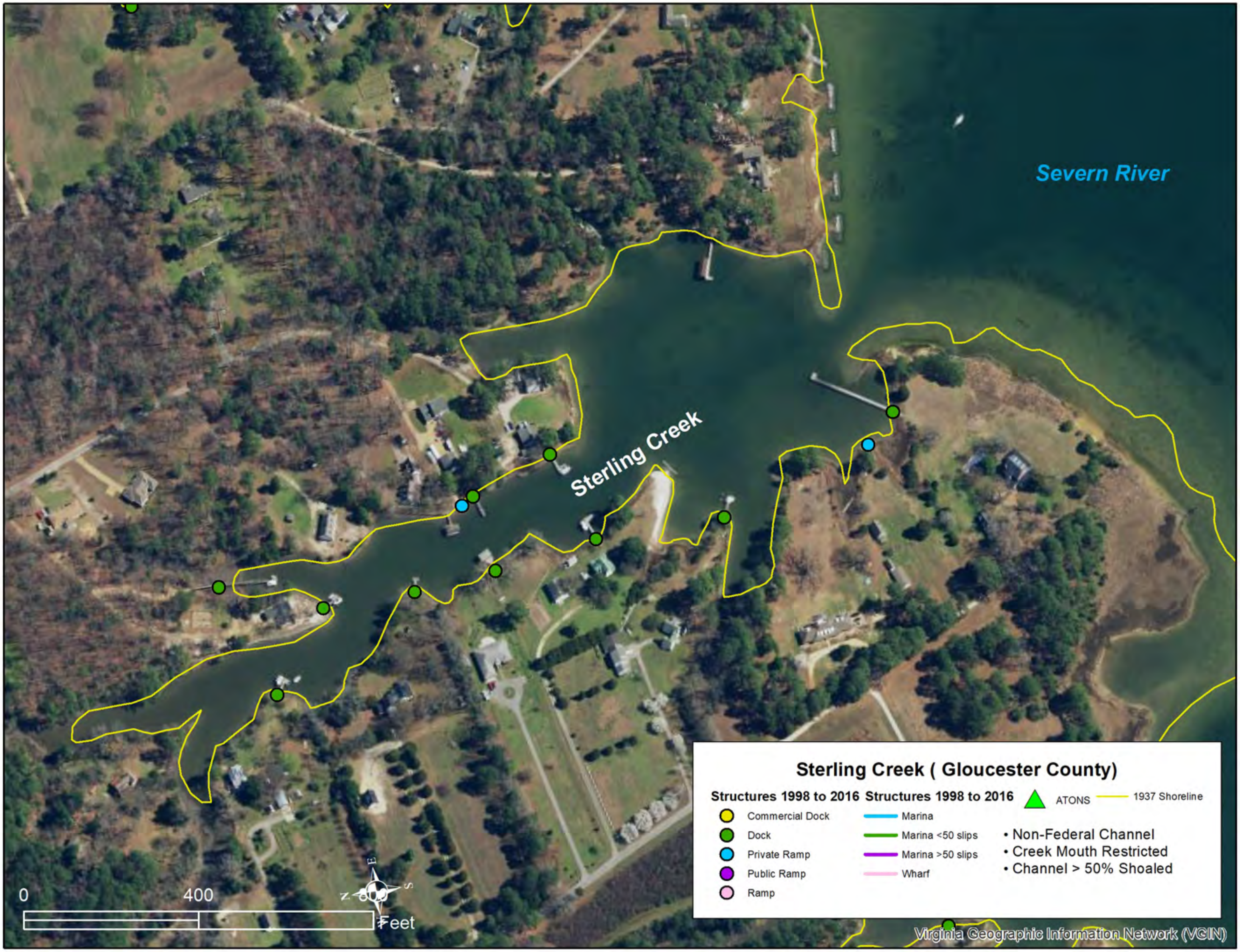
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Severn River
Sterling Creek
Sterling Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
400
800
Feet
N
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for Vaughans Creek

Creek ID Number: 89	**Locality:** Gloucester
Water Body: Severn River (Northern Branch)	**Channel Type:** Non-Federal
Latitude: 37.3193	**Longitude:** -76.4712
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 21	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 88
Average Depth of Creek Mouth (ft): -4.9	**Maximum Depth of Creek Mouth (ft):** -7.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

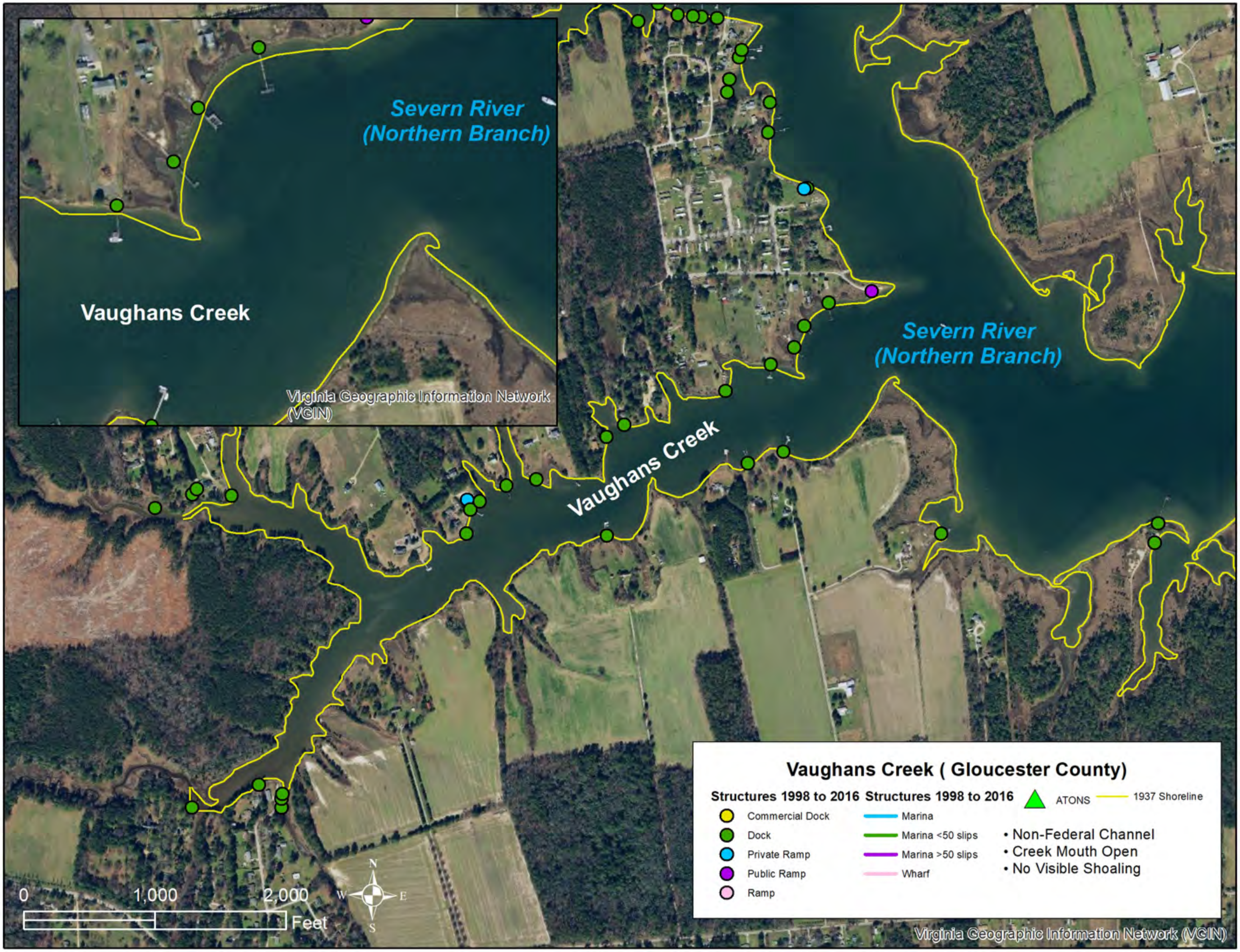
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Severn River (Northern Branch)
Vaughans Creek
Virginia Geographic Information Network (VGIN)
Severn River (Northern Branch)
Vaughans Creek
Vaughans Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
1,000
2,000
Feet
N
S
E
W
Virginia Geographic Information Network (VGIN)

Data Sheet for **Willetts Creek**

Creek ID Number: 90	**Locality:** Gloucester
Water Body: Severn River (Southwest Branch)	**Channel Type:** Non-Federal
Latitude: 37.3013	**Longitude:** -76.4562
Number of Marinas: 1	
Number of Boat Ramps: 1	
Number of Piers: 12	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 130
Average Depth of Creek Mouth (ft): -4.2	**Maximum Depth of Creek Mouth (ft):** -6.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

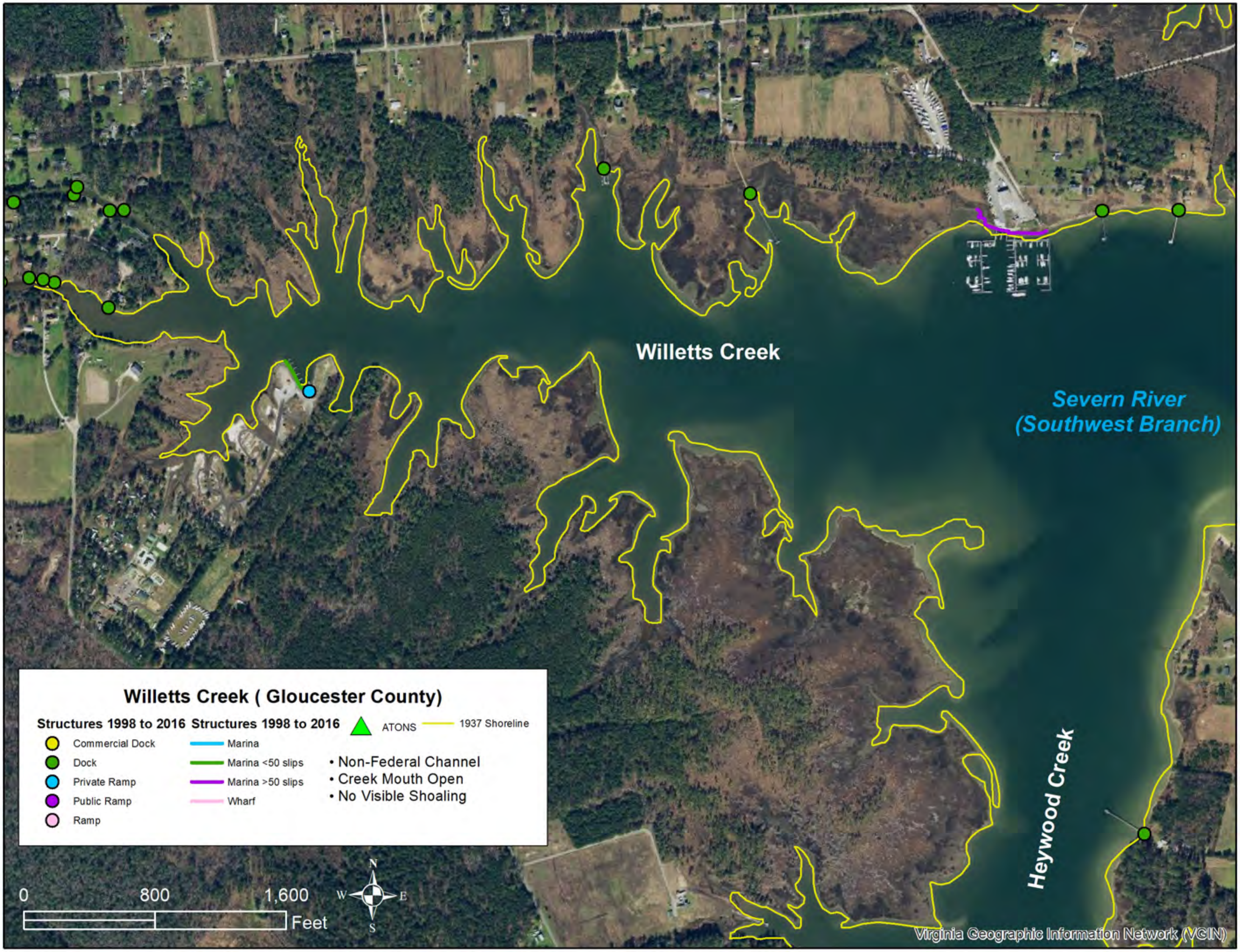
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Willetts Creek
Severn River
(Southwest Branch)
Heywood Creek
Willetts Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
800
1,600
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for Lady Creek

Creek ID Number: 91	**Locality:** Gloucester
Water Body: Severn River (Southwest Branch)	**Channel Type:** Non-Federal
Latitude: 37.2986	**Longitude:** -76.4477
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 2	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 7
Average Depth of Creek Mouth (ft): -2.2	**Maximum Depth of Creek Mouth (ft):** -3.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

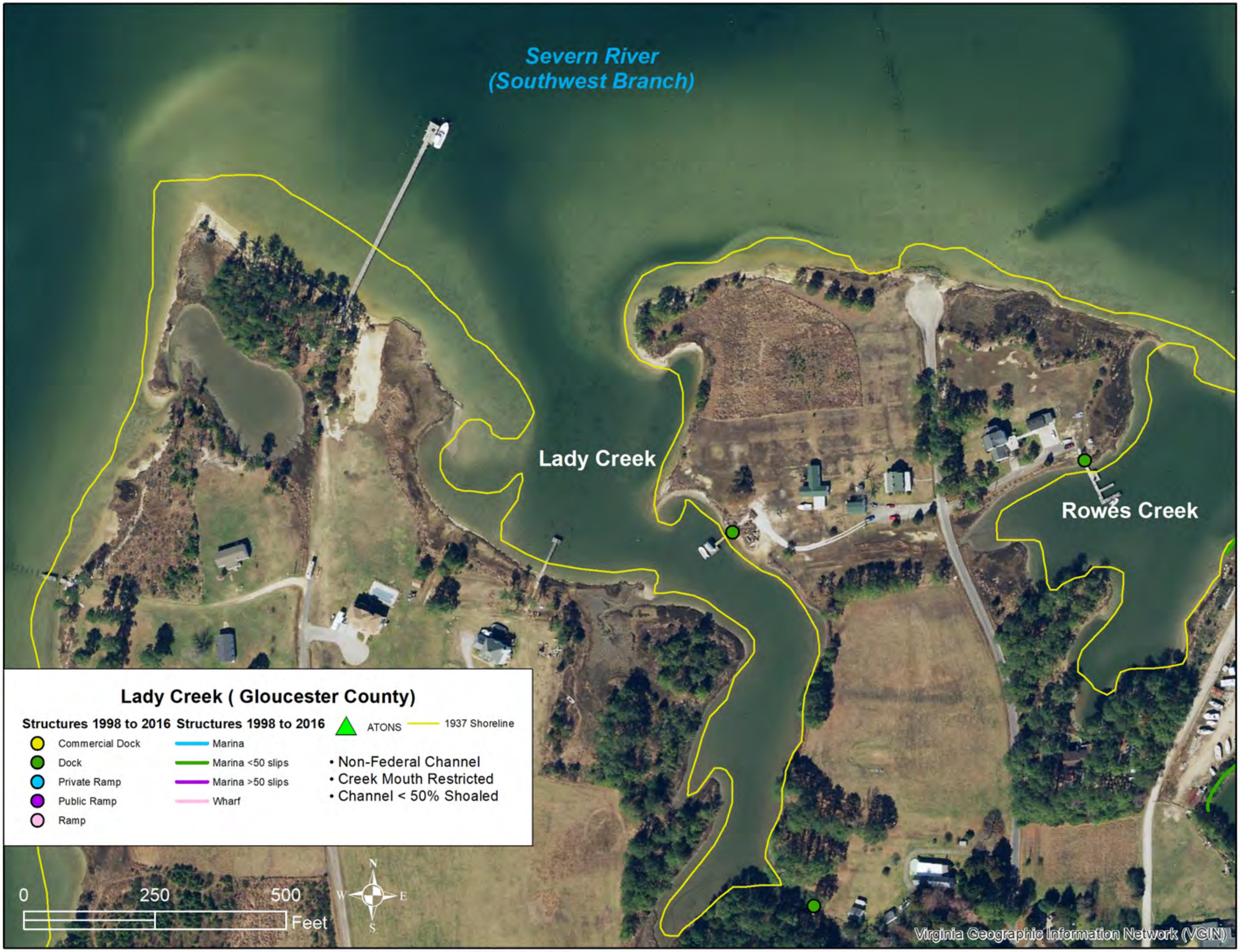
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Severn River
(Southwest Branch)
Lady Creek
Rowes Creek
Lady Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
0
250
500
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for Heywood Creek

Creek ID Number: 92	**Locality:** Gloucester
Water Body: Severn River (Southwest Branch)	**Channel Type:** Non-Federal
Latitude: 37.2922	**Longitude:** -76.4551
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 2	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 100
Average Depth of Creek Mouth (ft): -4.2	**Maximum Depth of Creek Mouth (ft):** -6.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

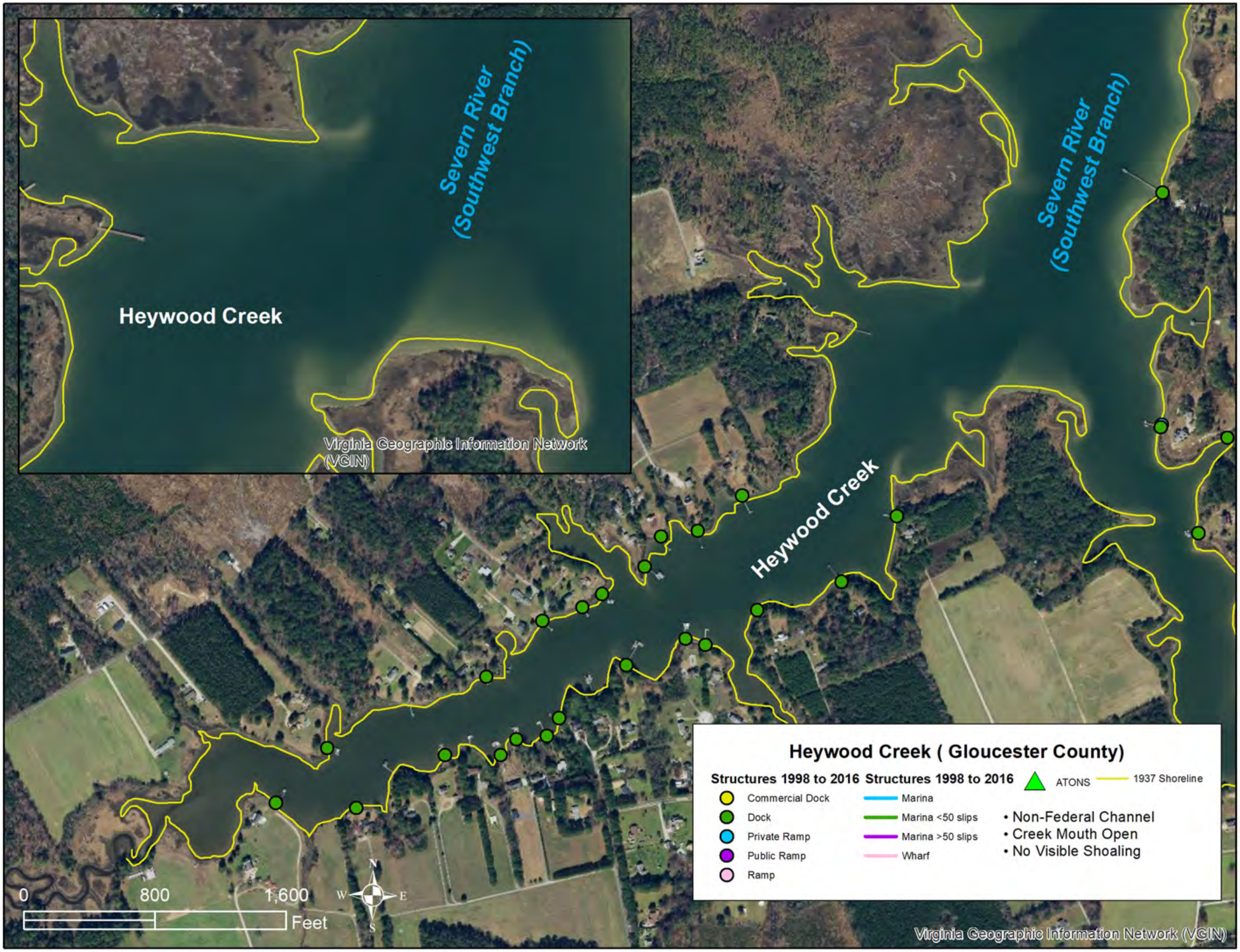
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Severn River (Southwest Branch)
Heywood Creek
Virginia Geographic Information Network (VGIN)
Severn River (Southwest Branch)
Heywood Creek
Heywood Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
800
1,600
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for **Thorntons Creek**

Creek ID Number: 93	**Locality:** Gloucester
Water Body: Severn River (Southwest Branch)	**Channel Type:** Non-Federal
Latitude: 37.2909	**Longitude:** -76.4523
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 16	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 55
Average Depth of Creek Mouth (ft): -3.1	**Maximum Depth of Creek Mouth (ft):** -5.7

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

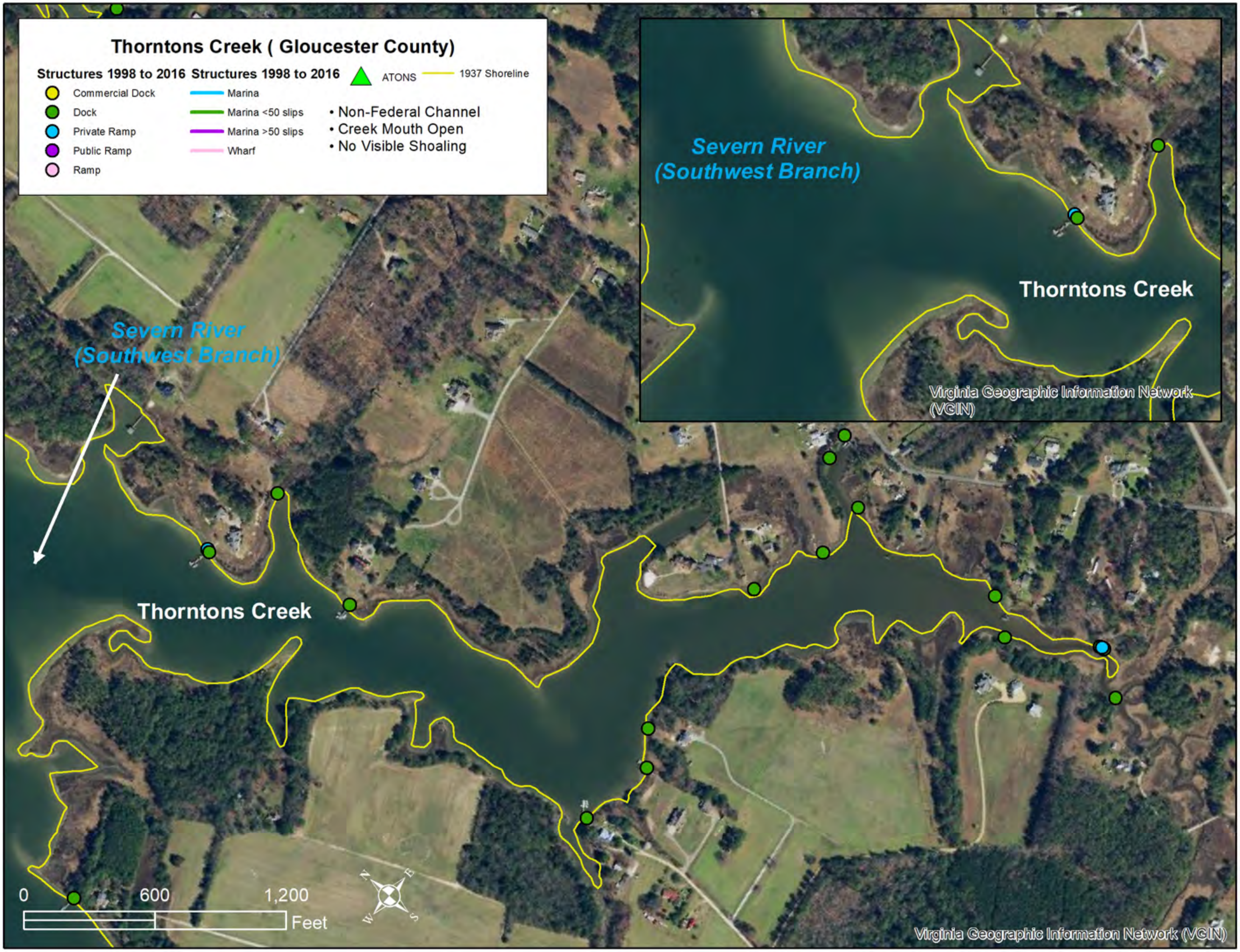
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Thorntons Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
Severn River (Southwest Branch)
Thorntons Creek
Virginia Geographic Information Network (VGIN)
Severn River (Southwest Branch)
Thorntons Creek
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Rowes Creek

Creek ID Number: 94	**Locality:** Gloucester
Water Body: Severn River (Southwest Branch)	**Channel Type:** Non-Federal
Latitude: 37.2996	**Longitude:** -76.4431
Number of Marinas: 1	
Number of Boat Ramps: 3	
Number of Piers: 20	
Creek Mouth Morphology: Semi-Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 39
Average Depth of Creek Mouth (ft): -3.4	**Maximum Depth of Creek Mouth (ft):** -5.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

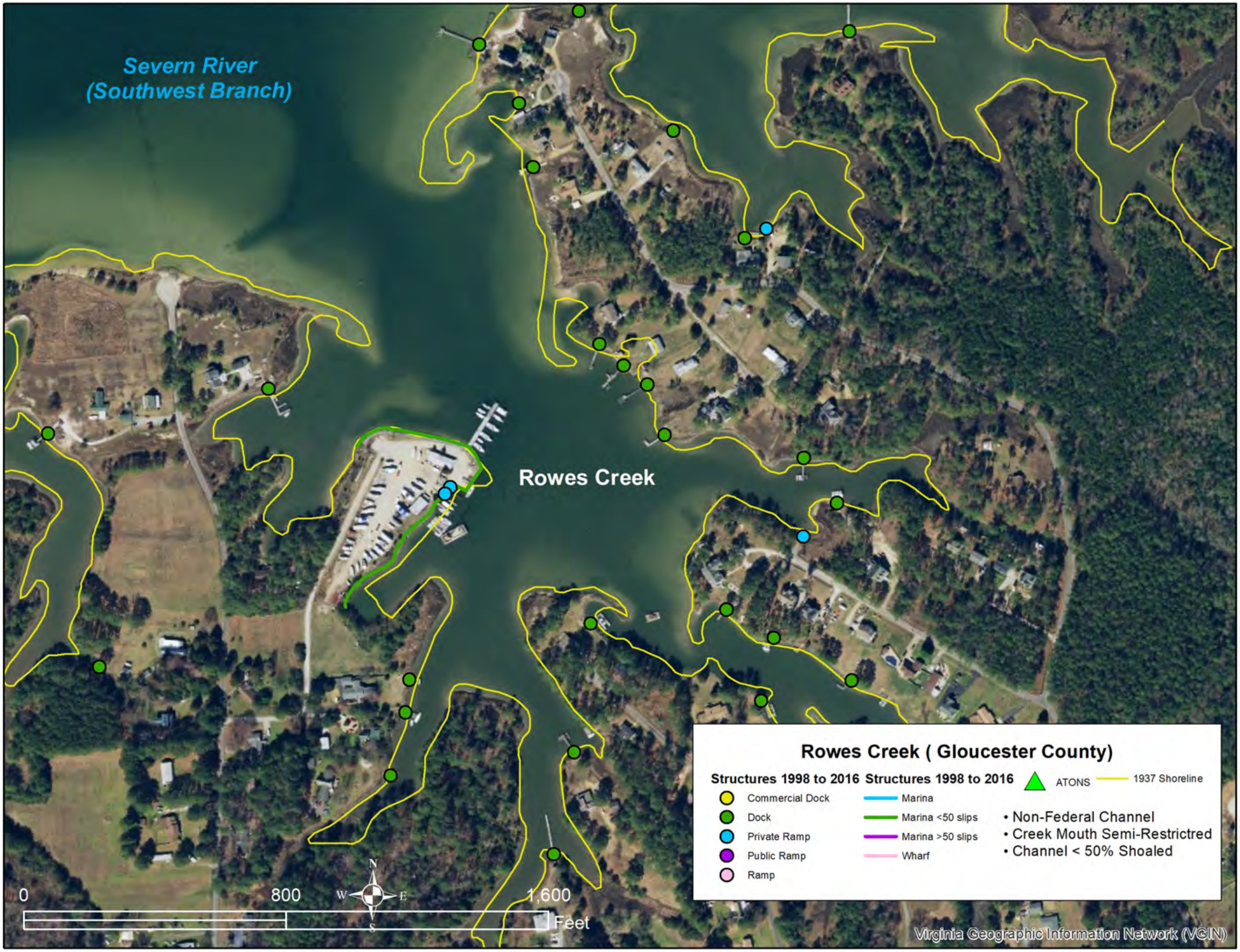
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Severn River
(Southwest Branch)
Rowes Creek
Rowes Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Semi-Restrictred
• Channel < 50% Shoaled
0
800
1,600
Feet
N
S
E
W
Virginia Geographic Information Network (VGIN)

Data Sheet for **Holly Bush Creek**

Creek ID Number: 95	**Locality:** Gloucester
Water Body: Severn River (Southwest Branch)	**Channel Type:** Non-Federal
Latitude: 37.3021	**Longitude:** -76.4405
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 3	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 27
Average Depth of Creek Mouth (ft): -3.6	**Maximum Depth of Creek Mouth (ft):** -6.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

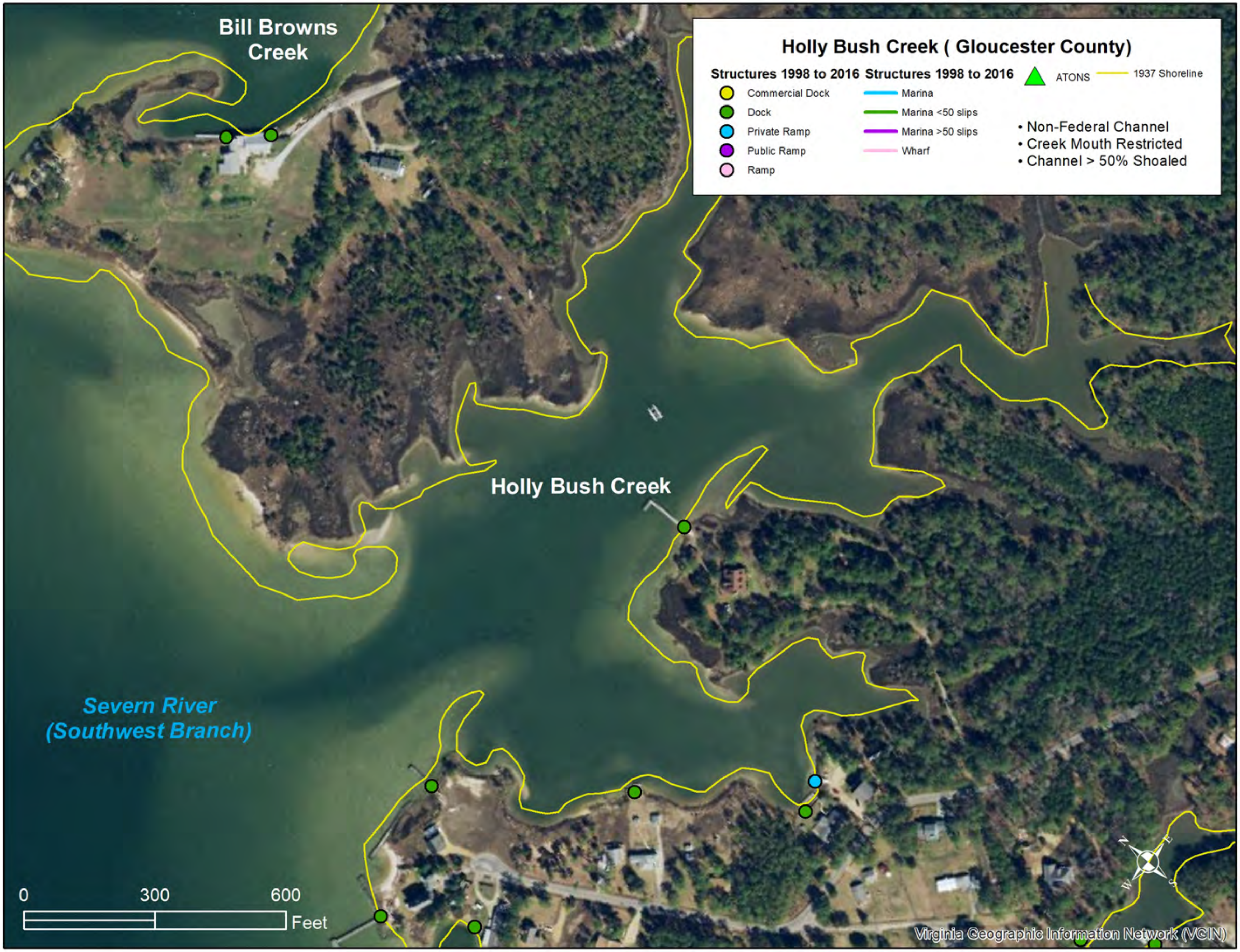
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Holly Bush Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
Bill Browns Creek
Holly Bush Creek
Severn River (Southwest Branch)
0 300 600 Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Bill Browns Creek**

Creek ID Number: 96	**Locality:** Gloucester
Water Body: Severn River (Southwest Branch)	**Channel Type:** Non-Federal
Latitude: 37.3062	**Longitude:** -76.4375
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 5	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.7	**Creek Area (acres):** 21
Average Depth of Creek Mouth (ft): -2.6	**Maximum Depth of Creek Mouth (ft):** -5.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Bill Browns Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
Bill Browns Creek
Severn River (Southwest Branch)
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Thomas Creek_GL**

Creek ID Number: 97	**Locality:** Gloucester
Water Body: Severn River (Southwest Branch)	**Channel Type:** Non-Federal
Latitude: 37.3089	**Longitude:** -76.4315
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Semi-Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 16
Average Depth of Creek Mouth (ft): -1.4	**Maximum Depth of Creek Mouth (ft):** -3.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Thomas Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Semi-Restricted
• Channel < 50% Restricted
Severn River
(Southwest Branch)
Thomas Creek
0
300
600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for King Creek

Creek ID Number: 98	**Locality:** Gloucester
Water Body: Severn River	**Channel Type:** Non-Federal
Latitude: 37.3072	**Longitude:** -76.4194
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 4	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.5	**Creek Area (acres):** 18
Average Depth of Creek Mouth (ft): -1.7	**Maximum Depth of Creek Mouth (ft):** -2.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Severn River
King Creek
King Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• Channel > 50% Restricted
0
600
1,200
Feet
Severn River
King Creek
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for Long Creek

Creek ID Number: 99	**Locality:** Gloucester
Water Body: Severn River	**Channel Type:** Non-Federal
Latitude: 37.3085	**Longitude:** -76.4101
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.5	**Creek Area (acres):** 28
Average Depth of Creek Mouth (ft): -1.3	**Maximum Depth of Creek Mouth (ft):** -2.1

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Severn River
Long Creek
Long Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• No Visible Shoaling
0
600
1,200
Feet
N
W
E
S
Severn River
Long Creek
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for **Browns Bay**

Creek ID Number: 100	**Locality:** Gloucester
Water Body: Mobjack Bay	**Channel Type:** Non-Federal ATON
Latitude: 37.3026	**Longitude:** -76.3873
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 1	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.5	**Creek Area (acres):** 44
Average Depth of Creek Mouth (ft): -4.4	**Maximum Depth of Creek Mouth (ft):** -7.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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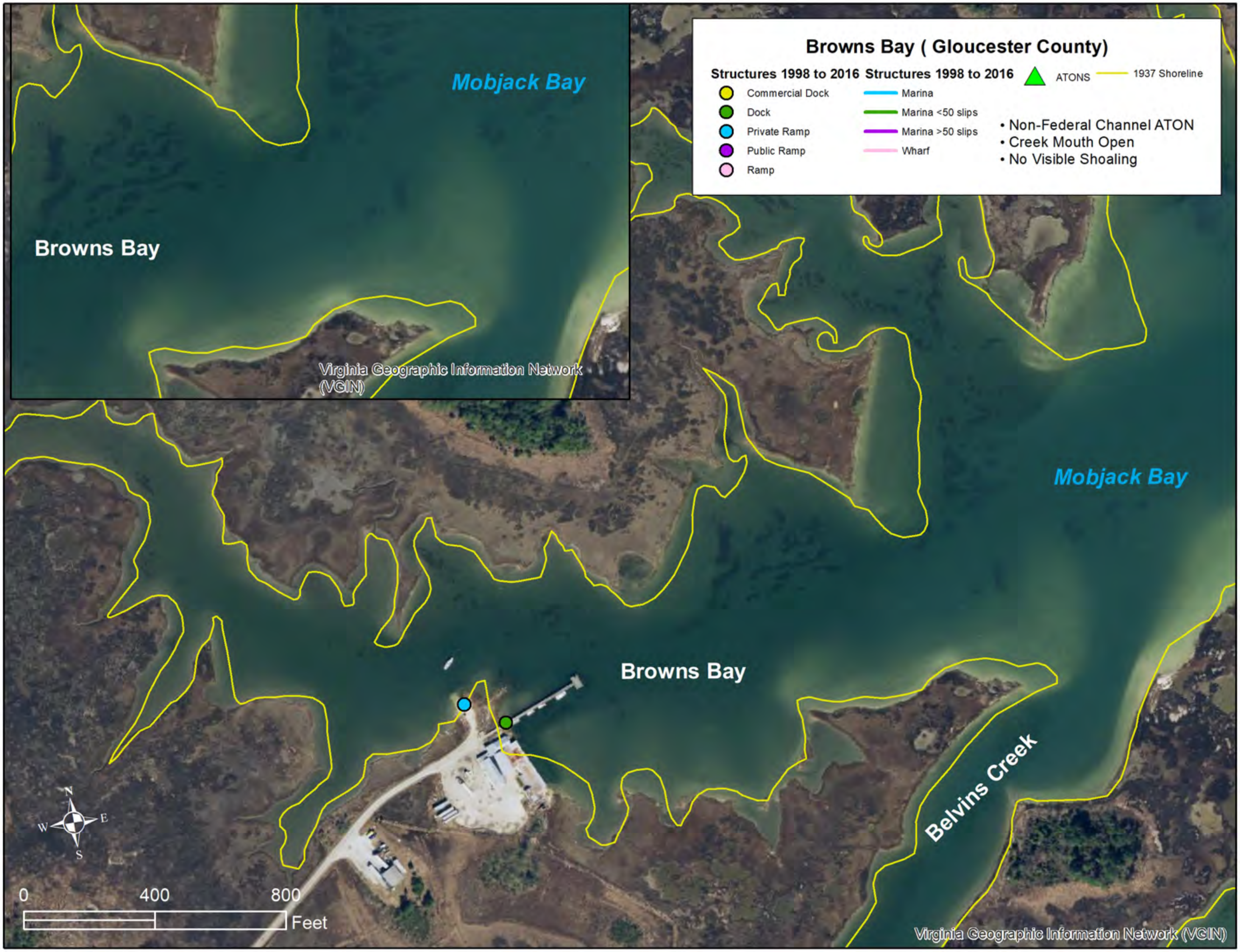
Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Browns Bay (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Open
• No Visible Shoaling
Mobjack Bay
Browns Bay
Virginia Geographic Information Network (VGIN)
Mobjack Bay
Browns Bay
Belvins Creek
N
W
E
S
0
400
800
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Blevins Creek**

Creek ID Number: 101	**Locality:** Gloucester
Water Body: Mobjack Bay	**Channel Type:** Non-Federal
Latitude: 37.3000	**Longitude:** -76.3975
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 3	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.5	**Creek Area (acres):** 46
Average Depth of Creek Mouth (ft): -3.2	**Maximum Depth of Creek Mouth (ft):** -4.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Blevins Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
Mobjack Bay
Blevins Creek
Mobjack Bay
Blevins Creek
N
W
E
S
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Johns West Creek

Creek ID Number: 102	**Locality:** Gloucester
Water Body: Mobjack Bay	**Channel Type:** Non-Federal
Latitude: 37.2957	**Longitude:** -76.3889
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.5	**Creek Area (acres):** 33
Average Depth of Creek Mouth (ft): -2.0	**Maximum Depth of Creek Mouth (ft):** -3.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

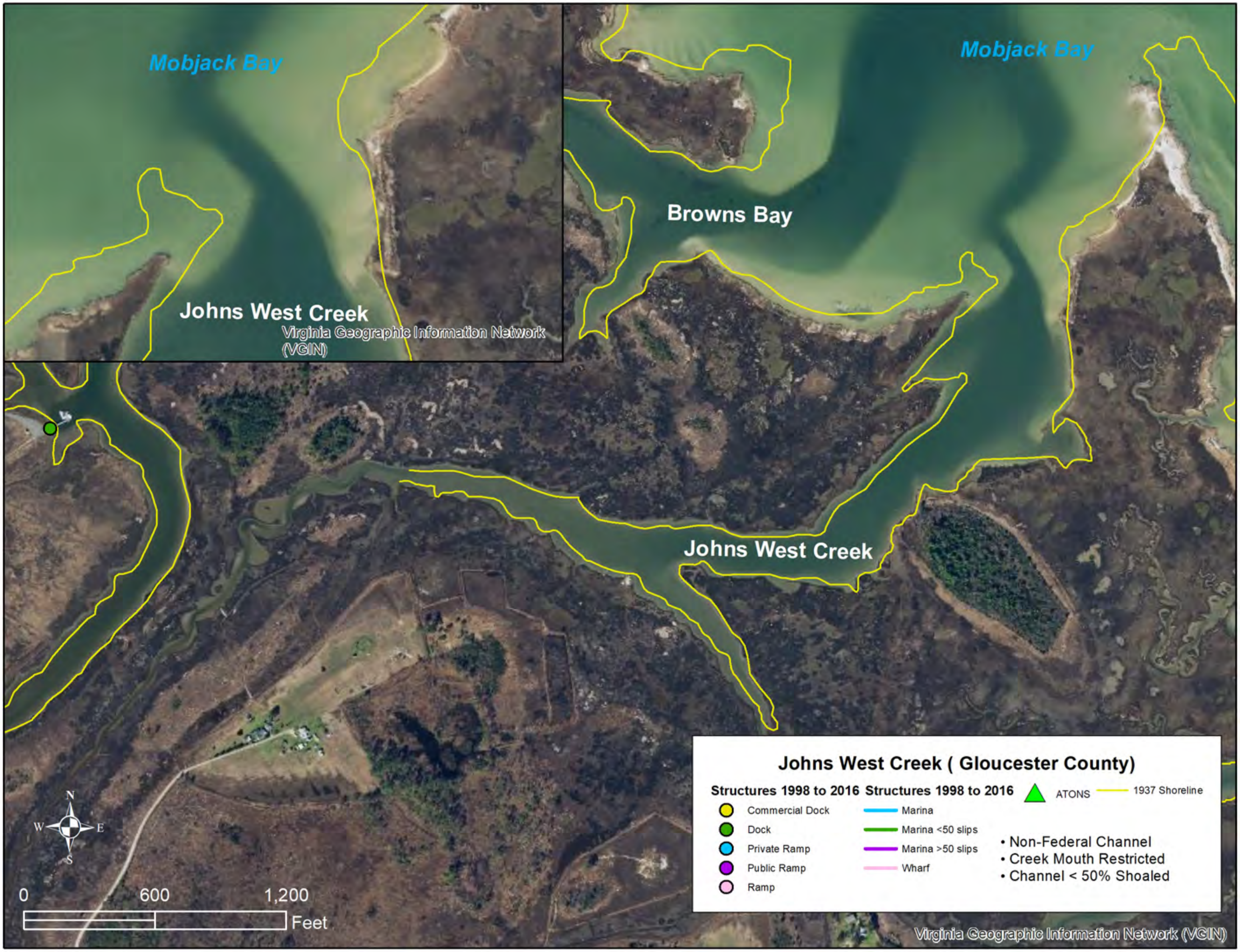
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Mobjack Bay
Johns West Creek
Virginia Geographic Information Network (VGIN)
Mobjack Bay
Browns Bay
Johns West Creek
Johns West Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel < 50% Shoaled
N
W
E
S
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Little Monday Creek

Creek ID Number: 103	**Locality:** Gloucester
Water Body: Mobjack Bay	**Channel Type:** Non-Federal
Latitude: 37.2860	**Longitude:** -76.3821
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.5	**Creek Area (acres):** 20
Average Depth of Creek Mouth (ft): -1.2	**Maximum Depth of Creek Mouth (ft):** -2.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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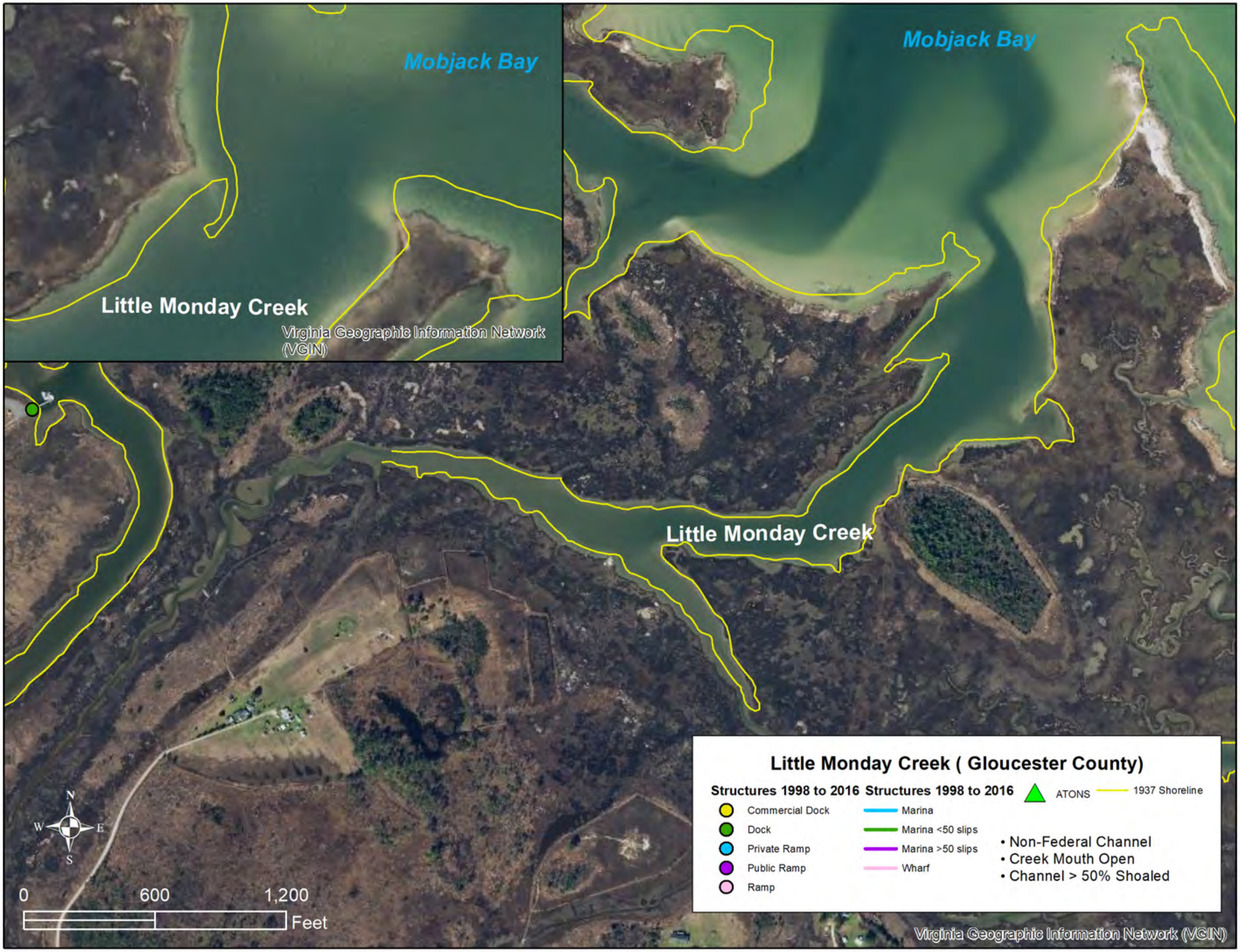
Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Mobjack Bay
Little Monday Creek
Virginia Geographic Information Network (VGIN)
Mobjack Bay
Little Monday Creek
Little Monday Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel > 50% Shoaled
N
W
E
S
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Monday Creek

Creek ID Number: 104	**Locality:** Gloucester
Water Body: Mobjack Bay	**Channel Type:** Non-Federal
Latitude: 37.2757	**Longitude:** -76.3819
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.5	**Creek Area (acres):** 91
Average Depth of Creek Mouth (ft): -4.1	**Maximum Depth of Creek Mouth (ft):** -6.6

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

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Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)

Mobjack Bay
Monday Creek
Hog Island
Monday Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
0
300
600
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for Perrin River

Creek ID Number: 105	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal ATON
Latitude: 37.2641	**Longitude:** -76.4234
Number of Marinas: 3	
Number of Boat Ramps: 9	
Number of Piers: 30	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 2.5	**Creek Area (acres):** 94
Average Depth of Creek Mouth (ft): -5.0	**Maximum Depth of Creek Mouth (ft):** -7.7

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

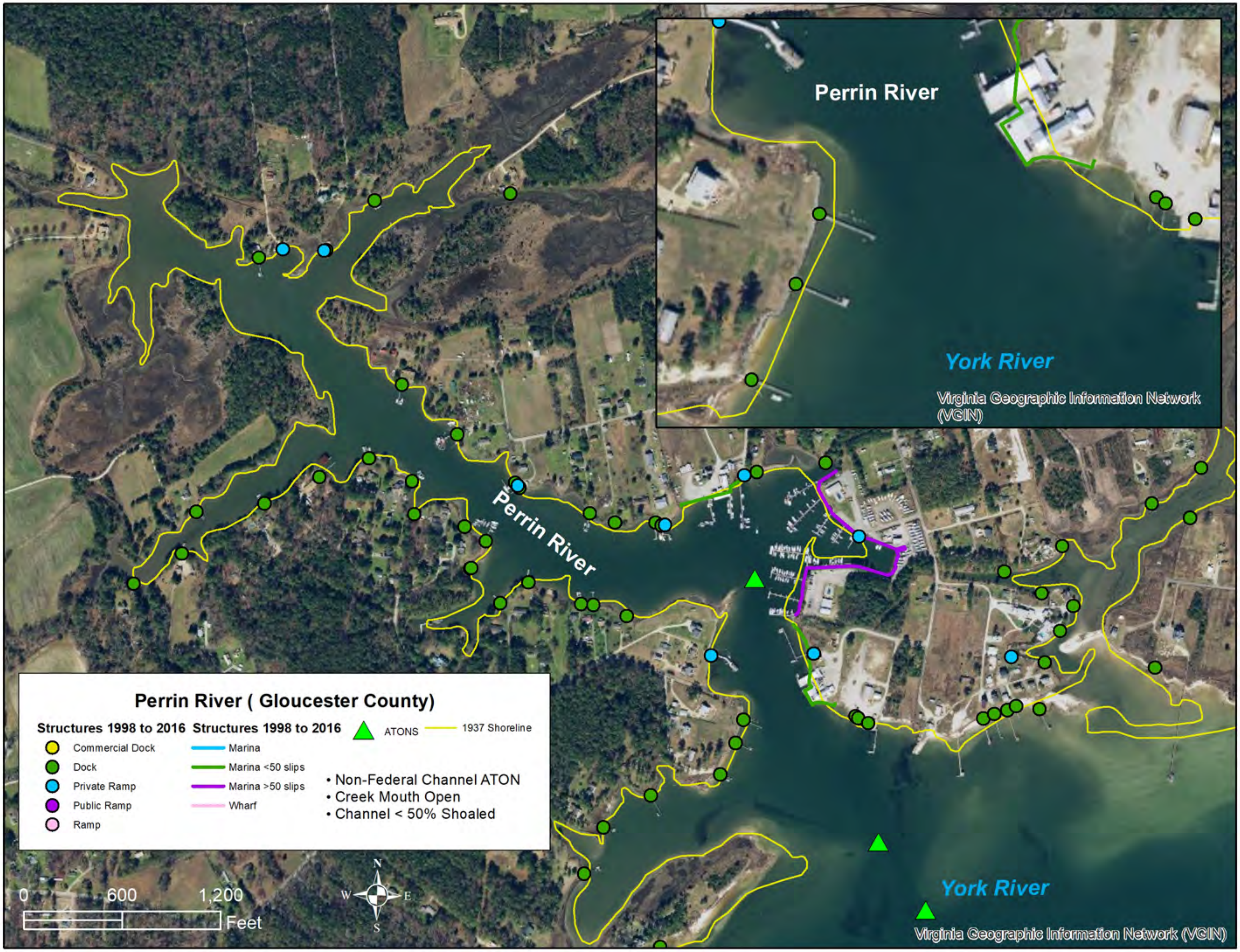
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Perrin River
York River
Virginia Geographic Information Network (VGIN)
Perrin River
Perrin River (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Open
• Channel < 50% Shoaled
0
600
1,200
Feet
N
W
E
S
York River
Virginia Geographic Information Network (VGIN)

Data Sheet for **Sarah Creek**

Creek ID Number: 106	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal ATON
Latitude: 37.2542	**Longitude:** -76.4815
Number of Marinas: 8	
Number of Boat Ramps: 11	
Number of Piers: 213	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.5	**Creek Area (acres):** 287
Average Depth of Creek Mouth (ft): -7.3	**Maximum Depth of Creek Mouth (ft):** -13.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

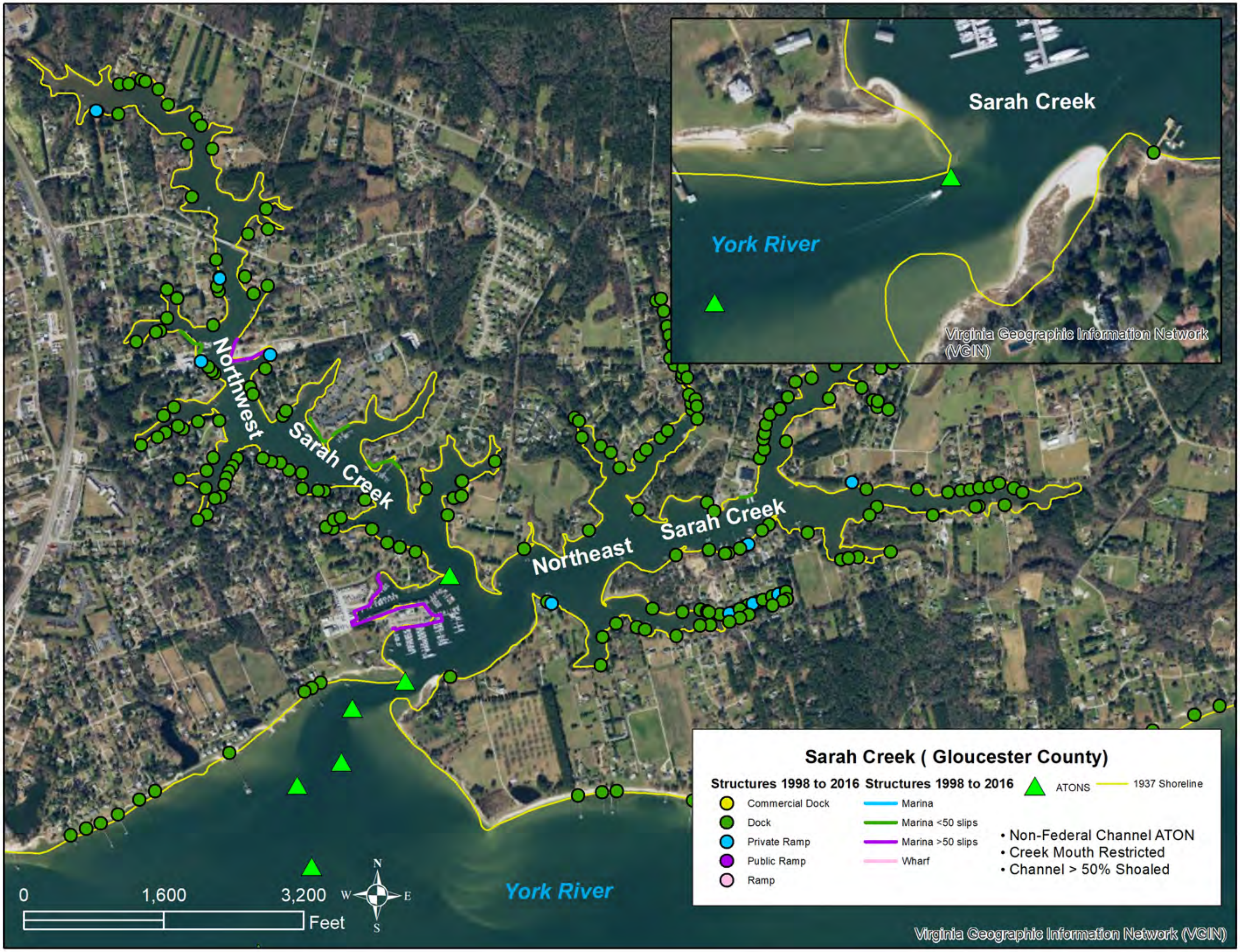
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Sarah Creek
York River
Virginia Geographic Information Network (VGIN)
Northwest
Sarah Creek
Northeast
Sarah Creek
York River
Sarah Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
1,600
3,200
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)

Data Sheet for Timberneck Creek

Creek ID Number: 107	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal ATON
Latitude: 37.2919	**Longitude:** -76.5347
Number of Marinas: 1	
Number of Boat Ramps: 2	
Number of Piers: 27	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.7	**Creek Area (acres):** 202
Average Depth of Creek Mouth (ft): -2.9	**Maximum Depth of Creek Mouth (ft):** -5.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

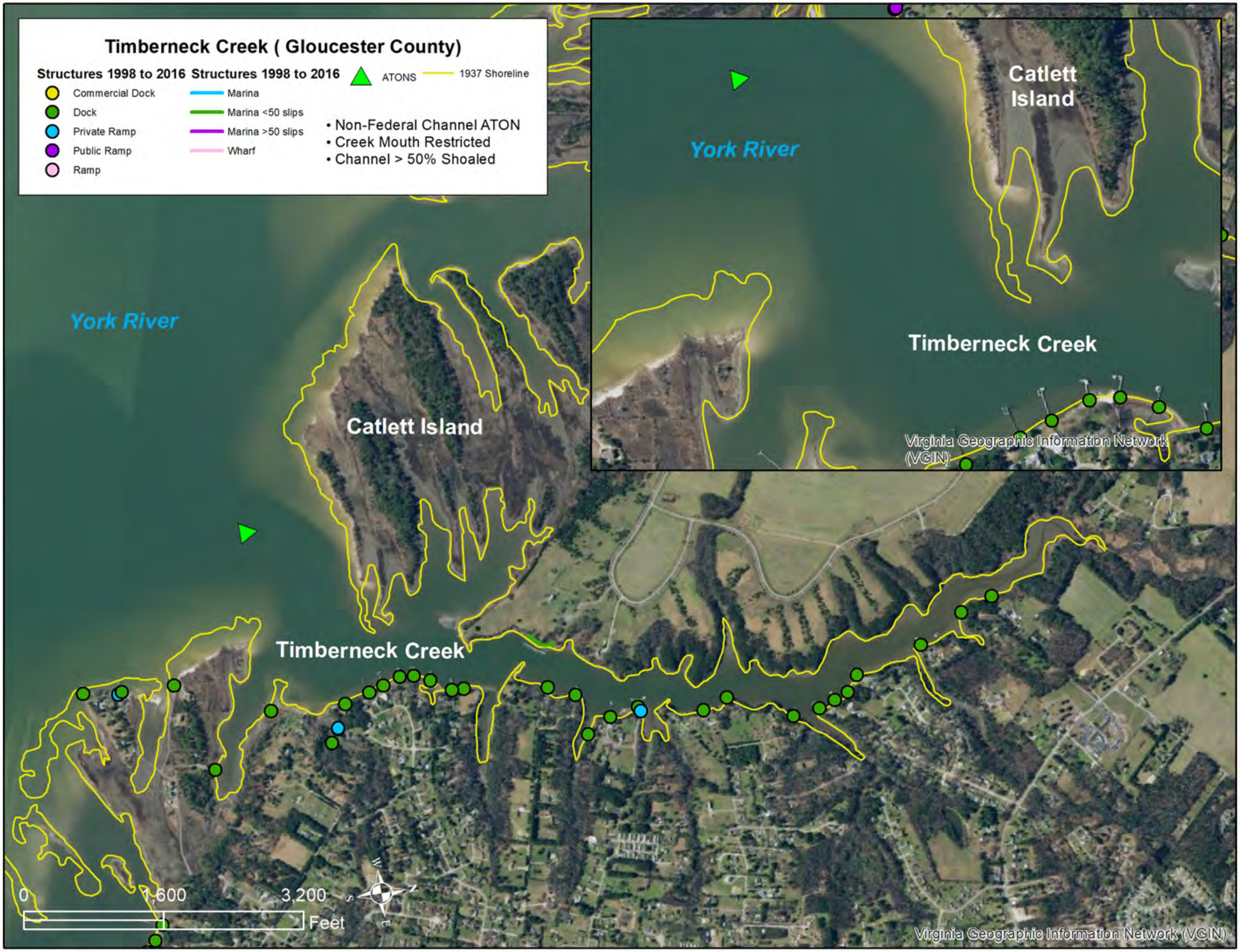
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Timberneck Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Restricted
• Channel > 50% Shoaled
York River
Catlett Island
Timberneck Creek
York River
Catlett Island
Timberneck Creek
Virginia Geographic Information Network (VGIN)
0
1,600
3,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Cedarbush Creek

Creek ID Number: 108	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.3102	**Longitude:** -76.5565
Number of Marinas: 0	
Number of Boat Ramps: 2	
Number of Piers: 21	
Creek Mouth Morphology: Semi-Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 2.8	**Creek Area (acres):** 82
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

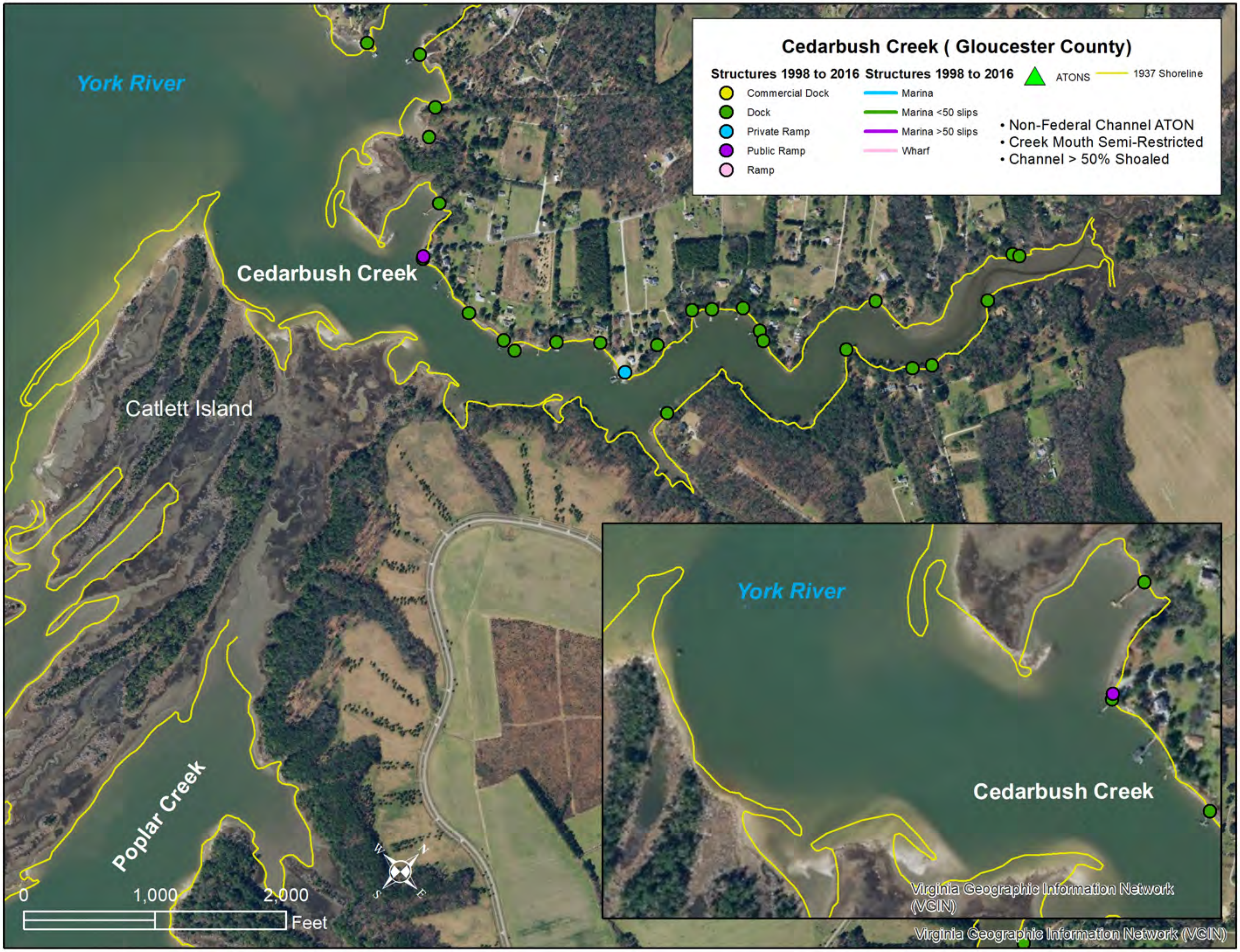
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Cedarbush Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel ATON
• Creek Mouth Semi-Restricted
• Channel > 50% Shoaled
York River
Cedarbush Creek
Catlett Island
Poplar Creek
0
1,000
2,000
Feet
York River
Cedarbush Creek
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for Carter Creek

Creek ID Number: 109	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.3167	**Longitude:** -76.5702
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 20	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.8	**Creek Area (acres):** 169
Average Depth of Creek Mouth (ft): -0.4	**Maximum Depth of Creek Mouth (ft):** -0.9

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

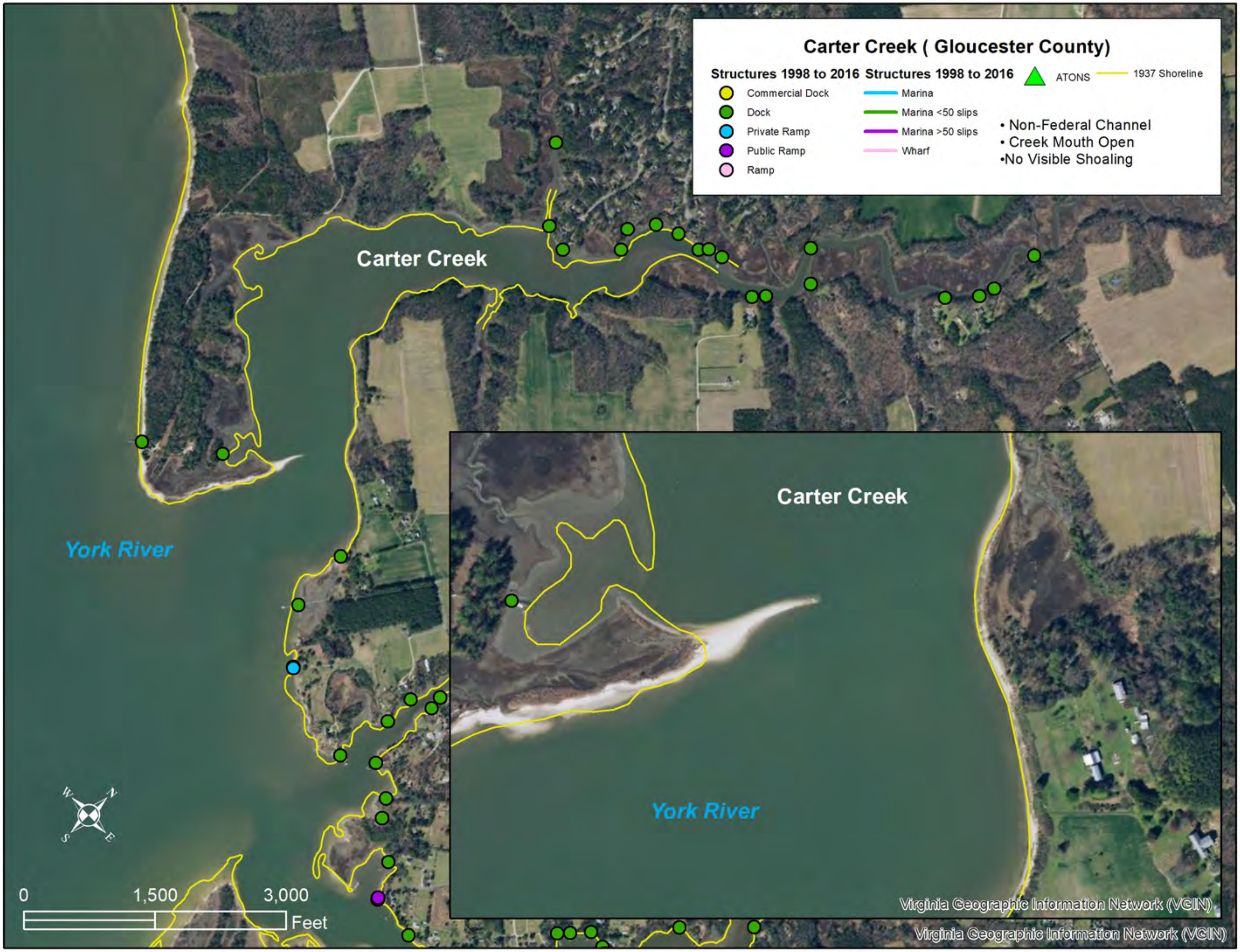
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Carter Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
•No Visible Shoaling
Carter Creek
York River
0
1,500
3,000
Feet
Carter Creek
York River
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for Aberdeen Creek

Creek ID Number: 110	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Federal
Latitude: 37.3375	**Longitude:** -76.5924
Number of Marinas: 1	
Number of Boat Ramps: 4	
Number of Piers: 22	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 3.0	**Creek Area (acres):** 77
Average Depth of Creek Mouth (ft): -1.0	**Maximum Depth of Creek Mouth (ft):** -1.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

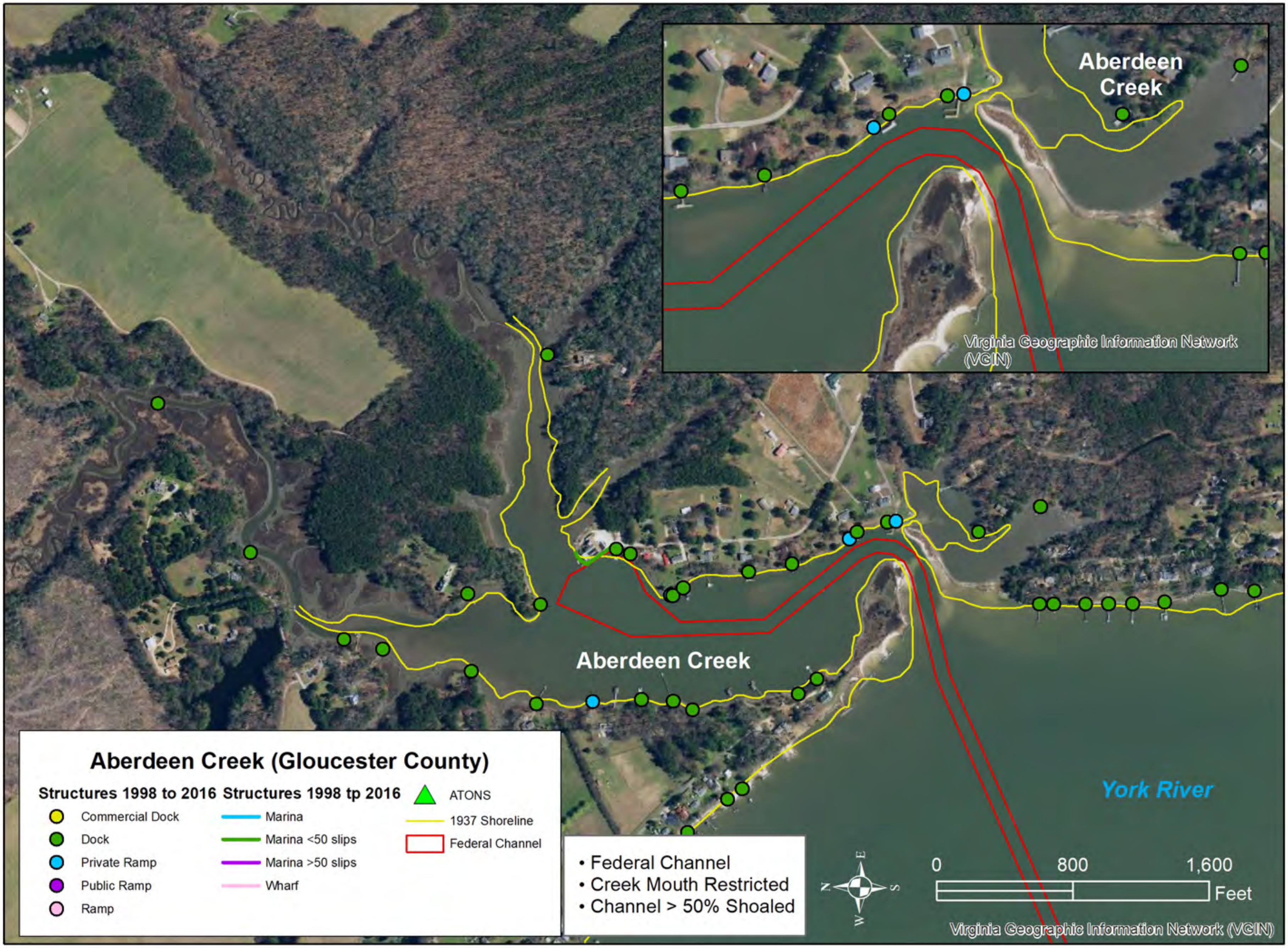
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Aberdeen Creek
Virginia Geographic Information Network (VGIN)
Aberdeen Creek
York River
Aberdeen Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 tp 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
Federal Channel
• Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
N
E
S
W
0
800
1,600
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for Jones Creek

Creek ID Number: 111	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.3607	**Longitude:** -76.6160
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 5	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 3.0	**Creek Area (acres):** 42
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

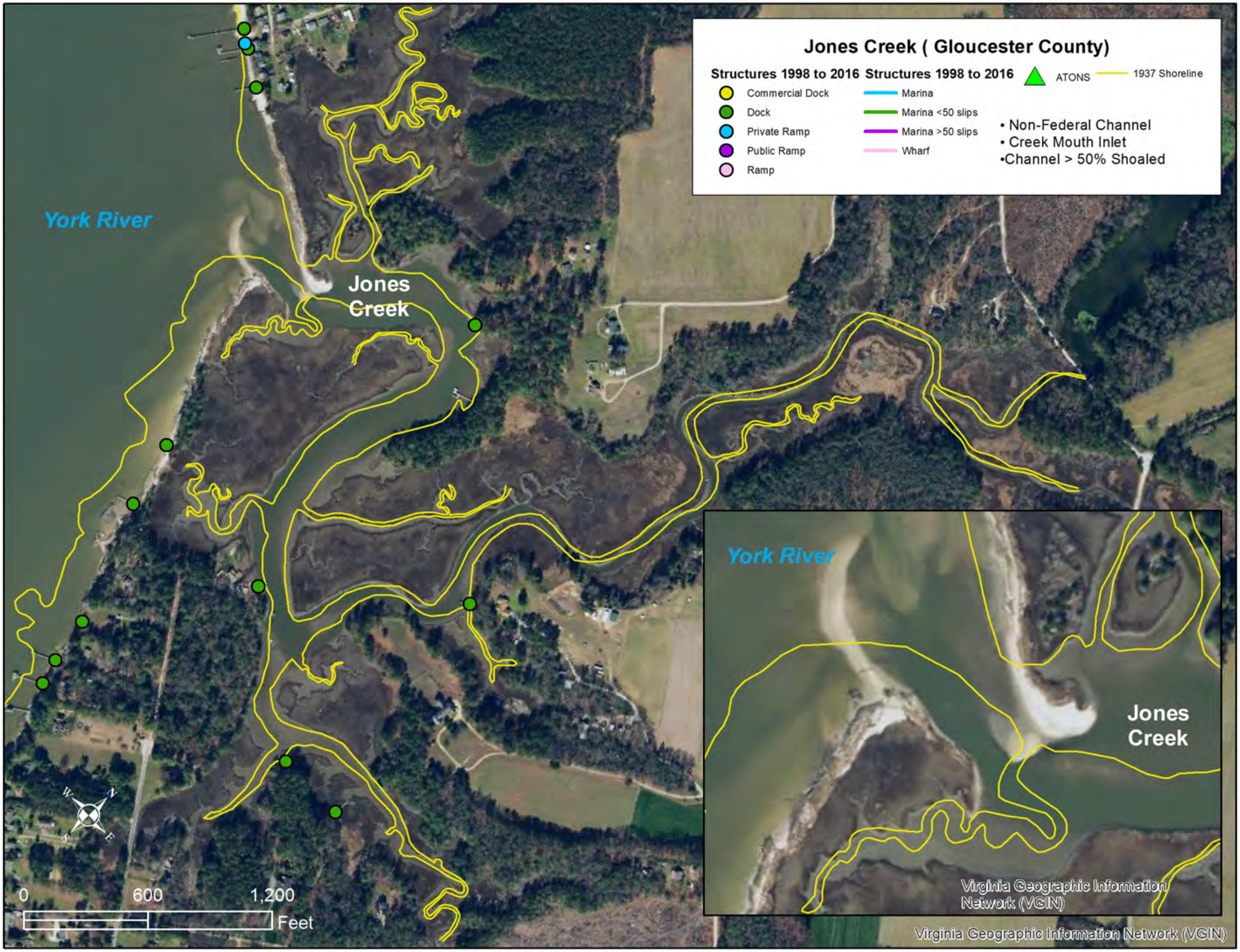
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Jones Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
•Channel > 50% Shoaled
York River
Jones Creek
York River
Jones Creek
Virginia Geographic Information Network (VGIN)
0
600
1,200
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Sandy Creek**

Creek ID Number: 112	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.3652	**Longitude:** -76.6227
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 3.0	**Creek Area (acres):** 6
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

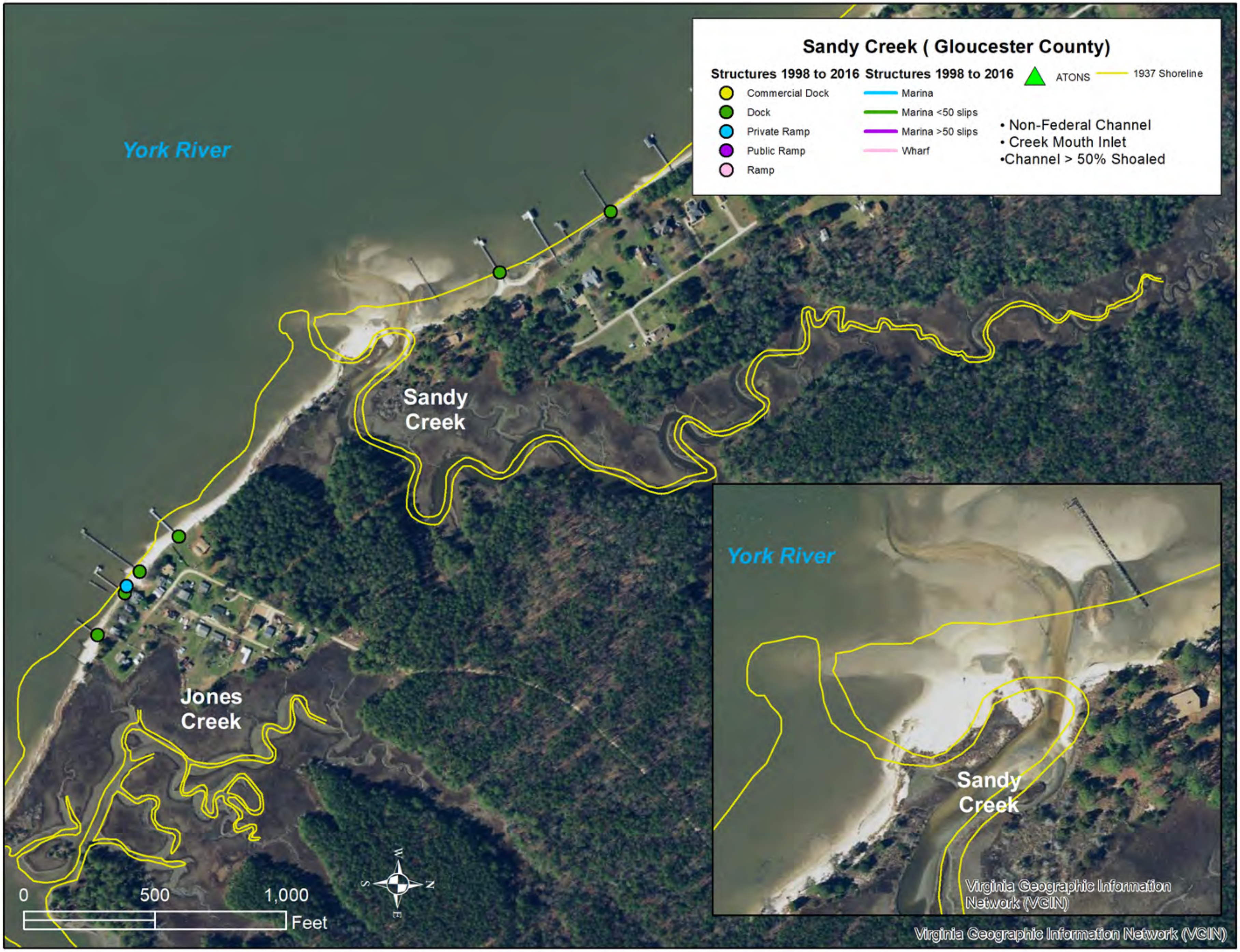
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Sandy Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
•Channel > 50% Shoaled
York River
Sandy Creek
Jones Creek
0
500
1,000
Feet
W
N
E
S
York River
Sandy Creek
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for Fox Creek

Creek ID Number: 113	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.3857	**Longitude:** -76.6428
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 3	
Creek Mouth Morphology: Inlet	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 3.0	**Creek Area (acres):** 13
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

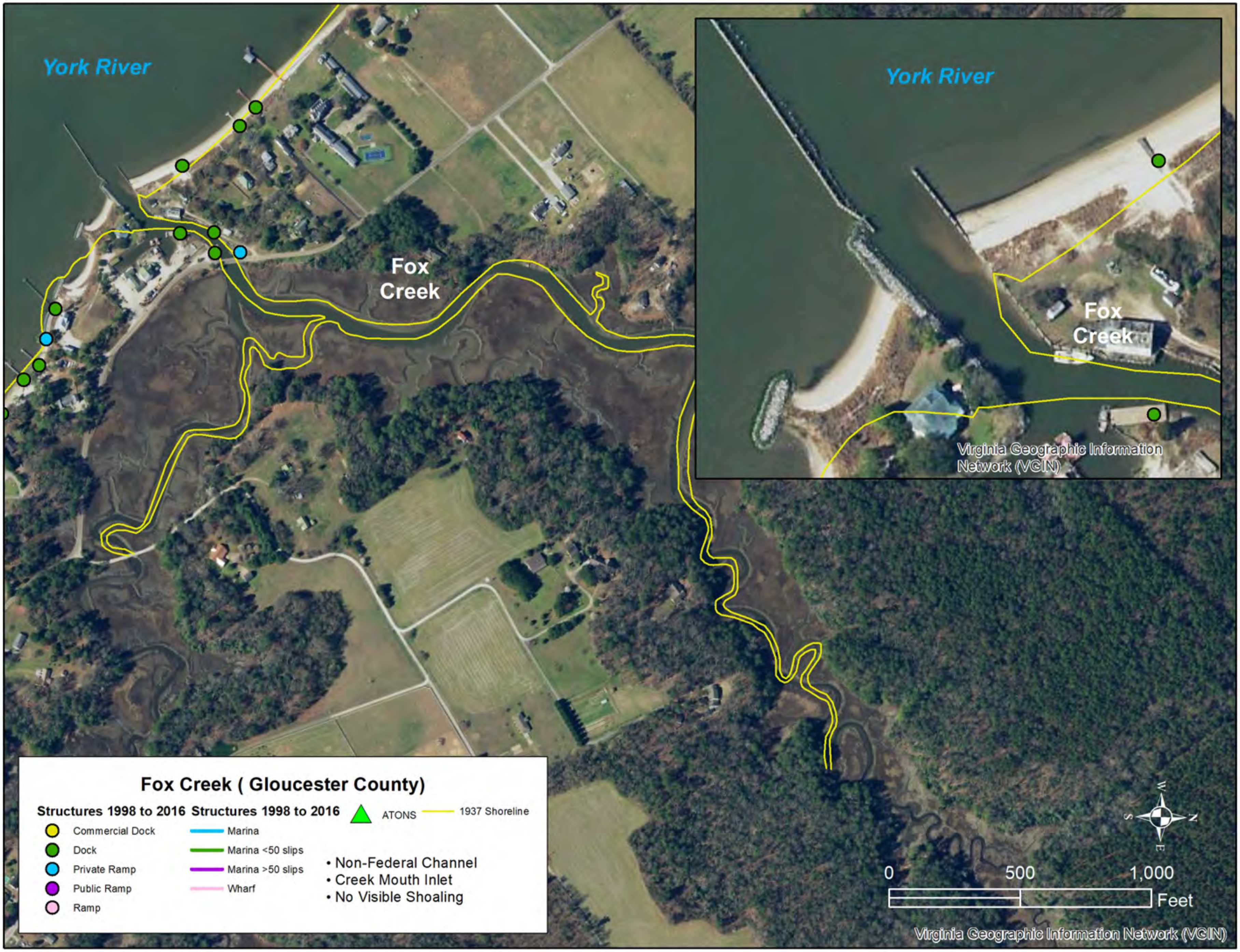
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


York River
Fox Creek
York River
Fox Creek
Virginia Geographic Information Network (VGIN)
Fox Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Inlet
• No Visible Shoaling
0
500
1,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Bland Creek**

Creek ID Number: 114	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.4058	**Longitude:** -76.6558
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 6	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 3.0	**Creek Area (acres):** 24
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

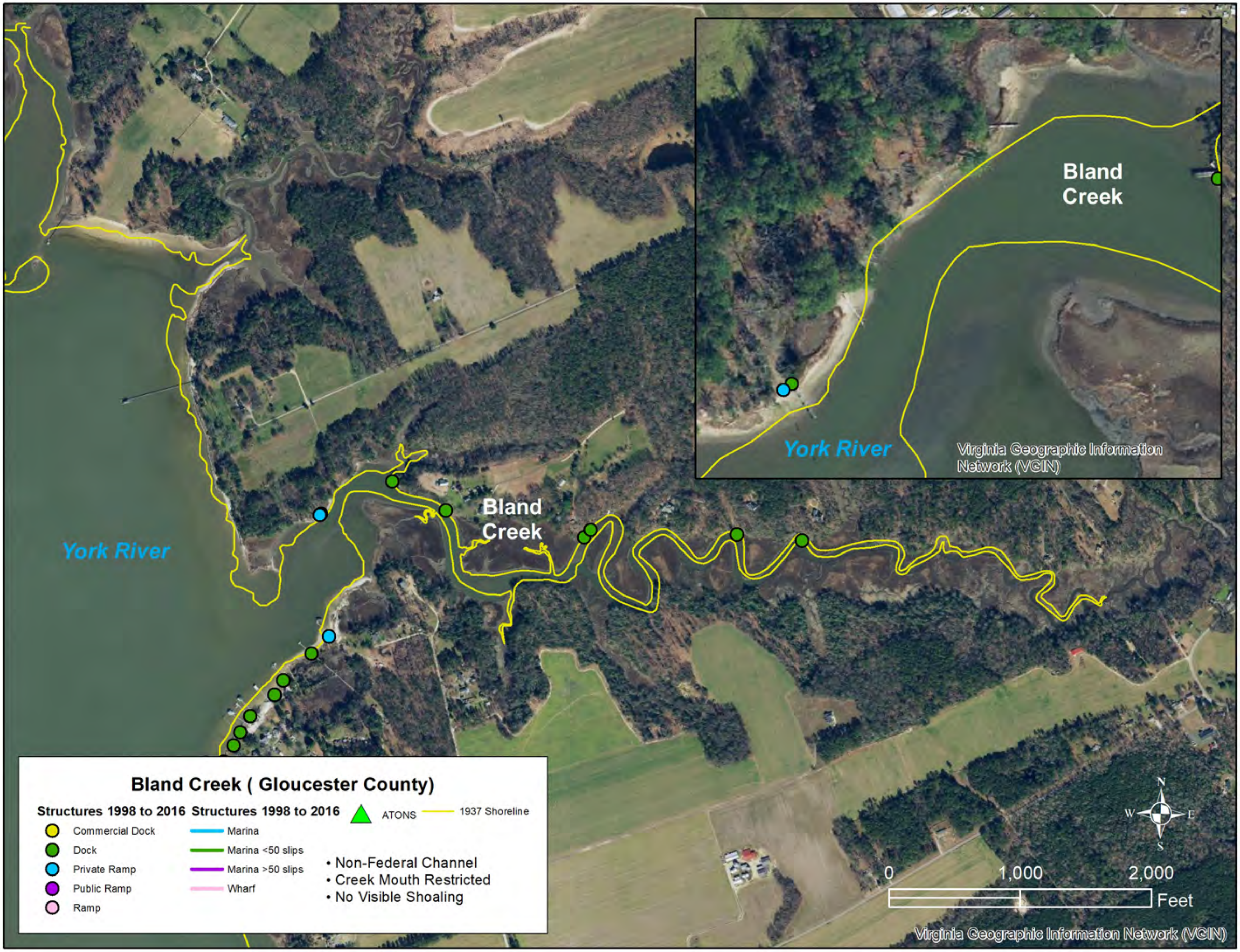
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Bland Creek
York River
Virginia Geographic Information Network (VGIN)
Bland Creek
York River
Bland Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• No Visible Shoaling
N
W
E
S
0
1,000
2,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Leigh Creek**

Creek ID Number: 115	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.4134	**Longitude:** -76.6576
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: >50% of channel
Tide Range (ft): 3.0	**Creek Area (acres):** 7
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


York River
Leigh Creek
York River
Leigh Creek
Virginia Geographic Information Network (VGIN)
Leigh Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• Channel > 50% Shoaled
0
500
Virginia Geographic Information Network (VGIN)

Data Sheet for Purtan Creek

Creek ID Number: 116	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.4138	**Longitude:** -76.6631
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 3.0	**Creek Area (acres):** 35
Average Depth of Creek Mouth (ft): -0.5	**Maximum Depth of Creek Mouth (ft):** -0.5

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

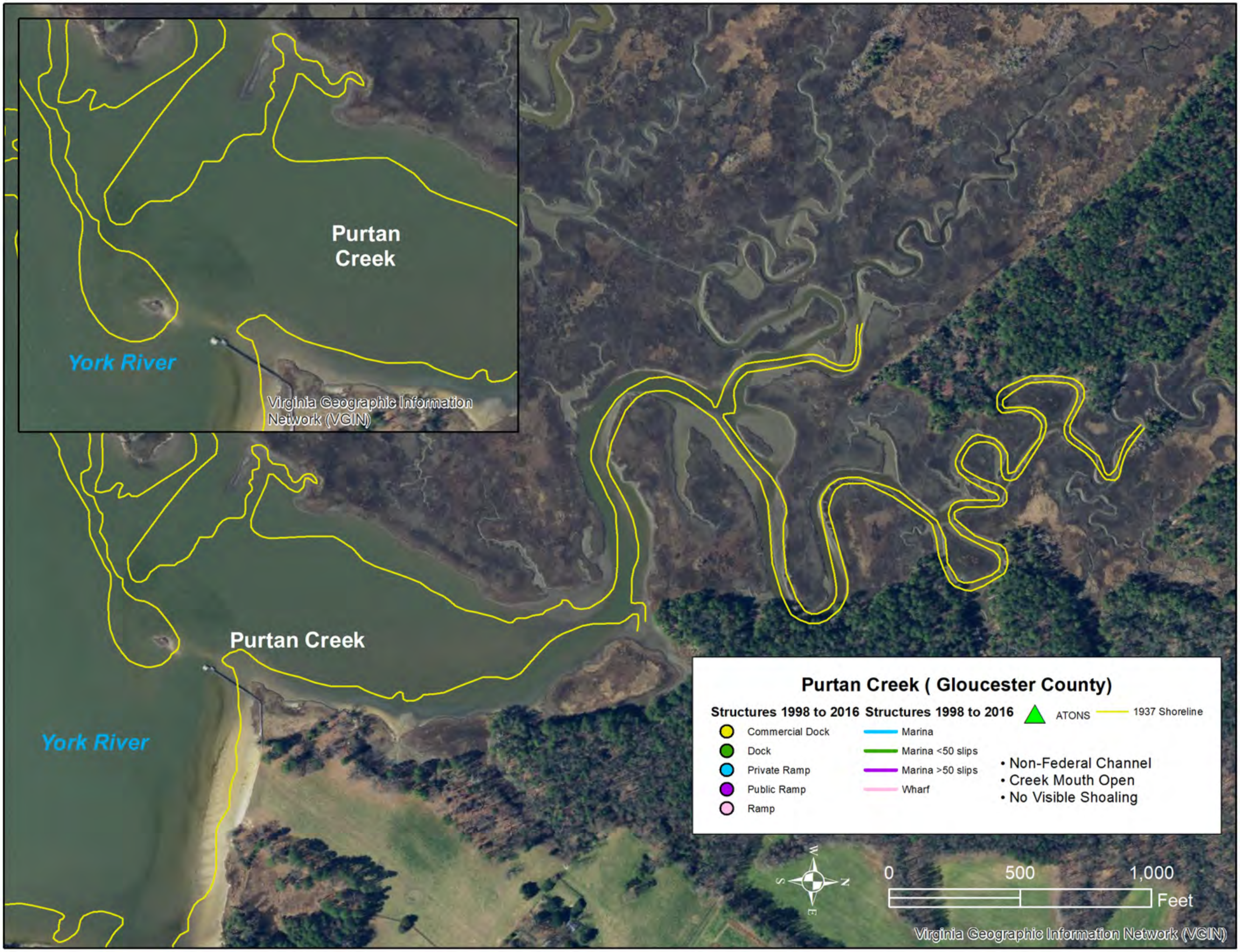
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Purtan Creek
York River
Virginia Geographic Information Network (VGIN)
Purtan Creek
York River
Purtan Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
0
500
1,000
Feet
Virginia Geographic Information Network (VGIN)

Data Sheet for **Adams Creek**

Creek ID Number: 117	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.4280	**Longitude:** -76.6924
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 8	
Creek Mouth Morphology: Restricted	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 3.0	**Creek Area (acres):** 103
Average Depth of Creek Mouth (ft): -0.3	**Maximum Depth of Creek Mouth (ft):** -0.3

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

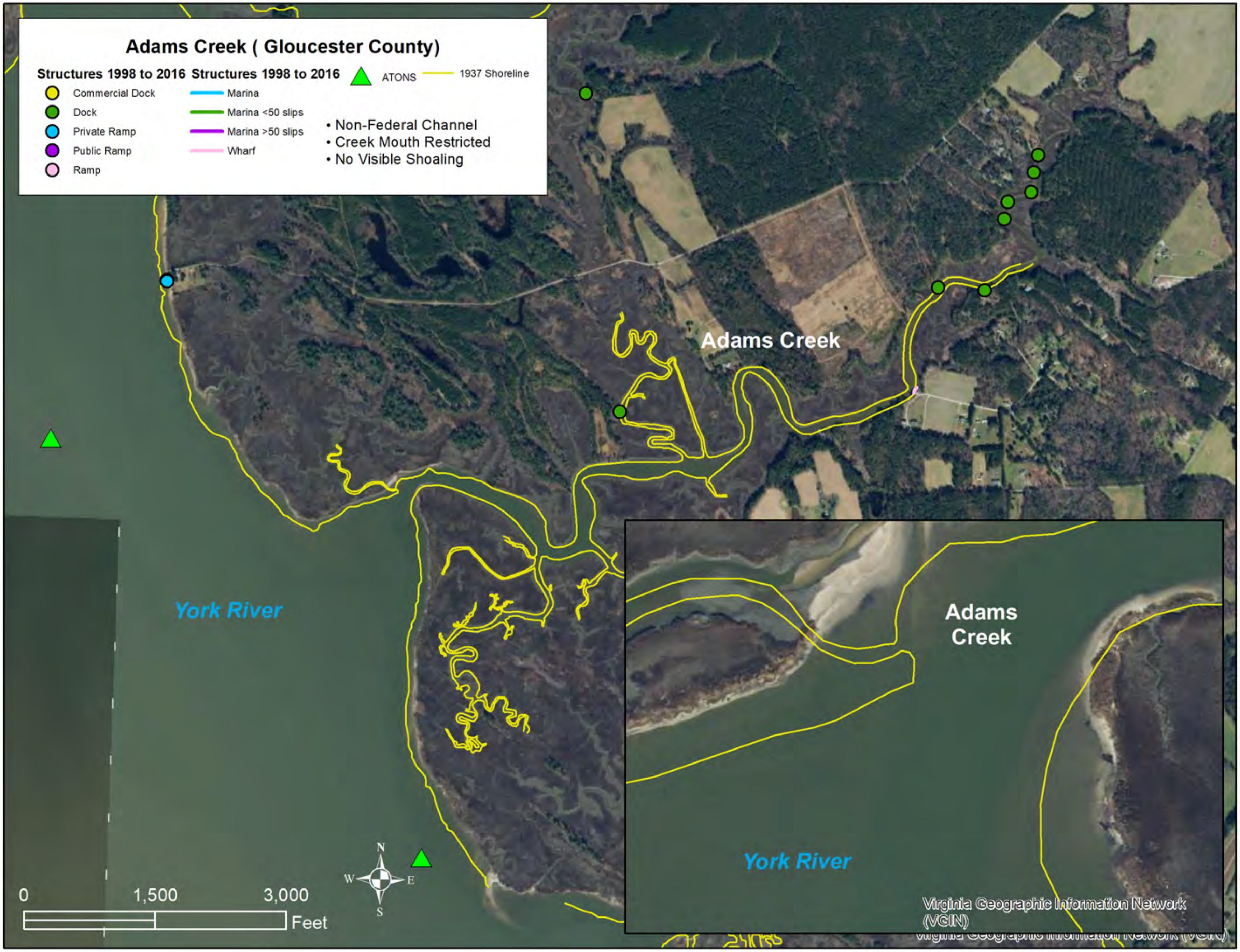
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Adams Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Restricted
• No Visible Shoaling
Adams Creek
York River
Adams Creek
York River
0
1,500
3,000
Feet
N
W
E
S
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for Poropotank River

Creek ID Number: 118	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.4437	**Longitude:** -76.7035
Number of Marinas: 0	
Number of Boat Ramps: 3	
Number of Piers: 48	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: <50% of channel
Tide Range (ft): 3.0	**Creek Area (acres):** 700
Average Depth of Creek Mouth (ft): -5.8	**Maximum Depth of Creek Mouth (ft):** -12.2

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

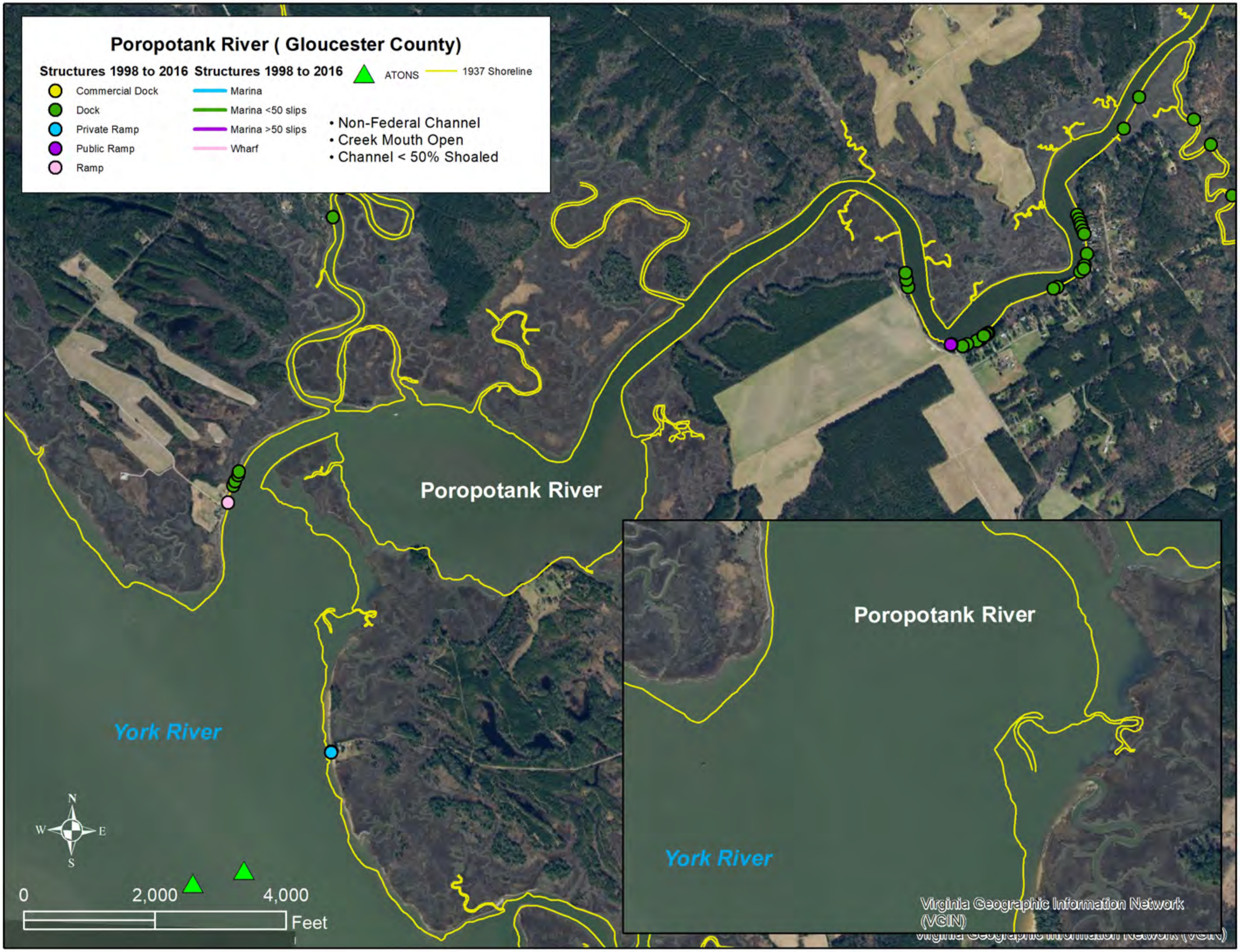
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Poropotank River (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• Channel < 50% Shoaled
Poropotank River
York River
Poropotank River
York River
N
S
E
W
0
2,000
4,000
Feet
Virginia Geographic Information Network (VGIN)
Virginia Geographic Information Network (VGIN)

Data Sheet for **Hockley Creek**

Creek ID Number: 119	**Locality:** Gloucester
Water Body: York River	**Channel Type:** Non-Federal
Latitude: 37.4922	**Longitude:** -76.7449
Number of Marinas: 0	
Number of Boat Ramps: 0	
Number of Piers: 0	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 3.0	**Creek Area (acres):** 33
Average Depth of Creek Mouth (ft): -4.8	**Maximum Depth of Creek Mouth (ft):** -8.4

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

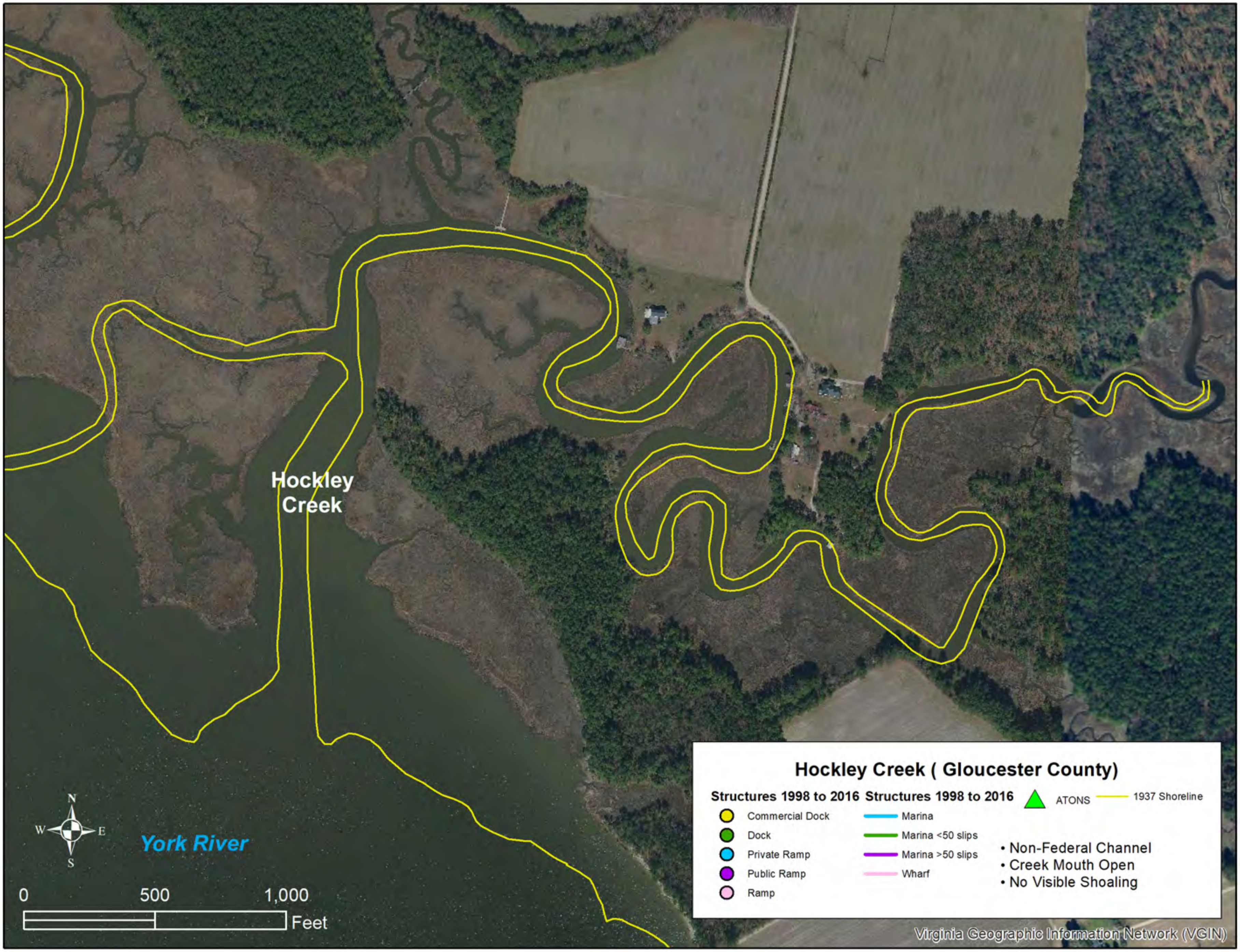
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program’s digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)



Hockley Creek
York River
N
W
E
S
0
500
1,000
Feet
Hockley Creek (Gloucester County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
1937 Shoreline
• Non-Federal Channel
• Creek Mouth Open
• No Visible Shoaling
Virginia Geographic Information Network (VGIN)

Data Sheet for Mattaponi River Entrance

Creek ID Number: 120	**Locality:** King and Queen
Water Body: Mattaponi River	**Channel Type:** Non-Federal
Latitude: 37.5290	**Longitude:** -76.7873
Number of Marinas: 0	
Number of Boat Ramps: 1	
Number of Piers: 15	
Creek Mouth Morphology: Open	**%Shoaling of Creek**: No Visible Shoaling
Tide Range (ft): 2.9	**Creek Area (acres):**
Average Depth of Creek Mouth (ft): N/A	**Maximum Depth of Creek Mouth (ft):** -37.0

Notes:

Channel type categories are Federal, which includes those shallow draft channels that have a federally-defined channel; Non-Federal ATON, which includes non-federally defined channels but those which have aids to navigation; and Non-Federal, which includes non-federally defined channels but those which do not have aids to navigation.

Structure data was obtained from the VIMS, Center for Resource Management shoreline structure GIS database.

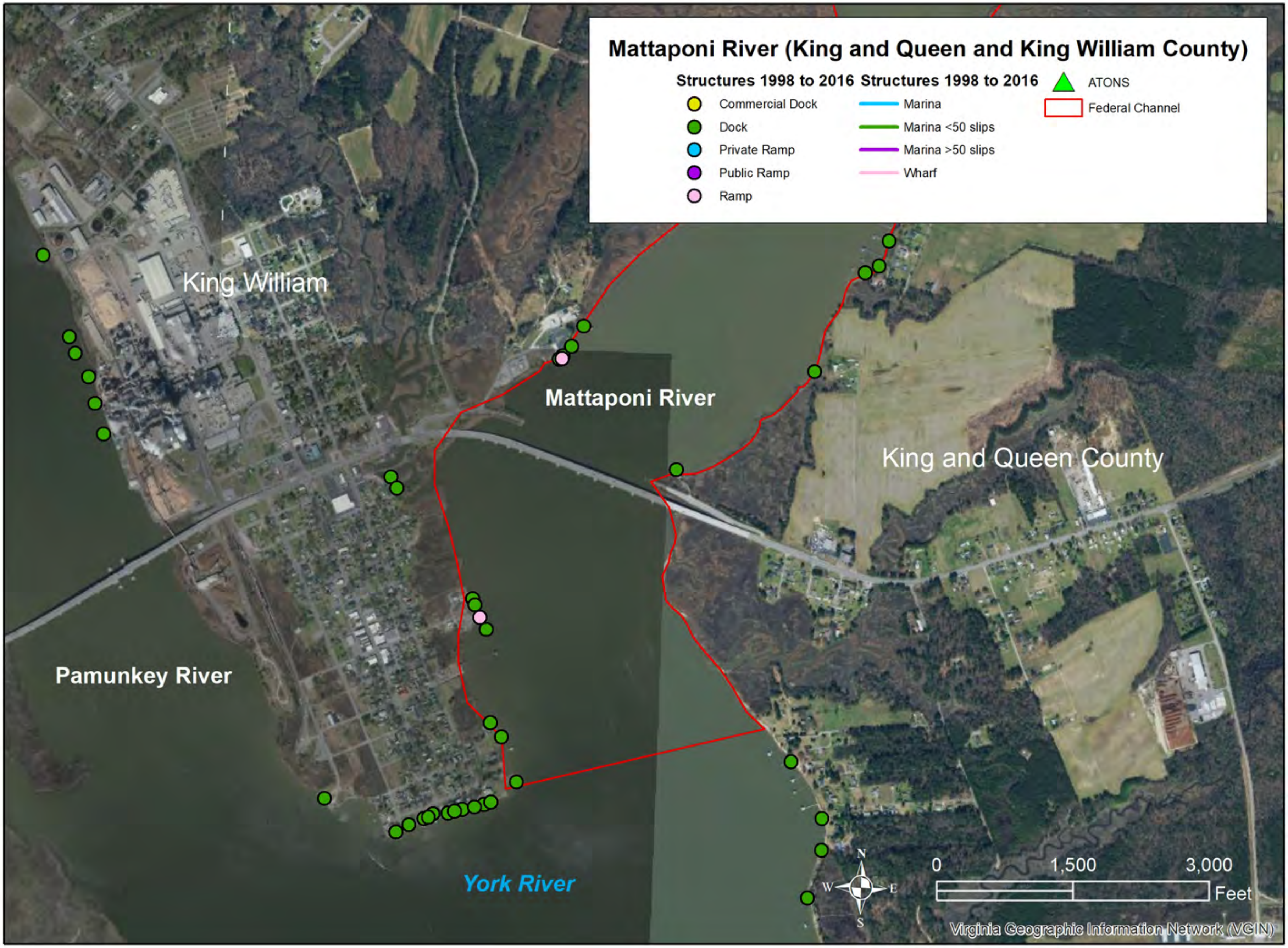
Creek mouth morphology was a qualitative assessment of the creek mouth performed for this project. An inlet morphology is defined as a narrow and very restricted channel such that the tidal range could be suppressed on the inside. A restricted inlet has narrowing headlands and possibly shoals on either side of the creek mouth somewhat restricting water flow. Semi-restricted ranges between restricted creek mouths and open creek mouths which have no land impeding creek flow.

% Shoaling of a creek was a qualitative assessment of shoaling within the creek, usually at the creek mouth or just outside the creek. It is related to the need for dredging. The assessment was performed using visual inspection of the 2017 VGIN images.

Tide Range was obtained using NOAA resources.

Creek Area was determined by using the Shoreline Studies Program's digitized 2017 shoreline which outlines the entire creek from the mouth to its headwaters. The mouth was visually-defined on the 2017 VGIN images. Area was calculated in GIS.

Average and maximum depth of the creek mouth was determined from the USGS topographic and bathymetric digital elevation model (https://www.usgs.gov/core-science-systems/eros/coned)


Mattaponi River (King and Queen and King William County)
Structures 1998 to 2016
Commercial Dock
Dock
Private Ramp
Public Ramp
Ramp
Structures 1998 to 2016
Marina
Marina <50 slips
Marina >50 slips
Wharf
ATONS
Federal Channel
King William
Mattaponi River
King and Queen County
Pamunkey River
York River
N
W
E
S
0
1,500
3,000
Feet
Virginia Geographic Information Network (VGIN)

Appendix B

Complete Table of Data for 120 Creeks on the Middle Peninsula

Summary Table	
Category	# of Creeks
Non-Federal	95
Non-Federal ATON	12
Federal	13
Category	# of Creeks
No Visible Shoaling	41
<50% of channel	39
>50% of channel	30
Completely shoaled	9
Category	# of Creeks
Open	45
Semi-Restricted	5
Restricted	50
Inlet	19
Category	# of Creeks
With Piers	106
With Marina	30
With Ramps	75
With Wharf	4

Consecutive Num	Creek Name	Type	County	Channel Type	Water Body	Creek Mouth
1	Hoskins	Creek	Essex	Federal	Rappahannock River	Restricted
2	Piscataway	Creek	Essex	Non-Federal	Rappahannock River	Open
3	Mud	Creek	Middlesex	Non-Federal	Rappahannock River	Open
4	Parrotts	Creek	Middlesex	Federal	Rappahannock River	Restricted
5	Harry George	Creek	Middlesex	Non-Federal	Rappahannock River	Restricted
6	Weeks	Creek	Middlesex	Non-Federal	Rappahannock River	Open
7	Lagrange	Creek	Middlesex	Non-Federal ATON	Rappahannock River	Restricted
8	Robinson	Creek	Middlesex	Non-Federal ATON	Rappahannock River	Restricted
9	Urbanna	Creek	Middlesex	Federal	Rappahannock River	Restricted
10	Whiting	Creek	Middlesex	Federal	Rappahannock River	Restricted
11	Meachim	Creek	Middlesex	Non-Federal	Rappahannock River	Restricted
12	Meachim East	Creek	Middlesex	Non-Federal	Rappahannock River	Restricted
13	Locklies North	Creek	Middlesex	Non-Federal ATON	Rappahannock River	Open
14	Locklies	Creek	Middlesex	Non-Federal	Rappahannock River	Open
15	Locklies Offshore	Channel	Middlesex	Federal	Rappahannock River	N/A
16	Mill	Creek	Middlesex	Non-Federal	Rappahannock River	Open
17	Bush Park	Creek	Middlesex	Non-Federal	Rappahannock River	Inlet
18	Hunting	Creek	Middlesex	Non-Federal	Rappahannock River	Inlet
19	Sturgeon	Creek	Middlesex	Non-Federal	Rappahannock River	Restricted
20	Unnamed	Cove	Middlesex	Non-Federal	Rappahannock River	Open
21	Broad	Creek	Middlesex	Federal	Rappahannock River	Restricted
22	Jackson	Creek	Middlesex	Federal	Piankatank River	Restricted
23	Moore East	Creek	Middlesex	Non-Federal	Piankatank River	Inlet
24	Moore	Creek	Middlesex	Non-Federal	Piankatank River	Inlet
25	Cores	Creek	Middlesex	Non-Federal	Piankatank River	Inlet
26	Healy	Creek	Middlesex	Non-Federal	Piankatank River	Open
27	Wilton	Creek	Middlesex	Non-Federal	Piankatank River	Open
28	Ferry	Creek	Gloucester	Non-Federal	Piankatank River	Restricted
29	Dancing	Creek	Gloucester	Non-Federal	Piankatank River	Restricted
30	Cobbs	Creek	Mathews	Non-Federal ATON	Piankatank River	Open
31	Roane Point	Creek	Mathews	Non-Federal	Piankatank River	Inlet
32	Warehouse	Cove	Mathews	Non-Federal	Piankatank River	Inlet
33	Chappel	Creek	Mathews	Non-Federal	Piankatank River	Inlet
34	Queens	Creek	Mathews	Federal	Piankatank River	Restricted
35	Winder	Creek	Mathews	Non-Federal	Piankatank River	Inlet
36	Milford	Haven	Mathews	Federal	Milford Haven	Restricted
37	Lanes	Creek	Mathews	Non-Federal	Milford Haven	Open
38	Edwards	Creek	Mathews	Non-Federal	Milford Haven	Open
39	Barn	Creek	Mathews	Non-Federal	Milford Haven	Open
40	Whites	Creek	Mathews	Non-Federal	Milford Haven/Chesapeake Bay	Open
41	Stutts	Creek	Mathews	Non-Federal ATON	Milford Haven	Open
42	Billups	Creek	Mathews	Non-Federal	Milford Haven	Open
43	Hole in the Wall	Channel	Mathews	Non-Federal ATON	Milford Haven/Chesapeake Bay	Open
44	Stoakes	Creek	Mathews	Non-Federal	Milford Haven	Open
45	Morris	Creek	Mathews	Non-Federal	Stutts Creek/Milford Haven	Open
46	Hudgins	Creek	Mathews	Non-Federal	Stutts Creek/Milford Haven	Restricted
47	Garden	Creek	Mathews	Non-Federal	Chesapeake Bay	Inlet
48	Winter	Harbor	Mathews	Federal	Chesapkeake Bay	Inlet
49	Horn	Harbor	Mathews	Federal	Chesapeake Bay	Open
50	Dyer	Creek	Mathews	Non-Federal	Chesapeake Bay	Open
51	Harper	Creek	Mathews	Non-Federal	Mobjack Bay	Open
52	Davis	Creek	Mathews	Federal	Mobjack Bay	Inlet
53	Pepper	Creek	Mathews	Non-Federal ATON	Mobjack Bay	Restricted
54	Sloop	Creek	Mathews	Non-Federal	Mobjack Bay	Restricted
55	West Landing	Creek	Mathews	Non-Federal	East River	Restricted
56	Tabbs	Creek	Mathews	Non-Federal	East River	Open

Consecutive Num	Creek Name	Type	County	Channel Type	Water Body	Creek Mouth
57	Weston	Creek	Mathews	Non-Federal	East River	Open
58	Mill	Creek	Mathews	Non-Federal	East River	Restricted
59	Todds	Creek	Mathews	Non-Federal	East River	Open
60	Put In	Creek	Mathews	Non-Federal	East River	Open
61	Woodas	Creek	Mathews	Non-Federal	East River	Open
62	Miles	Creek	Mathews	Non-Federal	East River	Open
63	Mill 2	Creek	Mathews	Non-Federal	East River	Inlet
64	Raines	Creek	Mathews	Non-Federal	East River	Restricted
65	Thomas	Creek	Mathews	Non-Federal	East River	Restricted
66	Sharp Point	Creek	Mathews	Non-Federal	East River	Restricted
67	Whites	Creek	Mathews	Non-Federal	East River	Restricted
68	Godsey	Creek	Mathews	Non-Federal	North River	Restricted
69	Diggs	Creek	Mathews	Non-Federal	North River	Restricted
70	Cakes	Creek	Mathews	Non-Federal	North River	Restricted
71	Raymond	Creek	Mathews	Non-Federal	North River	Restricted
72	Old Log School	Creek	Mathews	Non-Federal	North River	Restricted
73	Oakland	Creek	Mathews	Non-Federal	North River	Semi-Restricted
74	Greenmansion	Cove	Mathews	Non-Federal ATON	North River	Restricted
75	Blackwater	Creek	Mathews	Non-Federal	North River	Open
76	Hampton	Creek	Mathews	Non-Federal	North River	Open
77	Toddsbury	Creek	Gloucester	Non-Federal	North River	Restricted
78	Elmington	Creek	Gloucester	Non-Federal	North River	Restricted
79	Back	Creek	Gloucester	Non-Federal	North River	Restricted
80	Belleville	Creek	Gloucester	Non-Federal	North River	Restricted
81	Anchorage	Creek	Gloucester	Non-Federal	North River	Inlet
82	Davis	Creek	Gloucester	Non-Federal	North River	Restricted
83	Silver	Creek	Gloucester	Non-Federal	North River	Inlet
84	Wilson	Creek	Gloucester	Non-Federal	Ware River	Semi-Restricted
85	Oldhouse	Creek	Gloucester	Non-Federal	Ware River	Restricted
86	Whittaker	Creek	Gloucester	Non-Federal	Severn River	Open
87	Free School	Creek	Gloucester	Non-Federal	Severn River	Restricted
88	Sterling	Creek	Gloucester	Non-Federal	Severn River	Restricted
89	Vaughans	Creek	Gloucester	Non-Federal	Severn River (Northern Branch)	Open
90	Willets	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Open
91	Lady	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Restricted
92	Heywood	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Open
93	Thorntons	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Open
94	Rowes	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Semi-Restricted
95	Holly Bush	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Restricted
96	Bill Browns	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Open
97	Thomas	Creek	Gloucester	Non-Federal	Severn River (Southern Branch)	Semi-Restricted
98	King	Creek	Gloucester	Non-Federal	Severn River	Inlet
99	Long	Creek	Gloucester	Non-Federal	Severn River	Restricted
100	Browns	Bay	Gloucester	Non-Federal ATON	Mobjack Bay	Open
101	Blevins	Creek	Gloucester	Non-Federal	Mobjack Bay	Restricted
102	John West	Creek	Gloucester	Non-Federal	Mobjack Bay	Restricted
103	Little Monday	Creek	Gloucester	Non-Federal	Mobjack Bay	Open
104	Monday	Creek	Gloucester	Non-Federal	Mobjack Bay	Open
105	Perrin	River	Gloucester	Non-Federal ATON	York River	Open
106	Sarah	Creek	Gloucester	Non-Federal ATON	York River	Restricted
107	Timberneck	Creek	Gloucester	Non-Federal ATON	York River	Restricted
108	Cedarbush	Creek	Gloucester	Non-Federal	York River	Semi-Restricted
109	Carter	Creek	Gloucester	Non-Federal	York River	Open
110	Aberdeen	Creek	Gloucester	Federal	York River	Restricted
111	Jones	Creek	Gloucester	Non-Federal	York River	Inlet
112	Sandy	Creek	Gloucester	Non-Federal	York River	Inlet

Consecutive Num	Creek Name	Type	County	Channel Type	Water Body	Creek Mouth
113	Fox	creek	Gloucester	Non-Federal	York River	Inlet
114	Bland	Creek	Gloucester	Non-Federal	York River	Restricted
115	Leigh	Creek	Gloucester	Non-Federal	York River	Restricted
116	Purtan	Creek	Gloucester	Non-Federal	York River	Open
117	Adams	Creek	Gloucester	Non-Federal	York River	Restricted
118	Poropotank	River	oucester/King and Que	Non-Federal	York River	Open
119	Hockley	Creek	King and Queen	Non-Federal	York River	Open
120	Mattaponi Entrance*	River	King and Queen	Non-Federal	Mattaponi River	Open

*Mattaponi River is included, but only the shoreline at the mouth of the river was considered.

Consecutive Num	Creek Name	Creek Shoaled	Tide Range (ft)	# Piers	# Marina	# Ramps	# Wharf	Water Surface Area (acres)	Mouth Width (ft)
1	Hoskins	<50% of channel	1.84	18	0	1	0	132	212
2	Piscataway	No Visible Shoaling	1.84	36	0	4	0	427	566
3	Mud	>50% of channel	1.67	1	0	0	0	105	609
4	Parrotts	>50% of channel	1.67	19	0	4	0	115	528
5	Harry George	Completely shoaled	1.67	5	0	0	0	48	473
6	Weeks	No Visible Shoaling	1.67	2	0	1	0	110	526
7	Lagrange	<50% of channel	1.50	49	1	6	0	416	844
8	Robinson	>50% of channel	1.50	111	5	5	0	241	1799
9	Urbanna	>50% of channel	1.50	66	4	6	0	314	604
10	Whiting	Completely shoaled	1.50	59	0	1	0	132	299
11	Meachim	>50% of channel	1.50	83	0	2	0	158	344
12	Meachim East	Completely shoaled	1.50	9	2	2	0	25	708
13	Locklies North	<50% of channel	1.34	11	0	2	0	29	701
14	Locklies	<50% of channel	1.34	32	3	5	0	71	448
15	Locklies Offshore	<50% of channel	1.34	0	0	0	0	8	0
16	Mill	<50% of channel	1.34	37	0	2	1	75	587
17	Bush Park	Completely shoaled	1.34	38	5	4	0	77	107
18	Hunting	<50% of channel	1.34	35	1	2	0	26	57
19	Sturgeon	Completely shoaled	1.34	121	2	9	0	185	1508
20	Unnamed	Completely shoaled	1.34	18	0	0	0	12	743
21	Broad	<50% of channel	1.34	50	8	7	0	79	670
22	Jackson	No Visible Shoaling	1.34	103	5	6	0	156	1115
23	Moore East	<50% of channel	1.34	14	1	1	0	11	48
24	Moore	<50% of channel	1.34	53	0	3	0	50	89
25	Cores	>50% of channel	1.34	8	0	0	0	17	107
26	Healy	No Visible Shoaling	1.34	21	1	1	0	56	257
27	Wilton	No Visible Shoaling	1.34	50	2	1	0	100	520
28	Ferry	>50% of channel	1.50	17	0	1	0	75	594
29	Dancing	>50% of channel	1.50	14	0	1	0	23	287
30	Cobbs	No Visible Shoaling	1.34	58	3	1	0	69	342
31	Roane Point	<50% of channel	1.34	4	0	0	0	8	45
32	Warehouse	Completely shoaled	1.34	4	0	0	0	4	15
33	Chappel	Completely shoaled	1.34	8	0	0	0	44	79
34	Queens	<50% of channel	1.34	145	1	4	0	188	342
35	Winder	>50% of channel	1.34	9	0	0	0	16	112
36	Milford	<50% of channel	1.34	0	0	0	0	23	0
37	Lanes	No Visible Shoaling	1.34	26	0	1	0	50	581
38	Edwards	No Visible Shoaling	1.34	29	1	0	0	45	881
39	Barn	No Visible Shoaling	1.34	32	0	1	0	33	566
40	Whites	#N/A	1.34	16	0	0	0	0	0
41	Stutts	No Visible Shoaling	1.34	108	1	5	0	238	1229
42	Billups	No Visible Shoaling	1.34	24	1	5	0	218	2052
43	Hole in the Wall	>50% of channel	1.10	0	0	0	0	0	0
44	Stoakes	No Visible Shoaling	1.34	6	1	0	0	219	1694
45	Morris	No Visible Shoaling	1.34	37	0	2	0	72	332
46	Hudgins	<50% of channel	1.34	6	0	0	0	10	122
47	Garden	Completely shoaled	1.50	2	0	0	0	181	659
48	Winter	>50% of channel	1.70	44	1	2	0	916	0
49	Horn	<50% of channel	1.84	113	3	7	0	745	2266
50	Dyer	No Visible Shoaling	1.84	14	0	4	0	159	1652
51	Harper	>50% of channel	2.34	2	0	0	0	69	1908
52	Davis	>50% of channel	2.34	13	2	5	5	49	254
53	Pepper	No Visible Shoaling	2.50	16	0	1	0	214	1960
54	Sloop	<50% of channel	2.50	13	0	1	0	17	149
55	West Landing	<50% of channel	2.67	9	0	0	0	20	666
56	Tabbs	<50% of channel	2.67	10	0	2	0	59	1188

Consecutive Num	Creek Name	Creek Shoaled	Tide Range (ft)	# Piers	# Marina	# Ramps	# Wharf	Water Surface Area (acres)	Mouth Width (ft)
57	Weston	<50% of channel	2.67	9	0	0	0	23	410
58	Mill	<50% of channel	2.67	15	0	1	0	19	135
59	Todds	No Visible Shoaling	2.67	13	0	0	0	18	689
60	Put In	No Visible Shoaling	2.67	48	0	1	0	130	80
61	Woodas	No Visible Shoaling	2.67	23	0	2	0	33	620
62	Miles	No Visible Shoaling	2.67	19	0	1	0	29	288
63	Mill 2	<50% of channel	2.67	8	0	2	1	14	75
64	Raines	<50% of channel	2.67	8	0	3	0	20	657
65	Thomas	>50% of channel	2.67	4	0	0	0	11	210
66	Sharp Point	<50% of channel	2.67	2	0	2	0	14	390
67	Whites	>50% of channel	2.67	11	0	0	0	12	253
68	Godsey	>50% of channel	2.67	6	0	1	0	41	250
69	Diggs	>50% of channel	2.67	2	0	0	0	14	356
70	Cakes	<50% of channel	2.67	2	0	1	0	20	266
71	Raymond	<50% of channel	2.67	1	0	1	0	14	331
72	Old Log School	<50% of channel	2.67	3	0	1	0	14	370
73	Oakland	No Visible Shoaling	1.34	8	0	1	0	21	483
74	Greenmansion	No Visible Shoaling	1.34	10	1	1	0	37	407
75	Blackwater	No Visible Shoaling	1.34	51	1	4	0	265	1332
76	Hampton	No Visible Shoaling	1.34	0	0	0	0	19	520
77	Toddsbury	No Visible Shoaling	2.67	4	0	1	0	14	211
78	Elmington	<50% of channel	2.67	8	0	1	0	22	428
79	Back	<50% of channel	2.67	22	0	0	0	58	441
80	Belleville	No Visible Shoaling	2.67	17	0	1	0	37	329
81	Anchorage	<50% of channel	2.67	3	0	1	0	8	54
82	Davis	No Visible Shoaling	2.67	18	0	0	0	49	308
83	Silver	<50% of channel	2.67	1	0	0	0	1	12
84	Wilson	No Visible Shoaling	2.67	42	0	5	0	213	761
85	Oldhouse	>50% of channel	2.67	6	0	1	0	78	90
86	Whittaker	<50% of channel	2.67	0	0	1	0	45	680
87	Free School	>50% of channel	2.67	19	0	4	0	38	408
88	Sterling	>50% of channel	2.67	10	0	2	0	16	260
89	Vaughans	No Visible Shoaling	2.67	21	0	1	0	88	726
90	Willets	No Visible Shoaling	2.67	12	1	1	0	130	1523
91	Lady	<50% of channel	2.67	2	0	0	0	7	361
92	Heywood	No Visible Shoaling	2.67	2	0	0	0	100	730
93	Thorntons	No Visible Shoaling	2.67	16	0	2	0	55	516
94	Rowes	<50% of channel	2.67	20	1	3	0	39	754
95	Holly Bush	>50% of channel	2.67	3	0	1	0	27	545
96	Bill Browns	No Visible Shoaling	2.67	5	0	0	0	21	754
97	Thomas	<50% of channel	2.67	0	0	0	0	16	589
98	King	>50% of channel	2.50	4	0	0	0	18	65
99	Long	No Visible Shoaling	2.50	0	0	0	0	28	386
100	Browns	No Visible Shoaling	2.50	1	0	1	0	44	647
101	Blevins	<50% of channel	2.50	3	0	0	0	46	371
102	John West	<50% of channel	2.50	0	0	0	0	33	461
103	Little Monday	>50% of channel	2.50	0	0	0	0	20	408
104	Monday	<50% of channel	2.50	0	0	0	0	91	473
105	Perrin	<50% of channel	2.50	30	3	9	0	94	431
106	Sarah	>50% of channel	2.50	213	8	11	0	287	409
107	Timberneck	>50% of channel	2.67	27	1	2	0	202	1468
108	Cedarbush	>50% of channel	2.84	21	0	2	0	82	843
109	Carter	No Visible Shoaling	2.84	20	0	0	0	169	521
110	Aberdeen	>50% of channel	3.00	22	1	4	0	77	124
111	Jones	>50% of channel	3.00	5	0	0	0	42	138
112	Sandy	>50% of channel	3.00	0	0	0	0	6	38

Consecutive Num	Creek Name	Creek Shoaled	Tide Range (ft)	# Piers	# Marina	# Ramps	# Wharf	Water Surface Area (acres)	Mouth Width (ft)
113	Fox	No Visible Shoaling	3.00	3	0	1	0	13	70
114	Bland	No Visible Shoaling	3.00	6	0	0	0	24	220
115	Leigh	>50% of channel	3.00	0	0	0	0	7	134
116	Purtan	No Visible Shoaling	3.00	0	0	0	0	35	677
117	Adams	No Visible Shoaling	3.00	8	0	0	1	103	389
118	Poropotank	<50% of channel	3.00	48	0	3	0	700	2163
119	Hockley	No Visible Shoaling	3.00	0	0	0	0	33	434
120	Mattaponi Entrance*	No Visible Shoaling	2.90	15	0	1	0	NA	NA

*Mattaponi River is included, but only the shoreline at the mouth of the river was considered.

Consecutive Num	Creek Name	TidalPrism (m3)	Cross-Sectional Area (m2)
1	Hoskins	298,761	8
2	Piscataway	969,381	114
3	Mud	216,394	39
4	Parrotts	235,904	132
5	Harry George	97,860	25
6	Weeks	227,191	126
7	Lagrange	769,435	26
8	Robinson	446,594	86
9	Urbanna	580,895	205
10	Whiting	244,266	36
11	Meachim	292,038	72
12	Meachim East	46,406	205
13	Locklies North	48,312	253
14	Locklies	116,846	113
15	Locklies Offshore	14,062	0
16	Mill	123,720	143
17	Bush Park	127,900	5
18	Hunting	42,354	2
19	Sturgeon	305,923	150
20	Unnamed	20,040	229
21	Broad	130,929	386
22	Jackson	258,301	299
23	Moore East	18,303	1
24	Moore	82,916	3
25	Cores	28,673	6
26	Healy	91,979	128
27	Wilton	165,391	321
28	Ferry	139,192	227
29	Dancing	43,363	58
30	Cobbs	113,863	194
31	Roane Point	13,590	1
32	Warehouse	6,749	1
33	Chappel	73,530	2
34	Queens	310,902	201
35	Winder	25,843	9
36	Milford	38,502	0
37	Lanes	81,936	256
38	Edwards	73,884	498
39	Barn	54,802	189
40	Whites		
41	Stutts	529,037	816
42	Billups	360,459	898
43	Hole in the Wall		
44	Stoakes	361,411	547
45	Morris	119,301	186
46	Hudgins	17,112	14
47	Garden	335,065	67
48	Winter	-	0
49	Horn	1,691,280	1101
50	Dyer	360,475	562
51	Harper	198,929	346
52	Davis	140,877	62
53	Pepper	661,270	720
54	Sloop	53,490	10
55	West Landing	67,378	151
56	Tabbs	195,482	518

Consecutive Num	Creek Name	TidalPrism (m3)	Cross-Sectional Area (m2)
57	Weston	74,597	98
58	Mill	62,386	13
59	Todds	60,520	241
60	Put In	426,893	47
61	Woodas	110,055	178
62	Miles	96,548	124
63	Mill 2	45,614	5
64	Raines	65,531	260
65	Thomas	35,287	34
66	Sharp Point	46,742	84
67	Whites	40,227	26
68	Godsey	136,234	45
69	Diggs	45,099	39
70	Cakes	64,534	22
71	Raymond	46,480	46
72	Old Log School	46,343	75
73	Oakland	35,316	122
74	Greenmansion	61,043	148
75	Blackwater	566,467	849
76	Hampton	31,361	155
77	Toddsbury	44,528	39
78	Elmington	73,512	14
79	Back	192,407	136
80	Belleville	120,386	112
81	Anchorage	25,643	1
82	Davis	162,135	171
83	Silver	3,838	0
84	Wilson	699,895	403
85	Oldhouse	257,642	17
86	Whittaker	149,169	163
87	Free School	124,385	169
88	Sterling	52,308	76
89	Vaughans	288,998	331
90	Willets	427,296	589
91	Lady	24,036	73
92	Heywood	329,331	285
93	Thorntons	180,484	151
94	Rowes	127,422	239
95	Holly Bush	89,082	181
96	Bill Browns	67,911	157
97	Thomas	52,724	75
98	King	55,042	10
99	Long	85,128	45
100	Browns	134,685	266
101	Blevins	140,913	109
102	John West	101,961	85
103	Little Monday	60,372	45
104	Monday	281,640	178
105	Perrin	291,125	199
106	Sarah	886,548	278
107	Timberneck	666,256	400
108	Cedarbush	286,440	24
109	Carter	591,951	20
110	Aberdeen	283,700	12
111	Jones	153,925	4
112	Sandy	23,409	1

Consecutive Num	Creek Name	TidalPrism (m3)	Cross-Sectional Area (m2)
113	Fox	48,786	2
114	Bland	88,953	7
115	Leigh	24,524	4
116	Purtan	130,324	29
117	Adams	380,485	12
118	Poropotank	2,591,830	1172
119	Hockley	120,453	195
120	Mattaponi Entrance*	NA	

*Mattaponi River is included, but only the shoreline at the mouth of the river was considered.