Ports and Waterways Safety Assessment

Workshop Report

Houma, Louisiana

28 – 29 January 2026

Providing Navigation Safety Information
for America's Waterways Users

Released By:
CAPT Margaret Kennedy
Commanding Officer
U.S. Coast Guard Navigation Center

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Executive Summary

Coast Guard Marine Safety Unit (MSU) Houma sponsored a Ports and Waterways Safety Assessment (PAWSA) workshop in Houma, Louisiana from January 28, 2026, to January 29, 2026. Twenty-five participants and observers representing a range of waterway users, stakeholders, and federal, state, and local regulatory and public safety authorities met to collaboratively assess navigational safety on the waterways adjoining the Port of Houma and the Gulf of America. This report provides a visual depiction of the study area and contains the full list of workshop participants and their associated organizations. The first day of the workshop included discussions about port and waterway attributes and vessel traffic in relation to the sixteen Waterway Risk Factors (WRFs) in the PAWSA Waterway Risk Model, which is described in more detail in this report. During this dialogue, participants identified specific port WRF issues to inform mitigations and facilitate the Focused Quantitative Risk Assessment (FQRA) conducted on the second day of the workshop. At the conclusion of WRF discussions, Risk Characterization for each WRF was established based on participants' survey responses. Risk Characterization assesses the potential consequence, risk trend, risk tolerance, and effectiveness of existing mitigation strategies for a specific WRF. The metrics from the Risk Characterization quantitatively prioritized WRFs to inform discussions during the next phase of the workshop. During the second day, participants conducted a FQRA to approximate adverse economic impacts of prioritized WRF issues and engaged in follow-on discussions to identify and develop risk mitigation strategies. The output of the FQRA is called a Risk Index Number (RIN), a numerical value designed to quantify an issue's adverse monetary impact on a port to guide resource prioritization and decision-making. A value of one RIN is equivalent to one million dollars in economic loss to a port. A higher RIN value is indicative of larger projected annual economic loss due to a specific event type or issue. FQRA results for the average annual frequency for each type of event and its associated RIN Value for the workshop study area is provided in the table below.

Event Name	Sum of RIN	Sum of Avg Frequency
Collision	34.39	9.10
Allision	8.37	7.43
Sinking	6.24	1.51
Traffic Restricted	4.28	7.76
Grounding	2.00	6.67
Infrastructure Failure	1.60	1.42
Oil Spill	0.18	0.34
Fire/Explosion	0.00	0.00
HAZMAT Release	0.00	0.00
Total	**57.07**	**34.23**

FQRA results for the five issues with the highest RIN value and the associated numerical value are presented in Chapter 2.C. The RIN results, recommended mitigation strategies, and participant observations documented in this report will meaningfully facilitate continued collaboration between the Coast Guard and waterway stakeholders to improve safe and efficient navigation within the Marine Transportation System (MTS). The Director of Marine Transportation Systems (CG-5PW), the Coast Guard's Navigation Center (CG NAVCEN), and CG MSU Houma extend their sincere appreciation to participants for their contributions to the Houma PAWSA workshop.

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CHAPTER 1. GENERAL

A. Background and Purpose

1. The Director of Marine Transportation Systems (CG-5PW) is responsible for developing and implementing policies and procedures that facilitate commerce, improve safety and efficiency, and maximize the commercial viability of the Marine Transportation System (MTS). In the late 1990s, the Coast Guard convened a national dialogue group (NDG) comprised of maritime stakeholders to identify the needs of waterway users with respect to Vessel Traffic Management (VTM) and Vessel Traffic Service (VTS) systems. A major outcome of the NDG was the development of the Ports and Waterways Safety Assessment (PAWSA) process, which the Coast Guard established as the formal model for facilitating stakeholder discussion to identify VTM improvements and determine candidate VTS waterways. The PAWSA methodology has been modernized several times by the CG NAVCEN and Office of Waterways & Ocean Policy (CG-WWM) since its original inception for purposes of creating a more adaptable tool available to Sector Commanders to engage the maritime community to monitor and improve the health of the MTS within their area of responsibility. The most recent PAWSA process update occurred in 2025.

2. The current PAWSA process convenes a select group of waterway users and stakeholders to facilitate a structured workshop agenda to meet pre-identified risk assessment objectives. A successful workshop involves the participation of professional waterway users with local expertise in navigation, waterway conditions, and port safety. Stakeholder involvement is central to ensuring that important environmental, public safety, and economic consequences receive appropriate attention as risk interventions are identified and evaluated. The workshop culminates in a written report that includes proposed risk mitigations developed by participants, which is made publicly available on the CG NAVCEN's website (https://www.navcen.uscg.gov/ports-and-waterways-safety-assessment-final-reports.)

3. The PAWSA process strives to achieve the following objectives:

    a. Gather stakeholder input to identify major waterway trends, safety hazards, and potential mitigation strategies.

    b. Bolster public-private partnership and enhance cooperation across the MTS.

    c. Generate a stakeholder driven report that captures data gathered from the PAWSA to prioritize future projects impacting the MTS.

B. Methodology

1. Waterway Risk Conditions and Waterway Risk Factors. The PAWSA process is designed to convert qualitative experience, observations, and opinions of participants into quantitative assessments. This method uses numerical comparison among sixteen WRFs to build consensus among participants to better inform conversations regarding risk mitigation strategies within an identified study area. The Waterway Risk Condition categories and associated WRFs are listed in Table 1 and further defined in Appendix B.

Navigation	**Vessel Quality & Operation**	**Traffic**	**Waterway**
Winds	Large Commercial Vessels	Volume of Commercial Traffic	Dimensions
Currents and Tides	Small Commercial Vessels	Volume of Recreational Traffic	Obstructions
Visibility Restrictions	Commercial Fishing Vessels	Waterway Use	Visibility Impediments
Bottom Type	Recreational Vessels	Congestion	Configuration

Table 1 – The four Waterway Risk Condition categories and sixteen WRFs.

2. PAWSA Workshop Structure. Each PAWSA workshop is a two-day facilitated process. The following sections detail the structure and goals for each day of a workshop. A maximum of 30 stakeholders divided into 15 two-person teams may participate.

   a. PAWSA Workshop - Day 1.

      (1) WRF Discussion. During the first day of a PAWSA, participants gain a comprehensive understanding of the workshop study area and are led through individual discussions for each WRF identified in Table 1. The purpose of these discussions is to provide a collaborative forum for stakeholders to generate a list of specific challenges unique to their respective port as related to each WRF. Participants identify and prioritize the top three issues for each WRF to facilitate

the Focused Quantitative Risk Assessment (FQRA) process and inform mitigation discussions during Day 2. These issues are documented in Appendix E.

(2) Risk Characterization Survey. Risk Characterization is a combined qualitative measure of the risk tolerance, risk trend, and effectiveness of existing mitigation strategies for a specific WRF. Surveys are completed at the end of Day 1 by the established two-person teams. The survey asks teams to evaluate the Current Risk Level, Current Risk Trend, and Current Risk Mitigations to characterize the risk associated with each WRF. Participants select from a set of qualitative descriptors that have weighted numeric values assigned to each answer to calculate Risk Characterization. Table 2 provides the available selections for each Risk Characterization question.

	Available Selections
Current Risk Level	We could accept more risk
	Balanced
	Unacceptable
Current Risk Trend	Decreasing
	Steady
	Increasing
Current Risk Mitigations	Acceptable
	Acceptable, but tenuous
	Unacceptable *(*If unacceptable select all that apply*)
	Not Effective
	Too costly
	Slow operations
	Causes other issues

Table 2 – WRF Survey, Risk Characterization categories.

After each team completes the Risk Characterization survey, their assessment of the Waterway Risk Factors is compiled into a Characterization Count. The Characterization Count is crucial because it reflects how each team perceives risk for each WRF. The selected values from the survey generate a color-coded classification that informs the overall WRF Risk Characterization for each team. The results from each team survey are then aggregated together to determine the Characterization Rating for each WRF that represents the average of the stakeholder group. The Characterization Rating informs the prioritization of

WRFs to guide mitigation development discussions and evaluation of WRF issues through the FQRA during Day 2 of the workshop.

(3) <u>Characterization Count Color Designations.</u> Individual team Characterization Count for a WRF is designated as red, orange, or green. For this scale, red represents high risk, orange represents intermediate risk, and green represents low risk. The following subsections outline the thresholds for each color-coded Risk Characterization designation for team Characterization Count.

(a) A WRF is designated with a red Risk Characterization when an individual team determines the WRF Current Risk Level is "unacceptable," or the Current Risk Mitigations are "unacceptable."

(b) A WRF is designated with an orange Risk Characterization when an individual team determines the Current Risk Trend is "increasing" and the Current Risk Mitigations are "weak."

(c) A WRF is designated with a green Risk Characterization when an individual team's combinations of answers do not meet the threshold for red or orange.

(4) <u>Characterization Rating Color Designations.</u> When the teams complete the Risk Characterization survey, their assessments are combined to calculate and assign the overall Characterization Rating for each WRF, as shown as an example in Table 3.

Category	RF Small	Characterization	Red	Orange	Yellow	Green
Traffic	Rec	Red	10	3		1
Vessel	Rec	Red	11	1		2
Vessel	Small	Red	9	3		2
Traffic	Congestion	Orange	6	6		2
Traffic	Usage	Orange	4	8		2
Navigational	Bottom	Green	1	1		12
Navigational	Tides	Green	2	4		8
Navigational	Vis	Green	1			13
Navigational	Winds	Green		1		13
Traffic	Commercial	Green		5		9
Vessel	Fishing	Green	1			13
Vessel	Large	Green	2	4		8
Waterway	Config	Green	4	2		8
Waterway	Dims	Green	4	2		8
Waterway	Obstr	Green	2	1		11
Waterway	Vis	Green	4	2		8

Characterization Count - Individual Team
<u>Red</u>. The Risk Level is Unacceptable OR the Mitigations are Unacceptable.
<u>Orange</u>. The Risk Trend is Increasing AND the Mitigations are Weak.
<u>Green</u>. All others.

Characterization Rating - Overall
<u>Red</u>. 60% or more teams rated as Red.
<u>Orange</u>. 50% or more teams rated Yellow or higher.
<u>Green</u>. 50% or more teams rated as Green.

EXAMPLE

Table 3 – Example Risk Characterization survey results.

Characterization Rating for a WRF is designated as red, orange, or green. The color-coded scale for the Characterization Rating is the same as Characterization Count, but the thresholds for attributing the color designation are different. In Table 3, the numbers below each of the header columns labeled red, orange, and green represent the number of individual teams that attribute a certain risk level to that specific WRF. The Characterization Rating for a WRF is determined by plurality. The following subsections outline the thresholds for each color-coded Risk Characterization Rating designation.

(a) A WRF is designated with a red Characterization Rating if 60% or more of the teams select that specific rating.

(b) A WRF is designated with an orange Characterization Rating if 50% or more of the teams select that specific rating.

(c) A WRF is designated a green Characterization Rating if 50% or more of the teams select that specific rating.

(5) At the conclusion of Day 1, PAWSA facilitators present the Risk Characterization survey results and facilitate discussion among participants to determine and validate prioritization of WRFs for use in the FQRA and mitigation development.

b. PAWSA Workshop – Day 2. The second day of the workshop is focused on fulfilling two objectives. The first is to complete the FQRA to calculate the Risk Index Number (RIN) for the highest prioritized WRFs identified during Day 1. The second is to develop mitigations for issues associated with those WRFs. The following subsections provide more detail regarding the process and methodology for executing the FQRA and WRF mitigation development.

(1) Focused Quantitative Risk Assessment (FQRA). The FQRA is a process to conduct a normalized comparison between historical data and participant expertise to approximate the yearly adverse economic impact of individual WRFs on a port. The output from this calculation is called the RIN. The value of the RIN represents the annual average potential economic loss in millions of dollars based on the associated WRF. The FQRA uses existing historical data from Coast Guard vessel operational controls, waterways management operational controls, and incident investigation activities documented in the Coast Guard's Maritime Information for Safety and Law Enforcement (MISLE) database. The MISLE database is the centralized repository for capturing and reporting the information required to support Coast Guard marine safety, security, environmental protection,

and law enforcement programs and for ensuring compliance with statutory and regulatory record keeping requirements. The FQRA is a two-pronged method derived from combining the distribution of historical outcomes for a local area and the multiplication product of the likelihood and consequence for a specific scenario. Figure 1 depicts a flow chart that visually represents the process used in the FQRA.

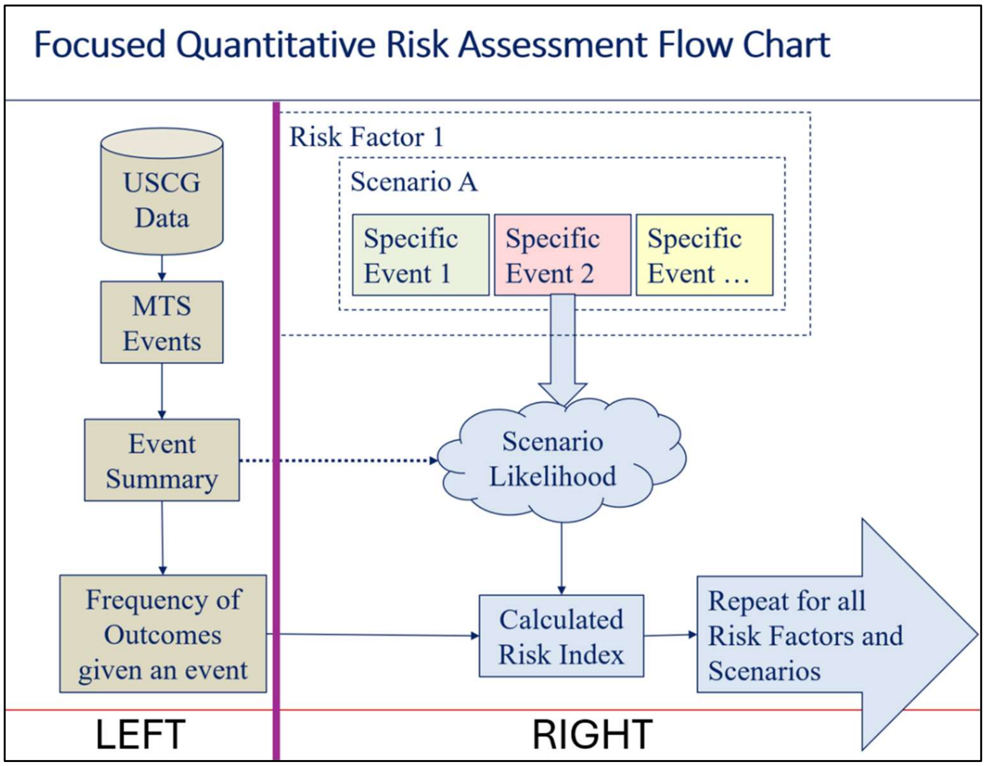


Figure 1 – FQRA Flow Chart.

(a) During the first step of the FQRA, represented on the left side of Figure 1, Coast Guard MISLE data is synthesized to determine the historical frequency of events and their outcomes. The outputs from this first step guide the calculations used in the second step to convert qualitative stakeholder input into a quantitative metric. In this model, outcomes are unwanted consequences that are classified as safety, environmental, or economic. For more information on the Coast Guard established consequence types, severity categories, and fiscal equivalence, please see Table 1 in section B.1 of Appendix B.

(b) During the second step of the FQRA, represented on the right side of Figure 1, participants provide qualitative data regarding the types and likelihood of an event occurring due to the issues identified for the top prioritized WRFs on

Day 1 of the workshop. To gather this information, facilitators provide participant teams with a Risk Event Form pre-populated with the prioritized WRFs and the associated top three issues for each factor that were determined during Day 1. The stakeholders use their local anecdotal knowledge of historical events to assign each issue up to three types of events that may occur due to the issue and the predicted frequency of the event. Available types of events on the Risk Event Form include allision, collision, fire/explosion, grounding, oil spill, sinking, or traffic restricted. For definitions of these event types, please see Appendix F. After selecting an event type, participants designate a predicted likelihood of the event, based on local knowledge and experience. Likelihood is the probability of an event based on local historical trends. Frequency thresholds for the likelihood designations used in the FQRA to calculate RIN are described in Table 4. The model standardizes the likelihood with incidents per fifty years to allow for easier understanding and comparison with historical numbers. The corresponding probability of each event is multiplied by the consequence value and normalized to millions of dollars, estimating the RIN to one million dollars in economic loss for an associated event.

Likelihood	**Frequency**	**Probability**
Very Unlikely	Once or twice in the history of the port/waterway	0.00055
Rare	Once every 50-100 years	0.006
Occasional	Once or twice every 10-20 years (2-20 every 50 years)	0.22
Probable	Once or twice every year or two (25-75 in 50 years)	1
Frequent	More than twice per year (100 in 50 years)	5

Table 4 – Likelihood designations, frequency thresholds, and probability values used to calculate RIN.

(c) The model uses MISLE data, including vessel operational controls, waterways management operational controls and incident investigation activities, to group historical investigations into consequence categories. This allows normalization of stakeholder inputs using historical data. It is important to note that the data used in this model was selected for its quality and availability and is therefore limited. It does not include reports or data from all types of events reported or investigated by the Coast Guard. The historically synthesized national and local data is used to pre-assign specific values for stakeholder qualitative input and create the frequency distribution used in the RIN calculation. During the FQRA, both the historical national events and local events are provided to stakeholders for review in handout form, prior to conducting the assessment. Please see Appendix F for the national and local event data provided to stakeholders during the PAWSA.

(d) For the FQRA, the stakeholders select a frequency for each event, which is then multiplied by the distribution of consequences. This is added together to calculate the RIN.

(2) FQRA Results. Facilitators use the qualitative data collected in the Risk Event Forms to conduct the FQRA. This generates a RIN and estimated annual frequency for each event type, which are sortable by WRF and issue. Table 5 and 6 provide examples of RIN results and data from the FQRA. A large volume of raw data is generated from the FQRA. To keep the report concise, only RIN results for all event types and the five issues with the highest RIN values are presented in this report and can be found in Chapter 2, Section C.3. Additional raw FQRA data, including the RIN results for all evaluated issues and associated event types, is available by request from the CG NAVCEN.

(a) The results summarized in Table 5 provide an example of the RIN and annual frequency for each event type as determined through the FQRA. The RIN represents a monetary quantification of identified risks. For the purposes of this assessment, a RIN value of '1' corresponds to a potential financial impact of $1 million (e.g., 2.5 RIN = $2.5 million). This quantification provides essential context for assessing the potential financial impact on the maritime system during an event.

Event Name	RIN	Avg Frequency
Collision	10.16	2.69
Traffic Restricted	7.72	14.01
Sinking	6.61	1.60
Infrastructure Failure	5.83	5.17
Allision	4.43	3.93
Grounding	1.08	3.60
Oil Spill	0.22	0.43
HAZMAT Release	0.04	0.08
Fire/Explosion	0.01	0.00
Total	**36.11**	**31.52**

EXAMPLE

Table 5 – Example RIN and annual frequency results by event.

(b) The results summarized in Table 6 provide an example of RIN values broken down by WRF, issue, and event type. Stakeholders can leverage the RIN to compare the costs associated with implementing mitigation measures against the potential cost of an incident and its subsequent cascading effects, thereby optimizing resource allocation for risk reduction. For example, in Table 6, if stakeholders reported that "Groundings throughout the study area can cause the waterway to shut down for an extensive amount of time," and associate a RIN of 1.02, this indicates that the issue is estimated to cost the local maritime system $1,020,000 annually.

Risk_Factor	RIN	Avg Events
⊟ **Bottom Type**	**6.52**	**8.69**
⊟ **Groundings throughout the study area can cause the waterway to shut down for an extensive amount of time.**	**1.02**	**1.76**
Allision	0.09	0.08
Collision	0.00	0.00
Grounding	0.05	0.17
HAZMAT Release	0.00	0.00
Infrastructure Failure	0.10	0.08
Oil Spill	0.09	0.17
Sinking	0.00	0.00
Traffic Restricted	0.69	1.25

Table 6 – Example RIN by WRF, issue, and event type.

(c) Normalizing the impact value in dollars provides the ability to update and localize the model as needed or desired. This enables comparison between past and current results of the same port and comparisons between different ports. Port specific results generated during a workshop can be compared to existing Coast Guard data of historical events to highlight local mariner knowledge of events captured through the RIN process. Chapter 2, Section C.3. contains participant issues with the top five RIN values extracted from the FQRA results.

(3) <u>Mitigations.</u> Following completion of the FQRA, facilitators present the Risk Characterization survey results and facilitate discussion among participants to determine prioritization of WRF for mitigation development. Stakeholders collaboratively determine the top WRFs to focus dialogue for mitigation development during the remainder of the workshop. The development of mitigation strategies is guided by facilitators using the key issues identified during discussions from Day 1. These issues are used as the starting point for participants to brainstorm mitigations to address concerns and are the same issues used in the FQRA. Facilitators assist participants in developing risk mitigation strategies that are both impactful and feasible, ideally capturing those that are well-developed

proposals with clear delineation of ownership and predicted timelines to enact change. Through this invaluable process, stakeholders make recommendations to improve safe and efficient waterways usage within the port study area, creating a comprehensive list of action items for future implementation or reevaluation.

CHAPTER 2. HOUMA PAWSA WORKSHOP

A. PAWSA Study Area

1. The geographical area for the Houma PAWSA is depicted by the polygon in Figure 2, which begins at the entrance of the Houma Navigation Canal and follows the channel until it intersects with the Gulf Intracoastal Waterway (GIWW) as depicted in Figure 2. The Northwest and Southeast vertices of the polygon are positioned at 29.51°N, 090.86°W and 28.97°N, 090.53°W, respectively. The study focused on the areas depicted in the irregular polygon depicted in Figure 2, not the entire area defined by the Northwest and Southwest points. Graphic representations of this study area were used to facilitate discussion with participants. Additionally, geographically referenced comments were collected during the workshop and are documented as chartlets in Appendix D.

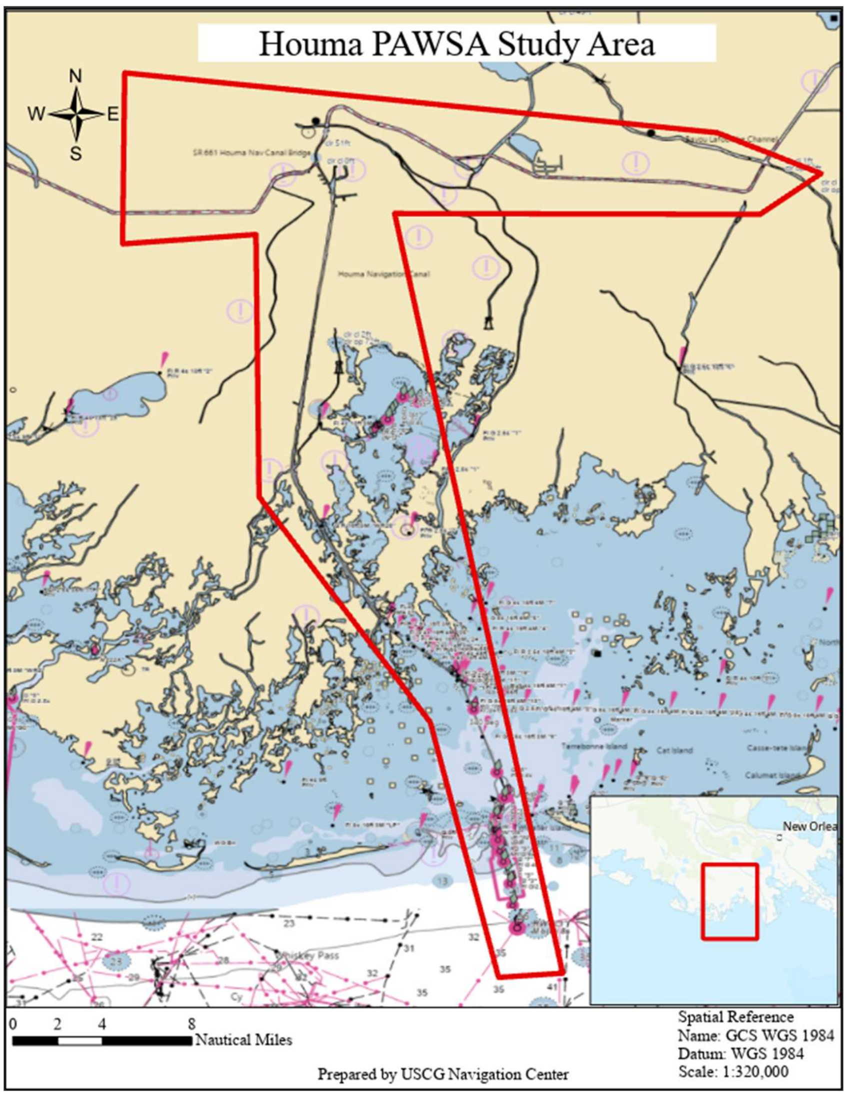


Figure 2 - Houma PAWSA workshop study area.

B. Participant Validation of WRF Prioritization

1. The Risk Characterization survey results are depicted below in Figure 3. The results are grouped by Risk Characterization. These results were presented to participants to validate the prioritization order of WRFs to facilitate the FQRA and for mitigation strategy development.

2. The Risk Characterization results indicated a generally low level of existing risk within the Houma PAWSA study area. Most WRFs were categorized as Green. This favorable risk profile appears to stem from the strong working relationships and proactive communication channels established among stakeholders within the port, preventing emerging issues from escalating into significant safety concerns. The WRFs with unacceptable or increasing risk trends include recreational vessel quality and operations, recreational vessel traffic, commercial vessel traffic, and traffic congestion. These risk levels reflect unsafe operating conditions, inadequate seamanship, and a lack of education of the recreational vessel community paired with commercial vessel industry growth in the port. Additionally, traffic congestion in the vicinity of multiple bridges in the study area creates choke points with increased risk of marine casualties.

Category	RF Small	Characterization	Red	Orange	Yellow	Green
Vessel	Rec	Red	8	1		
Traffic	Commercial	Orange	3	2		4
Traffic	Congestion	Orange	4	3		2
Traffic	Rec	Orange	3	2		4
Vessel	Fishing	Orange	4	1		4
Navigational	Bottom	Green	2			7
Navigational	Tides	Green	2	1		6
Navigational	Vis	Green	2	2		5
Navigational	Winds	Green	3			6
Traffic	Usage	Green		2		7
Vessel	Large	Green		1		8
Vessel	Small	Green	2	1		6
Waterway	Config	Green		1		8
Waterway	Dims	Green	3	1		5
Waterway	Obstr	Green	3	1		5
Waterway	Vis	Green	1	1		7

Characterization Count - Individual Team
Red. The Risk Level is Unacceptable OR the Mitigations are Unacceptable.
Orange. The Risk Trend is Increasing AND the Mitigations are Weak.
Green. All others.

Characterization Rating - Overall
Red. 60% or more teams rated as Red.
Orange. 50% or more teams rated Yellow or higher.
Green. 50% or more teams rated as Green.

Figure 3 - Risk Characterization survey results for all WRFs.

3. The Risk Characterization survey results determined the ranking of WRFs according to participant evaluation. Table 7 presents WRFs in descending priority from high to low. Following subjective evaluation, participants selected Quality and Operation of Recreational Vessels, Volume of Commercial Traffic, Congestion, Commercial Fishing Vessels, Dimensions, Obstructions, and Winds as the most significant WRFs that contributed to potential incidents in the Houma PAWSA study area.

Waterway Risk Category	**WRF**
Vessel Quality & Operation	Recreational Vessels
Traffic	Commercial
Traffic	Congestion
Vessel Quality & Operation	Commercial Fishing Vessels
Waterway	Dimensions
Waterway	Obstructions
Navigation	Winds

Table 7 - Validated and prioritized WRFs listed from high to low.

C. Risk Index Number Results

1. RIN Results by Frequency. As detailed in Table 7, participants validated and prioritized WRFs within the Houma PAWSA study area. Based on this prioritization, stakeholders completed Risk Event Forms (as described in Chapter 1.B.2.b.(1)(b)) for the top seven WRFs. Each form captured the top three validated issues that stakeholders deemed most pertinent for each of the seven highest prioritized WRFs. Appendix E contains a full list of these participant-presented and validated issues. The issues presented in this appendix are edited for clarity and syntax.

2. Below, Table 8 displays the average annual frequency for each type of event with its associated RIN value, listed from highest to lowest, determined within the Houma PAWSA study area.

Event Name	Sum of RIN	Sum of Avg Frequency
Collision	34.39	9.10
Allision	8.37	7.43
Sinking	6.24	1.51
Traffic Restricted	4.28	7.76
Grounding	2.00	6.67
Infrastructure Failure	1.60	1.42
Oil Spill	0.18	0.34
Fire/Explosion	0.00	0.00
HAZMAT Release	0.00	0.00
Total	**57.07**	**34.23**

Table 8- RIN by event type

3. RIN Results by Issue. The five issues with the highest RIN values as identified from stakeholder surveys completed during Day 2 of the PAWSA workshop are ordered from highest to lowest in Table 9. The verbiage for the issues in Table 9 are presented as agreed upon and used by participants during the FQRA. No changes were made to this wording following the conclusion of the workshop. Additional data and information for the Houma PAWSA RIN results is available by request from the CG NAVCEN.

<table>
<tr><td>Issue #1</td><td colspan="4">Recreational vessels operators do not understand hydrodynamic effects of water of large commercial vessels navigating the waterway and create hazardous conditions by navigating extremely close, such as bow and stern crossings.</td></tr>
<tr><td>Event Type</td><td>RIN</td><td>Event Type</td><td>RIN</td><td>Total RIN</td></tr>
<tr><td>Allision</td><td>0.09</td><td>Infrastructure Failure</td><td>0</td><td rowspan="5">6.16</td></tr>
<tr><td>Collision</td><td>4.73</td><td>Oil Spill</td><td>0</td></tr>
<tr><td>Fire/Explosion</td><td>0</td><td>Sinking</td><td>1.03</td></tr>
<tr><td>Grounding</td><td>0.03</td><td>Traffic Restricted</td><td>0.28</td></tr>
<tr><td>HAZMAT Release</td><td>0</td><td></td><td></td></tr>
<tr><td>Issue #2</td><td colspan="4">Recreational boaters lack basic seamanship skills and knowledge of Navigation Rules of the Road due to a lack of boater safety courses and lack of a robust Coast Guard Auxiliary presence within the study area.</td></tr>
<tr><td>Event Type</td><td>RIN</td><td>Event Type</td><td>RIN</td><td>Total RIN</td></tr>
<tr><td>Allision</td><td>0.10</td><td>Infrastructure Failure</td><td>0</td><td rowspan="5">5.97</td></tr>
<tr><td>Collision</td><td>4.42</td><td>Oil Spill</td><td>0</td></tr>
<tr><td>Fire/Explosion</td><td>0</td><td>Sinking</td><td>1.04</td></tr>
<tr><td>Grounding</td><td>0.15</td><td>Traffic Restricted</td><td>0.28</td></tr>
<tr><td>HAZMAT Release</td><td></td><td></td><td></td></tr>
<tr><td>Issue #3</td><td colspan="4">Volume of commercial fishing vessels within the Houma Navigation Canal, specifically wing net and skimmers, increases during shrimp fishing season from May to December.</td></tr>
<tr><td>Event Type</td><td>RIN</td><td>Event Type</td><td>RIN</td><td>Total RIN</td></tr>
<tr><td>Allision</td><td>0</td><td>Infrastructure Failure</td><td>0</td><td rowspan="5">4.38</td></tr>
<tr><td>Collision</td><td>4.10</td><td>Oil Spill</td><td>0</td></tr>
<tr><td>Fire/Explosion</td><td>0</td><td>Sinking</td><td>0</td></tr>
<tr><td>Grounding</td><td>0</td><td>Traffic Restricted</td><td>0.28</td></tr>
<tr><td>HAZMAT Release</td><td>0</td><td></td><td></td></tr>
<tr><td>Issue #4</td><td colspan="4">The GIWW through Houma is a strategic line of communication, linking major ports east and west of Houma with most vessels passing through in innocent transit. Waterway closures and disruptions rapidly result in congestion. This congestion creates elevated risks during tropical weather events, placing vessel crews, hazardous materials, and the channel in jeopardy, increasing the Coast Guard's post-storm emergency response operations related to Search and Rescue, Marine Environmental Response, and Martine Transportation System recovery.</td></tr>
<tr><td>Event Type</td><td>RIN</td><td>Event Type</td><td>RIN</td><td>Total RIN</td></tr>
<tr><td>Allision</td><td>0.56</td><td>Infrastructure Failure</td><td>0.56</td><td rowspan="5">3.94</td></tr>
<tr><td>Collision</td><td>1.89</td><td>Oil Spill</td><td>0.04</td></tr>
<tr><td>Fire/Explosion</td><td>0</td><td>Sinking</td><td>0.34</td></tr>
<tr><td>Grounding</td><td>0.03</td><td>Traffic Restricted</td><td>0.51</td></tr>
<tr><td>HAZMAT Release</td><td>0</td><td></td><td></td></tr>
</table>

Issue #5	Closures of the West Larose Lift Bridge, Bayou Dularge Bascule Bridge, and Houma Navigation Canal Bridge resulting from land-based traffic curfews cause marine traffic to bottleneck and back up to the Prospect Boulevard Bridge creating an increased risk of collisions, allisions and groundings in the immediate area.			
Event Type	**RIN**	**Event Type**	**RIN**	**Total RIN**
Allision	0.56	Infrastructure Failure	0.47	**3.87**
Collision	1.89	Oil Spill	0	
Fire/Explosion	0	Sinking	0	
Grounding	0.03	Traffic Restricted	0.92	
HAZMAT Release	0			

Table 9 – Highest five RIN values ranked by issue in descending order.

4. Summary of RIN Results. The data indicates that collisions, which have the highest RIN, occur most frequently on average. This finding reflects the complex interactions between the high volume of vessel traffic and constrained waterway dimensions within the study area. Risk of collisions is further elevated by the convergence of commercial, recreational, and fishing vessel traffic within narrow and restricted waterways, including but not limited to, in the vicinity of the West Larose Lift Bridge, Bayou Dularge Bascule Bridge, Houma Navigation Canal Bridge, and other frequently disrupted areas along the Gulf Intracoastal Waterway. Vessel congestion at bridge crossings, limited passing opportunities, and encroachments of moored vessels into the navigable channel additionally reduce maneuvering space and increase the likelihood of close-quarters situations. Environmental factors, particularly wind, compound these challenges by reducing vessel control. Groundings and allisions also rank prominently in the RIN results, influenced by shoaling, reduced channel depths, unmarked or submerged obstructions, and infrastructure which constrains the navigable waterway including bridges and bulkheads. These influences reduce navigational margins and increase the consequences of minor deviations from intended tracklines.

5. As detailed in Table 8, the total average frequency for all event types in the Houma PAWSA study area is 34.23 occurrences per year. The total annual RIN cost associated with these events is estimated at $57.07 million.

D. Risk Mitigation Strategies

1. The validated list of WRFs was used to prioritize discussion and development of risk mitigation strategies. Facilitators directed participants to capture potential mitigation strategies on sticky notes, which were then consolidated and grouped to identify major themes. From this bank of action items, participants were encouraged to generate mitigation strategies for Quality and Operation of Recreational Vessels, Waterway Use, Dimensions, and Obstructions. Due to time constraints, risk mitigation strategies were not developed for all issues within some WRFs and no risk mitigation strategies were discussed for Volume of Commercial Traffic, Congestion, Volume of Recreational Traffic, Commercial Fishing Vessels, and Winds. Recommended mitigation strategies documented in this section received consensus among workshop participants. Mitigation strategies are documented in order of significance to participants.

2. Participant comments are listed in Appendix C of this report and are referenced throughout this subsection to provide support of documented developed mitigation strategies.

3. Appendix E of this report contains a full list of the issues that participants presented and validated, informing the development of mitigation strategies discussed below. The issues presented in Appendix E are edited for clarity and syntax.

4. <u>WRF – Recreational Vessels.</u>

    a. Recreational vessel operators do not account for hydrodynamic effects generated by large commercial vessels. As a result, recreational vessel operators create hazardous situations by navigating unsafely close to large commercial vessels including during bow and stern crossings. Participants recommended the following mitigation strategies:

        (1) The Bayou Safety Committee (BSC) will establish and lead a dedicated subcommittee to deliver a sustained education campaign to target recreational vessel operators. Coordinate between the BSC, Coast Guard, Houma Pilots, and Louisiana Department of Wildlife and Fisheries to deliver standardized boater safety messaging pertaining to the maneuverability constraints of large commercial vessels, hydrodynamic effects, and safe navigation practices. Leverage the BSC to schedule and conduct public engagement at marinas, yacht clubs, boat ramps, and fuel piers, supported by the Coast Guard and partner agencies. Develop and distribute printed safety materials and coordinate with local media outlets to broadcast consistent safety messaging. Design and deliver

targeted digital campaigns across social media platforms to reach high-risk recreational operators. Additionally, through the BSC, identify and allocate available industry funding to support and sustain these outreach efforts.

(2) Coordinate between the BSC and waterway stakeholders, including local port authorities, parish governments, and facility owners, to identify high-risk locations for waterway users and standardize signage. Work with facility owners and parish authorities to install and maintain highly visible signage along the channel at chokepoints and at ingress or egress locations. Standardize signage to include clear warnings such as "Beware of passing ships" and "Stay clear of banks," reinforcing safe stand-off distances and awareness of vessel interaction effects. Through the BSC, monitor signage effectiveness and coordinate updates as needed.

(3) Petition Louisiana state elected officials and the Louisiana Department of Wildlife and Fisheries to establish and enforce mandatory in-person boating safety instruction for all recreational vessel operators, regardless of age. Through Louisiana Department of Wildlife and Fisheries, develop and administer a standardized curriculum that emphasizes hydrodynamic forces, large vessel maneuvering limitations, collision avoidance, and compliance with navigation rules. Through the same department, enforce certification requirements and integrate compliance checks into routine boating safety enforcement activities

(4) Petition MSU Houma and Coast Guard Heartland District to establish a Regulated Navigation Area (RNA) that restricts hazardous recreational activities, including tubing and water skiing, in identified high-risk areas. Specific waterway areas include the intersection of the Houma Navigation Canal and GIWW and reaches between Prospect Boulevard Bridge and Bayou Dularge Bascule Bridge. Engage with local parish governments to enact corresponding ordinances aligned with the RNA to authorize enforcement by local law enforcement agencies. Collaborate between the parish and state enforcement agencies to conduct patrols and issue civil penalties for violations to ensure consistent enforcement across federal, state, and local jurisdictions.

5. <u>WRF – Waterway Use</u>

a. The presence of shipyard and dry dock traffic in the Houma Navigation Canal causes increased risk due to dead ship towing operations that are restricted in the ability to maneuver. Additionally, cold-stack vessels encroach into the Houma Navigation Canal which reduces the navigable waterway, creating close quarter situations and reduced margins of error during vessel transits. Participants recommended the following mitigation strategies:

(1) To mitigate maritime risks within the waterways, key stakeholders, including vessel operators, pilots, and marine facility representatives, will report all instances of cold-stacked vessels encroaching into the Houma Navigation Canal directly to Coast Guard Sector New Orleans Command Center. To facilitate systematic oversight, the Bayou Safety Committee (BSC) will establish a permanent agenda item dedicated to the solicitation of formal tracking of these reports. Utilizing the BSC framework in this capacity will enable the port community to monitor ongoing resolution statuses, track reported cases, and maintain comprehensive, cross-organizational visibility.

(2) Request the United States Army Corps of Engineers (USACE), Coast Guard MSU Houma, and Coast Guard Sector New Orleans, through interagency agreement, coordinate corrective actions with facility owners to remove encroachments and restore full navigable width of the Houma Navigation Canal.

(3) Petition USACE to investigate reports and verify facility compliance with USACE permit limits governing mooring locations and channel boundaries.

(4) Request facility and vessel owners conduct targeted port assessment inspections of cold-stacked vessels ahead of forecasted heavy weather and hurricane conditions, with MSU Houma oversight. Employ inspection teams to evaluate the condition, strength, and configuration of heavy mooring lines and verify that mooring arrangements meet established safety and storm preparation standards. Direct facility operators to correct deficiencies immediately and reposition or secure vessels to prevent breakaways and channel obstructions. Coordinate follow-up inspections as required to ensure full compliance and readiness prior to storm arrival.

6. <u>WRF –Dimensions</u>

a. The GIWW's navigable channel narrows beneath the Houma Twin Spans Bridges and multiple vessel allisions occurred with the east side bulkhead. Participants recommended the following mitigation strategies:

(1) Request USACE to lead development and execution of a project to widen the Houma Navigation Canal under the Houma Twin Spans Bridges. Petition USACE to conduct required environmental and permitting reviews, needed to increase

channel width beneath the Northern Bridge by a minimum of 50 feet at the south corner of the span. Establish and enforce navigation safety measures during all current and future project planning and execution within the study area.

(2) Request USACE to remove or realign the east-side bulkhead that constrains vessel transit. Through USACE, coordinate project planning and execution with the United States Coast Guard and the Louisiana Department of Transportation and Development to ensure alignment with navigation safety requirements and bridge infrastructure considerations.

7. <u>WRF - Obstructions</u>

a. Sunken and unmarked abandoned and derelict fishing vessels block the navigable waterway. Participants recommended the following mitigation strategies:

(1) Establish a BSC task force with participation from the state government, parish government, Port of Terrebonne, and United States Coast Guard to develop and execute coordination of documenting, tracking, and removing of abandoned and derelict vessels in all navigable waterways of the study area.

(2) Establish a shared reporting and tracking system to maintain accountability for all identified vessels and prioritize removal based on navigational risk.

(3) Secure and administer grant funding received from the National Oceanic and Atmospheric Administration Marine Debris Program and coordinate with BoatUS Foundation to fund removal efforts through approved non-federal partners.

(4) Through appropriate Louisiana state agencies, establish and administer a vessel disposal program to provide a dedicated hotline and online reporting platform for vessel owners.

(5) Enable owners to surrender vessels for proper disposal and provide alternate solutions to prevent abandonment within the navigable waterway.

(6) Implement a state incentive-based disposal program modeled on a "cash for clunkers" approach to drive participation and reduce the number of derelict vessels.

(7) Coordinate program funding through state agencies, oversee contractor support for vessel removal and disposal, and integrate enforcement measures for non-compliant vessel owners.

Appendix A. Workshop Participants

Participant	Organization
1. Dallas Theriot	American Commercial Barge Line (ACBL)
2. Heath Jones	Bollinger Shipyards, LLC
3. Casey Thibodaux	Crosby Tugs, LLC
4. Roger T White III	Edison Chouest Offshore
5. Roger White	Edison Chouest Offshore
6. Billy Joe Pellegrin	Edison Chouest Offshore
7. James Leonard	Enterprise Marine Services
8. Paul Dittman	Gulf Intracoastal Canal Association
9. Karl Comeaux	Kirby Inland Marine
10. Jacob Oncale	Louisiana Department of Transportation & Development
11. Cameron Culpepper	LeBeouf Brothers Towing, LLC
12. Vaughn McDaniel	LeBeouf Brothers Towing, LLC
13. David Rabalais	Port of Terrebonne
14. Robert Swayze	United States Army Corps of Engineers
15. Michael Sullivan	United States Army Corps of Engineers
16. Timothy Lacoste	United States Army Corps of Engineers
17. Zameer Santiago Davis	United States Coast Guard
18. Lauren Bloch	United States Coast Guard
19. David Black	United States Coast Guard
20. Hollie Givens	United States Coast Guard
21. Kevin Whalen	United States Coast Guard
22. Rashel Oramas	United States Coast Guard
23. Aliyah Bruno	United States Coast Guard
24. Justin Kimrey	United States Coast Guard
25. Michael Elwell	United States Coast Guard

Appendix B. Waterway Risk Model Terms, Definitions, and Focused Quantitative Risk Assessment (FQRA)

A. Waterway Risk Conditions and Waterway Risk Factor (WRF) Definitions. The Ports and Waterway Safety Assessment (PAWSA) Waterway Risk Model utilizes sixteen WRFs categorized under four Waterway Risk Conditions. Definitions for each Waterway Risk Condition and their associated WRF are defined in this section.

1. Waterway Risk Condition - Navigation. The environmental conditions that affect vessel navigation, such as wind, currents, and weather.

    a. WRF - Winds. The difficulty in maneuvering vessels resulting from increased and unpredictable winds, particularly if the wind is from abeam.

    b. WRF - Tides and Currents. The difficulty in maneuvering vessels caused by water movement flow and speed, often affected by seasonal variations and sustained winds. Tide rips and whirlpools can be created by strong currents and affect the maneuverability of smaller vessels. The frequency of occurrence and the location of the strongest currents in the waterway are critical considerations (e.g., if current speed can exceed vessel speed, timing is critical when transiting the area).

    c. WRF - Visibility Restrictions. The natural conditions that may prevent a mariner from seeing other vessels, aids to navigation, or landmarks, such as fog, severe rain squalls, etc.

    d. WRF - Bottom Type. The material on the waterway bottom or just outside the channel, such as hard rock, mud, coral, etc.

2. Waterway Risk Condition - Vessel Quality and Operations. The quality of vessels and their crews that operate on a waterway. Each waterway has what are considered high risk vessels, such as old vessels, vessels with poor safety records, vessels registered in certain foreign countries, vessels belonging to financially strapped owners, vessels with inexperienced crews and operators, etc. When assessing risk, the following items should be considered (as appropriate) for each risk factor: maintenance, age, flag, class society, ownership, inspection record, casualty history, language barriers, fatigue related issues, and local area knowledge.

    a. WRF - Large Commercial Vessels. The quality of the large commercial vessel itself and the proficiency and quality of the crew. Large vessels are those ocean-going vessels, often in international trade, that usually are constrained by their draft to use dredged channels where such channels exist. Large vessels include such things as oil tankers, container ships, break bulk cargo ships, and cruise liners.

b. WRF - Small Commercial Vessels. The quality of the small commercial vessel itself and the proficiency and quality of the crew. Small vessels include all other commercial craft EXCEPT commercial fishing vessels. Examples include tugs and towboats, offshore supply vessels, charter fishing boats, and small passenger vessels (inspected under 46 CFR Subchapters T and K), such as dinner cruises and ferries.

c. WRF - Commercial Fishing Vessels. The quality of the commercial fishing vessel itself and the proficiency and quality of the crew. These vessels are included because they are not required to undergo annual vessel inspections nor are the crewmembers required to hold USCG licenses; therefore, there may be a greater potential for increased incidents involving commercial fishing vessels.

d. WRF - Recreational Vessels. The quality of the recreational vessel itself and the proficiency and operating knowledge of the individuals who operate them. Recreational vessels include all boats used for noncommercial purposes (e.g., pleasure craft or craft used by indigenous people for transportation or subsistence fishing). They can be powered by an engine, the wind, or human exertion. Examples include yachts, personal watercraft (a.k.a., jet skis), and kayaks.

3. Waterway Risk Condition - Traffic Conditions. The number of vessels that use a waterway and their interactions.

a. WRF - Volume of Commercial Traffic. The amount of commercial vessel traffic using the waterway (i.e., the more vessels there are on the water, the more likely that there will be a marine casualty). Deep draft and shallow draft commercial vessels as well as commercial fishing vessels are included in this risk factor. Shoreside infrastructure is also addressed in this risk factor (i.e., can it handle the volume of commercial traffic within the waterway).

b. WRF - Volume of Recreational Traffic. The amount of non-commercial vessel traffic using the waterway. The volume may vary depending on the time of day, the day of the week, the season of the year, or during a major marine event.

c. WRF - Waterway Use. The interaction between vessels or boats of different sizes using the same waterway and their maneuvering characteristics. Conflicts occur as risk increases with each type of vessel's maneuvering characteristics and actions that are often different and unpredictable (e.g., commercial mariners and recreational mariners using deep draft vessels and shallow draft vessels within the same waterway).

d. WRF - Congestion. The ability of the waterway to handle the volume and density of traffic. Risk increases when a large number of vessels uses a small geographic area for an extended period of time. Risk also increases substantially when you get a larger than normal number of vessels together for a short time (e.g., fishing tournament or short season commercial fishery).

4. Waterway Risk Condition - Waterway Conditions. The physical properties of the waterway that affect vessel maneuverability.

   a. WRF - Visibility Impediments. The man-made objects (e.g., moored ships, condominiums, background lighting, etc.) or geographic formations (e.g., headlands, islands, etc.) that prevent a mariner from seeing aids to navigation or other vessels.

   b. WRF - Dimensions. The room available for two vessels to pass each other within the waterway.

   c. WRF - Obstructions. Floating objects in the water that impede safe navigation and could damage a vessel, such as ice, debris, fishing nets, etc. Fixed objects such as wrecks, pipelines, overhead wires, derelict piers, fixed bridges, and permanently moored vessels.

   d. WRF - Configuration. The arrangement of a waterway, including elements such as waterway bends, multiple and converging channels, and perpendicular traffic flow.

B. Focused Quantitative Risk Assessment (FQRA) Background. As described in Chapter 1 Section B.2.b.(1), the Risk Index Number (RIN) is calculated for participant prioritized WRF issues using the FQRA process. Details are provided in the following sections regarding the consequence component of the FQRA.

1. Consequence. Table 1, as referenced in Chapter 1 Section B.2.b.(1).(a), displays the Coast Guard established consequence types, severity categories, and descriptions. Each consequence category is quantified in dollar value to allow comparison between consequence types. The fiscal equivalence for each consequence category provides economic weight for the RIN.

		Severity Categories				
		Cat 1	**Cat II**	**Cat III**	**Cat IV**	**Cat V**
Consequence Type	**Safety**	Injuries up to permanent disability.	One to 5 Deaths	6 to 15 Deaths	16 to 50 Deaths	51 or more Deaths
	Environmental (Oil)	Minor releases (of less than 100 gal)	Medium releases (of 100 to 5000 gal) OR local marine resource stock collapse for 1 to 5 years.	Disruption of the ecosystem (of 5000 to 50k gal) OR local marine resource stock collapse for 5 to 10 years.	Serious disruption of the ecosystem (of 50k to 500k gal) OR local marine resource stock collapse for 10-50 years.	Catastrophic disruption of the ecosystem (of more than 500k gal) OR local marine resource stock collapse for more than 50 years.
	Economic	Vessel damage, structure damage, economic activity, or port disruptions that incur less than $50k economic losses in total.	Between $50k and $250k economic losses in total.	Between $250k and $5M economic losses in total.	Between $5M and $250M of economic losses in total.	More than $250M of economic losses in total.

Table 1 – Severity categories by consequence type.

a. The following subsections explain how monetary values for different consequences are derived for each consequence type.

(1) *Safety*. These estimates use the Department of Transportation value of statistical life. The guidance is intended for analysis assessing the benefits of preventing fatalities. Reflecting 2025 inflation, a single death is equivalent to $12.5 million.

(2) *Environmental*. These estimates use the Environmental Protection Agency's Basic Oil Spill Cost Estimation Model (BOSCM). This is an adaptable model that allows for customizable inputs regarding spill recovery methods and efficiency, oil type, cultural factors, and impacted ecosystem descriptors to predict cost of an oil spill. Each of these inputs modifies the cost calculation in a different way. Once customizations for the model are set, three functions are combined to get total cost. These consist of direct response costs, socioeconomic and secondary costs, and environmental damage costs. Due to the extensive prep work required to use BOSCUM, the FQRA does not customize the model for individual ports. Instead, very conservative factors are selected with a bias towards over-estimating the cost and accounting for inflation adjusted to 2025. The primary limitation of this method is that not all environmental damage is caused by oil. An analysis of environmental damage costs from all maritime incident sources is difficult to estimate. Oil spill costs are the proxy that was selected until better models are found.

(3) *Economic*. This is the estimated dollar value for economic loss. It includes losses from vessel damage, facility damage, and economic activity.

Appendix C. Participant Comments

A. Background. This appendix documents participant observations and recommendations expressed during the workshop with respect to specific issues of concern within the study area. Discussion during the first day of the workshop was recorded and subsequently transcribed using professional services. Comments were compiled and categorized by most applicable Waterway Risk Condition and WRF.

B. Waterway Risk Condition - Navigation

1. WRF – Winds

   a. Frontal boundary passages generate rapid wind shifts and high wind conditions that challenge vessel control and transit timing. Limited availability of accurate, real-time wind data across the Houma Navigation Canal, Terrebonne Bay, and adjacent waterways reduces situational awareness for operators.

   b. Existing weather broadcasts provide valuable guidance on timing and severity and support safe operational decision-making.

   c. Prevailing southeast winds, commonly ranging from 10-20 knots across much of the year, create persistent environmental pressure on vessel movement and mooring integrity. Operators require improved wind and sea state forecasting tailored to localized waterway conditions.

   d. Sustained east and southeast wind patterns drive increased channel sediment movement resulting in reduced available under keel clearance in Terrebonne Bay. Wind-induced siltation creates recurring navigation hazards that require constant monitoring and dredging alignment. Encroachment into the Houma Navigation Canal decreases the available channel width for vessel maneuverability and reduces margins for error in restricted areas.

   e. Wind conditions complicate navigation through topographically constrained areas at the convergence of the Houma Navigation Canal and the Intracoastal Waterway at the Bayou Dularge Bridge and on the Gulf Intracoastal Waterway (GIWW) in the vicinity of the Houma Twin Span Bridge.

f. Narrow channel width on the GIWW from Bayou Dularge Bascule Bridge to Prospect Boulevard Bridge limits maneuvering space and increases risk of allisions during high wind conditions, particularly when vessels hold position at angles in one-way traffic zones or at pinch points. Additionally, operators rely on bridge-to-bridge radio communication to coordinate transits through restricted passages, including areas near the Bayou Dularge Bascule Bridge, which is especially critical during high wind conditions.

g. Severe weather events shift buoys and day markers out of position, degrading navigation accuracy, and resulting in an increased risk of vessel grounding. Flood control structures, including existing and planned GIWW floodgates, introduce additional constraints to vessel movement in high-wind conditions. Gates and structures 225 feet and wider create restricted transit windows requiring precise vessel handling.

h. Captain of the Port (COTP) directives, issued by the United States Coast Guard, establish operational restrictions during high-wind conditions, including limitations on night transits and movement controls across the waterway. Port leadership and waterway operators maintain continuous communication with vessel traffic operating along the gulf region to ensure alignment with safety directives. Cenac Marine Service, a local marine industry company that offers weather briefings using National Weather Service forecasts, distributes essential weather data to align operational decisions with real-time environmental conditions and maintain safe vessel movement throughout the port complex.

2. <u>WRF - Tides and Currents</u>

a. Channel narrowing, structural constraints, and flood control features alter current patterns and create complex hydrodynamic flows that directly impact vessel handling. Waterway modifications and permitting actions require full evaluation of current and tidal impacts to ensure safe vessel transit and prevent unintended flow conditions.

b. Insufficient current meter coverage across the waterway limits operator awareness of real-time conditions. Critical transit points, including areas near the Bayou Dularge Bascule Bridge, lack consistent and reliable current data. Operators require expanded current monitoring to support safe navigation decisions, particularly in constrained channels and during periods of strong tidal movement.

c. Strong outbound currents reduce effective draft and available under-keel clearance, increasing the risk of vessels contacting the channel bottom. These conditions complicate vessel meeting and passing scenarios, especially when offshore supply vessels operate in restricted channels.

d. An increase in storm surge events since Hurricane Katrina drive rapid water level changes and create unpredictable current conditions across the region. Expanding population and continued development of critical infrastructure, including liquefied natural gas facilities in low-lying areas, increase exposure to surge impacts. Operators need accurate storm surge forecasting and clearly defined action plans to support timely operational decisions for protecting vessels and shore-side infrastructure.

3. <u>WRF – Visibility Restrictions</u>

a. Frequent marsh fires generate persistent smoke that reduce visibility along the Houma Navigation Canal, GIWW, and adjacent waterways. Extended drought conditions increase fire frequency and intensity. Uncontrolled burns introduce sudden and severe visibility restrictions. These conditions create unpredictable transit environments and elevate collision and grounding risk.

b. Marine and inland fog develop under different conditions, persist for varying durations, and create inconsistent visibility across the waterway. Dense fog formations restrict visibility to unsafe levels. Mariners suspend transits in these conditions, and operators halt movements at night due to reduced visibility and increased risk.

c. Inadequate fog density forecasting and the absence of accessible, real-time visibility monitoring systems limit operator decision-making. Critical transit corridors, including the GIWW, lack publicly accessible camera systems that allow mariners to assess current visibility conditions. Liability concerns prevent broader sharing of existing camera feeds, leaving operators without reliable remote visibility confirmation.

d. Visibility restrictions drive operational slowdowns and complete shutdowns in high-risk areas. Mariners restrict or cease vessel movement during periods of reduced visibility, particularly at night, where darkness compounds fog-related limitations. These conditions delay vessel transits, increase congestion, and elevate risk when vessels attempt to operate in marginal visibility environments.

4. <u>WRF – Bottom Type</u>

a. Shoreline erosion dislodges stumps and debris that migrate into the Houma Navigation Canal and adjacent waterways. These submerged obstructions create unpredictable hazards and increase the risk of grounding and hull damage.

b. Heavy mud and silt accumulation, particularly between Mile Marker 20 and Mile Marker 29, create shallow, constricted sections of the channel. Persistent sediment deposition reduces effective channel width and limits safe maneuvering space, for larger vessels during meeting situations.

c. Dredging operations in the Houma Navigation Canal generate soft, unconsolidated material that settles unevenly and shifts rapidly. This bottom composition complicates hydrographic surveying and reduces confidence in depth data for transiting vessels. Fine sediments resuspend easily, slow vessel movement, and enter cooling and intake systems resulting in degraded vessel performance.

d. The Houma Navigation Canal contains a combination of sand, mud, and soft silt, each requiring different dredging techniques and equipment. This variability increases operational complexity for dredging contractors and affects the efficiency and consistency of channel maintenance efforts.

e. Reduced channel depths and tight under-keel clearance margins restrict the ability of shipyards, including facilities such as Bollinger Shipyards, to launch and transit newly constructed vessels. These limitations affect vessel design considerations, restrict operational flexibility, and influence decisions on vessel construction and routing within the region.

C. Waterway Risk Condition - Vessel Quality and Operation

1. <u>WRF – Commercial Fishing Vessels</u>

a. Fishing vessel crews frequently operate with personnel concentrated on deck and leave the pilothouse unattended or minimally staffed. This practice reduces continuous navigation oversight, delays response to developing traffic situations, and degrades overall vessel control in confined waterways.

b. Commercial fishing vessel operators demonstrate inconsistent awareness of surrounding traffic, channel constraints, and vessel interaction effects. Reduced attention to navigation dynamics and traffic density elevates the likelihood of unsafe maneuvers in restricted waters.

c. An aging commercial fishing fleet increases risk to the marine transportation system due to outdated equipment, reduced reliability, and degraded vessel performance. These factors affect maneuverability, propulsion reliability, and overall safety during transit and fishing operations within the waterway.

2. <u>WRF – Recreational Vessels</u>

a. Recreational vessel operators enter the waterway without formal training, structured education, or exposure to safe boating practices. Limited presence of United States Coast Guard Auxiliary vessel safety checks, classes, and outreach reduces awareness of navigation rules, local hazards, and vessel handling. High-value vessel ownership does not align with operator knowledge or competency, resulting in unsafe operation within a complex commercial waterway.

b. Recreational boaters regularly consume alcohol brought aboard, reducing situational awareness, reaction time, and decision-making. Impaired operation increases erratic vessel movement and elevates the risk of collision, allision, and unsafe interaction with commercial traffic.

c. Recreational operators conduct water skiing, tubing, and high-speed maneuvers near towing vessels and other commercial traffic. Operators navigate erratically, cross bows and sterns at unsafe distances, and fail to maintain safe stand-off from vessels with restricted maneuverability. These actions disrupt safe navigation and create immediate collision risk.

d. Recreational vessels strike obstructions that are clearly identified on nautical charts or marked with aids to navigation. Operators fail to interpret chart information and disregard visual navigation aids, leading to repeated groundings and allisions.

D. Waterway Risk Condition - Traffic

1. <u>WRF - Volume of Commercial Traffic</u>

a. High production rates at regional shipyards outpace available Coast Guard vessel inspection capacity. Limited marine inspector availability delays required vessel inspections, slowing delivery timelines and increasing the number of vessels holding position or awaiting clearance in the waterway. These delays contribute to congestion and reduce available maneuvering space.

b. There are limited bridge openings during peak roadway traffic periods, including rush hours, restricting vessel movement through key transit points. These constraints create vessel queues, increase congestion in approach areas, and force vessels to maintain position, elevating the risk of close-quarters situations and marine incidents.

2. WRF - Volume of Recreational Traffic

   a. Large fishing tournaments between Memorial Day and Labor Day drive sharp increases in recreational vessel traffic in the Houma Navigation Canal. Tournament activity concentrates vessels in transit corridors, marina approaches, and fishing areas, reducing available maneuvering space for commercial traffic. High vessel density during these events increases crossing, overtaking, and meeting situations in confined waterways. Elevated traffic volume intensifies coordination challenges between recreational and commercial operators and increases the likelihood of unsafe maneuvers and navigation conflicts.

3. WRF – Congestion

   a. Limited bridge opening schedules force vessels to queue in confined approach areas, reducing maneuvering space and increasing the risk of close-quarters situations during staging and transit.

   b. Funding limitations constrain dredging operations to maintain channel depth and width in the Houma Navigation Canal. Reduced depths prevent safe meeting and passing of vessels, forcing one-way traffic patterns, and increasing transit delays. These restrictions compound congestion and elevate navigation risk in already constrained waterways.

E. Waterway Risk Condition – Waterway

1. WRF – Dimensions

   a. Shallow depths narrow the Houma Navigation Canal effective channel profile and restrict under-keel clearance, forcing vessels into constrained passing arrangements. Limited depth reduces maneuvering margins, increases interactive forces between vessels, and elevates the risk of grounding or loss of control during meeting and overtaking situations.

   b. Bayou Terrebonne presents a narrow transit corridor where vessels operate near shore-side infrastructure. Documented allisions with bulkheads highlight the limited margin for error in this area. The presence of chemical barges carrying hazardous cargo increases incident severity due to potential for environmental release and waterway disruption from a breach in cargo.

2. WRF – Obstructions

   a. The Houma Navigation Canal Bridge is maintained in the open position to allow for vessel transit, except during peak vehicular traffic hours when it remains closed to marine traffic. During these peak hours, the bridge occupies usable channel space and restricts the available channel for vessel transits, creating a bottleneck for transiting vessels, limiting maneuvering room, and increasing the risk of allision in a constrained waterway.

b. Abandoned and derelict vessels, including those displaced during storm events, block navigation channels and create persistent hazards. Vessel owners fail to assume responsibility for removal, leaving obstructions in place and reducing safe transit space. The National Oceanic and Atmospheric Administration Marine Debris Program provides funding support for removal efforts, but coordination gaps delay execution and prolong exposure to risk.

c. Submerged hazards, including derelict pipelines and debris, remain inadequately marked or unreported within the waterway. Reporting processes lack clarity, and multiple agencies receive notifications without establishing clear ownership for response and removal. This fragmentation delays hazard mitigation and increases the likelihood of vessel strikes.

3. <u>WRF – Visibility Impediments</u>

a. Mooring slips at shipyards located along the GIWW and the Houma Navigation Canal accommodate vessels that exceed constructed slip length, resulting in overhang into adjacent waterways. These configurations obstruct sightlines for transiting vessels and reduce visibility of approaching traffic in already constrained corridors.

b. Moored vessels leave navigation lights energized while secured, creating false indications of vessel movement or underway status. This practice degrades mariner interpretation of traffic conditions and increases the risk of misjudgment during transit, particularly in congested or low-visibility environments.

c. Lighting from nearby industrial facilities, including drydock maintenance operations near the Prospect Boulevard Bridge, creates significant backlighting that obscures bridge structures, aids to navigation, and vessel silhouettes. This visual interference degrades depth perception and alignment during bridge transits.

4. WRF – Configuration

a. The channel alignment and bends between the Prospect Boulevard Bridge and Bayou Dularge Bascule Bridge limit visibility and maneuvering space, requiring towing vessels to coordinate transits via radio and conduct one-way traffic operations. These constraints force vessels to hold position and sequence movements through the bend, increasing exposure time in confined waters and elevating collision and allision risk.

b. Aids to navigation marking safe water in the study area are struck by vessels and repeatedly displaced. Frequent damage and misalignment degrade the reliability of channel markers and reduce mariner confidence in safe transit boundaries.

c. The waterway lacks adequate safe harbor locations and mooring capacity to accommodate the volume of vessels seeking refuge during severe weather events. Limited availability of protected slips forces vessels to remain in exposed areas or congested channels, increasing the risk of breakaways, collisions, and channel obstructions during adverse conditions.

Appendix D. Geospatial Participant Comments

Facilitators captured participant observations that made specific geographic references. Those observations were then transferred to an ArcGIS online web-application to generate chartlets reflecting the location and specific context of each comment. The chartlets, included below, are represented as Figures 1-4.

Geospatial Comments	
Point	**Comment**
1	Dredging operations occurred to reopen the area following storm surge impacts. However, the new depth is shallower than the depth prior to the storm surge.
2	Heavy congestion exists at this point due to vessel traffic generated by nearby shipyards.
3	Overhead cable lines are caught by vessel superstructures transiting Harvey Canal No. 2. These cable lines sag over the waterway and entangle vessels with large air draft.
4	On the Gulf Intracoastal Waterway from Bayou Dularge Bascule Bridge (4a) to Prospect Boulevard Bridge (4b), only one towing vessel can navigate at a time. A light system is desired to inform westbound vessels when a vessel is coming from the west and vice versa.
5	A current meter on Prospect Boulevard Bridge(4b) is needed to provide real-time readings for mariners.
6	The Houma Twin Spans Bridge is very narrow and presents navigational challenges to vessels that are exacerbated during high wind and heavy current events.
7	During the summer, recreational watersports including swimming and tubing interfere with the safe passage of commercial vessels.
8	There is a bottle neck for southbound vessels because the Bayou Dularge Bascule Bridge and Houma Navigational Bridge are restricted from currently opening for purposes of accommodating vehicle traffic.
9	Construction of a jetty is needed to manage sediment entering the Houma Navigation Canal

Table 1 - Geospatial Comments.

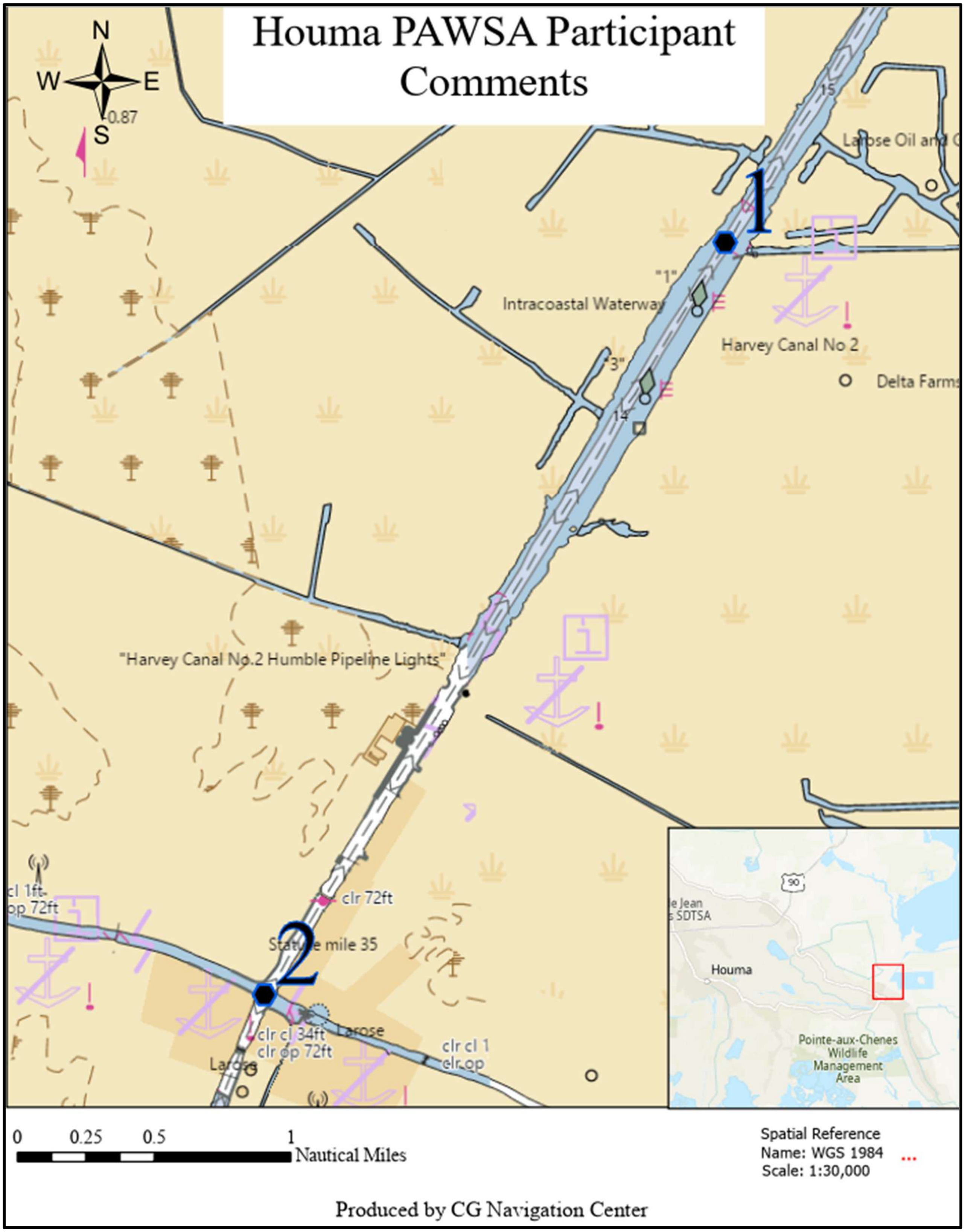


Figure 1 - Mapped location of geospatial participant comments 1-2.

Figure 2 - Mapped location of geospatial participant comment 3.

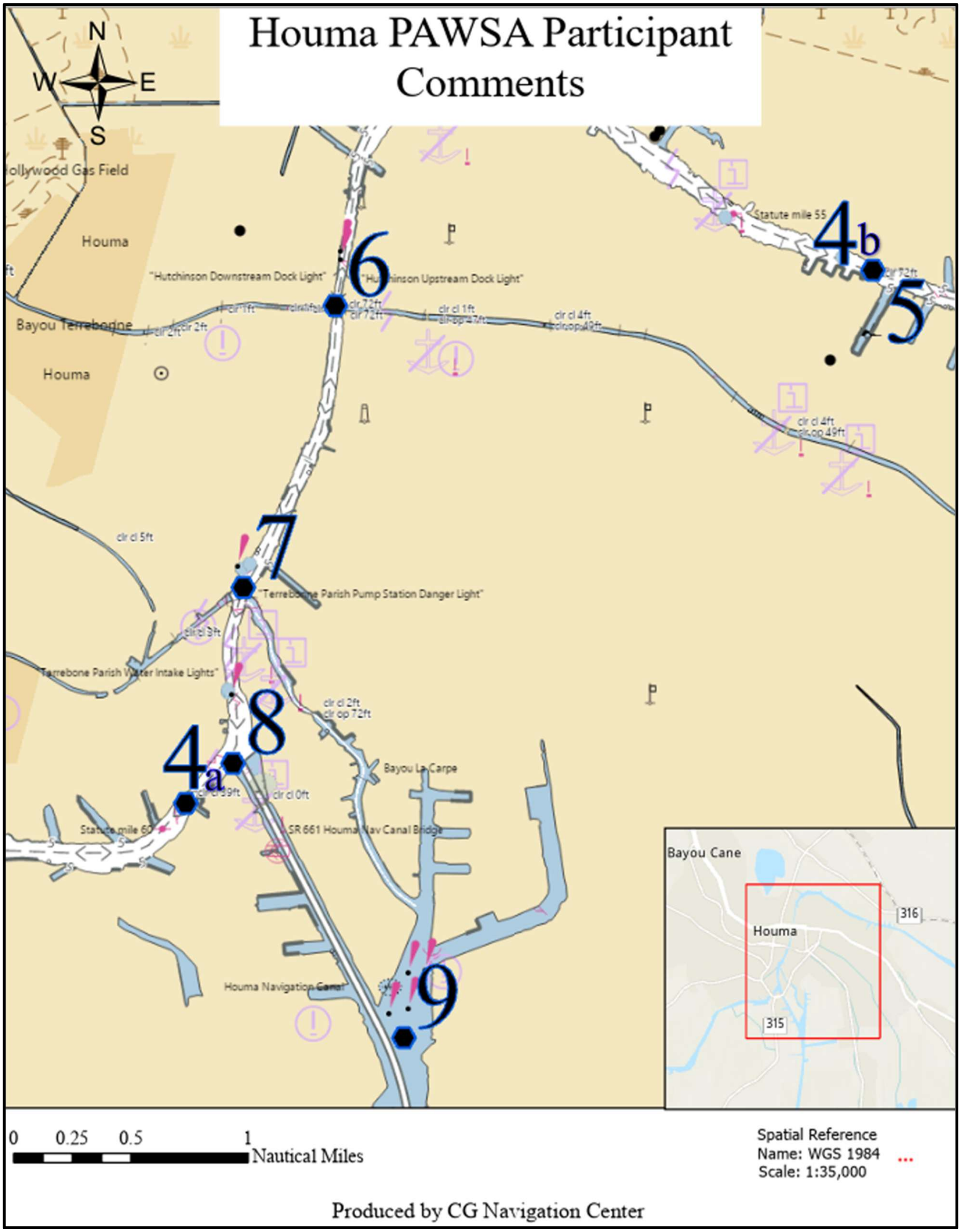


Figure 3 - Mapped location of geospatial participant comment 4-9.

Appendix E. Risk Factor Issues

A. Background

1. Following Day 1 workshop discussions, participants were asked to identify the most concerning issues for the highest prioritized and validated WRFs from the Risk Characterization survey. The following is a summary of the prioritized issues as selected by the participants. These issues are not listed in priority order and are also documented in Chapter 2.C preceding each mitigation strategy.

B. Waterway Risk Condition - Navigation

1. <u>WRF – Winds</u>

   a. Planners do not adequately consider how projects for new proposed shoreside structures along Houma Navigation Canal may cause changes in wind speed and direction that adversely impact safe vessel navigation.

   b. High wind events present challenges to vessels mooring in the navigable channel.

   c. There are a lack of wind sensors in the study area that provide real-time wind conditions to mariners.

2. <u>WRF – Currents and Tides</u>

   a. Current meters are insufficient within the study area. Current meters are particularly needed at Bayou Perot and Bayou Dularge Bridge (LA 315).

3. <u>WRF – Visibility Restrictions</u>

   a. There is a lack of fog density forecasting and access to real-time weather cameras to remotely determine visibility throughout the study area.

   b. Smoke generated by marsh fires compounded by the presence of fog causes decreased visibility and waterway closures.

C. Waterway Risk Condition – Vessel Quality and Operation

1. <u>WRF – Small Commercial Vessels</u>

   a. A large group of experienced licensed commercial towing vessel operators and cargo vessel operators recently retired, resulting in a loss of professional local subject matter expertise.

   b. Insufficient maintenance of aging offshore supply vessels (OSVs) causes increased risks associated with the material condition of these vessels.

2. WRF – Commercial Fishing Vessels

   a. Language barriers and poor radio communication etiquette pose challenges between fishing vessels and large commercial vessels in the Houma Navigational Canal.

   b. Insufficient crew complement onboard commercial fishing vessels causes decreased situational awareness, poor seamanship, and reduced adherence to the Navigation Rules.

3. WRF – Recreational Vessels

   a. Recreational vessels operators do not account for hydrodynamic effects generated by large commercial vessels. As a result, recreational vessel operators create hazardous situations by navigating unsafely close to large commercial vessels including during bow and stern crossings.

   b. Recreational boaters lack basic seamanship skills and knowledge of Navigation Rules due to a lack of boater safety education and insufficient presence of Coast Guard Auxiliary.

   c. Recreational vessels operate without adequate situational awareness and knowledge of the waterway resulting in groundings on unmarked shoals and strikes to underwater cables and dredge pipes.

D. Waterway Risk Condition – Traffic

1. WRF – Volume of Commercial Traffic

   a. Due to industry growth, the volume of inspected vessels exceeds the availability of Coast Guard vessel inspectors which results in inspection delays.

   b. The volume of wing net and skimmer commercial fishing vessels in the Houma Navigation Channel increases between May and December during shrimping season. These vessels cause increased traffic congestion due to deployed fishing gear and hinder the safe passage of other vessels in the waterway.

2. WRF – Volume of Recreational Traffic

   a. The volume of recreational traffic increases between Memorial Day and Labor Day. During this period, seasonal events, including fishing rodeos, result in increased recreational traffic volume by local and visiting mariners who lack experience and knowledge of local area.

3. WRF – Waterway Use

    a. The presence of shipyard and dry dock traffic in the Houma Navigation Canal causes increased risk due to dead ship towing operations that are restricted in the ability to maneuver.

    b. Cold-stack vessels encroach into the Houma Navigation Canal which reduces the navigable waterway, creating close quarter situations and reduced margins of error during vessel transits.

4. WRF – Congestion

    a. West Larose Lift Bridge, Bayou Dularge Bascule Bridge, and Houma Navigation Canal Bridge closures from land-based traffic curfews cause marine traffic to bottleneck and back up to Prospect Boulevard Bridge. This increases the risk of vessel collisions, allisions and groundings in the immediate area.

    b. Waterway closures and disruptions along the Gulf Intracoastal Waterway (GIWW) during tropical weather events result in congestion that increases the risk of vessel collisions and allisions.

E. Waterway Risk Condition – Waterway

1. WRF – Dimensions

    a. Reduced vessel under keel clearance is an issue throughout the study area. Vessels cannot meet in the Houma Navigation Canal and effectively pass without risk of running aground. Actions have not been taken to deepen the waterway despite the progressive increasing size of newly constructed vessels.

    b. The GIWW's navigable channel narrows beneath the Houma Twin Span Bridge and multiple vessel allisions occurred with the east side bulkhead.

2. WRF – Obstructions

    a. Sunken and unmarked abandoned and derelict fishing vessels block the navigable waterway.

    b. Overhead cable lines over Harvey Canal No. 2 are not installed at adequate heights to clear passing vessel superstructures and result in entanglement.

    c. Debris on the channel floor, including lines and tires, can damage vessel propulsion. This poses a severe risk of lost maneuverability, groundings, and collisions.

3. Visibility Impediments

    a. Flood lights at the dry dock and vessel maintenance facility in vicinity of Prospect Boulevard Bridge impede vessel visibility at night and make it difficult for mariners to identify navigational lights of marine traffic in the area.

    b. Vessels moored to slips designed for smaller vessels extend into the GIWW and HNC and impede the visibility of vessels transiting the area.

    c. Moored vessels display underway lighting configurations that cause confusion for underway vessels.

4. WRF – Configuration

    a. Traffic flow is reduced to one-way from Prospect Boulevard Bridge to Bayou Dularge Bascule Bridge when a tug and barge are transiting through. Vessels are forced to station keep while waiting for permission to pass which increases the risk of grounding.

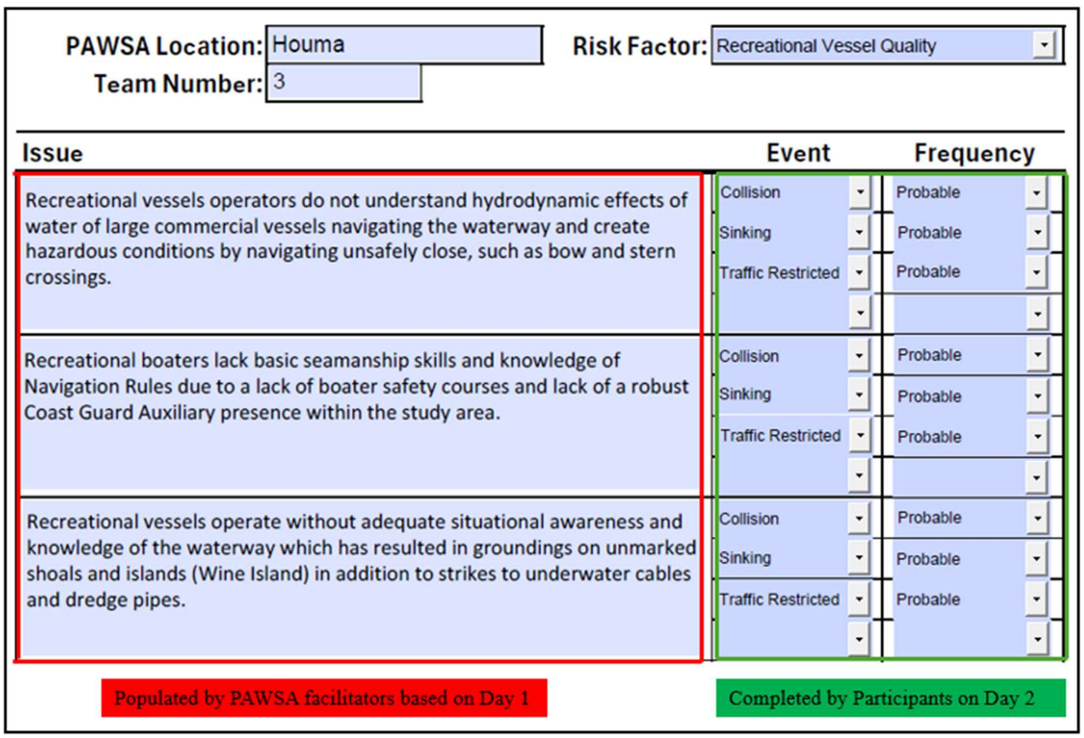
    b. There are frequent groundings and allisions with Aids to Navigation at the bend of the Houma Navigation Chanal when traversing the Terrebonne Bay Reach.

    c. There are a lack of safe harbors in the study area for vessels to moor during hurricanes and other heavy weather events.

Appendix F. National and Local Event and Consequence Data

A. National and Local Event and Consequence Data. As referenced in Chapter 1 Section B.2.b.(1)(c), the following section displays the tables and definitions for event types included in the handout provided to stakeholders prior to conducting the FQRA. The model uses national and local Coast Guard MISLE data that are updated as appropriate. The national event data in Table 1 contains information through September 2025. Table 2 and 3 contain the local event data for Marine Safety Unit (MSU) Houma that was derived prior to the workshop.

1. Event Types. During the FQRA process on the second day of the PAWSA, participants complete Event Forms that are pre-populated with issues validated during the first day of the PAWSA to enable RIN value calculations. An example of an event form completed by participants for this workshop is included below as Figure 1.



PAWSA Location: Houma

Team Number: 3

Risk Factor: Recreational Vessel Quality

Issue	Event	Frequency
Recreational vessels operators do not understand hydrodynamic effects of water of large commercial vessels navigating the waterway and create hazardous conditions by navigating unsafely close, such as bow and stern crossings.	Collision Sinking Traffic Restricted	Probable Probable Probable
Recreational boaters lack basic seamanship skills and knowledge of Navigation Rules due to a lack of boater safety courses and lack of a robust Coast Guard Auxiliary presence within the study area.	Collision Sinking Traffic Restricted	Probable Probable Probable
Recreational vessels operate without adequate situational awareness and knowledge of the waterway which has resulted in groundings on unmarked shoals and islands (Wine Island) in addition to strikes to underwater cables and dredge pipes.	Collision Sinking Traffic Restricted	Probable Probable Probable

Populated by PAWSA facilitators based on Day 1

Completed by Participants on Day 2

Figure 1 – Example event form from the Houma PAWSA.

2. For each issue listed, participants select up to three event types that may occur due to the associated issue. For example, if "Groundings throughout the study area can cause the waterway to shut down for an extensive amount of time," then allision, grounding, or traffic restricted are examples of three event types a participant may select that could occur because of this issue. Definitions for the nine event types available during the FQRA are provided below:

i. **Allision**: Vessel runs into stationary structure.
ii. **Collision**: Vessel runs into another vessel.
iii. **Fire/Explosion**: Fire or explosion.
iv. **Grounding**: Vessel draft exceeds water depth.
v. **HAZMAT Release**: Hazardous Material container breached or no longer working as designed (tank, package, pipe, etc.)
vi. **Infrastructure Failure**: Infrastructure stops working or damaged from non-vessel source.
vii. **Oil Spill**: Oil container breached or no longer working as designed (tank, pipe, etc.)
viii. **Sinking**: Vessel stops floating as designed. Capsizing is a sub-type of sinking.
ix. **Traffic Restricted**: Traffic not flowing normally; NOT from any event listed.

3. National and local event tables, displayed in the following Tables 1 – 3, omit infrastructure failure due to the lack of existing Coast Guard MISLE data for this event type. Results from the FQRA include all nine event types.

4. National Events. Table 3 provides data capturing the record of the yearly average of national events used in the FQRA process.

National Events

Event	Total Events	Yearly Avg
Allision	11,179	429.96
Collision	3,118	119.92
Fire/Explosion	2,442	93.92
Grounding	14,794	569.00
HAZMAT Release	611	23.50
Oil Spill	76,992	2,961.23
Sinking	4,457	171.42
Traffic Restricted	6,816	262.15
Total	**120,409**	**4,631.12**

Table 1 – Total and yearly average of national events.

5. Local Events. The data capturing the record of local events used in the FQRA process is specific to the port for the PAWSA. Table 2 and 3 provide the local event and consequence data provided to stakeholders prior to conducting the FQRA for the Houma PAWSA workshop.

Local Events

Event	Total Events	Yearly Avg
Allision	178	6.8
Collision	40	1.5
Fire/Explosion	27	1.0
Grounding	46	1.8
HAZMAT Release	61	2.3
Oil Spill	4724	181.7
Sinking	33	1.3
Traffic Restricted	530	20.4
Total	**5639**	**216.9**

Table 2 – Total and yearly average of local events for the Houma PAWSA workshop study area.

Type	Allision	Collision	Fire/Explosion	Grounding	HAZMAT Release	Oil Spill	Sinking	Traffic Restricted
Economic								
Ec0	Frequent	Probable	Occasional	Probable	Frequent	Frequent	Probable	Occasional
Ec1	Frequent	Occasional	Occasional	Occasional		Rare	Occasional	Frequent
Ec2	Probable	Occasional	Occasional	Occasional			Occasional	Frequent
Ec3	Occasional	Rare	Occasional	Rare		Rare	Rare	Probable
Ec4		Rare					Rare	Occasional
Ec5								Occasional
Environmental								
En0	Frequent	Probable	Probable	Probable	Frequent	Frequent	Probable	
En1	Rare		Rare		Rare	Frequent	Occasional	
En2	Occasional					Frequent	Occasional	
En3						Occasional		
En4						Occasional		
Safety								
Sa0	Frequent	Probable	Probable	Probable	Frequent	Frequent	Probable	
Sa1	Occasional	Occasional	Occasional	Occasional			Occasional	
Sa2	Occasional							

Table 3 – Local event consequences and likelihood for the Houma PAWSA workshop study area.