

Ports and Waterways Safety Assessment
Workshop Report
Los Angeles/Long Beach, California
19–20 August, 2015



United States Coast Guard
Marine Transportation Systems Directorate



Providing Navigation Safety Information
for America's Waterways Users

Executive Summary

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

Through the 1997 Coast Guard Appropriations Act, the Coast Guard was directed to establish a process to identify minimum user requirements for new Vessel Traffic Service (VTS) systems in consultation with local officials, waterways users and port authorities, and also to review private/public partnership opportunities in VTS operations. The Coast Guard convened a National Dialogue Group (NDG) comprised of maritime and waterway community stakeholders to identify the needs of waterway users with respect to Vessel Traffic Management (VTM) and VTS systems. The NDG was intended to provide the foundation for the development of an approach to VTM that would meet the shared government, industry, and public objective of ensuring the safety of vessel traffic in U.S. ports and waterways, in a technologically sound and cost effective way.

From the NDG came the development of the *Ports and Waterways Safety Assessment (PAWSA) Waterway Risk Model*, and the *PAWSA workshop process*. PAWSA is a disciplined approach designed to identify major waterway safety hazards, estimate risk levels, evaluate potential mitigation measures, and set the stage for the implementation of selected risk reduction strategies. The process involves convening a select group of waterway users and stakeholders and facilitating a structured workshop agenda to meet the risk assessment objectives. A successful workshop requires the participation of professional waterway users with local expertise in navigation, waterway conditions, and port safety. In addition, stakeholders are included in the process to ensure that important environmental, public safety, and economic consequences are given appropriate attention as risk interventions are selected.

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

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

Over 50 ports/waterways have been assessed using the PAWSA process. The risk assessment process represents a significant part of joint public-private sector planning for mitigating risk in waterways. When applied consistently and uniformly in a number of waterways, the process is expected to provide a basis for making best value decisions for risk mitigation investments, both on the local and national level.

The goal is to find solutions that are cost effective and meet the needs of waterway users and stakeholders.

PAWSA Waterway Risk Model/PAWSA Workshop Process

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

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

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

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

Los Angeles / Long Beach PAWSA Workshop

A PAWSA workshop for the Port of Los Angeles - Long Beach was held in Long Beach, California on 19-20 August 2015. The workshop was attended by 14 participants, representing waterway users, regulatory authorities, and stakeholders with an interest in the safe and efficient use of Los Angeles/Long Beach harbor from both a commercial and recreational perspective. Participants discussed and evaluated 24 of the 24 risk factors that make up the Waterways Risk Model. Participants discussed the various types of vessels operating within the ports' waterways system, challenges vessel operators faced when navigating amongst recreational boaters, fishing vessels, and smaller commercial vessels, and the risks associated with various emergencies resulting in the complete shutdown of any part of the port system.

For each of the 24 risk factors evaluated, participants discussed and then numerically evaluated the baseline risk levels using pre-defined qualitative risk descriptions for each risk factor. Participants then discussed existing risk mitigation strategies, evaluated how effective the mitigation strategies were at reducing risk, and then determined if the risks were well balanced. For 14 of the 24 risk factors evaluated, there was consensus (defined as 2/3 of the workshop participant teams being in agreement) that risks were well balanced by existing mitigations. For 10 risk factors (Commercial Fishing Vessel Quality, Small Craft Quality, Volumes of Commercial Traffic, Configuration, Personnel Injuries, Petroleum Discharge, Hazardous Materials Release, Mobility, Health and Safety, and Economic), there was consensus that risks were NOT well balanced by existing mitigations.

For these 10 risk factors, the participants engaged in further discussions to identify additional risk intervention strategies, and then they evaluated how effective those new strategies could be at reducing risks. To further reduce risks relating to Commercial Fishing Vessel Quality and Small Craft Quality, 5 of the 7 participant teams recommended increased mandatory training for these vessel operators and 4 of the 7 participant teams recommended mandatory VTS participation and AIS outfitting. To reduce risks associated with Waterway Dimensions, 4 of the 7 participant teams agreed that continued dredging and widening of the channels should be pursued. To further reduce risks for the Economic risk factor, all 7 of the participant teams agreed that the collective port efforts were focused on minimizing economic disruptions and that continued contingency planning and drills/exercises were the best mechanisms to reduce risk.

The results of the baseline risk level survey, existing risk mitigation strategies, additional risk interventions strategies, and participant comments and observations regarding the Port of Los Angeles - Long Beach, are outlined in this report with supporting data that was computed using the PAWSA Waterway Risk Model.

Conclusion

The goal of a PAWSA workshop is not only to further the Marine Transportation System (MTS) objective of improved coordination and cooperation between government and the private sector, and involving stakeholders in decisions affecting them, but to provide the Coast Guard Sector and District Commanders and members of the 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. In support of this goal, this report should be viewed as a starting point for continuing dialogue within Los Angeles - Long Beach's maritime community.

The United States Coast Guard, Marine Transportation System Management Directorate, extends a sincere appreciation to the workshop participants for their contributions to the Los Angeles/Long Beach PAWSA workshop. Their expertise was critical to the success of the workshop, and their recommendations will greatly assist the Coast Guard as it continues to work with the maritime community to further improve safety and efficiency in the Port of Los Angeles/Long Beach, California.

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Section 1: Los Angeles/Long Beach PAWSA - Assessment Area

The geographic area assessed during the workshop included the Los Angeles and Long Beach port approaches; the participant teams agreed to limit their assessment to the waterways and harbor as depicted in NOAA charts 18749 and 18751 (see **Figures 1** and **2** below). The assessed area focused on the waterways inside the Los Angeles/Long Beach breakwaters. **Figure 3** below depicts satellite imagery of the geographic area discussed.

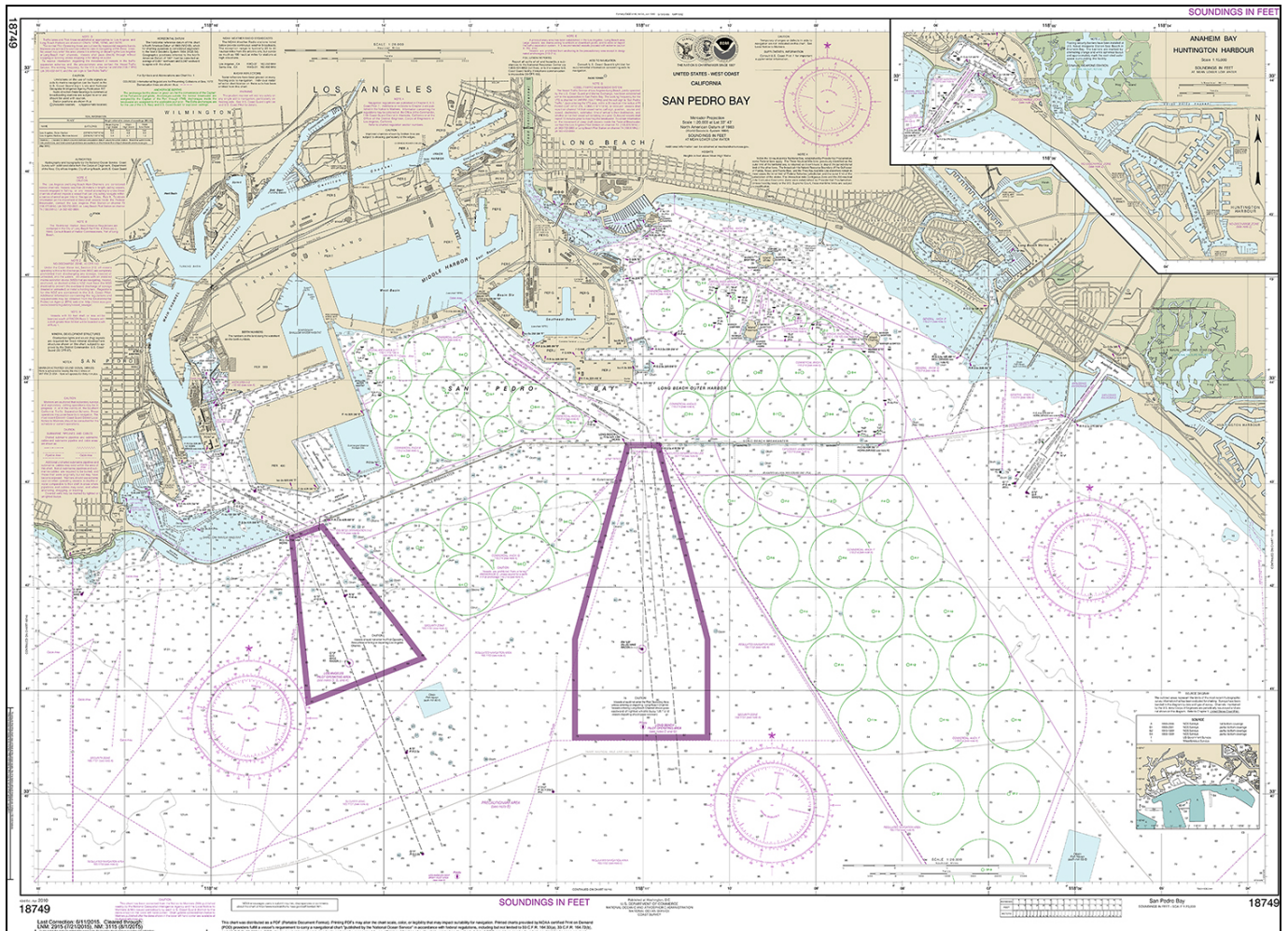


Figure 1: NOAA Chart 18749 - San Pedro Bay

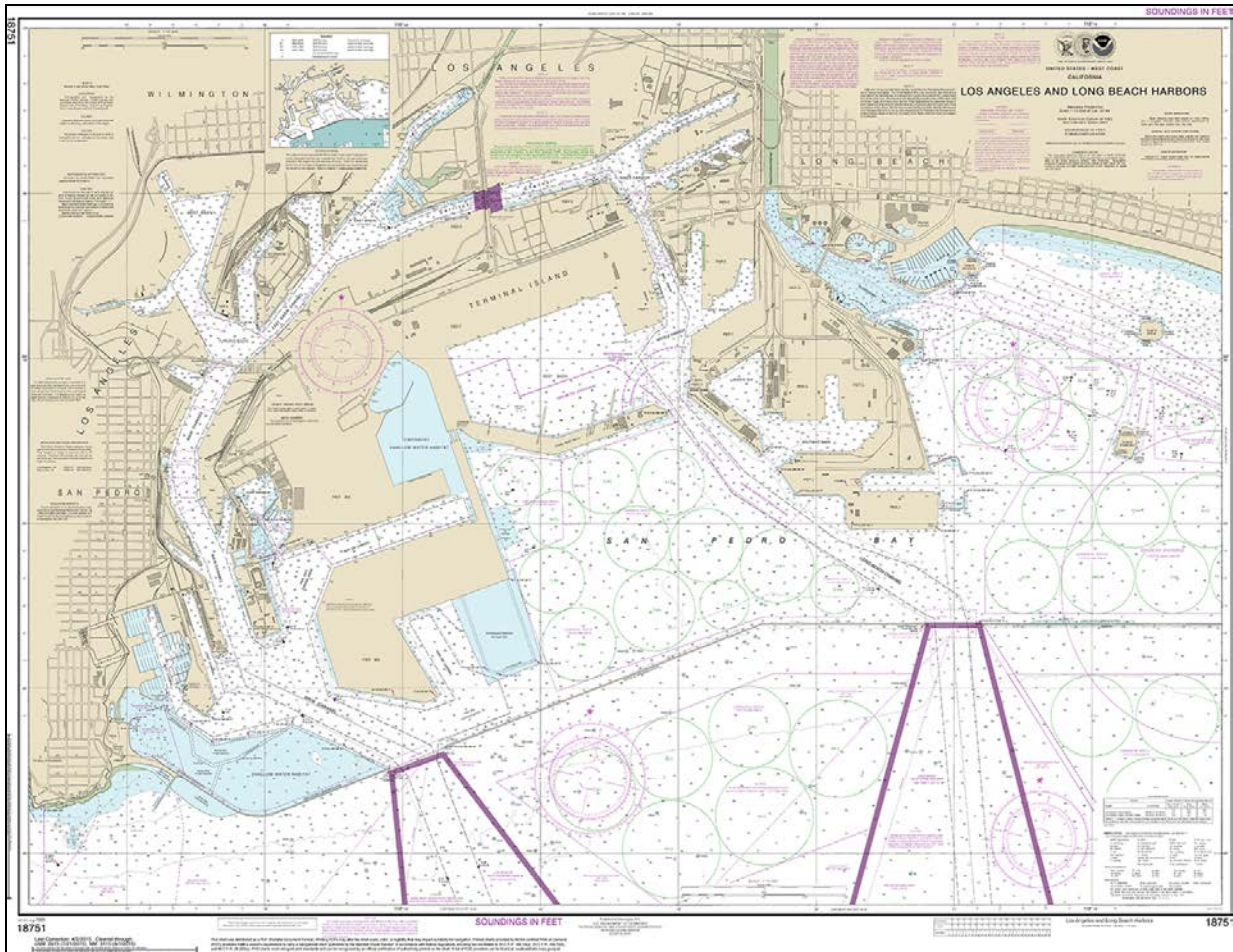


Figure 2: NOAA Chart 18751 - Los Angeles and Long Beach Harbors

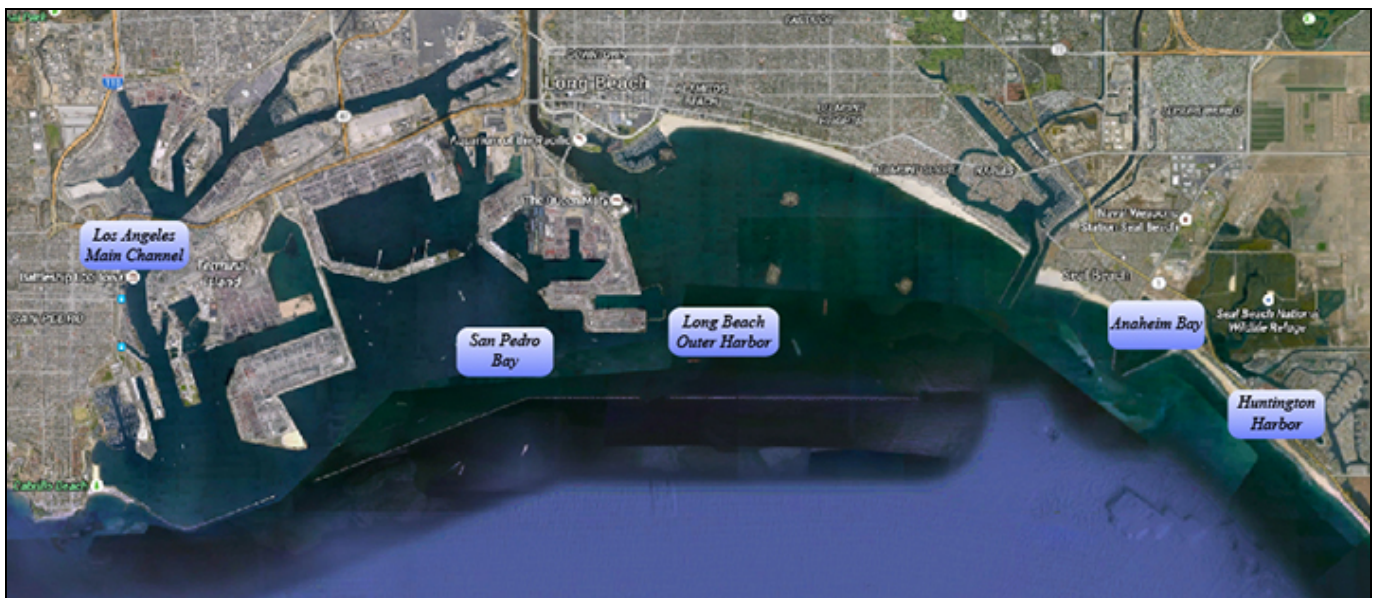


Figure 3: Satellite Imagery of Harbors and Waterways Assessed

Section 2: Baseline Risk Levels

The first step in the workshop was the completion of *Survey Book 1*, used to determine a baseline risk level value for each risk factor in the Waterway Risk Model. Participants discussed each of the 24 risk factors in the Waterways Risk Model and selected a qualitative description for each risk factor that best described the conditions in the port. These qualitative descriptions were then converted to numerical values. On those scales, 1.0 represents low risk (best case) and 9.0 represents high risk (worst case), with 5.0 being the mid-risk value.

Figure 4 below shows that 14 of 24 risk factors were scored at or above the mid-risk value. Risk values highlighted in red (values at or above 7.7) denote very high baseline risk levels; risk values highlighted in green (values at or below 2.3) denote very low baseline risk levels.

Baseline Risk Levels					
Vessel Conditions	Traffic Conditions	Navigational Conditions	Waterway Conditions	Immediate Consequences	Subsequent Consequences
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
3.8	8.1	1.8	4.7	9.0	9.0
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
4.2	5.8	1.0	6.6	9.0	7.6
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
8.4	4.9	5.8	5.1	8.6	2.5
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
8.5	5.4	4.1	8.3	9.0	9.0

Figure 4: Survey Book 1 Results - Baseline Risk Levels

As the participants discussed each of the 24 risk factors, their comments and observations were documented for inclusion in this workshop report. An Electronic Charting System (ECS) was also utilized to plot the charted location associated with participant comments and observations, and assign a risk factor marker number for that specific comment and/or observation. **Appendix B** includes participant comments and observations and **Appendix E** includes ECS chart extracts with the plotted locations associated with the comment / observation.

Section 3: Team Expertise Cross-Assessment

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

After being presented with the concepts underlying the model, each participant team was asked to discuss (among themselves) how their background and experience aligns with the model. They then verbally presented their conclusions to the other teams. These presentations gave all teams a sense of where everyone thought they were strong—or perhaps not so strong. After all teams had spoken, each team then evaluated whether they were in the top, middle, or lower third of all teams present with respect to knowledge and expertise in the six risk category areas.

The participants assessed their own and all the other participant teams' level of expertise for each of the six categories in the Waterway Risk Model. As depicted in **Figure 5** below, 40% of the participant teams were placed in the upper third, 38% in the middle third, and 22% in the lower third of all teams. While the “ideal” split should be closer to a 33%-33%-33% distribution, the expertise in the room was strong and evenly distributed for all categories.

Figure 5 further breaks down the participants' expertise for each risk category highlighting in yellow those assessments that were on the high or low ends from expected distribution values of 33%.

Team Expertise -- Distribution			
Risk Category	Top 1/3	Mid 1/3	Lower 1/3
Vessel Conditions	57%	18%	24%
Traffic Conditions	35%	49%	16%
Navigational Conditions	45%	35%	20%
Waterway Conditions	39%	33%	29%
Immediate Consequences	39%	51%	10%
Subsequent Consequences	24%	43%	33%
All Categories Average	40%	38%	22%

Figure 5: Survey Book 2 Results - Team Expertise Cross-Assessment

Section 4: Existing Risk Mitigation Strategies

The third step in the PAWSA workshop asked participants to evaluate the effectiveness of existing mitigation strategies in reducing the risk level for each risk factor. Participants discussed existing risk mitigations for all risk factors in the model, and then evaluated how effective they thought the mitigations were at reducing risks using *Survey Book 3*.

- or 18 risk factors (green), there was consensus that risks were well balanced by existing mitigations.
- or 2 risk factors (yellow), there was no consensus that risks were well balanced by existing mitigations.
- or 4 risk factors (red), there was consensus that risks were NOT well balanced by existing mitigations.

Consensus is defined as 2/3 of the workshop participant teams being in agreement.

Figure 6: *Survey Book 3* Results - Existing Risk Mitigation Strategies

Mitigation Effectiveness											
Vessel Conditions		Traffic Conditions		Navigational Conditions		Waterway Conditions		Immediate Consequences		Subsequent Consequences	
Deep Draft Vessel Quality		Volume of Commercial Traffic		Winds		Visibility Impediments		Personnel Injuries		Health and Safety	
3.8	1.8	8.1	3.6	1.8	1.7	4.7	3.3	9.0	5.4	9.0	7.6
Balanced		Balanced		Balanced		Balanced		Balanced		Balanced	
Shallow Draft Vessel Quality		Volume of Small Craft Traffic		Water Movement		Dimensions		Petroleum Discharge		Environmental	
4.2	2.5	5.8	4.5	1.0	1.0	6.6	6.3	9.0	5.1	7.6	6.2
Balanced		Maybe		Balanced		NO		Balanced		Balanced	
Commercial Fishing Vessel Quality		Traffic Mix		Visibility Restrictions		Bottom Type		Hazardous Materials Release		Aquatic Resources	
8.4	6.7	4.9	3.9	5.8	3.0	5.1	4.2	8.6	5.8	2.5	2.1
NO		Balanced		Balanced		Balanced		Balanced		Balanced	
Small Craft Quality		Congestion		Obstructions		Configuration		Mobility		Economic	
8.5	6.7	5.4	4.3	4.1	2.7	8.3	5.1	9.0	5.6	9.0	7.5
NO		Maybe		Balanced		Balanced		Balanced		NO	

Risk Factor	
Book 1 Score	Book 3 Score
Consensus Reached ?	

EXPLANATION	
Book 1	Level of risk - not taking into account existing mitigations
Book 3	Level of risk - taking into account existing mitigations
Balanced	Consensus that risks are well balanced by existing mitigations
Maybe	No Consensus that risks are well balanced by existing mitigations
Rising	Mitigated risk level is higher than the baseline risk level
NO	Consensus that existing mitigations do NOT adequately balance risk

Section 5: Additional Risk Intervention Strategies

The workshop participants next completed *Survey Book 4* for those risk factors not balanced by existing mitigations (Commercial Fishing Vessel Quality, Small Craft Quality, Volume of Small Craft Traffic, Congestion, Dimensions, Economic). Participants suggested additional risk intervention strategies, and then evaluated how successful a proposed risk intervention will be at lowering risk levels for each of the risk factors.

Discussion emphasized those risk factors that were found to be higher than the baseline risk level. To further reduce risks relating to Commercial Fishing Vessel Quality and Small Craft Quality, 5 of the 7 participant teams recommended increased mandatory training for these vessel operators and 4 of the 7 participant teams recommended mandatory VTS participation and AIS outfitting. To reduce risks associated with Waterway Dimensions, 4 of the 7 participant teams agreed that continued dredging and widening of the channels should be pursued. To further reduce risks for the Economic risk factor, all 7 of the participant teams agreed that the collective port efforts were focused on minimizing economic disruptions and that continued contingency planning and drills/exercises were the best mechanisms to reduce risk.

Appendix C is a description of each proposed risk intervention strategy and **Appendix D** describes all risk intervention strategies proposed and evaluated by the participants.

Figure 7 below shows the expected reduction in risk when taking the actions specified by the participants.

Figure 7: Survey Book 4 Results - Additional Risk Intervention Strategies

Additional Interventions					
Vessel Conditions	Traffic Conditions	Navigational Conditions	Waterway Conditions	Immediate Consequences	Subsequent Consequences
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
Balanced	Balanced	Balanced	Balanced	Balanced	Balanced
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
Balanced	Voluntary Training 4.2	Balanced	Waterway Changes 5.0	Balanced	Balanced
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Voluntary Training 5.8	Balanced	Balanced	Balanced	Balanced	Balanced
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
Rules & Procedures 6.3	Active Traffic Mgmt 3.4	Balanced	Balanced	Balanced	Coordination / Planning 6.9
	Caution				Caution

Risk Factor
Intervention Category
Risk Outcome

EXPLANATION	
Intervention Category	Intervention general strategy that most participants selected for further risk mitigation actions.
Risk Outcome	The expected risk outcome, the risk level that could be obtained if new mitigation measures were implemented

Appendix A - Workshop Participants

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Appendix B

Participant Observations - Trends in the Port and Existing Risk Mitigations

Deep Draft Vessel Quality

Trends/Observations:

Note: To ensure standardization throughout all PAWSA Workshops, a deep draft vessel is defined as any vessel with a draft of 12 feet or greater.

Participants discussed the general trend of the construction of larger vessels with minimally manned crews; better vessel quality has been observed especially since companies have begun to phase out ships that are older than 15 years. For the oil industry, an international consortium has come up with an inspection protocol for oil tankers. Oil owners send inspectors to the ships twice a year for the inspections. This protocol has improved the operations, maintenance, and safety of tanker vessels. All oil carrying ships are double hulled as required by OPA 90. Oil carrying vessels are conducting routine training of crews in operational safety meeting Coast Guard standards; industry is also imposing additional training standards to improve vessel safety. Pilots reported that oil tanker maneuverability tended to be difficult in comparison to other vessels.

According to the Marine Exchange of Southern California and the USCG, deep draft vessels are currently averaging 25 incidents per year that include breakdowns and mechanical malfunctions; additionally, there are approximately two cases per month as a result of steering casualties.

It was discussed that switching to low sulfur fuels mitigated environmental impacts but that there have been issues with the changeover for ships. Residual heat from heating fuels when switching to diesel causes fuel to become too viscous. Pump seals are too much of a clearance. Therefore, the best option is to stay on Marine Gas Oil (MGO) even if chillers have to be put onboard.

Air pollution and whale strike issues have resulted in low speed restrictions for cruise ships. Cruise ships are now burning Marine Gas Oil (MGO) and wonder if the previously imposed speed limits (put in place to reduce emissions) might be lifted; the speed restriction is costing the cruise ships money. It was reported that cruise lines are investing in extensive resources in training their crews to improve operations safety, including sustainment of training programs.

Tug operators reported the trend that they have seen less of a need for their services, particularly the rescue tugs. The remaining issue is that of communications (particularly among internationally crewed ships) and certified bits and bollards, or bits and bollards that are not in good condition. Since tugs are getting more powerful and older container ships were not constructed for this power rating or maintained for these kinds of stresses / loads, the result is that tugs can rip bits and bollards loose from the ships. This is not a problem for cruise ships or oil tankers due to newer construction. These incidents may account for up to 25% of the vessel traffic. However, the trend of actually pulling out bits over the last 20 years has reduced.

Existing Mitigations:

- Increased internal and international voluntary training programs being implemented by vessel owners
- Interoperable training between pilots and ship captains; continued training partnerships
- Vessels' increased reporting to the USCG before arrival with any mechanical or navigation equipment problems; if vessels are down to one radar, for example, the USCG is notified and restrictions are put in place (e.g. vessel may only transit in daylight hours)

- Requirement to have tug escort; if there is a subpar vessel, the additional horsepower helps to maneuver
- Diversion to available anchorage if pilots find any issues
- USCG providing direction for situations when ship equipment is discovered to be compromised
- High level of real-time communication within the port between all stakeholder to include the vessel, USCG, pilots, and tugs
- Robust and proactive Harbor Safety Committee; plans constantly reviewed and updated
- High caliber VTS and excellent communications; movement of vessels is well organized and controlled
- High quality pilots resulting in no transit incidents

Shallow Draft Vessel Quality

Trends/Observations:

Note: To ensure standardization throughout all PAWSA Workshops, a shallow draft vessel is defined as any vessel with a draft less than 12 feet (not including commercial fishing vessels in this category).

This class of vessel has a broad diversity of cultures regarding safe operations. Generally, these vessels are not as controlled as deep draft vessels by the VTS. Crew fatigue can be an issue, but overall these vessels are operating safely within the waterways. At the top of the class, the tugs are extremely cautious, while the lower end of the class is not as rigorous with respect to safe operations. The tug industry trains up to a 1600 ton requirement to assist pilots as a back stop. Contracts with oil companies also require higher level certifications. Competition for these contracts has driven the industry in general to a higher level of safety. Ferries have a training program that graduates their crew through increasingly larger vessels. They also go beyond statutory requirements, such as using two masters per vessel rather than a master and a mate. It was noted that the towing vessel industry is about to become subject to vessel inspections by the USCG. It was agreed that towing vessel risk has greatly reduced in the last decade.

It was noted that all petroleum barges are required to be double hulled.

Existing Mitigations:

- Addition of AIS coupled with the VTS has proven invaluable and made significant improvements to vessel safety
- Vessel operators are knowledgeable of the waterways and maintain professional crews
- Ongoing implementation of 46 CFR Subchapter M by the USCG
- High caliber VTS and excellent communications; movement of vessels is well organized and controlled
- Joint simulator training and live escort training between shipping companies and pilots
- Oil spill and emergency response drills, including live and tabletop drills
- Barge operators conduct simulator training every other year even though it is not a requirement
- USCG required drills and exercises and voluntary additional exercises by stakeholders
- Robust communications on both the backside (coordination) and live operations; limited to no language barriers exist for ships transiting waterways

Commercial Fishing Vessel Quality

Trends/Observations:

The amount of investment in commercial fishing vessels is directly related to the health of fishing which is rapidly declining in Southern California. The last commercial fishing boat purchased in Southern California was likely 30 years ago. Squid fishing is currently the most profitable, but the stocks of fish have declined. The bottom line is that very little money gets reinvested in the vessels; this results in vessel owners being concerned about profitability versus crew safety, following traffic patterns, or the materiel condition of the vessel. Whether intentional to

disguise themselves from competition or a matter of maintenance, commercial fishing vessels are usually operating without running lights. Since many of these vessels are being operated by immigrants, the lack of running lights may also be a result of language issues when being hailed by other vessels to turn on their lights.

Commercial fishing vessels are not required to be licensed by the USCG; USCG boardings are approximately once a year for each vessel and often cite safety issues and result in voyage termination. The USCG reports that squid fishermen tend to have the better maintained vessels. The most common risks associated with the commercial fishing fleet is the lack of AIS, no requirement to check in or out with VTS, lack of following traffic lanes, and lack of effective radio communications.

It was noted that the commercial fishing fleet does not currently have a representative on the Harbor Safety Committee.

Existing Mitigations:

- Shrinking size of the fleet is reducing the number of safety issues
- USCG inspections to include voluntary dockside boardings and underway inspections that check permits, safety equipment, fishing equipment, logs, and catches
- USCG commercial fishing inspector attends local meetings and is proactively spreading safety messages

Small Craft Quality

Trends/Observations:

This is a diverse class of operators that range from highly competent sailors to more casual operators; small craft categories include high speed motorboats, low speed motor boats, cruising sailboats, and racing sailboats. It was recommended that commercial traffic should become more aware of small craft capabilities in order to better ascertain movements within the waterways. Other than competitive sailors, the other three categories have issues concerning knowledge of Rules of the Road (ROTR), awareness of other traffic, operating the vessel on autopilot without situational awareness, and inebriation. It was noted that for all classes, the vessel construction and maintenance is good; the major risk issues lie with the operators especially since there is a lack of radio communications (due to operation or lack of installation). For example, small craft operators assume other operators have ROTR knowledge which often leads to increased cases of potential collisions. While there are no licensing requirements for California operators, the USCG Auxiliary offers significant training opportunities.

Human powered vessels (HPVs), especially kayaks and canoes, are a growing concern because they have no radar return and low profiles. They are also increasingly found further off shore (up to 3 or 4 NM). ROTR has no category for HPVs and since the harbor is an open area, it is difficult to regulate the traffic at times. It was suggested that the USCG or other organizations might explore the use of Computer Based Training (CBT) and offer insurance discounts to motivate small craft users to operate safer.

Existing Mitigations:

- USCG Auxiliary and Power Squadron programs and courses; pamphlets distributed to recreational boaters explaining local concerns (i.e. sailboat in a shipping lane)
- USCG recreational boating safety program; increased courtesy safety boardings (200 conducted in 2014; targeting more in 2015 and 2016)
- USCG special maritime events process that results in closer scrutiny of events with HPVs
- USCG representatives at boat shows
- Increased boating safety awareness from boat manufacturers to ensure sales

Volume of Commercial Traffic

Trends/Observations:

The waterways have very high traffic conditions with approximately 26,000 commercial traffic movements per year to include barges, ferries, and tugs; the ports average 35-55 commercial traffic arrivals each day. The highest traffic conditions exist at Angel's Gate (Marker TC1 on ECS; see **Figure 10**) and Queen's Gate (Marker TC2 on ECS; see **Figure 10**). It was noted that despite the high volume of traffic, the associated risk was low because of the Harbor Safety Committee's proactive approach, a robust VTS, and the professionalism associated with pilotage and tug operations. The risk increased as a result of adding recreational vessels into the waterways.

The trend of larger ships coming in was discussed which results in fewer transits; the ports continue to push for larger ships and are actively doing research and testing the waterways for deepening. Since 2007, transits are down 24% due to the economy crash and the increase in vessel size; however, the TEU count continues to trend upward.

Existing Mitigations:

- Mandatory pilotage and required tug escorts
- Ship arrivals are decreasing (as a result of ship sizes increasing)
- Robust VTS and AIS; excellent two-way communications; constant improvement of ship navigation equipment
- Increased cooperation between shipping lines; sharing resources which reduces the ship count
- 100% escort of cruise ships by USCG and local law enforcement
- Geography of ports and harbor minimizes risk; relatively easy transits in comparison to other transits and approaches in other major U.S. ports

Volume of Small Craft Traffic

Trends/Observations:

The highest volume of traffic is from the ports to Catalina Island with more traffic occurring in the summer; it is estimated that the small craft volume doubles in the summer with launch ramps being extremely active. During wintertime, the traffic is more contained to the shallower waters marked on Charts 18749 and 18751. It was discussed that most of the small craft traffic risk is associated with lack of ROTR knowledge versus the actual volume of traffic. For the most part, problems that do arise are not a matter of the quantity of small craft traffic, but rather the one or two boats operating in an unsafe manner.

Existing Mitigations:

- Ratio of the volume of small craft traffic compared to commercial traffic is not sufficiently high to cause a significant problem
- Professionalism of small craft vessel operators and good communications

Traffic Mix

Trends/Observations:

Participants stated that although it is a multiple use waterway with regular conflicts, the actual numbers of incidents and injuries are extremely low. It is extremely common for ROTR conflicts to exist that typically are resolved by pleasure craft or yachts just getting out of the way of commercial ships due to whistle signals. Pilots use their radars to see if any crafts will cross in front of others and communicate that information to avoid collisions.

The USCG must be aware of and approve any non-commercial traffic coming into the waterways especially for organized marine events; they must know the number of participants, whether it will affect the flow of traffic, or if there are any hazardous materials.

Existing Mitigations:

- USCG special marine events protocols and subsequent communications to vessels and operators
- High caliber VTS and excellent communications; movement of vessels is well organized and controlled

Congestion

Trends/Observations:

Participants stated that the early morning (starting at 0500) is particularly congested with a gradual lower afternoon rush. Cruise ships have very few delays due to congestion since they receive highest priority for movements. The 12 knot speed limit has greatly improved safety of ships racing for the sea buoy. The highest congestion areas exist at Angel's Gate (Marker TC3 on ECS; see **Figure 10**) and Queen's Gate (Marker TC4 on ECS; see **Figure 10**). It was noted that Long Beach is building a new bridge that can handle additional traffic as the economy improves and continues to drive more vessel movements.

Existing Mitigations:

- Interaction between Marine Exchange, VTS, pilots, and tugs in terms of queuing vessels during periods of high congestion
- Optimization software to include scheduling system within the port does an excellent job and minimizes wait times
- Strong coordination within the operators in the port to make common sense decisions when congestion arises
- Harbor Safety Committee is regularly looking at future requirements and forecasting the required number of tugs and pilots for efficient operations
- Marine Exchange proactively assigns vessels to anchorages and waiting areas so they do not block the flow of traffic

Winds

Trends/Observations:

Winds have an impact during the mooring of cruise ships due to large sail area; 25 knots is a threshold for the cruise industry. For other deep draft ships, wind is also an issue; however, forecasting is considered especially good and helps with planning and mitigation. It was stated that the majority of the time winds are between 10 and 15 knots with only 20 knots being exceeded once or twice a month.

Existing Mitigations:

- Existing weather flow and ability to predict conditions
- Harbor Safety Committee guidelines for high wind operations such as procedures to avoid activities like bunkering when the winds pick up

Water Movement

Trends/Observations:

The area does not experience much current. Infrequent winter storms tend to cause the only water movement issues which have occurred once or twice in the last 10 years. The only area of major concern for current flow is the Los Angeles River (Marker NC1 on ECS; see **Figure 11**).

Existing Mitigations:

- No mitigations discussed due to natural conditions and low baseline risk

Visibility Restrictions

Trends/Observations:

Pilots cited that inside the breakwater they are on radar navigation about 40 days a year. Outside the breakwater there is a higher occurrence of fog that requires regular radar use. Ferries running to Catalina operate in reduced visibility frequently. The most critical areas of low visibility are Queen's Gate (Marker NC2 on ECS; see **Figure 11**) and Angel's Gate (Marker NC3 on ECS; see **Figure 11**) since there are smaller vessels operating without radars. Improvements to Aids to Navigation (ATON) such as replacing incandescent bulbs with LEDs has improved low visibility navigation immensely.

Existing Mitigations:

- Improved ATON to include LED lights; Long Beach and Los Angeles lights are activated by radio and sound for 30 minutes
- Improving technology on vessels to include radars and GPS
- Constant communication between pilots and VTS

Obstructions

Trends/Observations:

Relatively few obstructions exist within the waterways; occasionally the placement of lobster pots and gill nets within the channel pose a navigation concern to vessels. According to the USCG, about four incidents per year are attributed to a mechanical failure due to hitting an obstruction (net, line, debris, or unknown object). Most obstructions are attributed to weather and washout from the Los Angeles River. Obstructions of concern include:

- Lobster traps (Marker NC 4, Marker NC 5, Marker NC 6, Marker NC7 on ECS; see **Figure 11**)
- Bait boats/fishing nets (Marker NC 8 and Marker NC9 on ECS; see **Figure 11**)
- Container cranes (Marker NC10 on ECS; see **Figure 11**)

Existing Mitigations:

- Port control is immediately called when obstructions are located; *Big Dipper* is deployed to clear obstructions
- USCG patrols and ATON crews regularly recover obstructions
- City of Los Angeles deploys booms that contain most debris which is removed prior to reaching the harbor

Visibility Impediments

Trends/Observations:

Participants did not cite any significant visibility impediments due to manmade construction or naturally occurring within the waterways. Container vessels with highly stacked cargo were the main cause of reduced navigation visibility. Background lighting is a general problem throughout the area.

Existing Mitigations:

- Notification to USCG when background lights limit usefulness of range lights
- Increased use of AIS on ATON
- Improved GPS and technologically advanced piloting system used by the pilots

Dimensions

Trends/Observations:

There are tide restrictions at the Vincent St. Thomas Bridge and a couple of channel areas for tanker vessels. There are locations where pilots self-impose one-way traffic schemes due to potential risks. In general, it is tight maneuvering in-port for cruise ships. Inside the breakwater it is always close quarter passing but it is expertly controlled. Outside the breakwater it is still well controlled, but not as close.

Existing Mitigations:

- Design of the waterway lends to optimal traffic pattern schemes and reduces dimension risks
- USACE and Port of Los Angeles / Long Beach regular meetings regarding widening channel and dredging
- Use of simulation to explore possible scenarios for dredging and widening the channel to accommodate larger ships

Bottom Type

Trends/Observations:

It was discussed that the bottom type did not pose any significant risks. Slopes on the side of the channels are mostly mud and the bottom of the approach channels and associated waterways is sand. The only significant risk is the actual breakwater. Shallow water habitats (Marker WC1, Marker WC2, and Marker WC3 on ECS; see **Figure 12**) have rock bottoms.

Existing Mitigations:

- No mitigations discussed due to natural bottom type being sand and mud and the active amount of surveying and dredging

Configuration

Trends/Observations:

In general, configuration of the waterways does not pose any significant risks due to continuous training, effective communications, and tug support. Harbor configuration segregates much activity naturally. Areas of greatest crossing are in front of the Los Angeles and Long Beach gates. Configuration areas of concern are:

- Queen's Gate (Marker WC4 on ECS; see **Figure 12**) - crossing traffic
- Angel's Gate (Marker WC5 on ECS; see **Figure 12**) - crossing traffic
- Inner Harbor (Marker WC6 on ECS; see **Figure 12**) - 90 degree turns
- Southeast Basin (Marker WC7 and Marker WC 8 on ECS; see **Figure 12**) - 90 degree turns

Existing Mitigations:

- Pilot training, stakeholder communications, training for pilots, tugboats,
- GPS systems for large ships

Personnel Injuries

Trends/Observations:

For cruise ships, there are very high consequences due to the concentration of people onboard the vessel. When an incident occurs the need for emergency services is extremely high. It was cited that one of the largest causes of personnel injuries was USCG required sills / thresholds onboard ships that are a tripping hazard. Another potential risk for injuries is the possibility of collisions with floating exhibits.

Existing Mitigations:

- Rapid response by all law enforcement and response agencies, including a well-planned incident command structure
- Sheer volume of response agencies available in Port of Los Angeles/Long Beach area of operations
- Regular drills run through the Area Maritime Security Committee (AMSC)

Petroleum Discharge

Trends/Observations:

Over 300,000 tons of oil are being transported through the port making it extremely busy; a discharge incident inside the breakwater would close down all port activity. It was stated that a petroleum discharge was a low probability/high consequence event. Bunkering operations occur at the rate of about 4 per year. The last significant spill was in 2011 when a ship dumped 100+ barrels of oil during an internal transfer which shut down most of the inner harbor for cleanup operations. There are two major response companies that can quickly take care of large oil spills; oil companies pay for response equipment and all minor spills are immediately contained. There are 4-5 small subcontractors to deal with oil spills and have boom/equipment already staged. The port complex is tightly knit with lots of assets conducting interoperability training (e.g. between oil terminals / tug companies).

Existing Mitigations:

- Improved ship design and double hulls
- Waterways scheme, pilots, tugs, VTS, and strong communications to avoid collisions/allisions

- Excellent response assets; 2 major response companies along with 4-5 smaller subcontractors with quick response capabilities
- Small geographic area of the port complex also contributes to quick response activities; orientation and shape of harbors lend to natural containment
- Routine training and exercise program provides great confidence in spill response
- Required booming of all petroleum transfer operations

Hazardous Materials Release

Trends/Observations:

More hazardous materials come into the ports via container rather than in bulk transport; petroleum coke is shipped on a daily basis. Explosives are being transported regularly through Seal Beach; sulfur, fireworks, and cleaning materials are other common hazardous materials within the port complex. It was noted that hazmat packaging has improved dramatically and that the USCG inspections of hazmat cargo minimizes the threat of release.

Existing Mitigations:

- Hazmat is largely transferred by container providing an added level of containment
- Advance declaration of hazmat with the USCG
- Packaging and security zones for ammunition deliveries

Mobility

Trends/Observations:

Due to the restricted waters within the gates, an incident could quickly shutdown all traffic. One of the two gates might stay open to continue access if vessels can maneuver safely. Based on this risk, the CG has been working with companies to ensure continuity of operations. Incidents several times a year caused by jumpers from the Vincent St. Thomas Bridge close the channel temporarily. Eleven years ago there was a plane that went down that closed the channel for two days while search and rescue operations took place and the concern for a navigation hazard and ensuring the channel was clear.

Existing Mitigations:

- Robust incident command system (ICS)
- Redundancy in the VTS system, USCG operations, and most all port systems
- Tremendous investments in security
- Plan by allied agencies such as LAX for an air/sea disaster
- Portwide continuity and trade resumption/resiliency plan

Health and Safety

Trends/Observations:

There were no significant comments regarding health and safety aside from the inherent risk to a large coastal population in the event of a major transportation security incident or hazmat release within the port complex. Thorough reviews and studies are being done on port facilities to include risk assessments and LNG studies.

Existing Mitigations:

- Reviews of new facilities proposed for construction in the port
- Port wide Strategic Risk Management Plan and facility threat assessments

Environmental**Trends/Observations:**

The State designates sensitive areas and habitat areas which are laid out in Protection Contingency Plans. Break water areas are sensitive areas. Seasonally between April and September, there are different locations for nesting/foraging areas for threatened and endangered birds; the USCG cited buoys as being one area of concern for nesting of endangered birds. The regional propensity for earthquakes could have a large impact environmentally due to disaster within the port complex.

Existing Mitigations:

- Comprehensive environmental review by USCG for all activities that require a safety or security zone, and events requiring a Marine Event Permit.
- Close relationship and comprehensive reviews between USCG, EPA, and Fish and Wildlife for some marine events

Aquatic Resources**Trends/Observations:**

The port area being assessed does not include any harvesting areas. Only moderate recreational fishing occurs within the channel. Outside the gates, lobster traps are the first and nearest type of commercial fishing activities.

Existing Mitigations:

- No mitigations necessary; the port area does not include harvesting areas

Economic**Trends/Observations:**

Given the strategic importance of the ports to the national and international economies, any degree of shutdown will affect trade and have severe financial implications at the global scale. None of the refineries have a great deal of storage. If the waterway is closed, the refineries would have to ramp down quickly and could shut down operations for as long as the port is closed. Labor disputes and strikes pose a significant threat to economic security within the port. In the event of a port shutdown, companies are prepared to direct their shipping to other ports; a company-by-company response would occur for the supply chain to continue operating.

Existing Mitigations:

- All previously cited risk mitigation efforts contribute towards economic risk mitigation
- Redirection of ships to other ports
- Portwide and company business continuity plans/continuity of operations plans

Appendix C

Definitions – Risk Mitigation Strategies

<i>Coordination / Planning</i>	Improve long-range and/or contingency planning and better coordinate activities / improve dialogue between waterway stakeholders
<i>Voluntary Training</i>	Establish / use voluntary programs to educate mariners / boaters in topics related to waterway safety (Rules of the Road, ship / boat handling, etc.)
<i>Rules & Procedures</i>	Establish / refine rules, regulations, policies, or procedures (navigation rules, pilot rules, standard operating procedures, licensing, required training and education, etc.)
<i>Enforcement</i>	More actively enforce existing rules / policies (navigation rules, vessel inspection regulations, standards of care, etc.)
<i>Nav/Hydro Info</i>	Improve navigation and hydrographic information (Notice to Mariners, charts, Coast Pilots, Light Lists, Automatic Identification System (AIS), tides and current tables, etc.)
<i>Communications</i>	Improve the ability to communicate bridge-to-bridge or ship-to-shore (radio reception coverage, signal strength, reduce interference & congestion, monitoring, etc.)
<i>Active Traffic Mgmt</i>	Establish / improve a Vessel Traffic Service: information / navigation / traffic organization
<i>Waterway Changes</i>	Widen / deepen / straighten the channel and/or improve the aids to navigation (buoys, ranges, lights, DGPS, etc.)
<i>Other Actions</i>	Risk mitigation measures needed that do not fall under any of the above strategy categories

Appendix D

Additional Risk Intervention Strategies

For those categories assessed where risk was determined to be unbalanced with existing mitigation strategies, existing risk intervention strategies were proposed by teams as outlined below. (The number listed before each risk intervention strategy is the number of participant teams out of seven (7) who voted for that particular risk intervention strategy.)

Commercial Fishing Vessel Quality

Coordination / Planning:

- (2) Participate in the Harbor Safety Committee
- (1) Include insurance representatives at future Harbor Safety Committee meetings and events
- (1) Conduct an industry day

Voluntary Training:

- (5) Organize outreach for training events to include attendance at commercial fishing meetings

Rules & Procedures:

- (3) Stricter licensing and added regulations to commercial fishing fleet
- (1) Increased AIS coverage and associated training

Enforcement:

- (3) Increased maritime law enforcement operations and boardings

Navigation / Hydro Info:

- (2) Add mandatory AIS

Communications:

- (2) Must monitor VTS channels

Active Traffic Management:

- (3) Mandatory VTS participation

Waterway Changes:

- (1) Prohibited fishing areas

Other Actions:

- (2) Involve marine insurance underwriters in harbor safety discussions
- (1) Increased public awareness campaign

Small Craft Quality

Voluntary Training:

- (2) Increased participation in safety training and boating safety classes
- (3) Require through marine insurance companies mandatory safety training

Rules & Procedures:

- (2) Mandatory online boating safety training
- (2) Minimum license requirements

Enforcement:

- (2) Increased enforcement presence and boardings

Navigation / Hydro Info:

- (1) Require use of ECS

Communications:

- (2) Educate boaters on proper radio communications and encourage more frequent use

Other Actions:

- (3) Involve marine insurance underwriters in harbor safety discussions
- (1) Increased public awareness campaign

Dimensions

Coordination / Planning:

- (1) Specific times for transits
- (1) Plan for future port expansion

Waterway Changes:

- (5) Continue to dredge and widen channels; add a small vessel channel

Other Actions:

- (1) Install air gap sensors in the Port of Los Angeles

Economic

Coordination / Planning:

- (1) Continued disaster planning

Voluntary Training:

- (1) Continue drills and exercise programs

Rules and Procedures:

- (1) Increased competition for longshore operations

Appendix E

Electronic Charting System (ECS) Risk Factor Locations

As the workshop participants discussed each of the 24 risk factors, an ECS was utilized to plot the geographic locations associated with their comments and observations and assign a risk factor marker number for that specific comment and/or observation. The diagram below describes the ECS marker color and numbering symbols for each risk factor in the PAWSA Waterways Risk Model.

Figure 8: Risk Factor Marker Table

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
①	①	①	①	①	⑤
Shallow Draft Vessel Quality	Volume of Small Craft	Water Movement	Dimensions	Petroleum Discharge	Environmental
②	②	②	②	②	⑥
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
③	③	③	③	③	⑦
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
④	④	④	④	④	⑧

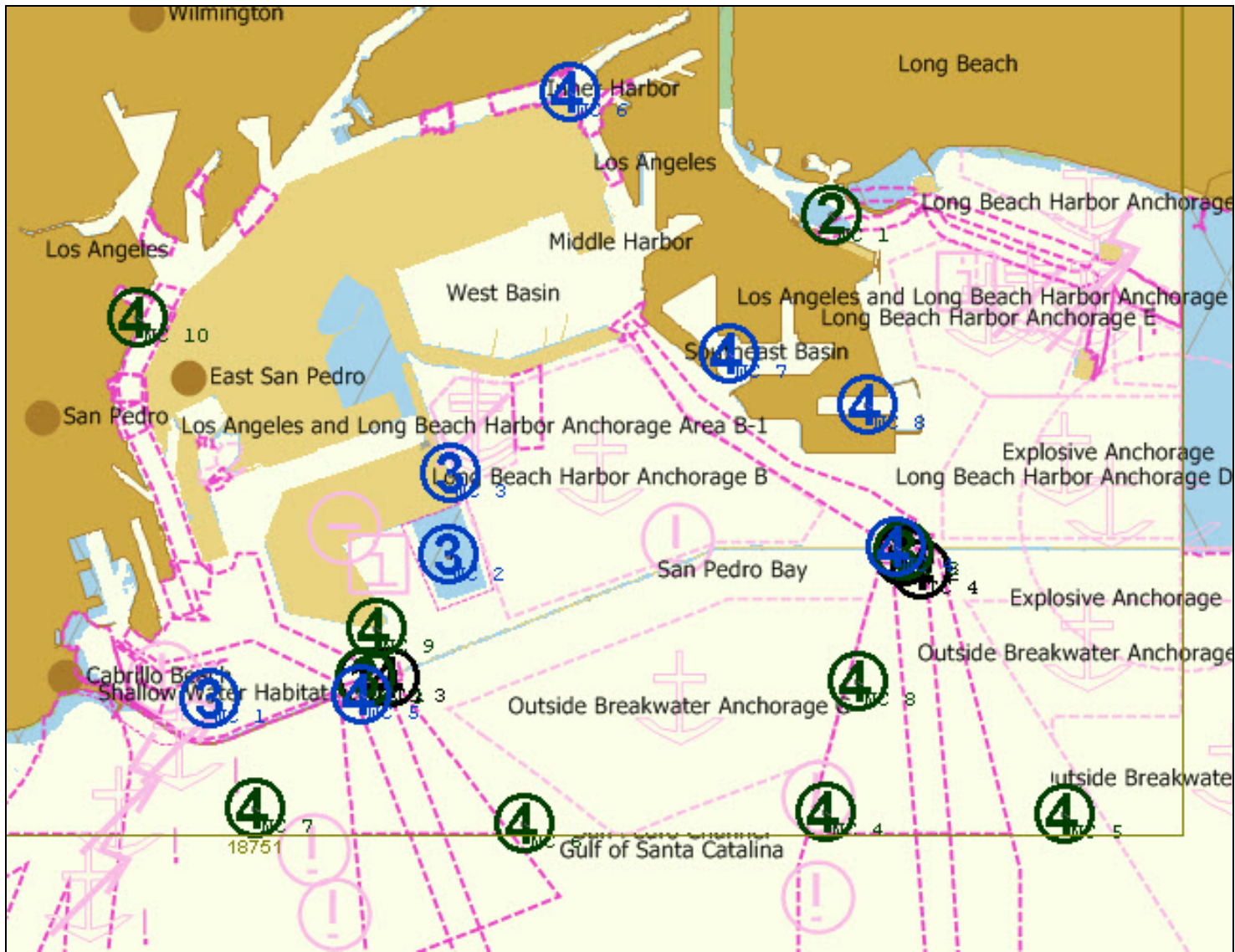


Figure 9: All Risk Factor Markers

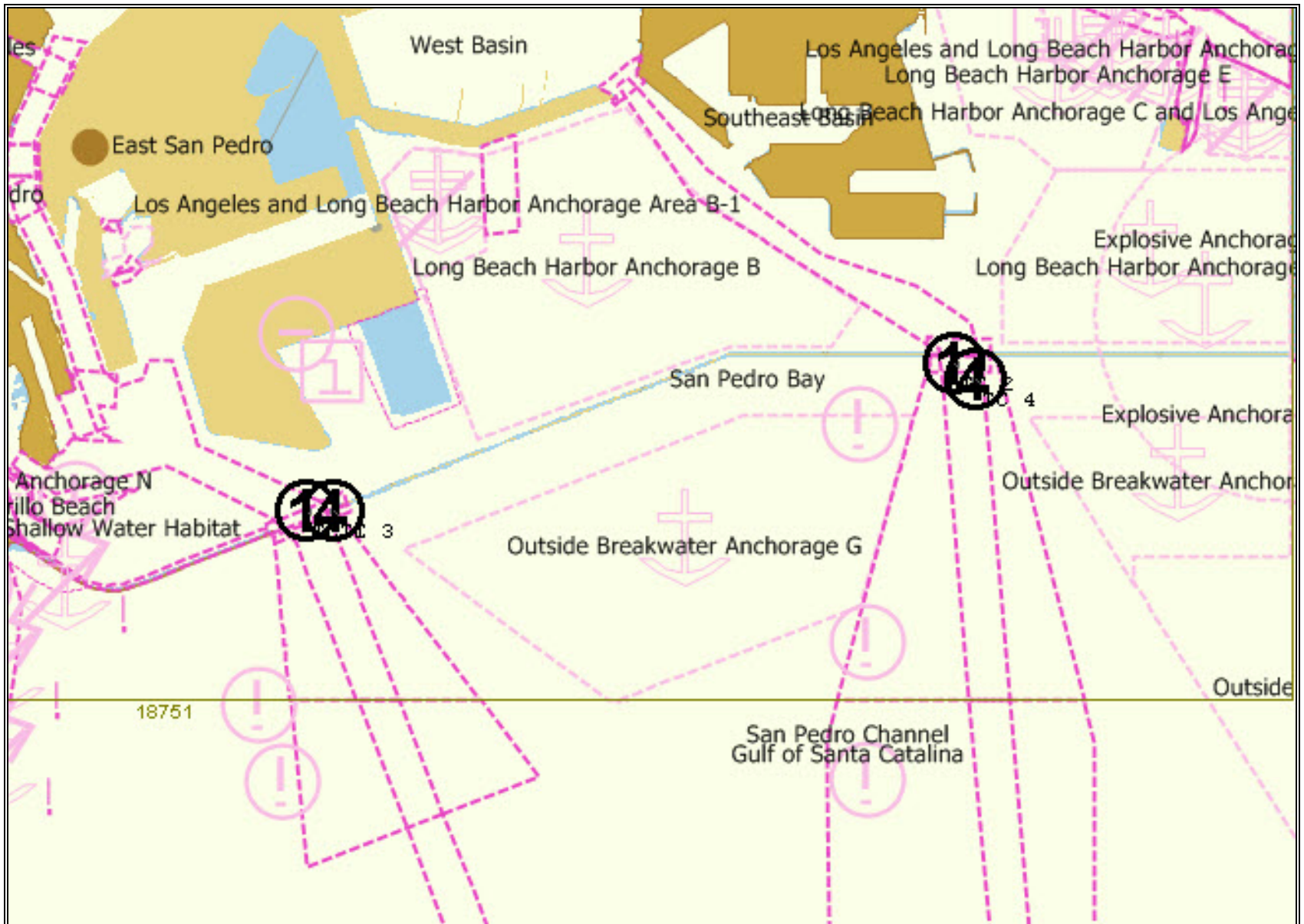


Figure 10: Markers Indicating Risk Areas for Traffic Conditions

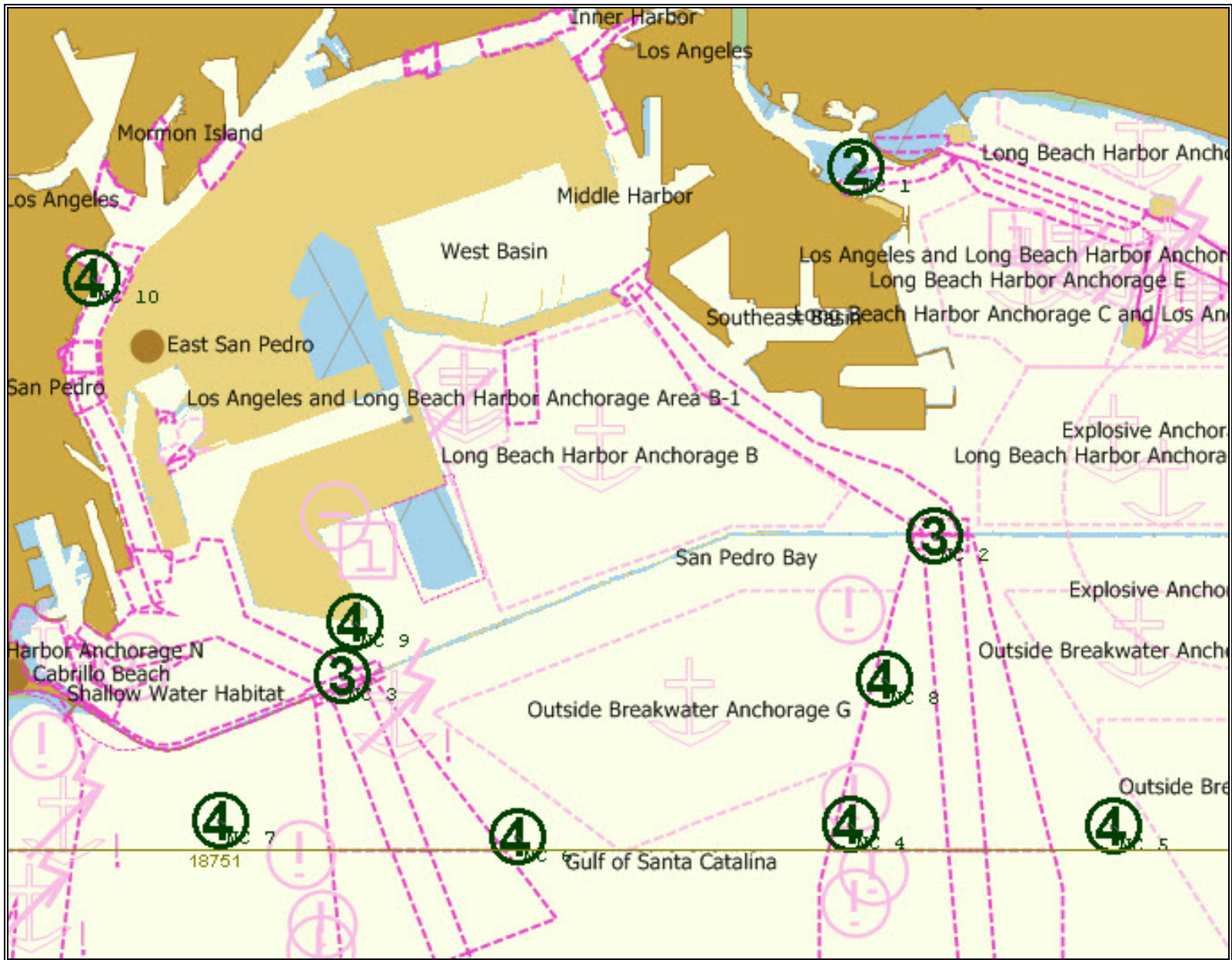


Figure 11: Markers Indicating Risk Areas for Navigational Conditions

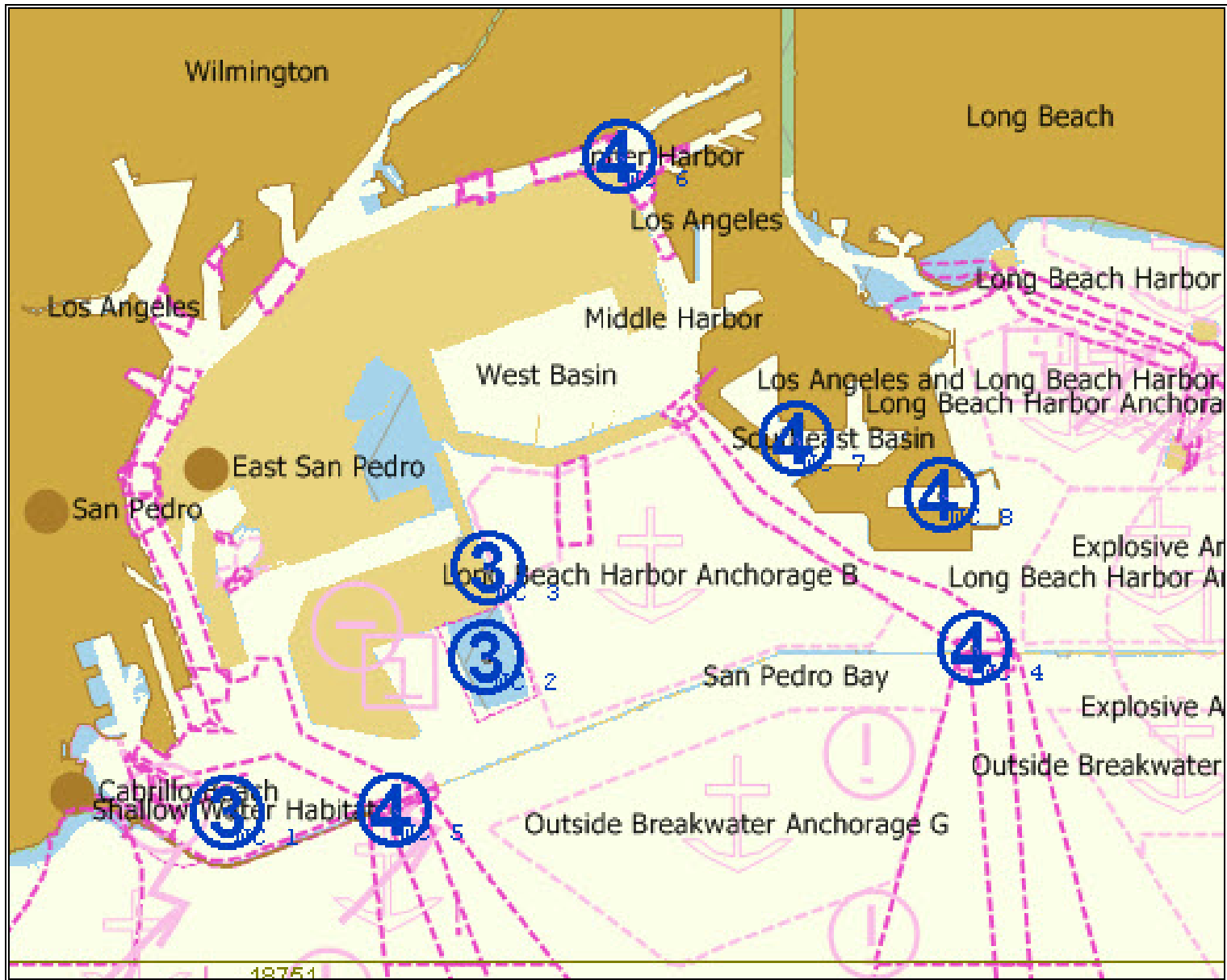


Figure 12: Markers Indicating Risk Areas for Waterway Conditions

Appendix F References/Guidance

	<u>Vessel Conditions / Operations</u>	<u>Navigation Safety</u>	<u>References / Statistics</u>
California Division of Boating & Waterways	Boat Registration http://www.dmv.org/ca-california/boat-registration.php	State-Specific Boating Safety Requirements http://www.dbw.ca.gov/	Boating Safety Education http://www.dbw.ca.gov/Pubs/Abc/
U.S. Coast Guard	46 CFR Subchapter C – Uninspected vessels 46 CFR Chapter I – Vessel Inspection requirements Electronic Code of Federal Regulations: Recreational Boating Safety - Federal Regulations Regulations	U.S. Navigation Rules Navigation Rules Online Navigation regulations by location Navigation Regulations Search Boating Safety Division Home Page	Recreational Boating Safety - Accident Statistics Statistics USCG Auxiliary –Requirements - Recreational Boats Recreational Boating Safety Information & Resources
U.S. Army Corps of Engineers	Los Angeles District - Regulatory Branch http://www.spl.usace.army.mil/Home.aspx	Los Angeles District -Navigation Notices http://www.spl.usace.army.mil/Media/PublicNotices.aspx	Navigation Data Center - Vessel Transit Statics http://www.ndc.iwr.usace.army.mil/
National Oceanic and Atmospheric Administration		National Data Buoy Center – San Pedro http://www.ndbc.noaa.gov/station_page.php?station=46222 National Weather Service NOAA's National Weather Service	Safe Boating Weather Tips http://www.nws.noaa.gov/om/brochures/safeboat.htm U.S. Coast Pilot 7 – Pacific Coast http://www.uscg.mil/d13/cfvs/Training/D17/CFVSTraining/2014CoastPilot7Updated_14DEC2014.pdf

Appendix G

Waterways Management/Best Practices

Port of Los Angeles – Official Website

<https://www.portoflosangeles.org>

Port of Long Beach - Official website

<http://www.polb.com>

California Department of Motor Vehicles

<https://www.dmv.ca.gov>

American Waterways Operators Foundation

[The American Waterways Operators](#)

American Canoe Association

[American Canoe Association](#)

U.S. Coast Guard

<http://www.uscg.mil/>

British Rowing

<http://www.britishrowing.org/>

Port of London Authority

<http://www.pla.co.uk/index.cfm>

Port of Los Angeles Strategic Plan for Safety and Security

[https://www.portoflosangeles.org/DOC/POLA%20Strategic Plan for Safety and %20Security Apr 07.pdf](https://www.portoflosangeles.org/DOC/POLA%20Strategic%20Plan%20for%20Safety%20and%20Security%20Apr%2007.pdf)

Port of Long Beach Strategic Plan

<http://www.polb.com/about/plan.asp>

Vessel Boat Registration and Information / ABCs of California Boating

<https://www.dmv.ca.gov/portal/dmv/detail/boatsinfo/boatreg>

<http://www.dbw.ca.gov/Pubs/Abc/>

Life Lines Brochure - Safety Tips That Could Save Your Life

http://www.americanwaterways.com/commitment_safety/lifelines.pdf

Top 10 Safety Tips for Paddlers

[Top 10 Safety Tips - American Canoe Association](#)

Guidance for the Establishment / Development of Harbor Safety Committees

<http://www.uscg.mil/hq/cg5/nvic/pdf/2000/n1-00.pdf>

Notices for the Boating Public

[Boating Safety Circulars](#)

Incident Reporting

<http://www.britishrowing.org/sites/default/files/rowsafe/4-1-IncidentReporting-v1.pdf>

Codes of Practice:

Safe mooring of vessels

Rowing on the Tideway

Passenger vessel operations

[Codes of Practice > Safety](#)

Guidance Documents

Mariners' Guide to Bridges on the Tidal Thames

Recreational Users Guide for the tidal River Thames

[Guidance Documents > Safety](#)