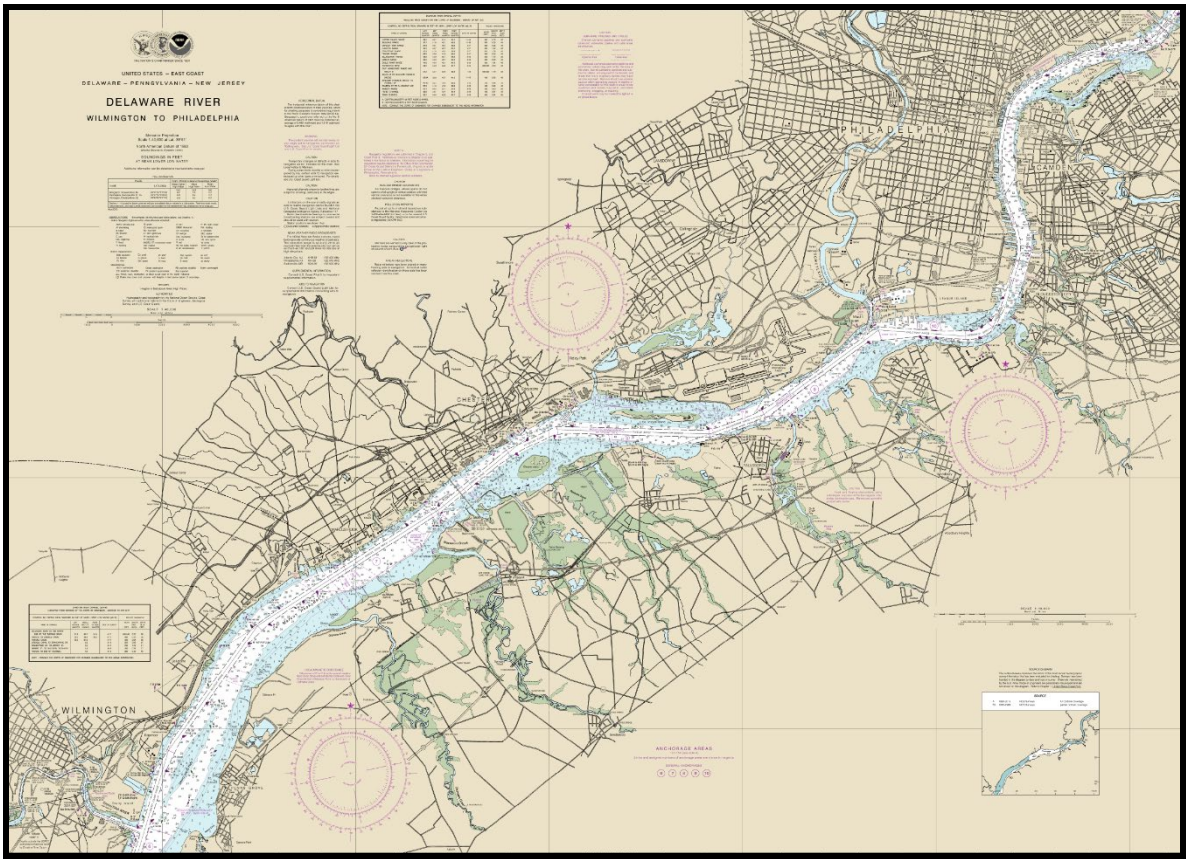
Ports and Waterways Safety Assessment

Workshop Report

Delaware River



United States Coast Guard
Marine Transportation Systems Directorate

Providing Navigation Safety Information
for America's Waterways Users

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Background and Purpose

The United States Coast Guard (USCG), Marine Transportation Systems Directorate, is responsible for developing and implementing policies and procedures that facilitate commerce, improve safety and efficiency, and inspire dialogue with ports and waterway users with the goal of making waterways as safe, efficient, and commercially viable as possible.

Through the 1997 Coast Guard Appropriations Act, the Coast Guard was directed to establish a process to identify minimum user requirements for new Vessel Traffic Service (VTS) systems in consultation with local officials, waterway users and port authorities, and to review private / public partnership opportunities in VTS operations.

The Coast Guard convened a National Dialogue Group (NDG) comprised of maritime and waterway community stakeholders to identify the needs of waterway users with respect to Vessel Traffic Management (VTM) and VTS systems. The NDG was intended to provide the foundation for the development of an approach to VTM that would meet the shared government, industry, and public objectives of ensuring the safety of vessel traffic in U.S. ports and waterways, in a technologically sound and cost effective way.

From the NDG came the development of the ***Ports and Waterways Safety Assessment (PAWSA) Waterway Risk Model,*** and the ***PAWSA workshop process***. PAWSA is a disciplined approach designed to identify major waterway safety hazards, estimate risk levels, evaluate potential mitigation measures, and set the stage for the implementation of selected risk reduction strategies.

The process involves convening a select group of waterway users and stakeholders and facilitating a structured workshop agenda to meet the risk assessment objectives. A successful workshop requires the participation of professional waterway users with local expertise in navigation, waterway conditions, and port safety. In addition, stakeholders are included in the process to ensure that important environmental, public safety, and economic consequences are given appropriate attention as risk interventions are identified and evaluated.

The long-term goals of the PAWSA process are to:

1) Provide input when planning for projects to improve the safety of navigation,
2) Further the Marine Transportation System (MTS) goals of improved coordination and cooperation between government and the private sector, and involving stakeholders in decisions affecting them,
3) Foster development and/or strengthen the roles of Harbor Safety Committees within each port, and
4) Support and reinforce the role of Coast Guard Sector Commanders/Captains of the Port (COTP) in promoting waterway and VTM activities within their geographic areas of responsibility.

61 ports/waterways have been assessed or reassessed using the PAWSA process. The risk assessment process represents a significant part of joint public-private sector planning for mitigating risk in waterways. When applied consistently and uniformly in a number of waterways, the process is expected to provide a basis for making best value decisions for risk mitigation investments, both on the local and national level. The goal is to find solutions that are effective and meet the needs of waterway users and stakeholders.

PAWSA Waterway Risk Model and Workshop process

The PAWSA Waterway Risk Model includes variables dealing with both the causes of waterway casualties and their consequences. In the Waterway Risk Model, risk is defined as a function of the probability of a casualty and its consequences. The diagram below shows the six general risk categories, and corresponding risk factors, that make up the Waterway Risk Model.

Waterway Risk Model					
Vessel Conditions	**Traffic Conditions**	**Navigational Conditions**	**Waterway Conditions**	**Immediate Consequences**	**Subsequent Consequences**
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic

- ***Vessel Conditions*** – The quality of vessels and their crews that operate on a waterway.
- ***Traffic Conditions*** – The number of vessels that use a waterway and how they interact with each other.
- ***Navigational Conditions*** – The environmental conditions that vessels must deal with in a waterway.
- ***Waterway Conditions –*** The physical properties of the waterway that affects vessel maneuverability.
- ***Immediate Consequences*** – The instantaneous impacts to the port as a result of a vessel casualty.
- ***Subsequent Consequences*** – The longer-term impacts felt days, months, and even years afterwards.

Workshop activities include a series of discussions about the port/waterway attributes and the vessels that use the waterway, followed by completion of workbooks to establish baseline risk levels, evaluate the effectiveness of existing risk mitigations, and identify additional risk intervention strategies to further reduce risk in the port / waterway. Workbook 1 is used to numerically evaluate the baseline risk levels using pre-defined qualitative risk descriptions for pre-defined risk factors. Workbook 2 is used to assess the expertise of participants with respect to the risk categories in the model. Those expertise assessments are used to weight inputs obtained during the other steps in the workshop process. Workbook 3 is used to evaluate how effective the existing mitigation strategies are at reducing risks, and to determine if the risks are well balanced or not. For those risk factors where risk is judged to be not well balanced by existing mitigations, participants use workbook 4 to identify additional risk intervention strategies and then evaluate how effective those new strategies could be at reducing risks.

Delaware River PAWSA Workshop

A PAWSA workshop to assess navigation safety on the Delaware River was held in Philadelphia, Pennsylvania on 29-30 November, 2018. The workshop was attended by 28 participants representing waterway users, stakeholders, environmental interest groups, and Federal, State and local regulatory authorities. The purpose of the workshop was to bring waterway users, stakeholders and members of the Delaware River maritime community together for collaborative discussions. The sponsor of the workshop was Coast Guard Sector Delaware Bay.

Participants discussed the quality of vessels and their crews that operate on the waterway; the volume of commercial, non-commercial and recreational small craft vessel traffic using the waterway, navigational and waterway conditions that mariners encounter when transiting the assessment area, and the potential environmental impacts that could result from a marine casualty or incident on the waterway.

Over the two-day workshop, the participants discussed and then numerically evaluated 23 risk factors in the PAWSA Waterways Risk Model; the Commercial Fishing Vessel Quality risk factor was not evaluated due to no commercial fishing operations taking place within the assessment area.

Baseline risk levels were first evaluated using pre-defined qualitative risk descriptions for each risk factor. Participants then discussed existing risk mitigation strategies, evaluated how effective those mitigation strategies were at reducing risk, and then determined if the risks were balanced. For those risk factors that were not balanced by existing mitigations, or where there was no consensus that risks were balanced, or not balanced, by existing mitigations, the participants engaged in further discussions and completed workbook 4 to identify additional risk mitigation strategies and evaluated how effective those new strategies could be at reducing risk. The results of the baseline risk level survey, existing risk mitigation strategies, additional risk intervention strategies, and participant comments and observations are outlined in this report.

The primary goal of a PAWSA workshop is to improve coordination and cooperation between government agencies and the private sector. A PAWSA workshop is intended to involve stakeholders in decisions affecting them, and provide the Coast Guard and members of the waterway community with an effective tool to evaluate risk and work toward long-term solutions tailored to local circumstances.

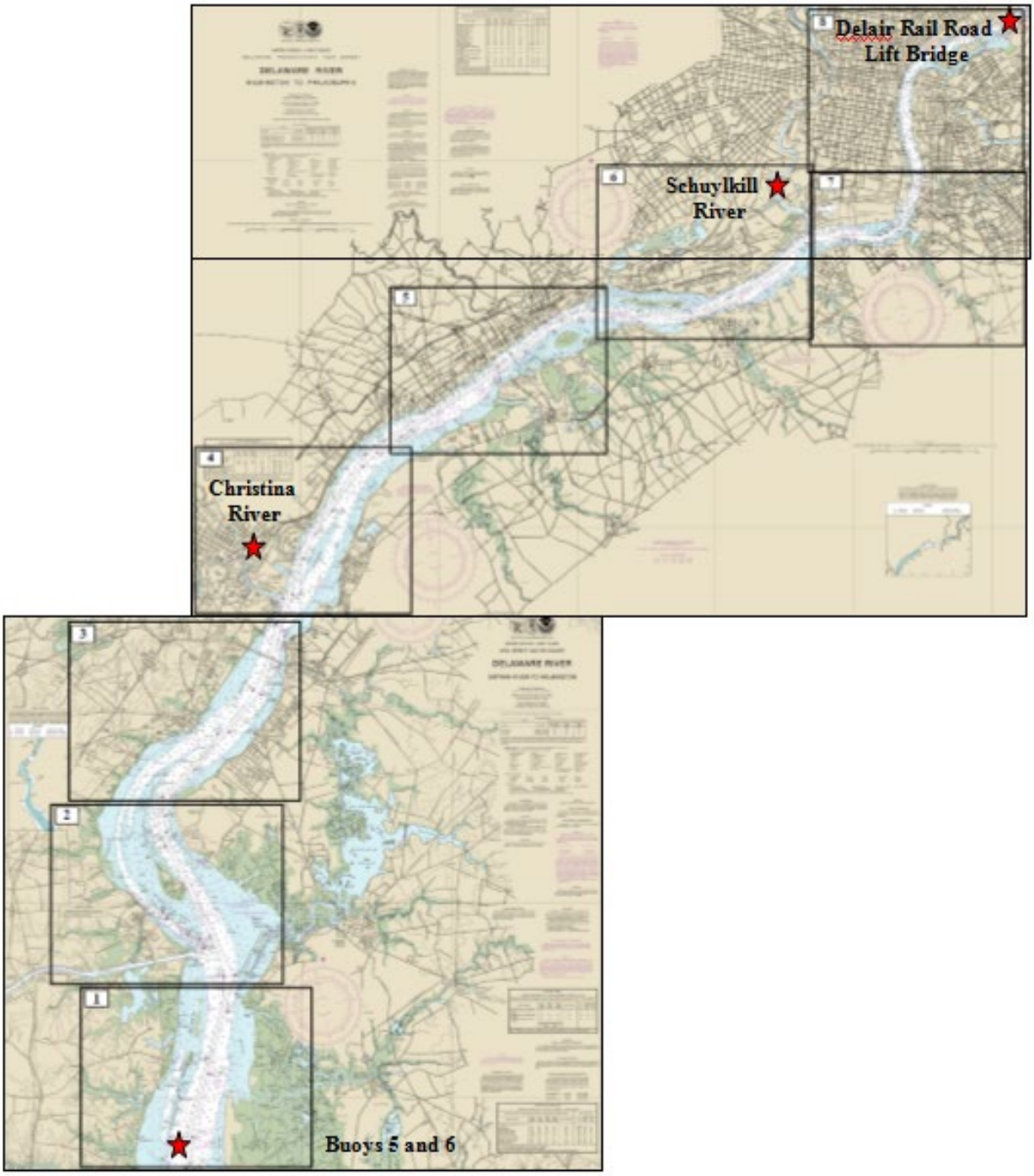
In support of these goals, this report should be viewed as a starting point for continued dialogue within the Delaware River maritime community. The Coast Guard will use this PAWSA report, together with other information, to determine whether, and to what extent, regulatory or other actions are needed to address navigation safety risk. Any rulemaking efforts will follow Coast Guard public notice and comment rulemaking procedures to allow for public participation in the process.

The United States Coast Guard, Marine Transportation Systems Directorate and Coast Guard Sector Delaware Bay, extend a sincere appreciation to the workshop participants for their contributions to the Delaware River PAWSA workshop. Their expertise was critical to the success of the workshop, and their recommendations will greatly assist the Coast Guard as it continues to work with all Delaware River stakeholders to further improve safe and efficient navigation on the Delaware River.

Section 1: Delaware River PAWSA - Assessment Area

The geographic bounds of the waterway assessment area included the Delaware River from buoys 5 and 6 to the Delair Rail Road lift bridge, the Christina River, and the Schuylkill River.

Nautical charts 12311 and 12312 were displayed for reference and to annotate geographic locations associated with participant comments and observations; the below segment excerpts from the annotated charts are included as appendix D to this report.



Section 2: Baseline Risk Levels

The first step in the workshop was the completion of workbook 1 to determine a baseline risk level value for each risk factor in the Waterway Risk Model. To establish the baseline risk levels, participants discussed each of the 24 applicable factors in the Waterway Risk Model and selected a qualitative description for each risk factor that best described the conditions in the assessment area. These qualitative descriptions were converted to discrete values using numerical scales that were developed during earlier PAWSA workshops. What results is the risk level for each risk factor, not taking into account any actions already implemented to reduce risk.

On those scales, 1.0 represents low risk (best case) and 9.0 represents high risk (worst case), with 5.0 being the mid-risk value. Risk values highlighted in red (values at or above 7.7) denote very high baseline risk levels. Risk values highlighted in green (values at or below 2.3) denote very low baseline risk levels.

The table below shows the baseline risk level values for all risk factors evaluated by the workshop participants.

Baseline Risk Levels					
Vessel Conditions	**Traffic Conditions**	**Navigational Conditions**	**Waterway Conditions**	**Immediate Consequences**	**Subsequent Consequences**
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
5.5	6.4	1.8	9.0	8.3	9.0
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
7.0	1.7	3.0	8.1	9.0	7.3
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Not Evaluated	4.9	5.2	6.0	9.0	2.4
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
9.0	5.4	6.0	9.0	9.0	8.6

Section 3: Team Expertise Cross-assessment

The second step in the workshop was the completion of a team expertise cross-assessment (workbook 2). The team expertise cross-assessment was conducted early in the workshop process and was used to weigh the relative strengths of each team with respect to the six risk categories. The results of the team expertise cross-assessment was used to weight the inputs that each team provided in the other workbooks completed during the workshop.

After being presented with the concepts underlying the model, each participant team was asked to discuss (among themselves) how their background and experience aligns with the model. They then verbally presented their self-assessment to the other teams. These presentations gave all teams a sense of where everyone thought they were strong – or perhaps not so strong. After all teams had spoken, each team then evaluated whether they were in the top, middle, or lower third of all teams present with respect to knowledge and expertise in the six risk category areas. The participants assessed their own and all the other participant teams' level of expertise for each of the six risk categories in the Waterway Risk Model.

The table below breaks down the participants' expertise for each risk category.

Team Expertise -- Distribution

Risk Category	Top 1/3	Mid 1/3	Lower 1/3
Vessel Conditions	39%	44%	17%
Traffic Conditions	40%	35%	25%
Navigational Conditions	49%	21%	30%
Waterway Conditions	40%	40%	20%
Immediate Consequences	36%	44%	20%
Subsequent Consequences	25%	33%	42%
All Categories Average	38%	36%	26%

Section 4: Existing Risk Mitigations

The third step in the workshop was for participants to evaluate the effectiveness of existing mitigation strategies in reducing the risk level for each risk factor. Workbook 3 is used for two purposes. First, after the participants describe the risk mitigation strategies that already exist to help reduce the risk level for their waterway, workbook 3 is used to evaluate the effectiveness of those strategies in reducing the risk level for each factor in the model. What results from that evaluation is the present risk level, taking into account those existing mitigations. Second, the participants decide whether the risk mitigation strategies already in place adequately balance the resulting risk level. If, for any given risk factor, there is consensus (defined as 2/3 of the workshop participant teams in agreement**)** that existing mitigations do adequately deal with those risks, then that risk factor is dropped from further discussion.

For risk factors show in green (Balanced) there was consensus that risks were balanced by existing mitigations.

For risk factors shown in red (Rising/No) there was consensus that risks were not balanced by existing mitigations.

For risk factors shown in yellow (Maybe) there was no consensus that risks were balanced by existing mitigations.

Mitigation Effectiveness					
Vessel Conditions	**Traffic Conditions**	**Navigational Conditions**	**Waterway Conditions**	**Immediate Consequences**	**Subsequent Consequences**
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
5.5 3.2	6.4 3.7	1.8 1.5	9.0 5.6	8.3 3.5	9.0 4.7
Balanced	Balanced	Balanced	Maybe	Balanced	Balanced
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
7.0 4.5	1.7 1.7	3.0 2.4	8.1 5.3	9.0 3.0	7.3 3.7
Balanced	Balanced	Balanced	Maybe	Balanced	Balanced
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Not Evaluated	4.9 4.4	5.2 3.7	6.0 4.2	9.0 3.2	2.4 2.4
	Maybe	Balanced	Balanced	Balanced	Balanced
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
9.0 7.9	5.4 4.6	6.0 4.2	9.0 4.8	9.0 4.7	8.6 4.5
NO	Maybe	NO	Balanced	Balanced	Maybe

Risk Factor	
Book 1 Score	Book 3 Score
Consensus Reached?	

EXPLANATION

Book 1 Score	Level of risk - not taking into account existing mitigations
Book 3 Score	Level of risk - taking into account existing mitigations
Balanced	Consensus that risks are well balanced by existing mitigations
Maybe	No consensus that risks are well balanced by existing mitigations
NO	Consensus that existing mitigations DO NOT adequately balance risks

For the following 16 risk factors, there ***was consensus*** (defined as 2/3 of the workshop participant teams agreeing) ***that risks were balanced*** by existing mitigations.

Risk Factor	Risk Level with Existing Mitigations
Configuration	4.8
Health and Safety	4.7
Mobility	4.7
Shallow Draft Vessel Quality	4.5

Bottom Type	4.2
Volume of Commercial Traffic	3.7
Environmental	3.7
Visibility Restrictions	3.7
Personnel Injuries	3.5
Hazardous Materials Release	3.2
Deep Draft Vessel Quality	3.2
Petroleum Discharge	3.0
Aquatic Resources	2.4
Water Movement	2.4
Volume of Small Craft Traffic	1.7
Winds	1.5

For the following five risk factors, there ***was no consensus*** that risks were balanced, or not balanced, by existing mitigations.

Risk Factor	Risk Level with Existing Mitigations
Visibility Impediments	5.6
Dimensions	5.3
Congestion	4.6
Economic	4.5
Traffic Mix	4.4

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For the remaining two risk factors, there ***was consensus that risks were NOT balanced*** by existing mitigations.

Risk Factor	Risk Level with Existing Mitigations
Small Craft Quality	7.9
Obstructions	4.2

Section 5: Additional Risk Intervention Strategies

The last step in the workshop process was to complete workbook 4, wherein workshop participants propose additional risk interventions. Participants suggested additional risk intervention strategies, and then evaluated how successful the proposed strategies could be at lowering risk levels.

Additional mitigations were discussed for those risk factors where there was consensus that risks were not adequately balanced by existing mitigation (Rising/No) from the workbook 3 evaluation. Due to workshop time limitations the Economic risk factor was not included in the workbook 4 evaluation/discussion process.

The table below shows the expected level of risk if taking the actions recommended by the participants.

Additional Interventions					
Vessel Conditions	**Traffic Conditions**	**Navigational Conditions**	**Waterway Conditions**	**Immediate Consequences**	**Subsequent Consequences**
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
Balanced	Balanced	Balanced	Rules & Procedures	Balanced	Balanced
			3.7 Caution		
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
Balanced	Balanced	Balanced	Waterway Changes	Balanced	Balanced
			2.8 Caution		
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Not Evaluated	Coordination / Planning	Balanced	Balanced	Balanced	Balanced
	2.1 Caution				
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
Enforcement	Rules & Procedures	Other Actions	Balanced	Balanced	Book 4 not completed
7.2	4.5	2.0			

Risk Factor	
Intervention Category	
Risk Improvement	Caution

EXPLANATION

Intervention Category	Intervention category most participants selected to further reduce risks.
Risk Improvement	The expected level of risk that could be obtained if the new mitigation measures were implemented.
Caution	When Caution is displayed, an intervention strategy other than the one displayed was judged to provide more risk reduction that the one displayed. This is an indicator that the teams were divided in their opinions about what actions should be taken to further reduce risks for that factor. It indicates there is possibility more than "one" best mitigation measure to achieve further risk reduction.

The following shows the results of the workbook 4 evaluations for those risk factors that were not balanced by existing mitigations, or where there was no consensus that risks were balanced, or not balanced, by existing mitigations. Due to workshop time constrains workbook 4 was not completed for the Economic risk factor.

Risk Factor	Risk Level with Existing Mitigations	Risk Level with Proposed Mitigations
Small Craft Quality	7.9	7.2
Visibility Impediments	5.6	3.7
Dimensions	5.3	2.8
Congestion	4.6	4.5
Traffic Mix	4.4	2.1`
Obstructions	4.2	2.0
Economic	4.5	Not Evaluated

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Appendix A

Workshop Participants

Participant	Organization
Jesse Guarneri	Dann Marine Towing
Rich Gaudiosi	Delaware Bay and River Cooperative, Inc.
Mike Nesbitt	Energy Transfer Partners, L.P.
Jennifer Gramata	Gloucester Terminal, LLC
Larry Strohm	Hays Tug and Launch Services
Kurt Ferry	Holt Logistics Corporation
Steve Richter	Interport Pilots Agency, Inc.
Stuart Griffin	Mariners Advisory Committee for the Bay & River Delaware
Paul Myhre	Maritime Exchange for the Delaware River and Bay
Joe Benton	McAllister Towing of Philadelphia, Inc.
Juan Carlos Vernetti	Monroe Energy, LLC
Andrew Hinger	Moran Towing Corporation
Dan Weamer	OSG Ship Management, Inc.
Hank Mallon	OSG Ship Management, Inc.
James Miller	Philadelphia Energy Solutions, Inc.
Lukas Sunkler	Philadelphia Energy Solutions, Inc.
Jon Kemmerly	Pilots Association for the Bay & River Delaware
George Murphy	South River Maritime, LLC
Deb Peretz	Vane Brothers Company
William Nash	U.S. Army Corps of Engineers
Andy Daum	USCG Cutter William Tate, Commanding Officer
Ethan Coble	USCG Fifth District, Waterways Management Division
Tom Robertson	USCG Auxiliary
Frank Williams	USCG Auxiliary
Edgardo Cruz	USCG Sector Delaware Bay, Prevention Department
Todd Wardell	USCG Sector Delaware Bay, Incident Management Division
Michael Bennett	USCG Sector Delaware Bay, Station Philadelphia
Peter Knoor	USCG Sector Delaware Bay, Station Philadelphia

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Appendix B

Participant Observations- Trends in the Port and Existing Risk Mitigations

The workshop participants are local subject matter experts and these comments capture their opinions and analysis, providing a general sense of the ideas discussed during the workshop. These comments provide various perspectives representing widely different interests and should not be construed to represent the views of or statements by the United States Coast Guard.

Deep Draft Vessel Quality

(Vessels 1600 Gross Tons and higher engaged in commercial trade)

Trends/Observations:

- Vessels evaluated under this category included Tank Vessels, Chemical Ships, Bulk Cargo Carriers, Roll On/Roll Off Vessels, Car Carriers, and Container Ships.
- Deep draft vessel quality is very good. This class of commercial vessels are subject to internal annual examinations, independent safety audits, Classification Society inspection requirements, and company imposed maintenance standards and policies that go beyond USCG vessel inspection regulations. The industry is moving towards better oversight, work hours, job safety analysis, and redundancy in safety systems.
- The USCG Port State Control (PSC)[1] vessel inspection program has resulted in inspections deficiencies and vessel detentions rates trending downward over the last several years.
- The USCG 96-hour Notice of Arrival and Departure (NOAD)[2] reporting regulations identify and prioritizes commercial vessels, arriving U.S. ports, for PSC safety examinations. In 2018, there were approximately 2,400 distinct vessel arrivals into port; the USCG conducted 748 PSC examinations, and issued approximately 282 deficiencies.
- Crewmember proficiency is also very good. Crewmember training and proficiency is completed and standardized as required by USCG licensing regulations and the International Convention of Standards of Training, Certification and Watchkeeping (STCW)[3] convention requirements, which sets minimum qualification standards for vessel masters, officers and watch personnel.
- The material condition and crew proficiently for tank vessels is great overall. Tank vessels and chemical ships have very high crew training and certification standards that improve crew proficiency to a higher level than that normally found on bulk carrier vessels.

[1] USCG PSC regulations: https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Commercial-Vessel-Compliance/Foreign-Offshore-Compliance-Division

[2] USCG NOAD regulations: https://www.govinfo.gov/content/pkg/FR-2015-01-30/pdf/2015-01331.pdf

[3] STCW: http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-on-Standards-of-Training,-Certification-and-Watchkeeping-for-Seafarers-(STCW).aspx

- It is not uncommon for tank vessels and chemical ships to finish cargo transfer operations and elect to remain dockside for several hours so crewmembers could rest and prepare for the outbound transit.
- Many tank vessel owners and operators also utilize the Oil Companies International Marine Forum (OCIMF)[4] to review a vessels compliance history before entering a port. Areas evaluated include the vessels past terminal experience, compliance with USCG PSC inspections, and OCIMF compliance reports.
- The material condition and crew proficiency for the larger container ships is very good. The larger vessels in this class are operated by multi-national corporations who are very consistent in their manning, training and operating standards. Newer container ship arrivals are becoming more prevalent that older container ship arrivals.
- The material condition of bulk cargo carriers is not as high as is found on tank vessels, and chemical and container ships.
- Deep draft vessels are subject to USCG inspection regulations, International Maritime Organization (IMO) [5] convention requirements, and Classification Society inspection and safety standards.

Existing Mitigations:

- USCG Vessel Inspection regulations
- USCG Port State Control regulations
- USCG Notice of Arrival and Departure reporting regulations
- Standards of Training, Certification and Watchkeeping standards
- Oil Companies International Marine Forum safety initiatives
- International Maritime Organization convention requirements

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Shallow Draft Vessel Quality

(Vessels less than 1600 Gross Tons engaged in commercial trade)

Trends/Observations:

- Vessels evaluated under this category included towing vessels, passenger vessels, dinner cruisers and offshore supply vessels.
- Overall, discussions indicated shallow draft vessel quality is very high. This class of commercial vessels are in good material condition and are operated by competent mariners.
- The majority of the towing vessels operate mainly within the upper Delaware River system conducting deep draft vessel docking/undocking operations and moving tank barges, construction barges, and dredge spoil scows. The towing vessel and passenger vessel operators have extensive local knowledge of the river system and the types of vessels that operate within the assessment area.

[4] OCIMF: https://www.ocimf.org/
[5] International Maritime Organization: http://www.imo.org/en/About/Pages/Default.aspx

- Towing vessels are subject to inspection under USCG Subchapter M[6] inspection requirements. Some towing vessels owners and operators also conduct internal safety audits that include proficiency evaluations for the captains and mates. Auditors also observe crew proficiency in docking, undocking and maneuvering operations.
- There are approximately 20 passenger vessels under 100 gross tons that operate within the assessment area. Passenger vessels less than 100 gross tons that carry 150 or less passengers, or have overnight accommodations for 49 or less passengers, are subject to USCG Subchapter T[7] inspection requirements. Passenger vessels less than 100 gross tons that carry more than 150 passengers, or have overnight accommodations for more than 49 passengers, are subject to USCG Subchapter K[8] inspection requirements.

Existing Mitigations:

- USCG Subchapter M – Towing Vessel Inspection Regulations
- USCG Subchapter T and K - Passenger Vessel Inspection Regulations
- Internal safety audits

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Small Craft Vessel Quality

Trends/Observations:

- Small craft evaluated under this category included power driven recreational vessels, jet skis, uninspected vessels carrying 6 passengers or less, sailing vessels and human powered craft such as paddleboards, kayaks, rowboats and canoes.
- Participant's comments indicated that small craft quality and operator proficiency is lower compared to licensed commercial mariners, primarily because there are no mandatory crew testing and licensing requirements to operate powered and non-powered small craft.
- Comments on the interactions between small craft and commercial towing and deep draft vessels indicated that power driven small craft operators generally lack navigational experience, knowledge of the Navigation Rules, and how to properly use VHF marine radios.
- Human powered craft are relatively inexpensive, making it very easy for people with no waterway experience to purchase and operate the craft with little or no training. It is easy to purchase a low cost kayak or paddleboard and begin operating on the water, having little or no on the water practical experience.

[6] USCG Subchapter M: https://www.govinfo.gov/content/pkg/CFR-2016-title46-vol5/pdf/CFR-2016-title46-vol5-chapI-subchapM.pdf
[7] USCG Subchapter T: https://www.govinfo.gov/content/pkg/CFR-2012-title46-vol7/pdf/CFR-2012-title46-vol7-chapI-subchapT.pdf
[8] USCG Subchapter K: https://www.govinfo.gov/content/pkg/CFR-2012-title46-vol4/pdf/CFR-2012-title46-vol4-chapI-subchapK.pdf

- Small craft operators also generally lack an understanding of the limited maneuvering characteristics of large deep draft vessels and the navigational challenges they encounter when transiting a very narrow shipping channel.
- Voluntary recreational craft Vessel Safety Checks (dockside examinations) are conducted by the USCG Auxiliary[9]. Within the assessment area, approximately 1/3 of the recreational pleasure craft examined under this program were found, on the initial examination, to be in compliance with USCG uninspected vessel requirements. Follow-up exams are conducted to resolve discrepancies and further educate small craft operators.

Existing Mitigations:

- USCG Auxiliary Vessel Safety Checks

Additional Mitigations:

- See appendix C.

Volume of Commercial Traffic

Trends/Observations:

- In 2018 there were approximately 2,400 discrete commercial cargo vessel arrivals, not including towing vessels, calling on the port[10]. Vessels shifting berths or moving between facilities results in approximately 200 additional discreet vessel movements.
- Philadelphia has the largest refinery capacity on the U.S. East Coast, is the 5th largest U.S. port complex, and is the largest fruit and juice concentrate import center in the U.S. In calendar year 2017, the port seen an increase of 18% in overall container throughput with 972,412 containers being handled. Container throughput is trending upwards and is expected to exceed 1 million Total Equivalent Units (TEU) in the year 2019. [11]
- The increasing number of vessel arrivals and inter-port ship movements has resulted in heavy use of the designated anchorages. The number of vessels that anchor in one of the designated anchorages is approximately 1,100 annually.
- The volume of commercial traffic increases from October to May due to the increased number of fruit-service vessels arrivals delivering perishable products from South America; the number of fruit-service vessel arrivals is trending upwards.
- The port also sees an increase in tank ship and tank barge traffic due to seasonal (winter) demands for home heating oil. Many times tankers have to anchor and wait until reception capacity opens up at an oil terminal, putting additional strain on available anchorage capacity.

[9] USCG Auxiliary: http://cgaux.org/
[10] Appendix G: Delaware River PAWSA - Vessel Transit Statistics
[11] Appendix H: Delaware River PAWSA - Waterway Profile Information

- Deep draft tanker traffic (crude oil carriers) arrival numbers have seen a slight decrease, while Liquefied Natural Gas (LNG) carriers and container ships arrivals numbers are trending upwards. The possible construction of an LNG pipeline would push LNG transit numbers even higher.
- The Mariners Advisory Committee for the Bay and River Delaware (MAC)[12] provides a significant amount of navigation safety information that is not common in other ports. The MAC publishes Transit Advisories to alert mariners to waterway safety issues, provides recommendations for deep draft vessel transits, and guidance on the efficient use of designated anchorages. Information provided by the MAC drives down risk for many of the PAWSA risk factor categories.
- For very large deep draft vessel movements transit planning is conducted and includes input from the USCG. Communications and dialog are very good between the Coast Guard, the Pilots, and the commercial vessel operators involved in the transit.

Existing Mitigations:

- Mariners Advisory Committee for the Bay and River Delaware
- Good communications between the USCG, Pilots and commercial vessel operators

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Volume of Small Craft Traffic

Trends/Observations:

- May to October is the typical recreational boating season. Small craft traffic was described as being composed of local recreational boaters, and seasonal boaters who transit through the assessment area on their way to the Delaware Bay, or to the Chesapeake Bay via the Chesapeake and Delaware Canal.
- Small craft from other ports transit the assessment area which increases traffic seasonally. Areas in the northern part of the assessment area that see high numbers of small craft include Penn's Landing, Weeks Marine, Camden, the Ben Franklin Bridge, Dredge Harbor and the Rancocas Creek.
- The area near the southern end of the Tinicum Range also experience heavy small craft volumes from small craft departing the Essington area.
- An annual event called the Walnut-to-Walnut draws large numbers of kayakers who depart the Schuylkill River and transit the Delaware River as far north as Penn's Landing.
- Seasonal firework displays results in large numbers of small craft operating in close proximity to deep draft commercial traffic.
- Commercial vessel operators routinely communicate the number and locations of small craft to improve their (commercial vessel operators) overall situational awareness of the presence, locations and volumes of small craft.

[12] Mariners Advisory Committee for the Bay and River Delaware: http://macdelriv.org/index.php

- The USCG routinely issues Broadcast Notice to Mariners (BTM)[13] that alert waterway users to issues that could impact safe navigation. The USCG issues BTMs to report navigational warnings and information of importance to the safety of navigation such as the position of ice and debris, and the status of Aids to Navigation ATON).
- The USCG also issues Local Notice to Mariners (LNM)[14] to disseminate information concerning ATON, hazards to navigation, and other items of interest to mariners. LNMs are essential to all navigators for the purpose of keeping charts, Light Lists, Coast Pilots and nautical publications corrected and up-to-date.
- Although the volume of small craft rises in the spring and summer boating season, the volumes are fairly light compared to other similar sized ports.

Existing Mitigations:

- USCG Broadcast Notice to Mariners
- USCG Local Notice to Marines
- Mariners Advisory Committee for the Bay and River Delaware
- Good communications between the USCG, Pilots and commercial vessel operators

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Traffic Mix

Trends/Observations:

- With the exception of commercial fishing vessels, which only transit through the assessment area to fishing ground in the lower Delaware Bay, all classes and types of vessels operate in close proximity to each other in the assessment area.
- The channel at the entrance to the Christina River experiences heavy traffic mix between deep-draft vessels navigating the main channel and small craft entering and departing the Christina River.
- Kayaker's operate mostly on the Schuylkill River, but on occasion will depart the river and transit up the Delaware River as far as Penn's Landing.
- The marina located on the north side of Little Tinicum Island area experiences heavy traffic mix between deep-draft vessels navigating the main channel and small craft departing the marina and entering the main channel.
- Seasonal and maintenance dredging results in dredges, towing vessels and barges operating in close proximity to the main channel.
- Conflicts and "un-pleasant" interactions mostly occur between pleasure craft and deep draft vessels.

[13] USCG BTM: https://www.law.cornell.edu/cfr/text/33/72.01-25
[14] USCG LNM: https://www.navcen.uscg.gov/?pageName=lnmFAQ

- Commercial vessel operators routinely communicate the locations of small craft to improve their overall situational awareness of the presence, locations and volumes of small craft.
- Transit planning is conducted between the pilots and commercial vessel operators before the deep draft vessels enter or leave the port. Having a transit plan in place helps to minimize dangerous crossing situations and close quarter interactions.
- The maritime community works very well together to minimize risks associated with traffic mixing. Conflicts happen from time to time, but they are rare. Occasionally, an out-of-town boat, or an out-of-town company, will be less cooperative but overall the Delaware River marine transportation system is very functional.

Existing Mitigations:

- USCG Broadcast Notice to Mariners
- USCG Local Notice to Mariners
- Mariners Advisory Committee for the Bay and River Delaware
- Good communications between the USCG, Pilots and commercial vessel operators
- Transit planning

Additional Mitigations:

- See appendix C.

Congestion

Trends/Observations:

- Congestion is very seasonal, with certain areas in the assessment area being more congested than other areas.
- From Penn's Landing to the Walt Whitman Bridge the channel runs directly parallel to the Philadelphia waterfront. Shore-side events attract large numbers of small craft who loiter in the area, which increases congestion and the risk of collisions.
- Anchorage 7 (adjacent to Marcus Hook) experiences frequent congestion due to bunkering operations, vessels anchoring until a berth opens, vessels using the anchorage for maneuvering and vessels anchoring due to unforeseen cargo loading/unloading delays at the shore-side facility. From October 2017 to September 2018, Marcus Hook anchorage was the most heavily used anchorage in the assessment area, with 337 vessel anchoring's being reported.[15] During maintenance or deepening work sections of the anchorage 7 are closed which contributes to congestion because of the limited number of anchorages in the upper river system that can accommodate deep draft vessels.
- Anchorage 9 (adjacent to Mifflin Range) also experiences frequent congestion due to bunkering operations, vessels anchoring until a berth opens, and vessels anchoring due to unforeseen cargo loading/unloading delays at the shore-side facility.

[15] Appendix H: Delaware Bay PAWSA - Waterways Profile Material

- The MAC and USCG Sector Delaware Bay convened an Anchorage Management Working Group[16] to assess current operational needs and specific challenges that are affecting efficient anchorage utilization
- The intersection of the Delaware River main channel and the entrance to the Chesapeake and Delaware Canal experiences heavy traffic mix between deep-draft vessels navigating the main channel, and small craft entering and departing the canal.
- Larger deep draft vessel movements require a two tug escort which contributes to traffic congestion.
- Seasonal and maintenance dredging results in dredges, towing vessels and barges operating in close proximity to the main channel which contributes to traffic congestion.
- The port community is also working with the National Oceanic Atmospheric Administration (NOAA) to conduct bottom surveys with the objective of creating new anchorage space that will help to de-conflict usage of the prime anchorages, and specifically, the heavily used Marcus Hook and Mifflin Range anchorages.

Existing Mitigations:

- USCG Broadcast Notice to Mariners
- USCG Local Notice to Marines
- Mariners Advisory Committee for the Bay and River Delaware
- Anchorage Management Working Group
- Tug escorts for large deep draft vessels transits

Additional Mitigations:

- See appendix C.

Winds

Trends/Observations:

- The prevalent wind directions are from the North and West. 20 knot winds are not uncommon; during the winter the season (approximately October to May), wind speeds are generally higher. This period coincides with the increased number of fruit ship arrivals and tank ship and tank barge home heating oil movements.
- Vessels with high wind-profile areas (car carriers, larger container ships) are most impacted by winds and must maintain sufficient speed in order to maintain vessel maneuverability.
- Vessel maneuverability can be impacted by winds as vessels make the turn from Bellevue Range onto Marcus Hook Range.
- High winds in the Horseshoe Bend area can create high sea states and rough water conditions which can impact small craft maneuverability.
- The Delaware Bay and River has a NOAA Physical Oceanographic Real-Time System (PORTS)[17] installed that provides meteorological information in real time, and is readily available to help mariners plan and

[16] MAC Anchorage Advisory Working Group: http://www.macdelriv.org/mb.php?mid=820

prepare for changes in weather conditions. Also, unlike other PORTS installed at other U.S. ports, the maritime community worked with the NOAA to develop the Delaware Bay Operational Forecast System (DBOFS)[18] which provides forecast predictions of water levels, water temperatures, salinity levels, current velocities and wind speeds and directions.

Existing Mitigations:

- PORTS
- DBOFS

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Water Movement

Trends/Observations:

- Significant rain events in the spring and snow melt run-off from the winter increases water flow movement and can increase current speeds from the normal 1-2 knots, to over 4 knots. The increased current speeds also contribute to larger quantities of debris flowing from upriver estuaries and drifting downriver through the assessment area.
- The sharp bend at Horseshoe Bend can result in a heighten sea state and rough water that can impact small craft maneuverability. Commercial vessel operators and deep draft vessel Pilots are very familiar with the Delaware River system tides and currents and the impact they can have on navigating large commercial vessels in a confined, mixed-use waterway.
- The Delaware Bay and River PORTs provides real-time meteorological information that is readily available to help mariners plan/prepare for changes in weather conditions.
- Crosscurrents occasionally occur in the area just north of the Walt Whitman Bridge.
- The Delaware River north of the Delair Railroad Lift Bridge (marking the northern limit of the assessment area) is most impacted by significant rain fall and snow melt run-off.
- An extremely high tidal cycle can also increase water movement speeds.

Existing Mitigations:

- PORTS
- DBOFS

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

[17] NOAA PORTS: https://tidesandcurrents.noaa.gov/ports.html
[18] NOAA DBOFS: https://tidesandcurrents.noaa.gov/ofs/dbofs/dbofs.html

Visibility Restrictions

Trends/Observations:

- Fog routinely occurs along the Chesapeake and Delaware Canal year round including the eastern entrance, forming more frequently in the winter. Fog forms overnight and usually dissipates by around 10:00 am in the morning. If the canal is closed due to fog the Marine Exchange of Philadelphia announces the closure and disseminates e-mails to the maritime community.
- Fog is seasonal, spring and fall are traditionally low visibility times of the year. Fog occurs approximately 24 times each year, with impacts lasting less than 24 hours. As of 29 November, 2018 there have been 26 Chesapeake and Delaware Canal closures since the beginning of the calendar year.
- During reduced visibility conditions there are increased communications between vessel operators. Vessels at anchor or moored elect to not get underway until visibility conditions improve.

Existing Mitigations:

- PORTS
- DBOFS

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Obstructions

Trends/Observations:

- Encountering obstructions in the assessment area is a daily occurrence, especially after a weather event such as heavy rain or during a snow melt. The Delaware River between the Schuylkill River and off of Penn's Landing are areas that see very heavy concentrations of debris and floating obstructions.
- Debris is always present in the Schuylkill River and poses a hazard to navigation for small craft. Heavy rain and snow melt increases the amount of debris flowing downriver. Navigating the river at night requires small craft operators to proceed slowly to avoid the obstructions. After a heavy rain, the volume of large obstructions flowing out of the Schuylkill River and entering the Delaware River shipping channel increases dramatically. There is a small trash recovery vessel that operates on the Schuylkill River. The vessel primarily recovers recyclable material and lack the ability to remove larger obstruction from the water.
- When the USCG receives a report of a large obstruction in the water, mariners are alerted to the type of obstruction and its current position via a BNM.
- Horseshoe Bend is a natural collection point for debris flowing downriver. Debris includes not just small logs, but entire trees and pier sections. Ice flowing downriver also collects in this area. Obstructions in this area pose a hazard to navigation for small craft operators.
- Large obstructions such as dead heads, trees, railroad ties and drums can be an “irritant: to the larger vessels, but pose a major hazard for recreational craft and smaller vessels.

- Ice accumulates at Bulkhead Bar Range and behind the Bulkhead Shoal breakwater, which affects vessel maneuverability. The January to March time frame is when ice normally forms and becomes an obstruction to navigation.
- Because traditional ATON buoys are susceptible to being drug off station due to ice flows, the USCG places ice buoys that are more resilient in the winter environment, approximately 18 ice buoys are placed in service every winter.
- There are very good lines of communication between the Delaware River maritime community and the USCG; mariners assist the USCG with tracking off station ATON by notifying the USCG about the position and operating status of the ATON.
- The USCG also utilizes Automatic Identification Systems (AIS) [19] to broadcast the presence, identity, position and status of ATON.
- Each year the USCG sponsors an ice-conference to collaborate with the Delaware River maritime community and prepare for the winter navigational season. Federal presence includes the USCG and NOAA. USCG Sector Delaware Bay operates two 65-foot ice breakers to ensure the river remains open to navigation during the winter season
- When high wind events are forecast, shore-side facilities are reminded to secure items on the facility that could be blown into the water and become an obstruction to navigation.
- Floating dredge pipe lines placed during dredging and deepening operations can obstruct navigation.

Existing Mitigations:

- ATON ice buoys
- Schuylkill River small trash recovery vessel
- USCG ice breakers
- Strong lines of communications between all segments of the maritime community
- Annual ice-conference
- AIS ATON
- USCG BNM
- USCG LNM

Additional Mitigations:

- See appendix C.

- [19] AIS carriage requirements improve situational awareness. AIS is a maritime navigation safety communications system that provides vessel information, including the vessel's identity, type, position, course, speed, navigational status and other safety-related information automatically to appropriately equipped shore stations and other vessels. AIS ATON: https://www.navcen.uscg.gov/pdf/AIS/AIS_ATON_Special_Notice_v4.pdf

Visibility Impediments

Trends/Observations:

- Tinicum Upper and Lower Range Lights are obscured by shore-side lighting from the refineries located on Mantua Creek.
- Buildings located adjacent to Pier 96 and the Packer Avenue Terminal can pose a visibility impediment for down-bound towing vessels and small craft as they approach the Walt Whitman Bridge and line up on East Horseshoe Range.
- Shore side lighting from the Marcus Hook refineries are a visibility impediment.
- Background lighting from shore side facilities on both side of the river are a visibility impoundment and make it difficult to see small craft traffic.
- The refinery lights at Eagle Point make it hard to see vessels berthed alongside. Inbound towing vessels and small craft traffic coming from Eagle Point headed for the harbor are also difficult to see due to the refinery lights.
- The sharp bends in the channel at Bulkhead Bar Range and at Horseshoe Bend obscures the presence of approaching vessel traffic.
- AIS assist in safe navigation by alerting mariners to the position of other vessels that would not otherwise be seen visually or by radar. Multiple agencies have their own AIS system to track vessel movements and work collaboratively to share information among waterways users.

Existing Mitigations:

- Good communication among commercial vessel operators about areas where visibility impediments exist.
- Local knowledge
- AIS carriage requirements

Additional Mitigations:

- See appendix C.

Dimensions

Trends/Observations:

- The Walt Whitman Bridge has a 150 foot air gap clearance (at the center of the main span) which restricts the size of vessels that can transit further upriver. On occasion, vessels will transit at low tide to safely pass under the bridge.
- The Interstate 95 Bridge that crosses the Schuylkill River has an air gap clearance of 135 feet, vessels with 132 foot air clearances routinely transit under the bridge.
- Vessel squat is also concern for vessels with little under keel clearance; vessels with little under keel clearance must proceed at slower speeds to preclude the vessel from squatting and striking bottom. The

recently approved main channel deepening project[20], which will increase the main channel depth from 40 feet to 45 feet, will help alleviate the dangers of grounding due to vessel squatting.

- Although the ongoing depending of the main channel will provide additional under keel clearances, deep draft vessels still have to exercise caution to ensure the surge from (their vessel) passing close to moored vessels does not pull the moored vessels away for the dock.
- Seasonal dredging and deepening operations further reduce the available channel dimensions which contributes to close quarter interactions and conflicts.
- New Castle Range channel adjacent to Pea Patch Island is very narrow; the channel runs right up the edge of the island on the western side, and is bounded by anchorage 5 on the eastern side.
- Vessels moored at facilities along the Christina River and the Paulsboro facilities reduce the channel dimensions.
- The US Army Corps of Engineers (USACE) is constantly taking surveys of the channel; when obstructions are identified the USACE works with the USCG, Pilots and the MAC who will issue a Transit Advisory alerting mariners about the identified obstructions. It was also noted that the USACE surveys recently achieved a category of zone of confidence (CATZOC) A2 [21] rating.
- The presence of extremely large, wide beamed deep draft vessels in the channel reduces the available channel width and precludes two-way traffic in some areas. The presence of the dredging equipment also reduces the dimensions of the waterway.

Existing Mitigations:

- MAC Transit Advisories
- USACE bottom surveys
- USACE CATZOC A2 rating for bottom surveys

Additional Mitigations:

- See appendix C.

Bottom Type

Trends/Observations:

- The bottom type in the assessment area is a mix of sand, mud, and hard rock.
- There are areas of the river that are distinctively muddy. The majority of the river bottom is fairly soft, compared to other hard rock areas such as like Marcus Hook that have hard ledges and outcroppings

[20] USACE Delaware River Main Channel Deepening project: https://www.nap.usace.army.mil/Missions/Civil-Works/Delaware-River-Main-Channel-Deepening/

[21] The portion of the federal channel from Newbold Channel Range down to the mouth of the Delaware Bay is the first waterway in the U.S. to have an improved quality classification assigned to USACE survey data—category of zone of confidence (CATZOC) A2. Improving survey quality and upgrading the CATZOC classification allows operators to accommodate smaller margins of error while still ensuring that navigating maritime approaches and constrained environments remain safe. These decreased tolerances allow ships to maximize their loads, ultimately increasing inbound and outbound cargoes. See: https://www.nauticalcharts.noaa.gov/updates/?p=170957

immediately adjacent to the main channel. Dredging these areas requires blasting and the use of hydraulic hammers.

- The bottom is hard rock from the Bellevue Range area to the Tinicum Range area, dredging in this area also requires blasting and the use of hydraulic hammers.

Existing Mitigations:

- MAC Transit Advisories
- USACE bottom surveys
- USACE CATZOC A2 rating for bottom surveys

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Configuration

Trends/Observations:

- The assessment area encompassed approximately 35 miles of the Delaware River system. Channel widths vary from 1600 feet at the widest to 400 feet at the narrowest.
- Three river systems that intersect with the Delaware River include the Christine River (1.5 miles long with channel widths from 150 to 320 feet), the Salem River (1 mile long with channel widths from 250 to 300 feet), and the Schuylkill River (1 mile long with varying channel widths).[22] Entering and departing these river systems requires vessel to make 90 degree turns when entering/departing the Delaware River main shipping channel.
- The main channel has several sharp bends and turns that impact the ability of vessels to see each other.
- The Chesapeake and Delaware Canal also intersects with the Delaware River shipping channel. Vessels that are departing the canal and entering the Delaware River are required to make a sharp turns while at the same time entering a highly congested, confined area.

Existing Mitigations:

- MAC Transit Advisories
- USACE bottom surveys
- USACE CATZOC A2 rating for bottom surveys

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

[22] Appendix H: Delaware River PAWSA - Waterway Profile Information

Personnel Injuries

Trends/Observations:

- There are several passenger vessels that carry more than 150 passengers and are subject to Subchapter K inspection requirements. These vessels offer dinner cruises and operate mostly from the Penn's Landing to the Navy Yard to the south, and the Ben Franklin Bridge to the north. The vessels operate on a year round basis.
- Some multi-deck passenger vessels will book several events, with each event taking place solely on a single deck of the vessel. This precludes the intermixing of the passengers going up and down stairs and ladder ways between the decks which reduces the risk of passenger injuries.
- It has been several years since ocean going cruise ships have called on the port. There are several smaller coastal cruise ships that occasionally call on the port but not on a regular basis.
- There are only a few water taxis, operated by small crews, which operate seasonally within the assessment area. It was noted that when water taxis depart the dock and make the required sound signal, the whistle they blow is high-pitched and distinguishable from sound signals made by non-water taxi vessels.
- The assessment area is a relatively protected body of water/river system that reduces the risk of personnel injury incidents. If bad weather is predicted, passenger vessels will sometime elect to stay moored up and provide the paid for entertainment and/or dinner services while the vessel is moored. Passengers are provided a refund if requested, but many elect to stay aboard even though the vessel will remain moored.
- There are numerous Federal, State and local emergency response resources available along the entire assessment area to quickly respond in the event of an emergency. Passenger vessel are also not far from shore-side moorings and can quickly return to a dock if an emergency arises.
- Passenger vessel operations are mostly limited to the upper river system, off Penn's Landing, and are short in duration.

Existing Mitigations:

- Mass rescue operation plans have been developed and exercises are conducted that involve numerous Federal, State (Pennsylvania, New Jersey and Delaware) and local emergency response agencies
- Passenger vessel operators employ good business practice such staying moored during bad weather, and minimizing the use of stairs and ladder ways to reduce the risk of injuries to passengers

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Petroleum Discharge

Trends/Observations:

- The assessment area has 5 active refineries which refine approximately 1 million barrels of crude oil per day, and currently supply 72% of gasoline and refined products for the Northeast U.S.

- The crude oil trade is very important to the port community, but its prominence has changed with the number of crude oil tankers being replaced by LNG tankers trending upwards. LNG vessel traffic has increased rapidly and the importance of the LNG trade has grown considerably.
- The petroleum industry is very well regulated and takes safety measures above and beyond regulatory requirements. Tank vessels arriving the port are boarded prior to arrival by independent safety auditors who review the vessels pollution response plans and observe all cargo loading and unloading operations to ensure the vessels and crew follow all oil terminal safety standards. If cargo transfer operations are conducted in a manner that might potentially result in an accident or pollution incident, the safety auditors have "stop work" authority to cease cargo transfer operations.
- Petroleum discharge and hazardous materials release response exercises are conducted annually and include representation from Pennsylvania, New Jersey and Delaware State Regulatory agencies. A recent fire and pollution response exercise was held at an oil terminal facility and was attended by approximately 120 people that included representatives from all the oil refineries, numerous fire departments, and Federal, State and local regulatory authorities.
- The oil and transportation industries established the Delaware Bay and River Cooperative (DBRC)[23] that leverages first responder resources (people and equipment) to respond to pollution spills and hazardous material releases. Members of the DBRC include firefighters trained to fight industrial fires.
- First responder training includes having members of the Philadelphia Fire Department go aboard vessels so they are aware of the differences between fighting a shore side fire as opposed to a vessel fire.
- USCG Sector Delaware Bay Area Committee meetings are also held on a quarterly basis to discuss port readiness, logistics, emergency preparedness and response planning for domestic emergencies and regional contingencies. The Area Committee (at-large) meets quarterly and includes approximately 300 members. The Area Committee (Executive Steering) also meets on a quarterly basis.
- The maritime industry has established guidelines and procedures that limits maneuvering, and conducing lightering operations, when wind velocities reach a certain thresholds.

Existing Mitigations:

- Delaware Bay River Cooperative
- U.S. Government initiated unannounced exercises
- Emergency response exercises include the deployment of personnel resources and equipment
- Training shore side fire-fighters on ship-board firefighting principles
- Independent safety audits
- USCG Sector Delaware Bay Area Committee

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

[23] DBRC: http://dbrcinc.org/

Hazardous Materials Release:

Trends/Observations:

- Bulk Hazardous materials of all types are transported through the assessment area including acetone, ethane, formic acid, sodium hydroxide, benzene, and acetic acid.
- The chemical ships are not as larger as the tank ships entering the port with the average chemical ship being approximately 55,000 deadweight tons.
- Compared to crude oil and product shipments, the amount and frequency of bulk hazardous materials shipment is very low. There is only one chemical facility within the assessment area that handles bulk hazardous materials.
- The chemical industry, like the petroleum industry, is very well regulated and takes safety measures above and beyond regulatory requirements. Response exercises are conducted annually and include representation from Pennsylvania, New Jersey and Delaware State Regulatory agencies.

Existing Mitigations:

- Delaware Bay River Cooperative
- U.S. Government initiated unannounced exercises
- Emergency response exercises include the deployment of personnel resources and equipment
- Independent safety audits
- USCG Sector Delaware Bay Area Committee

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Mobility:

Trends/Observations:

- A major marine casualty would have a significant impact on the port complex. Shutting down the waterway would have a major impact to the oil refiners who rely upon daily imported crude oil shipments to keep the refineries operating.
- Shore-side infrastructure would also be impacted by a port closure. Outbound shipments of refined products by railroad tank car would be disrupted.
- There are several railroads that could be utilized to bring in and ship out limited amounts of cargo, but the capacity of the rail lines could not sustain long term operations.
- Shore side facilities that rely upon daily and weekly cargo transfers (crude oil for example) would be greatly impacted by a port closure. The larger refineries receive in some cases 1 million gallon shipments of crude oil daily, an extended port closure could result in the refinery running out of crude oil to processes and having to shut-down refining operations. Facilities that receive vessels every few weeks would be less impacted by a port closure.

- Bridge fending systems have been upgraded for several bridges located within the assessment area. Updated fending systems offer a higher degree of protection to preclude the bridge abutments from being struck by a vessel. Emergency response exercises have been conducted that focused on how to respond to a port closure as a result of a vessel striking a bridge.
- There are several large marine construction companies that operate within the assessment area; heavy lift and salvage response equipment is readily available to assist in re-opening the port in the event of a port closure. Salvage and marine firefighting plants are now required for vessels that call on the port.
- The USCG has established Marine Transportation System Recovery Units (MTSU) [24] to assist in restoring port functions and resuming commercial activity as quickly as possible following a significant port disruption.

Existing Mitigations:

- USCG MTSRU
- Emergency response exercises include the deployment of personnel resources and equipment
- Salvage and heavy lift response capabilities
- Salvage and marine firefighting plans

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Health and Safety:

Trends/Observations:

- A major marine casualty would have a significant impact on the port complex. Shutting down the waterway would have a major impact to the oil refiners who rely upon imported crude oil to keep the refineries operating.
- The assessment area is surrounded by several major cities with heavily populated communities. A major marine casualty such as pollution incident, or a chemical release from a chemical waterside facility or chemical ship, could have a significant impact on a very large number of people.
- Waterfront facilities are in some cases located direly adjacent to large population centers with some residential communities located direct adjacent to some of the larger facilities.

Existing Mitigations:

- Delaware Bay River Cooperative
- U.S. Government initiated unannounced exercises
- Pollution response exercises include the deployment of resources and equipment
- Strong communication lines between Federal/State agencies and waterways users and stakeholders.
- Emergency response planning and annual exercises reduce the impacts of health and safety risks.

[24] USCG MTSRU: https://homeport.uscg.mil/Lists/Content/Attachments/1626/MTSRU%20Information%20Sheet%20v4%200.pdf

- Independent safety audits

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Environmental:

Trends/Observations:

- Environmentally Sensitive Index (ESI)[25] maps of the assessment area indicate that approximately 50% of the assessment area is designated as environmentally sensitive assessment with environmental restrictions in place to protect marine species and endangered aquatic resources.

Existing Mitigations:

- Environmentally Sensitive Index maps
- Area Contingency Plans identify pre-designated areas for placing containment boom
- Active Federal/State Environmental response planning and capabilities

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

Aquatic Resources:

Trends/Observations:

- Although there are no commercial fishing operations taking place within the assessment area there are protected species present such as sturgeon and ospreys.
- When blasting is conducted as part of dredging operations, sensors are place on buoys to detect the presence of sturgeon. The spawning cycle of the sturgeon is of very high significance; dredging of the main river channel and the docks and shore side moorings are permitted activities. There are certain times so the year that dredging permits are not issued due to the presence of spawning sturgeon.

Existing Mitigations:

- Environmentally Sensitive Index maps
- Area Contingency Plans identify pre-designated areas for placing containment boom
- Active Federal/State Environmental response planning and capabilities

Additional Mitigations:

- Risks determined to be balanced by existing mitigations.

[25] Environmental Sensitivity Index (ESI) maps provide a concise summary of coastal resources that are at risk if an oil spill occurs nearby. Examples of at-risk resources include biological resources (such as birds and shellfish beds), sensitive shorelines (such as marshes and tidal flats), and human-use resources (such as public beaches and parks). See: https://response.restoration.noaa.gov/maps-and-spatial-data/download-esi-maps-and-gis-data.html#Pennsylvania

Economic:

Trends/Observations:

- The maritime industry in assessment area contributes approximately $85 billion dollars to the economy.
- A long term port closure would have huge impact on refining capacities and significant, national economic consequences. The price of gasoline would spike immediately across the nation because demands could not be fulfilled.
- The impact of closing a refinery for more than five days would be shutting down the refinery because imported crude oil would not be available to keep the refinery operating.
- One refinery produces 80% of the domestic fuel needs for a major airline. If the refinery were forced to shut down there would be immediate, very significant impacts for the airline and its passengers.
- If there was a port closure, some types of traffic and cargo such as general cargo and perishable products such as fruit and produce, could be diverted to other ports.

Existing Mitigations:

- Good communication between all port partners and stakeholders.
- USCG MTSRU
- Emergency response exercises include the deployment of personnel resources and equipment
- Salvage and heavy lift response capabilities
- Salvage and marine firefighting plans

Additional Mitigations:

- Not evaluated.

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Appendix C

Workshop participants identified, discussed and evaluated additional risk intervention strategies to further reduce risks. The recommended additional risk intervention strategies should not be construed to represent the views of or statements by the United States Coast Guard.

Additional Risk Intervention Strategies

Small Craft Quality:

- Rules and Regulations: Develop a comprehensive boater education, training and certification program for small craft operators who operate on the Delaware Bay and River.
- Coordination and Planning: Increase public outreach to educate the recreational boating community on the navigational safety risks of operating small craft on the Delaware Bay and River.
- Enforcement: Enhance existing boating safety law enforcement patrols that target Boating While Intoxicated violations.

Traffic Mix:

- Rules and Regulations: Develop a comprehensive boater education, training and certification program for small craft operators who operate on the Delaware Bay and River.
- Coordination and Planning: Increase public outreach to educate the recreational boating community on the navigational safety risks of operating small craft on the Delaware Bay and River.
- Navigation and Hydrographic Information: Develop an enhanced technology alert system to warn boaters of dangerous vessel traffic conditions.

Congestion:

- Radio Communications: Place Automatic Identification System (AIS) transponders on un-attended barges.
- Active Traffic Management: Establish a Vessel Traffic Service (VTS) for the Delaware River.
- Rules and Regulations: Simplify the regulatory processes for establishing designated anchorages.
- Coordination and Planning: Encourage and support the ongoing operations of the Mariners Advisory Committee (MAC) Anchorage Management Working Group.

Obstructions:

- Navigation and Hydrographic Information: Develop a crowd-sourced mobile phone application for boaters to report the locations of obstructions sighted in the waterway.
- Other Actions: Establish a dedicated debris-removal vessel that is capable of removing large obstructions from the waterway.

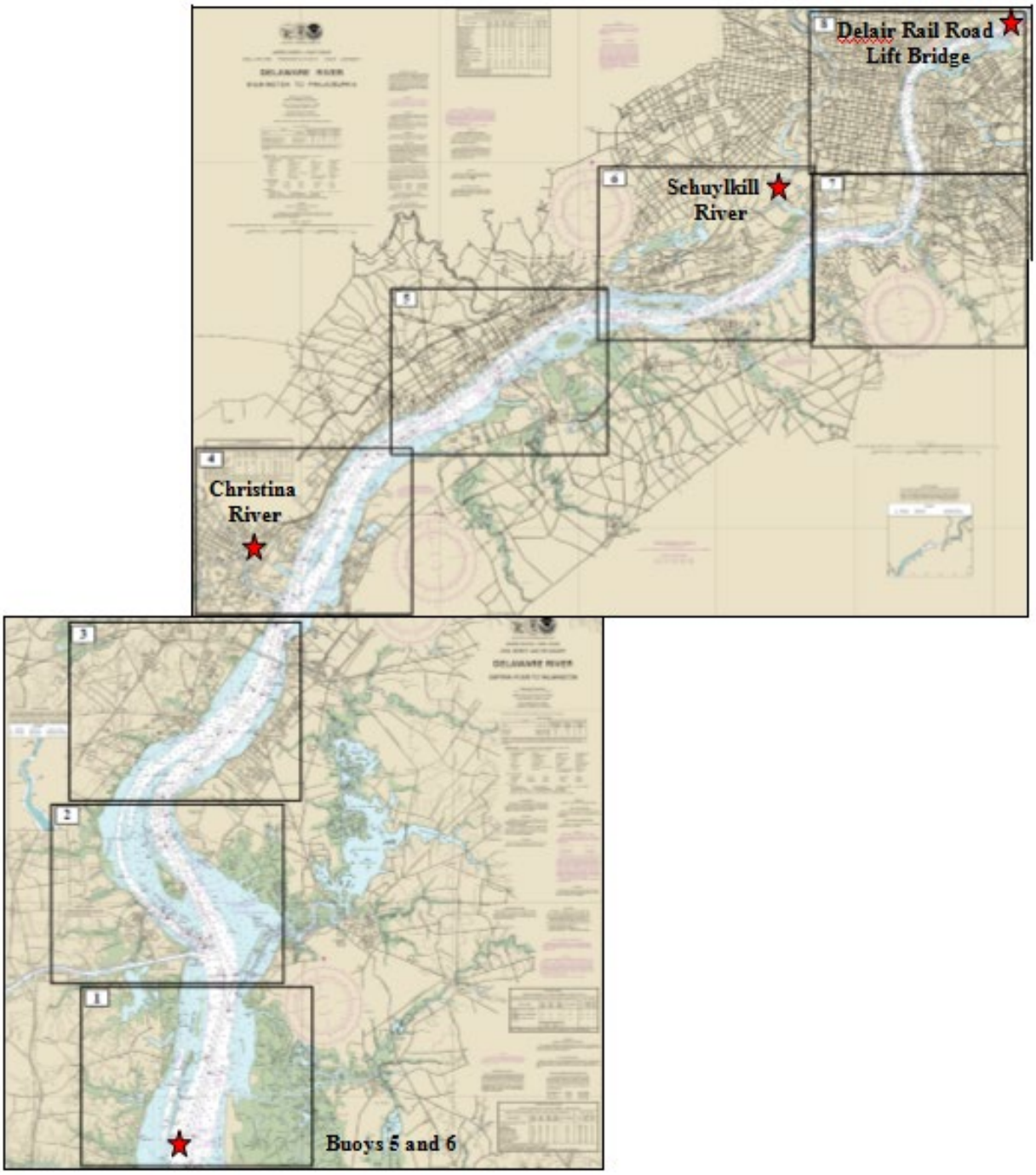
Visibility Impediments:

- Rules and Procedures: Establish and enforce rules to ensure navigational aids are visible and (shore-side) background lighting that impacts navigation safety is removed or reduced.
- Other Actions: Conduct a USCG Waterways Analysis and Management (WAMS) study for the Delaware Bay and River.
- Coordination and Planning: Continue efforts to place lights on the un-lighted Aids to Navigation buoys.

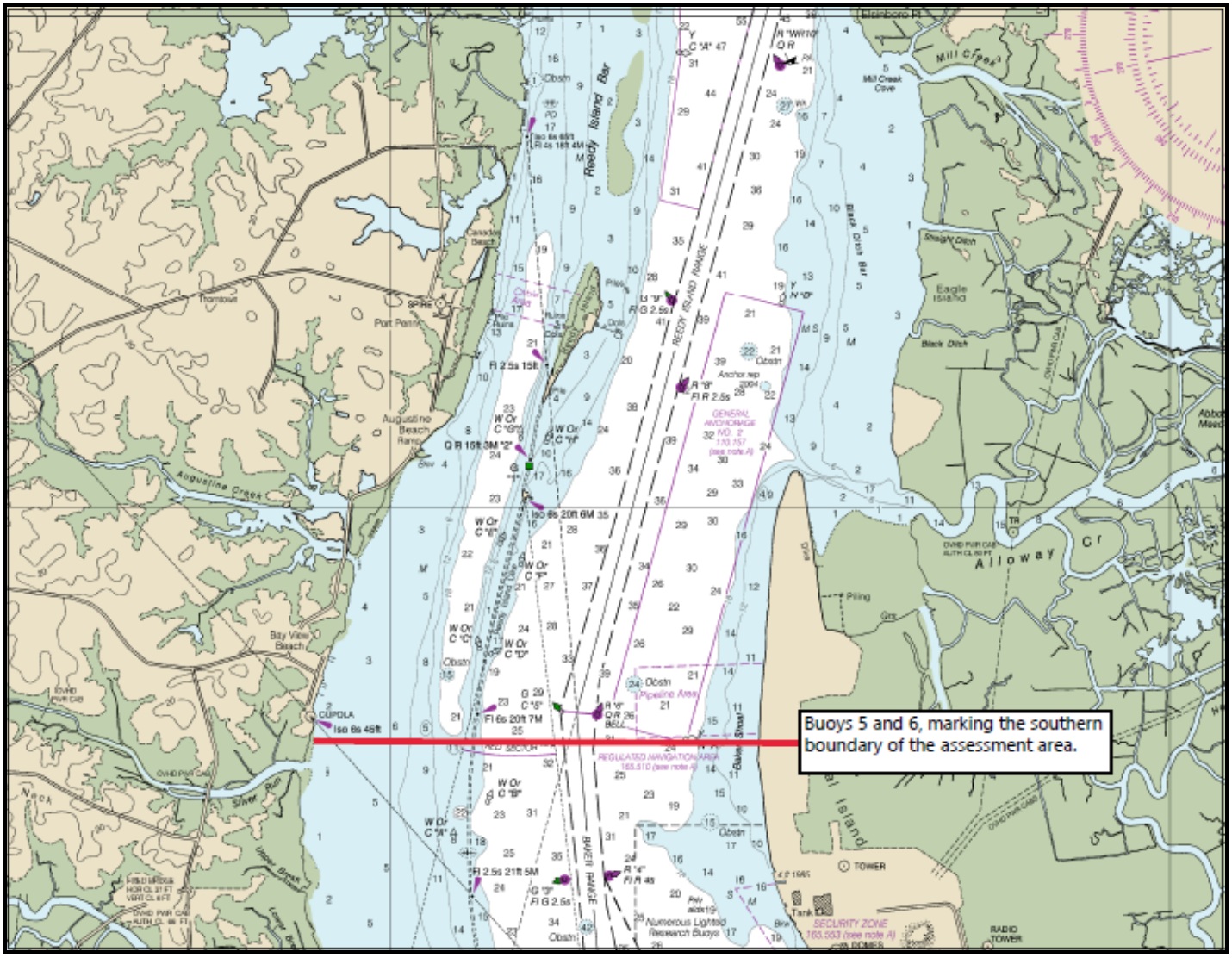
Dimensions:

- Waterway Changes: Widen critical turns (Horseshoe Bend, Entrance to the Chesapeake and Delaware Canal, etc.) to improve navigation safety.
- Navigation and Hydrographic Information: Evaluate the channel dimensions and depths in the area that encompasses the eastern entrance into the Chesapeake and Delaware Canal, the entrance into Bulkhead Shoal Channel, and the southern area of the New Castle Range channel with the intent to identify possible channel configuration changes that could improve navigation safety in this area.
- Coordination and Planning: Place continued emphasis on maintaining the 45-foot channel depth project dimensions.

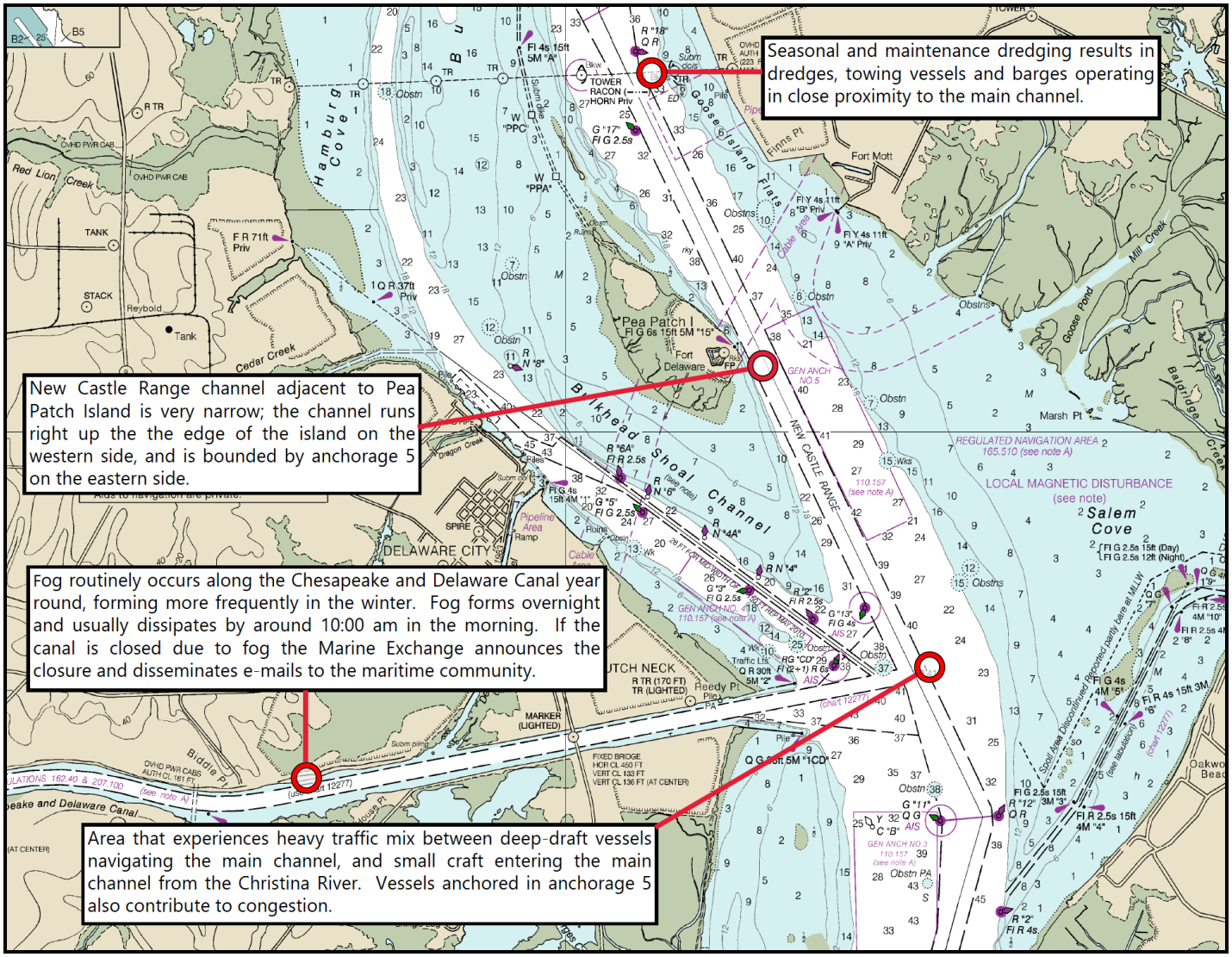
Appendix D **Charts 12311 & 12312 – Participants Comments**



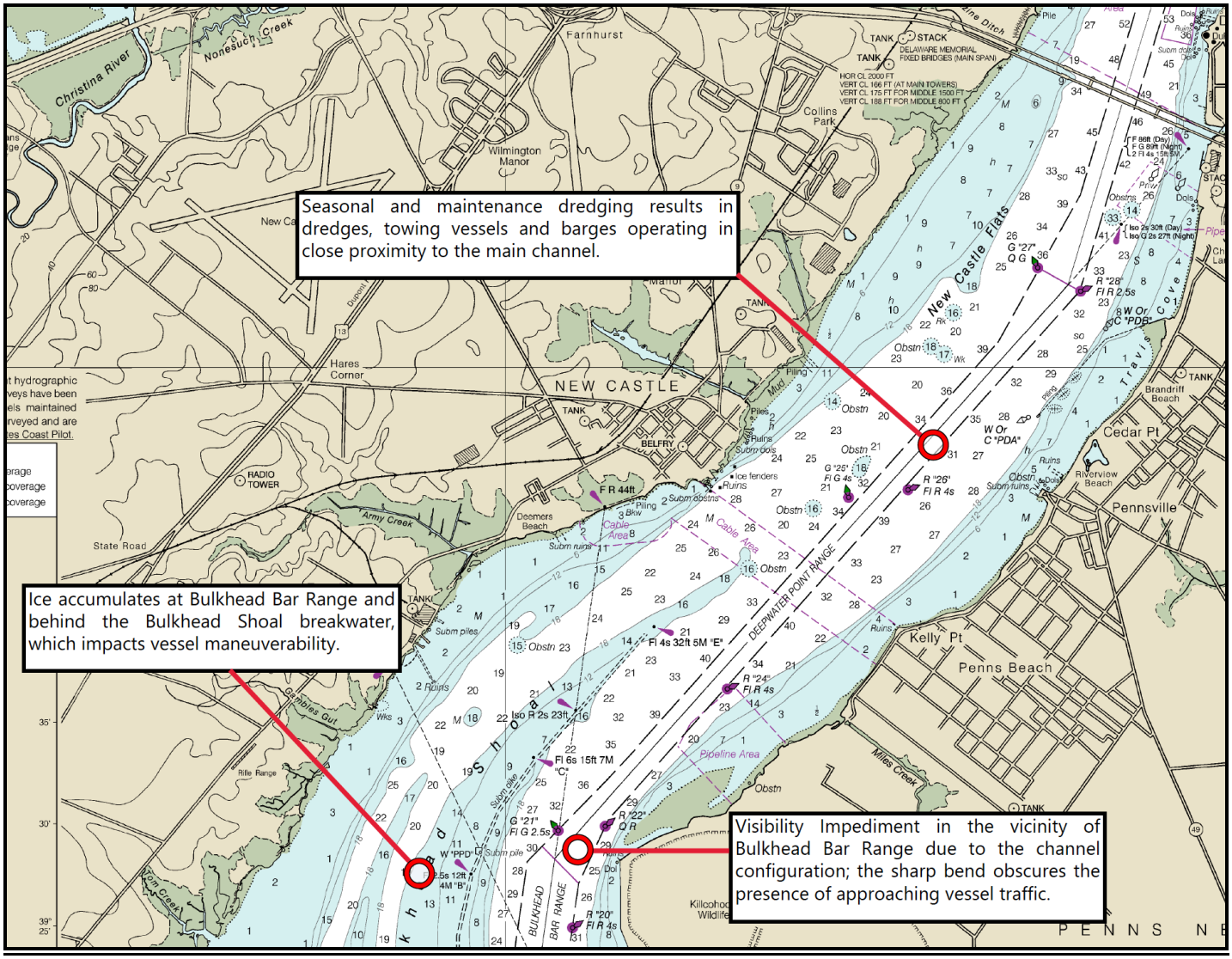
Segment 1


Buoys 5 and 6, marking the southern boundary of the assessment area.
Reedy Island Bar
REEDY ISLAND RANGE
BAKER RANGE
Augustine Creek
Augustine Beach
Bay View Beach
Port Penn
Mill Creek
Mill Creek Cove
Eagle
Black Ditch
Alloway Cr
Baker Shoal
Reedy Island
CUPOLA
Iso 6s 45ft
Fl 6s 20ft 7M
Iso 6s 20ft 6M
Fl 2.5s 21ft 5M
Fl G 2.5s
Numerous Lighted Research Buoys
TOWER
RADIO TOWER
SECURITY ZONE
GENERAL ANCHORAGE
REGULATED NAVIGATION AREA
Pipeline Area

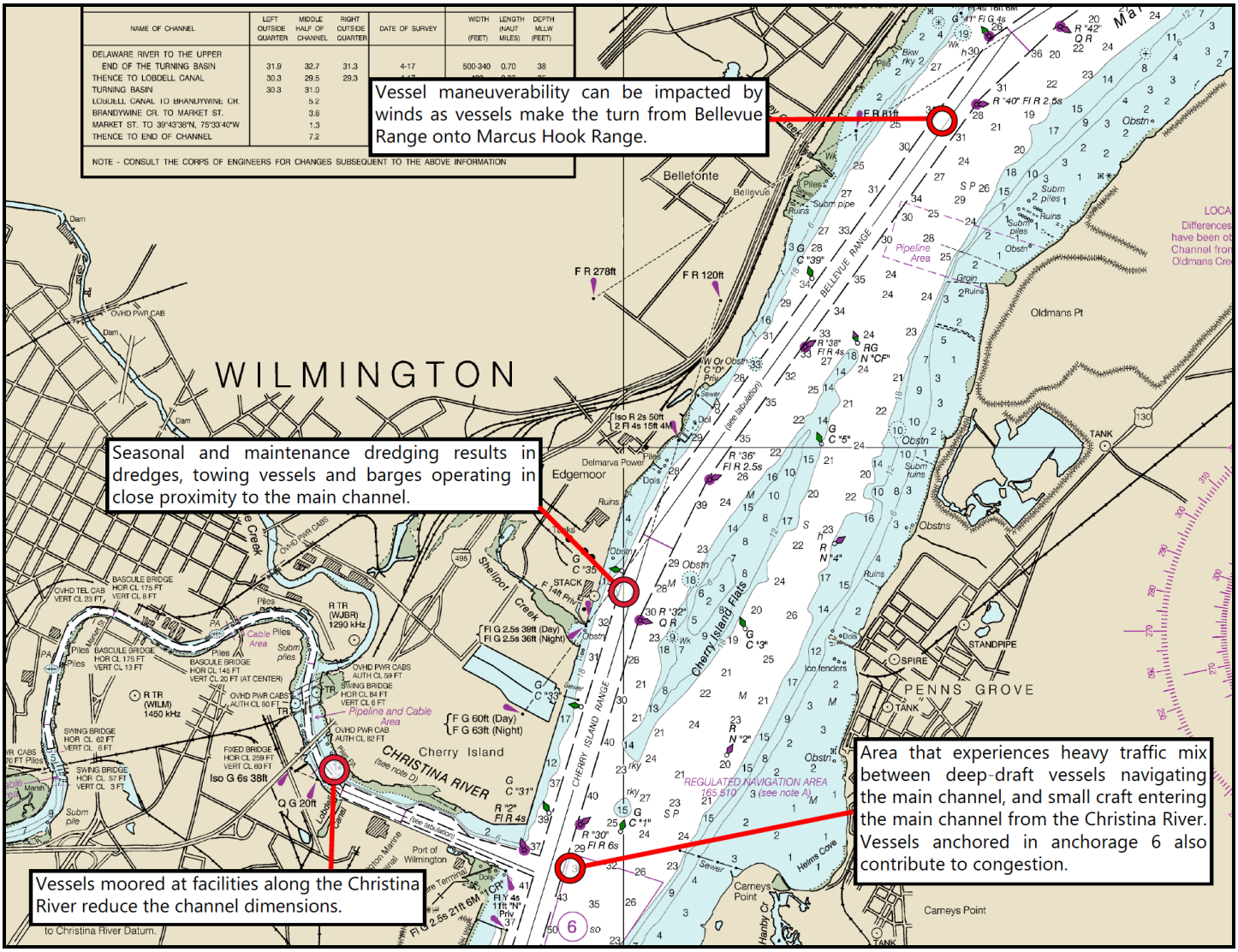
Segment 2


Seasonal and maintenance dredging results in dredges, towing vessels and barges operating in close proximity to the main channel.
New Castle Range channel adjacent to Pea Patch Island is very narrow; the channel runs right up the the edge of the island on the western side, and is bounded by anchorage 5 on the eastern side.
Fog routinely occurs along the Chesapeake and Delaware Canal year round, forming more frequently in the winter. Fog forms overnight and usually dissipates by around 10:00 am in the morning. If the canal is closed due to fog the Marine Exchange announces the closure and disseminates e-mails to the maritime community.
Area that experiences heavy traffic mix between deep-draft vessels navigating the main channel, and small craft entering the main channel from the Christina River. Vessels anchored in anchorage 5 also contribute to congestion.
Pea Patch I
Fort Delaware
Bulkhead Shoal Channel
NEW CASTLE RANGE
DELAWARE CITY
Salem Cove
Fort Mott
Marsh Pt
Mill Creek
Goose Pond
Hamburg Cove
Red Lion Creek
Cedar Creek
Dragon Creek
Reedy Pt
Biddle Pt
Finns Pt
Goose Island Flats
LOCAL MAGNETIC DISTURBANCE
(see note)
REGULATED NAVIGATION AREA
165.510 (see note A)
Chesapeake and Delaware Canal

Segment 3


Seasonal and maintenance dredging results in dredges, towing vessels and barges operating in close proximity to the main channel.
Ice accumulates at Bulkhead Bar Range and behind the Bulkhead Shoal breakwater, which impacts vessel maneuverability.
Visibility Impediment in the vicinity of Bulkhead Bar Range due to the channel configuration; the sharp bend obscures the presence of approaching vessel traffic.
Christina River
Nonesuch Creek
Farnhurst
Wilmington Manor
Collins Park
Hares Corner
NEW CASTLE
BELFRY
RADIO TOWER
State Road
Army Creek
Deemers Beach
Cable Area
DEEPWATER POINT RANGE
New Castle Flats
Travis Cove
Brandriff Beach
Cedar Pt
Riverview Beach
Pennsville
Kelly Pt
Penns Beach
Pideline Area
Miles Creek
Gabbies Gut
Rifle Range
Killcohook Wildlife
BULKHEAD
BAR RANGE
PENNS NE

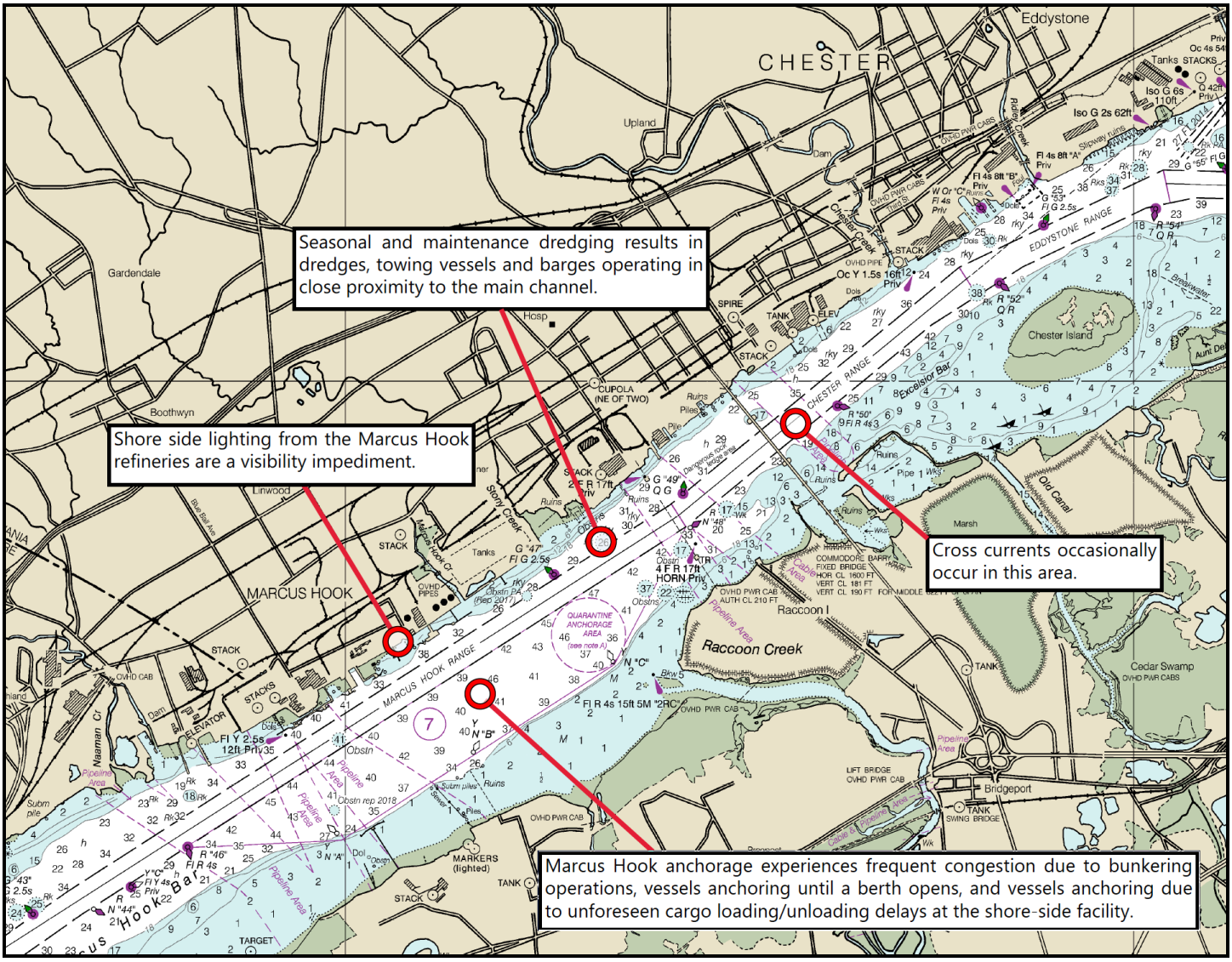
Segment 4



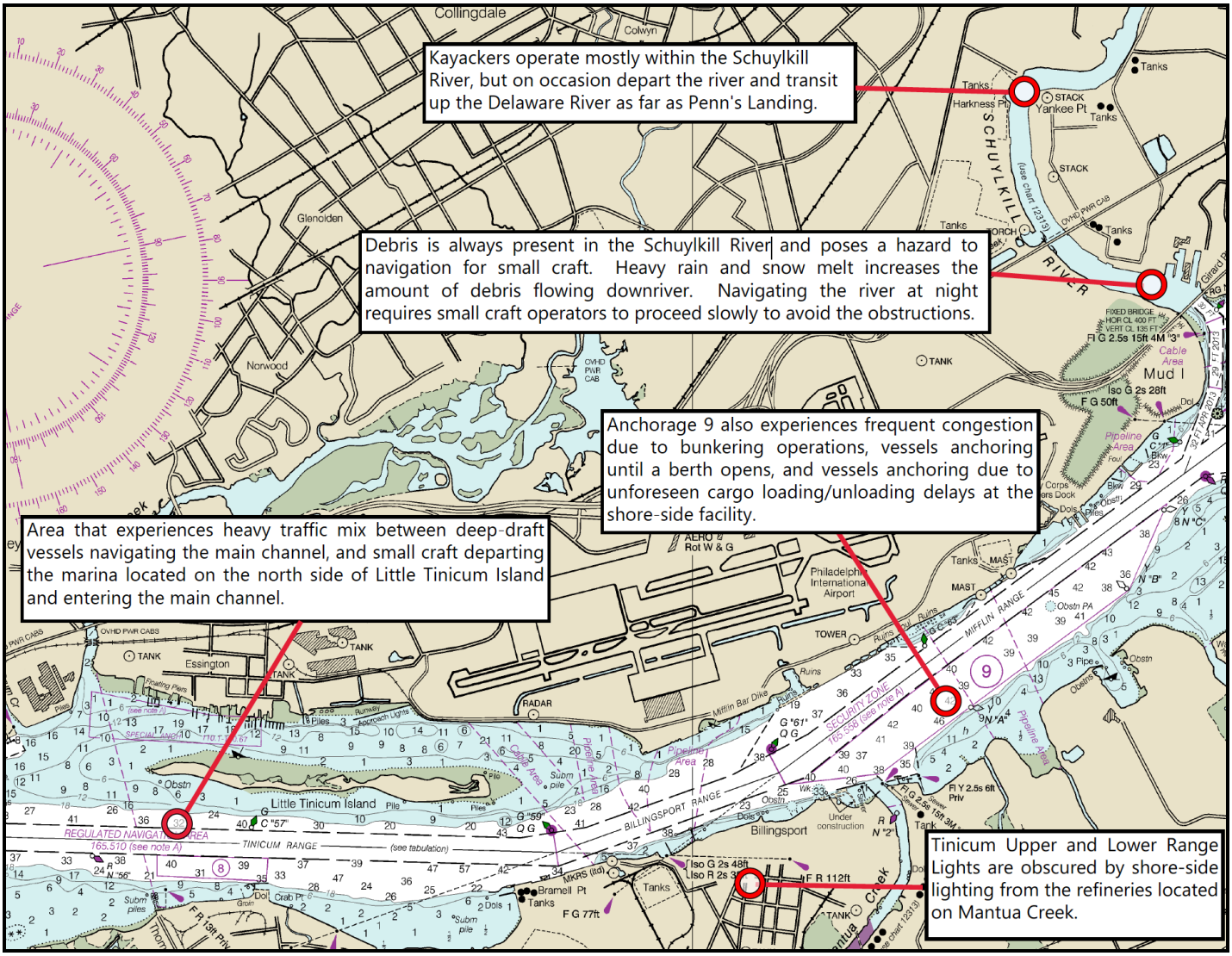
NAME OF CHANNEL	LEFT OUTSIDE QUARTER	MIDDLE HALF OF CHANNEL	RIGHT OUTSIDE QUARTER	DATE OF SURVEY	WIDTH (FEET)	LENGTH (NAUT MILES)	DEPTH MLLW (FEET)
DELAWARE RIVER TO THE UPPER END OF THE TURNING BASIN	31.9	32.7	31.3	4-17	500-340	0.70	38
THENCE TO LOBDELL CANAL	30.3	29.5	29.3				
TURNING BASIN	30.3	31.0					
LOBDELL CANAL TO BRANDYWINE CR.		5.2					
BRANDYWINE CR. TO MARKET ST.		3.8					
MARKET ST. TO 39°43'38"N, 75°33'40"W		1.3					
THENCE TO END OF CHANNEL		7.2					

NOTE - CONSULT THE CORPS OF ENGINEERS FOR CHANGES SUBSEQUENT TO THE ABOVE INFORMATION

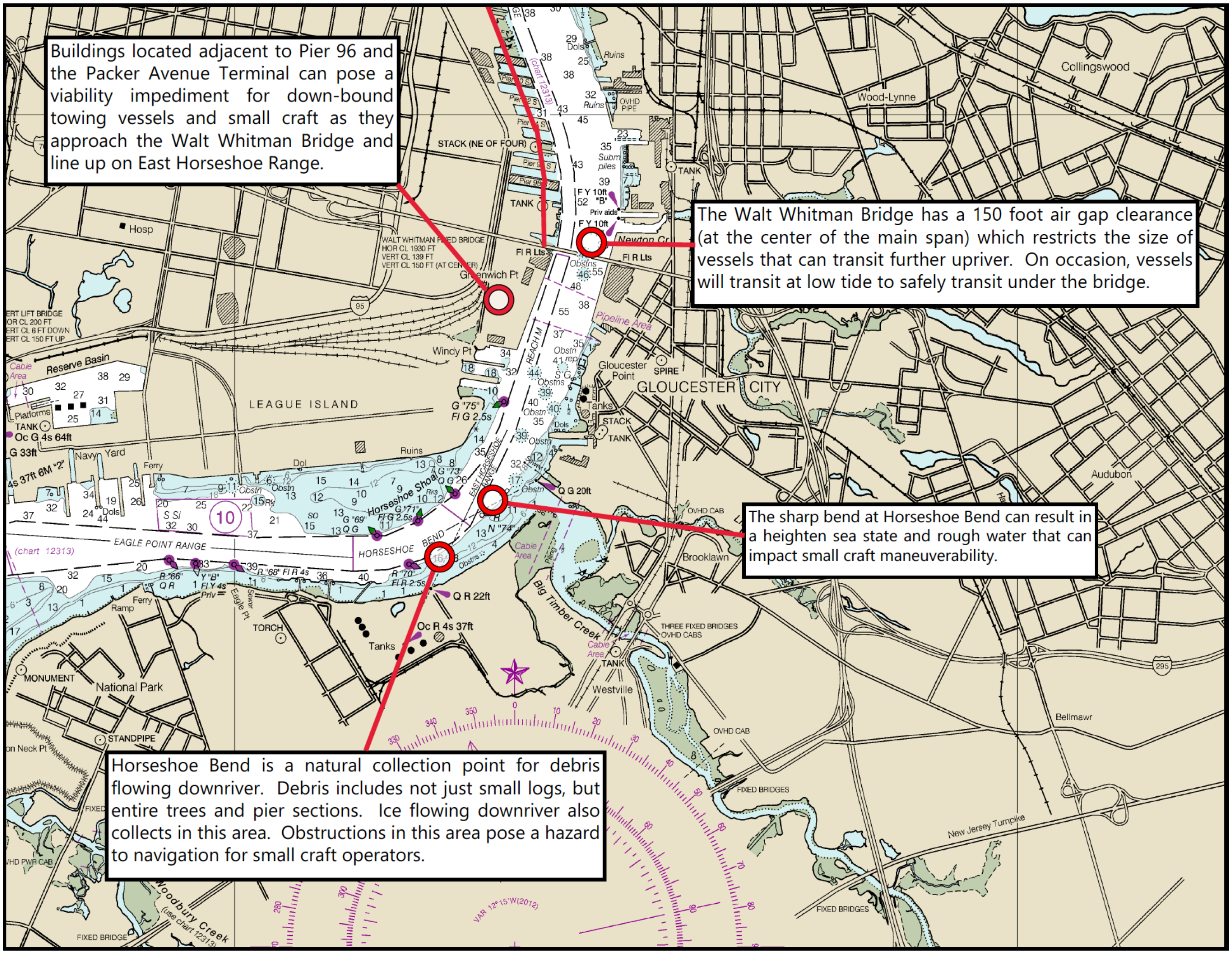
Segment 5


Seasonal and maintenance dredging results in dredges, towing vessels and barges operating in close proximity to the main channel.
Shore side lighting from the Marcus Hook refineries are a visibility impediment.
Cross currents occasionally occur in this area.
Marcus Hook anchorage experiences frequent congestion due to bunkering operations, vessels anchoring until a berth opens, and vessels anchoring due to unforeseen cargo loading/unloading delays at the shore-side facility.
CHESTER
Eddystone
Upland
Gardendale
Boothwyn
Linwood
MARCUS HOOK
Chester Island
Marsh
Raccoon I
Raccoon Creek
Bridgeport
Hook Bar
Excelsior Bar
Old Canal
Cedar Swamp
MARCUS HOOK RANGE
CHESTER RANGE
EDDYSTONE RANGE
QUARANTINE ANCHORAGE AREA
Fl R 4s 15ft 5M "2RC"
Fl Y 2.5s 12ft Priv
MARKERS (lighted)

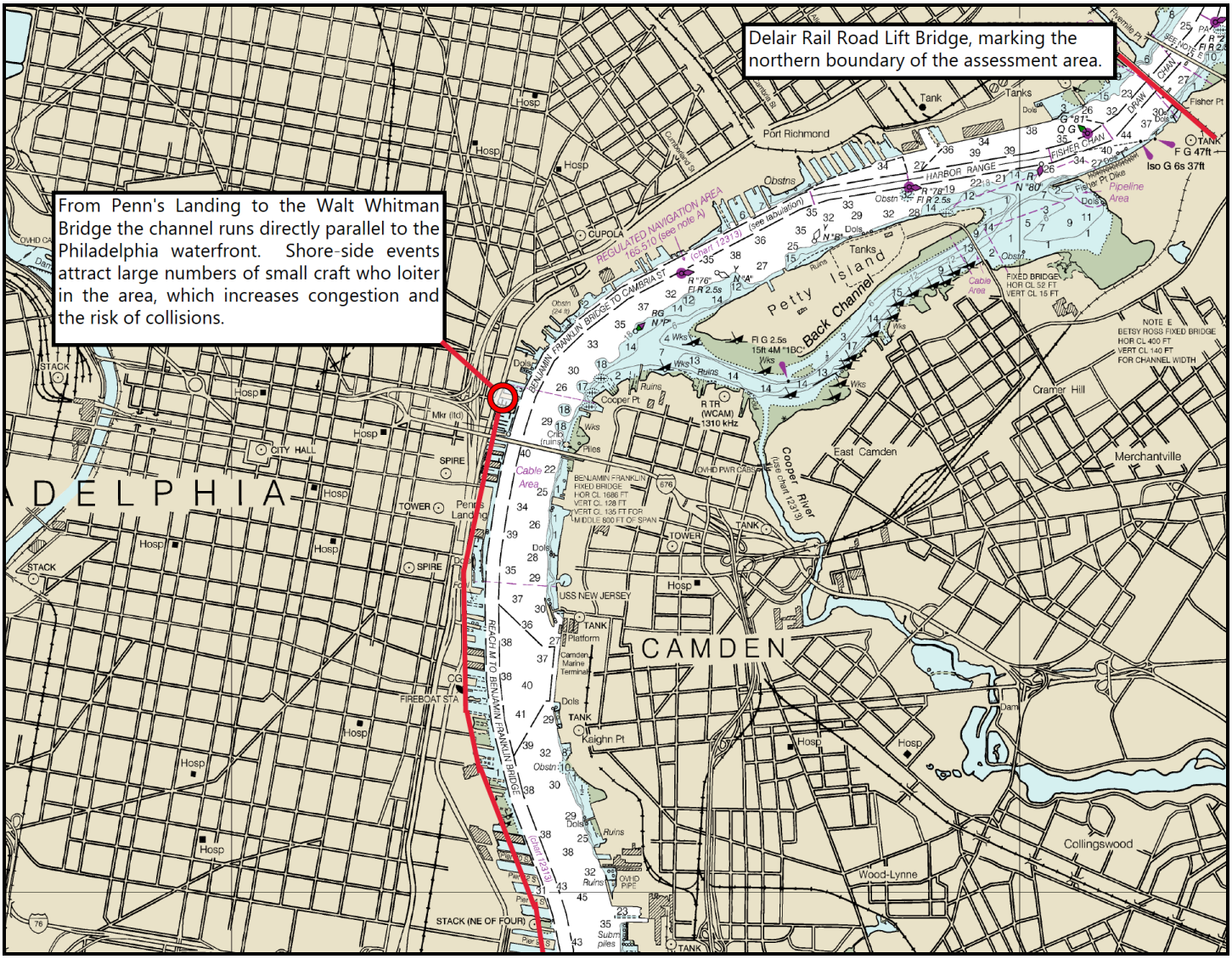
Segment 6


Kayackers operate mostly within the Schuylkill River, but on occasion depart the river and transit up the Delaware River as far as Penn's Landing.
Debris is always present in the Schuylkill River and poses a hazard to navigation for small craft. Heavy rain and snow melt increases the amount of debris flowing downriver. Navigating the river at night requires small craft operators to proceed slowly to avoid the obstructions.
Anchorage 9 also experiences frequent congestion due to bunkering operations, vessels anchoring until a berth opens, and vessels anchoring due to unforeseen cargo loading/unloading delays at the shore-side facility.
Area that experiences heavy traffic mix between deep-draft vessels navigating the main channel, and small craft departing the marina located on the north side of Little Tinicum Island and entering the main channel.
Tinicum Upper and Lower Range Lights are obscured by shore-side lighting from the refineries located on Mantua Creek.
Collingdale
Colwyn
Glenolden
Norwood
Essington
Little Tinicum Island
Philadelphia International Airport
Billingsport
Bramell Pt
Harkness Pt
Yankee Pt
SCHUYLKILL RIVER
MIFFLIN RANGE
BILLINGSPORT RANGE
TINICUM RANGE
Mantua Creek
Mud I

Segment 7


Buildings located adjacent to Pier 96 and the Packer Avenue Terminal can pose a viability impediment for down-bound towing vessels and small craft as they approach the Walt Whitman Bridge and line up on East Horseshoe Range.
The Walt Whitman Bridge has a 150 foot air gap clearance (at the center of the main span) which restricts the size of vessels that can transit further upriver. On occasion, vessels will transit at low tide to safely transit under the bridge.
The sharp bend at Horseshoe Bend can result in a heighten sea state and rough water that can impact small craft maneuverability.
Horseshoe Bend is a natural collection point for debris flowing downriver. Debris includes not just small logs, but entire trees and pier sections. Ice flowing downriver also collects in this area. Obstructions in this area pose a hazard to navigation for small craft operators.
LEAGUE ISLAND
GLOUCESTER CITY
Collingswood
Wood-Lynne
Audubon
Brooklawn
Westville
Bellmawr
National Park
Greenwich Pt
Windy Pt
Gloucester Point
Reserve Basin
Navy Yard
Horseshoe Shoal
HORSESHOE BEND
EAGLE POINT RANGE
Big Timber Creek
Woodbury Creek
New Jersey Turnpike
WALT WHITMAN FIXED BRIDGE
HOR CL 1930 FT
VERT CL 139 FT
VERT CL 150 FT (AT CENTER)
STACK (NE OF FOUR)
THREE FIXED BRIDGES
OVHD CABS
FIXED BRIDGES
MONUMENT
STANDPIPE
Tanks
TORCH

Segment 8


Delair Rail Road Lift Bridge, marking the northern boundary of the assessment area.
From Penn's Landing to the Walt Whitman Bridge the channel runs directly parallel to the Philadelphia waterfront. Shore-side events attract large numbers of small craft who loiter in the area, which increases congestion and the risk of collisions.
Port Richmond
Petty Island
Back Channel
Cramer Hill
East Camden
Merchantville
Collingswood
Wood-Lynne
CAMDEN
DELPHIA
Penns Landing
CITY HALL
TOWER
SPIRE
STACK
USS NEW JERSEY
Camden Marine Terminal
Kaighn Pt
Cooper Pt
Fisher Pt
Cooper River
BENJAMIN FRANKLIN FIXED BRIDGE
HOR CL 1686 FT
VERT CL 128 FT
VERT CL 135 FT FOR MIDDLE 800 FT OF SPAN
FIXED BRIDGE
HOR CL 52 FT
VERT CL 15 FT
BETSY ROSS FIXED BRIDGE
HOR CL 400 FT
VERT CL 140 FT
FOR CHANNEL WIDTH
REGULATED NAVIGATION AREA
165.510 (see note A)
HARBOR RANGE
FISHER CHAN
Pipeline Area
Cable Area
FIREBOAT STA
REACH TO BENJAMIN FRANKLIN BRIDGE
STACK (NE OF FOUR)
Iso G 6s 37ft
F G 47ft
Fl G 2.5s
15ft 4M "1BC"
R TR (WCAM)
1310 kHz

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Appendix E

References

Pennsylvania Fish and Boat Commission
https://www.fishandboat.com/Boat/BoatingRegulations/Pages/default.aspx

Pennsylvania Department of Conservation and Natural Resources
https://www.dcnr.pa.gov/Pages/default.aspx

New Jersey Division of Fish and Wildlife
https://www.state.nj.us/dep/fgw/about.htm

New Jersey Department of Environmental Protection
https://www.nj.gov/dep/

Delaware Office of Boating Safety and Education
https://dnrec.alpha.delaware.gov/fish-wildlife/boating/safety/

Delaware Department of Natural Resources and Environmental Control
https://dnrec.alpha.delaware.gov/

Mariners' Advisory Committee for the Bay & River Delaware
http://www.macdelriv.org/

Maritime Exchange for the Delaware River and Bay
https://www.maritimedelriv.com/

U.S. Coast Guard - Vessel Inspection Regulations
http://www.ecfr.gov/cgi-bin/ECFR?page=browse

U.S. Coast Guard - Vessel Traffic Services
https://www.navcen.uscg.gov/?pageName=vtsLocations

U.S. Coast Guard - Navigation Rules and Regulations
http://www.navcen.uscg.gov/?pageName=navRuleChanges

U.S. Army Corps of Engineers - Philadelphia District
https://www.nap.usace.army.mil/

U.S. Army Corps of Engineers - Regulatory Policies
http://www.usace.army.mil/Missions/

U.S. Army Corps of Engineers - Vessel Transit Statics
http://www.navigationdatacenter.us/

U.S. Army Corps of Engineers – Chesapeake and Delaware Canal
https://www.nap.usace.army.mil/Missions/Civil-Works/Chesapeake-Delaware-Canal/

U.S. Coast Guard Auxiliary Requirements for Recreational Boats
http://www.cgaux.org/boatinged/classes/2011/bss.php

Recreational Boating Safety - Accident Statistics
http://www.uscgboating.org/statistics/accident_statistics.php

National Oceanic and Atmospheric Administration, National Ocean Service
https://oceanservice.noaa.gov/

National Oceanic and Atmospheric Administration, National Ocean Service, Delaware River and Bay - Physical Oceanographic Real-Time System
https://tidesandcurrents.noaa.gov/ports/index.html?port=db

State Specific Boating Safety Requirements
http://www.americasboatingcourse.com/lawsbystate.cfm

Oil Company International Marine Forum (OCIMF)
https://www.ocimf.org/

Offshore Vessel Inspection Database (OVID)
https://www.ocimf-ovid.org/

Ship Inspection Report Program (SIRE)
https://www.ocimf.org/sire/

International Marine Contracting Association (IMCA) Standards
https://www.imca-int.com/

International Tanker Owners Pollution Federation (ITOP)
http://www.itopf.com/

International Convention of Standards of Training, Certification and Watchkeeping (STCW)
http://www.imo.org/en/About/conventions/listofconventions/pages/international-convention-on-standards-of-training,-certification-and-watchkeeping-for-seafarers-(stcw).aspx

The American Waterways Operators
http://www.americanwaterways.com/

Life Lines Brochure - Safety Tips That Could Save Your Life
http://www.americanwaterways.com/commitment_safety/lifelines.pdf

American Canoe Association
http://www.americancanoe.org/

Appendix F

Abbreviations and Acronyms

ACP	Area Contingency Plan
AIS	Automated Identification System
ANPRM	Advance Notice of Proposed Rulemaking
ATON	Aids to Navigation
BWI	Boating While Intoxicated
BTM	Broadcast Notice to Mariners
COTP	Captain of the Port
EPA	Environmental Protection Agency
MARAD	Maritime Administration
MTS	Marine Transportation System
MTSRU	Marine Transportation System Recovery Unit
NDG	National Dialogue Group
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
MAC	Mariners' Advisory Committee for the Bay & River Delaware
OSRO	Oil Spill Response Organization
PAWSA	Ports and Waterways Safety Assessment
PDF	Personal Flotation Device
PSC	Port State Control
PORTS	Physical Oceanographic Real-Time System
RNA	Regulated Navigation Areas
STCW	Standards of Training Certification of Watchkeeping
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
VHF	Very High Frequency
VMRS	Vessel Movement Reporting System
VTM	Vessel Traffic Management
VTS	Vessel Traffic Service

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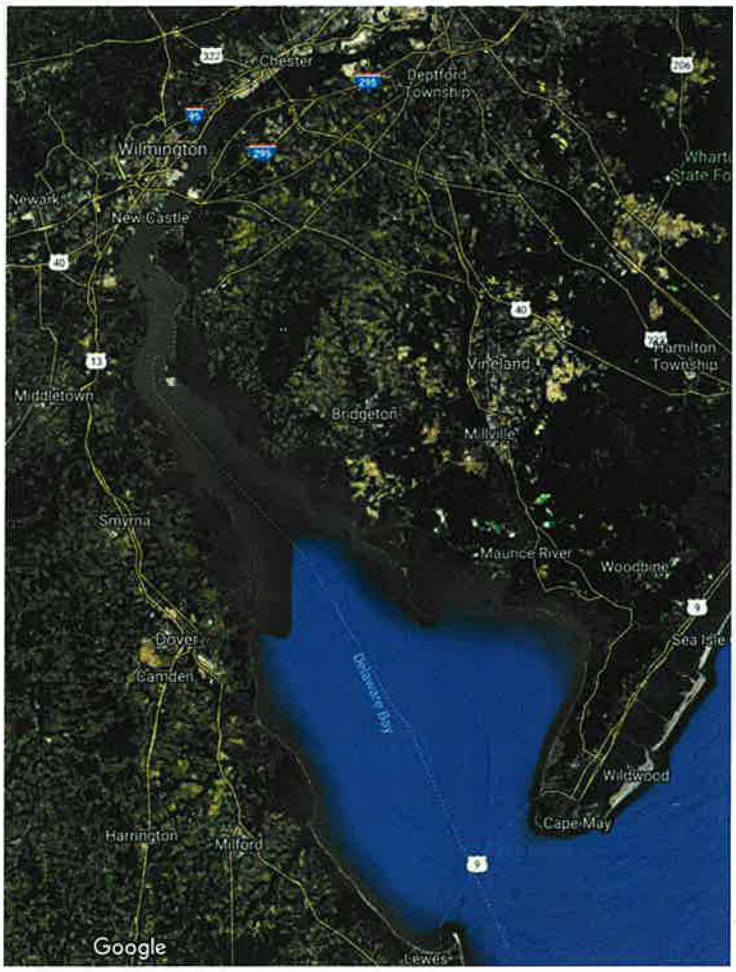
Appendix G

DELAWARE BAY PORTS AND WATERWAY SAFETY ASSESSMENT (PAWSA)

Traffic Statistics Nov 2017 – Oct 2018



Prepared by US Coast Guard Navigation Center

DESCRIPTION AND METHODOLOGY

Traffic data in this report is from the Nationwide Automated Information System (NAIS) collected by the US Coast Guard. Maps were created in ArcMap 10.3 by the Navigation Center. The data covers the area from the Walt Whitman Bridge south to the Delaware Bay entrance. The intent of providing this data is to better inform discussion at the PAWSA workshop.

The heat maps on the following pages show traffic density by category. Density of traffic is relative to each type; therefore, the colors represent different values from map to map. Density is represented on a green, yellow, red scale where low density is green and high density is red. The total transits on each map and monthly summary on page 2 can be used to compare traffic across maps. A *transit* starts when a vessel enters the area and ends when the vessel is unmoving for 5 hours or turns off their AIS transponder. Densities are calculated by enumerating the length of transits per square mile for the whole year ($\frac{Miles\ transited\ (year)}{mile^2}$). The monthly total graph on each map provides a sense of seasonal variation.

For more information please contact:
LCDR Ian Hanna
Waterways Risk Assessment and Support Division Chief
703-313-5858
ian.s.hanna@uscg.mil

MARINE SAFETY INFORMATION

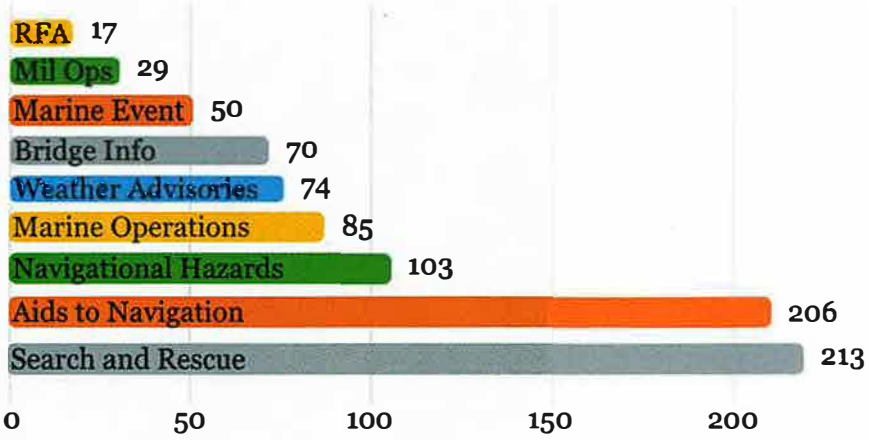
These statistics depict the level of Coast Guard activity and safety issues from Marine Safety Information history. All categories represented here are from events that occurred within the Delaware river south of the Walt Whitman bridge to the entrance of Delaware Bay.

Coast Guard Activities

Incident Management	226
Investigations	122
Operational Controls	179

- Incident Management includes minor Search and Rescue, pollution, groundings, collisions, and allisions.
- Investigations pertain to marine accidents, equipment failures, illegal discharges from ships, and other incidents that required dispatch of Sector Delaware Bay marine investigators.
- Operational Controls are instances where the Captain of the Port has had to restrict movement of a vessel because of a safety hazard or regulatory violation.

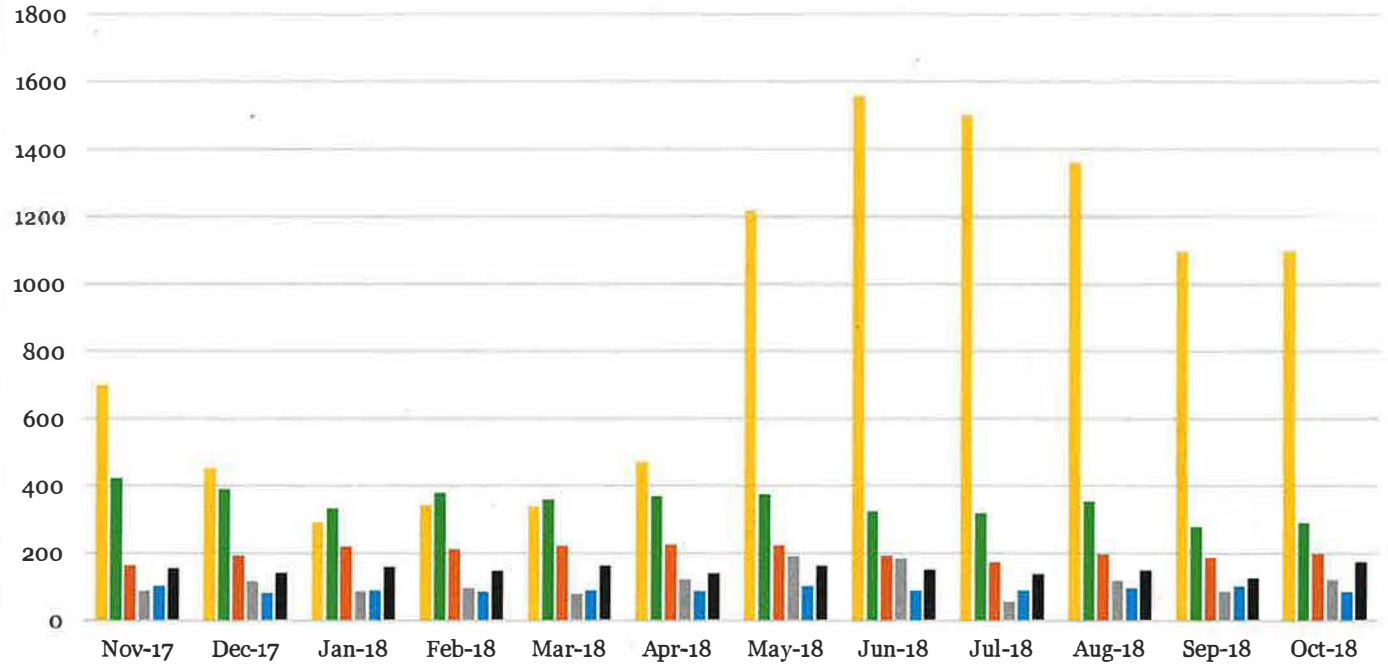
Broadcast Notice to Mariners



Broadcast Notice to Mariners (BNM)

BNMs are safety notices transmitted by the Coast Guard over VHF radio that alert mariners to information critical to safe navigation. The categories shown above give an idea of the type of safety hazards typically encountered in the waterway. A Request for assistance (***RFA***) occurs when a mariner's request is not categorized as Search and Rescue. ***Mil Ops*** are operations which involve support to the Department of Defense, including the establishment and enforcement of safety and/or security zones. ***Marine Events*** are public organized events that occur in the waterway, are permitted by the Coast Guard, and have a potential to impact navigation. ***Bridge Information*** is time sensitive safety related bridge advisories including unscheduled closures, casualties, lighting discrepancies, and construction work. ***Weather Advisories*** are weather warnings from the National Weather Service or safety announcements where current weather conditions could impact safe navigation. ***Marine Operations*** are projects in the waterway such as dredging, construction, and diving. ***Navigational Hazard*** broadcasts advise mariners of hazards in the waterway such as shoaling, vessels adrift or aground, debris, or other obstructions that could impact navigation. ***Aids to Navigation*** (AtoN) broadcasts inform mariners of discrepancies, updates and corrections to all federal and private AtoN. ***Search and Rescue*** (SAR) broadcasts are urgent broadcasts concerning safety of ships or persons and inform mariners of the status of ongoing SAR cases.

Monthly Summary

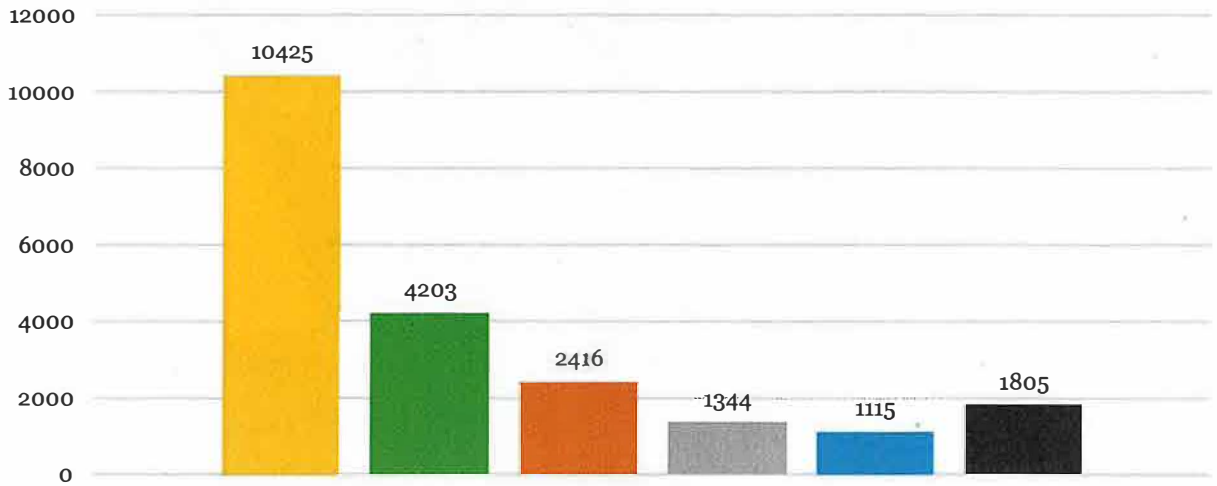


Other Vessels	53%
Tugs	22%
Cargo Vessels	12%
Fishing Vessels	7%
Tanker Vessels	6%
Vessels Over 1600 GRT*	9%

*Vessels over 1600GRT are also included in other categories based on type.

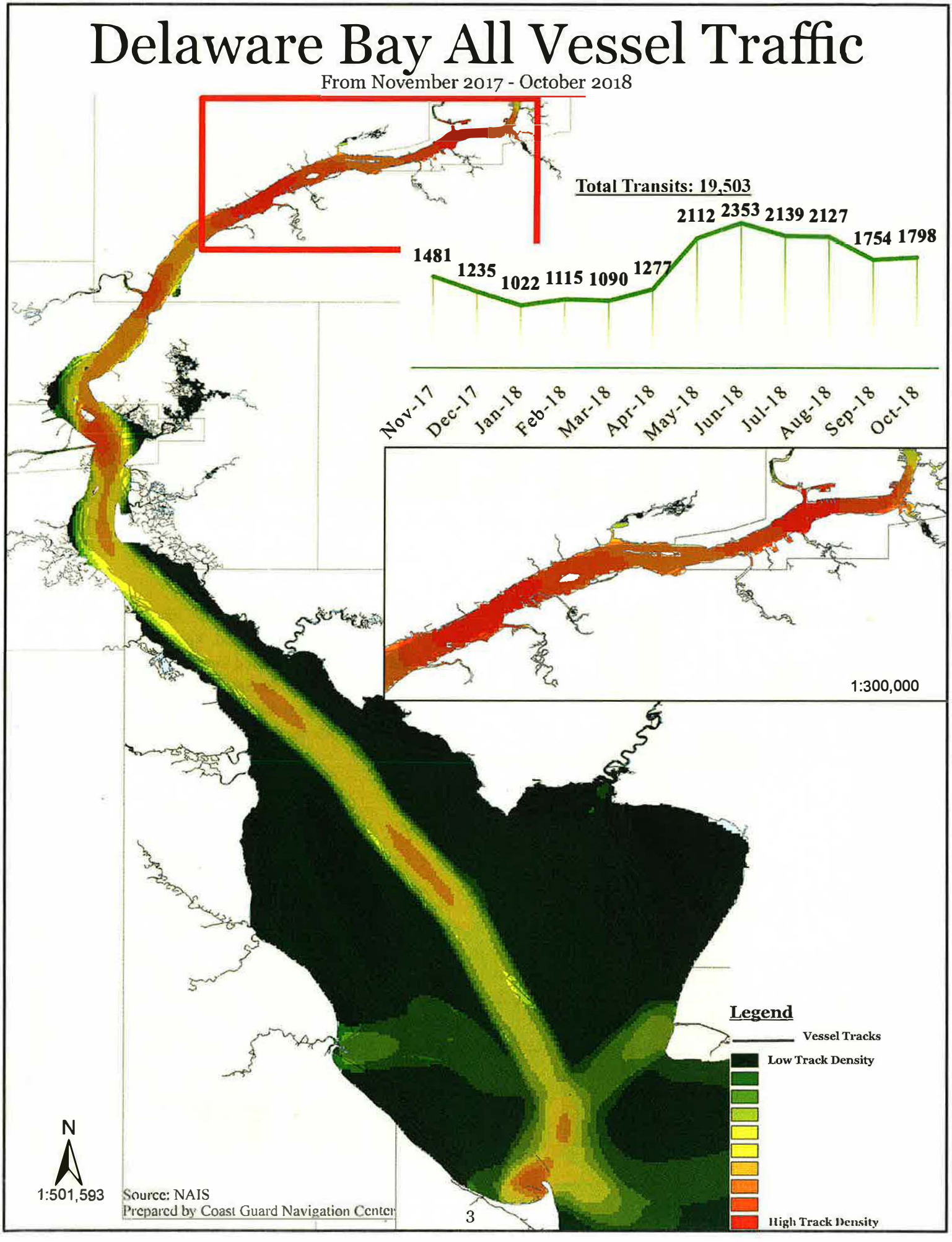
Traffic statistics come from the same NAIS data. Vessel type is user defined. Vessel tonnage was determined by registered tonnage of each vessel's Maritime Mobile Service Identity (MMSI). The category "Vessels over 1600 GRT" applies to vessels of this tonnage spanning all categories.

Yearly Summary



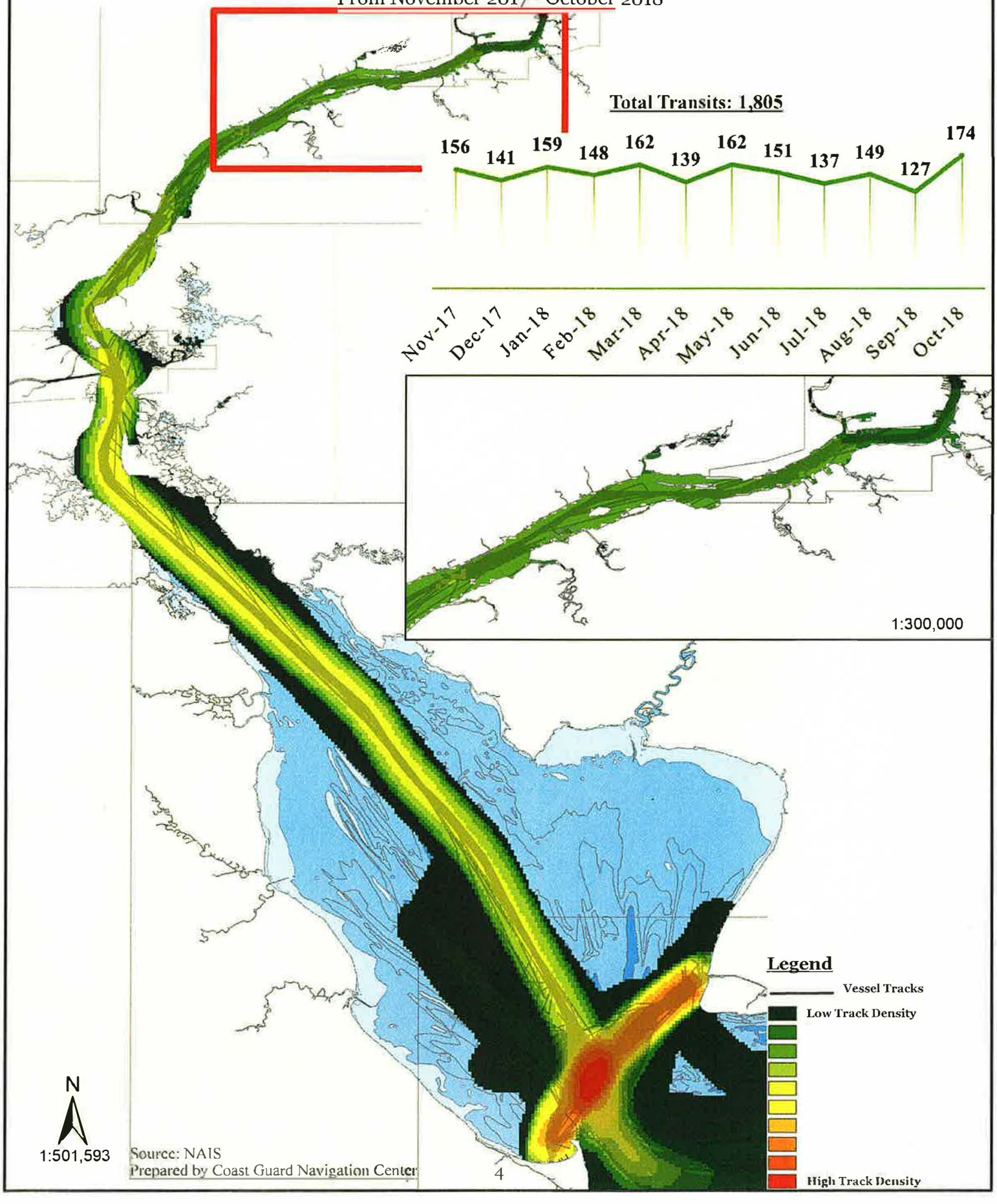
Delaware Bay All Vessel Traffic

From November 2017 - October 2018



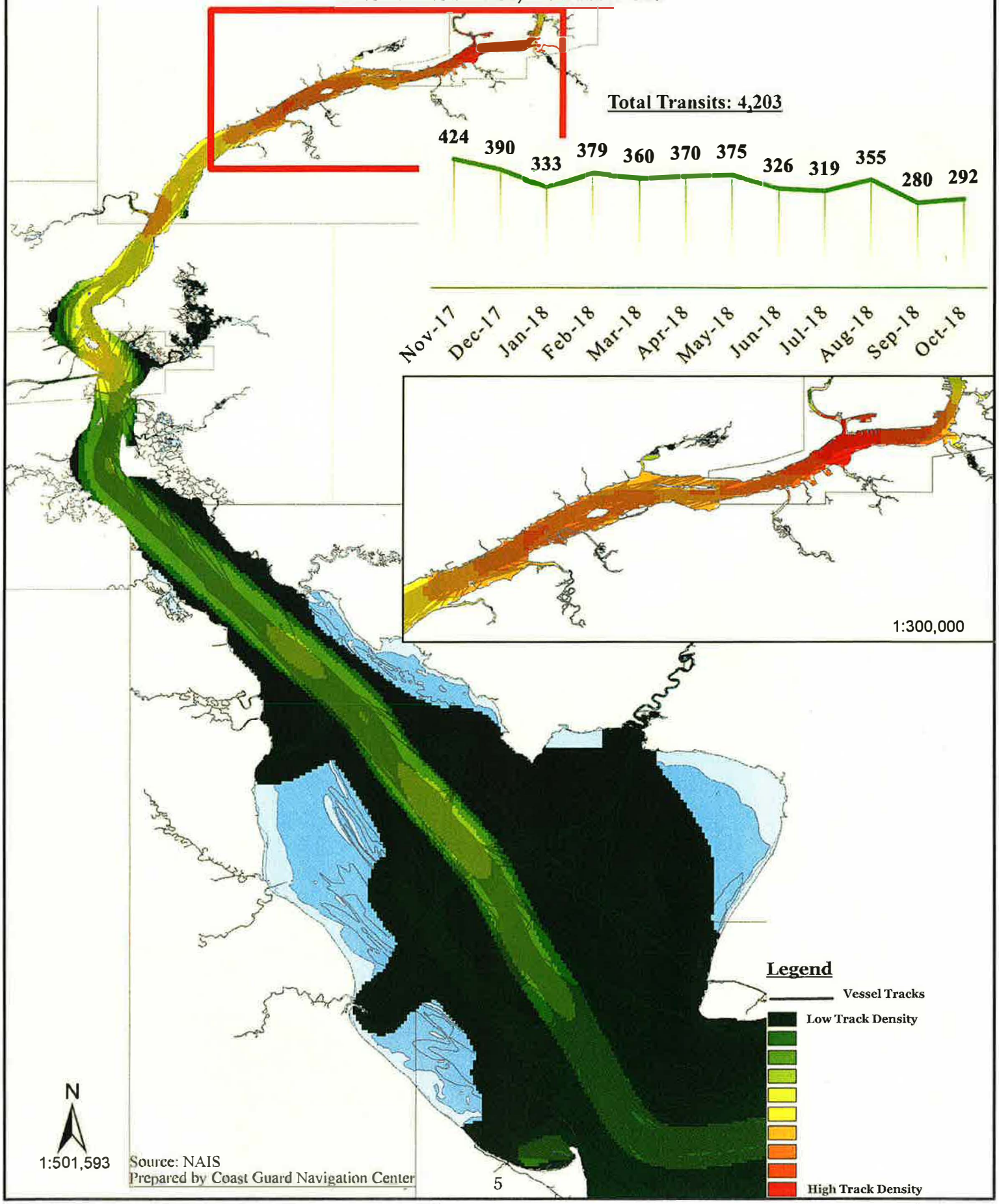
Delaware Bay Vessels Over 1600GRT

From November 2017 - October 2018



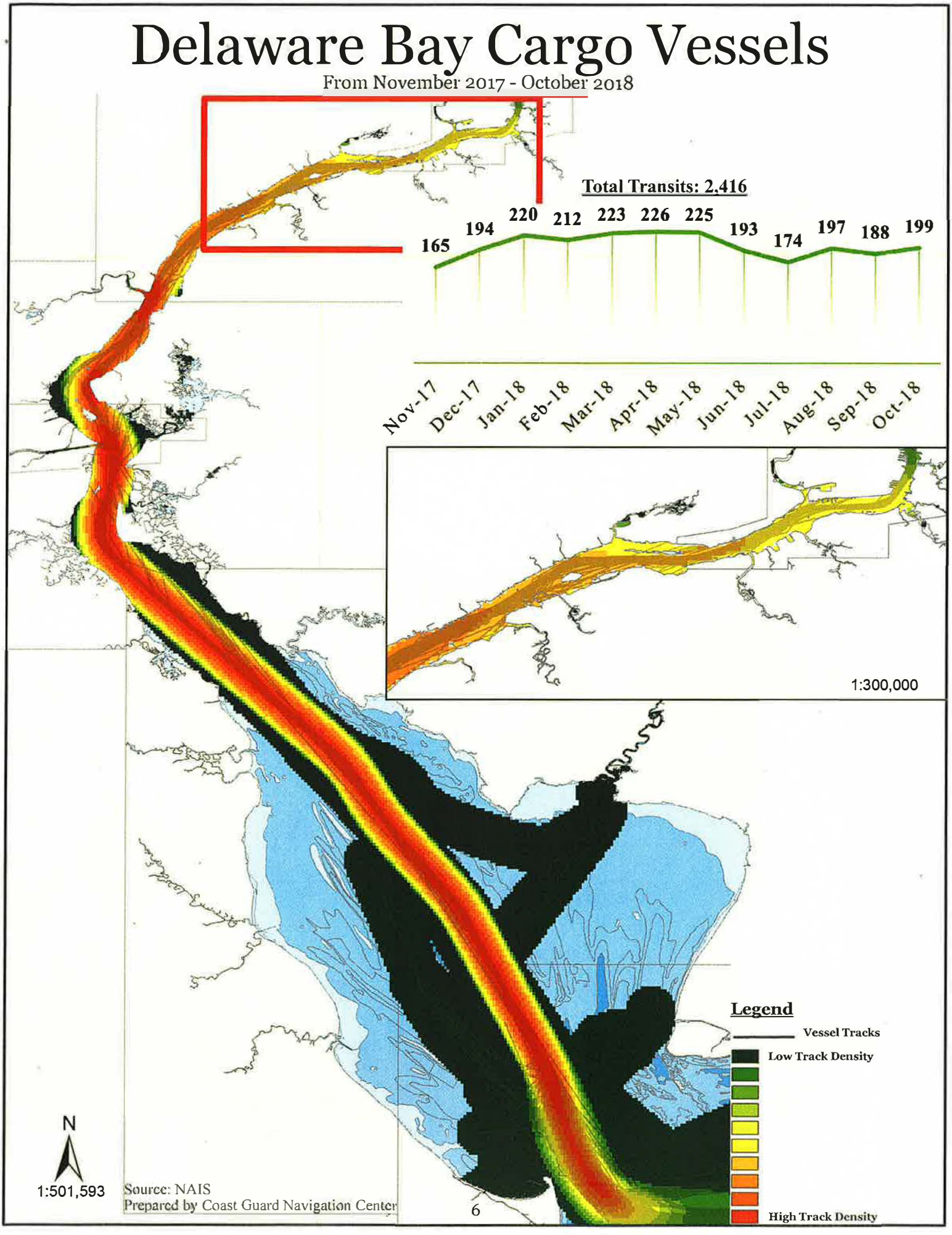
Delaware Bay Tug Vessels

From November 2017 - October 2018



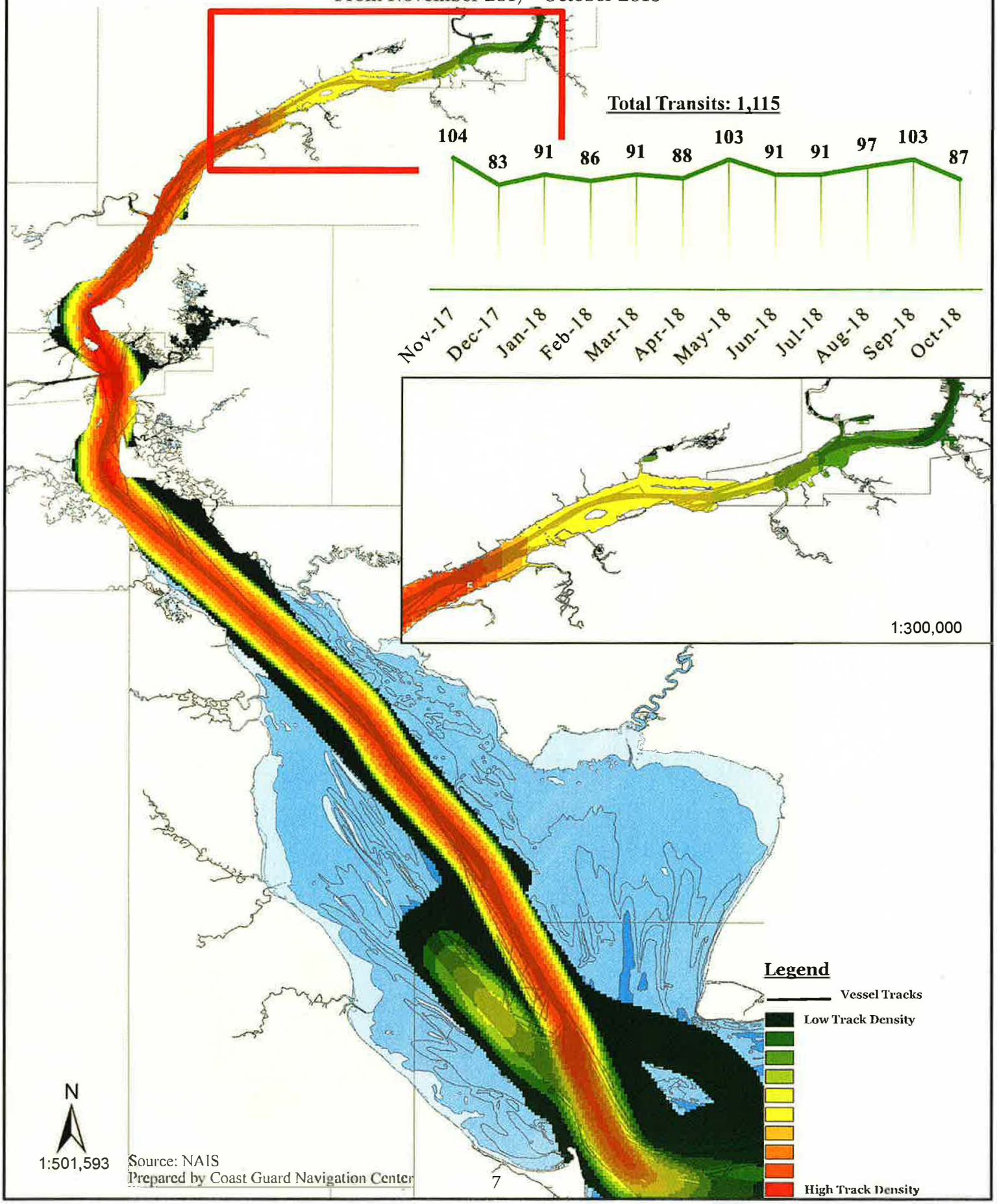
Delaware Bay Cargo Vessels

From November 2017 - October 2018



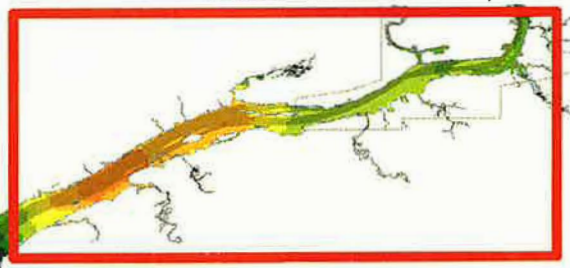
Delaware Bay Tanker Vessels

From November 2017 - October 2018

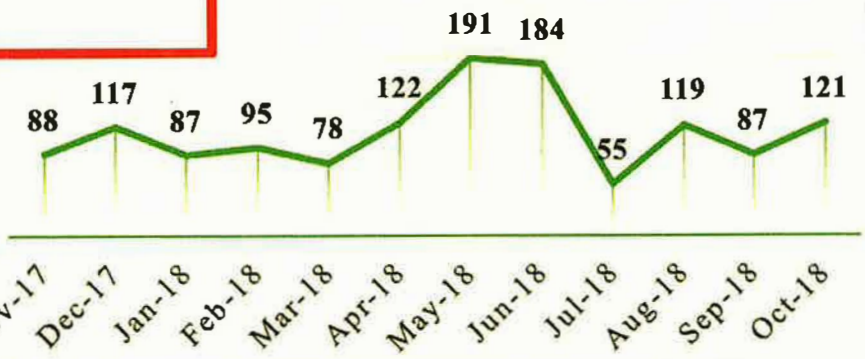


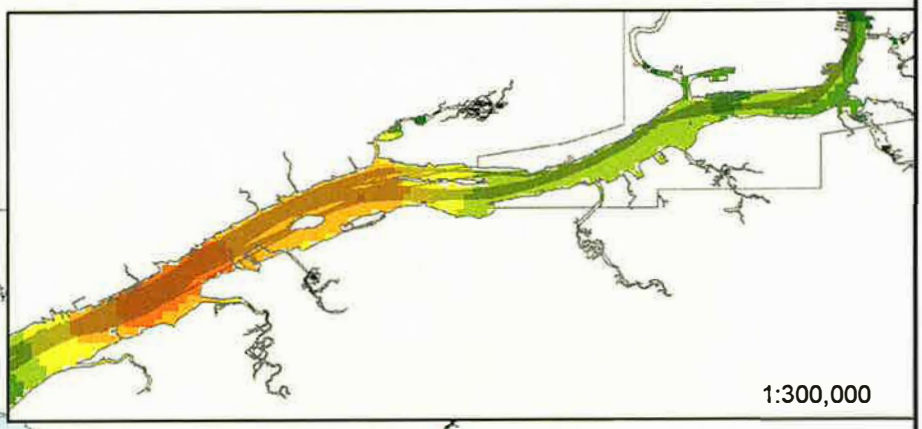
Delaware Bay Fishing Vessels

From November 2017 - October 2018



Total Transits: 1,344





1:300,000

Legend

- Vessel Tracks
- Low Track Density
- High Track Density

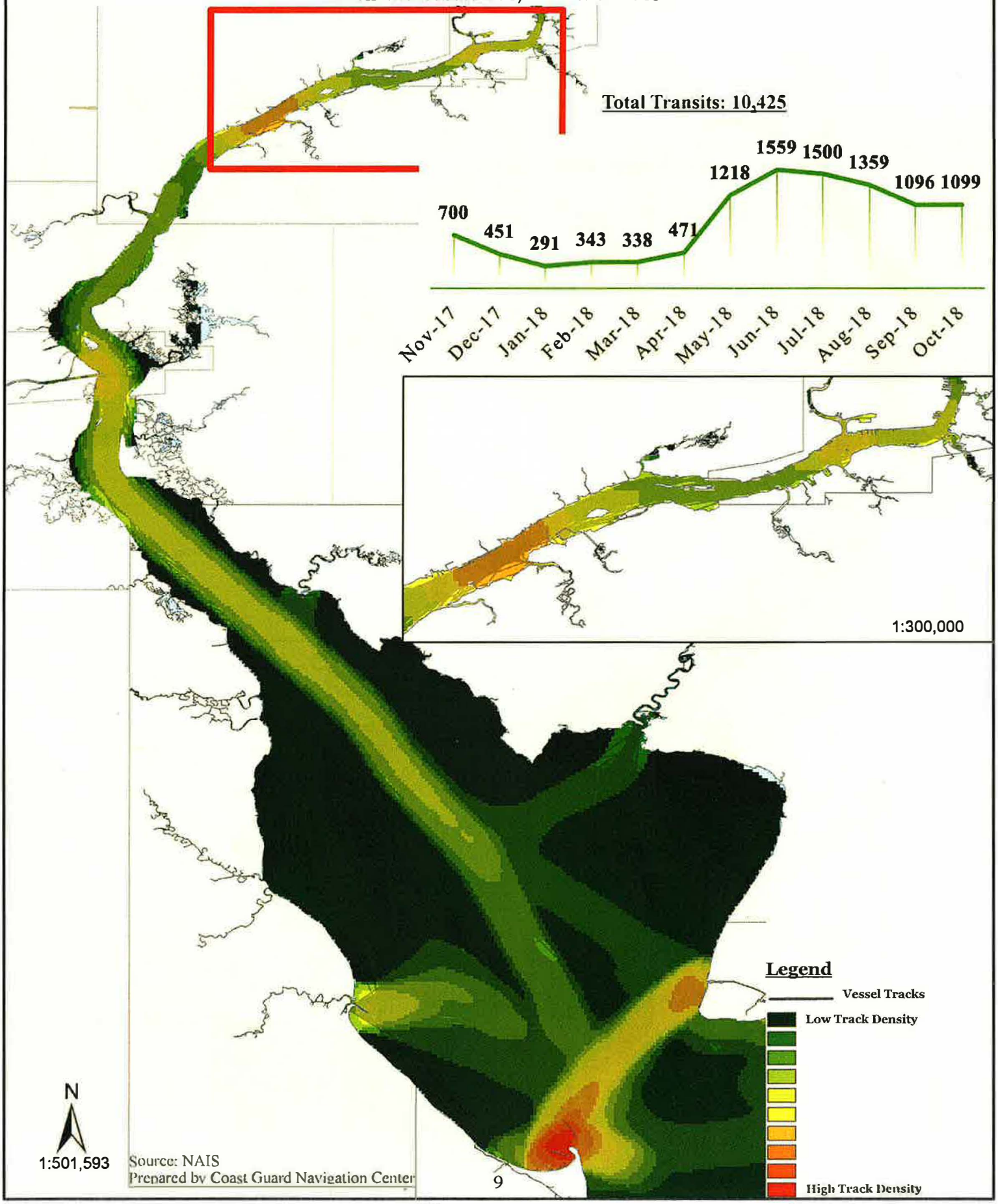
N

1:501,593

Source: NAIS
Prepared by Coast Guard Navigation Center

Delaware Bay All Other Vessels

From November 2017 - October 2018



Delaware River and Bay Waterway Profile Information (Walt Whitman Bridge-South) Sector Delaware Bay (2018)

USCG Sector Delaware Bay at a glance

- **Largest refining capacity on the East Coast**
- **The Delaware River Ports are the 5th largest U.S. Port complex, handling more than 972,412 TEU**
- **The largest fruit and juice concentrate import center in the U.S.**
- **$77.6 Billion total value added to the Tri-State economy**

Ports of Delaware Bay Container Stats	
Calendar Year	**TEUs**
2011	564,087
2012	572,370
2013	696,699
2014	783,042
2015	764,662
2016	822,193
2017	**972,412**

*CY 2017 had an increase **of 18% in overall container throughput** with 972,412 containers at the Port Complex. This was a significant increase, culminating **an overall 72% increase since 2011**. With East Coast container handling demand increasing, container throughput in FY19 should increase well beyond FY 2018 levels to over 1 million TEU handled across Delaware Bay.*

Sector Delaware Bay (AOR):

Delaware Bay and River Vessel Activity

A broad array of activities occur daily on US waterways without the Coast Guard's specific review and approval. Though the movement of non-exempted large commercial ships requires reporting (33 CFR 160, Subpart C), the Coast Guard does not have legal authority to require reporting or otherwise collect information regarding the movement of recreational vessels, uninspected and inspected small passenger vessels, fixed route ferries, tug and barges transiting domestically, and certain other vessel transits.

Vessel transits South of the Walt Whitman Bridge in the Delaware Bay COTP zone.
(OCT 2017 – OCT 2018)

MARITIME EXCHANGE for the Delaware River and Bay

Vessel Arrival Statistics

10/01/17 To 10/01/18

Generated: 11/20/18 124

Page 1 of

Vessels Arrived During Period: 2369

Locations

Piers

PACKER AVENUE	446	WILM PORT	377	GLOUCESTER/HOLT	180
PAULSBORO REFINING	173	SUN MARCUS HOOK	161	PENN TERMINAL	151
DELAWARE CITY	132	FORT MIFFLIN	111	MONROE	96
BALZANO MARINE	73	TIOGA	59	179 NORTH	56
EAGLE POINT	52	BERMUDA INTL	51	122 SOUTH	51
FAIRLESS	50	CONTANDA	50	80 SOUTH	49
AXEON	42	WASTE MANAGEMENT	38	1 BROADWAY	32
BUCKEYE ENERGY	29	PAULSBORO MARINE TERMINAL	28	PBF LOGISTICS	20
82 SOUTH	20	RIVERSIDE	19	OCEANPORT	18
WILM OIL PIER	12	NATIONAL GYPSUM	12	84 SOUTH	11
GIRARD POINT	8	NAVY YARD	4	HOG ISLAND	4
38-40 SOUTH	4				

TOTAL: 2,619

Anchorages

MARCUS HOOK ANCH	337	BIG STONE BEACH ANCH	235	BREAKWATER ANCH	108
KAIGHNS POINT ANCH	97	MANTUA CREEK ANCH	90	WILM ANCH	88
REEDY ISLAND ANCH	33	BOMBAY HOOK ANCH	2	MARCUS HK A	1
BROWN SHOAL	1				
ARTIFICIAL ISLAND	2				
CHESTER RANGE	1				
BAKER RANGE	1				
REEDY ISLAND RANGE	1				

Waterway Navigational Attributes

1. Traffic: Approximately 2,700+ ship movements per year consisting of tank vessels and freighters.

2. Wind: Wind velocities are moderate. The north-south Delaware River Valley has had a marked effect on the lighter winds and the warm months usually average out as a south wind. Destructive winds occur infrequently.

3. Visibility Restrictions: The CG occasionally receives reports of fog in the survey area from commercial mariners utilizing the waterway. 9 fog signals exist on the Delaware Bay and River within the survey area.

4. Water Movement: The tides in Delaware Bay and River are affected by freshets, winds, and droughts. The currents in Delaware Bay and River are influenced by the same variables that affect the tides. The times of slack water and the velocities and durations of flood and ebb are subject to extensive changes; the times of strengths are less likely to be affected. The currents usually set fair with the channels except in the vicinities of bends and wharves. Velocities of currents are generally between 1.5 and 2.0 knots.

5. Obstructions: The navigable channel within the Delaware Bay is generally clear of obstructions. Shoaling has been known to occur in bends and along the channel within the Delaware River. These areas have been identified by the ACOE and are included in annual maintenance dredging.

Changes in water depth and flow due to the Delaware River Deepening project have resulted in both the creation of new shoaling areas and the extinction of some traditional shoaling areas. These changes are being tracked and maintained by the ACOE.

The ice season usually starts in early January and ends in mid-March. Normally shipping is affected most seriously in the northern Delaware River. Modern vessels experience little difficulty maneuvering through the ice, but may be slowed by other river traffic. In addition to the problem of getting through the ice, aids to navigation are covered or dragged off station by moving ice. Sector Delaware Bay and District 5 assets conduct Operation OLAF, designated to clear the waterway of ice and create a channel to maintain navigation.

6. Dimensions: Dredged channel approximately 80 nautical miles long and 40 feet deep from its start in the Delaware Bay to the Walt Whitman Bridge. Channel Width varies from 1,600 feet at its widest to 400 feet at the most narrow. The 139 foot height of the Walt Whitman Bridge is the limiting vertical clearance.

6a. Salem River: The Salem River branches easterly off the Delaware River near Salem NJ. Its approach is approximately 2 nautical miles to the mouth. Approximately 1.5 miles long, the Salem river channel is maintained at 16 foot control depth with a width ranging from 150 feet to 320 feet.

6b. Christina River: The Christina River branches Westerly off the Delaware River near Wilmington Delaware. The Christina River turning basin is approximately 1 nautical mile long. The depth in the turning basin is maintained at 38 feet depth and 340-500 feet width. The remainder of the federally maintained channel in the Christina River ranges from 21 to 10 feet in depth and 250 to 300 feet in width.

6c. Chesapeake and Delaware Canal: The C&D Canal branches westerly off the Delaware River near Delaware City Delaware and is maintained and monitored primarily by the ACOE. It is approximately 23.5 miles in length from the Delaware River to the Chesapeake Bay and 450 feet wide with a depth of 35 feet.

6d. Schuylkill River: The Schuylkill River branches westerly off the Delaware River near Philadelphia Pennsylvania. It is approximately 1mile in length and maintained at a depth of 26 feet.

7. Bottom Type: The primary bottom type is mud, and also includes hard bottom, sand, rock, and sea grass at various intervals along the waterway.

8. Waterway Configuration: South of the Walt Whitman Bridge the Delaware River and Bay consists of 18 ranges and 6 anchorages. One of these anchorages is Anchorage #7 Marcus Hook anchorage. Anchorage #7 is also the quarantine anchorage for the Delaware Bay COTP zone.

9. Number of Passengers/Inspected Vessels: There are approximately 150 inspected small passenger vessels (Subchapter K, and Subchapter T) and approximately 30 towing vessels that operate primarily in the vicinity of the assessment area.

10. Volume of Petroleum: There are 24 petroleum facilities (including mobile facilities and public facilities). The CG does not have authority to collect the amount of petroleum carried in each load and transfer quantities as facilities record their own cargo information.

11. Volume of Chemicals: There is one chemical facility in the survey area.

12. Mobility: The Delaware River and Bay south of the Walt Whitman Bridge is the only waterborne access to the cities of Philadelphia, PA and Camden, NJ. Vessels calling any of the 16 waterfront facilities north of the Walt Whitman Bridge must pass through this waterway.

Cargo Tonnage History

The legal authority for the collection, compilation and publication of waterborne commerce statistics by the Army Corps of Engineers is Section 11 of the Rivers and Harbors Appropriations Act of 1922 (42 Stat. 1043), as amended, and codified in 33 U.S.C. 555. The following data is from the USACE Waterborne Commerce Statistics Center at < https://www.iwr.usace.army.mil/About/Technical-Centers/WCSC-Waterborne-Commerce-Statistics-Center/>:

Cargo Tonnage History
2015 - 2017

2015						
RANK	PORT_NAME	TOTAL	DOMESTIC	FOREIGN	IMPORTS	EXPORTS
70	Camden-Gloucester, NJ	6,923,348	2,020,633	4,902,715	4,382,019	520,696
105	Chester, PA	2,313,669	1,194,273	1,119,396	826,603	292,793
44	Marcus Hook, PA	12,550,222	10,043,756	2,506,466	1,520,243	986,223
63	New Castle, DE	7,836,612	5,147,685	2,688,927	2,000,774	688,153
33	Philadelphia, PA	19,966,352	9,852,020	10,114,332	9,197,626	916,706
62	Wilmington, DE	7,914,373	2,481,077	5,433,296	4,309,993	1,123,303

2016						
RANK	PORT_NAME	TOTAL	DOMESTIC	FOREIGN	IMPORTS	EXPORTS
65	Camden-Gloucester, NJ	7,440,328	2,417,183	5,023,145	4,211,678	811,467
123	Chester, PA	1,582,309	328,316	1,253,993	922,191	331,802
39	Marcus Hook, PA	15,692,302	9,363,068	6,329,234	5,181,595	1,147,639
50	New Castle, DE	10,595,745	5,212,278	5,383,467	4,989,355	394,112
30	Philadelphia, PA	22,973,188	11,218,865	11,754,323	10,827,584	926,739
64	Wilmington, DE	7,481,031	2,371,330	5,109,701	3,984,986	1,124,715

2017						
RANK	PORT_NAME	TOTAL	DOMESTIC	FOREIGN	IMPORTS	EXPORTS
67	Camden-Gloucester, NJ	6,734,653	2,113,979	4,620,674	3,976,548	644,126
107	Chester, PA	2,187,677	49,822	2,137,855	1,799,656	338,199
42	Marcus Hook, PA	14,132,355	5,217,799	8,914,556	7,081,610	1,832,946
63	New Castle, DE	7,139,208	3,521,470	3,617,738	3,414,655	203,083
23	Philadelphia, PA	28,523,744	12,231,790	16,291,954	14,840,381	1,451,573
65	Wilmington, DE	6,864,705	1,227,927	5,636,778	4,350,824	1,285,954

Current Vessel Traffic Management Measures

1. Aids to Navigation (USCG & Private):

- The lighted buoys marking the Delaware River channel are replaced during the winter by smaller lighted ice buoys or unlighted buoys.

2. Vessel Traffic Systems:

- There is no VTS coverage in the Delaware Bay COTP zone. The Maritime Exchange tracks vessel movements within the COTP zone.

3. Situation Awareness for Each Ship:

- Own Vessel's Position and Intention: Situational awareness derived by harbor pilot communication between vessels, visual and radar observation by the pilot, and through vessel traffic coordination by the pilots' association dispatcher; good bridge-to-bridge communications in this port.
- Port problems: Anomalies broadcast via Notices to Mariners and by Sector Command Center for relevant information for COTP Zone.

Planned and Anticipated Changes

1. Planned Infrastructure Developments:

- Delaware River Deepening Project. Anticipated opening of a portion of the channel to vessels drafting 45' is spring of 2019.

2. Changes in Levels and/or Nature of Waterway Activities:

Steady increase has been noted in the past few years as is shown above in the tonnage statistics. Private recreational vessel traffic has also increased.

3. Forecast Traffic Levels:

- An increase in recreational boating and human powered craft has been witnessed during the past few years and is likely to continue.

4. USCG Regulations of note:

- 33 CFR § 165.510 Delaware Bay and River, Salem River, Christina River and Schuylkill River-Regulated Navigation Area.
- 33 CFR § 165.550 Safety Zones: Ice covered waterways within the Fifth Coast Guard District.
- 33 CFR § 165.558 Security zone; Delaware River, and Schuylkill River, Philadelphia, PA.

Additional Waterway Activity

1. Facilities:

- Sample compliance inspection facility discrepancies at facilities within the survey area included the following categories:

Safety:

- No annual transfer hose/pipeline tests conducted.
- Improper/no marking of transfer hoses.
- Facility Response Plan (FRP) annual reviews not conducted.
- Spill exercises not being conducted.

Security:

- Drills/Exercises not completed
- Inadequate Access Control
- Maintenance of valid TWICs
- Lack of/improper Restricted/Secure Area signage
- Failure to submit amendments of the Facility Security Plan (FSP) to the CG.
- Failure to conduct annual audit on FSP.

FSP review issues:

- Access Control Measures
- Restricted/Secure Area designation
- Comprehension of Variable Risk Facility criteria
- Transportation Worker Identification Card (TWIC) Enforcement
- Screening at access points.

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