

IALA GUIDELINE

G1124

THE USE OF PORTS AND WATERWAYS SAFETY ASSESSMENT (PAWSA) MK II TOOL

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1 INTRODUCTION

Regulation 13 of Chapter V of the 1974 SOLAS Convention (as amended) states that ‘each Contracting Government undertakes to provide, as it deems practical and necessary either individually or in co-operation with other Contracting Governments, such aids to navigation as the volume of traffic justifies and the degree of risk requires’. A similar requirement is laid down in Regulation 12 of SOLAS Chapter V, covering the provision of VTS.

The assessment and management of risk is therefore fundamental to the provision of effective aids to navigation (AtoN)¹. To address this, IALA published Recommendation O-134 on IALA Risk Management Tool for Ports and Restricted Waterways for use by National Members. One method of risk management identified in Recommendation O-134 was the use of the qualitative Ports and Waterways Safety Assessment (PAWSA) tool developed by the United States Coast Guard.

At its 88th session in late 2010, the Maritime Safety Committee of the International Maritime Organization (IMO) approved the circulation of Recommendation O-134 to its Member Governments². This endorsement by the IMO underscored the importance of formal risk management. This Guideline aims to provide specific guidance on the use of PAWSA so that all IMO Member Governments can use this proven risk management tool where appropriate to meet their obligations under SOLAS.

2 BACKGROUND

The United States Coast Guard (USCG) developed PAWSA in the late 1990’s to assess the requirement for the use of Vessel Traffic Services and other AtoN. By 2010, over 40 ports and waterways had been assessed successfully using PAWSA. According to the official PAWSA Workshop Guide, the ultimate goal of PAWSA ‘is not only to establish a baseline of waterways for VTS consideration, but to provide the local host and waterway community with an effective tool to evaluate risk and work toward long term solutions tailored to local circumstances. The goal is to find solutions that are both cost effective and meet the needs of waterway users and stakeholders’.

To assist the conduct of a PAWSA workshop, the USCG published the *Ports and Waterways Safety Assessment Workshop Guide* which provided guidance and procedures required for conducting a PAWSA. The Guide was organized into seven sequential chapters with supporting appendices that introduced the PAWSA process before describing the methodology; pre-workshop logistics requirements; participant selection; workshop preparation; session facilitation and post-workshop reporting.

2.1 REVISED PAWSA WORKSHOP GUIDE

In 2014, The Directorate General of Coastal Safety (DGCS) in Turkey used the PAWSA Workshop Guide produced by the USCG to analyse risk in a Turkish waterway. This successful assessment led DGCS to prepare an updated version of the Workshop Guide. This updated Implementation Guide, based principally on the USCG version, is at 0 to this Guideline.³

1 The overarching guidance on risk management is contained in IALA Guideline 1018

2 IMO SN.1/Circ.296 dated 7 December 2010. In addition to Recommendation O-134, the Annex to the Circular made particular mention of Recommendation O-138 on the Use of GIS and Simulation by Aids to Navigation Authorities; Guideline 1057 on the use of GIS by Aids to Navigation Authorities and Guideline 1058 on the use of Simulation as a Tool for Waterway design and Aids to Navigation Planning

3 The United States Coast Guard, the copyright holders of the Excel™ Workbooks and PAWSA Workshop Guide, graciously confirmed that it has no objection to the publication of the Directorate General of Coastguard Safety’s amended Implementation Guide nor its use by other IALA member States

3 PURPOSE

The purpose of this document is to provide guidance on PAWSA's systematic approach to the identification of major waterway safety hazards; the estimate of levels of risk and the evaluation of potential risk mitigation measures so that selected measures can be implemented to reduce such risk.

4 OVERVIEW OF PAWSA MK II

PAWSA provides an assessment of risk in a defined waterway by means of a structured two-day workshop. It is undertaken by carrying out a subjective assessment of the probable risk in that waterway based on the experience of teams of maritime experts and other stakeholders under the supervision of a Facilitator.

The theoretical concept underlying the PAWSA process is the proven systematic decision making 'Delphi' method of converting the opinions of experts with local knowledge into quantified results. The experts complete a series of tasks set out in MS Excel™-based Workbooks. After each stage, the Facilitator provides a summary of the experts' decisions from the previous stage as well as the reasons for these decisions. The experts are therefore encouraged to revise their earlier answers based on the replies of other members of their team. This will ideally reduce the range of the answers so the team will converge towards the 'correct' answer. The 'Delphi' method used in PAWSA is based on the principle that decisions from a structured group of individuals are more accurate than those from unstructured groups.

The output from PAWSA indicates whether the **existing** risk in a waterway is:

- **Acceptable** and that no further work is needed unless changes occur in significant criteria, such as the traffic pattern or types of vessels using that waterway;
- **Not acceptable** but the risk control options necessary to make the risk level of the waterway acceptable have been identified adequately;
- **Not acceptable** and more detailed study is necessary to enable the risk control options that will make the risk level of the waterway acceptable to be identified adequately.

5 FACTORS AFFECTING THE DELIVERY OF PAWSA MK II

The successful outcome of any PAWSA workshop hinges on the Facilitator. This person has been defined as 'an individual who enables groups and organizations to work more effectively; to collaborate and achieve synergy. He or she is a 'content neutral' party who by not taking sides or expressing or advocating a point of view during the meeting, can advocate for fair, open, and inclusive procedures to accomplish the group's work'.⁴

The delivery of a successful PAWSA depends critically upon considerable pre-Workshop planning. This process is set out in 0, Chapters 3 - 5. It should be clear that PAWSA can therefore only be delivered successfully if the following are available:

- 1 Sufficient participants comprised of maritime experts and stakeholders.⁵
- 2 A competent Facilitator.⁶
- 3 A dedicated administration team.
- 4 Detailed records of maritime traffic; cargoes and maritime casualties.
- 5 Official nautical charts and publications based, where possible, on modern surveys.

4 Michael Doyle, quoted in Kaner, et al., 2007, p. xiii

5 See 0, Chapter 4. Participants should ideally comprise 60% waterway users and 40% stakeholders

6 See 0, Chapter 3 which includes a list of competencies that a Facilitator should possess



- 6 Meteorological records.
- 7 Details of proposed or planned maritime projects in or near the waterway to be assessed.
- 8 Details of any IWRAP risk assessments or analysis of simulations conducted in or near the waterway to be assessed.

The amount of preparation effort required for the successful delivery of PAWSA should not be underestimated. If the resources listed above are not available, the competent authority should consider using alternative methods to analyse and manage risk in its waters.

6 SUMMARY

PAWSA is one of the proven IMO-endorsed tools which Contracting Governments to the SOLAS Convention are invited to consider when conducting risk management in their waters. It uses quantitative data generated by teams of maritime experts and other stakeholders to determine whether an existing risk is acceptable; whether the implementation of an identified risk control option would make that risk acceptable or whether more study is required.

PAWSA requires considerable pre-planning; a competent Facilitator and a sufficient resource of maritime experts.

The systematic Implementation Guide at 0 should enable existing and potential users of PAWSA to use this powerful tool successfully.

7 ACRONYMS

AIS	Automatic Identification System
AtoN	Aid(s) to Navigation
Bk	Book
BRM	Bridge Resource Management
DGCS	Director General of Coastal Safety (Turkey)
DGPS	Differential Global Positioning System
Disp	Display
GRT	Gross register tonnage
Hydro	Hydrographic
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities - AISM
IMO	International Maritime Organization
LORAN	Long Range Navigation System
Mgmt	Management
MS	MicroSoft
Nav	Navigation
PAWSA	Ports and Waterways Safety Assessment
PAWSS	Ports and Waterways Safety System
SN/Circ.	Safety of Navigation Circular (IMO)
SOLAS	International Convention for the Safety of Life at Sea (IMO 1974 as amended)
USCG	United States Coast Guard
VTs	Vessel Traffic Services

8 REFERENCES

- [1] IMO SN.1/Circ.296 dated 7 December 2010

DRAFT



ANNEX A **PORTS AND WATERWAYS SAFETY ASSESSMENT (PAWSA) - DRAFT IMPLEMENTATION GUIDE**

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Chapter 1: Introduction to PAWSA

1. Purpose and Scope of Guide

The *Ports and Waterways Safety Assessment Implementation Guide* provides the guidance required for conducting a Ports and Waterways Safety Assessment (PAWSA). The Implementation Guide is organized into seven sequential chapters that introduce the PAWSA process, describe methodology, pre-workshop logistics requirements, participant selection, workshop preparation, session facilitation, and post-workshop reporting. Annexes provide some standardized materials designed to be used directly or tailored to meet local needs.

2. PAWSA Background

The PAWSA process grew out of the tremendous changes that took place during the 1990s in the United States Coast Guard (USCG) Vessel Traffic Service (VTS) acquisition program. As a result of the Congressional direction, the USCG established the Ports and Waterways Safety System (PAWSS) to address waterway user needs and place a greater emphasis on partnerships with industry to reduce risk in the marine environment.

As part of PAWSS, the USCG immediately 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.

Work done by the NDG led to the development of the PAWSA process, which was established to open a dialogue with waterway users and stakeholders to identify needed improvements. PAWSA provides a formal structure for identifying risk factors and evaluating potential mitigation measures through expert inputs. The process 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 selected.

3. Objectives

The risk assessment process is a disciplined approach to identify major waterway safety hazards, estimate risk levels, evaluate potential mitigation measures, and set the stage for implementation of selected measures to reduce risk. The process involves convening a select group of waterway users / stakeholders and conducting a two-day structured workshop to meet these objectives. A sponsor (e.g., Local Port Authority) is required to initiate and manage the workshop. However, the process must be a joint effort involving waterway users, stakeholders, and the agencies / entities responsible for implementing selected risk mitigation measures.

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 provides a basis for making best value decisions for risk mitigation investments, both on the local and aggregate level.

4. Methodology Overview

The PAWSA methodology developed by the USCG uses a generic model of waterway risks. That model was developed from the work done by the NDG in 1998 and the risk factors identified by the NDG were put into model form by Dr. Jack Harrold of George Washington University and Dr. Jason Merrick of Virginia Commonwealth University. During the course of more than five years of PAWSA workshops throughout the United States and in international venues, the model has been substantially revised to more accurately reflect the nature of waterway risks being experienced. The security-related issues are not covered by PAWSA because the workshop is unclassified and usually open to the public whereas discussions of security issues quickly delve into sensitive topics that should be treated as classified information.

Methodology Explanation

Using this Implementation Guide as the primary reference, the sponsor arranges for a meeting location and selects a group of waterway users and stakeholders from the local community to participate in the workshop. During the workshop, participants discuss safety-related issues relating to the waterway and then provide numerical inputs to quantify those discussions. Those quantitative assessments are organized into five logical

segments, referred to as ‘books.’ An overview of each book is provided later in this chapter. As each book is completed, the responses are entered into the PAWSA Excel software and, except for *Book 1*, aggregated results are then presented to the participants. Except for *Books 1* and *2*, participants use the results from each preceding book as the springboard for discussions during the subsequent phase of the process.

Waterway Risk Model

Since risk is defined as the product of the probability of a casualty and its consequences, the Waterway Risk Model includes variables dealing with both the causes of waterway casualties and their effects. The six risk categories used in the model are:

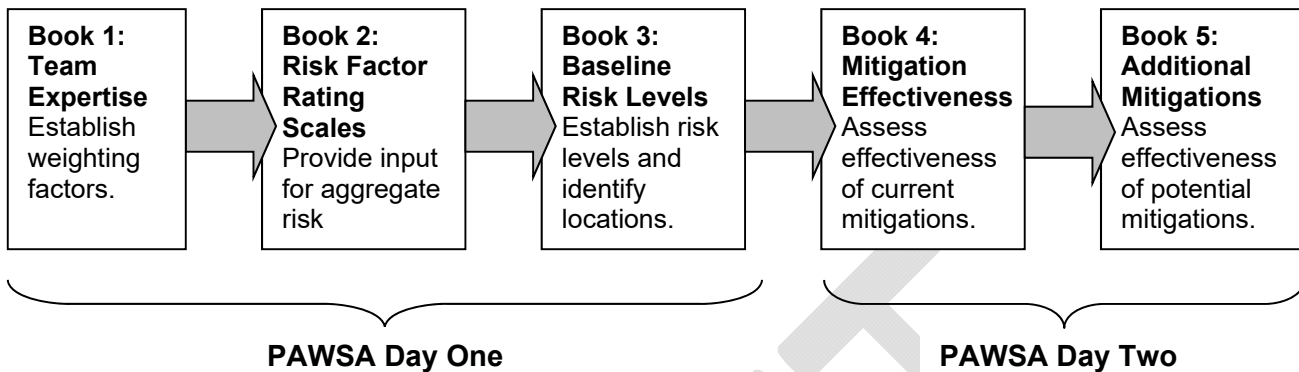
- 1 **Vessel Conditions** – the quality of vessels and their crews that operate on a waterway.
- 2 **Traffic Conditions** – the number of vessels that use a waterway and their interactions.
- 3 **Navigational Conditions** – the environmental conditions that vessels must deal with in a waterway relating to wind, water movement (i.e., currents), and weather.
- 4 **Waterway Conditions** – the physical properties of the waterway that affect how easy it is to manoeuvre a vessel.
- 5 **Immediate Consequences** – the immediate impacts of a waterway casualty: people can be injured or killed, petroleum and hazardous materials can be spilled and require response resources, and the marine transportation system can be disrupted.
- 6 **Subsequent Consequences** – the subsequent effects of waterway casualties that are felt hours, days, months, and even years afterwards, such as shore side facility shut-downs, loss of employment, destruction of fishing areas, decrease or extinction of species, degradation of subsistence living uses, and contamination of drinking or cooling water supplies.

The diagram below shows the form of the six risk categories and corresponding risk factors in 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

Quantitative Assessments

The five main steps used in the PAWSA process are described in more detail on the following page and then again in Chapter 2; however, the graphic below provides a simple overview of the process:



Book 1: Team Expertise is used to capture the expertise of each team relative to the other teams in the workshop. The results from *Book 1* are used to weight each team's inputs for all other books.

Book 2: Risk Factor Rating Scales develops measurement scales for each risk factor by asking participants to compare specified qualitative descriptions to each other in a pair-wise manner. Those qualitative descriptions characterize the range of possible conditions that affect risk in a waterway for that factor.

Book 3: Baseline Risk Levels is used by the participants to determine where their waterway falls on the risk scales developed in Book 2. What results is the risk level for each factor, not taking into account any actions already implemented to reduce risk in the waterway.

Book 4: Mitigation Effectiveness is used for two purposes. After the participants describe the risk mitigation strategies that already exist to help reduce the risk level for their waterway, Book 4 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, they decide whether the risk mitigation strategies already in place adequately balance the resulting risk level, or not. If, for any given risk factor, there is strong consensus among the participants that existing mitigations do adequately deal with those risks, then that risk factor could be dropped from further discussion.

Book 5: Additional Mitigations provides the participants an opportunity to offer ideas about specific risk mitigation actions that should be taken and to estimate how effective those actions would be in further reducing risk levels. Participants first discuss what else should be done only for those risk factors where the *Book 4* results show that risk levels are not adequately balanced with existing mitigations. Following the discussion, participants decide which ideas have the most promise for each risk factor that was discussed and what mitigation category the ideas relate to. They write a short description of the action needed, that is, the idea with the most promise, and then evaluate how much risk reduction would result if that idea was implemented.

PAWSA Software Program

An Excel file is used to enter all quantitative data gathered during the workshop. This file, containing spreadsheets for the data collected from each Book, and is often referred to as the 'PAWSA software'. The use of this PAWSA software is discussed in a more comprehensive manner in Chapter 6 where the details of conducting a PAWSA workshop are provided.

Workshop Outputs

Workshop outputs should include a participant list, workshop critique comments, and the *PAWSA Workshop Report*. The *PAWSA Workshop Report* includes the quantitative results from *Books 1 – 5*, discussion comments

made during the workshop, and an in-depth analysis providing specific recommendations as to what mitigation strategies would be implemented.

Chapter 2: Methodology

1 Preamble

For those not yet familiar with the setup of a PAWSA workshop, it may be advantageous for understanding the theoretical backgrounds covered in this chapter, to first read (at least) Chapter 6. The mathematics involved in the process, as implemented in the PAWSA software, are explained in the current chapter.

2 Theory

The theoretical concept underlying the PAWSA process is the proven Delphi method of converting the opinions of local subject matter experts into quantified results. This method is used so that those quantified results can be compared internally (i.e., the results for one risk factor can be compared to those for other risk factors and the results from one stage (e.g., *Book 3*) can be compared to the results from other stages (e.g., *Book 4*) during the workshop) and externally (i.e., the results from one waterway can be compared to the results from other waterways). The strength of the PAWSA process derives from several sources:

- a The participants are carefully selected as they are knowledgeable with respect to a particular maritime interest and so that all important interests are represented within the group.
- b Before converting their opinions into numbers, the participants thoroughly discuss the issues being judged.
- c The same 1 to 9 scale is used repeatedly throughout the process.
- d All quantified inputs are weighted by the relative expertise of each participant team with respect to each risk category in the Waterway Risk Model.

Proof that the PAWSA process works (i.e., produces valid results) comes from the internal consistency checks that are built into the results spreadsheets within the Excel workbook (PAWSA software) used to capture and analyse the participants' quantified inputs. Those consistency checks have repeatedly shown that workshop participants develop strong consensus about the levels of risk in the waterway and the effectiveness of various risk mitigation strategies. This consensus emerges in spite of the fact that the participants typically represent widely different interests within the overall maritime community and in spite of the fact that the 1 to 9 measurement scale used is correlated only loosely with qualitative descriptors for each value on that scale (see Chapters 6 and 7 for elaboration).

The rest of this chapter specifically describes *Books 1 – 5*. Understanding how each book is used, the methodology behind each book, and how the PAWSA software relates to each book are critical to understanding the overall PAWSA process.

3 Book 1: Team Expertise

There is no expectation that every participant invited to a PAWSA workshop will be equally knowledgeable with respect to all of the risk factors included in the Waterway Risk Model. The 24 risk factors in the model were developed to provide the foundation for discussions that could include the very broad range of maritime safety issues.

Because the PAWSA participants are expected to have varying expertise with respect to the risk categories in the Waterway Risk Model, *Book 1: Team Expertise* is used early in the session to weigh the relative strengths of each team with respect to the six risk categories. After being presented with the concepts underlying the model, each participant team is asked to discuss (among themselves) how their background and experience aligns with the model. They then verbally present their conclusions to the larger group. This presentation gives all teams a sense of where everyone thinks they are strong or perhaps not so strong. After all teams have spoken, each team evaluates whether they think they are in the top, middle, or lower third of all teams present in knowledge about

the six risk category areas. Throughout the workshop, these preliminary expertise evaluations are used to produce preliminary results for all other Books. Towards the end of the workshop, when each team has a much more in-depth feel for how all the teams compare to everyone else present, the team expertise evaluations are returned to each team for them to evaluate all of the other teams' level of expertise as well as to review and revise their own scores as necessary. The completed expertise evaluations are used to determine the final workshop results.

The teams, in doing the expertise evaluation, conceptually are dividing up six expertise pies (risk categories) into different sized slices, with the relative size of each slice from each pie equalling the expertise of each team relative to the other teams for that risk category. An example for the Navigational Conditions Risk Category:

Team 1: Circles a 1 indicating they are in the Top 1/3 of all teams present

Team 2: Circles a 3 indicating they are in the Lower 1/3 of all teams present

Team 3: Circles a 1 indicating they, also, are in the Top 1/3 of all teams present

These responses are entered into the data input cells in the *Bk 1 Input* spreadsheet in the PAWSA software. Those inputs are inverted, i.e., all inputs are subtracted from 4 so that a 1 becomes a 3 and a 3 becomes a 1. This is done so that the Top 1/3 teams get the biggest slice of the pie. Those inverted scores are added up (showing that, in this case, the total pie size = $3 + 1 + 3 = 7$). Then each team's slice is computed by dividing their inverted score by the total pie size. For our example:

Team 1: $3/7 = .429$ ($\approx 43\%$ of the Navigational Conditions expertise pie)

Team 2: $1/7 = .143$ ($\approx 14\%$ of the Navigational Conditions expertise pie)

Team 3: $3/7 = .429$ ($\approx 43\%$ of the Navigational Conditions expertise pie)

Obviously, but mathematically very important, adding all of the slices together equals 100% of each expertise pie. These computations are done independently for each of the six risk categories (expertise pies). Each team's relative expertise in each category (size of their slice) is multiplied by their inputs for the four risk factors in that category during all of the other quantitative evaluations (*Books 2 – 5*). When this multiplication is done, the products that result are the weighted inputs for that team for that book. Because the sum of the expertise for each category equals 100%, the sum of the weighted inputs equals the risk level.

4 Book 2: Risk Factor Rating Scales

The concepts that define each of the 24 risk factors in the Waterway Risk Model have been described in qualitative terms, such that they range from a very benign, best case risk scenario to a highly dangerous, worst case risk scenario. Two intermediate qualitative risk level descriptors describe risk somewhere between the best and worst cases, with the first intermediate descriptor less risky than the second intermediate descriptor. Those qualitative descriptors have been refined over the course of many PAWSA workshops to remove ambiguities and use of multiple variables, both of which lead to poor consensus. The qualitative descriptors presented in this Implementation Guide have proven to give reliable, high consensus results.

For uniformity, all risk assessment in the PAWSA workshop is done using a 1 to 9 point scale, where 1 represents the lowest risk and 9 represents the highest risk. The purpose of *Book 2: Risk Factor Rating Scales* is to establish the numerical relationships between the two intermediate qualitative risk descriptors and the best case and worst case end points. This is done with a pair-wise comparison technique, used to break up a complex problem (e.g., defining numerically how risk increases across a range of qualitative descriptions) into manageable component parts. In the PAWSA process, participant teams are asked to evaluate the increase in risk associated with moving from the lower risk descriptor in the left-hand column of *Book 2* to the higher risk descriptor in the right-hand column. Three pairs of comparisons are done for each risk factor. When the inputs from all participants for those three comparisons are aggregated, a risk rating curve results. The three comparisons for Wind Conditions are:

Strong winds occur LESS than twice a month AND well forecast	1	2	3	4	5	6	7	8	9	Strong winds occur MORE than twice a month BUT well forecast
Strong winds occur MORE than twice a month BUT well forecast	1	2	3	4	5	6	7	8	9	Strong winds occur LESS than twice a month BUT without warning
Strong winds occur LESS than twice a month BUT without warning	1	2	3	4	5	6	7	8	9	Strong winds occur MORE than twice a month AND without warning
	Equally Risky	Somewhat Risky		Much More Risky		Extremely more Risky				

Continuing with the three team example from the previous section, hypothesize the following Book 2 inputs for the Wind Conditions risk factor:

	Team 1	Team 2	Team 3
First Comparison	4	3	3
Second Comparison	7	5	6
Third Comparison	7	8	8

The inputs from each team for each risk factor in a particular risk category are multiplied by that team's expertise score for that risk category. For our example, that produces the following results:

	Team 1	Team 2	Team 3	Sum
First Comparison	$4 * .43 = 1.72$	$3 * .14 = .42$	$3 * .43 = 1.29$	3.43
Second Comparison	$7 * .43 = 3.01$	$5 * .14 = .70$	$6 * .43 = 2.58$	6.29
Third Comparison	$7 * .43 = 3.01$	$8 * .14 = 1.12$	$8 * .43 = 3.44$	7.57
	Grand Total:			17.29

The first comparison is between the descriptor for the best case (which we call the 'A' value) and the first intermediate descriptor (which we call the 'B' value). The second comparison is between the 'B' value and the second intermediate descriptor (which we call the 'C' value). The third comparison is between the 'C' value and the worst case descriptor (which we call the 'D' value). The sums at the end of each row above show how much the risk increases going from the lower risk descriptor to the higher risk descriptor. Obviously the sum of those sums (17.29 in this example) represents the total increase in risk going from the best case to the worst case descriptors. On the 1 to 9 scale used throughout the rest of the PAWSA process (Books 3, 4, and 5), the best case is always assigned a risk level value of 1.0 and the worst case is always assigned a risk level value of 9.0. Note that the difference between those values is: $9 - 1 = 8$ points. From this information, we see that the 'B' risk level value equals the best case value (1.0) plus the sum of the first comparison products (3.43) divided by the total increase in risk going from the best to the worst case scenario (17.29) times the total distance along the 1 to 9 scale (8). Doing the math, the 'B' value in this example equals:

$$B = 1.0 + (3.43 / 17.29 * 8) = 2.59$$

In like manner, the 'C' value equals the 'B' value plus the sum of the second comparison products (6.29) divided by 17.29 times 8, or:

$$C = 2.59 + (6.29 / 17.29 * 8) = 5.50$$

Finally, although we already know that the worst case value always equals 9.0, we can show mathematically that that value equals the 'C' value plus the sum of the third comparison products (7.57) divided by 17.29 times 8, or:

$$D = 5.50 + (7.57 / 17.29 * 8) = 9.0$$

Typical results are:

A Value (Best Case Descriptor)	1.0
B Value (First Intermediate Descriptor)	2.5 to 3.0
C Value (Second Intermediate Descriptor)	5.0 to 6.0
D Value (Worst Case Descriptor)	9.0

To compare results from one workshop to the results from other workshops for the same waterway, all PAWSA workshops must use the same 'aggregate' risk measuring scales. Those scales (one for each of the 24 risk factors in the Waterway Risk Model) are being developed through an iterative process wherein the Book 2 results from this workshop are combined with the results from all previous workshops. This is done by simply averaging together the 'B' values that were calculated during preceding workshops with the 'B' values calculated for this workshop. The same is done for the 'C' values. This produces a four-point risk measuring curvilinear scale for each factor. The aggregate risk measuring curves thus defined then are used as described in the next section.

5 Book 3: Baseline Risk Levels

To determine a risk level value for every factor in the Waterway Risk Model, *Book 3: Baseline Risk Levels* uses the same four qualitative descriptors for each risk factor as were used in *Book 2*. In theory those qualitative descriptors are written in absolute terms; that is, the risk level values that are produced by *Book 3* do not take into account any actions already implemented to reduce risk in the waterway. In practice, PAWSA participants sometimes have difficulty thinking in such absolute terms and the effects of existing mitigations tend to creep into the discussion and evaluation of this workshop stage.

Key to achieving strong consensus in the *Book 3* results is the discussion period that immediately precedes filling out this quantitative evaluation. During that discussion the various perspectives concerning each risk factor are voiced and, sometimes, debated. Often participants refer to read-ahead material provided by the sponsor (or readily available to them via other means), especially for risk factors amenable to measurement and/or quantification (e.g., volume of traffic, wind conditions, cargo volumes). Once the discussions have run their course, participants simply check the box next to the qualitative descriptor for a particular risk factor that best matches conditions in the waterway being evaluated.

If a team checks the first box (describing the best case), then a 1 is entered into the Bk 3 Input spreadsheet, obviously corresponding to a value of 1.0 for that input. If a team checks the second box, then a 2 is entered into the spreadsheet and the computer algorithm assigns the 'B' value from the aggregate risk measuring scale for that factor to that input. In like manner, a check in the third box is entered as a 3 and assigned the 'C' value; a check in the fourth box (describing the worst case) is entered as a 4 and assigned a value of 9.0.

Building on the same three team Wind Conditions example from previous sections, hypothesize the following *Book 3* inputs:

	<u>Team 1</u>	<u>Team 2</u>	<u>Team 3</u>
Box Checked	Third	Second	Third
Spreadsheet Entry	3	2	3
Risk Value	C	B	C
Value Assigned	5.50	2.59	5.50

The inputs for each team for each factor are multiplied by their team expertise scores and then added together to produce the baseline risk value for that factor. Continuing our example:

	<u>Team 1</u>	<u>Team 2</u>	<u>Team 3</u>	<u>Sum</u>
Value Assigned	5.50	2.59	5.50	
Expertise Score	.43	.14	.43	
Product	2.36	.36	2.36	5.08

Thus, for this example, the baseline risk value for the Wind Conditions factor is 5.1. (Note: All results are displayed rounded to one decimal place because the qualitative descriptors that underlie these quantitative results are not precise enough for greater numerical precision.) The results from *Book 3* for each risk factor in the Waterway Risk Model become the baseline from which the effectiveness of existing mitigation strategies is evaluated in *Book 4*. Those baseline numbers are marked on the *Book 4* assessment forms using a highlighter pen.

6 Book 4: Mitigation Effectiveness

Again, the key to good consistency in results from the *Book 4: Mitigation Effectiveness* stage is the discussion that immediately precedes filling out the quantitative evaluations. Those discussions should focus on three issues: (1) the specifics of what has been done to reduce the risk associated with a particular factor; (2) the effectiveness of those mitigation actions; and (3) whether existing mitigations are well balanced with the baseline risk value.

Once the discussions are complete, the participants are asked to do two things: (1) circle a number on the 1 to 9 scale that shows the effectiveness of existing mitigations in reducing risk below the absolute levels determined via *Book 3* and (2) circle Yes (or No) depending on whether they think existing mitigations adequately balance the risks for each factor (or not).

The vast majority of the time, participants will circle a number on the 1 to 9 scale to the left of (smaller than) the highlighter mark denoting the *Book 3* result. However, if they conclude that actions taken previously are having no effect on reducing the baseline risk, they will circle the *Book 3* result mark. Though unusual, participants might state (and then evaluate) that existing mitigations actually increase the risk for some factor(s). For example, while discussing the Dimensions risk factor, participants cite as an existing risk mitigation strategy that a range light has been established to help waterway users keep from running aground in a narrow channel, but state that the range is out of alignment with the channel, thereby increasing the risk of groundings. They then could evaluate the effect of that mitigation by circling a higher number (i.e., to the right) of the *Book 3* result mark.

The numbers that are circled by the participants are entered exactly as indicated into the *Bk 4 Scores* spreadsheet with two exceptions: (1) if the participants circle the space between two whole numbers, the entry is invalid and the team is required to reassess providing a whole number entry; and (2) if the participants circle the *Book 3* result mark, a lower case 'e' is entered and the computer algorithms convert that entry into the *Book 3* results value.

As with *Books 2 and 3*, the *Book 4* numerical entries are multiplied by the *Book 1* expertise scores and then those products are added together to produce the present risk level, which takes into account the effectiveness of existing mitigations.

Continuing our example from previous sections:

	<u>Team 1</u>	<u>Team 2</u>	<u>Team 3</u>	<u>Sum</u>
Number Circled	3	Highlighter mark	4	
Spreadsheet Entry	3	e	4	
Value Assigned	3	5.08	4	
Expertise Score	.43	.14	.43	
Product	1.29	.71	1.72	3.72

Rounding this result to one decimal place, we see that the effectiveness of existing mitigations in reducing Wind Conditions risk is judged to be: $5.1 - 3.7 = 1.4$ points.

As the final step in *Book 4*, participants make a subjective evaluation, based on the preceding discussions, as to whether they think risks are adequately balanced with existing mitigations for each factor. They do this by circling Yes (they are balanced) or No (they are not balanced) on the line in *Book 4* for each factor. Those Yes / No answers are coded into the *Bk 4 Y-N* spreadsheet as lower case 'y' or 'n'. If 2/3 or more of the participant team expertise indicates Yes, then that risk factor is dropped from further discussion / evaluation in *Book 5: Additional Mitigations*. This condition is denoted by a green *Balanced* on the *Book 4* results display spreadsheet (*Bk 4 Disp*). If 2/3 or more of the participant team expertise indicates No, then that risk factor should definitely be discussed / evaluated in *Book 5*. That condition is denoted by a red *NO* on the *Book 4* results display. If there is less than 2/3 consensus about the efficacy of existing mitigations then a yellow *maybe* is displayed. Those 'Maybe' risk factors should also be discussed / evaluated in *Book 5*. Finally, if the present risk level is evaluated as being HIGHER than the risk level from *Book 3* or, when appropriate, is higher than the risk level determined during a previous PAWSA held for the same waterway, then a red *Rising* is shown on the *Book 4* results display.

7 Book 5: Additional Mitigations

In the final quantitative evaluation stage of the PAWSA process, discussion is focused on those risk factors where the present risk level is not *balanced*. For each risk factor displaying a *No*, *Rising*, or *Maybe* flag, the *Book 4* results are marked using a highlighter on blank copies of the *Book 5: Additional Mitigations* evaluation forms. This serves as a starting point for evaluating the possible effectiveness of new mitigation strategies. For each risk factor so marked, the workshop participants are asked to offer ideas about what should be done to reduce the present risk level. Again, the quality of the discussion directly affects consistency of results obtained.

Analysis of risk mitigation ideas offered to date showed that those ideas usually fall into nine major implementation categories which are fully described in Chapter 6. Those categories are:

- co-ordination / planning;
- voluntary training;
- rules & procedures;
- enforcement;
- navigation / hydrologic Information;
- radio communications;
- Active Traffic Management;
- waterway changes;
- other actions.

After the participants have presented / discussed their risk mitigation ideas, they are asked to write short phrases (3 to 5 words each) describing the ideas they think have merit. Those short phrases are written on the lines next to the categories into which the ideas best fit. For example, if the risk factor being discussed is Wind Conditions and the idea being considered is 'Install wind sensor at Long Point', then the participants would write those words on the line next to the Nav / Hydro Info intervention category under that risk factor. After recording an idea, the participants indicate what risk level would result from implementing that idea. This is done by circling a number

to the left of (lower than) the Book 4 risk level mark on the 1 to 9 scale next to the implementation category where the idea was written. As in Book 4, only whole numbers are used; therefore, if the participants circle the space between two whole numbers, the entry is invalid and the team is required to reassess providing a whole number entry. The closer that circle is to 1, the more effective the participant team feels the idea to be. Those evaluations are again multiplied by the team's expertise scores and then those products are added together to get the possible risk level resulting from implementing the ideas written down for a particular category.

Again using our Wind Conditions example:

	<u>Team 1</u>	<u>Team 2</u>	<u>Team 3</u>	<u>Sum</u>
Number Circled	2	3	2	
Spreadsheet Entry	2	3	2	
Expertise Score	.43	.14	.43	
Product	.86	.42	.86	2.14

The algorithms for the Book 5 display spreadsheet (Bk 5 Disp) determine which implementation category most teams have chosen and then how much risk improvement would result from the ideas written down for that category. Those Book 5 display algorithms also determine which implementation category was judged to be most effective (i.e., had the biggest delta between the Book 5 and Book 4 results). A yellow Caution flag is displayed if the most chosen implementation category is not the same as the most effective category and either fewer than 50% of the teams chose the most chosen category or more than 50% of the teams chose the most effective category. The presence of the yellow Caution flag for any risk factor indicates the possibility that there is more than one 'best' mitigation measure to use to achieve further risk reduction for that factor.

Chapter 3: Preliminary Logistics

1 Preparing for a Successful PAWSA Workshop

This chapter discusses initial preparations for planning a PAWSA workshop, with specific details regarding sponsor and facilitation team roles / responsibilities and the logistics of arranging for the workshop meeting facility.

The quality of the advance preparations may well decide the success of the waterway risk assessment. The participants are busy people; scheduling the workshop well in advance is critical to ensuring that the right people can attend. The following are proposed general timeframes for some of the more critical steps in the planning process:

- commence preliminary logistics (e.g., notice to local community, initial workshop participant considerations, locate facility, etc.) at least 60 days in advance;
- set the workshop dates and location approximately 45 days in advance;
- ensure invitees receive the sponsor's letter of invitation and read ahead material approximately 30 days in advance of the workshop.

2 Roles and Responsibilities

Sponsor

- assign primary point of contact;

The importance of, and workload imposed by, the PAWSA process often dictates that a senior member of the sponsor's staff be designated as the primary point of contact for overall co-ordination of activities before, during, and following the workshop.

- assign facilitation team members;

In addition to the sponsor's point of contact person, an appropriate facilitation team should be selected approximately two to three months in advance of the workshop.

- selection of participants (see guidance in Chapter 4);

- review results (see guidance in Chapter 7).

Primary Point of Contact

- assist with logistical issues such as workshop facilities and equipment concerns;
- assist in the participant selection and homogenous team assignments;
- disseminate invitations and read ahead material;
- manage the day-to-day contacts leading up to the workshop including invitations responses;
- arrange for a waterway familiarization tour for facilitation team members as necessary;

In cases where the facilitation team, specifically the facilitator and the note taker, are not familiar with the waterway, a familiarization tour should be provided for those individuals.

- Assist in drafting PAWSA Workshop Report.

Facilitator

- must have a thorough understanding of the Waterway Risk Model and the PAWSA process;
- must have excellent public speaking skills, and be comfortable presenting technical information to a large group of waterway experts;
- must be properly briefed on the details regarding any controversial or politically sensitive issues specific to the waterway;
- presents workshop briefs, including the PAWSA Background brief, and explain the Waterway Risk Model, including the six main risk categories and twenty-four risk factors;
- facilitates all discussion sessions;
- oversees completion of the five quantitative assessment books;
- assists in the preparation of equipment and documentation materials for the risk assessment;
- should attend a previous PAWSA workshop, if possible.

Logistics Co-ordinator

- arranges for and prepare the workshop facility and all associated equipment requirements;
- provides on-site logistical support during the workshop.

Note Taker

- must have good listening and keyboarding skills;
- collects the qualitative input from participants during the waterway risk and mitigation discussions.
- assists in the preparation of equipment and documentation materials for the risk assessment.

Data Entry Person

- must have excellent data entry computer skills;
- enters the quantitative data into the PAWSA Excel™ spreadsheet for each of the five books;
- assists in the preparation of equipment and documentation materials for the risk assessment.

3 Selecting a Suitable Workshop Facility

Select the facility well in advance to ensure adequate space and appropriate accommodations will be available. Generally, selecting a location 60 days in advance of the workshop allows enough time for the facility point of contact and the facilitation team to properly prepare for the workshop. The meeting facility should be

convenient for the participants and the sponsor to get to, taking into account where people live and the commuting situation. More importantly, the meeting facility must be large enough to accommodate the expected number of participants, observers, and facilitation team needs.

To convey an image of serious intent, to minimize unintended distractions, and to focus the attention of participants, adequate facilities and amenities are required for the workshop. The use of a sponsor facility is not recommended for the workshop for two reasons: (1) most sponsor facilities cannot meet the space requirements, and (2) meeting at a facility other than the sponsor's venue helps to project the image of a local planning partnership facilitated, but not dominated, by the sponsor.

The workshop room should be spacious, well lit and ventilated, with sufficient space for all participants to be comfortably seated at tables. The meeting room must be large enough to accommodate participant and observer space, facilitation team requirements and visual displays.

Chapter 4: Participants

1 Selecting Participants

Once the facilitation team is assigned and the location and dates of the workshop are determined, the participants must be selected.

The sponsor has two key objectives in selecting workshop participants: (1) to draw into the process navigation and traffic management expertise, and (2) to ensure representation of all significant stakeholder groups within the affected local community. Meeting both objectives can be a challenge, especially while limiting the number of participants actively involved in the workshop sessions to 30 people. The sponsor's knowledge of who the key people are in the maritime community is the single best tool in the selection process, and must be applied to ensure that a knowledgeable, respected, and inclusive group is convened.

The sponsor has to convince prospective workshop participants, via both a formal invitation letter and telephone contact, that the sponsor's agency is preparing a thoroughly organized and critically important forum for discussing the waterway's safety requirements. The following ideals must be adequately conveyed to each prospective workshop participant:

- the concept of equal partnership in waterway community planning;
- that his/her individual expertise and energy are needed;
- that the participants will represent a cross section of the waterway users;
- that the common goal is to improve the safety of their waterways and infrastructure.

Criteria

Some standard criteria should be considered for the selection of workshop participants. Sponsors should work to achieve a 60/40 mix of 'waterway users'⁷ and 'stakeholders'.⁸ Ideal participants include those who have been in the local area for an extended period of time and regularly use professional skills in one or more of the following areas: pilotage, ship handling, aids to navigation, maritime law enforcement, vessel traffic management, protection of natural resources, marine casualty response and investigation, and waterway community planning and economics.

Collectively, workshop participants should:

- represent a broad cross-section of the local community that can speak as reliable and respected representatives of others engaged in similar work, or having similar interests;

⁷ 'Waterway users' are defined, for this risk assessment process, as those people who are actually involved in the movement of vessels in the waterway being assessed, such as vessel masters, pilots, officers of operating companies, and the like.

⁸ 'Stakeholders' represent all others whose livelihood and/or quality of life are affected by waterway activities.

- be recognized by the entire local community as a group of individuals who can represent all their interests.

2 Inviting Participants

The waterway user and stakeholder selection process should involve exploratory contact by the sponsor and the primary point of contact in addition to initial discussions with prominent members of the local community. The effort to identify able and willing candidates to provide comprehensive expert representation should be initiated approximately 45 days in advance of the workshop. Building the final participant list and establishing a schedule acceptable to all will be an iterative process involving numerous telephone calls by the sponsor and the primary point of contact. This advance effort should be completed before the invitation letter is prepared and mailed to participants.

When contacting potential participants emphasize the importance of their attending both days of the workshop. If a participant is unable to attend both days, an alternate arrangement should be made to ensure a similarly qualified individual is able to fill in.

Once the final participant list is determined, the sponsor should mail a formal letter of invitation to each selected participant. The objective of the sponsor's formal letter of invitation is to:

- confirm the objective and scope of the assessment;
- remind the invitees of the dates, times, and location of the workshop;
- encourage the invitees to review the read ahead material;
- characterize the waterway users and stakeholders with whom the invitee will collaborate;
- motivate an affirmative response and active participation from the invitees by stressing the potential benefits of participation, and by inference, the potential loss from failing to participate.

3 Read Ahead Material

Prior to the workshop, a read ahead package containing general PAWSA related information, including the history of PAWSA and a description of the workshop process, should be sent to each invitee, along with the formal letter of invitation. This material provides the participants with details about the assessment objectives, the process, and the expected output. However, experience indicates that several reminders will be required to obtain a high percentage of compliance with this requirement. The sponsor or the primary point of contact should remind each invited participant—both before and after the invitation letter is sent—of the importance of actually reviewing the read ahead material prior to the workshop, as well as reviewing the participant folder contents upon arrival at the workshop.

Personal contact and the formal letter of invitation should reinforce the motivational message and allow the sponsor / primary point of contact to respond to any relevant questions that might arise before the PAWSA workshop. Past experience shows a very high correlation between the sponsor personally making follow-up contact with invitees and people showing up at the workshop. This is not something that should be delegated to junior staff.

Chapter 5: Workshop Preparation

1 Workshop Equipment and Material Requirements

The purpose of this chapter is to provide the user with a detailed understanding of the materials and equipment required for a PAWSA workshop.

Producing some of the materials requires several weeks of advance planning. Other materials, which are more administrative in nature, can be prepared a few days before the workshop, as long as the necessary resources are obtained in advance.

2 Waterway Chart(s)

Selecting Charts

Chart(s) of the waterways are required to facilitate in-depth discussions of navigation issues. The chart(s) must cover the entire waterway area that is expected to be defined by workshop participants. Charts must cover the main waterway, its navigation channels, and any adjacent or converging waterways that impact vessel traffic.

Charts should be the latest edition, but do not need to be corrected to bring them up to date with notices to mariners. Chart(s) must be of adequate scale to provide details relevant to navigation such as waterway infrastructure (e.g., bridges, pipelines, etc.), commercial cargo and passenger facilities, and marinas, etc. The ideal scale will vary depending on the size of the waterway.

Ideally, all charts selected should be close to the same scale to minimize confusion during the discussion periods.

Colour Coding Charts

The facilitator will use the charts throughout the workshop, first to define the waterway and later to discuss specific areas of risk. As the participants identify areas where risks exist, the facilitator places coloured adhesive dots on the chart to mark those areas. The adhesive dots are color-coded to match the colours of the risk categories on the Waterway Risk Model. This provides a visual display of the waterway risks and helps participants stay focused on the risk category that is currently being discussed. Since the adhesive dots are difficult to remove, the chart(s) used for the workshop should not be the primary charts used by the sponsor's personnel, but chart(s) that can be discarded, if desired.

3 Participant Folders

A folder containing general information should be prepared for each participant and observer. This information, often referred to as session handouts, assists participants in understanding the PAWSA process and schedule, clarifies key points for completing Books 1 – 5, and provides space for notetaking throughout the workshop.

The following items are recommended for inclusion in the folders:

- Workshop Agenda;
- Facilitation Team;
- Waterway Risk Model;
- Waterway Risk Model Explanation;
- Risk Factor Mitigations;
- Waterway Profile Material.

4 Waterway Profile Material

The waterway-specific data should be factual⁹ and presented in both graphic and text format. Ideally, five years of data depicts a good representation of the information requested in factual terms. In some locations, however, five years' worth of statistical data may not be available for various reasons, while in other locations more than five years of statistical data may be available. Therefore, provide as much specific data as possible based on the amount of existing information.

The sponsor should provide the participants with enough data to understand the nature of the risks in the waterway. Explanations and examples provided on the following pages identify the different types of data that are typically used during a PAWSA workshop. They should be used as a general guide for format when presenting

⁹ Actual historical statistics characterizing the operation of the port are NOT incorporated into the calculations of the waterway risk assessment process. Rather, they are used to focus attention on the major port attributes during deliberations throughout the process. However, in an effort to facilitate future risk assessments at the local level, a member of the facilitation team should record any changes to the information identified by workshop participants and update the port profile as needed.

the data. An alternate format may be used, as long as the same information is provided. More or less data can be used based on the extent of operations in the waterway under discussion.

Distributions of Vessel Transits by Vessel Type

Workshop participants will need data showing which types of vessels, proportionately, are transiting the waterways.

Waterway Navigational Attributes

Many of the waterway's characteristics can be represented in a simple bulleted or narrative form. List the specifications pertaining to the following topics regarding the waterway's navigational characteristics:

- a **Traffic:** Briefly describe the amount of traffic using the waterway. Traffic includes deep draft vessels (e.g., ocean-going cargo vessels, passenger vessels, oil rigs), shallow draft vessels (e.g., tugs and tows, offshore supply vessels), commercial fishing vessels, and pleasure craft. Include information regarding traffic mix (i.e., is the waterway single use or multi-use (e.g., commercial / recreational) and, if the latter, do conflicts occur, and congestion issues (e.g., heavy volume at certain dates / times or areas of waterway).
- b **Wind:** Briefly describe the prevailing wind conditions in the area. Estimate the percentage of time that the wind blows greater than 20 knots sustained (would be tailored based on local conditions). Note any difficulties being encountered by waterway users due to wind effects.
- c **Visibility Restrictions:** Briefly describe how often restricted visibility conditions occur within the waterway. These conditions include all phenomena that prevent the waterway user from being able to see other traffic and aids to navigation (e.g., fog, rain squalls, snowstorms, smoke, etc.). Estimate the percentage of time that fog closes the waterway or that snowstorms hinder operations in winter.
- d **Visibility Impediments:** Briefly describe visibility impediments within the waterway area. These include all obstacles, other than previously listed, and naturally occurring features that prevent the waterway user from being able to see other traffic and aids to navigation (e.g., moored vessels, structures, background lighting, vegetation, etc.).
- e **Water Movement:** Describe current flow in the waterway. Be specific about the type and speed of current (e.g., flow with or across the channel at varying speeds, flow in different depth layers). Also include information about predominant seasonal currents (e.g., fast currents in spring with slower movement in the fall).
- f **Obstructions:** Briefly describe obstructions (e.g., ice, floating debris, fishing nets, etc.) in the waterway that affect safe vessel navigation. Estimate the percentage of time obstructions occur and note any difficulties encountered by waterway users due to obstructions.
- g **Dimensions:** Describe the width and depth of the channel and how much room there is for two vessels to pass each another. Identify areas where the width and depth changes and areas that are considered problem areas for vessel movement.
- h **Bottom Type:** Briefly describe the type of bottom in the waterway and any areas that concern waterway users. Bottom types include mud, silt, rock, sand, etc.
- i **Waterway Configuration:** Briefly describe any major bends in the waterway and their location. Describe the locations where traffic merges from converging waterways, and any locations where traffic regularly crosses the main ship channel.
- j **Number of Passengers:** Describe how many passengers transit the waterway on an annual basis, and describe how well prepared the waterway community is to deal with personnel injuries in the event passenger vessels are involved in a marine incident. Describe how well the waterway community is prepared to treat and/or evacuate passengers if the situation arises (e.g., incorporate data pertaining to the number of mass casualty drills held in the area). Types of passenger vessels that carry large

numbers of passengers and should be considered include cruise ships, charter fishing boats, dinner cruises, military craft, ferries, etc.

- k **Volume of Petroleum:** Describe the volume of petroleum products coming in and out of the waterway in terms of the number of vessel / barge movements and the total volume being transported by water.
- l **Volume of Chemicals:** Describe the volume and type of chemicals being transported on the waterway. Specifically, state whether any chemical cargoes are moving in bulk.
- m **Mobility:** Describe how vulnerable the waterway is to impacts resulting from marine incidents involving critical infrastructure in or alongside the waterway; that is, those shoreside things critical to moving marine cargo throughout the waterway (e.g., terminals, pipelines, bridges, etc.). Describe the impacts if the channel cannot be used (e.g., waterway / channel closure resulting from a sunken ship, oil or hazardous material spill, etc.).

Distribution of Cargo Tonnage

Compile a graphic representation in the form of a pie chart (in percentages) to proportionately show the amount and types of cargo carried throughout the waterway for the most recent year for which data is available.

Cargo Tonnage History

Compile a graphic representation in the form of a bar chart using the total cargo tonnage statistics, by year, beginning with the earliest data available.

Waterway Casualty History

Providing waterway casualty statistics proves useful when discussing the consequences side of the Waterway Risk Model equation. Compile a graphic representation in the form of a bar chart using the number of casualties by type and year. The following types of casualties should be considered:

- a Collisions.
- b Allisions.
- c Groundings.
- d Loss of Vessel Control.
- e Flooding / Sinking.
- f Capsize.
- g Structural Failure.
- h Fire / Explosion.

Historical casualty data should, at a minimum, focus on incidents that resulted in significant damage, or pollution, loss of life, or that affected vessel movement.

Pollution Spill History

In an effort to provide participants with a comprehensive perspective of the waterway's pollution spill statistics, create a graphic representation in the form of a bar chart. Present the number of spills, by year, from the commercial vessels, recreational craft and shore facilities.

Planned and Anticipated Changes

In a simple bulleted or narrative form, list the known changes that may affect waterways management. Examples include things such as alterations to channel configuration due to bridge construction or repair, dredging, changes in shoreside facilities, changes in levels and/or nature of waterway activities, and forecasted traffic levels. The list should also highlight anticipated changes that may be under consideration, but have no firm commitment yet.

5 Books 1 – 5

As described in the first chapter, a standard set of books is used to guide the participants' self-evaluation and pair-wise choices throughout the workshop.

Prepare one copy of Books 1 – 5 for each team, plus one copy for each observer. Each book is handed out and completed separately during the workshop; therefore, prepare Books 1 – 5 separately (i.e., do not bind the books together into full sets). Books 1 – 4 should be stapled; however, Book 5 is completed one page at a time and should not be stapled.

Write each team's number on the first page of each book. Also write the team number in the space provided on the top-right corner of each page of Book 5. This will be important during the workshop in the event there are any questions about a particular team's data for which the facilitation team needs clarification. For easy distribution during the workshop, organize books in stacks by the book number and chronologically by team number (e.g., one stack of Book 1, another stack of Book 2, etc.).

Annexes 1 - 5 contain Books 1 – 5, respectively, and are designed to be used directly or tailored to meet local needs.

6 Critiques

Upon completion of the two-day assessment, participants and observers, if interested, are asked to provide feedback on various aspects of the PAWSA process, facilities, and the presentation of material. The Workshop Critique is an invaluable tool used to enhance the process by incorporating beneficial comments, as well as provide the facilitation staff with an understanding of how they performed their duties associated with the workshop. The second benefit is especially helpful to the facilitation staff where an additional workshop is warranted.

Chapter 6: Conducting the Workshop

The purpose of this chapter and appendices is to show Implementation Guide users how to conduct an actual PAWSA workshop from start to finish. Proper review and use of this chapter and appendices is not only an absolute necessity for conducting a PAWSA workshop, but will greatly enhance the facilitation team's performance during the workshop. Specifically, the notes provided throughout this documentation will enable the facilitator, as well as the rest of the facilitation team, to gain a complete understanding of the step-by-step actions required during each segment of the workshop.

1 Pre-Workshop Meeting

A couple of days before the PAWSA begins, the sponsor, appropriate members of the sponsor's staff, the facilitation team, and any other personnel responsible for helping with the workshop should meet in person to review and discuss workshop details, including, but not limited to, the following:

- a Overall workshop objectives (not a detailed review of the waterway risk assessment process, which will be discussed in detail by the facilitator early on the first morning), discussion of why the participants were selected, and the workshop products.
- b Issues specific to that waterway including significant safety risks from the sponsor's perspective, politically sensitive issues and the recommended geographic boundaries of the waterway.
- c Participant details including a list of actual attendees (known at that point), homogenous team assignments and any participant strengths and weaknesses.
- d Logistics details including final facility requirements (e.g., providing final head count to facility as required in advance of the function, last-minute changes to times, etc.), completion and use of the waterway chart and workshop materials (e.g., participant folders, books, etc.).
- e Daily session review plans, including who should attend.
- f Waterway familiarization tour issues, if necessary.

2 Workshop Design

A successful risk assessment workshop for any waterway requires the following, at a minimum:

- a Sufficient time for proper instruction of the participants about the overall process and risk model concepts.
- b Time for adequate guided discussion of each risk factor.
- c Elicitation of considered responses from each expert for each risk factor in each book.
- d Feedback.
- e Confirmation of results.

Typically, 16 working hours, over a period of two full days, are required to accomplish the foregoing.

Scope and Objective of Each Day

- a Day One:
 - i The presentations that occur in the morning on the first day provide an overview of the entire PAWSA process, while hopefully motivating the participants. The information includes the sponsor's opening remarks, administrative items, review of the workshop agenda, the PAWSA background briefing, and an explanation of the risk assessment process. During this portion of the workshop the participants are introduced to the Waterway Risk Model and the associated risk categories and risk factors that will be the focus of the two-day session. Once the general information is provided, participants complete Book 1: Team Expertise just for their team. That input is used to create preliminary weights for subsequent inputs. Participants also complete Book 2: *Risk Factor Rating Scales*.
 - ii Following lunch, participants review the Book 2 results, which leads into discussions pertaining to actual risk in the waterway for each risk factor. Book 3: *Baseline Risk Levels* is used to numerically evaluate risk levels based on the participants' discussions. This portion of the workshop does not consider risk mitigating measures that are already in place. During discussions, participants should be encouraged to identify, where appropriate, trends and changes under consideration, so that they are incorporated into the risk assessment process.
- b Day Two:
 - i The second day begins with a review of the preliminary Book 3 results and continues with an in-depth discussion and evaluation of Book 4: *Mitigation Effectiveness*. This portion of the workshop does consider current mitigation measures. Just before lunch, the Book 1 evaluation forms are returned to the participants, who finish evaluating the relative expertise of all teams.
 - ii Following lunch on the second day, the participants review the final Book 3 and Book 4 results, which leads to discussion and evaluation of Book 5: *Additional Mitigations*. Late during this session participants complete the workshop critique and review the final results from Book 5.

Comprehensive Methodology Explanation

Throughout the remainder of this chapter, several references are made to an electronic file used for entering all quantitative data gathered during the workshop. This file is the PAWSA spreadsheet application containing worksheets for the data collected from each Book, and is often referred to as the 'PAWSA software'. There is an essential need for the facilitation team to review the Excel™ file in its entirety prior to the workshop to gain a full understanding of how the data is collected and processed during the workshop.

Book 1: Team Expertise

The results from Book 1, which captures the expertise level of each team relative to one another, are used to weight each team's inputs for all of the other books. This is done as a five-step process:

- a First, participants are assigned to teams, with every effort made to put two people with the same basic general background on each team. For example, if there are two harbor pilots in the group, then they would be put together into one team; likewise, if there are two environmentalists in the group, they

would become one team. The intent is that each team ideally consists of two people with a similar perspective on waterway safety issues. Use a 'team' of one or three people only as a last resort.

- b In the second step, the two teammates introduce themselves, if necessary, and discuss their knowledge of the concepts underlying the Waterway Risk Model. Then a representative from each team is asked to tell the entire panel about his/her team's strengths and weaknesses with respect to the six risk categories in the Waterway Risk Model.
- c After each team is heard, part of Book 1 is completed as the third step. In that evaluation, the teams place themselves into the top 1/3, middle 1/3, or lower 1/3 of the teams comprising the panel with respect to knowledge about each of the six risk categories. The teams evaluate only themselves at this point.
- d The data entry person enters the scores from each team into the gray shaded cells of the Bk 1 Input spreadsheet in the PAWSA software. The Book 1 results appear in the Bk1 Rslts spreadsheet. Those results are not shown to the participants.
- e In the final step, immediately after the participants finish filling out Book 4: Mitigation Effectiveness at the end of the second morning, the facilitator discusses the overall Book 1 results with the participants, gives them back their original Book 1 forms, and then asks the teams to reevaluate their initial inputs in light of those results and their greater understanding (at that point) of each team's true expertise. Additionally, the teams are asked to evaluate the expertise level for all of the other teams at this time. Participants should be encouraged to assign the same number of 1's, 2's, and 3's on each line (i.e., for each risk category) of the evaluation form. The scores are entered in the Bk 1 Input spreadsheet by the data entry person. These changes automatically update the calculations in all the other spreadsheets in the PAWSA software, thereby producing the final PAWSA quantitative results.

Book 2: Risk Factor Rating Scales

The qualitative descriptions in *Book 2* characterize the range of possible conditions that affect risk in a waterway for that factor. As explained previously in Chapter 2, there are four levels of risk described for each of the 24 risk factors. The lowest level of risk describes the best case situation, becomes the 'A' value on the risk measurement scales, and always has a numerical value of 1.0. The highest level of risk describes the worst case situation, becomes the 'D' value on the risk measurement scales, and always has a numerical value of 9.0. Two intermediate risk level descriptions also are given – the 'B' and 'C' values. Participants are asked to compare, in turn, the 'A' and 'B' risk level descriptions, then the 'B' and 'C' descriptions, and finally the 'C' and 'D' descriptions. This is done by the participants circling a number on a 1 to 9 scale that shows how much riskier they judge the right hand description to be compared to the left hand description for each pair. The greater the difference between the values assigned to two descriptors, the greater the difference in their perceived effects on risk. As seen on the next page, that 1 to 9 scale is loosely correlated with a qualitative risk increase progression, where:

Score	Risk Progression
1 =	The two descriptors are <u>equally</u> risky
≈ 4 =	The right hand descriptor is <u>somewhat more</u> risky than the left hand descriptor
≈ 6 =	The right hand descriptor is <u>much more</u> risky than the left hand descriptor
9 =	The right hand descriptor is <u>extremely more</u> risky than the left hand descriptor

The three inputs from each team for each risk factor are entered into cells B4:P75 of the *Bk 2 Input* spreadsheet by the data entry person. Those inputs are multiplied by the team's expertise score from *Book 1*, then mathematically manipulated as described in Chapter 2 to produce the aggregate rating scales for each risk factor. The results appear in the *Bk 2 Disp* spreadsheet. Those results are copied and pasted into the PAWSA Day One

PowerPoint™ presentation as explained in section 4 of this chapter. Those *Book 2* results are shown to and discussed with the participants.

Book 3: Baseline Risk Levels

Book 3, which is used to determine a risk level value for every factor in the Waterway Risk Model, uses the same four qualitative descriptors for each risk factor as were used in *Book 2*. As far as possible, those qualitative descriptors are written in absolute terms; that is, the risk level values that are produced by *Book 3* are intended not to take into account any actions already implemented to reduce risk in that waterway. After discussing the risks associated with the four factors in a particular category, the participants check the box next to the qualitative descriptor that best describes the risk level in this waterway for each of the four factors being discussed. Once all six categories have been discussed and the corresponding risk factors evaluated, the data entry person enters the scores into cells B4:P27 of the *Bk 3 Input* spreadsheet. If a team checks the first box (describing the best case), then the computer algorithm assigns a value of 1.0 to that input. If a team checks the second box, then the 'B' value from the aggregate risk measuring scale for that factor is assigned to that input. In like manner, the third box is assigned the 'C' value and the fourth box (describing the worst case) is assigned a value of 9.0. The inputs for each team for each factor are weighted by their team expertise and then added together to produce the baseline risk value for that factor. Similar to *Book 2*, the results appear in the *Bk 3 Disp* spreadsheet and are copied to the PAWSA Day Two PowerPoint™ presentation as described in section 4 of this chapter. Early on the second morning of the workshop those results are presented to and discussed with the participants.

Book 4: Mitigation Effectiveness

Book 4 is used to evaluate the effectiveness of existing mitigation strategies in reducing the risk level for each factor in the model. The facilitation team prepares the workbook using a highlighter to roughly mark the results from *Book 3* on the blank copies of *Book 4*. The participants then discuss the actions taken / strategies already in place that help to reduce risk for each factor. For example, under the Deep Draft Vessel Quality risk factor you would expect the participants to mention vessel inspections by government agencies as an existing risk mitigating strategy. You also would expect them to mention that this strategy only applies to certain vessel classes. The facilitator should encourage the participants to describe, in qualitative terms, the effectiveness of that particular strategy.

Once all existing strategies have been discussed for the four factors in each risk category, the participants are asked to circle a number on the 1 to 9 scale that shows where they think the risk level really is based on those existing mitigation discussions. In other words, how effective are those mitigations in reducing risk below the absolute levels determined via *Book 3*. Though unusual, participants might state (and then evaluate) that existing mitigations actually increase the risk for some factor(s). For example, if while discussing the Dimensions risk factor, participants cite as an existing risk mitigation strategy that a range light has been established to help waterway users avoid running aground in a narrow channel, but the range is out of alignment with the channel, they could evaluate the effect of that mitigation by circling a higher number (i.e., to the right) of the *Book 3* result.

As the final step in filling out *Book 4*, participants make a subjective evaluation of whether they think risks are adequately balanced with existing mitigations for each factor. They do this by circling Yes (they are well balanced) or No (they are not well balanced) on the *Book 4* line for each factor.

The data entry person enters the inputs from the circles on the 1 to 9 scales into cells B4:P27 of the *Bk 4 Scores* spreadsheet. The computer algorithms weight each team's input by their team expertise score and then add the results together to produce the present risk level, taking into account those existing mitigations. The Yes / No inputs are entered into cells B4:P27 of the *Bk4 Y-N* spreadsheet. The results for both components of *Book 4* appear in the *Bk 4 Disp* spreadsheet, are copied to the PAWSA Day Two PowerPoint™ presentation as described section 5 of this chapter, and then are discussed with the participants. Because the updates to the *Book 1* inputs are done just before the results are displayed, the participants see final results for *Book 4*.

Book 5: Additional Mitigations

Book 5 is used to focus discussion on those risk factors where the present risk level is not well balanced with existing mitigations. For each risk factor displaying a No, Rising, or Maybe flag, the facilitation team (normally done by the data entry person) again uses an orange highlighter to mark the *Book 4* results on the blank copies of the *Book 5* evaluation form before those forms are handed to the participants. Workshop participants then are asked to offer ideas about what should be done to reduce the risk level for each risk factor so marked. At this point in the proceedings, the facilitator often needs to guide the participants through an on-the-fly root cause analysis. In other words, the facilitator reminds the participants about the specific nature of the risks that they described for a given risk factor (referring back to the *Book 3* discussions). Then the facilitator asks what is causing those risks, i.e., why do they exist? By the facilitator repeatedly asking why, eventually the participants should uncover the root cause of the high risk situation. Usually the root cause, when finally identified, points directly to the intervention needed to reduce the risk. The facilitator writes down the risk mitigation ideas offered by the participants on a flipchart in 3 to 5 word 'bullet' form.

Analysis of ideas offered in the first 28 PAWSA workshops showed that risk mitigation ideas usually fall into about nine major categories. Those categories are presented in a later section of this chapter and also are defined on the first page of *Book 5: Additional Mitigations*.

Once the participants have offered / discussed their ideas for reducing risk, they are asked to write short phrases (3 to 5 word bullets) describing ideas with merit on the lines after the categories into which the ideas best fit. For example, if the risk factor being discussed is 'Small Craft Quality' and the idea being considered is 'Mandatory boat operator licensing', then the participants would write those words on the line next to the Rules & Procedures category under that risk factor. After recording each of their ideas, the participants evaluate what risk level would result from implementing that idea. This is done by circling a number to the left of the *Book 4* risk level mark on the 1 to 9 scale next to the implementation category where the idea was written. The closer that circle is to 1, the more effective the participant team feels the idea to be. Participants should be asked to reconsider their input if they circle the highlighter mark as that indicates they do not expect any improvement from implementing their idea. The data entry person enters those numeric evaluations into cells C4:Q219 of the *Bk 5 Input* spreadsheet, being very careful to put the inputs into the correct cells. Those inputs again are multiplied by the team's expertise scores and then those scores are added together to get the average risk level if the ideas written down for a particular category were implemented.

The algorithms for the *Book 5* display determine which category most teams have chosen and then how much risk improvement would result from the ideas written down for that category. Those *Book 5* display algorithms also determine which category was judged to be most effective. A yellow Caution flag is displayed if the most chosen category is not the same as the most effective category and either fewer than 50% of the teams chose the most chosen category or more than 50% of the teams chose the most effective category. The presence of the yellow Caution flag for any risk factor indicates lack of consensus about the best way to achieve further risk reduction for that factor. The *Book 5* results appear in the *Bk 5 Disp* spreadsheet, are copied to the PAWSA Day Two PowerPoint™ presentation as described in section 5 of this chapter, then are shown / discussed with the participants. Because the updates to the *Book 1* inputs are done just before this stage in the process, the participants see final results for *Book 5*.

3 Day One Activities

A great deal of information is provided to the participants on the morning of the first day of the workshop. Very often, the first few minutes set the tone for the rest of the workshop. Without a proper start and thorough knowledge of the session details, these first few minutes can set a poor, rather than a positive, tone for the entire process. Therefore, the facilitation team must ensure that everyone knows their role(s) and most importantly, keeps the workshop on schedule to avoid having to rush things later in the day.

Unless otherwise noted, during the remainder of this chapter all steps should be completed by the facilitator.

Morning Procedures

The morning portion of the workshop focuses on why the workshop is necessary, the reasoning behind the specific participant selection, the background of the PAWSA process, and a thorough explanation of the Waterway Risk Model and its components.

The first and critically important step of the entire workshop is the sponsor's welcoming remarks. The sponsor should be thoroughly prepared to deliver the welcoming remarks information in such a way that the participants feel like their time commitment will be well worthwhile. The basic topics that the sponsor should cover include the workshop objectives, the reasoning behind selecting the individuals who are present, and the products that result from the workshop. In general, the sponsor should try to reinforce the idea that cooperative state/local effort is the best approach to accurately identifying risks and selecting appropriate countermeasures.

Once the sponsor has welcomed the group, the facilitator introduces the facilitation team and then invites the participants to introduce themselves. While this is occurring, the facilitator should pass around the Attendee Contact List to all participants and observers. After the list has circulated, the facilitator should make an announcement ensuring that each attendee has had the opportunity to review the list and make changes as necessary. Once completed, the data entry person should review / correct the document as needed, making note of which individuals are observers.

Upon completing the introductions, all necessary administrative items should be addressed to the participants.

After covering all necessary administrative items, the PAWSA background and an overview of the Waterway Risk Model to explain the concepts underlying each risk factor in the model should be introduced. This necessitates a very brisk pace and requires in depth knowledge by the facilitator about nuances in the concepts underlying the model. Encourage the participants to take notes and ask questions. Once this explanation is done, make sure all teammates are seated next to each other, either based on original team assignments or on necessary adjustments due to additional participants and/or substitutions.

Instruct the participants to discuss with their teammate(s) the team's strengths and weaknesses with respect to the Waterway Risk Model categories. Then have a spokesperson from each team brief the other workshop participants on their discussion. Following those short presentations from each team, explain how to fill out *Book 1*, and ask them to do so. Remind the participants to complete only their team's column. Once all teams are finished, collect all copies and give them to the data entry person for entry into the PAWSA software.

Similarly, describe how to fill out *Book 2*, and have the teams complete *Book 2* accordingly. As with the previous book, as the teams complete their evaluations collect the books and give them to the data entry person for entry into the PAWSA software.

Afternoon Procedures

Display the *Book 2* results and review them with the participants. Make sure the participants are clear on how those *Book 2* rating scales are used. The rest of the afternoon session focuses on assessing the current risk levels in the waterway, without taking into account the mitigating measures already in place; that is, the baseline risk for each factor in the Waterway Risk Model.

Begin this discussion by having the participants define the geographic area to be discussed; the note taker should record this information for the *PAWSA Workshop Report*. While *Book 3* discussions are occurring, the note taker also should record a general sense of the discussion in short sentence form for the same *PAWSA Workshop Report*. Participants should be reassured that all notes will be recorded anonymously, i.e. there will be no individual or organizational identification of who made a particular comment.

Explain that the waterway chart presented at the front of the room is used to visually identify risk areas during the *Book 3* discussion. As noted in Chapter 5, this can be accomplished by placing adhesive markers on specific risk areas mentioned, color-coded to match the Waterway Risk Model category being discussed.

Due to the length of the discussions and evaluations, the *Book 3* discussion can be broken down into three logical sections between scheduled break periods as follows:

- a Vessel Conditions and Traffic Conditions: Initiate a discussion of waterway risks for the Vessel Conditions risk factors. Once that discussion is done, explain how to fill in Book 3, then ask participants to check the blocks on page 1 of Book 3 that best describe the waterway being discussed. Once all teams are finished evaluating the Vessel Conditions category, continue the discussion for the Traffic Conditions risk factors. Finally, ask participants to complete page 2 of Book 3 before taking a break.
- b Navigational Conditions and Waterway Conditions: Initiate a discussion of waterway risks for the Navigational Conditions risk factors, then ask participants to fill out page 3 of Book 3. Once all teams are finished with the Navigational Conditions category, continue the discussion for the Waterway Conditions risk factors and ask participants to complete page 4 before taking a second break.
- c Immediate Consequences and Subsequent Consequences: Remember to shift the focus to the impact side of the risk equation when discussing these two risk categories. Initiate a discussion of waterway risks for the Immediate Consequences risk factors, then ask participants to complete page 5 of Book 3. Once all teams are finished with the Immediate Consequences category, continue the discussion for the Subsequent Consequences risk factors and ask participants to complete page 6 of Book 3.

Once all teams have finished their Book 3 evaluations, collect all copies and provide them to the data entry person for entry into the PAWSA software.

To wrap up the participant-portion of the first day of the workshop, provide a quick review of what they did today and what they can expect to do tomorrow. After any and all questions are answered, the participants may be excused.

Session Review

After the participants have left the workshop room, a session review is conducted (i.e., a discussion of how the first day went). During the session review the sponsor and all members of the facilitation team, as well as any supporting sponsor personnel deemed appropriate, are given the opportunity to provide feedback on how the workshop is going. That feedback should cover overall impressions, presentations, facilities, participant mix and level of involvement. During this discussion, constructive criticism is necessary, focused on any changes needed before the second day of the workshop.

4 Day Two Activities

The process used for the second day is very much like what was done for the first day, but with a much different focus. The second day focuses on mitigating the risks that were brought up during the first day's discussion and evaluation. After the Book 3: Baseline Risk Levels results are reviewed, participants discuss the mitigating measures that are currently in place for each factor, which are then quantitatively measured using Book 4. During the afternoon session, other suggestions are offered for further reducing risk in the waterway. The potential effectiveness of those additional actions are then evaluated using Book 5: Additional Mitigations.

Morning Procedures

At the start of the day, review the agenda for Day Two to refocus all participants and observers as necessary, and display, review and discuss the results from Book 3.

The rest of the morning focuses primarily on existing risk mitigations. There are sure to be many mitigating measures already in place. Consequently, the discussion needs to be about both the extent to which they are used and their effectiveness. These concepts must be fully understood before moving on to the afternoon portion of the workshop.

As was done on Day One, the note taker should record a general sense of the Book 4 discussions in short sentence form for the PAWSA Workshop Report.

As was done with Book 3, the Book 4 discussion can be broken down into three logical sections between scheduled break periods, as follows:

- a Vessel Conditions and Traffic Conditions: Initiate a discussion of existing risk mitigations for the Vessel Conditions risk factors. Once complete, explain how to fill out Book 4 and ask participants to complete the Vessel Conditions section of Book 4. Once all teams are finished evaluating the Vessel Conditions category, continue the discussion of existing risk mitigations for Traffic Conditions risk factors; ask participants to complete the Traffic Conditions section of Book 4.
- b Navigational Conditions and Waterway Conditions: Initiate a discussion of existing risk mitigations for the Navigational Conditions risk factors; ask participants to complete the Navigational Conditions section of Book 4. Once all teams are finished with the Navigational Conditions category, continue the discussion of existing risk mitigations for Waterway Conditions risk factors; ask participants to complete the Waterway Conditions section of Book 4.
- c Immediate Consequences and Subsequent Consequences: Remember to shift the focus to the impact side of the risk equation when discussing these two risk categories. Initiate a discussion of existing risk mitigations for the Immediate Consequences risk factors; ask participants to complete the Immediate Consequences section of Book 4. Once all teams are finished with the Immediate Consequences category, continue the discussion of existing risk mitigations for Subsequent Consequences risk factors; ask participants to complete the remainder of Book 4.

Once all teams have completed their Book 4 evaluations, collect all copies and give them to the data entry person for entry into the PAWSA software.

Give each team their copy of Book 1: Team Expertise and tell the teams in general terms about the Book 1 results. Typically at least 50% of the teams will have put themselves into the Upper Third division, and very few will have put themselves in the Lower Third division. Have the teams completely fill out Book 1, evaluating where all the teams relate to each other with respect to their expertise in each risk category. Encourage participants to place equal numbers of 1's, 2's, and 3's on each line of the form, which will achieve the desired expertise distribution. Remind teams that if they choose to change the input previously provided about their own expertise, they should X out the previous entry and circle the new number. As teams finish Book 1, collect the forms and give them to the data entry person for entry into the PAWSA software. This completes the morning portion of the workshop; therefore, tell the participants where to get lunch and when the workshop will reconvene.

Afternoon Procedures

On the second day, the afternoon focuses on interventions that might provide additional risk reduction for the waterway. Before beginning those discussions, first review the Book 4 results with the participants. Next, explain in detail the concepts underlying the mitigation intervention categories. Analysis of past PAWSA workshop results has shown that mitigation strategies seem to fall into the following nine categories:

Co-ordination / Planning	Improve long-range and/or contingency planning and better co-ordinate activities / improve dialogue between waterway stakeholders
Voluntary Training	Establish / use voluntary programs to educate waterway users in topics related to waterway safety (Rules of the Road, ship / boat handling, etc.)
Rules & Procedures	Establish / refine rules, regulations, policies, or procedures (navigation rules, pilot rules, standard operating procedures, licensing, required training and education, Regulated Navigation Areas, etc.)
Enforcement	More actively enforce existing rules / policies (navigation rules, vessel inspection regulations, standards of care, etc.)
Nav / Hydro Info	Improve navigation and hydrographic information (Broadcast Notices To Mariners, charts, coast pilots, Automatic Identification System (AIS), tides and current tables, etc.)
Radio Communications	Improve the ability to communicate bridge-to-bridge or ship-to-shore (radio reception coverage, signal strength, reduce interference and congestion, etc.)

Active Traffic Mgmt	Establish / improve a Vessel Traffic Service or Local Traffic Service
Waterway Changes	Widen / deepen / straighten the channel and/or improve the aids to navigation (buoys, ranges, lights, LORAN C, Differential Global Positioning System (DGPS), etc.)
Other Actions	Risk mitigation measures needed that do not fall under any of the above intervention strategy categories

The Book 4 results are used to stimulate discussion relating to what additional interventions are needed to further mitigate risks in the waterway. The only risk factors discussed during this portion of the workshop are those that the Book 4 evaluation showed are not well balanced with existing mitigations (i.e., those risk factors with either a red flag (No or Rising) or a yellow flag (Maybe) as the result). After being properly instructed, participants consider what else needs to be done for a particular risk factor, and indicate their opinions in Book 5.

As with earlier portions of the workshop, while Book 5 discussions are occurring, the note taker should record a general sense of the discussion in short sentence form in the appropriate portion of the same PAWSA Workshop Report template. The facilitator also may use a flipchart (or an appropriate mean) at the front of the room to write down brief phrases (e.g., three-to-five word bullets) that capture the essence of the new mitigation ideas being discussed for each risk factor. If this is done the teams will have something to refer back to when filling out Book 5.

Again, due to the length of the discussions and evaluations, the Book 5 discussion can be broken down into three logical sections between scheduled break periods, just as was done for Book 3 and Book 4. Remember, only discuss and have the participants evaluate risk factors displaying a red or yellow flag; there is no need to discuss / evaluate mitigation interventions for those risk factors displaying a green flag.

- a Vessel Conditions and Traffic Conditions: Initiate a discussion of additional risk mitigations for the Vessel Conditions risk factors only. Then explain how to fill out Book 5 and ask participants to complete page 2 of Book 5. Once all teams are finished with the Vessel Conditions section, continue the discussion of additional risk mitigations for Traffic Conditions risk factors; ask participants to complete page 3 of Book 5.
- b Navigational Conditions and Waterway Conditions: Initiate a discussion of additional risk mitigations for the Navigational Conditions risk factors; ask participants to complete page 4 of Book 5. Once all teams are finished with the Navigational Conditions section, continue the discussion of additional risk mitigations for Waterway Conditions risk factors; ask participants to complete page 5 of Book 5.
- c Immediate Consequences and Subsequent Consequences: Initiate a discussion of additional risk mitigations for the Immediate Consequences risk factors; ask participants to complete page 6 of Book 5. Once all teams are finished with the Immediate Consequences section, continue the discussion of additional risk mitigations for Subsequent Consequences risk factors; ask participants to complete page 7 of Book 5.

Due to the amount of time needed for Book 5 data entry, each page should be collected by the facilitator upon completion and given to the data entry person for immediate entry into the PAWSA software, allowing the results display to be completed prior to the participants' review.

While the data entry person continues to enter the Book 5 inputs, ask all participants and observers to individually complete the Workshop Critique. When collecting the critiques, remember to do so in a manner that preserves anonymity. Once all critiques are collected, display, review, and discuss Book 5 results with the participants. Upon conclusion of the discussion, wrap up the workshop by thanking the participants and the observers on behalf of the facilitation team. Then turn the floor over to the sponsor for final remarks.

Session Review

As was done on Day One, a session review should be conducted once the participants have left the room following the last workshop session. Aside from discussing overall impressions of Day Two, the basis for this meeting is to ensure that the sponsor, sponsor's primary point of contact, and each member of the facilitation

team are aware of the post-workshop action items, and the agreed upon order and timeline for completing those items.

Chapter 7: Post-Workshop Actions

1 Post-Workshop Outputs

This chapter provides the details of how to develop each post-workshop output. Following the completion of the PAWSA workshop, the facilitation team should begin working on the following action items. Each item should be completed as soon as possible after the workshop ends while memories are still fresh. Action items include:

- perform a quality assurance check on Books 1, 4, and 5;
- analyse the workshop's quantitative results;
- complete the final Attendee Contact List;
- perform the workshop critique analysis;
- prepare the PAWSA Workshop Report;

2 Quality Assurance Check

The quality assurance (QA) process ensures that all results from Books 1, 4, and 5 are accurate. The Day One QA check for Books 2 and 3 should already have been conducted, but if not, perform the QA check at this time. This task requires two people – usually the data entry person and another member of the facilitation team. Ideally, since the data entry person originally entered the numbers into the PAWSA software, the alternate person should check the entries while the data entry person verbally reads the numbers from the books. Obviously all keypunching errors must be corrected. This cross-check ensures that the final results are 100% accurate.

3 Quantitative Results Analysis

The Excel™ workbook that is used for the PAWSA process includes spreadsheets that are used to capture the participants' quantitative evaluations, analyze that data, and display results. This section details information available from those spreadsheets that should be reviewed after the workshop concludes. While the most critical results are displayed during the PAWSA workshop, the additional information in the PAWSA software will give the sponsor a fuller sense of those results, important to judging the strength of feeling in various areas.

The Bk 1 Rslts spreadsheet is used to analyze the Book 1: Team Expertise evaluations. Results to note are displayed in cells B4:D11 of that spreadsheet. Blocks highlighted in yellow indicate that between $\frac{1}{2}$ and $\frac{2}{3}$ of the teams placed themselves in that block. This typically happens in the six 'Top 1/3' blocks (B4:B9) due to the fact that participants are invited to PAWSA workshops because of their acknowledged expertise. Consequently, they tend to evaluate their expertise pretty highly. However, pay close attention to any of those cells that are highlighted in red – denoting that $\frac{2}{3}$ or more of the teams placed everyone in a particular block. Given that all blocks ideally will be exactly 33%, red highlights could denote both an unwillingness of participants to judge the other teams and an imbalance in workshop expertise. That imbalance sometimes also is manifested by critique comments indicating that key interest groups were not adequately represented in the workshop. Taken together, these indicate possible bias in the overall workshop results.

As explained in previous chapters, Book 2: Risk Factor Rating Scales obtains input from each workshop for the aggregate scales used to quantify risk in each PAWSA waterway. Results of interest from that evaluation are found in cells A28:E29 of the Bk 3 Calcs spreadsheet of the PAWSA software. In those cells, the average B and C values for this workshop can be compared to the average results from all other workshops. Typically, there is very little variance between each workshop, usually on the order of one to two tenths of a point.

Using Book 3: Baseline Risk Levels the PAWSA participants decide which of four qualitative descriptors for each risk factor best fits the waterway being studied. While strong consensus in those decisions is expected, particularly for risk factors that can be directly quantified (e.g., Wind Conditions), sometimes that does not occur. Cells V4:V27 in the Bk 3 Calcs spreadsheet presents the standard deviation in the scores that were entered into

the Bk 3 Input spreadsheet. Red highlights in that column denote a standard deviation greater than 1.0, warranting a close inspection of the raw inputs to determine which teams see the waterway's risks radically differently than the other teams. Knowing who holds that different perspective can be very enlightening.

In like manner, cells D4:D27 in the Bk 4 Rslts spreadsheet gives the standard deviation for the Bk 4 Scores inputs from the Book 4: Mitigation Effectiveness evaluations. Not as much consensus is expected in those scores because the 1 to 9 scale used for that evaluation is only loosely anchored. Therefore, standard deviations between 1.0 and 2.0 are highlighted yellow and shouldn't be cause for much concern. However, cells highlighted red (standard deviation greater than 2.0) should be investigated to see which teams see the effectiveness of existing risk mitigations radically differently than the other teams. Again, knowing who holds that different perspective can be enlightening.

Cells R29:AG31 in the Bk 4 Y-N spreadsheet summarize how each team voted with respect to whether existing mitigations are well balanced with the risks for all 24 risk factors in the Waterway Risk Model. Line 32 in that spreadsheet shows a yellow highlight if a team's number of Yes votes is more than one standard deviation from the average number of Yes votes for all teams. Again, knowing which teams see things much differently than the others can provide important insight into the workshop dynamics and the issues that were raised during the sessions.

Yellow Caution flags that appear on the Bk 5 Disp spreadsheet should be investigated by examining cells A1:H27 in the Bk 5 Rslts spreadsheet. If desired, even more detail can be gleaned from columns U:V in the Bk 5 Calcs spreadsheet. As explained in Chapter 6, those yellow caution flags occur when the most selected intervention category is different from the most effective intervention category and (first case) either less than 50% of the participant teams chose the most selected category or (second case) more than 50% of the participant teams chose the most effective category. The first case is an indicator that the participants are undecided as to the best course of action with respect to further reducing risks for that factor. The second case shows that there are two strong risk mitigation approaches which should be considered.

4 Attendee Contact List

After all participants and observers have provided the information requested on the Attendee Contact List, the data entry person should prepare the information electronically. During the workshop, the Attendee Contact List should be prepared, printed out, and validated by the attendees.

5 Workshop Critique Analysis

After gathering the completed workshop critiques, a comprehensive review and analysis of the comments should be performed. Typically, the positive comments, although reviewed and usually encouraging, are not captured in this analysis. Constructive criticisms are the primary focus because they generally offer ways to improve the overall process; these comments become especially important when planning a subsequent PAWSA workshop.

Critique comments are separated into two categories: (1) recommended changes to the process and (2) terms and concepts that were not clear. While doing so, be as precise as possible, and enter the comments where they best fit based on the categories. Try to place all similar comments next to one another within the two categories, and then, if necessary, further classify the types of comments within each category. After all comments are entered, manually count similar comments to get an indication of the strength of feeling for any particular issue.

6 PAWSA Workshop Report

The PAWSA Workshop Report can be an invaluable tool. Without some form of resulting documentation, there may be participants who feel as though the time spent in the PAWSA workshop was not justified. The PAWSA Workshop Report can provide that justification, providing each participant with a tangible item showing the results of the group's efforts over the entire two-day period.

The PAWSA Workshop Report should be finalized as soon as possible after the workshop finishes. The purpose of Workshop Report is to provide the sponsor with an overall sense of the results stemming from the PAWSA process. The report should summarize the PAWSA proceedings including specific risks identified, existing mitigations, desired new mitigations, and the results of all quantitative evaluations. Based on the sponsor's



understanding of organizational responsibilities and lines of authority, the PAWSA Workshop Report also should provide specific mitigation intervention recommendations and assign recommended responsibility for specific items. The sponsor can use the report as a tool to inform other individuals / agencies / organizations about workshop results and garner support for risk mitigation actions, as well as to spark further discussion about risk reduction strategies with other stakeholders in the maritime community.

DRAFT



APPENDIX 1 BOOK 1 – TEAM EXPERTISE

Ports and Waterways Risk Assessment [\[location\]](#)

Team Number: _____

Compare each team's knowledge (level of expertise) about the factors that affect the probability and consequences of marine accidents with that of the other participant teams in this workshop. Please enter in each block the number which best describes each team, where:

- 1 = The team is probably in the UPPER THIRD of all the teams.
- 2 = The team is probably in the MIDDLE THIRD of all the teams.
- 3 = The team is probably in the LOWER THIRD of all the teams.

Team / Risk Category	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Vessel Conditions															
Traffic Conditions															
Navigational Conditions															
Waterway Conditions															
Immediate Consequences															
Subsequent Consequences															

APPENDIX 2 BOOK 2 – RISK FACTOR RATING SCALE

Ports and Waterways Risk Assessment [\[location\]](#)

Team Number: _____

How much riskier is the condition on the right than the condition on the left?

Vessel Conditions: Deep Draft Vessel Quality

(Circle one number on each line)

Nearly **100%** of deep draft vessels using the waterway operate safely

1 2 3 4 5 6 7 8 9

90% of deep draft vessels using the waterway operate safely

90% of deep draft vessels using the waterway operate safely

1 2 3 4 5 6 7 8 9

80% of deep draft vessels using the waterway operate safely

80% of deep draft vessels using the waterway operate safely

1 2 3 4 5 6 7 8 9

70% of deep draft vessels using the waterway operate safely

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Vessel Conditions: Shallow Draft Vessel Quality

(Circle one number on each line)

Nearly **100%** of shallow draft vessels using the waterway operate safely

1 2 3 4 5 6 7 8 9

90% of shallow draft vessels using the waterway operate safely

90% of shallow draft vessels using the waterway operate safely

1 2 3 4 5 6 7 8 9

80% of shallow draft vessels using the waterway operate safely

80% of shallow draft vessels using the waterway operate safely

1 2 3 4 5 6 7 8 9

70% of shallow draft vessels using the waterway operate safely

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Vessel Conditions: Commercial Fishing Vessel Quality	
(Circle one number on each line)	
Nearly 100% of commercial fishing vessels using the waterway operate safely	<div>1 2 3 4 5 6 7 8 9</div>
90% of commercial fishing vessels using the waterway operate safely	<div>1 2 3 4 5 6 7 8 9</div>
80% of commercial fishing vessels using the waterway operate safely	<div>1 2 3 4 5 6 7 8 9</div>
	<div>Equally Risky → Somewhat More Risky → Much More Risky → Extremely More Risky</div>
90% of commercial fishing vessels using the waterway operate safely	
80% of commercial fishing vessels using the waterway operate safely	
70% of commercial fishing vessels using the waterway operate safely	

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Vessel Conditions: Small Craft Quality

(Circle one number on each line)

Nearly **100%** of small craft using the waterway operate safely

1 2 3 4 5 6 7 8 9

90% of small craft using the waterway operate safely

90% of small craft using the waterway operate safely

1 2 3 4 5 6 7 8 9

80% of small craft using the waterway operate safely

80% of small craft using the waterway operate safely

1 2 3 4 5 6 7 8 9

70% of small craft using the waterway operate safely

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Traffic Conditions: Volume of Commercial Traffic

(Circle one number on each line)

Light commercial traffic
(less than 10 vessel
transits per day)

1 2 3 4 5 6 7 8 9

Moderate commercial
traffic (10-50 vessel
transits per day)

Moderate commercial
traffic (10-50 vessel
transits per day)

1 2 3 4 5 6 7 8 9

Heavy commercial traffic
BUT waterway
infrastructure handles
load easily

Heavy commercial traffic
BUT waterway
infrastructure handles
load easily

1 2 3 4 5 6 7 8 9

Heavy commercial traffic
AND vessels regularly
have to wait for berths

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Traffic Conditions: Volume of Small Craft Traffic

(Circle one number on each line)

Light small craft use of the
waterway

1 2 3 4 5 6 7 8 9

Moderate small craft use
of the waterway

Moderate small craft use
of the waterway

1 2 3 4 5 6 7 8 9

Heavy small craft
use **BUT** seasonal

Heavy small craft
use **BUT** seasonal

1 2 3 4 5 6 7 8 9

Heavy small craft use
YEAR ROUND

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Traffic Conditions: Traffic Mix

(Circle one number on each line)

Predominantly single use
waterway serving one
interest

1 2 3 4 5 6 7 8 9

Multiple use waterway
BUT no conflicts occurring

Multiple use waterway
BUT no conflicts occurring

1 2 3 4 5 6 7 8 9

Multiple use waterway
AND some **MINOR**
conflicts occurring

Multiple use waterway
AND some **MINOR**
conflicts occurring

1 2 3 4 5 6 7 8 9

Multiple use waterway
AND MAJOR conflicts
occurring

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Traffic Conditions: Congestion

(Circle one number on each line)

NO congestion ever occurs in the waterway

1 2 3 4 5 6 7 8 9

Congestion **ONLY** occurs in small areas for limited times

Congestion **ONLY** occurs in small areas for limited times

1 2 3 4 5 6 7 8 9

Congestion occurs regularly **BUT** flow of vessel traffic is **NOT** impeded

Congestion occurs regularly **BUT** flow of vessel traffic is **NOT** impeded

1 2 3 4 5 6 7 8 9

Congestion occurs regularly **AND** flow of vessel traffic **IS** impeded

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Navigational Conditions: Winds

(Circle one number on each line)

Strong winds occur **LESS**
than twice a month **AND**
well forecast

1 2 3 4 5 6 7 8 9

Strong winds occur **MORE**
than twice a month **BUT**
well forecast

Strong winds occur **MORE**
than twice a month **BUT**
well forecast

1 2 3 4 5 6 7 8 9

Strong winds occur **LESS**
than twice a month **BUT**
without warning

Strong winds occur **LESS**
than twice a month **BUT**
without warning

1 2 3 4 5 6 7 8 9

Strong winds occur **MORE**
than twice a month **AND**
without warning

Equally
Risky



Somewhat
More Risky



Much More
Risky



Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Navigational Conditions: Water Movement

(Circle one number on each line)

Fastest tidal and/or river currents are **WEAK**
(less than 2 knots)

1 2 3 4 5 6 7 8 9

Fastest tidal and/or river currents are **MODERATE**
(2-5 knots)

Fastest tidal and/or river currents are **MODERATE**
(2-5 knots)

1 2 3 4 5 6 7 8 9

Fastest tidal and/or river currents are **STRONG BUT** do **NOT** affect maneuverability

Fastest tidal and/or river currents are **STRONG BUT** do **NOT** affect maneuverability

1 2 3 4 5 6 7 8 9

Fastest tidal and/or river currents are **STRONG AND** affect maneuverability

Equally
Risky



Somewhat
More Risky



Much More
Risky



Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Navigational Conditions: Visibility Restrictions

(Circle one number on each line)

Restricted visibility
(1/2 mile or less) occurs
LESS than 24 days
a year

1 2 3 4 5 6 7 8 9

Restricted visibility **MORE**
than 24 days a year **BUT**
usually lasts **LESS** than 6
hours

Restricted visibility **MORE**
than 24 days a year **BUT**
usually lasts **LESS** than 6
hours

1 2 3 4 5 6 7 8 9

Restricted visibility **MORE**
than 24 days a year **BUT**
usually lasts **LESS** than 24
hours

Restricted visibility **MORE**
than 24 days a year **BUT**
usually lasts **LESS** than 24
hours

1 2 3 4 5 6 7 8 9

Restricted visibility **MORE**
than 24 days a year **AND**
usually lasts **MORE** than
24 hours

Equally
Risky



Somewhat
More Risky



Much More
Risky



Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Navigational Conditions: Obstructions						
<p>NO obstructions (ice, floating snags, deadheads, dredging, or fixed fishing gear)</p>	<p>(Circle one number on each line)</p> <p>1 2 3 4 5 6 7 8 9</p>	<p>Some obstructions BUT NOT affecting navigation</p>				
<p>Some obstructions BUT NOT affecting navigation</p>	<p>1 2 3 4 5 6 7 8 9</p>	<p>Obstructions affecting SOME navigation</p>				
<p>Obstructions affecting SOME navigation</p>	<p>1 2 3 4 5 6 7 8 9</p>	<p>Obstructions affecting ALL navigation</p>				
Equally Risky	→	Somewhat More Risky	→	Much More Risky	→	Extremely More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Waterway Conditions: Visibility Impediments	
(Circle one number on each line)	
NO visual impediments on the waterway	1 2 3 4 5 6 7 8 9
Areas of waterway where aids to navigation are obscured	1 2 3 4 5 6 7 8 9
Areas of waterway where vessel movements are obscured	1 2 3 4 5 6 7 8 9
Areas of waterway where BOTH vessel movements AND aids to navigation are obscured	
Equally Risky → Somewhat More Risky → Much More Risky → Extremely More Risky	

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Waterway Conditions: Dimensions

(Circle one number on each line)

Open roadstead; no waterway constrictions	1	2	3	4	5	6	7	8	9	Constricted waterway where passing arrangements are routinely needed
Constricted waterway where passing arrangements are routinely needed	1	2	3	4	5	6	7	8	9	Constricted waterway with SHORT stretches where large vessels generally avoid passing
Constricted waterway with SHORT stretches where large vessels generally avoid passing	1	2	3	4	5	6	7	8	9	LONG stretches where passing can't be avoided AND involves close quarters encounters

Equally Risky → Somewhat More Risky → Much More Risky → Extremely More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Waterway Conditions: Bottom Type	
<p>(Circle one number on each line)</p> <p>Deep water throughout; vessel breakdown unlikely to result in grounding or allision</p>	<p>Soft bottom with NO hard obstructions outside channel</p>
<p>Soft bottom with NO hard obstructions outside channel</p>	<p>Sand, shale, or some hard obstructions outside of channel</p>
<p>Sand, shale, or some hard obstructions outside of channel</p>	<p>Hard or rocky bottom lines the channel edges</p>

1 2 3 4 5 6 7 8 9

1 2 3 4 5 6 7 8 9

1 2 3 4 5 6 7 8 9

Equally Risky → Somewhat More Risky → Much More Risky → Extremely More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Waterway Conditions: Configuration

(Circle one number on each line)

No turns over 45 degrees
AND no convergences

1 2 3 4 5 6 7 8 9

One or more turns over
45 degrees **BUT** no
convergences

One or more turns over
45 degrees **BUT** no
convergences

1 2 3 4 5 6 7 8 9

No turns over 45 degrees
BUT waterway has
convergences

No turns over 45 degrees
BUT waterway has
convergences

1 2 3 4 5 6 7 8 9

One or more turns over
45 degrees **AND**
waterway has
convergences

Equally
Risky



Somewhat
More Risky



Much More
Risky



Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Immediate Consequences: Personnel Injuries

(Circle one number on each line)

NO passenger vessels
(dinner cruises, charter
fishing, ferries, cruise ships)
using waterway

1 2 3 4 5 6 7 8 9

ONLY small passenger
vessels (< 150 persons on
board) using waterway

ONLY small passenger
vessels (< 150 persons on
board) using waterway

1 2 3 4 5 6 7 8 9

Large passenger vessels (>
150 persons on board)
using waterway
OCCASIONALLY

Large passenger vessels (>
150 persons on board) using
waterway **OCCASIONALLY**

1 2 3 4 5 6 7 8 9

Large passenger vessels (>
150 persons on
board) using waterway
DAILY

Equally
Risky



Somewhat
More Risky



Much More
Risky



Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Immediate Consequences: Petroleum Discharge

(Circle one number on each line)

NO bulk petroleum cargo movements	1	2	3	4	5	6	7	8	9	Bulk petroleum cargo movements via tank barge ONLY
Bulk petroleum cargo movements via tank barge ONLY	1	2	3	4	5	6	7	8	9	Bulk petroleum cargo movements via tank ships UNDER 40,000 GRT
Bulk petroleum cargo movements via tank ships UNDER 40,000 GRT	1	2	3	4	5	6	7	8	9	Bulk petroleum cargo movements via tank ships OVER 40,000 GRT

Equally Risky → Somewhat More Risky → Much More Risky → Extremely More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Immediate Consequences: Hazardous Materials Release

(Circle one number on each line)

NO bulk hazardous
material cargo
movements

1 2 3 4 5 6 7 8 9

Bulk hazardous material
cargo movements via tank
barge **ONLY**

Bulk hazardous material
cargo movements via tank
barge **ONLY**

1 2 3 4 5 6 7 8 9

Bulk hazardous material
cargo movements via tank
ships **UNDER**
40,000 GRT

Bulk hazardous material
cargo movements via tank
ships **UNDER**
40,000 GRT

1 2 3 4 5 6 7 8 9

Bulk hazardous material
cargo movements via tank
ships **OVER**
40,000 GRT

Equally
Risky



Somewhat
More Risky



Much More
Risky



Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Immediate Consequences: Mobility

(Circle one number on each line)

Major marine casualty would NOT require waterway closure	1	2	3	4	5	6	7	8	9	Major marine casualty would result in waterway closure BUT NOT likely to disrupt shore MTS
Major marine casualty would result in waterway closure BUT NOT likely to disrupt shore MTS	1	2	3	4	5	6	7	8	9	Major marine casualty would result in w/w closure and MINIMAL disruption to shore MTS
Major marine casualty would result in w/w closure and MINIMAL disruption to shore MTS	1	2	3	4	5	6	7	8	9	Major marine casualty would result in w/w closure & SIGNIFICANT disruption to shore MTS

Equally Risky → Somewhat More Risky → Much More Risky → Extremely More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Subsequent Consequences: Health and Safety

(Circle one number on each line)

NO bulk hazardous
cargoes moving on
waterway

1 2 3 4 5 6 7 8 9

Small population near
waterway **WITH** bulk
hazardous cargoes
moving on waterway

Small population near
waterway **WITH** bulk
hazardous cargoes
moving on waterway

1 2 3 4 5 6 7 8 9

Medium population near
waterway **WITH** bulk
hazardous cargoes
moving on waterway

Medium population near
waterway **WITH** bulk
hazardous cargoes
moving on waterway

1 2 3 4 5 6 7 8 9

Large population near
waterway **WITH** bulk
hazardous cargoes
moving on waterway

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Subsequent Consequences: Environmental

(Circle one number on each line)

Less than 10% of waterway is environmentally sensitive	1 2 3 4 5 6 7 8 9	Between 10 – 50% of waterway is environmentally sensitive
Between 10 – 50% of waterway is environmentally sensitive	1 2 3 4 5 6 7 8 9	Between 50 – 90% of waterway is environmentally sensitive
Between 50 – 90% of waterway is environmentally sensitive	1 2 3 4 5 6 7 8 9	More than 90% of waterway is environmentally sensitive

Equally Risky → Somewhat More Risky → Much More Risky → Extremely More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Subsequent Consequences: Aquatic Resources

(Circle one number on each line)

Very little harvesting of
aquatic resources from a
waterway

1 2 3 4 5 6 7 8 9

Moderate recreational
fishing **BUT** little
commercial harvesting of
aquatic resources

Moderate recreational
fishing **BUT** little
commercial harvesting of
aquatic resources

1 2 3 4 5 6 7 8 9

Heavy recreational fishing
OR moderate commercial
harvesting of aquatic
resources

Heavy recreational fishing
OR moderate commercial
harvesting of aquatic
resources

1 2 3 4 5 6 7 8 9

Heavy recreational fishing
AND heavy commercial
harvesting of aquatic
resources

Equally
Risky

→

Somewhat
More Risky

→

Much More
Risky

→

Extremely
More Risky

Book 2: Risk Factor Rating Scales

How much riskier is the condition on the right than the condition on the left?

Subsequent Consequences: Economic

(Circle one number on each line)

Economic impact of waterway closure affects ONLY port area	1	2	3	4	5	6	7	8	9	Economic impact of waterway closure affects metropolitan area
Economic impact of waterway closure affects metropolitan area	1	2	3	4	5	6	7	8	9	Economic impact of waterway closure affects wide region
Economic impact of waterway closure affects wide region	1	2	3	4	5	6	7	8	9	Economic impact of waterway closure affects entire nation

Equally Risky → Somewhat More Risky → Much More Risky → Extremely More Risky

APPENDIX 3 BOOK 3 – BASE LINE RISK LEVELS

Check the block that best describes the condition in this waterway

Vessel Conditions

Deep Draft Vessel Quality

- ☐ Nearly 100% of deep draft vessels operate safely
- ☐ 90% of deep draft vessels operate safely
- ☐ 80% of deep draft vessels operate safely
- ☐ 70% or fewer of deep draft vessels operate safely

Shallow Draft Vessel Quality

- ☐ Nearly 100% of shallow draft vessels operate safely
- ☐ 90% of shallow draft vessels operate safely
- ☐ 80% of shallow draft vessels operate safely
- ☐ 70% or fewer of shallow draft vessels operate safely

Commercial Fishing Vessel Quality

- ☐ Nearly 100% of commercial fishing vessels operate safely
- ☐ 90% commercial fishing vessels operate safely
- ☐ 80% of commercial fishing vessels operate safely
- ☐ 70% or fewer of commercial fishing vessels operate safely

Small Craft Quality

- ☐ Nearly 100% of small craft operate safely
- ☐ 90% of small craft operate safely
- ☐ 80% of small craft operate safely
- ☐ 70% or fewer of small craft operate safely

Traffic Conditions

Volume of Commercial Traffic

- ☐ Light commercial traffic (less than 10 vessel transits per day)
- ☐ Moderate commercial traffic (10-50 vessel transits per day)
- ☐ Heavy commercial traffic (more than 50 vessel transits per day) BUT waterway infrastructure handles load easily
- ☐ Heavy commercial traffic (more than 50 vessel transits per day) AND vessels regularly have to wait for berths

Volume of Small Craft Traffic

- ☐ Light small craft traffic
- ☐ Moderate small craft traffic
- ☐ Heavy small craft traffic BUT seasonal
- ☐ Heavy small craft traffic YEAR ROUND

Traffic Mix

- ☐ Predominantly a single use waterway serving one interest (i.e., government, commerce, or recreation)
- ☐ Multiple use waterway (government, commerce, and / or recreation) BUT no conflicts occurring
- ☐ Multiple use waterway (government, commerce, and / or recreation) AND some MINOR conflicts occurring
- ☐ Multiple use waterway (government, commerce, and / or recreation) AND MAJOR conflicts occurring

Congestion

- ☐ NO congestion ever occurs in the waterway
- ☐ Congestion ONLY occurs in small areas for limited times
- ☐ Congestion occurs regularly BUT flow of commercial vessel traffic is NOT impeded
- ☐ Congestion occurs regularly AND flow of commercial vessel traffic IS impeded

Navigational Conditions

Winds

- ☐ Strong winds (20 knots sustained) occur LESS than twice a month AND well forecast
- ☐ Strong winds (20 knots sustained) occur MORE than twice a month BUT well forecast
- ☐ Strong winds (20 knots sustained) occur LESS than twice a month BUT without warning
- ☐ Strong winds (20 knots sustained) occur MORE than twice a month AND without warning

Water Movement

- ☐ Fastest tidal and / or river currents are WEAK (less than 2 knots)
- ☐ Fastest tidal and / or river currents are MODERATE (2 – 5 knots)
- ☐ Fastest tidal and / or river currents are STRONG (over 5 knots) BUT do NOT affect manoeuvrability
- ☐ Fastest tidal and / or river currents are STRONG (over 5 knots) AND affect manoeuvrability

Visibility Restrictions

- ☐ Restricted visibility (1/2 mile or less) occurs LESS than 24 days a year
- ☐ Restricted visibility (1/2 mile or less) occurs MORE than 24 days a year BUT usually persists LESS than 6 hours
- ☐ Restricted visibility (1/2 mile or less) occurs MORE than 24 days a year BUT usually persists LESS than 24 hours
- ☐ Restricted visibility (1/2 mile or less) occurs MORE than 24 days a year AND usually persists MORE than 24 hours

Obstructions

- ☐ NO obstructions, that is: ice never forms, no floating snags / deadheads, no dredging, and no fixed fishing gear
- ☐ Some obstructions BUT NOT affecting navigation
- ☐ Obstructions affecting SOME navigation
- ☐ Obstructions affecting ALL navigation

Waterway Conditions

Visibility Impediments

- ☐ NO visual impediments on the waterway
- ☐ Areas of the waterway where aids to navigation are obscured
- ☐ Areas of the waterway where vessel movements are obscured
- ☐ Areas of the waterway where BOTH vessel movements AND aids to navigation are obscured

Dimensions

- ☐ Open roadstead; no waterway constrictions
- ☐ Constricted waterway where passing arrangements are routinely needed
- ☐ Constricted waterway with some SHORT stretches where large vessels generally avoid passing each other
- ☐ Constricted waterway with LONG stretches where some large vessel passing can't be avoided AND involves close quarters encounters

Bottom Type

- ☐ Deep water throughout the waterway; no channel is needed; vessel breakdown unlikely to result in grounding or allision
- ☐ Soft bottom with NO hard obstructions outside channel
- ☐ Sand, shale, or some hard obstructions outside of channel
- ☐ Hard or rocky bottom lines the channel edges

Configuration

- ☐ No turns over 45 degrees AND no convergences
- ☐ One or more turns over 45 degrees BUT no convergences
- ☐ No turns over 45 degrees BUT waterway has convergences
- ☐ One or more turns over 45 degrees AND waterway has convergences

Immediate Consequences

Personnel Injuries

- ☐ NO passenger vessels (i.e., dinner cruises, charter fishing, passenger ferries, cruise ships) using the waterway
- ☐ ONLY small passenger vessels (less than 150 persons on board) using the waterway
- ☐ Large passenger vessels (more than 150 persons on board) using the waterway OCCASIONALLY
- ☐ Large passenger vessels (more than 150 persons on board) using the waterway DAILY

Petroleum Discharge

- ☐ NO bulk petroleum cargo movements
- ☐ Bulk petroleum cargo movements via tank barge ONLY
- ☐ Bulk petroleum cargo movements via tank ships UNDER 40,000 GRT
- ☐ Bulk petroleum cargo movements via tank ships OVER 40,000 GRT

Hazardous Materials Release

- ☐ NO bulk hazardous material cargo movements
- ☐ Bulk hazardous material cargo movements via tank barge ONLY
- ☐ Bulk hazardous material cargo movements via tank ships UNDER 40,000 GRT
- ☐ Bulk hazardous material cargo movements via tank ships OVER 40,000 GRT

Mobility

- ☐ Major marine casualty would NOT require a waterway closure
- ☐ Major marine casualty would result in a waterway closure BUT NOT likely to disrupt the shoreside marine transportation system
- ☐ Major marine casualty would result in waterway closure BUT would cause MINIMAL disruption to the shoreside marine transportation system
- ☐ Major marine casualty would result in waterway closure AND would cause SIGNIFICANT disruption to the shoreside marine transportation system

Subsequent Consequences

Health and Safety

- ☐ NO bulk hazardous cargoes moving on the waterway
- ☐ Small population (under 50,000 people) near the waterway WITH bulk hazardous cargoes moving on the waterway
- ☐ Medium population (50,000 to 100,000 people) near the waterway WITH bulk hazardous materials cargoes moving on the waterway
- ☐ Large population (over 100,000 people) near the waterway WITH bulk hazardous materials cargoes moving on the waterway

Environmental

- ☐ Less than 10% of the waterway is environmentally sensitive
- ☐ Between 10 – 50% of the waterway is environmentally sensitive
- ☐ Between 50 – 90% of the waterway is environmentally sensitive
- ☐ More than 90% of the waterway is environmentally sensitive

Aquatic Resources

- ☐ Very little harvesting of aquatic resources from this waterway
- ☐ Moderate recreational fishing BUT little commercial or subsistence harvesting of aquatic resources from this waterway
- ☐ Heavy recreational fishing OR moderate commercial or subsistence harvesting of aquatic resources from this waterway
- ☐ Heavy recreational fishing AND heavy commercial or subsistence harvesting of aquatic resources from this waterway

Economic

- ☐ Economic impact of waterway closure affects ONLY port area
- ☐ Economic impact of waterway closure affects metropolitan area
- ☐ Economic impact of waterway closure affects wide region
- ☐ Economic impact of waterway closure affect entire nation

APPENDIX 4 BOOK 4 - MITIGATION EFFECTIVENESS

Referring to the results from Book 3 (orange marks which denote the baseline levels of risk in this waterway), circle the number on each risk factor scale which best describes the present level of risk for that factor, taking into consideration existing risk mitigation strategies.

For each risk factor, if you think the risk mitigation strategies already in place adequately balance the present level of risk, circle Yes. If you are NOT comfortable with the present level of risk and think something significant needs to be done to further reduce that risk, circle No.

VESSEL CONDITIONS

Deep Draft Vessel Quality	1	2	3	4	5	6	7	8	9	Yes	No
Shallow Draft Vessel Quality	1	2	3	4	5	6	7	8	9	Yes	No
Commercial Fishing Vessel Quality	1	2	3	4	5	6	7	8	9	Yes	No
Small Craft Quality	1	2	3	4	5	6	7	8	9	Yes	No

TRAFFIC CONDITIONS

Volume of Commercial Traffic	1	2	3	4	5	6	7	8	9	Yes	No
Volume of Small Craft Traffic	1	2	3	4	5	6	7	8	9	Yes	No
Traffic Mix	1	2	3	4	5	6	7	8	9	Yes	No
Congestion	1	2	3	4	5	6	7	8	9	Yes	No

NAVIGATIONAL CONDITIONS



Winds	1	2	3	4	5	6	7	8	9	Yes	No
Water Movement	1	2	3	4	5	6	7	8	9	Yes	No
Visibility Restrictions	1	2	3	4	5	6	7	8	9	Yes	No
Obstructions	1	2	3	4	5	6	7	8	9	Yes	No

WATERWAY CONDITIONS

Visibility Impediments	1	2	3	4	5	6	7	8	9	Yes	No
Dimensions	1	2	3	4	5	6	7	8	9	Yes	No
Bottom Type	1	2	3	4	5	6	7	8	9	Yes	No
Configuration	1	2	3	4	5	6	7	8	9	Yes	No

IMMEDIATE CONSEQUENCES

Personnel Injuries	1	2	3	4	5	6	7	8	9	Yes	No
Petroleum Discharge	1	2	3	4	5	6	7	8	9	Yes	No
Hazardous Materials Release	1	2	3	4	5	6	7	8	9	Yes	No
Mobility	1	2	3	4	5	6	7	8	9	Yes	No

SUBSEQUENT CONSEQUENCES

Health and Safety	1	2	3	4	5	6	7	8	9	Yes	No
Environmental	1	2	3	4	5	6	7	8	9	Yes	No
Aquatic Resources	1	2	3	4	5	6	7	8	9	Yes	No
Economic	1	2	3	4	5	6	7	8	9	Yes	No

APPENDIX 5 BOOK 5 – ADDITIONAL MITIGATIONS

Team Number: _____

Evaluate **ONLY** those risk factors with orange highlighting. That highlighting shows the present level of risk (taking into account existing mitigations) from the group's earlier assessment (*Book 4: Mitigation Effectiveness*) for those risk factors where risk was judged NOT to be at an acceptable level already.

Under each risk factor are abbreviations for categories of possible risk mitigation interventions. The definitions for each of those abbreviations are given below.

Think about what should be done to further reduce the risks associated with each of the risk factors marked in orange. In the space provided next to the appropriate mitigation intervention category, write a brief phrase (3 to 5 words) to indicate what specific action should be taken. [Legibility would be MOST appreciated!]

For each intervention category where you think action should be taken, circle the number on the adjacent 1 to 9 scale which indicates where you think the risk level would end up if that mitigation intervention were implemented.

<u>Abbreviations</u>	<u>Definitions (examples)</u>
Co-ordination / Planning	Improve long-range and/or contingency planning and better co-ordinate activities / improve dialogue between port stakeholders
Voluntary Training	Establish / use voluntary programs to educate mariners / boaters in topics related to waterway safety (Rules of the Road, ship/boat handling, etc.)
Rules & Procedures	Establish / refine rules, regulations, policies, or procedures (nav rules, pilot rules, standard operating procedures, licensing, require training and education, etc.)
Enforcement	More actively enforce existing rules / policies (navigation rules, vessel inspection regulations, standards of care, etc.)
Nav / Hydro Info	Improve navigation and hydrographic information (PORTS, BTM/BRM, charts, coast pilots, AIS, tides & current tables, etc.)
Radio Communications	Improve the ability to communicate bridge-to-bridge or ship-to-shore (radio reception coverage, signal strength, reduce interference & congestion, etc.)
Active Traffic Mgmt	Establish/improve a Vessel Traffic Service (info, advice & control) or Vessel Traffic Information Service (information & advice only)
Waterway Changes	Widen / deepen / straighten the channel and/or improve the aids to navigation (buoys, ranges, lights, LORAN C, DGPS, etc.)
Other Actions	Risk mitigation measures needed do NOT fall under any of the above strategy categories



VESSEL CONDITIONS

Deep Draft Vessel Quality

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Shallow Draft Vessel Quality

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Commercial Fishing Vessel Quality

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Small Craft Quality

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9



TRAFFIC CONDITIONS

Volume of Commercial Traffic

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Volume of Small Craft Traffic

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Traffic Mix

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Congestion

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9



NAVIGATIONAL CONDITIONS

Winds

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Water Movement

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Visibility Restrictions

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Obstructions

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9



WATERWAY CONDITIONS

Visibility Impediments

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Dimensions

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Bottom Type

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Configuration

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9



IMMEDIATE CONSEQUENCES

Personnel Injuries

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Petroleum Discharge

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Hazardous Materials Release

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Mobility

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9



SUBSEQUENT CONSEQUENCES

Health and Safety

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Environmental

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Aquatic Resources

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

Economic

Co-ordination / Planning	_____	1	2	3	4	5	6	7	8	9
Voluntary Training	_____	1	2	3	4	5	6	7	8	9
Rules & Procedures	_____	1	2	3	4	5	6	7	8	9
Enforcement	_____	1	2	3	4	5	6	7	8	9
Nav / Hydro Info	_____	1	2	3	4	5	6	7	8	9
Radio Communications	_____	1	2	3	4	5	6	7	8	9
Active Traffic Mgmt	_____	1	2	3	4	5	6	7	8	9
Waterway Changes	_____	1	2	3	4	5	6	7	8	9
Other Actions	_____	1	2	3	4	5	6	7	8	9

APPENDIX 6 PAWSA SOFTWARE

The PAWSA software (MS Excel format) is available separately from the IALA Secretariat.

DRAFT