Virginia Chesapeake Bay and Its Tributaries Proposed No Discharge Zone (NDZ): Commercial Vessel Population & Pump-Out Assessment

Final Report

Prepared for
Virginia Department of Environmental Quality
P.O Box 115
Richmond, VA 23218

Prepared by
Center for Coastal Resources Management
Virginia Institute of Marine Science
William & Mary
P.O. Box 1346
Gloucester Point, VA 23062
(804) 684-7912

Tombleson, C. (2021). *Virginia Chesapeake Bay and Its Tributaries Proposed No Discharge Zone (NDZ): Commercial Vessel Population & Pump-Out Assessment, Phase 1 Report to the Virginia Department of Environmental Quality.* Center for Coastal Resources Management, Virginia Institute of Marine Science.

VIMS | William & Mary
Virginia Institute of Marine Science

AUGUST 6, 2021

Center for Coastal Resources Management
Virginia Institute of Marine Science

Table of Contents

Acronyms

ACOE – Army Corps of Engineers
AIS – Automated Information System
AWO – The American Waterways Operators
BAE -British Aerospace
CCRM – Center for Coastal Resources Management
CHT – Collection, Holding, and Transfer
CLIA – Cruise Lines International Association
CVA – Clean Vessel Act
DC – District of Columbia
DEQ – (Virginia) Department of Environmental Quality
DWR – Department of Wildlife Resources
ESRI – Environmental Systems Research Institute
GIS – Geographic Information Systems
HRSD – Hampton Roads Sanitation District
ICW – Intercoastal Waterway
IMO – International Maritime Association
MMSI – Maritime Mobile Service Identity
MSC – Marine Sealift Command
MSD – Marine Sanitation Device
NDZ – No Discharge Zone
NOAA – National Oceanic and Atmospheric Administration
NMFS – National Marine Fisheries Services
PMA – Pacific Maritime Association
SIP – Newport News Seafood Industrial Park
USCG – United States Coast Guard
VDH – Virginia Department of Health
VDOT – Virginia Department of Transportation
VIMS – Virginia Institute of Marine Science
VMA – Virginia Maritime Association
VMRC – Virginia Marine Resources Commission

List of Tables

List of Figures

Proposed Virginia Chesapeake Bay NDZ - Commercial Vessels

As part of the Virginia Department of Environmental Quality's (DEQ) Phase 1 to gather information for the development of a No Discharge Zone (NDZ) application for the Chesapeake Bay (Bay) and it's tributaries, the Center for Coastal Resources Management (CCRM) at the Virginia Institute of Marine Science (VIMS) collected data to estimate the population of all non-recreational types of marine vessel traffic that included commercial, governmental, and military vessels (from now on collectively referred to as "commercial vessels") that may periodically, transiently, or normally navigate within the mainstem of the Virginia portion of the Chesapeake Bay or its tributaries during the course of a year. This data was collected to determine the composition of commercial vessels operating in the Bay. CCRM also conducted a data gap analysis for commercial vessel data and current pump-out station availability and assessed potential pump-out needs and issues if an NDZ were to be implemented in the Chesapeake Bay.

Vessel Populations and Pump-out Needs

Data Sources & Approach

The initial phase of data collection began in January 2021. The information desired to be collected for this study more specifically included:

1. An estimate of the number and types of commercial vessels operating in the Bay in a one-year time frame. (Based on the available datasets, the year chosen for analysis was 2019);
2. The sewage containment or treatment on board, sewage holding capacity, length of time able to hold sewage before needing to be pumped out, average number of crew and passengers on board;
3. The spatial and temporal characterization of the vessels;
4. The location and other data[1] of existing stationary and mobile commercial vessel pump-outs;
5. An adequacy determination of commercial pump-outs in the Bay;
6. A needs assessment for additional pump-outs and locations.

The data gaps identified in this report reveal how the desired scope and specificity of data assessment for this study is ambitious with the limited data available, time constraints, and other resources required.

A search for commercial vessel and pump-out data was conducted by CCRM using the internet; communication with the Virginia Department of Environmental Quality (DEQ), the Virginia Department of Wildlife Resources (DWR), various sections of the United States Coast Guard (USCG), the Virginia Marine Resources Commission (VMRC), the Virginia Maritime Association (VMA), The American Waterways Operators (AWO), the Virginia Department of Health (VDH) Marina Program, VDH Division of Shellfish Safety, Virginia Department of Transportation (VDOT), Moran Towing, McAllister Towing, Elizabeth River Ferries, Environmental Protection Agency (EPA) NDZ coordinator, Hampton Roads Sanitation District (HRSD), Norfolk District Army Corps of Engineers (ACOE), American Bureau of Shipping (ABS), Virginia Pilots Association, Newport News Seafood Industrial Park (SIP), NOAA, Virginia Institute of Marine Science (VIMS), Rover Cruises, Cruise Lines International Association (CLIA), U.S. Navy; and informal conversations with commercial vessel operators (to include captains of tug, tour, pump-out, charter fishing, commercial fishing, dredging, research and survey, and pilot vessels), seafood and other commercial fishing industry owners, marinas, septic haulers, launch services, non-governmental environmental organizations, and local governments. Efforts were made to communicate with additional stakeholder contacts which resulted in no response.

[1] See Appendix A

Vessel Populations

Information collected was intended to estimate commercial vessel types and counts operating in the Virginia portion of the Chesapeake Bay and its tributaries, as well as the number of people generally on each vessel, practices of sewage management including type of Marine Sanitation Device (MSD) on board, presence of holding tanks, existing sewage pump-out capabilities and locations, and potential impediments to compliance if an NDZ were to be designated. The majority of this information is not documented or tracked in any databases found. Due to the variability of uses, configurations, ownerships, and other characteristics of commercial vessels, even within the same vessel type, much of this information is difficult to ascertain without communicating directly with each specific vessel owner or operator using the Chesapeake Bay and compiling the results; an intensity of data collection beyond the scope of this project.

Table 1 below lists the existing datasets identified in this study providing commercial vessel type and counts. Due to the limited resources of this study, datasets investigated were restricted to those publicly available at no cost.

Database Name	Description	Source
Automatic Identification System (AIS) Data	Vessel traffic data collected by the US Coast Guard in 2019 through approximately 200 land-based receiving stations located near important navigation routes that transmit and monitor the location and characteristics of larger vessels in real time through an on-board transponder device. Records are filtered to one-minute pings (one ping per minute) identifying vessel location by latitude and longitude. • Due to data file size limitations, 1 ping per vessel per day was extracted. • Data provides spatial distribution of vessels.	Nationwide Automatic Identification System 2019 Marine Cadastre, 2020 https://marinecadastre.gov/ais Citation: Office for Coastal Management, 2021: Nationwide Automatic Identification System 2019, https://www.fisheries.noaa.gov/inport/item/62733.
Automatic Identification System (AIS) Data – Vessel Tracks	Same AIS data source as above but providing vessel track information filtered by month. No latitude or longitude provided. • Data provides spatial distribution of vessels.	Atlantic vessel tracks 2019, Marine Cadastre, 2020 https://www.esri.com/arcgis-blog/products/arcgis-living-atlas/data-management/introducing-the-u-s-vessel-traffic-application-from-living-atlas/
Merchant Vessels of the United States or USCG List of Documented Vessels	Data file of merchant and recreational vessels documented under the laws of the United States by the U.S. Coast Guard (U.S. Flagged vessels) containing vessel particulars and managing owner information for vessels 5 net tons or larger and documented by the USCG; National form of registration for international purposes • Foreign vessels are not included. • Vessels less than 5 net tons or smaller are numbered (registered) by the state, not USCG. • Military vessels are not included. • Data does not provide spatial characterization of vessels.	https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Office-of-Investigations-Casualty-Analysis/Merchant-Vessels-of-the-United-States/ Source of data: U.S. Coast Guard's Marine Information for Safety and Law Enforcement (MISLE) and Vessel Documentation System (VDS) databases. The file used in this project contains vessel information as of Jan 2019.

USCG Documented Inspected Vessels	Type and count of vessels, using the Bay in 2019, inspected by the USCG. This list does not include vessels transiting through the Bay headed into or out of Baltimore. No other attributes are provided for the vessels. (Received August 2, 2021)	ENS Shannon Young Domestic Vessel Inspections USCG Sector Virginia 200 Granby St Norfolk, VA 23510 (757) 668-5511 Shannon.L.Young@uscg.mil
Virginia Department of Wildlife Resources (DWR) Boat Registration Database 2019	All boats propelled by machinery, including gasoline, diesel, and electric motors regardless of whether or not the machinery is the principal source of propulsion, and principally operated on Virginia waters (for more than 90 consecutive days) must be registered and issued a Virginia Certificate of Number (Registration) by the DWR. The database contains information pertaining to the description of the boat including use, type, model, length, purchase price (where available), date registered, motor information (horsepower and model) and owner information including name, address, city, state, and zip code. • Data does not provide spatial characterization of vessels.	https://dwr.virginia.gov/boating/database/ This dataset has a $95 annual subscription fee, however, DEQ obtained the dataset from DWR. DWR is responsible for regulating the state boating laws in Virginia and maintaining the Virginia boat registration database.
Army Corps of Engineers Lock Vessel Data	Vessel traffic counts through the Great Bridge Guard Lock and Deep Creek Lock in 2019. • Data does not provide spatial characterization of vessels.	Army Corps of Engineers See Appendix B
Naval Vessel Register	Dataset of information on ships and service craft that comprise the official inventory of the US Navy. The data query for this project includes Active ships in the Atlantic Fleet with homeports in Virginia. Data does not provide spatial characterization of vessels.	https://www.nvr.navy.mil/ Request Data:NFSH_NNSY_NVR_CUSTODIAN@navy.mil
National Marine Fisheries Services (NMFS) Vessel Monitoring System (VMS) Data	A satellite surveillance system primarily used to monitor the location and movement of commercial fishing vessels in the U.S. (Vessel activity data 2015-2016 indicated from high to low) indicating relative levels of vessel presence. The maps show the density of vessel locations following the removal of individually identifiable vessel positions.	North East Ocean Data – Data Explorer Vessel Monitoring Systems (VMS) – National Oceanographic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) www.northeastoceandata.org/data-explorer

Table 1. Datasets collected providing commercial vessel types and other information.

The AIS, VA DWR Boat Registration (DWR), and USCG Documented (Merchant) Vessels (USCG) are the main datasets used to gather and analyze information regarding the types and counts of commercial vessels using the Chesapeake Bay and its tributaries in this study. The Navy Vessel Register provides additional vessel counts for military vessels; the ACOE Lock Vessel Data provide additional vessel counts for tugs, government, and passenger vessels; and the inspected USCG Documented Vessel data from ENS Shannon Young provide additional counts of vessels by vessel type using the Chesapeake Bay in 2019 via inspections by the USCG. These datasets better complete our data inventory, however, it is not possible to determine if these vessels are already captured in the AIS data since there are no matching fields to identify duplicates. In addition, no location or other data attributes are provided for these vessels, therefore, they are considered supplementary. Perhaps additional attributes can be obtained for these datasets in a future phase of this project. The Marine Fisheries Vessel Monitoring System Data provides visuals of the density tracks of vessels engaged in the different types of commercial fisheries, but does not provide a count.

Compiling information from the available data was problematic since the fields provided in each dataset were not standardized, uniform, or consistent. The datasets employed different vessel type groups, categories, and/or definitions. Vessel categories in each dataset were reviewed and re-grouped for consistency across all three datasets, as best as possible. Further, various records in all datasets contained incomplete, erroneous, and/or null fields; fields had misspellings, various forms of abbreviations, inconsistent format, missing information, and varying content. Data queries to determine vessel counts, groups, and location could not be made until fields were consistent. In addition, in determining vessel type, all datasets had other, unknown, and unclassified categories that were not useful. Efforts were made to research the vessel type for these records and update the databases, however, this was not feasible to do for all involved records. In addition, it was very difficult to find contacts able to provide more detailed information or explanation regarding the datasets.

The AIS Data is the only available dataset that provides for spatial characterization of vessels. AIS transmits information in digital form indicating who a vessel is, where they are, and other useful information such as course, speed and heading. All vessels over 300 tons on international voyages, 500 tons non-international voyages, and all passenger ships are required by the International Maritime Organization (IMO) to have AIS. (Refer to https://www.navcen.uscg.gov/?pageName=AISRequirementsRev#Operations for further information on AIS requirements). Other vessels may voluntarily have AIS, usually for navigational safety purposes. The “ping” data from AIS provides latitude and longitude in real-time of vessel locations obtained from receivers. Using geographic information systems (GIS) software, ping data converted to track lines showing where a vessel has traveled and the density of those tracks is very useful in visualizing the characterization of vessel traffic in the Bay.

The use of the AIS data is a huge advantage over the DWR and USCG datasets that do not provide information as to the location of where, when, or if a vessel is used; only where a vessel has been registered or documented. To best identify the location of these vessels, we were constrained to making assumptions and were limited to land-based options. The dataset fields used to assign a vessel to a locality were the *hailing port* (per USCG, may be used to best determine the vessels geographic area of operation) and *fips_used* (per DWR, is where the boat is most often used; fips is a code to identify counties and cities). Unfortunately, the information provided in these fields has no requirements; a vessel owner may specify any location in these fields.

However, there are limitations of the AIS data as well. Not all commercial vessels using the Chesapeake Bay have AIS on board. Not all vessels that have AIS have it turned on or functioning properly. A vessel with AIS turned on may not be in the vicinity of a land-based receiver for vessel data to be collected. The MMSI (Maritime Mobile Service Identity) number, a nine-digit number assigned to an AIS unit on a vessel to uniquely identify that vessel is manually entered by the vessel operator which can be accidently, or on purpose, inputted incorrectly. This results in inaccurate data for a vessel or can create a record in the dataset with no data. In addition, the dataset may contain numerous records with

the same MMSI number assigned to a variety of vessels making it difficult or unfeasible to identify the correct vessel and corresponding vessel type.

It was necessary to standardize and/or research information in some fields before the datasets could be used. For example, hailing port and fips_code fields were revised in the DWR and USCG datasets to be equivalent county names to allow for identification of vessel location to a Tidewater locality. However, a range of identifiers was inputted into the USCG hailing port field by vessel owners including locality, place, subdivision, waterway, marina, area, and other location names. Additionally, many of the entries used a variety of different spellings and abbreviations for the same hailing port. These hailing port locations had to be looked up in order to assign the appropriate locality name. The DWR data provided fips codes for vessel locations. The fips codes needed to be converted to locality names before these vessel locations could be identified.

Vessel types in all datasets had to be re-categorized to generate and assign vessel type groups across all datasets to be consistent as possible. In addition, MMSI numbers were searched in MarineTraffic.com to identify vessel type for some records in AIS data where only an MMSI number was provided. Some records with *other, unclassified*, or *unknown* vessel types were researched using Google or MarineTraffic.com. This was time consuming and it was not feasible to identify all missing vessel type information, therefore, the majority of *Other*, *Unclassified*, and *Unknown* categories are "as is" in the dataset.

Lastly, the three main datasets (DWR, USCG, and AIS) were reviewed for duplicate vessels. The DWR and USCG data were reviewed for duplicates using the Hull Identification number where it was provided and complete. Since these forms of titling have different purposes, only one duplicate was found and it was removed. There were no similar fields between the DWR and AIS data to identify duplicates, however it was assumed duplicates would be minimal since the registered vessels tended to be smaller vessel types than in the AIS. The vessel name, call sign, and IMO (International Maritime Organization) number fields in the USCG data were used to identify duplicates in the AIS data. Many of these fields were null or had incomplete data, however three duplicates were found and removed.

Environmental Systems Research Institute (ESRI) Geographical Information Systems (GIS) software ArcGIS Pro 2.8.1 was used to select, query, and analyze data for this project, as well as generate maps. Microsoft Access 365 2019 was also used in this project to query, sort, and analyze data. Excel 365 2019 was used to generate charts. Word 365 2019 was used to generate tables and the report itself.

Data Assumptions/Parameters

1. Vessels under 26 feet in length were assumed to be too small to have a Type I, II, or III MSD installed on board. These vessels most likely employed a bucket or had no facilities and were removed from all datasets.
2. The extent of the spatial AIS data used for this analysis was limited to the tidal waterways within the Virginia portion of the Chesapeake Bay watershed; the limit of the proposed NDZ.
3. Vessels located in the Tidewater localities of Virginia were assumed to be the most likely to be using the Chesapeake Bay and its tributaries. Tidewater localities were identified as those defined by Article 2.5 Chesapeake Bay Preservation Act. Vessels in these localities were selected in the non-spatial VA DWR and USCG datasets using the fips_used and hailing port fields, respectively.
4. Military vessel data in the Naval Vessel Register was limited to Active status vessels in the Atlantic Fleet with Virginia and blank home ports to identify those vessels most likely using the Chesapeake Bay. Military vessels in the other datasets came under the query rules of those datasets (see 2 and 3).
5. Though some research was done to correct vessel groups or provide missing information in many records, researching individual records was beyond the scope of this project. Records not researched were used "as is."

Vessel Groups

Vessel groups were reviewed and recategorized to generate consistent vessel groups across all datasets. The resultant vessel groups are shown in Table 2 below.

Vessel Group	Includes Vessel Types/Uses
Cargo	Barge Carrier, Bulk Carrier, Cargo Barge, Container Ship, General Cargo, Vehicles Carrier, Freight Barge, Unknown
Fishing	Commercial Fishing (Offshore-Supply, Trawler, Watermen), Unknown
Industrial	Anti-Pollution, Dredger, Off-Shore Supply (Oil & Gas), Marine Construction, Oil Recovery, Unknown
Government	Law Enforcement (local government, DWR, VMRC, unknown), Search and Rescue, Fire, Government
Military	Military
Passenger	Charter Fishing, Diving, Cruise Ship, Tour Boat, Pilot Vessel, Port Tender, Ferry, Passenger Barge, Museum Vessel, Crew Boat
Research/Survey	Scientific research vessels, hydrographic surveys, schooling ships
Tanker	Tankers
Tugs	Pusher, Towing, Tractor
Other/Unknown/Unclassified	Unknown

Table 2. Vessel groups used across all datasets

Vessel Counts

The counts of individual vessels by vessel group identified as potentially using the Virginia portion of the Chesapeake Bay in 2019, based on the available datasets, are indicated in Table 3 below.

Vessel Group	**USCG Documented**	**DWR**	**AIS**	**Potential Total**	**USCG Inspected***
Cargo	382	0	1349	1731	2809 (includes Tankers
Tanker	43	0	146	189	
Fishing	788	206	217	1211	1096
Government	0	45	43	88	
Industrial	46	44	12	102	
Military	0	1	239	240	NA
Passenger	299	21	119	439	135
Research/Survey	13	6	8	27	
Tugs	144	6	276	426	172
Other/Unknown/Unclassified	111	22	488	621	65
Total	1826	351	2897	5074	4292

Table 3. Total vessel counts by vessel group in all datasets

The DWR and USCG vessel counts in Table 3 are those commercial vessels registered (DWR) or documented (USCG) in the Tidewater localities in 2019. All (non-foreign) vessels[2] using the Chesapeake Bay must be either registered with DWR or documented with the USCG. There are several data gaps with these counts:

- It is impossible to know if these vessels were used, and if so, where
- Vessels registered in other countries are not included
- Military vessel information is not available

*Supplementary data was obtained from ENS Shannon Young with Domestic Vessel Inspections, USCG Sector Virginia, August 2, 2021 providing vessel counts from commercial vessels known to have been in the Bay in 2019 via vessel inspections conducted by the USCG. These totaled 4,292 and are listed in Table 3. These counts include only inspected vessels, not all vessels entering the Bay. These counts also do not include vessels transiting through the Bay headed into or out of Baltimore. These counts include foreign and US flagged vessels however, the majority of cargo and tanker vessels in the inspected USCG list are foreign flagged vessels.

Being able to combine all data into one consistent dataset of vessels using the Bay is a challenge!

The AIS data identifies those commercial vessels using the Bay in real-time by land-based transponders communicating with the vessels. (The spatial characterization of AIS vessel groups is discussed later in the Pump-Out section of this report). The number of individual commercial vessels in each vessel group in the AIS data stayed relatively consistent

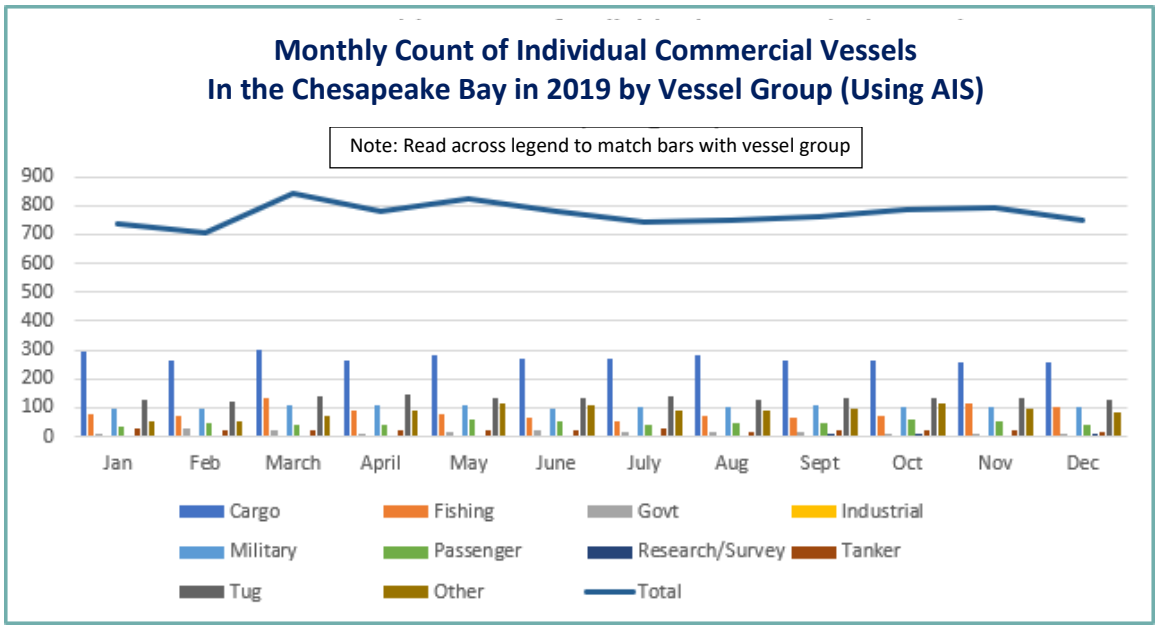


Figure 1. Monthly count of individual commercial vessels in the Chesapeake Bay in 2019 by vessel group

in the Bay throughout 2019, with a slight overall increase in spring and decrease in winter (see Figure 1). This may indicate that the community of vessels is stable or it could mean that the AIS receivers are consistently collecting data from those same vessels that reliably have their AIS on and functioning, and the others are "going under the radar."

Vessels arriving into the Bay not equipped with AIS (or have it turned off) from areas outside of Virginia, such as Maryland, North Carolina, anywhere along the East Coast or internationally represent a data gap in this study. There is no way to know (without AIS) what vessels from these other areas are using the Bay; no datasets exist for these vessels.

[2] Meeting the minimum criteria described in Table 1.

Vessel Locations

Vessel numbers by themselves are only partially informative. The number of arrivals of a vessel to the Bay, where the vessel travels, and how long a vessel stays in the Bay is important in the assessment of adequate pump-out facilities and/or services; and potential identification of any challenges in providing them. Commercial vessels busily and continually travel into and out of the Virginia portion of the Bay on a daily basis arriving from and traveling to Maryland waters, the Intercoastal Waterway (ICW), and the Atlantic Ocean, to move up and down the East Coast and around the world. Some vessels such as certain tug boats and passenger vessels stay primarily in the Bay on a constant basis. Arrival frequency and duration of stay of each of the varied groups of commercial vessels using the Bay on a yearly basis are data gaps of this phase of the project and are recommended as essential elements for any potential Phase II. This information is a permanent data gap in reference to the DWR registered and USCG documented vessels where it is impossible to determine due to no data. Density track lines of AIS vessel activity have been determined for some vessel groups and are discussed in the individual vessel group sections of the Commercial Pump-Outs portion of this report.

DWR & USCG Vessel Locations

As already mentioned, the best spatial characterization obtainable of vessels identified in the DWR and USCG data is the association with a locality in Tidewater, Virginia. Figure 2 illustrates the total number of registered (DWR) and documented (USCG) vessels in 2019 by locality, as well as the variation of vessel counts in each locality shown by the gradated colors; the darker the color, the greater the number of vessels. The localities adjacent to the waterways have the greater number of counts as compared to the minimal number of vessel registrations/documentations inland. These datasets do not provide information to spatially characterize vessels in the waterway. These vessels are assumed to be using the Chesapeake Bay and its tributaries. The lack of information to depict the spatial distribution of these vessels in the waterway is one of the major data gaps of this study.

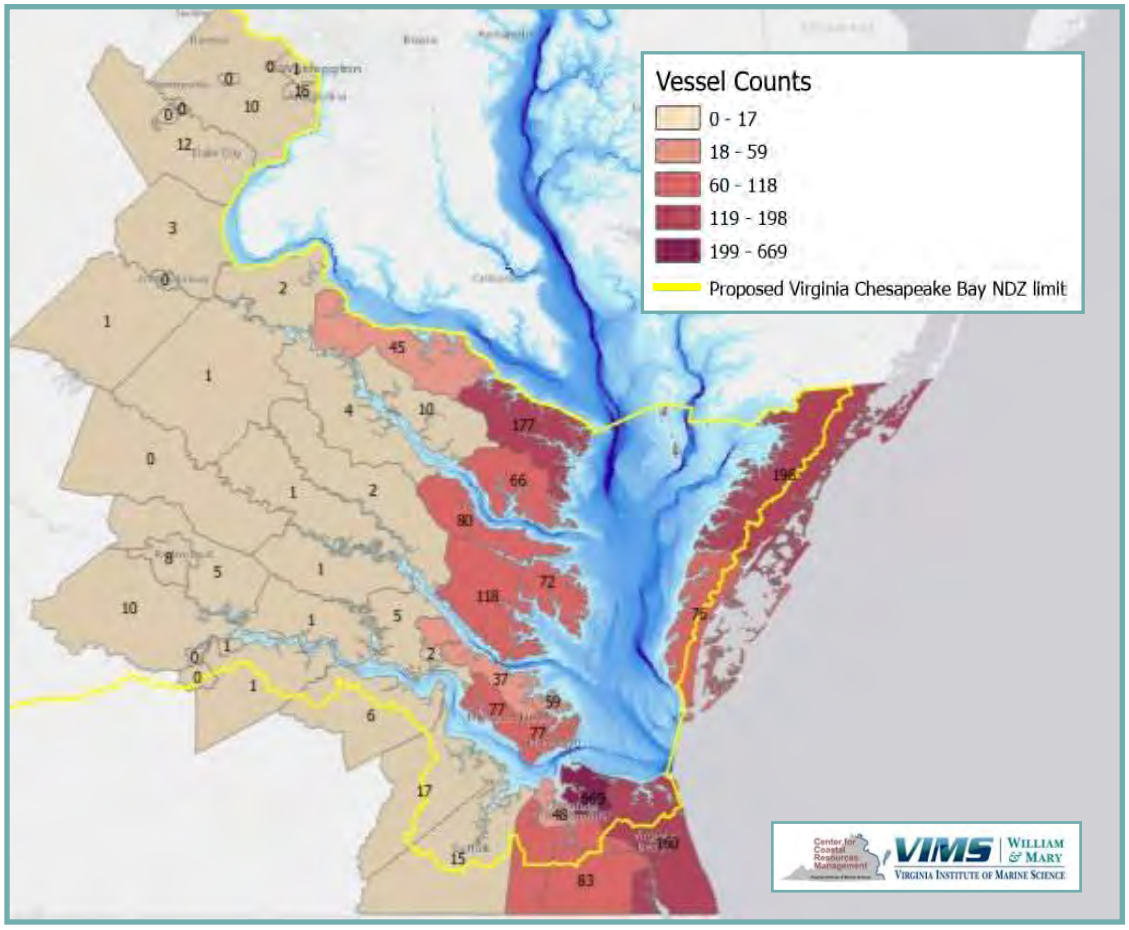
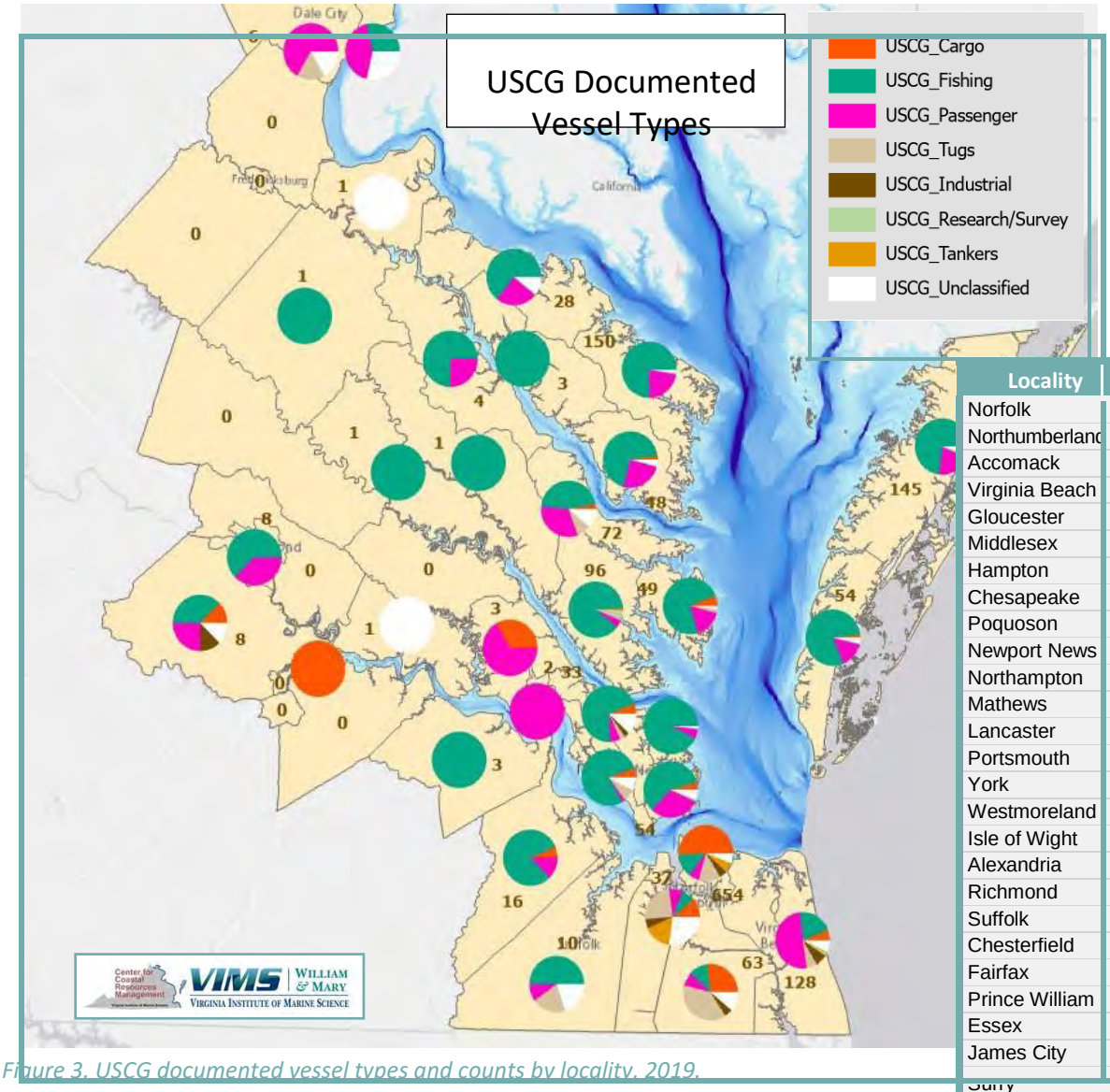


Figure 2. Total counts DWR & USCG vessels by locality in 2019

Figure 3 illustrates the distribution of vessel types **documented by the USCG** in each locality. The colors in the pie charts shown on the map in the approximate center of a locality indicate the propotion of different vessel types documented in that locality. The number shown near the center of a locality is the total number of documented vessels in that locality.

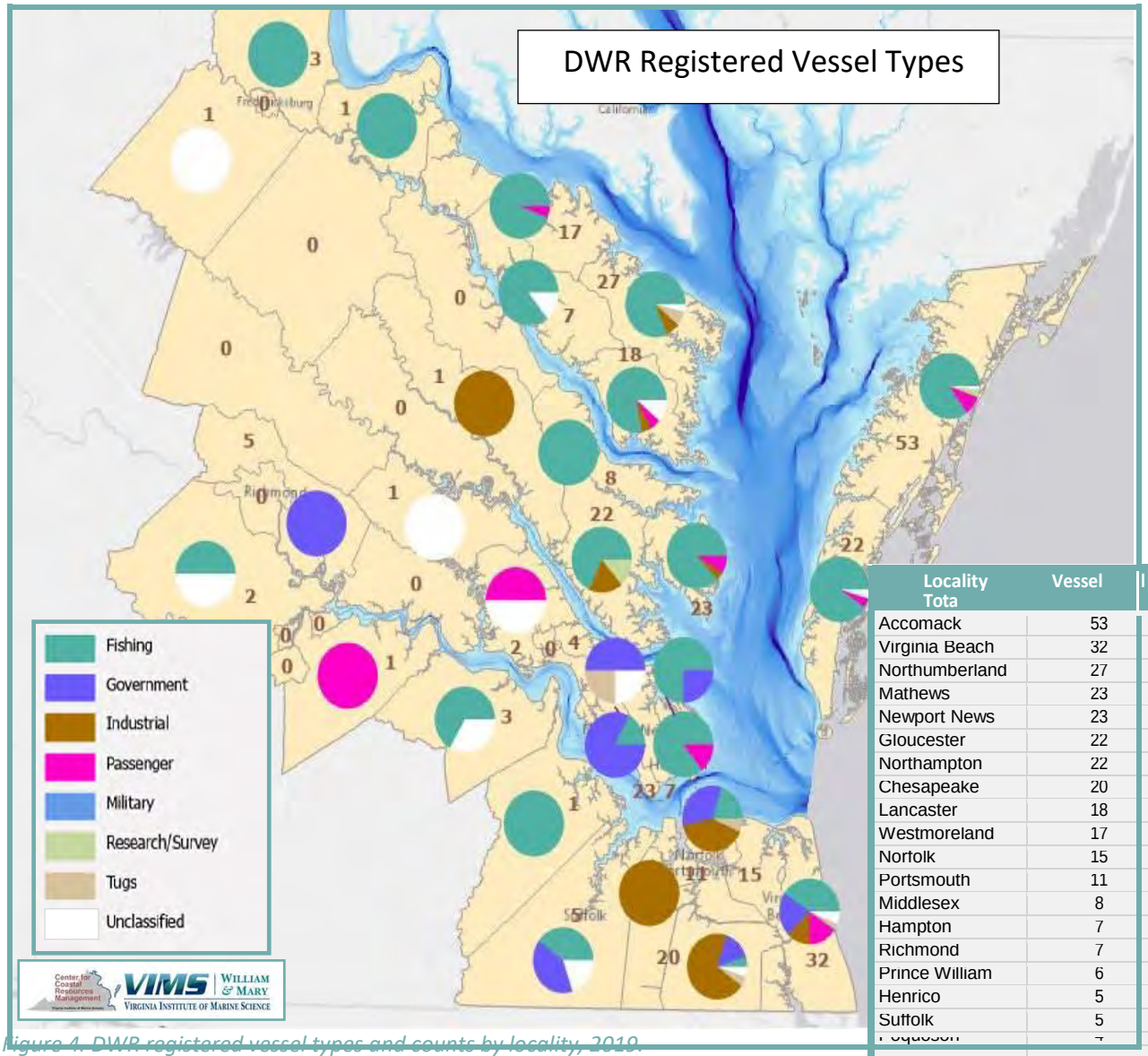


Locality	Vessel Total
Norfolk	654
Northumberland	150
Accomack	145
Virginia Beach	128
Gloucester	96
Middlesex	72
Hampton	70
Chesapeake	63
Poquoson	55
Newport News	54
Northampton	54
Mathews	49
Lancaster	48
Portsmouth	37
York	33
Westmoreland	28
Isle of Wight	16
Alexandria	13
Richmond	11
Suffolk	10
Chesterfield	8
Fairfax	7
Prince William	6
Essex	4
James City	3
Surry	3
Williamsburg	2
Arlington	1
Caroline	1
Charles City	1
Hopewell	1
King and Queen	1
King George	1
King William	1

Figure 3. USCG documented vessel types and counts by locality, 2019.

The USCG map indicates the South Hampton Roads area, in the vicinity of Norfolk, Portsmouth, and the Elizabeth River, has a higher number of documented tugs compared to other areas around the Bay. The pink pie chart in James City County most likely highlights the documentation of the VDOT Jamestown-Ferry system vessels. Fishing vessels appear to be the most commonly documented vessel in the majority of other localities, with passenger vessels coming in second.

The distribution of vessel types **registered by VA DWR** are illustrated in Figure 4. The industrial vessels dominate in the South Hampton Roads area and fishing vessels dominate in the majority of localities bordering the Bay. The government vessels can be seen on Figure 4 indicated in blue; these smaller government vessels tend to be registered *by DWR vs documented by the USGC.*



Locality	Vessel Tota
Accomack	53
Virginia Beach	32
Northumberland	27
Mathews	23
Newport News	23
Gloucester	22
Northampton	22
Chesapeake	20
Lancaster	18
Westmoreland	17
Norfolk	15
Portsmouth	11
Middlesex	8
Hampton	7
Richmond	7
Prince William	6
Henrico	5
Suffolk	5
[illegible]	[illegible]
York	4
Alexandria	3
Fairfax	3
Stafford	3
Surry	3
Chesterfield	2
James City	2
Isle of Wight	1
King and Queen	1
King George	1
New Kent	1
Prince George	1
Spotsylvania	1

Figure 4. DWR registered vessel types and counts by locality, 2019.

AIS Vessel Locations

Vessels with AIS can be spatially characterized. Since commercial vessels are so varied and their pump-out options dependent upon their unique characteristics, operations, and the areas they frequent, the locations of the AIS vessel groups are discussed in the Commercial Pump-Out section of this report.

Commercial Pump-Outs

Section 312 of the Clean Water Act requires all vessels equipped with installed toilets operating on U.S. navigable waters to have a US Coast Guard approved/certified marine sanitation device (MSD) on board to treat sewage to approved standards or store it until it can be pumped out at an appropriate location. The discharge of treated sewage is allowed within 3 nautical miles of shore, except in designated No Discharge Zone areas. Untreated sewage may be discharged beyond 3 nautical miles from shore out at sea.

There are three types of permissible MSDs; Type I, Type II, and Type III. Type I and II are flow-through devices that treat sewage at different standards and then discharge into the waterway. Type III is a holding tank that stores sewage until it can be discharged at sea or pumped out at an appropriate facility on land. Vessels 65 feet and under may install a Type I, II, or III MSD. Vessels over 65 feet may install a Type II or III, but not Type I. Requirements apply to recreational and commercial vessels alike.

Vessels with no toilet facilities are not required to have a MSD on board and therefore NDZ requirements are not applicable. If a toilet is installed on a vessel that only has a Type I or Type II MSD on board, operators are prohibited from discharging these in an NDZ. If disposal of sewage would be necessary by these vessels in an area designated an NDZ, the vessel would need to be retrofitted to install a holding tank (Type III) to store sewage on board until the vessel was located outside of the NDZ or the sewage could be pumped out at an appropriate facility.

The commercial vessels equipped with Type I and Type II MSDs that generate sewage on a regular basis are the vessels that will be most impacted by an NDZ designation in the Bay and its tributaries. Information as to the type of MSD on board different vessels is not documented anywhere. This information is essential in determining which vessels would be negatively impacted if an NDZ were implemented. The registration and documentation processes do not collect information on the MSD on board a vessel. AIS does not collect the information in its vessel characteristics. The Virginia Maritime Association does not collect it. The American Waterways Operators does not collect it from their members. No source was found to house this data. This is a huge data gap for this project. Since commercial vessels are so varied and their uses diverse, even vessels within the same vessel type will have an assortment of various sewage systems making it challenging to identify vessels that may be affected by an NDZ designation.

Pump-Out Facilities

The Virginia Department of Health (VDH) Marina Program maintains information on the stationary pump-out facilities located across the Tidewater localities, primarily at marinas. This pump-out location dataset was obtained from Preston Smith, VDH Marina Programs Manager (Preston.Smith@vdh.virginia.gov), provided in Excel and entitled "Official Guide to VA Pump-Outs." Many of these pump-outs were funded by the Clean Vessel Act (CVA) Grant which provides financial assistance for the installation of sewage pump-out facilities for recreational vessels and use by military, commercial, or government is prohibited.

Some pump-outs in the data were identified as not being CVA funded. DEQ contacted some of these facilities to identify those that serve commercial vessels. In addition, conversations with vessel operators contacted indicated they used stationary pump-outs at the following locations: Bluewater Yachting Center, Hopewell City Marina, Portsmouth Boating Center, Custom's House Marina, Waterside Marina, Old Point Comfort Marina, Severn Yachting Center, and Norfolk Yacht and Country Club Marina. Some vessel operators use private pump-outs at their own facilities.

There are few *public*, stationary pump-outs available to commercial vessels in the Virginia portion of the Chesapeake Bay, as illustrated in Figure 5. See Table 4 for a list of the facilities and their locations serving commercial vessels identified in this study.

While many commercial vessels are too large to use pump-outs designed for recreational vessels, the smaller commercial vessel types such as fishing charters, search and rescue, law enforcement (local, marine, and conservation), fire boats, pilot vessels, port tenders, and local government vessels can easily access these pump-outs.

Unfortunately, there are minimal pump-outs identified available for commercial vessels on any of the main tributaries of the Bay. The facilities available on the Potomac River are useful, however the Potomac River is part of Maryland and located outside the limits of the proposed NDZ.

Stationary Pump-Outs

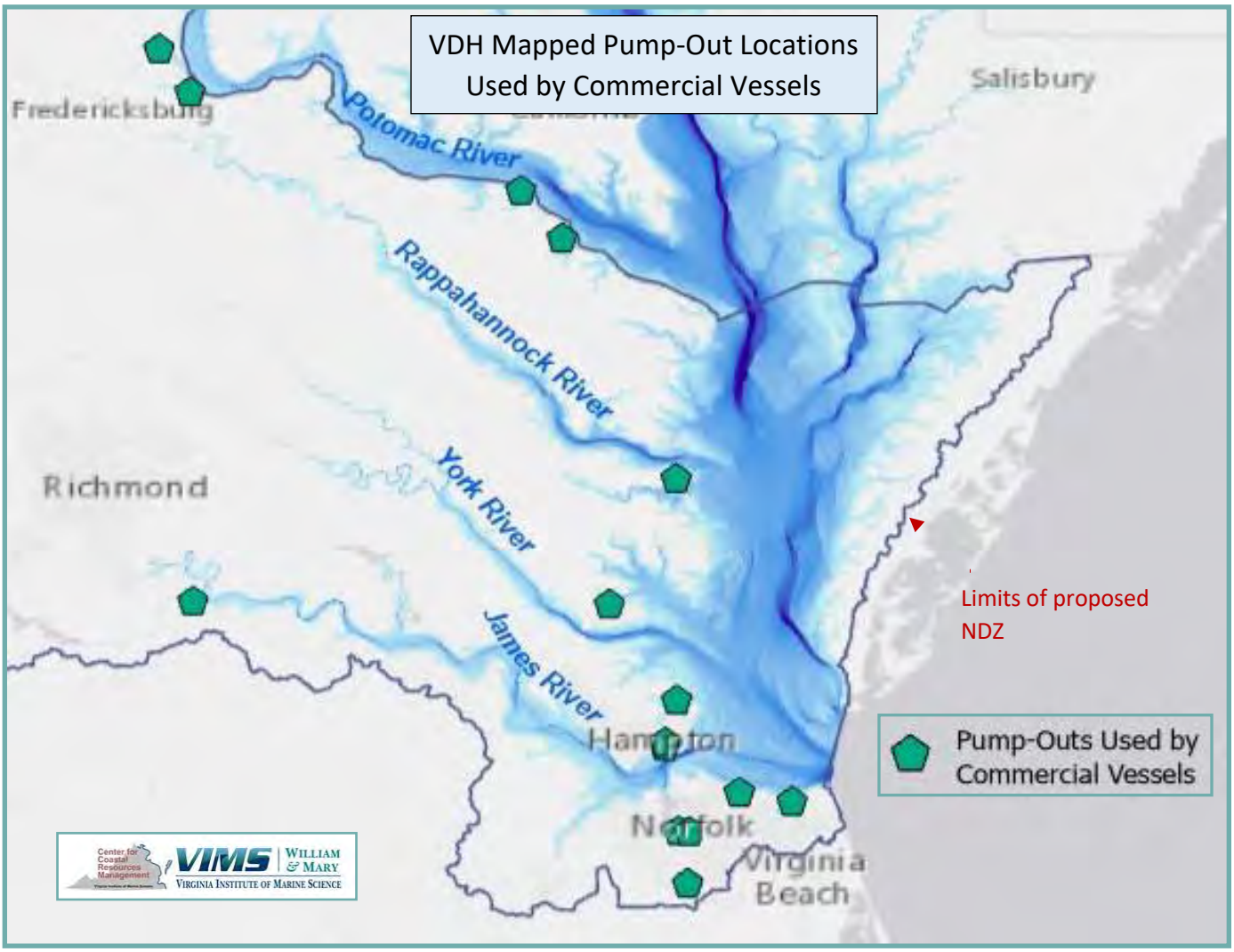


Figure 5. VDH mapped pump-outs allowing commercial vessels

Identified Pump-Out Locations Serving Commercial Vessels		
Facility	Address	Waterway
Bluewater Yachting Center	15 Marina Rd, Hampton, VA	Hampton River
Coles Point Marina	190 Plantation Dr, Hague, VA	Potomac River
Custom's House Marina	710 Settlers Landing Rd, Hampton, VA	Hampton River
Fort Belvoir Marina	5465 Hudson Rd, Fort Belvoir, VA	Dogue Creek off Potomac River
Hopewell City Marina	1051 Riverside Ave, Hopewell, VA	Appomattox River
Lynnhaven Municipal Marina	3211 Lynnhaven Dr, Virginia Beach, VA	Lynnhaven River
Messick Point Landing	413 Messick Road, Poquoson, VA	Back River
Morningstar Marina	8166 Shore Dr, Norfolk, VA	Little Creek
Old Point Comfort Marina	100 McNair Dr, Hampton, VA	Hampton Roads/Fort Monroe
Norfolk Yacht & Country Club	7001 Hampton Blvd, Norfolk, VA	Lafayette River
Portsmouth Boating Center	1244 Bay St, Portsmouth, VA	Elizabeth River
Sandy Point Marina	1276 Skip Jack Rd, Westmoreland, VA	Potomac River
Severn Yachting Center	3398 Stonewall Rd, Hayes, VA	Severn River
Timberneck Marina	970 Timberneck Rd, Deltaville, VA	Broad Creek off Rappahannock River
Top Rack Marina	5532 Bainbridge Blvd, Chesapeake, VA	Elizabeth River
Waterside Marina	333 Waterside Dr, Norfolk, VA	Elizabeth River
Waugh Point Marina	5180 Waugh Point Rd, King George, VA	Potomac Creek off Potomac River
Willow Landing Marina	121 Willow Landing Rd, Stafford, VA	Aquia Creek off Potomac River

Table 4. Identified pump-out locations serving commercial vessels

Reviewing all pump-out records in the VDH pump-out data for accuracy and/or completeness was beyond the scope of this project. A thorough, in-depth, updated inventory of stationary pump-outs available and/or potentially available to commercial vessels is recommended if a Phase II of this study is conducted. Based on the VDH data, there are over 200 miles of waterway where public, stationary pump-out facilities are not available to commercial vessels.

In a conversation with Preston Smith, he noted that he believed it would be permissible for fishing charter boats to use the CVA grant funded pump-outs with the rationale that these grants receive funds from the sale of recreational fishing gear and other associated items, which charter fishing vessel owners must purchase to run their business.

Conversations with some operators of smaller commercial vessels indicated they don't, or rarely, pump-out out since they use facilities on land, are only on the vessel a limited time, or only one or two people are aboard the vessel. From discussions with the Virginia Pilots Association, a harbor pilot, the Virginia Police Department, local fire departments, and local governments, an NDZ would most likely not affect the smaller vessels that were configured similar to recreational vessels. Vessels such as fire and search and rescue boats used for specific purposes on a limited basis; vessels used for short trips such as by the Virginia Pilots Association who use vessels to take a harbor pilot out to and back from a ship; and organizations that have access to and availability of facilities on land such as VMRC, DWR, and local police did not feel an NDZ would impact them.

The smaller commercial vessels that currently discharge and would need to use a pump-out would be impacted by an NDZ. To increase the availability of pump-out facilities for these vessels, identifying additional non-CVA grant funded pump-outs that may be able to allow commercial vessels is a recommendation. However, there appears to be a data gap in how many of these vessels exist. The stakeholders who indicated they currently discharge were primarily from the larger type vessel groups that may not easily access the design of a stationary pump-out at a marina.

Creating a similar grant program to the CVA grant that would provide funds to install additional pump-outs that serve smaller commercial vessels is also a recommendation.

Public and Private Commercial Fishing Facilities

The Newport News Seafood Industrial Park (SIP) according to their website is one of the nation's premier seafood harbors. The SIP is owned by the City of Newport News. According to Harbor Master Doreen Kopacz, the facility has a stationary pump-out, but due to disuse, it is no longer functioning. This was also the case at the boat basin of the Virginia Institute of Marine Science (VIMS) where the pump-out is no longer functioning due to disuse. Andy Hall, General Manager of Omega Protein, the largest U.S. producer of fish meal and fish oil derived from harvested menhaden stated they have a pump-out at their facility but do not use it. Bill Wells, owner of the Seaford Scallop Company also indicated they had a pump-out at their facility, but did not use it. These pump-outs are not used since the vessels at these facilities go out to sea on a regular basis or the vessels have MSDs that discharge treated waste. These pump-outs are not open to the commercial vessel public.

Shipyards and Military Installations CHT Connections

Many, but not all, local shipyards and all military installations have piers with Collection, Holding and Transfer (CHT) connection points that attach with hoses and special fittings to the CHT tank, the sewage holding tank on a ship and discharge sewage directly to the Hampton Roads Sanitation District wastewater facility. Depending on the design of a vessel's system, the sewage in the CHT tank can be raw, treated, or a mixture. A vessel at pier side connects a special fitting on a hose to the ship's holding tank to the CHT connection at the pier to discharge sewage directly to the sanitary sewer line. This wastewater discharge is metered (and charged) by HRSD. These connections are privately owned by the shipyard or owned by the federal government such as the Navy and Coast Guard.

Directly discharging in the waterway at the dock is not usually permitted. A ship may connect to a CHT connection to discharge if there is a connection at the pier where they are located. If there is no CHT connection at that specific pier or the connection is broken, a mobile septic pump-out service must be hired to transfer the sewage from the ship to the nearest connection. These connections are not public or open to any vessel; permission is required. If permission is not granted, a mobile septic pump-out service must be hired.

Todd Schaubach with Shipboard Services indicated few facilities will allow others to discharge their sewage at their facility, but added a few private facilities occasionally allow others to use their CHT connections; Northrop Grumman, BAE Systems, and Accurate Marine Environmental (wastewater treatment facility). These connections require HRSD permits that have limitations and parameters these companies are responsible for regarding these connections, so permission is not always granted and has been less frequent in the last several years.

Mobile Pump-Out Services

Many commercial vessels in the Chesapeake Bay use a mobile pump-out service. There are two types of these services: land-based and aquatic. The majority of mobile pump-out services are land-based because they are less expensive and require less logistics, therefore preferred if necessary. Land-based pump-out is by truck at pier or dockside. The truck can be a vacuum truck, a tanker, or tractor trailer set up. Trucks either suck out the sewage from the vessel or the vessel pumps the sewage to the hauler.

According to the commercial mobile pump-out companies contacted, a 5,000-gallon septic truck can service a large 30,000-gallon cargo ship by sending multiple trucks and pumping trucks in tandem, or using larger tanker trucks. Surprisingly, the volume to be pumped is not an issue, it's more of the size of the vessel and the inability to physically connect. The limitations for land-based mobile pump-outs are dock access and availability for both the vessel and the hauler. Sometimes permission or ID Badges are required, the dock needs to be open, and configuration must allow the truck sufficient access to connect to the vessel. Of course, the vessel must be able to access the dock and the dock should be within reasonable distance to the vessel's current location.

Many haulers indicated that treated waste from vessels can be an issue. This waste is required to be tested and can sometimes have a chemical or chlorine level a wastewater plant does not want in their facility. In these cases, the sewage must be treated in some way before the wastewater treatment plant will accept it. This process can sometimes take days and the hauler may have to store the sewage in the truck, which is then not usable for other jobs. It is never a guarantee that pumped sewage will be accepted. (This is usually not the case for raw sewage). Some haulers indicated the process to discharge sewage to a wastewater facility can be difficult.

The other type of mobile pump-out for commercial vessels is aquatic. This involves a barge equipped with storage tanks pulled or pushed by a tug. This option is used by large military vessels, cruise ships, and cargo ships anchored in the Bay. This is not a desired option for many commercial vessels since it is extremely expensive. Three companies were identified that provide mobile pump-out by barge: Cape Henry Launch, Accurate Marine Environmental, and Shipboard Services. Table 5 lists the mobile pump-out companies serving commercial vessels identified in this study, however there are additional companies providing mobile pump-out services in the Bay. The majority of the companies contacted are located in Hampton Roads (Portsmouth, Norfolk, Virginia Beach, and Chesapeake) and most stated their service area was the Chesapeake Bay; however, the cost increases the further the service must travel. Identification of mobile pump-out companies located on the tributaries of the Bay and near Richmond is a data gap in this study.

There are so many cost variables associated with a mobile pump-out that cost estimates were difficult to obtain. How far does the hauler need to travel to access the vessel? How many people are needed for the job; a driver is needed as well as people to assist with any spills or other logistics of the pump-out. How long will it take? How many trucks are needed? How many gallons are to be pumped? Can the sewage be disposed of or does it need to be held in a truck until required testing of the sewage is completed? Many haulers said once the sewage is transferred to the truck, a hauler can't just arrive at HRSD or other treatment facility and discharge. It can be 3 or 4 days before the sewage is accepted to be taken. Then there is the disposal fee based on the volume of sewage. Aquatic mobile-pump out by barge is very expensive and incurs the cost of operating a tug. The cost of pump-out is a data gap in this study.

No aquatic mobile pump-out service for commercial vessels using a boat, instead of a barge, was identified. This is primarily due to the fact this service would not be feasible, nor safe, during rough seas or weather where sewage could be spilled and the pump-out vessel may get damaged up against a larger vessel. This service may be an option for smaller commercial vessels such as charter fishing or some passenger boats.

Commercial Vessel Mobile Pump-Out Companies	Address	Phone	Services	Disposal
Accurate Marine Environmental	3965 Burtons Point Rd, Portsmouth, VA	757-393-5840	Pump-out by barge; pier side; wastewater treatment; most vessels up to 500 ft (draft is limiting)	HRSD
Blue Ridge Tank Cleaning Inc	803 Seaboard Ave, Chesapeake, VA	757-482-7001	Pump-out pier side; ships & tugs	HRSD or Accurate Marine Environmental
C.S. Hines Septic	1828 Mt Pleasant Rd, Chesapeake, VA	757-482-7001	Pump-out pier-side; any vessel	HRSD or Land (spray) application
Cape Henry Launch Service Inc	3112 Lynnhaven Dr, Virginia Beach, VA	757-412-2700	Pump-out by barge; ships and military vessels	HRSD or Accurate Marine Environmental
Clean Harbors	7545 Harvest Rd, Prince George, VA 23875	804-796-6994/757-390-9758	Pier-side; can arrange to use barge; tankers, vacuum trucks; all vessels	HRSD, local wastewater treatment plants
Coastal Services (Hampton Roads Marine Services)	805 Ford Dr, Norfolk, VA	757-488-4244	Pump-out pier-side; ships & tugs	HRSD
Shipboard Services	1512 Technology Drive, Chesapeake, VA	757-778-7174	Barge; Port pier-side tanker truck; vacuum truck; any vessel	HRSD

Table 5. Commercial vessel mobile pump-out companies identified serving the Chesapeake Bay

The data gaps in this study do not allow for the use of calculations to determine pump-out adequacy and needs. However, based on the information collected, the need for additional mobile pump-out services appear necessary for certain vessel groups, especially tugs, if an NDZ were implemented. The good news, septic haulers stated if the market made it economically feasible, more pump-out trucks would be in service. The bad news, many vessel operators stated that mobile pump-out is expensive, and even more expensive if it has to be done on a frequent basis.

The capacity of HRSD or other wastewater plants to accept the unknown additional amount of sewage that would be generated by an NDZ designation is another data gap in this analysis. Chris Carlough, Pollution Prevention Manager at HSRD, stated it is difficult to determine not having data and knowing the content and volume of the future sewage. For example, if copper were to elevate in the system (since copper is contained in CHT waste), this could be a problem. HRSD has maximum allowable hydraulic load designations for different pollutants coming into the facility. Increased amounts of sewage coming into the facility could change things. An increase in international sewage would also be a question regarding impact to the wastewater treatment facility.

Pump-Out Needs of Commercial Vessels

Recreational vessels with installed toilets tend to be more uniform in 1) size, 2) number of persons on board, and 3) volume of sewage produced than commercial vessels. The needs of a recreational vessel for access and use of a pump-out are generally consistent. This is not the case for commercial vessels. The characteristics of commercial vessels are extremely varied and not necessarily consistent among similar vessel uses. Vessel size and draft vary between vessel types, and number of crew, number of passengers, volume of sewage produced and other characteristics can vary among the same vessel type and even on the same vessel depending on the current use. This variation directly affects the type of pump-out facility a commercial vessel can access. That is why the remainder of the pump-out discussion is divided by vessel group.

Cargo Ships and Tankers

Cargo ships are vessels that carry packaged, dry cargo, merchant goods and other materials from one port to another around the world. In the Chesapeake Bay, the largest port is the Port of Virginia that is comprised of 6 terminals. The two classes of vessels primarily using the Port include cargo ships and harbor craft (pilot boats and tug boats). There are a variety of vessels that are considered cargo ships including but not limited to barge carriers, bulk carriers, cargo barges, general cargo, vehicle carriers, roll-on/roll-off (RoRo), and container ships (the most popular to frequent the Chesapeake Bay). Tankers are basically cargo ships that carry petroleum and other liquid goods. The majority of cargo ships are registered in foreign countries.

The 2019 AIS data from the Coast Guard does not provide complete, specific vessel class information. Many of the records for the Cargo vessel group use the general vessel class *Cargo, all ships of this type*. This will not allow a more specific characterization of the type of cargo ships using the Bay.

However, the Virginia Maritime Association published *Vessel Arrivals in Hampton Roads for 2013-2019* (See Appendix C) that provides the arrival totals for different types of cargo vessels arriving at the Port of Virginia. From these counts we know container ships make up the largest cargo vessel class going to the Port and from conversations with tug operators and others who make a living on the water, container ships are observed as the largest cargo ship type using the Bay.

According to the VMA arrival data, there were 2,327 vessel entries into the Port of Virginia from various cargo ships in 2019. The total entries into the Bay could be higher since cargo ships go to other ports, up to Baltimore, and destinations other than the Port of Virginia.

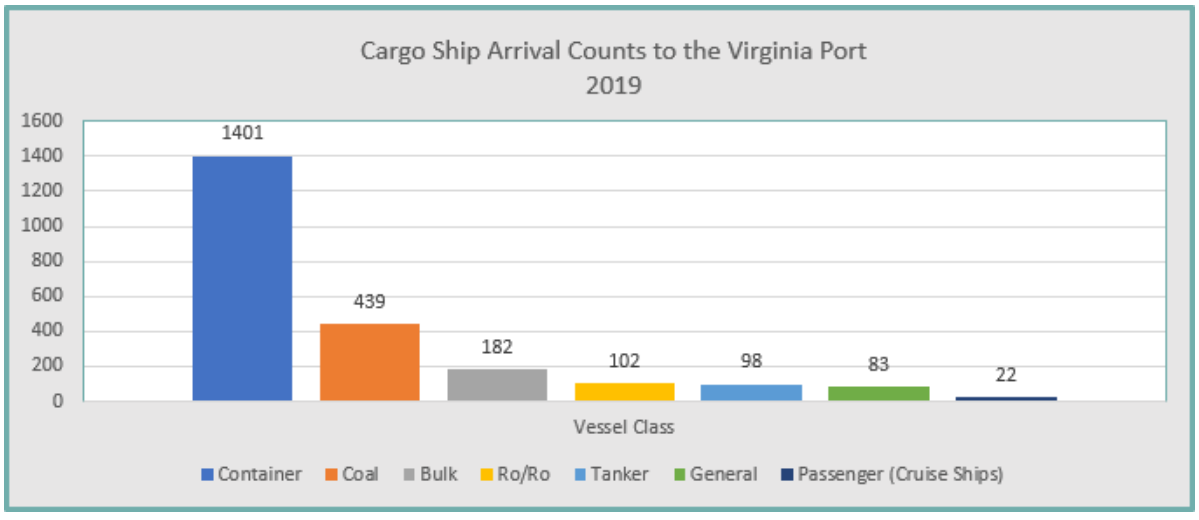


Figure 6. Cargo Ship arrival counts to the Port of Virginia 2019

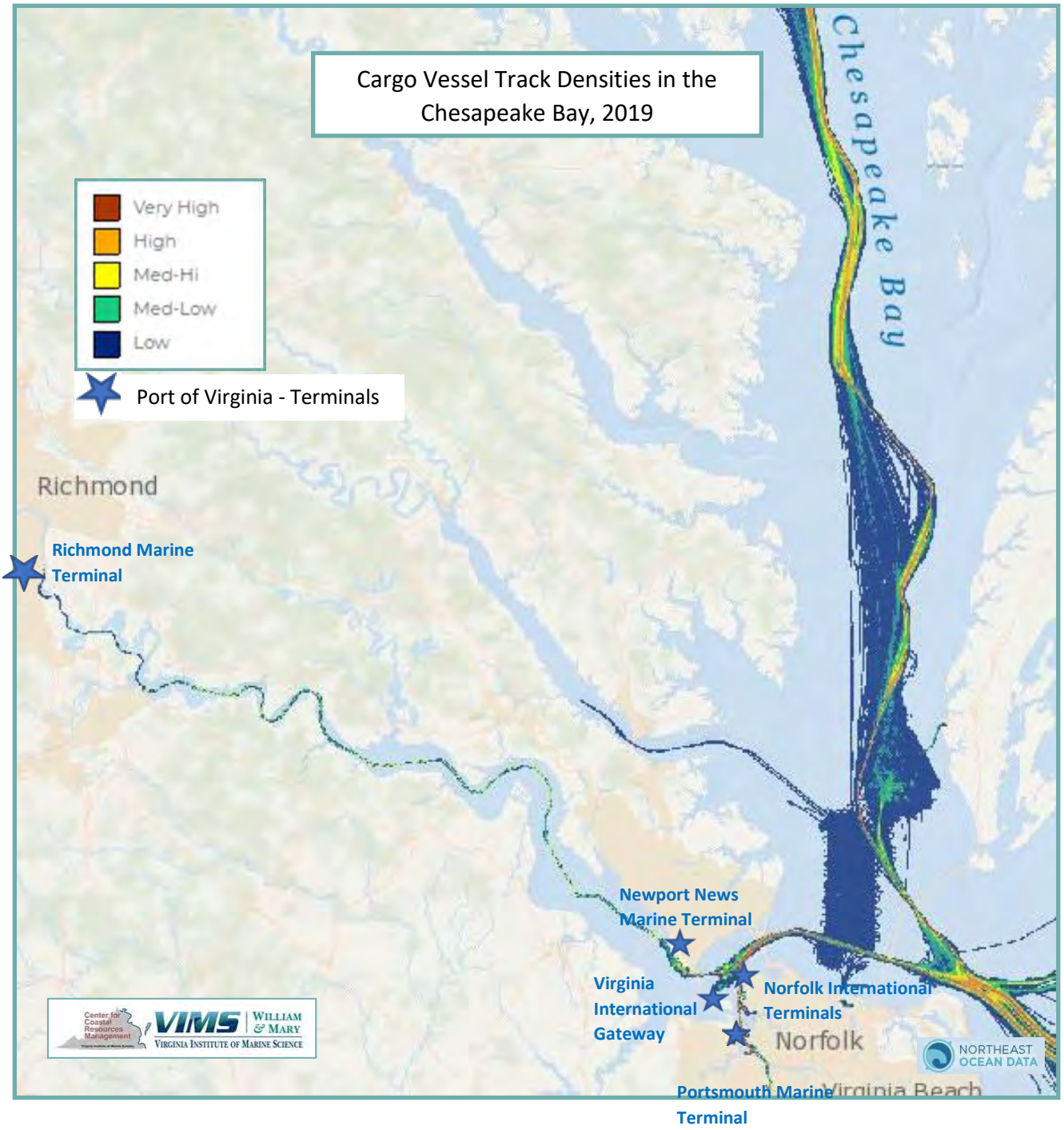


Figure 7. Chesapeake Bay cargo vessel track density, 2019

To visualize the areas frequented by cargo vessels in the Chesapeake Bay, Figure 7 illustrates the 2019 AIS cargo vessel transit counts calculated by the NorthEast Ocean Data portal. The data represent vessel transit counts in 100-meter grid cells. A single transit is counted each time a vessel track passes through, starts, or stops within each cell. The more heavily traveled tracks are colored in red and orange; medium in yellow and green; and lesser in blue.

Cargo ships enter the Bay and dominantly travel to the Port of Virginia (Norfolk, Portsmouth and Newport News) and travel north, up the main stem of the Bay.

The Virginia Maritime Association represents commercial vessels including cargo ships. Will Fediw, Vice President of Industry and Government Affairs at VMA, was asked for an estimate of how long these ships may spend in the Bay. According to Mr. Fediw, container vessels would typically be the only type of cargo vessel that is usually in and out of Virginia's port within 24-72 hours. All of the vessel traffic transiting up to Maryland (i.e. to Baltimore) would spend considerably more time in the Bay due to the northern transit and the type of cargo they would carry. For those cargo and tanker ships calling on the Port of Virginia, it depends on where they are going and what they are carrying. The time spent in the Bay by cargo ships is variable based on ship conditions, route, cargo load, and other issues.

The Pacific Maritime Association (PMA) states that most container/cargo and tanker vessels have a combination of Type II and Type III MSDs with holding times of about 1 to 3 days[3]. Under normal conditions they treat and hold sewage until it can be discharged out at sea. According to Will Fediw, roughly 25% (at least) of the annual vessel calls in the Port of Virginia over the last few years were vessels that can typically be at anchorage or at a facility up to several weeks. These vessels would then need services if their holding tanks were to reach capacity; it cannot be assumed that just because they will eventually go back to sea that they can wait until then.

A cargo ship at a terminal may need to be pumped if the system is down, can't process or hold sewage, or is in an area where discharge is not possible; discharging at the terminal is not desired. If a cargo ship is at anchorage and not at dock, a launch and barge service is used. This is very expensive due to logistics required for a tugboat to take a barge out to a vessel. Pumping pier side is cheaper. A cargo ship being repaired at a shipyard facility may have access to a CHT connection, but this is not guaranteed. If a ship cannot access a CHT, a mobile pump-out service is required.

No pump-out facilities exist at the Port of Virginia, with the exception of outside mobile pump-out services. Todd Schaubach with Shipboard Services provides mobile pump-out services to cargo ships at the Port, as well as other areas in the Bay. He and other mobile pump-out companies stated getting access to the Port or terminals can be a challenge. An ID is needed and terminal workers are union requiring non-union workers permission to work at the terminal. Pumping at a terminal can also be dangerous. Due to all of the loading and off-loading activity associated with a terminal, pumping in this setting can be hazardous. An NDZ designation may increase the need for pump-out at the Port and other areas if cargo vessels are no longer permitted to discharge while transiting the Bay. The ability of a cargo vessel to stay at the pier is also an issue. It costs to stay longer, and schedules are tight and unpredictable. Being pumped-out or waiting to be pumped-out may cause anchorage issues if berths and spots are not available. This could slow down the system, creating issues.

Mr. Fediw of VMA stated "any undue burden that increases the cost of doing business in the Port of Virginia could negatively impact the nearly $1 billion the Commonwealth has invested in our maritime infrastructure to increase business." Mr. Fediw further mentioned the concern of cargo vessels traveling to other ports, by-passing the Chesapeake Bay, to avoid the issues with an NDZ.

The Port of Virginia is a hot-spot for cargo vessels. If an NDZ were to be implemented, increasing frequency of mobile pump-outs (the current pump-out option at the Port) may pose safety and operational issues that could have large

[3] Phase 2 Commercial Vessel Sewage Management & Pump-out Facilities – Puget Sound No Discharge Zone for Vessel Sewage, November 2013, pg 3.

economic consequences. Shipyards and military installations have CHT connections pier side for large deep-draft ships to use to discharge directly to the sanitary sewer. A study of the cost, benefits, and feasibility of installing CHT connections at the Port of Virginia is recommended for Phase II of this project.

Tugs

Information provided on tugs is based on communication with tug operators, tug companies, The American Waterways Operators (AWO), mobile pump-out owners, and AIS data.

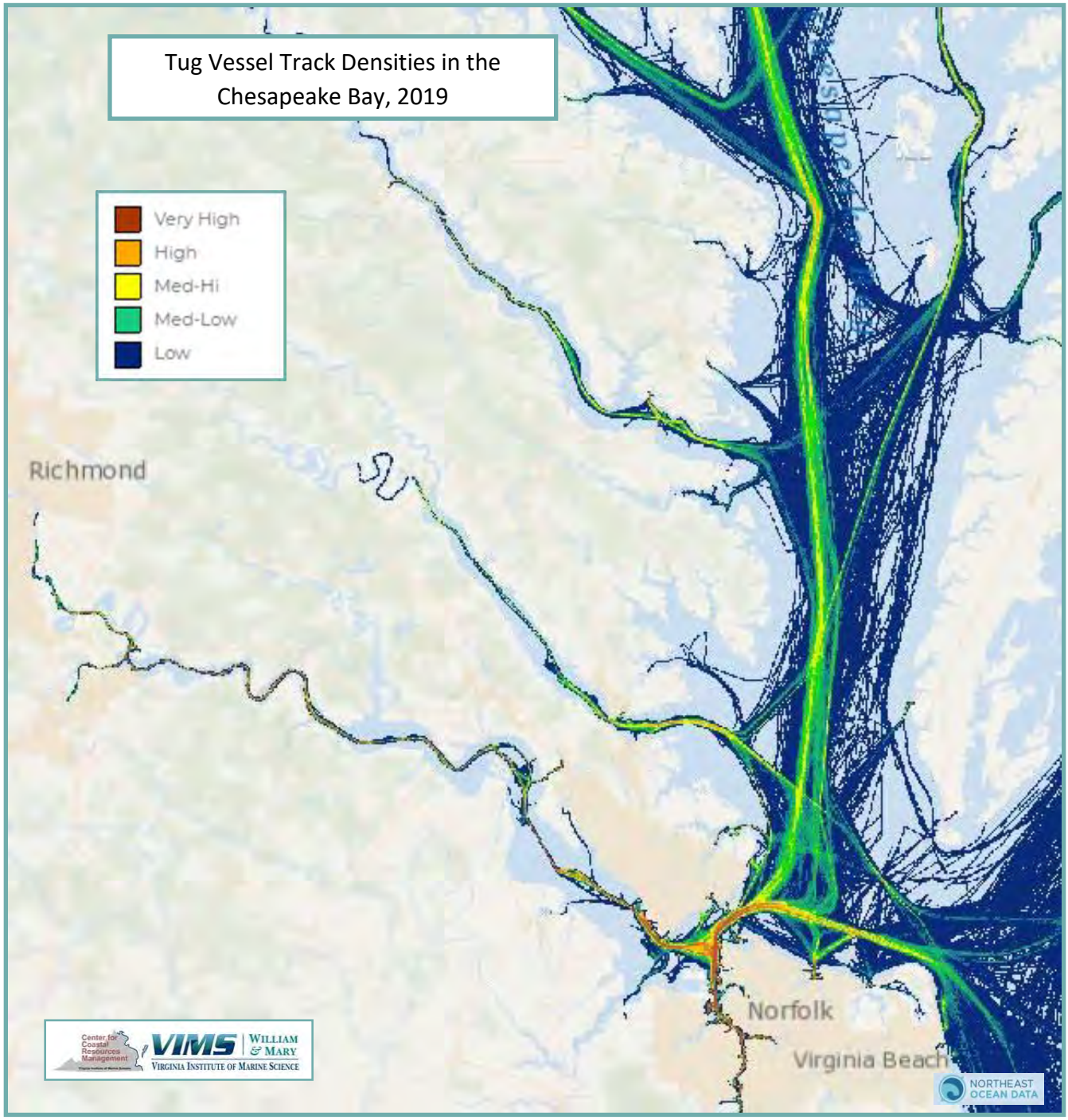


Figure 8. Chesapeake Bay tug vessel track density, 2019

A tug (tugboat, towboat) is a vessel that maneuvers other vessels by pushing or pulling them; with direct contact or a tow line. They assist ships into and out of port, move barges to transport cargo, move disabled vessels, and much more. AIS data captured 276 individual tugs working in the Chesapeake Bay and its tributaries in 2019.

Tugs that assist ocean-going ships into port stay in the Bay almost exclusively. Tugs transporting cargo by barge travel into and out of the Bay on a frequent basis. Tugs regularly push barges up the James River to Richmond and up the Bay to Baltimore. If a tug needs to wait on a berth to unload at a terminal, it may be necessary to anchor in the Bay until that berth becomes available. Tugs work 24/7; they are either working (pushing or pulling) or waiting. According to The American Waterways Operators (AWO), a national trade association for tugs and barges, towing vessels operate in all major tributaries of the Chesapeake Bay, and among the busiest are the York River, James River, and Elizabeth River. For ship assist work, tug boats will anchor in the Bay waiting on large vessels requiring navigation assistance into berths in Norfolk and other areas. Figure 8 illustrates the AIS vessel transit count densities for tug boats in the Chesapeake Bay in 2019.

Tugs are on the Bay 24/7 always working with an average 4-6 people on board at all times. Commercial tugs have Type I or Type II MSDs installed on board designed to treat their wastewater and discharge as needed. Less common is an additional Type III MSD (holding tank) on board. According to conversations with personnel at McAllister Towing and Moran Towing, tugs at both of these larger tug companies have holding tanks. However, most towing vessels are not equipped to hold sewage on board for any length of time; just a few days. Smaller working vessels do not have the available space within the vessel for a holding tank.

If an NDZ were to be implemented, tugboats would be the commercial vessel group most impacted by the designation. The two main challenges are cost and access. Most tugs do not have the equipment to allow them to pump-out. These vessels would need to retrofit with holding tanks and associated piping to have the ability. As stated earlier, smaller tugs do not have the space to install a holding tank. For those vessels where a tank could be installed, the cost of the vessel out of commission, design by Naval architects, installation of the required equipment, and vessel stability tests and other associated requirements to be able to return the vessel safely into service would be costly. The AWO estimated a cost of several hundred thousand dollars upwards to a million per vessel.

Once a tank is installed, there are limited pump-out facilities available for tugs in the Chesapeake Bay and its tributaries. It is important to note that tug operators typically do not have the flexibility to travel off-course or out of their way to use pump-out facilities. Stationary pump-out facilities tend to be designed for recreational vessels and are neither safe nor even logistically possible for tugs to access. In addition, the owners of these facilities do not want them there. Without stationary facilities available, mobile pump-out services would need to be hired. Due to the 24/7 working schedule of tugs, continually manned with crew, the frequency required for these services would be costly in time and money. CHT hookups are available at shipyards and military installations for tugs working at these facilities; however, these are private and are only available through coordination and permission from these facilities. Some larger tug companies pump-out at their own facilities.

According to Doreen Kopacz, Harbor Master at the Newport News Seafood Industrial Park, tugs boats stop over and stay a few days at their facility. While there they use mobile pump-out services. However, there is a non-functioning pump-out station at the Park; installing a new pump-out at this location to service tugs may be an option.

A potential option may be the provision of “permanent” barge pump-out stations anchored in the Bay for tugs to use while waiting for berths or ships; or placed in the more heavily traveled tributaries. The barges would need to be monitored and managed. The safety and logistics of this would also need to be investigated.

Passenger

Information for passenger vessels came from conversations with Kevin Maroney, Captain and Operations Manager of the Jamestown-Scotland Ferry; Brooke Smith with Rover Cruises; David Jordan, Elizabeth River Ferries; Todd Schaubach, Shipboard Services; Frank Rabena, Virginia Pilots Association; Maureen Hayes, Cruise Lines International Association (CLIA); Alan Alexander, York River Charters; Geraldine Galloway, Tangier Cruises; Stewart Lamerdin, Director of Marine Operations at VIMS; and AIS data.

Figure 9 illustrates the transit tracks frequented by passenger vessels in the Chesapeake Bay. The areas in red and orange indicate the heaviest traveled routes and yellow and green moderate traveled routes by passenger vessels determined by AIS data.

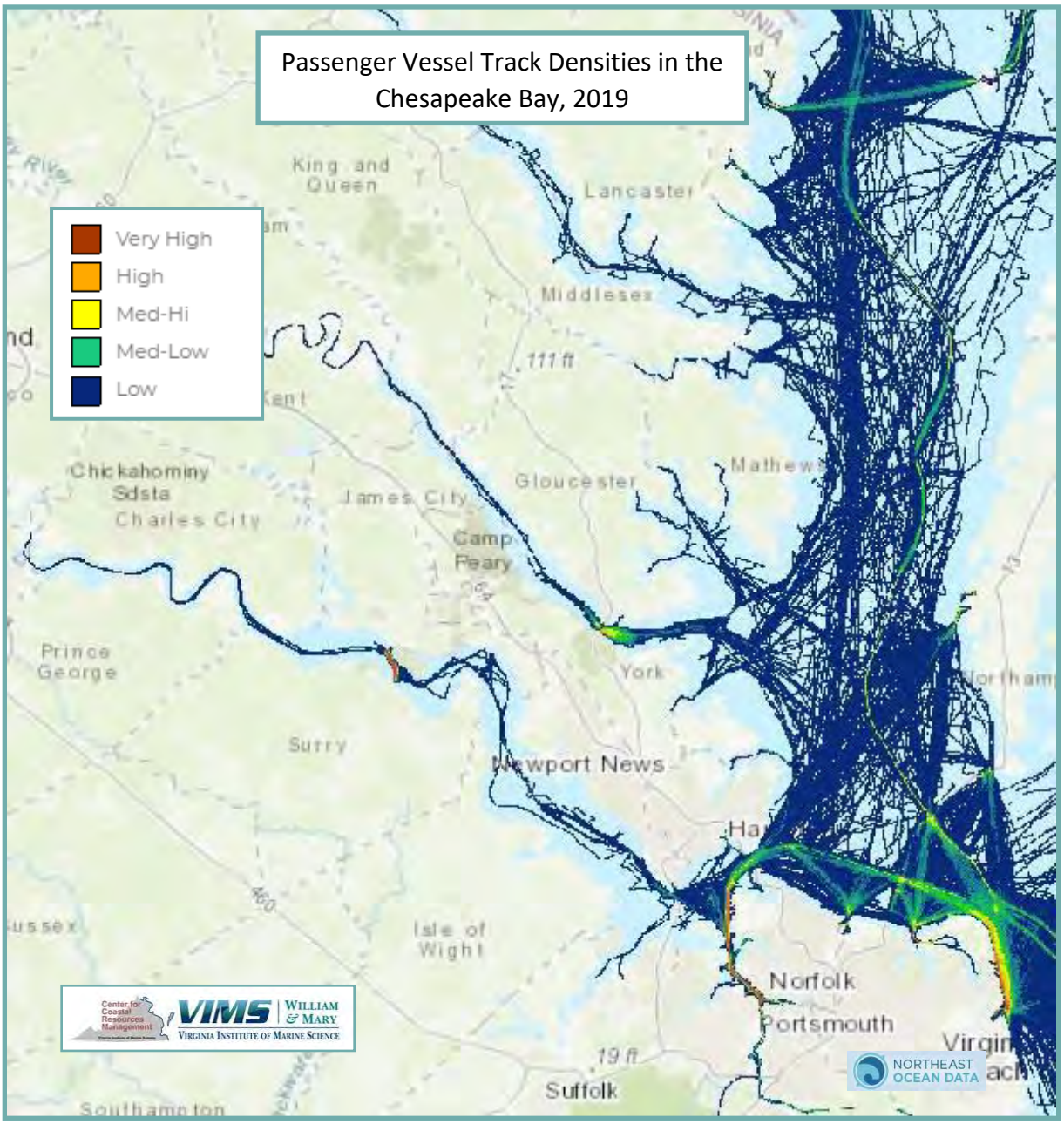


Figure 9. Chesapeake Bay passenger vessel track density, 2019

Commercial passenger vessels are designed and equipped primarily for the transport of people, instead of cargo. This vessel group has an assortment of vessel configurations ranging from large deep-draft cruise ships to small pilot vessels varying in number of people on board, trip duration, overnight accommodations, and purpose. There are numerous passenger type vessels throughout the Bay; it is beyond the scope of this project to inventory and assess the impact an NDZ would have on all vessels. However, a general indication of the ability of these vessels to comply with an NDZ designation is described below from the information collected from the vessel operators and owners contacted.

Smaller Passenger Vessels

Pilot vessels, port tenders, and diving vessels for the most part do not have or use MSDs due to short or limited trips. Charter fishing boats are generally already set up to pump-out and use the facilities at marinas. These vessels would generally not be affected by an NDZ, however there are always exceptions to these generalizations.

Ferries

There are several ferry systems that operate in the Chesapeake Bay. Ferries conducting short trips are not required to provide toilets, therefore do not have MSDs onboard and would not be affected by an NDZ designation. These include the Elizabeth River Ferries that cross the Elizabeth River from Norfolk to Portsmouth, the VDOT Merry Point Ferry that crosses the Corrotoman River in Lancaster County, and the VDOT Sunnybank Ferry that crosses the Little Wicomico River in Northumberland County.

Ferries that have installed toilets on board do need to comply with an NDZ. The Chesapeake Breeze is a 150-passenger ferry providing transportation to Tangier Island every day from May - October leaving from Buzzard's Point Marina and returning to Reedville. The trip is about 1 ½ hours. The vessel has a holding tank and uses a mobile pump-out service for pump-out. Compliance is not an issue for vessels that already have existing holding tanks and pump-out capabilities.

The VDOT Jamestown-Scotland Ferry System provides service across the James River to and from Route 31 near the Jamestown Settlement to Scotland, Virginia in Surry County. The free ferry service operates 24 hours a day, 365 days a year, including holidays and can carry up to 444 passengers. This system has four vessels, each equipped with a Type II MSD that treats the sewage and discharges into the waterway; no holding tanks are on board. If an NDZ were implemented, all vessels would need to be retrofitted to be able to hold and pump-out sewage. Kevin Maroney, Captain and Operations Manager of the Jamestown-Scotland Ferry provided a detailed cost estimate for the retrofitting that would be required for the VDOT ferries to comply with an NDZ (See Appendix D). The estimate assessed a cost of $685,312 to retrofit four vessels and $72,800 a year for weekly pump-out of all vessels. No commercial pump-outs were identified in the vicinity of the ferry operations. A mobile pump-out service would be required.

Overall, it appears ferry vessels would be able to comply with an NDZ designation, with the exception of the VDOT Jamestown-Scotland Ferry system that outlined their high cost of complying with an NDZ.

Tour Boats

A tour boat typically provides short trips to tourists starting and ending in the same place, and normally lasting only a portion of the day. The Chesapeake Bay has a variety of these vessel types, with many concentrated in the Hampton Roads area, as well as some on the York River, in Alexandria, and around Tangier. These vessels provide a variety of sightseeing, unique excursions, dolphin watching, dinner cruises, and more.

Some of these vessels such as the Miss Hampton have holding tanks and currently pump-out. The Miss Hampton pumps-out at the Custom's House Marina in Hampton, along with the Godspeed and Ocean Eagle according to marina owners. The Carrie B that operates in the Norfolk area also has a holding tank and has adequate pumping facilities at their private dock in Portsmouth. The Atlantic Explorer, at the Virginia Aquarium and Marine Science Center used for dolphin watching cruises, has a Type II MSD, a holding tank, and routinely goes out to sea. The Owl Creek pump-out facility is located in close proximity to the Aquarium. The Victory Rover, owned by Rover Cruises, provides two-hour

harbor cruises in Norfolk departing from Town Point Park. This vessel has a holding tank and currently pumps out via a pump on board the boat, not at the landing, and utilizes a private pump-out facility located near Town Point Park. These vessels are already equipped to pump-out and have adequate pump-out facilities available and therefore would not be affected by an NDZ designation.

In contrast, vessels that currently discharge only will have challenges and extensive costs in complying with an NDZ. The American Rover, a three-masted top sail schooner, also owned by Rover Cruises, provides sailing cruises of the Elizabeth River and Port of Virginia departing from Waterside. This vessel is equipped with a Type II MSD, but no holding tank, and discharges treated waste into the Elizabeth River; retrofitting would be required to provide pump-out capabilities. Brook Smith with Rover Cruises stated he was not sure there was enough room to install a holding tank on the vessel. Since the American Rover is a USCG inspected passenger vessel, proposed changes to the vessel would need to be submitted to the Marine Safety Center in DC. Mr. Smith estimated the retrofits to the American Rover to be approximately $250,000 for naval architects, engineering, review process, equipment, installation, and other costs. He stated "It would basically put an end to a 37-year business already digging out from Covid."

From the vessels identified in this study, it appears tour boats, in general could potentially comply with an NDZ, but some exceptions occur that may have severe economic impacts to vessel owners.

Cruise Ships

Cruise ships are much larger vessels that provide excursions for around 3,000 people (sometimes more) that last for a number of days to a few weeks and provide overnight accommodations. According to Maureen Hayes with Cruise Lines International (CLIA), cruise ship traffic in the Bay is mostly in the Norfolk area with a few going up the Potomac toward DC and Alexandria. Ships coming into the Chesapeake Bay primarily dock at the Half Moone Cruise Terminal in Port Norfolk on the Elizabeth River. VMA reported 22 passenger ship arrivals to the Port in 2019.

Cruise ships have large holding tanks on board (up to 40,000 gallons) with a holding capacity of 3 to 7 days. Cruise ships pump-out, though the Norfolk terminal does not have a pump-out facility. Conversations with mobile pump-out owners indicate cruise ships use mobile pump-outs at pier side and at anchorage. The nature of the cruise ship business and marketing decisions already preclude these vessels from discharging into the waterway; it isn't good for business. Complying with an NDZ designation would not be an issue for large cruise ships.

Fishing

Commercial fishing vessels are employed for the catching of fish and other seafood. Information regarding commercial fishing in the Chesapeake Bay came from conversations with Tommy Leggett, local waterman and owner of Chessie Seafood and Aquafarms; Doreen Kopacz, Harbor Master, Newport News Seafood Industrial Park; Andy Hall, General Manager Omega Protein; Bill Wells, owner of Seaford Scallop Company; David Townsend, VMRC; and Matt Outland, Dock Master, Cape Charles Harbor & Yacht Center.

Based on conversations with stakeholders and the AIS data, there are primarily two main groups of commercial fishing vessels using the Bay: A smaller, shallow draft vessel that stays in the Bay used to harvest crabs, oysters, various types of finfish and other catch. These vessel operators are commonly known locally as "watermen." The other group includes the larger vessels going off-shore for scallops, flounder, seabass, squid, and menhaden. Examples of these would be scallop boats (trawlers) and off-shore supply ships, such as used by Omega Protein.

The shallow draft vessels typically don't have an MSD on board, other than a bucket. Where these buckets get emptied is a data gap in this study. They also generally do not have (and are not required to have) AIS on board. The off-shore vessel group typically has holding tanks on board. Seaford Scallop Company and Omega Protein have pump-outs at their own facilities. In addition, these fishing operations travel offshore on a daily basis where they can discharge 3

plus nautical miles out at sea. Both Seaford Scallop Company and Omega Protein stated they do not use their pump-outs; they discharge offshore. The majority of the larger commercial vessels are equipped with AIS.

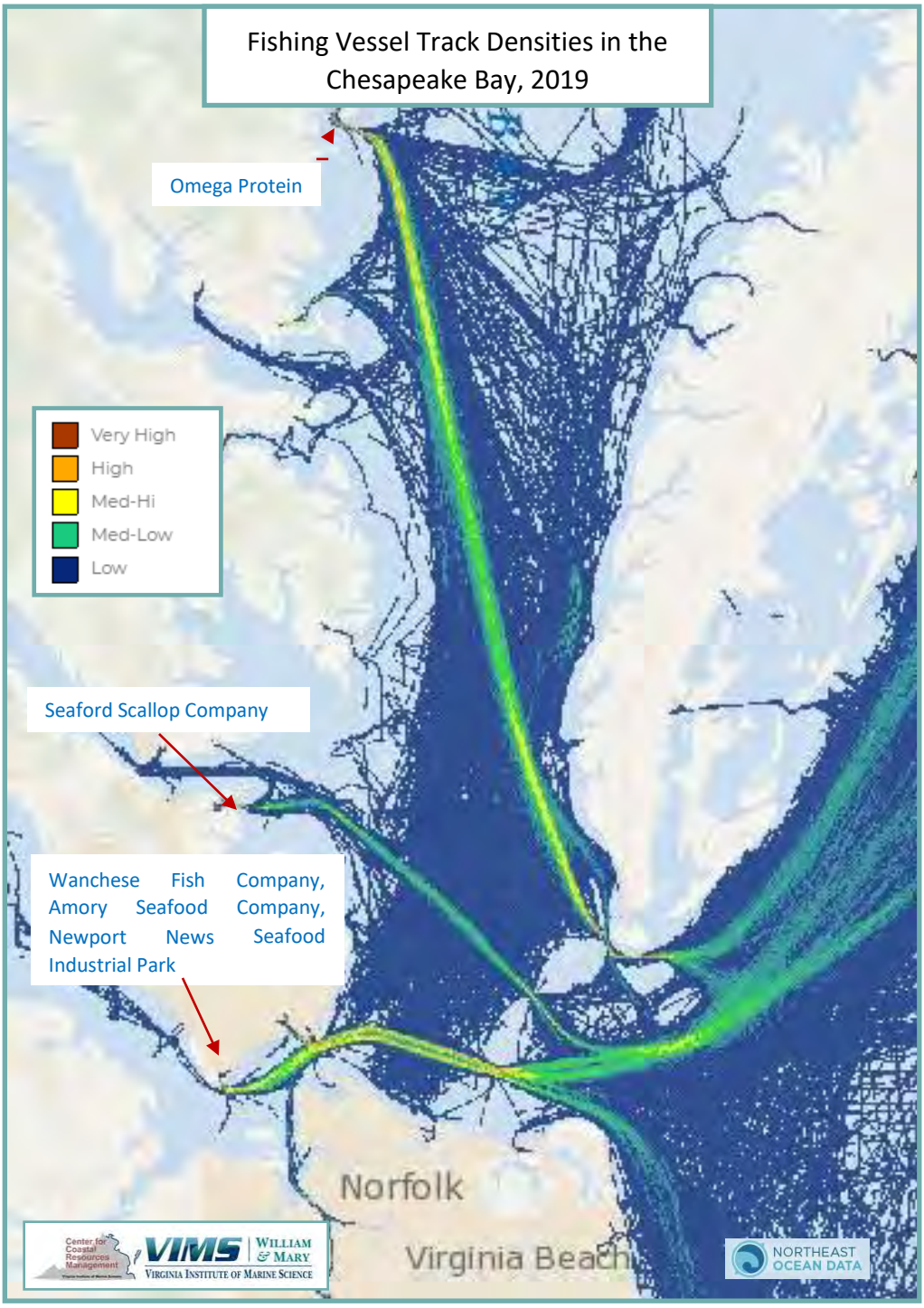


Figure 10. Chesapeake Bay commercial fishing track density, 2019.

AIS data of vessel tracks captured the density of the larger commercial fishing vessels in the Bay (see Figure 10). The areas with the densest fishing vessel tracks traveled to the Newport News Seafood Industrial Park (SIP); the Omega Protein Plant in Reedville; Wanchese Fish Company, Amory Seafood Company in Hampton, and the Seaford Scallop Company in York County.

The Newport News Seafood Industrial Park (SIP) is one of the busiest commercial fishing ports on the East Cost providing full-service accommodations to the seafood industry such as utility hookups, fuel, service and repair. The Park contains a variety of fishing operations, processors, and maintenance facilities. The bulk of production involves sea scallops; however, crabs, oysters, and finfish also pass through the facility. Fishing vessels offload catch and tie up at the SIP. According to Doreen Kopacz, SIP Harbor Master, there are 70-75 vessels at the park, almost all of which are large fishing trawlers that have holding tanks and discharge untreated waste 3 plus nautical miles offshore. There are also a handful of skiffs used by watermen, who use buckets for waste. There is a pump-out facility located at the Park, however, due to disuse, it is no longer functioning. If additional pump-out facilities were to be

determined necessary for commercial fishing vessels, it would be recommended to install a new one (or more) at this Park.

The Port of Hampton Roads is consistently ranked among the top ports in the nation in total value of seafood, mostly due to the catches of scallops[4].

The map below (Figure 11) broadly depicts the density of commercial scallop fishing vessel activity (2015-2016) from the National Marine Fisheries Services (NMFS). (Note: 2019 data not available). These scallop vessels primarily use the lower part of the Bay and travel outside the Bay on a regular basis. Their main destinations in the Bay include the Newport News Seafood Industrial Park, Wanchese Fish Company, Amory Seafood Company, and the Seaford Scallop Company.

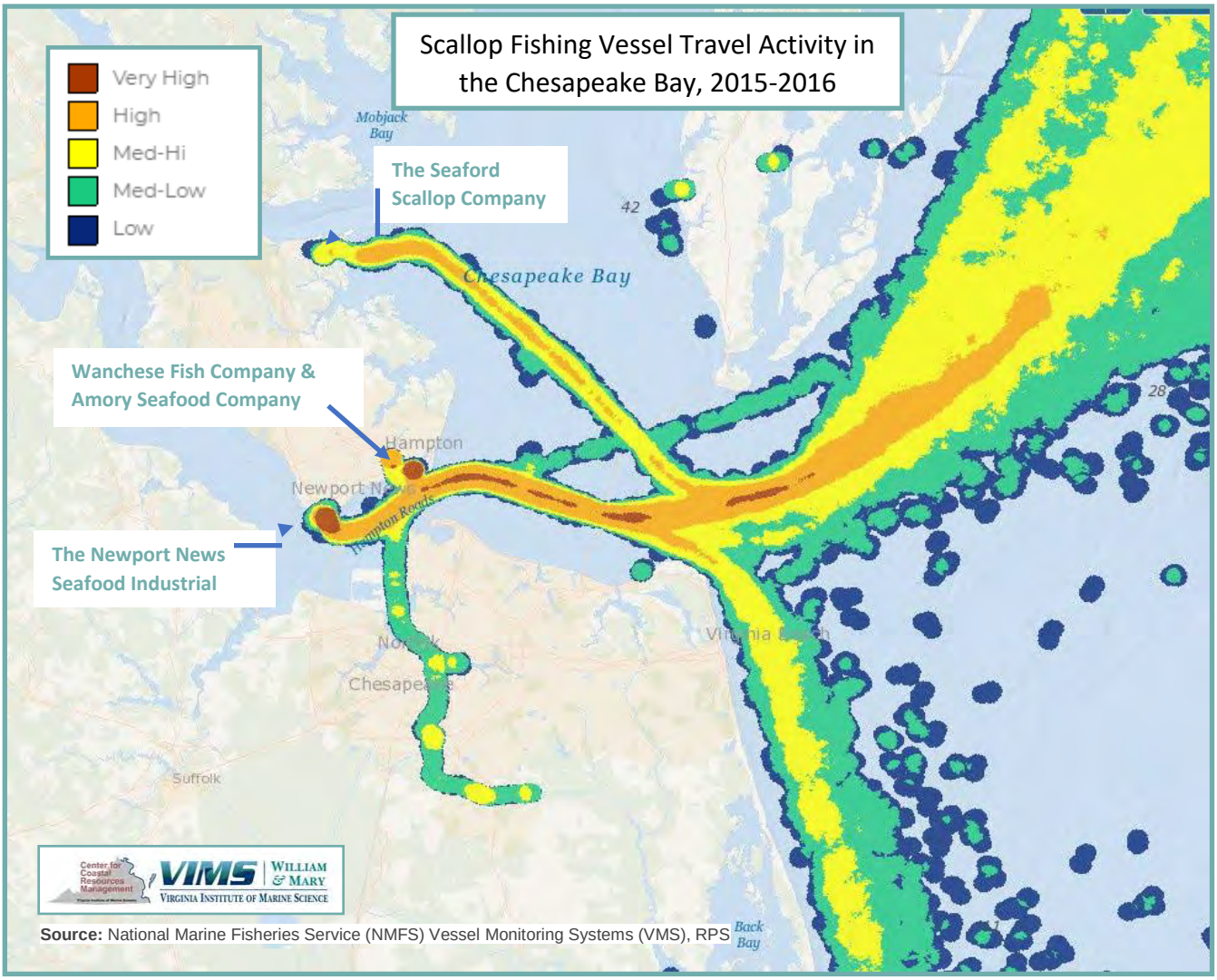


Figure 11.Density of commercial fishing vessel activity for scallop vessels, 2015-2016.

Overall, the shallow-draft commercial fishing vessels would not be affected by an NDZ designation since they generally do not have MSDs on board. Those few with Type II MSDs and no pumping capabilities would be affected. The larger

[4] Commercial Fishing. https://www.commercial-fishing.org/regional/usa/virginia-commercial-fishing/newport-news-seafood-industrial-park/

commercial fishing vessels going offshore would not be affected by an NDZ designation because they have regular access to discharge at sea, have holding tanks, and may have pump-outs at their own facilities.

Military

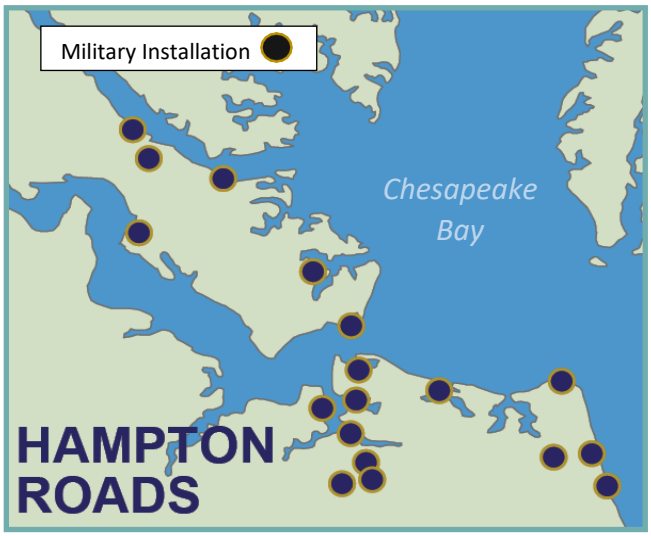


Figure 12. Military installations in Hampton Roads, VA

The Virginia portion of the Chesapeake Bay has numerous military installations, mostly concentrated in the Hampton Roads area at the lower end of the Bay (see Figure 12; *Source: Department of Defense Chesapeake Bay Program*). According to Gretchen Sosbee with the US Navy, the Navy and Military Sealift Command (MSC) regularly operate a variety of vessels which transit through the Chesapeake Bay and its tributaries. Military Sealift Command, headquartered at Naval Station Norfolk, is the leading provider of ocean transportation to the Department of Defense and controls the replenishment of military transport ships of the Navy.[5]

There is a limited amount of publicly available information on the number and type of military vessels in the Chesapeake Bay, a data gap in this analysis. One dataset available is the Navy Vessel Register. This data provides a list of commissioned vessels (vessels in active service) at installations. For this study, the Navy Vessel Register data was filtered by the Atlantic Fleet and Virginia home ports. There were many gaps in the home port data making it impossible to determine if these vessels were using the Bay versus somewhere else along the East Coast; there was no way to determine where these vessels were located in the Bay. USCG inspected vessel information obtained from ENS Shannon Young of the USCG Sector Virginia purposefully left out the data on military vessel type and count.

The 2019 AIS data does provide information on the location of military vessels in the Bay. Figure 13 shows military vessel location latitude and longitude position points ("pings" data) collected by the USCG land-based receivers; and illustrates that military vessels access the entire Bay and its tributaries. However, the dominance of vessel activity is located in Little Creek Harbor, the Elizabeth River, the Lower James River, the York River, the mouth and main channel of the Chesapeake Bay.

Military vessels in this dataset comprise a variety of vessel types including landing craft, replenishment vessels, submarines, survey vessels, torpedo recovery vessels, tugs, guided missile cruisers, law enforcement, logistic support vessels, medical support, search and rescue, fast transport, heavy load carriers and more. According to Gretchen Sosbee, the Navy has 6 aircraft carriers, 32 surface combatants, 7 amphibious support ships, 11 submarines, approximately 40 MSC ships, and approximately 800 boats and service craft.

Sewage management strategies on these vessels vary by ship type. Commissioned vessels and MSC vessels have either Type II or Type III MSDs and are designed to have a holding capacity of roughly half a day. MSC vessels' holding capacities vary from a few hours to days depending on the ship's configuration and treatment system design.

[5] Sealiftcommand.com

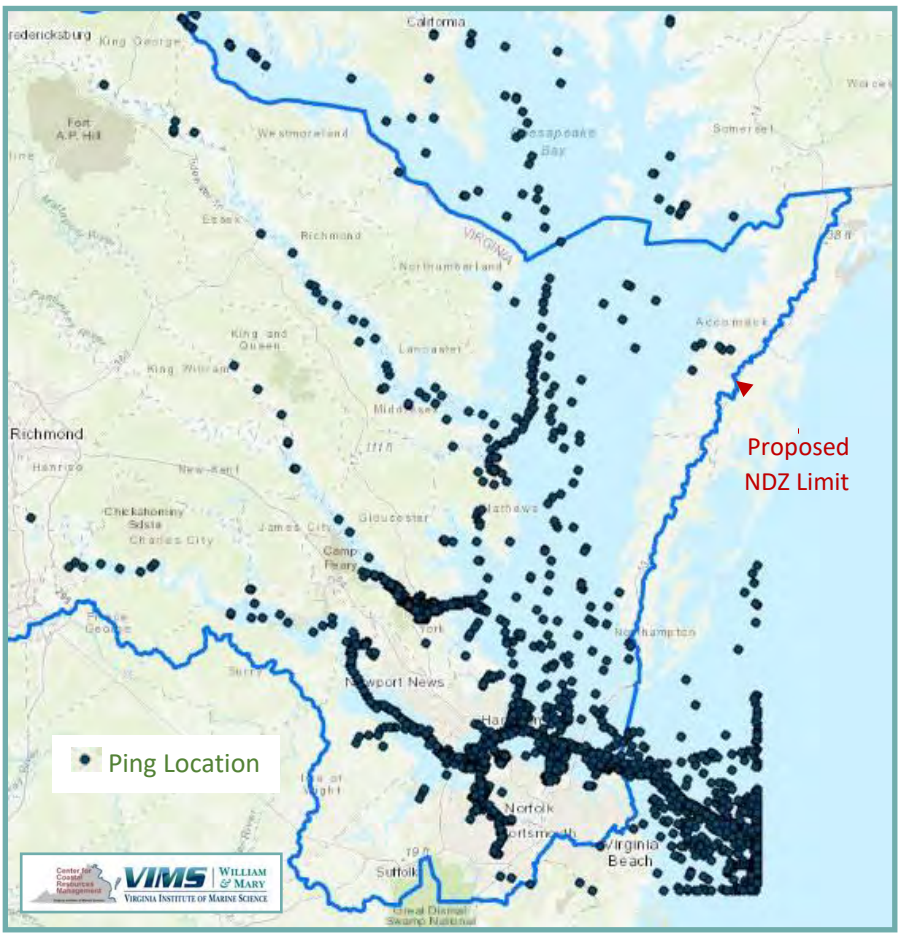


Figure 13. Military vessel ping locations from 2019 AIS

Smaller non-commissioned vessels, similar to recreational vessels, may have no capability to collect and transfer sewage to shore and therefore have no holding capacity.

According to Gretchen Sosbee, Navy vessels equipped with toilets underway, discharge treated sewage from Type II MSDs when within 3 nautical miles of the shore; greater than 3 miles, they directly discharge sewage. In Navy ports, ships have access to sewage collection facilities (CHT connections with connection directly to HRSD). Surface ships, submarines, and service craft must be fitted with cam-lock sewage discharge connections that allow quick connection and disconnection with these shore side pump-out hoses. Military ships docked at shipyards may have access to a CHT connection pier side, if not mobile pump-out service is required.

Gary Bradford, owner of Cape Henry Launch Service, stated he pumps-out military vessels at anchorage using a barge. Todd Schaubach with Shipboard Services indicated he pumps-out military ships pier side when located at a dock without a CHT connection or if the connection is broken.

If an NDZ were implemented in the Chesapeake Bay, Navy ships installed with only Type II MSDs would need to retrofit to provide holding capacity and pump-out capabilities. Vessels with Type III MSD on board would meet NDZ requirements if they also had pumping capabilities. Smaller Navy vessels with no installed toilets would not be affected by an NDZ designation.

The number of military ships that would require retrofit to provide pump-out capabilities is a data gap in this study. Since many military vessels do transit out to sea where discharge is permitted or dock at a military installation where sewage collection facilities are available, tanks to provide holding capacity for in between appear to be the largest need for the Navy. If a Navy ship is not underway at sea or docked at a military installation (i.e. at anchorage), mobile-pump out would be required.

Navy stakeholder representative Gretchen Sosbee commented that if the Chesapeake Bay were to be designated an NDZ, this could result in several negative issues to Navy operations: (1) Inability to transit and/or conduct exercises due to the lack of sewage holding capacity until a pump-out option was reached or the ship exited the NDZ; (2) Considerable cost to retrofit numerous vessels with different MSDs to meet the requirements; (3) Inability to access all locations, which could result in a change of how and where the Navy operates.

Summary

The commercial vessels using the Chesapeake Bay and its tributaries are not well documented. The minimal available datasets providing commercial vessel types and counts exhibit poor data quality as to accuracy, completeness, and consistency. Further, the datasets are not standardized in a common format to easily enable analysis. Data gaps also impact the ability to accurately characterize the type and count of commercial vessels using the Bay. For non-spatial datasets, assumptions were required to select those vessels using the Bay. These selected vessels were counted, however, the location, frequency, and duration of these vessels in the Bay were not possible to assess. The number of arrivals of a vessel to the Bay, where the vessel travels, and how long a vessel stays in the Bay is important in the assessment of adequate pump-out facilities and/or services.

Due to the variability of uses, configurations, and other characteristics of commercial vessels, even within the same vessel type, much of the data needs requested in this study aren't documented or tracked and require communication with vessel owners and operators using the Bay. No datasets were identified to provide information on the type of MSD installed on board commercial vessels. This information is important in determining which vessels will be impacted by an NDZ designation. This along with the other data gaps make it difficult to calculate the pump-out adequacy and needs for commercial vessels in the Bay.

The variation in vessel configuration and use affect the type of pump-out facility a commercial vessel can access. Smaller commercial vessels currently discharge treated sewage from approved MSDs, use stationary pump-outs at marinas, and/or use on land restroom facilities. Larger commercial vessels currently discharge treated sewage from approved MSDs, directly discharge when located greater than 3 nautical miles offshore, connect to a CHT connection pier side at a shipyard or military installation, and/or use mobile pump-out services.

If an NDZ were to be implemented in the Chesapeake Bay and its tributaries, discharge from Type I and Type II MSDs would be prohibited. The commercial vessels in the Bay, equipped with these MSDs with no holding tank, that generate sewage on a regular basis would be most affected by the designation. Tugboats could be the commercial vessel group most impacted. The two main challenges are cost and access. Most tugs do not have the equipment to allow them to pump-out. The AWO estimated a cost of several hundred thousand dollars upwards to a million per vessel for retrofit. Once a tank is installed, there are limited pump-out facilities available for tugs in the Bay. Stationary pump-out facilities tend to be designed for recreational vessels and are neither safe nor even logistically possible for tugs to access. Without stationary facilities available, mobile pump-out services are the option. Due to the 24/7 working schedule of tugs with 5-6 crew on board, the frequency required for mobile pump-out services would be a continual cost in time and money.

For cargo ships, the impact to the Port of Virginia is a concern. With no pump-out facilities at the Port, and mobile pump-out the only current pump-out option, the increased frequency of mobile pump-out may pose safety and operational issues that could have large economic consequences.

The military maintains numerous vessels throughout the Bay; the number of vessels that would require retrofit is unknown at this time. In addition to retrofit costs, an NDZ designation could potentially result in the inability of the Navy to conduct exercises or change how the Navy operates due to the lack of sewage holding capacity while in an NDZ.

For other vessel groups, some vessels could potentially comply with an NDZ, while others would result in severe economic impacts to the owners for retrofit.

Mobile pump-out appears to be the most versatile option to address the need for increased pump-out facilities in the Bay, if an NDZ were implemented. Mobile pump-out operators indicated if the market made it economically feasible, the necessary services would be provided. However, increased pump-out results in increased sewage to the wastewater treatment facility. The capacity of HRSD or other wastewater plants to accept the undetermined amount of additional sewage and its impacts is currently unknown.

Data Gaps

- Lack of complete, accurate, more detailed datasets of vessels using the Chesapeake Bay (locally, regionally and internationally)
    - Low data quality standards found in all datasets
- Limited amount of publicly available information on the number and type of military vessels in the Bay
- Lack of spatial data for all vessels using the Chesapeake Bay
    - USCG and DWR datasets do not provide information to spatially characterize vessels in the waterway; these vessels are assumed to be using the Chesapeake Bay and its tributaries, but where is unknown
    - AIS provides spatial data, however not all vessels are equipped with AIS or have it turned on, MMSI numbers identifying vessels inputted incorrectly
- Vessels arriving into the Bay from areas outside of Virginia, such as Maryland, North Carolina, anywhere along the East Coast or internationally (not captured by AIS)
- Inventory of smaller commercial vessels that currently discharge that will need to pump-out; and can access standard stationary pump-out facilities
- Type of MSD aboard vessels; information is not documented or tracked
- Complete, in-depth, updated inventory of stationary pump-outs available to commercial vessels
- Complete list of mobile pump-out companies serving commercial vessels
    - Mobile pump-out companies located on the tributaries of the Bay and near Richmond
- Cost of mobile pump-out
- Capacity or other issues of HRSD accepting future increase in sewage volume associated with implementation of an NDZ; issues with increased waste from international ships at the wastewater plant
- Where watermen buckets are emptied
- Overall cost to commercial vessel community for retrofit to comply with NDZ
    - Overall initial cost of retrofit and yearly costs for pump-out services for the tug industry, the most anticipated group to be impacted
    - The number of military ships that would require retrofit to provide pump-out capabilities
- Cost and feasibility to install CHT facilities in other locations such as the Port of Virginia
- Impact to Port of Virginia schedule and operations if increased pump-out of vessels is made necessary
- Due to the variability of uses, configurations, ownerships, and other characteristics of commercial vessels, even within the same vessel type, much information in this study was difficult to ascertain, other than generally
    - This restricts the ability to do calculations to determine pump-out adequacy and needs
- Inventory of wastewater facilities in the tributaries that will accept vessel sewage
- Impact on industrial and research/survey vessels

Recommendations

- Conduct in-depth analysis of AIS data to determine arrival frequency, location, and duration of stay of each of the varied groups of commercial vessels using the Bay on a yearly basis. These are essential data elements required in determining NDZ designation impacts and pump-out needs.
- Conduct a thorough, in-depth, updated inventory of stationary pump-outs serving commercial vessels.
- Identify additional non-CVA grant funded pump-outs that will allow commercial vessels.
- Study the cost, benefits, and feasibility of installing CHT connections at the Port of Virginia.
- Install one (or more) pump-outs at the Newport News International Seafood Park. This facility is already equipped to address large commercial vessels.
- Investigate the potential option of "permanent" barge pump-out stations anchored in the Bay for tugs to use while waiting for berths or ships; or placed in the more heavily traveled tributaries. The barges would need to be monitored and managed. The safety and logistics of this would also need to be investigated.
- Inventory all mobile pump-out companies serving commercial vessels in the Chesapeake Bay.
- DWR and USCG capture MSD system information in registration and documentation process.
- Maryland designate their portion of the Bay an NDZ.
- Consider a smaller proposed NDZ geographical area.
- Consider a phased approach to implementing an NDZ in the Bay (in time and geographic region).
- Work with commercial boat builders to construct vessels having the equipment necessary to comply with an NDZ.
- Consider alternative measures to improve water quality in the Bay such as improvements to wastewater treatment plants.
- Investigate technology necessary to have vessels discharge wastewater at the same standards as HRSD.

Stakeholder Input

The following is a list of individual stakeholders that contributed information used in the compiling of this report.

Name	Affiliation
Aaron Quick	Accurate Marine Environmental
Alan Alexander	York River Charters
Andy Hall	Omega Protein
Ben Buonviri	American Bureau of Shipping
Bill Well	Seafood Scallop Company
Brent Hunsinger	Friends of the Rappahannock
Brian Ricardo	Virginia Beach Police Marine Patrol
Brian Vahey	The American Waterways Operators
Brook Smith	Rover Cruises
Chris Carlough	Hampton Roads Sanitation District
Chris Moore	Chesapeake Bay Foundation
Cliff Larch	Edison Industries
Dan Martin	PumpOutUSA
Daniel	Clean Harbors
Dave Wolfram	Vessel Captain, Virginia Aquarium
David Jordan	Elizabeth River Ferries
David Laurier	Tugboat Captain
David Townsend	Virginia Marine Resources Commission
Deanna Austin	Virginia Department of Environmental Quality
Doreen Kopacz	Newport News Seafood Industrial Park
Eric Whitehurst	Richmond Utilities
Ernest Wiggins	Blue Ridge Tank Cleaning Inc
Frank Rabena	Virginia Pilots Association
Gary Bradford	Cape Henry Launch Service
Geraldine Galloway	Tangier Cruises
Greta Hawkins	City of Hampton
Gretchen Sosbee	US Navy
Keith Bonham	Naval Vessel Register
Ken Flowers	Moran Towing
Kevin Maroney	VDOT Jamestown-Scotland Ferries
Lee Fleming	United States Coast Guard
Luke Miyard	United States Coast Guard
Donnie McCrae	Moran Environmental
Matt Konfirst	EPA
Matt Outland	Cape Charles Harbor & Yacht Center
Maureen Hayes	Cruise Lines International Association
Mike Nash	Norfolk Yacht & Country Club Marina
Ms. Hines	CS Hines Septic
Preston Smith	Virginia Department of Health Marina Program
Richard Gordon	Skiff Creek Towing, Inc. of Yorktown
Rick Amory	Virginia Pilots Association
Ryan Chartier	United States Coast Guard
Scott Titus	Army Corps of Engineers, Norfolk District
Shannon Young	United States Coast Guard

Stephen Johnsen	Citizen
Stuart Lamerdin	VIMS Director of Marine Operations
Taz Fitzgerald	Harbor Pilot
Todd Schaubach	Shipboard Services
Tom Guess	Virginia Department of Wildlife Resources
Tommy Leggett	York River Oysters/Chessie Seafood & Aquafarms
Tommy Ottenwaelder	Retired USCG
Unknown	McAllister Towing of Virginia
Unknown	Coastal Services (Hampton Roads Marine Services)
Will Fediw	Virginia Maritime Association
Yvonne Brandt	SailTime Captain

Appendix A

Data Needs for Pump-Outs and Dump Stations

For all types of pump-outs and dump stations

a. Specific categories of vessels serviced (e.g. tanker, tug, ferry, naval ship, recreational, etc.)
b. Specific days and hours of operation throughout year
c. Number of pump-out and dump stations per facility
d. Location of stations for mapping purposes
e. Description of sewage management (how/where is pumped out sewage managed – does that sewage go into a sewer? A Septic tank? Another holding tank which is pumped out and transported to a treatment plant? Does method follow all federal, state, and local sewage management regulations?
f. Cost of service
g. Private or public
h. Are vessels with any type of port-a-john accommodated and, if so, how (e.g. a wand attachment to a pump-out or is a separate dump station provided)
i. Minimum depth at low tide at station or location required for service
j. Maximum draft of a vessel that can be accommodated at low tide
k. Any overhead restrictions on way to pump-out station or location (e.g. bridges) that prevent types of vessels (height restrictions) from getting to pump-out
l. Contact information

II. Data needs specific to Mobile Units (aquatic and land-based)
a. Aquatic or land-based?
b. Capacity of holding tank
c. Geographic areas of operation
d. Serviceable location limitations e.g. at dock, at anchorage or mooring, at port
e. Does the service have ability to take on additional business?
f. Does mobile operator know, on average, how many gallons they pump out per vessel category?

III. Data needs specific to Land-based facilities
a. Portable or stationary?
b. How many pump-outs and how many dump stations at each facility?

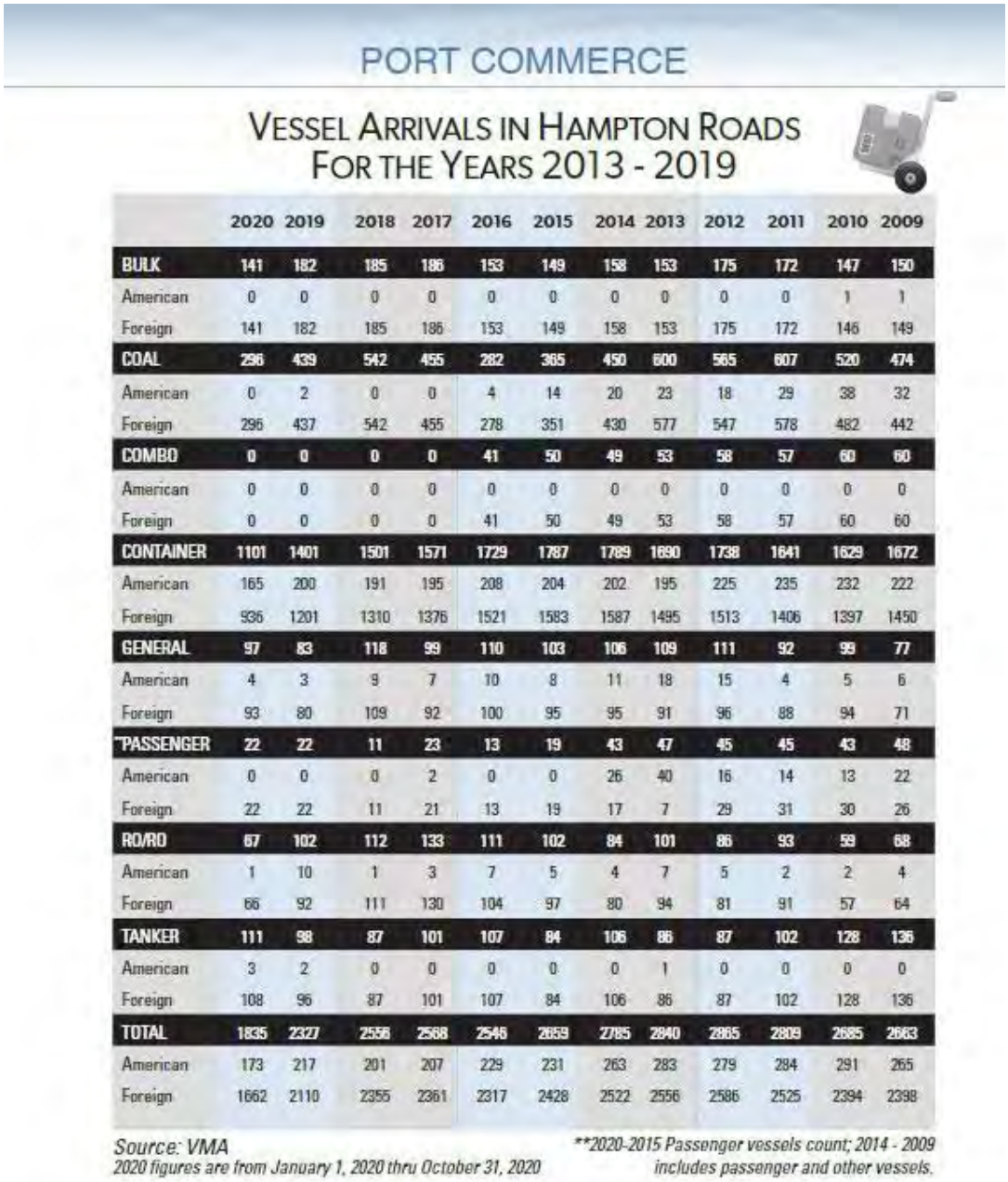
Appendix B

Army Corps of Engineers (ACOE) Lock System Vessel Traffic Counts

FISCAL YEAR		GREAT BRIDGE GUARD LOCK (#11)							DEEP CREEK LOCK (#01)							SOUTH MILLS LOCK (#02)						
2019	Direction	Government Vessels	Passenger Boat or Ferry	Recreation Vessels	Towboats w/Barges	Towboats wo/Barges	*Tonnage*	Lockings	Government Vessels	Passanger Boat or Ferry	Recreation Vessels	Towboats w/Barges	Towboats wo/Barges	*Tonnage*	Lockings	Government Vessels	Passanger Boat or Ferry	Recreation Vessels	Towboats w/Barges	Towboats wo/Barges	*Tonnage*	Lockings
OCTOBER	N	1	1	66	35	10	2,550	104	0	0	15	0	0	0	13	0	0	12	0	0	0	11
	S	4	2	984	38	12	75,626	323	0	0	201	0	0	0	81	0	0	183	0	0	0	73
NOVEMBER	N	3	0	56	44	33	660	107	0	0	5	0	0	0	3	0	0	2	0	0	0	2
	S	1	1	865	48	29	85,520	311	0	0	196	0	0	0	76	0	0	197	0	0	0	71
DECEMBER	N	4	1	24	54	20	431	88	1	0	1	0	0	0	2	1	0	1	0	0	0	2
	S	3	0	200	46	25	95,025	160	1	0	38	0	0	0	26	1	0	39	0	0	0	29
1ST QUARTER TOTALS		16	5	2,195	265	129	259,812	1,093	2	0	456	0	0	0	201	2	0	434	0	0	0	188
JANUARY	N	2	0	15	25	11	2,700	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	S	2	0	57	32	11	70,122	86	0	0	6	0	0	0	6	0	0	5	0	0	0	4
FEBRUARY	N	4	0	13	37	14	780	61	1	0	3	0	0	0	4	0	0	2	0	0	0	2
	S	3	1	30	33	13	72,375	69	1	0	3	0	0	0	4	0	0	2	0	0	0	2
MARCH	N	0	0	84	40	34	1,810	110	0	0	16	0	1	0	14	0	0	18	0	0	0	13
	S	1	0	44	46	37	48,120	94	0	0	4	1	0	0	5	0	0	4	0	0	0	4
2ND QUARTER TOTALS		12	1	243	213	120	195,907	468	2	0	32	1	1	0	33	0	0	31	0	0	0	25
APRIL	N	5	0	383	31	17	2,610	244	1	0	111	0	0	0	61	0	0	108	0	1	0	57
	S	4	0	102	33	16	70,923	120	2	0	16	0	4	0	17	1	0	15	0	4	0	13
MAY	N	8	7	950	31	23	3,450	349	1	0	210	0	0	0	87	0	0	200	0	0	0	83
	S	8	5	183	33	17	75,707	174	1	0	46	0	0	0	32	0	0	31	0	0	0	27
JUNE	N	6	0	666	33	16	10,900	326	1	0	119	0	0	0	65	0	0	103	0	0	0	61
	S	7	1	181	27	12	63,338	163	1	0	35	0	0	0	23	0	0	34	0	0	0	22
3RD QUARTER TOTALS		38	13	2,465	188	101	226,928	1,376	7	0	537	0	4	0	285	1	0	491	0	5	0	263
JULY	N	8	0	297	29	10	1,960	235	0	0	26	0	0	0	23	0	0	24	0	0	0	20
	S	9	0	179	26	7	61,573	157	0	0	23	0	0	0	23	0	0	16	0	0	0	16
AUGUST	N	7	0	188	29	6	4,000	166	0	0	19	0	0	0	16	0	0	21	0	0	0	19
	S	7	0	195	27	8	65,522	174	0	0	16	0	0	0	16	0	0	19	0	0	0	16
SEPTEMBER	N	10	1	147	27	26	7,880	151	0	0	25	0	0	0	22	0	0	25	0	0	0	23
	S	7	2	320	35	20	48,424	214	0	0	37	0	0	0	26	0	0	32	0	0	0	26
4TH QUARTER TOTALS		48	3	1,326	173	77	189,359	1,097	0	0	146	0	0	0	126	0	0	137	0	0	0	120
GRAND TOTAL		114	22	6,229	839	427	872,006	4,034	11	0	1,171	1	5	0	645	3	0	1,093	0	5	0	596

Appendix C

Virginia Maritime Association Vessel Arrivals in Hampton Roads



PORT COMMERCE

VESSEL ARRIVALS IN HAMPTON ROADS
FOR THE YEARS 2013 - 2019

	2020	2019	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009
BULK	**141**	**182**	**185**	**186**	**153**	**149**	**158**	**153**	**175**	**172**	**147**	**150**
American	0	0	0	0	0	0	0	0	0	0	1	1
Foreign	141	182	185	186	153	149	158	153	175	172	146	149
COAL	**296**	**439**	**542**	**455**	**282**	**365**	**450**	**600**	**565**	**607**	**520**	**474**
American	0	2	0	0	4	14	20	23	18	29	38	32
Foreign	296	437	542	455	278	351	430	577	547	578	482	442
COMBO	**0**	**0**	**0**	**0**	**41**	**50**	**49**	**53**	**58**	**57**	**60**	**60**
American	0	0	0	0	0	0	0	0	0	0	0	0
Foreign	0	0	0	0	41	50	49	53	58	57	60	60
CONTAINER	**1101**	**1401**	**1501**	**1571**	**1729**	**1787**	**1789**	**1690**	**1738**	**1641**	**1629**	**1672**
American	165	200	191	195	208	204	202	195	225	235	232	222
Foreign	936	1201	1310	1376	1521	1583	1587	1495	1513	1406	1397	1450
GENERAL	**97**	**83**	**118**	**99**	**110**	**103**	**106**	**109**	**111**	**92**	**99**	**77**
American	4	3	9	7	10	8	11	18	15	4	5	6
Foreign	93	80	109	92	100	95	95	91	96	88	94	71
PASSENGER	**22**	**22**	**11**	**23**	**13**	**19**	**43**	**47**	**45**	**45**	**43**	**48**
American	0	0	0	2	0	0	26	40	16	14	13	22
Foreign	22	22	11	21	13	19	17	7	29	31	30	26
RO/RO	**67**	**102**	**112**	**133**	**111**	**102**	**84**	**101**	**86**	**93**	**59**	**68**
American	1	10	1	3	7	5	4	7	5	2	2	4
Foreign	66	92	111	130	104	97	80	94	81	91	57	64
TANKER	**111**	**98**	**87**	**101**	**107**	**84**	**106**	**86**	**87**	**102**	**128**	**136**
American	3	2	0	0	0	0	0	1	0	0	0	0
Foreign	108	96	87	101	107	84	106	86	87	102	128	136
TOTAL	**1835**	**2327**	**2556**	**2568**	**2546**	**2659**	**2785**	**2840**	**2865**	**2809**	**2685**	**2663**
American	173	217	201	207	229	231	263	283	279	284	291	265
Foreign	1662	2110	2355	2361	2317	2428	2522	2556	2586	2525	2394	2398

Source: VMA
2020 figures are from January 1, 2020 thru October 31, 2020

***2020-2015 Passenger vessels count; 2014 - 2009 includes passenger and other vessels.*

85 ULTRA LARGE CONTAINER VESSELS (ULCV),
SHIPS CAPABLE OF CARRYING MORE THAT 10,000 TEU'S,
CALLED ON THE PORT OF VIRGINIA IN 2020.

Appendix D

VDOT Jamestown-Scotland Ferry Vessel Retrofit Estimate

ROUGH ORDER OF MAGNITUDE / SCOPING FORM - WORKSHEET

Hull:	One VDOT Ferry	Order No:			Initiated by:	Kevin Moroney	
Date Created:	6/23/21	Project Manager:		TBD	Project Engineer:		
		Material Mark-up Rate:		30%	Trade Charge		

Scope of Work: **Remove Existing RedFox MSD System & Install Grey / Black Water Holding Tank**

Remove interferences - Cut access through the deck - Remove RedFox MSD System - Remove all unneeded electrical, plumbing & foundation/structure - Fabricate and install newly fabricated 4300 gallon black / grey water tank - Modify structure as required - Install required plumbing including one (1) externaly mounted macerator pump, independant suction pipe, manifold plumbed to the deck & 4" vent line tied into existing vent - Install low level pump shut off - Install tank level indication with high & low level alarm in pilot house and ECB - Wire electrical systems - Apply coatings as required - Commission / test systems - Reinstall deck and interferences

Work / Item Description		Estimated Material				Estimated Labor				
Item Number	Item Description	Qty	Cost Each	Cost Extension	Material Sub-Total	WC	WC Description	Planned Hours	Trade Charge	Labor Sub-Total
1	Engineering / Labor						Eng/Adm	26	150.00	$3,900
2	Remove & Reinstall Access Thru Deck						Skilled Trades	140	95.00	$13,300
3	Materials (Deck Access)	1	$850	$850	$1,105					
4	Remove RedFox System From Vessel						Skilled Trades	78	95.00	$7,410
5	Materials (Remove RedFox)	1	$675	$675	$878					
6	Fabricate New Holding Tank	1	$48,722	$48,722	$63,339					
7	Install New Holding Tank						Skilled Trades	89	95.00	$8,455
8	Materials (Install New Holding Tank)	1	$1,075	$1,075	$1,398					
9	Plumbing						Skilled Trades	252	95.00	$23,940
10	Materials (Plumbing)	1	$6,475	$6,475	$8,418					
11	Electrical						Skilled Trades	144	95.00	$13,680
12	Materials (Electrical)	1	$3,125	$3,125	$4,063					
13	Coatings						Int Coatings	32	75.00	$2,400
14	Materials (Coatings)	1	$575	$575	$748					
15	Commissioning / Testing						Skilled Trades	13	95.00	$1,235
16	Crane						Crane/Lift	9	150.00	$1,350
17	Shipping	1	$1,350	$1,350	$1,755					
18	Dockage	15	$700	$10,500	$13,650					
19	Waste Disposal	1	$650	$650	$845					
				Material:	$96,196		Labor Hours:	757	Labor:	$71,770
							Builder's Risk	0.75%		$1,262
							Warranty	1.25%		$2,100
							Shipping			
							TOTAL Labor & Materials:			$171,328