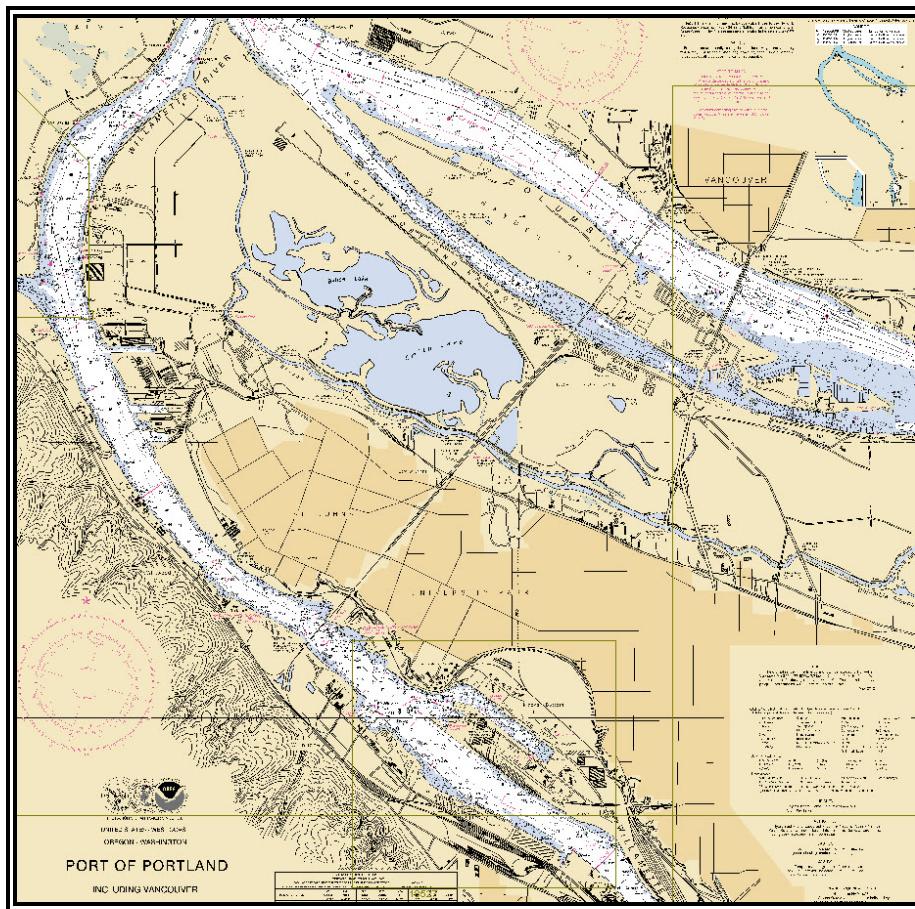


Ports and Waterways Safety Assessment

Workshop Report

Portland, Oregon



United States Coast Guard
Marine Transportation Systems Directorate



Providing Navigation Safety Information
for America's Waterways Users

Background

The United States Coast Guard (USCG), Marine Transportation Systems Directorate, is responsible for developing and implementing policies and procedures that facilitate commerce, improve safety and efficiency, and inspire dialogue with 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) Waterways Risk Model***, and the ***PAWSA workshop process***. PAWSA is a disciplined approach designed to identify major waterway safety hazards, estimate risk levels, evaluate potential mitigation measures, and set the stage for the implementation of selected risk reduction strategies. The process involves convening a select group of waterway users and stakeholders and facilitating a structured workshop agenda to meet the risk assessment objectives. A successful workshop requires the participation of professional waterway users with local expertise in navigation, waterway conditions, and port safety. In addition, stakeholders are included in the process to ensure that important environmental, public safety, and economic consequences are given appropriate attention as risk interventions are identified and evaluated.

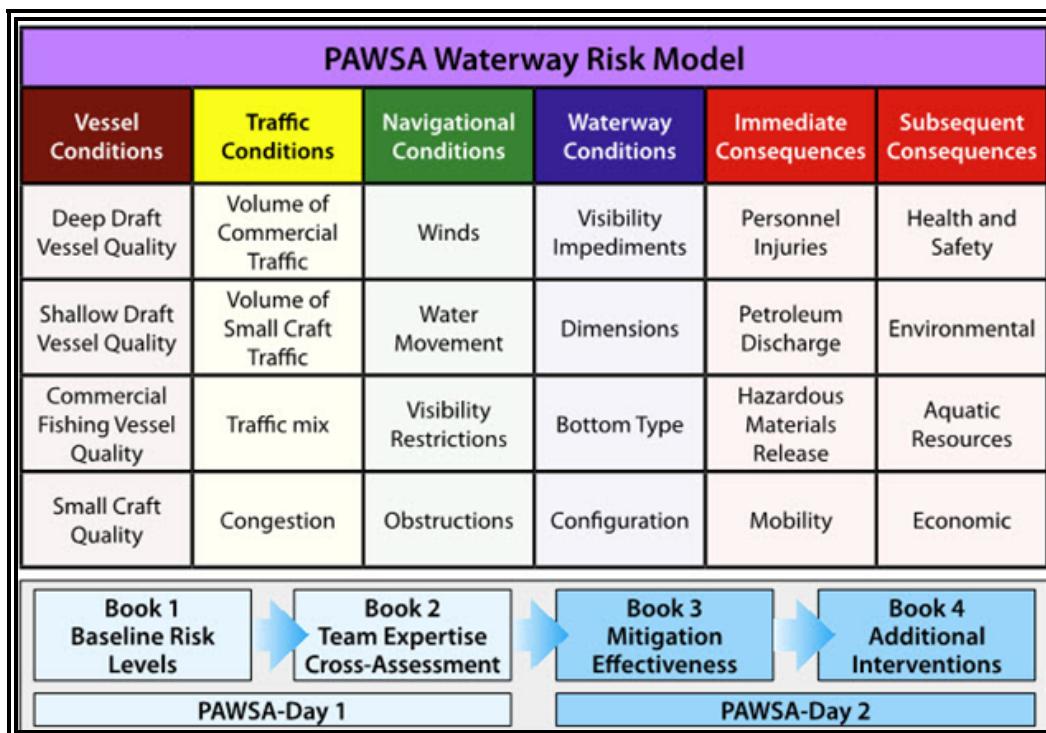
The long-term goals of the PAWSA process are to:

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

55 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 and Workshop process

The PAWSA Waterway Risk Model includes variables dealing with both the causes of waterway casualties and their consequences. In the Waterway Risk Model, risk is defined as a function of the probability of a casualty and its consequences. The 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.



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

Workshop activities include a series of discussions about the port/waterway attributes and the vessels that use the waterway, followed by completion of 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 the mitigation strategies are at reducing risks, and to determine if the risks are well balanced or not. For those risk factors where risk is judged to be not well balanced by existing mitigations, participants use survey book 4 to identify additional risk intervention strategies and then evaluate how effective those new strategies could be at reducing risks.

Executive Summary

A PAWSA workshop for the Port of Portland was held in Portland, Oregon on 15-16 November, 2016. The workshop was attended by 24 participants, representing waterway users, regulatory authorities and stakeholders with an interest in the safe and efficient use of Portland from both a commercial and recreational perspective. Over the course of the 2-day workshop, participants discussed and evaluated each of the 24 risk factor that make up the Waterways Risk Model.

Participants discussed the challenges deep draft commercial vessels encounter when entering the Columbia River to Government Island in Portland and the Willamette River to Oregon City.

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 are well balanced.

For 21 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 2 risk factors (Small Craft Quality, Volume of Small Craft Traffic) there was consensus that risks were NOT well balanced by existing mitigations.

For the remaining risk factor (Commercial Fishing Vessel Quality), there was no consensus among the participants that risks were well balanced by existing mitigations. For the three risk factors not balanced by existing mitigations, the participants engaged in further discussions to identify additional risk intervention strategies, and then evaluated how effective those new strategies could be at reducing risk.

To further reduce risks relating to Small Craft Quality, participant recommendations included supporting potential legislation that would require permits for human powered vessel operation, to leverage social media to provide educational outreach to recreational boater, and to work with manufacturers of small crafts to install educational signage on vessels.

Additional mitigations to reduce risks associated with the Volume of Small Craft Traffic included closely evaluating the permitting of marine events (Tom McCall Waterfront Park, for example) which may have a negative impact on waterway safety, ensure that marine event sponsors obtain marine event permits when necessary, and to require the event sponsors to install temporary markers/aids to reduce risk to other waterway users.

To further reduce risks relating to Commercial Fishing Vessel Quality, the participants recommended that efforts be made to reach out to commercial fisherman and ask for their involvement and attendance at harbor safety committee meetings. It was also recommended that harbor safety committee meetings should be better advertised. Increased law enforcement of safety regulations was also suggested as a strategy to drive down risk.

The results of the baseline risk level survey, existing risk mitigation strategies, additional risk intervention strategies, and participant comments and observations in the Lower Columbia and Willamette Rivers, are outlined in this report.

Conclusion

The goal of a PAWSA workshop is not only to further the Marine Transportation System 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 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 the Lower Columbia River maritime community.

The United States Coast Guard, Marine Transportation Systems Directorate, extends a sincere appreciation to the workshop participants for their contributions to the Portland 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 on the Lower Columbia and Willamette Rivers.

United States Coast Guard Marine Transportation Systems Directorate



**Providing Navigation Safety Information
for America's Waterways Users**

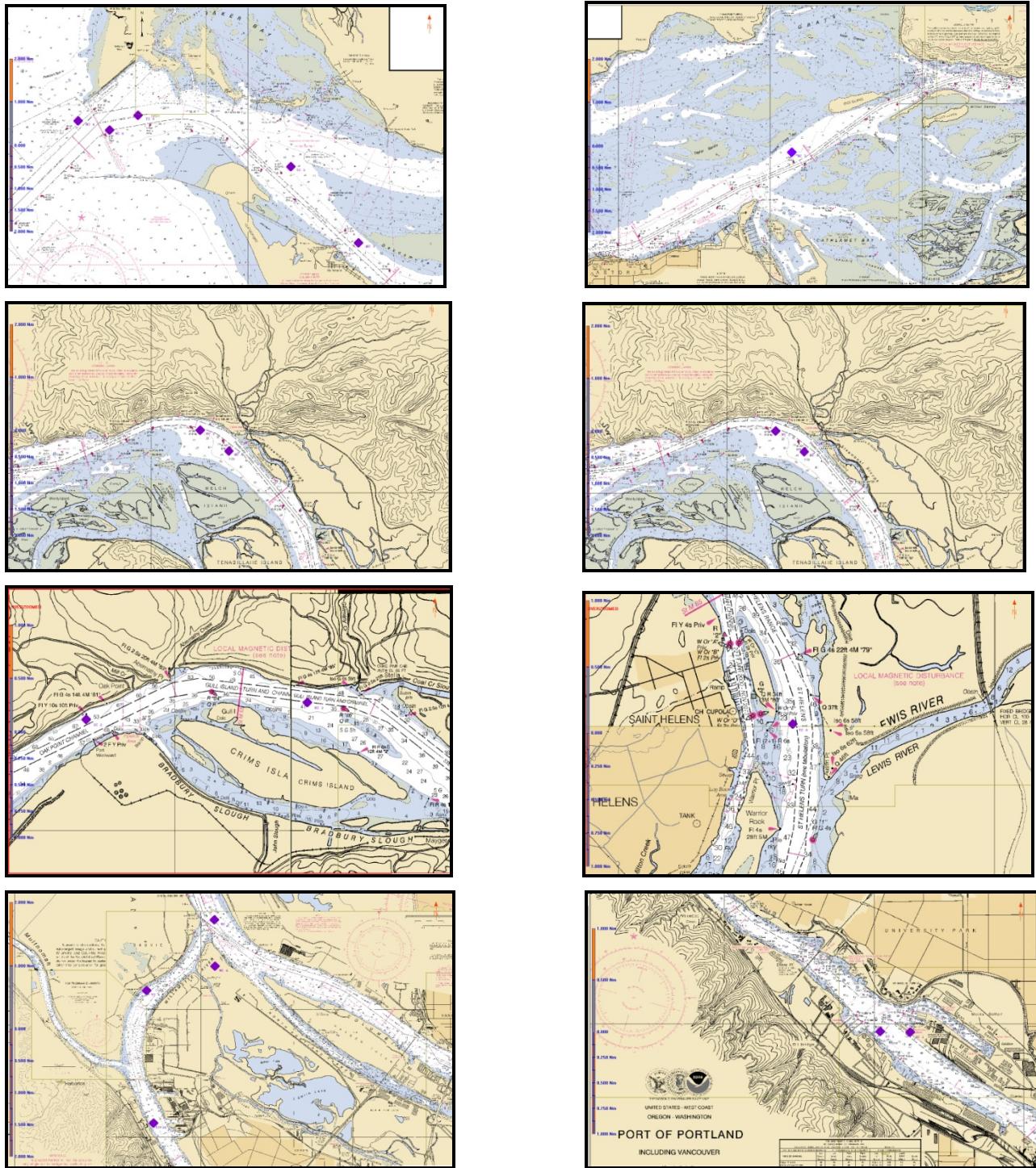
Table of Contents

	Page
Section 1: Portland PAWSA – Assessment Area	7
Section 2: Baseline Risk Levels.....	8
Section 3: Team Expertise Cross-Assessment	9
Section 4: Existing Risk Mitigations	10
Section 5: Additional Risk Intervention Strategies.....	11
Appendix A Workshop Participants - Facilitation Team	
Appendix B Participant Observations - Trends in the Port and Existing Risk Mitigations	
Appendix C Definitions - Risk Mitigation Strategies	
Appendix D Participant Recommendations – Additional Risk Mitigation Strategies	
Appendix E Electronic Charting System (ECS) diagrams	
Appendix F References - Best Practices	

Section 1: Portland PAWSA - Assessment Area

The area assessed included the Columbia River from the Pacific Coast entrance to Government Island in Portland (MM 115), and the Willamette River to Oregon City.

Figure 2



Section 2: Baseline Risk Levels

The first step in the Portland PAWSA workshop was the completion of survey book 1 to determine a baseline risk level value for each risk factor in the Waterway Risk Model. To establish the baseline risks level, participants discussed each of risk 24 applicable factors in the Waterways Risk Mode and selected a qualitative description for each risk factor that best described the conditions in the port. These qualitative descriptions were converted to discrete values using numerical scales that were developed during earlier PAWSA workshops.

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 3 below shows that 7 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

Figure 3

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
2.5	5.2	4.6	6.5	7.0	8.6
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
2.7	6.0	7.0	5.7	6.3	8.6
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
6.7	7.0	4.6	5.4	6.2	8.0
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
8.7	6.6	5.2	7.2	8.1	8.2

As the participants discussed trends and observations for each of the 24 risk factors, their comments and observations were documented for inclusion in this workshop report. Appendix B is a summary of participant comments and observations on trends in the port and existing risk mitigations.

An Electronic Charting System (ECS) was used to displayed nautical charts of the assessment area and to plot the charted locations associated with participant comments and observations. Appendix E includes ECS chart extracts with the plotted locations associated with the comments/observations.

Section 3: Team Expertise Cross-assessment

The next second step in the Portland PAWSA workshop was the completion of 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. Overall, 36% of the participant teams were placed in the upper third, 41% in the middle third, and 23% in the lower third of all teams.

Appendix A is a list of the PAWSA workshop participants and the workshop facilitation team.

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

Figure 4

Team Expertise -- Distribution			
Risk Category	Top 1/3	Mid 1/3	Lower 1/3
Vessel Conditions	46%	50%	4%
Traffic Conditions	53%	36%	10%
Navigational Conditions	42%	39%	19%
Waterway Conditions	32%	42%	26%
Immediate Consequences	38%	45%	17%
Subsequent Consequences	6%	33%	61%
All Categories Average	36%	41%	23%

Section 4: Existing Risk Mitigations

The third step in the Portland PAWSA workshop was for participants to evaluate the effectiveness of existing mitigation strategies in reducing the risk level for each risk factor. Participants discuss existing risk mitigations for all risk factors in the model, and then evaluated how effective they thought the mitigations were at reducing risks.

For 21 risk factors (green), there was consensus that risks were well balanced by existing mitigations.

For 2 risk factors (red), there was consensus that risks were not balanced by existing mitigations.

For 1 risk factor (yellow), there was no consensus that risks were well balanced by existing mitigations.

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

Figure 5

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	
2.5	2.3	5.2	4.9	4.6	4.6	6.5	6.1	7.0	6.5	8.6	8.2
Balanced		Balanced		Balanced		Balanced		Balanced		Balanced	
Shallow Draft Vessel Quality		Volume of Small Craft Traffic		Water Movement		Dimensions		Petroleum Discharge		Environmental	
2.7	2.5	6.0	6.5	7.0	5.2	5.7	5.4	6.3	5.3	8.6	8.1
Balanced		NO		Balanced		Balanced		Balanced		Balanced	
Commercial Fishing Vessel Quality		Traffic Mix		Visibility Restrictions		Bottom Type		Hazardous Materials Release		Aquatic Resources	
6.7	6.6	7.0	7.0	4.6	5.7	5.4	5.0	6.2	5.4	8.0	7.6
Maybe		Balanced		Balanced		Balanced		Balanced		Balanced	
Small Craft Quality		Congestion		Obstructions		Configuration		Mobility		Economic	
8.7	8.7	6.6	6.6	5.2	5.1	7.2	6.2	8.1	7.8	8.2	7.8
NO		Balanced		Balanced		Balanced		Balanced		Balanced	

Risk Factor		EXPLANATION	
Book 1 Score	Book 3 Score	Book 1	Baseline risk level
		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
		Not Balanced	Consensus that existing mitigations do NOT adequately balance risk
Consensus Reached ?			

Section 5: Additional Risk Intervention Strategies

The workshop participants finally completed survey book 4 for those risk factors that were still not balanced by existing mitigations. Participants suggested additional risk intervention strategies to further reduce risk, and then evaluated how successfully a proposed risk intervention strategy could be at lowering risk levels for each these risk factors.

Appendix C is a description of each risk intervention general strategy.

Appendix D describes all risk intervention strategies proposed and evaluated by the participants.

The table below shows the expected reduction in risk when taking the actions specified by the participants.

Figure 6

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	Enforcement	Balanced	Balanced	Balanced	Balanced
	5.9				
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Enforcement	Balanced	Balanced	Balanced	Balanced	Balanced
5.2 Caution					
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
Enforcement	Balanced	Balanced	Balanced	Balanced	Balanced
8.0					

Risk Factor	EXPLANATION
Intervention Category	Intervention general strategy that most participants selected for further risk mitigation actions.
Risk Improvement	The amount that present risk levels might be reduced if new mitigation measures were implemented

Caution – No Consensus Alert

When Caution is displayed, an intervention strategy other than the one displayed was judged to provide more risk reduction than the one displayed. This is an indicator that the teams were divided in their opinions about what actions should be taken to further reduce risk for that factor. It indicates there is a possibility of more than "one" best mitigation measure to achieve further risk reduction!

Appendix A**Workshop Participants**

Liz Wainwright	Merchants Exchange of Portland
Fred Harding	Shaver Transportation / AWO
Kirk Bonnin	Olympic Tug and Barge
Captain Andrea Mickelson	American Empress
Hannah Zaayer	Columbia River Steamship Operators Association
BM1 Courtney Lund	USCG Aids to Navigation Team Astoria
Captain Josh Nichols	Tidewater Marine
Captain Mike Santini	Crowley Marine
Ken Lawrenson	USCG Marine Safety Unit Portland
Lars Uglum	Port of Vancouver
Captain Dan Yates	Portland Spirit
Captain Todd Bulger	Portland Spirit
Randy Henry	Oregon State Marine Board
Sergeant Stephen Dangler	Multnomah County Sheriff's Office
Brad Howton	Columbia River Yachting Association
Marlin Bump	Riverplace Marinia
Captain Ross McDonald	Sause Brother Towing
Captain Paul Hendrick	Foss Maritime
Brian Kirk	Washington State Department of Ecology
Chief Scott Heesacker	Portland Fire and Rescue
Captain Dan Jordan	Columbia River Bar Pilots
Captain John Aschoff	Columbia River Pilots
LCDR Andrew Madjeska	USCG Sector Columbia River
LCDR Christopher Morris	USCG Sector Columbia River

Facilitation team

LCDR Jamie Rickerson – lead facilitator	LT Ben Earling
Mr. Andrew Haley	Mr. Burt Lahn

Appendix B

Participant Observations- Trends in the Port and Existing Risk Mitigations

Deep Draft Vessel Quality

Trends / Observations:

- Deep draft vessel defined as commercial shipping 1600 tons and above. Must use designated channels to navigate.
- Mixed nationality crews can sometimes create communication issues.
- Vessel quality has improved over the last 20 years. More double hull vessels, better crew training, newer average vessel age, etc.
- STCW/ISM requirements have improved vessel quality.
- Low incidence of casualty. In 2015 there were three groundings with risk of a spill out of 2700 vessel transits.
- Port state control actions are infrequent and relatively minor. In the past year there were two detentions and 97 COTP orders. Majority of traffic is bulk carriers and Ro-Ros.
- Companies are placing improved internal controls to improve vessel quality.
- Customer demands and Oil Companies International Marine Forum (OCIMF) Ship Inspection Report (SIRE) program inspections have led to improved vessel quality for petroleum carrying vessels.

Existing Mitigations:

- Mandatory pilotage requirements. Pilots utilize VTIS to improve situational awareness. Pilots also require anchors ready for entire transit.
- Full inspection program / Port State Control.
- Load Max – customized form of NOAA PORTS for Columbia River system.
- Extensive use of AIS system with TV32 on pilotage systems. TV32 mainly used by pilots, but system is available to anyone requesting the information.

Shallow Draft Vessel Quality

Trends / Observations:

- Defined as; coastal or inland trade vessels, tugs/barge, mostly sub chapters T, H, and K.
- Small percentage that are very low quality. Some are derelict and often sink. Most have been identified and have pending COTP orders.
- Most of the operators are local users who have strong local knowledge.
- Tug and barge traffic is generally high quality. Local companies implement very robust training plan.
- Inspection routine ensures vessels maintain satisfactory vessel quality.

Existing Mitigations:

- New sub chapter M rules.
- AIS carriage requirements improve situational awareness.
- Local tug industry employs safety management systems (ISO, ISM and, AWO RCP). Includes third party inspections regime.
- STCW
- Most users have strong local knowledge.
- Improved training for crews. Includes both required training and company specific policies. Expanding industry training also available.
- Regulations for T, K, and H vessels.

Commercial Fishing Vessel Quality

Trends / Observations:

- Commercial fishing vessel quality varies based on specific fishery. For example, crab boats may be of high quality while, salmon vessels may be lower quality.
- Fleet of commercial fishing vessels has decreased over last 20 years due to corporate consolidation. Remaining vessels are generally of higher quality. Professionalism still lags behind deep draft vessels.
- Fishing industry is struggling financially, which may lead to challenges with maintaining vessel quality.

- Five fatalities in the last year related to commercial fishing (within the COTP zone, not within the assessment area).
- Fishing vessels from out of the local area (CA/WA) are less experienced than the local fisherman.

Existing Mitigations:

- Mandatory commercial fishing vessel exam program, crew requirements, licensing requirements.
- Quota management requirements and discussion of when fishing vessels can operate (weather and bar conditions) reduce risk.
- High local knowledge of the area.

Small Craft Quality

Trends / Observations:

- Small craft operators are inexperienced and typically have very low navigational knowledge. Many operators rely on cell phones for navigation and do not have basic skills. There is a required boater safety course requirement in Oregon and Washington for motor boat users. Approximately 90-95% of users have taken the course.
- Incidence of marijuana use for small craft users is relatively high. During the summer months, groundings and collisions are common.
- Quality of small crafts operators is declining, while the average size is growing.
- Small craft vessel quality is likely improving because there are many new boats on the waterway.
- Stand up paddle boarders are increasing and very low navigational knowledge. Rental community is also growing and giving water access to inexperienced people.

Existing Mitigations:

- Sheriff's department and CG AUX offer voluntary inspection programs.
- Material quality of small crafts is increasing because people are buying newer boats. Concurrently the knowledge of users is decreasing because inexperienced people are buying boats.
- Oregon has mandatory boater education requirements for operators of vessels with 10hp or more.
- Sheriff's department has conducted outreach for kayak, stand up paddle board, and jet ski rental companies.
- Enforcement activities have been utilized to increase awareness and inform mariners that they cannot impede the channel.
- Make Way program seeks to inform recreational mariners about various requirements and regulations for vessel operators.

Volume of Commercial Traffic

Trends / Observations:

- Confluence of Columbia and Willamette rivers is a hot spot for traffic.
- Tom McCall Riverfront Park is a high traffic area, roughly 40 transits per day.
- 1378 vessel calls 2015. Projected 1447 calls for 2016. 2000 - 2209 deep draft vessel calls.
- Port of Vancouver has roughly 400 ships per year.
- Astoria to sea buoy has the highest concentration of commercial fishing. Fishing vessels are a source of cross traffic in the river.
- Grain harvest season is the highest concentration of commercial shipping. Approximately 48% of the vessels are engaged in grain exports. During the harvest period there is often a wait for berths.
- Traffic flow is very linear transiting up or down the river.
- Estimated 40-50 commercial transits per day.

Existing Mitigations:

- Mandatory pilotage. Pilots utilize VTIS and TV32 to improve situational awareness.
- Yearly maintenance dredging program leads to larger vessels, but fewer overall.
- AIS carriage requirements.
- ACOE is very active and conducts frequent hydrographic surveys; this provides real-time data to mariners.

Volume of Small Craft Traffic

Trends / Observations:

- 1999: 196,000 registered recreational boats statewide. Registered boaters have decreased to 160,000 in 2016. Majority of small craft operators in the Portland area.
- 5,000 permanent slips in Portland area.
- Ride sharing app for boats is increasing water access for inexperienced operators.
- Very large kayaker community. Likely increased 4x since 2000.
- Crew shells are also very common throughout the river system.
- Heavy seasonality based on fishing seasons (fall/spring) and summer watersports. Buoy 10 fishing season in August on the Columbia bar creates major traffic issues. There is also a waterfowl hunting season from boats.
- Small craft use led to 17 fatalities in 2016.

Existing Mitigations:

- Make way program seeks to inform recreational mariners about rules and regulations for operations.
- The Oregon State Marine Board is conducting outreach to improve awareness for recreational users.
- CG Auxiliary conducts outreach and education for users, especially during salmon fishing season.
- CG AUX patrols are being assigned for paddling events and targeting outreach at conferences and events.

Traffic Mix

Trends / Observations:

- River system is a mixed use waterway throughout the entire river system.
- Gill netters have led to multiple entanglements.
- Vancouver reach (fall-summer) has a very active sailing community.
- Fall season has highest percentage of commercial traffic due to grain exports.
- “Hog lines” are an issue in the Columbia and Willamette Rivers. Small recreational vessels are often tied/anchored 4-5 (or more) abreast across a waterway. Creates conflict with commercial traffic.
- Marine events are concentrated in downtown Portland near Tom McCall Waterfront Park. This area is generally booked from April-September.
- Astoria to Buoy 10 is the area of greatest conflict between fisherman and commercial traffic. Sport fisherman also anchor in the river from Multnomah Channel upstream the Willamette River to Willbridge.
- At certain times of the year, deep draft vessels (up to 10) are loitering offshore awaiting upriver anchorages and berths.

Existing Mitigations:

- Very active Harbor Safety Committee meets every other month.
- Harbor Safety Plan is available publically.
- River Safety Panel meets monthly – focused on sharing information amongst law enforcement and first responder partners on the river and what events are upcoming. Includes a very diverse group of stakeholders.
- Tow boat / Crabber agreement deconflicts areas of mixed use between fisherman and towing vessels. Designates fairways for towing vessel operations.

Congestion

Trends / Observations:

- Grain harvest season is the period of highest commercial vessel concentration.
- Astoria to buoy 10 is the area of highest fishing concentration.
- Weather contributes to vessel concentrations. When the bar is closed (8x per winter) commercial traffic halts.
- Very seasonal and localized areas of predictable congestion.

Existing Mitigations:

- Multiple agencies coordinate through Operation Make Way and other events to manage traffic congestion. There is a focus on outreach to improve overall mariner awareness.
- Harbor Safety Committee/River Safety Group seeks to reduce congestion.
- LNM and BNM pass information about events and possible times of congestion.

- Improving coordination on marine event planning. Efforts include the State of Oregon coordinating directly with CG Director of Auxiliary to streamline patrols for marine events.
- Pilots utilize helicopters to allow earlier and easier access to large vessels entering port. Reduced congestion at sea buoy.
- Pilotage ground extends offshore to reduce congestion at mouth of river.

Winds

Trends / Observations:

- Winds are high throughout the year, but winter months have highest concentration of high winds (20kts+). Wind varies greatly geographically. Winds may be lower in the city, but other parts of the river will experience very high winds.
- Winds are generally blowing in the direction of the river.
- Cape Horn/northern side of Puget Island and Astoria heading seaward are areas of crosswinds.
- Often times predicted winds do not match actual conditions. The averaging of wind speeds often creates impression of lower wind speeds.

Existing Mitigations:

- Meteorological data is readily available to plan/prepare for changes in water movement, including a National Ocean Service Physical Oceanographic Real-Time System (PORTS) and LoadMax. LoadMax is a system implemented by the Port of Portland to use PORTS data to predict river water heights along the river over time, enabling laden vessels to 'ride' tidal flows over shallower sections of the river.
- National Weather Service office in Portland is very active and coordinates directly with the pilots and CG.
- NOAA and the pilots worked together to deploy additional weather buoys to monitor winds and waves.
- Standard procedures for bar closures due to high winds.

Water Movement

Trends / Observations:

- Tidal all the way to Bonneville/Oregon City.
- Strongest currents are on the bar, between the jetties. Currents are sometimes up to 7kts.
- Snow melts in late spring lead to high currents.
- Tides and currents are predictable.
- NOAA model for currents is very accurate in the region.
- Willamette is greatly impacted by rain events.
- Interaction of Columbia/Willamette Rivers and dams can create periods of extreme currents.
- River level and speed vary greatly on the rivers. Can be up to a 15' variation throughout the year.
- Very high surf at the Columbia River Bar. Combination of locally driven waves and sea swell can create up to 50' waves.

Existing Mitigations:

- Meteorological data is readily available to plan/prepare for changes in water movement, including a National Ocean Service Physical Oceanographic Real-Time System (PORTS) and Load Max.
- Very high local knowledge due to relative predictability.

Visibility Restriction

Trends / Observations:

- Fog is a very common throughout the year, but concentrated in the fall/spring. Roughly 2-3x per week. Fog settles on the water. Skamokawa is an area of dense fog in the mornings. Coastal fog across the bar is common in the fall.
- Rain (Oct-Jun) and snow (Nov-Feb) reduce visibility.

Existing Mitigations:

- Forecasting is spotty; sometimes it is predictable, sometimes it is not.
- Harbor Safety Plan addresses reduced visibility. If visibility is less than .5nm, vessels do not get underway.

Obstructions

Trends / Observations:

- Dead heads and logs are common in the rivers, most common in fall/winter.
- Derelict fishing vessels often sink or break free and drift down river.
- There are 76 “homeless” boats in the Portland area. The boats are in very poor condition and sink frequently.
- Gill net season leads to entanglements.
- After periods of high water, obstructions are more common.
- Crab pots are sometimes in the channel during the fishing season. Derelict crab pots are also an issue.

Existing Mitigations:

- State has authority to remove obstructions if they are an extraordinary hazard.
- USACE does have an obstruction removal program, but it is not very active.

Visibility Impediments

Trends / Observations:

- Large number of bridges across the river.
- Deck lights on crab boats cause an issue with background lighting.
- Municipal areas and new commercial development on the river create background lighting.
- Lights at airports and drift net boats in Vancouver reach confuse mariners.
- Pile dikes and wing dams create navigational hazards. Historically they were marked by dolphins, but they have been removed in some cases.

Existing Mitigations:

- Pilots provide Tide Books to inform crab boats to turn off their deck lights when near commercial traffic.
- Construction companies are invited to Harbor Safety Committees to provide information to stakeholders.
- CG coordinates with USFWS to legally remove bird nests that reduce visibility (as permitted, when birds are not actively nesting).
- ATON lights have been converted to LEDs, improving visibility.
- The use of eATON is increasing in situations where ATON are missing or discrepant.

Dimensions

Trends / Observations:

- Development is encroaching on the waterway.
- Navigable channel is generally larger than the 600' USACE maintained channel. Control depth is 43'. Channel deepening project completed in 2010 has reduced number of groundings and draft restrictions.
- There are a couple areas where meeting is not recommended, but the channel width is at least 600' throughout. Bugby Hole, Bunker Hill, Gull Island, and Skamokawa are areas where vessels generally avoid passing.
- Vessels avoid meeting under bridges.
- Lowest water occurs in August.
- Very little dredging upriver in last 20 years. Some minor maintenance dredging, but no major dredging. This caused issues with the fire boat being able to reach certain areas.

Existing Mitigations:

- Very robust dredging program. USACE meets monthly with stakeholders to facilitate effective communication of issues.

Bottom Type

Trends / Observations:

- Primarily sand bottom in the river.
- There are several (20+) rocky areas right outside the channel.

Existing Mitigations:

- USACE conducts continual maintenance dredging.
- Navigational charts for the port provide good coverage. NOAA/USACE conduct frequent surveys to ensure charted depths are accurate.

Configuration

Trends / Observations:

- Large bends in the river at Bugby Hole, Kelley Point, and Elk Rock.
- Convergence of the Columbia and the Willamette and Astoria are areas of crossing traffic.
- Ferry crossing at the south side of Puget Island. Anticipate more ferry traffic in the future.
- Large number of bridges crossing rivers causes logistical problems for mariners. Timing bridge openings is often a challenge. Specifically, the Burlington Northern Railroad Bridge and the I5 crossing create issues for waterway users.

Existing Mitigations:

- Set bridge opening and closing schedules create predictability for mariners.

Personnel Injuries

Trends / Observations:

- Cruise ships have seasonal port calls in Astoria. Currently 8-10 per year; 25+ port calls are anticipated in the coming years. Worst case would be cruise ship grounding on the jetty.
- Dinner cruise boats hold up to 600 people. Smaller charter fishing vessels common.
- Gang violence on dinner cruises is becoming an issue.

Existing Mitigations:

- Regular exercises conducted to practice for large and small scale incidents. Participants include federal, state, and local agencies.
- Portland Fire Department operates several response vessels for 24/7 response capabilities.
- River Safety Committee improves communication and coordination among response agencies.
- Maritime Fire and Safety Association – improves situational awareness for land based fire fighters for dealing with maritime incidents.
- Recent port security grant allowed for the purchase of new response boats.

Petroleum Discharge

Trends / Observations:

- Crowley marine moves 175,000 bbls capacity vessels ranging from refined oils to crude. Tankers and fuel barges offload in Willbridge. Largest vessels are less than 300,000 barrels.
- 2015: 28 tankers/157 barges
- 2014: 35 tankers/214 barges
- 2000: 214 tankers/198 barges
- There hasn't been a major oil spill since 1984, pre OPA 1990.
- Ethanol is a growing export commodity in Port Westward. Output fluctuates greatly.
- Nearly all of the petroleum is for local use and varies based on usage.

Existing Mitigations:

- Oregon and Washington have very robust oil spill programs. The Marine Fire and Safety Association (MFSA) provides plans to all vessels transiting the river system.
- Coordinated incidence response teams and the Area Contingency Plan help to balance the risk.
- Very extensive training and frequent exercises for response assets.
- Nearly all oil carrying vessels utilize pilots.
- Harbor Safety Plan includes Tow Barge Guidelines chapter. Plan recommends that all oil barges use two tugs, one acting as a tail boat.
- Increased focus on overall safety in oil industry.

Hazardous Materials Release

Trends / Observations:

- Common HAZMAT includes toluene, anhydrous ammonia (6x per year), sodium hydroxide, uranium, and caustic soda (1x per month). Transits are relatively stable in numbers. Tank vessels are generally small and not fully loaded.
- Mining explosives transit river approximately 6x per year.

Existing Mitigations:

- Coordinated incidence response teams and the Area Contingency Plan help to balance the risk.
- Volume of HAZMAT cargo is low.
- Increased focus on safety in recent years.
- Additional security requirements for HAZMAT carrying vessels reduce risks.

Mobility

Trends / Observations:

- Protest groups employ unique tactics to impact commerce and waterway traffic.
- A significant vessel grounding which blocks the main channel would be a major issue due to river blockage. Highly likely the disturbance would only be short term. Major grounding would likely cause complete shutdown/bottleneck of waterway.
- Major mudslide could have mobility impacts.
- Minimal salvage fleets in local area, most salvage services are located in Seattle.
- Jetty breach would lead to major channel impacts.
- Impacts to grain storage facilities would likely cause disruptions up the transportation chain (rail, truck, etc.).
- Entrance to North Portland Harbor requires dredging and is limiting access for response assets.

Existing Mitigations:

- Robust tug/towing and oil recovery fleet.
- Good communication between all port partners and stakeholders.
- Towing fleet has existing agreements with salvage companies to provide small scale local support.
- Vessel Response Plan does provide guidance and requirements for salvage operations. Larger vessels must have salvage company under contract.

Health and Safety

Trends / Observations:

- Population centers include: Astoria 9,000; City of Portland 600,000; Portland metropolitan area is 3.1 million.
- Very few water intakes on the river. Roughly 4 intakes on the Columbia River: St Helens, Prescott, Rainer, and Portland.

Existing Mitigations:

- Cascadia Rising drill – exercised earthquake response personnel at all levels and increased awareness of deficient areas.
- City of Portland has an agreement with local tug/barge operators to provide services in the case of a large scale incident.
- Strong relationship with the NOAA scientific support coordinator.
- Effective communication between stakeholders.

Environmental

Trends / Observations:

- There are numerous environmentally sensitive areas in the region. Endangered species include 6 species of fish. Whales are common off the coast. Nearly the entire river system is habitat for salmon.
- Most areas around the rivers are protected wetlands.
- Major fly way for migratory birds.
- Environmental community is very active in Oregon.

Existing Mitigations:

- Area Contingency Plans identify sensitive areas.
- Robust environmental response resources, both commercial and government.
- Very active environmental community in the local area.

Aquatic Resources**Trends / Observations:**

- Major fisheries include salmon, crab, oysters, shellfish, herring, eel, anchovies, etc. Spring and Fall salmon fisheries are the largest, both commercially and recreationally. There are smaller fish runs throughout the year.
- Aquaculture and hatcheries in Astoria.
- Oyster beds throughout the river system.
- Commercial, recreational, and subsistence fishing is very common.
- There are Tribal and treaty obligations regarding the salmon that swim upriver into Canada.

Existing Mitigations:

- Vast federal and state coordination for environmental permitting or approval.
- Environmentally sensitive areas maps are available for the region.
- Risk to aquatic resources is reduced due to the community awareness, education, and academic research.
- The local community greatly values the aquatic resources because they rely on the fishery for economic benefits.

Economic**Trends / Observations:**

- The River system supports >46M tons per year in international trade representing \$24 billion dollars.
- 40,000 local jobs related to shipping.
- Over \$5 billion in future investments.
- Recreational fishing is a major part of the economy in Astoria.
- Grain exports (#1 wheat exporter) and car imports (#2 west coast) are important cargos.
- Large shipyard and largest floating dry-dock in the country that serves Naval and commercial vessels.

Existing Mitigations:

- Grain storage capacity allows for some resiliency in the bulk shipping industry.
- Rail system can transport come cargo in the event of an incident in the port or waterway.
- Overall very few mitigation measures for economic impacts.
- Pacific Northwest Waterway Association provides information and visibility on economic importance of port.

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>Navigation / 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>Radio 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 risk mitigation strategies.

Appendix D

Additional Risk Intervention Strategies

Commercial Fishing Vessel Quality

- Make concerted efforts to involve commercial fisherman in established committees and meetings.
- Better advertise harbor safety committee meetings.
- Increase enforcement activities.
- Make safety or informational broadcasts targeted at the fishing fleet. For example, where fishing is taking place or reminders to extinguish deck lights when transiting in the channel.
- Pass out informational fliers to the fishing fleet about the Harbor Safety Plan.
- Remove boater education exemption for commercial fishing vessels.

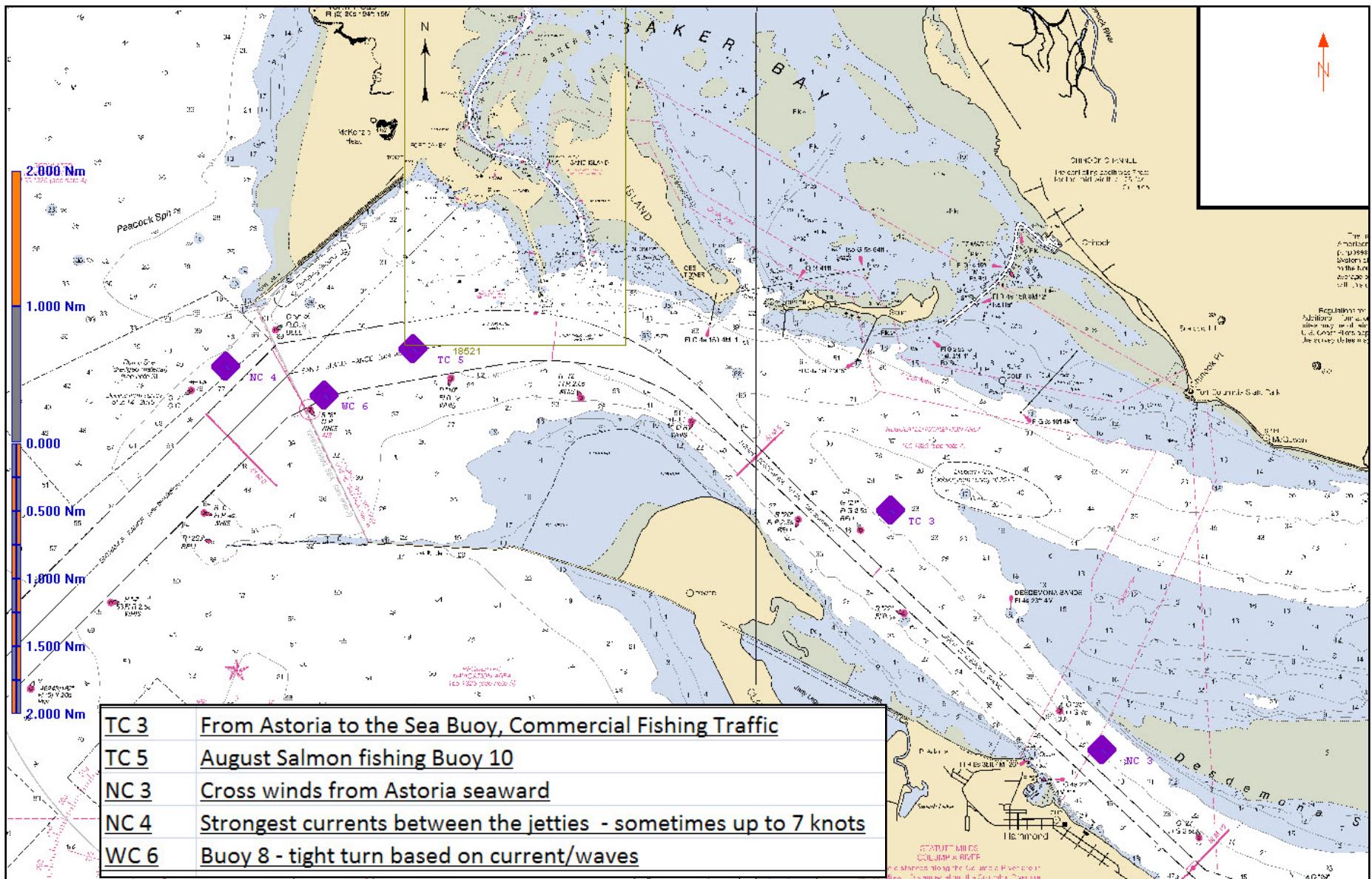
Small Craft Quality

- Support potential legislation that requires permits for human powered vessel operation. Permit could have an educational component.
- Leverage social media to provide educational outreach to recreational boaters.
- Work with manufacturers of small crafts to install educational signage on vessels.
- Continue and expand enforcement through the Make Way program.
- Tailor existing boater safety courses to navigating on the Columbia River.

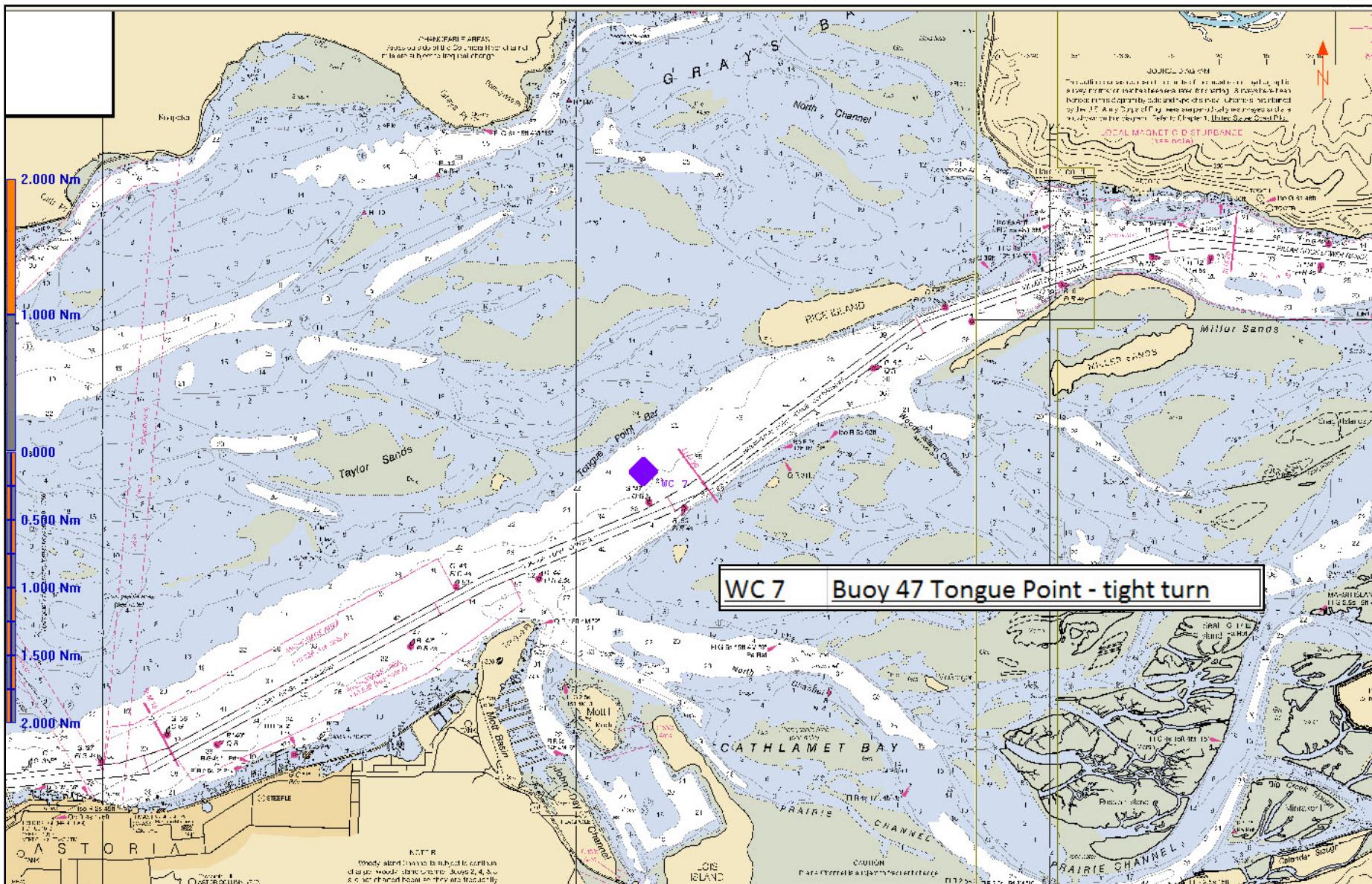
Volume of Small Craft Traffic

- Pay special attention to the permitting of events (especially at congested areas, such as Tom McCall Waterfront Park) which may have a waterway impact.
- Ensure sponsors seek marine event permits when necessary.
- Require sponsors to install temporary markers to reduce risk to waterway users.
- Continue and expand enforcement through Make Way program.
- Reach out to problem users such as gill netters, crabbers, and hog liners.
- Increase BUI enforcement and apply political pressure to pursue convictions.
- Dredge the active recreational areas to a reasonable depth.

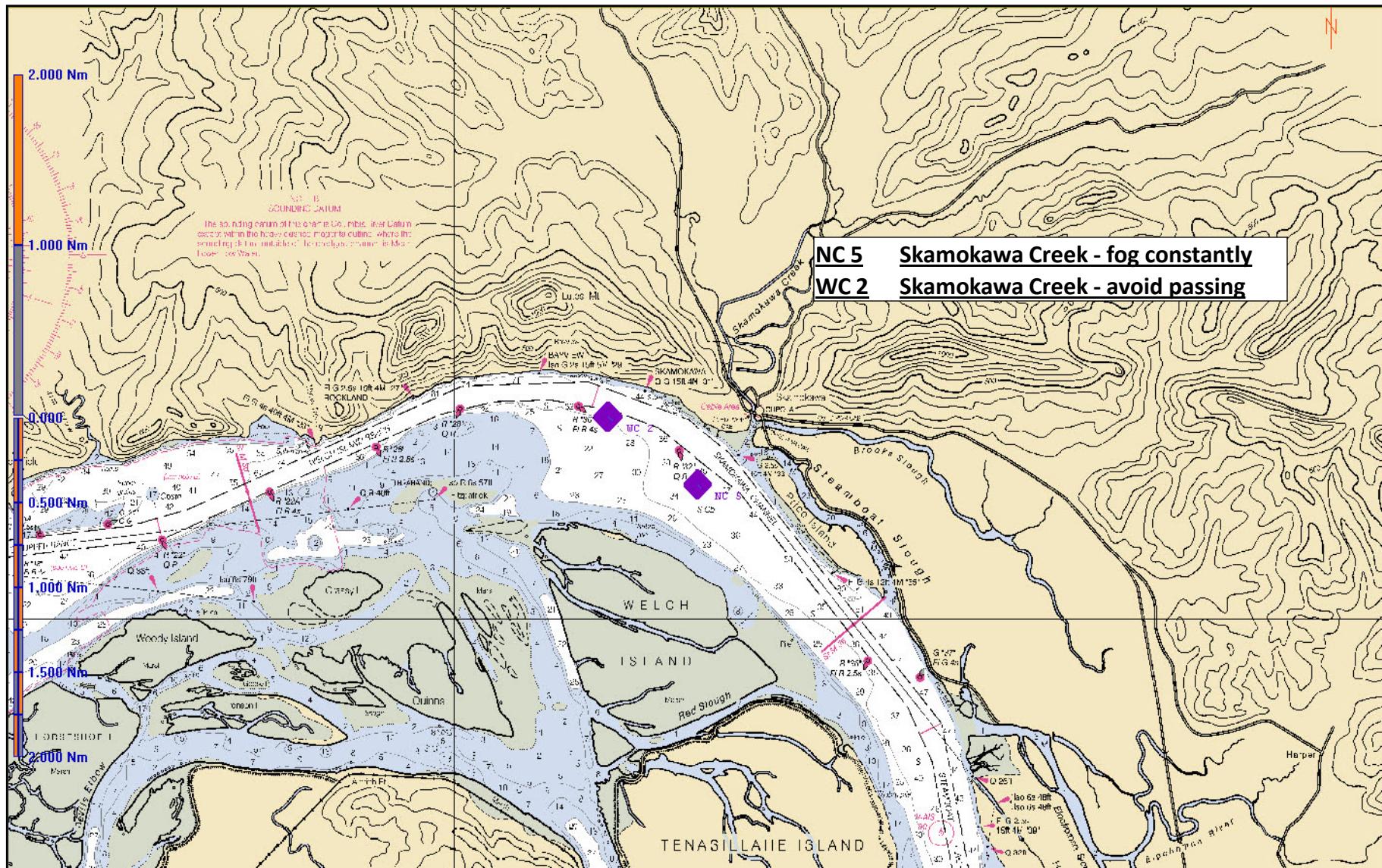
Appendix E - Figure 1- Columbia River Entrance



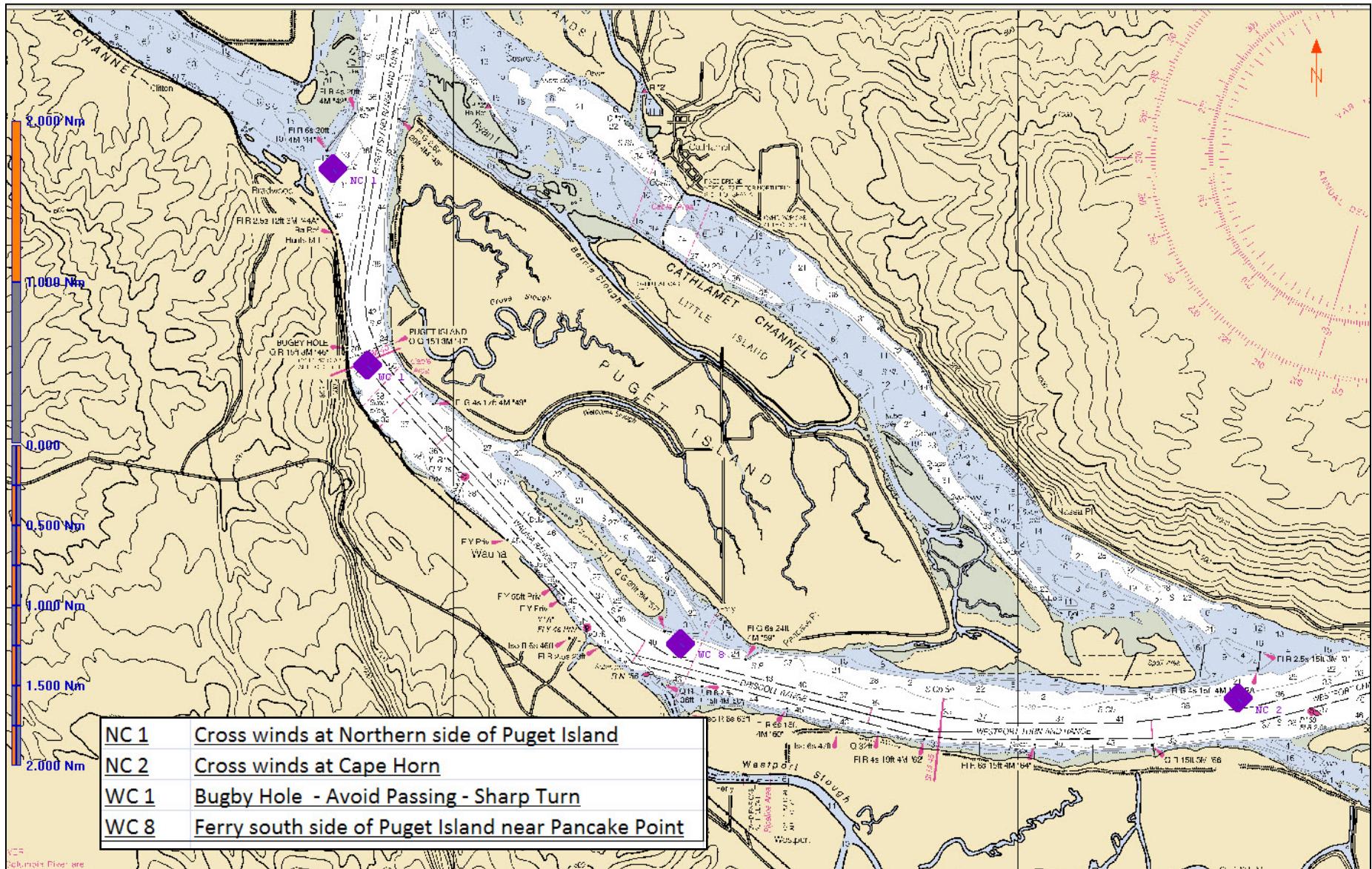
Appendix E - Figure 2 - Buoy 47 - Tongue Point



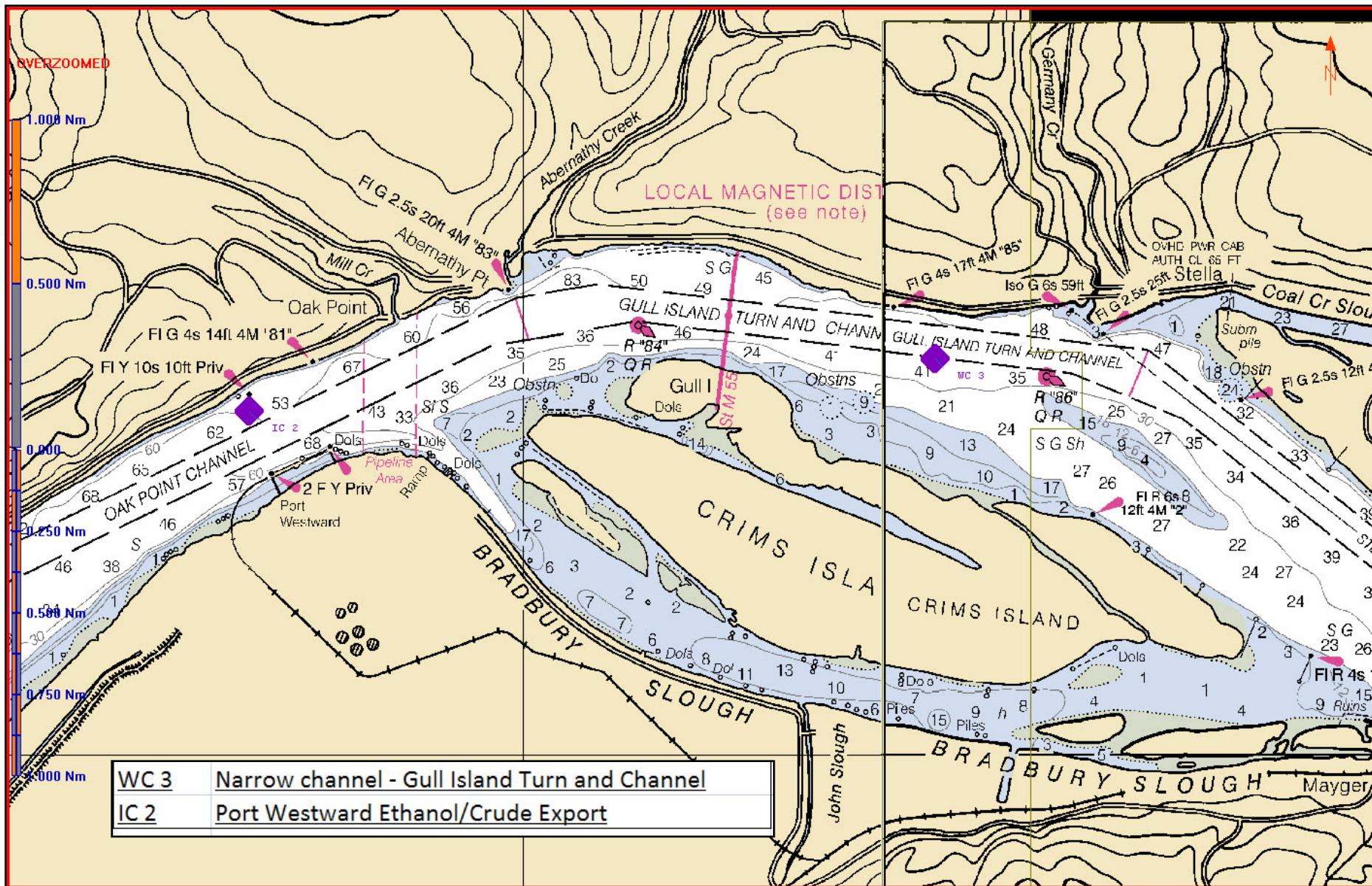
Appendix E - Figure 3 - Skamokawa Creek



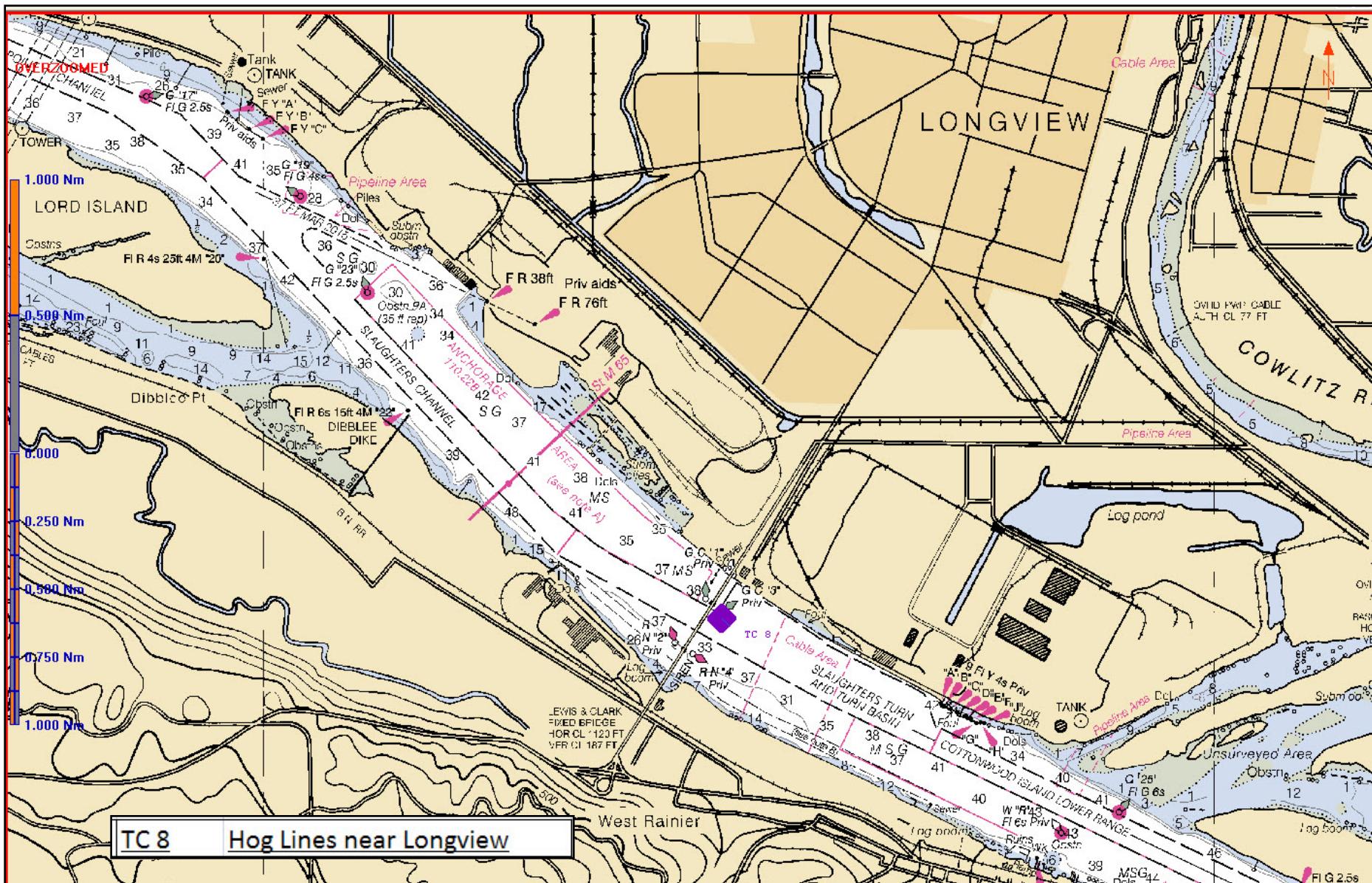
Appendix E - Figure 4 - Puget Island



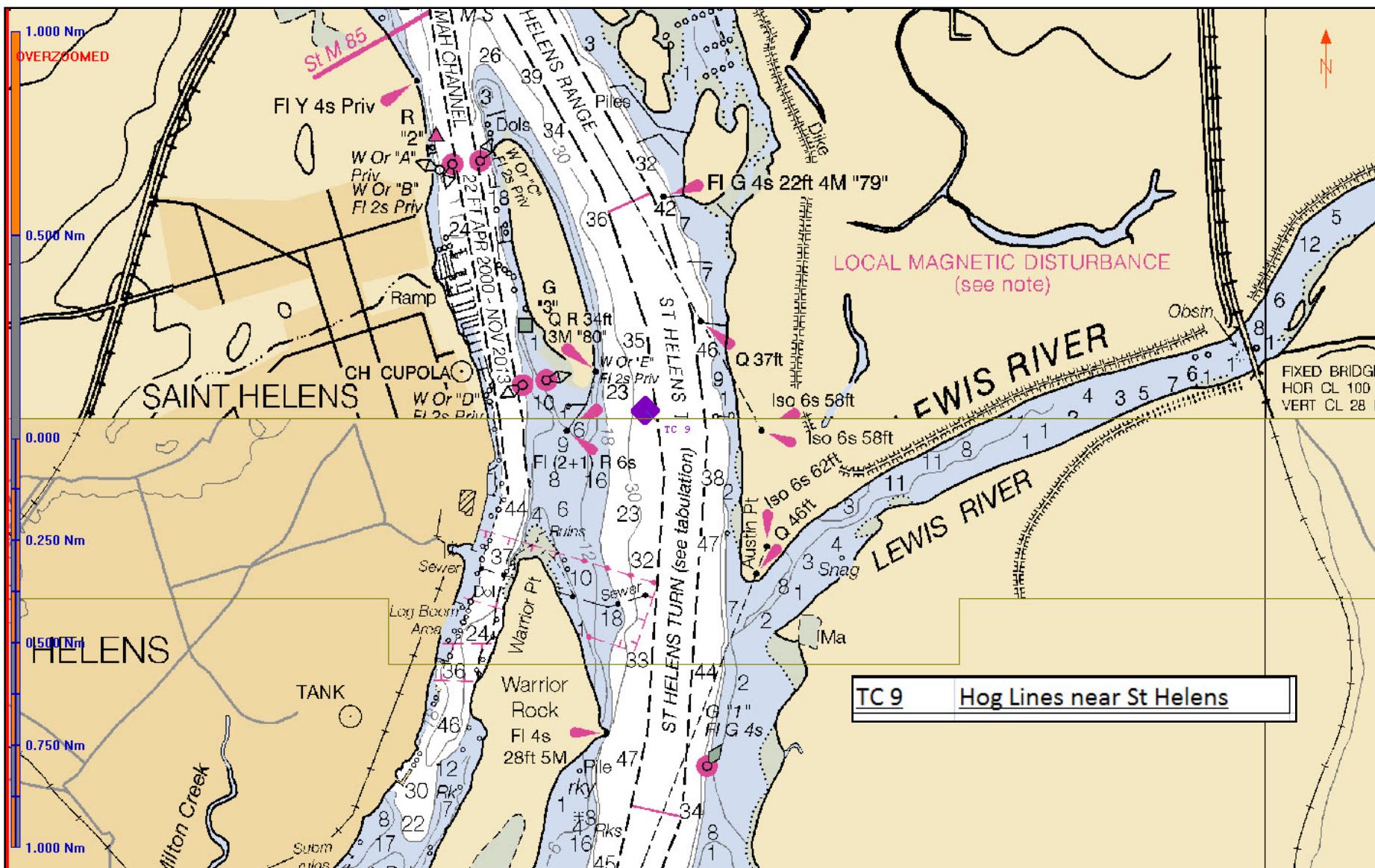
Appendix E - Figure 5 - Gull Island Turn and Channel



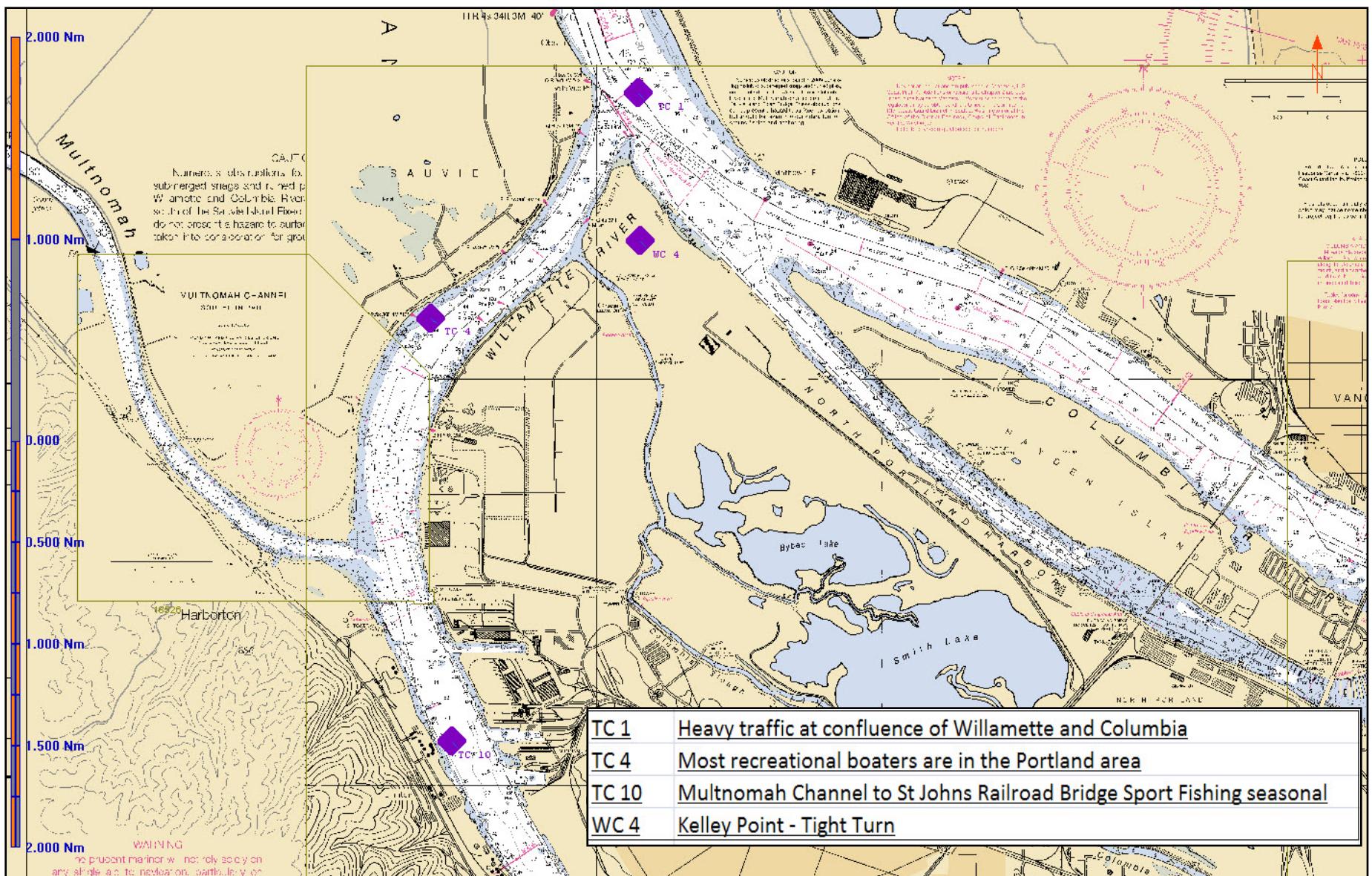
Appendix E - Figure 6 - Longview



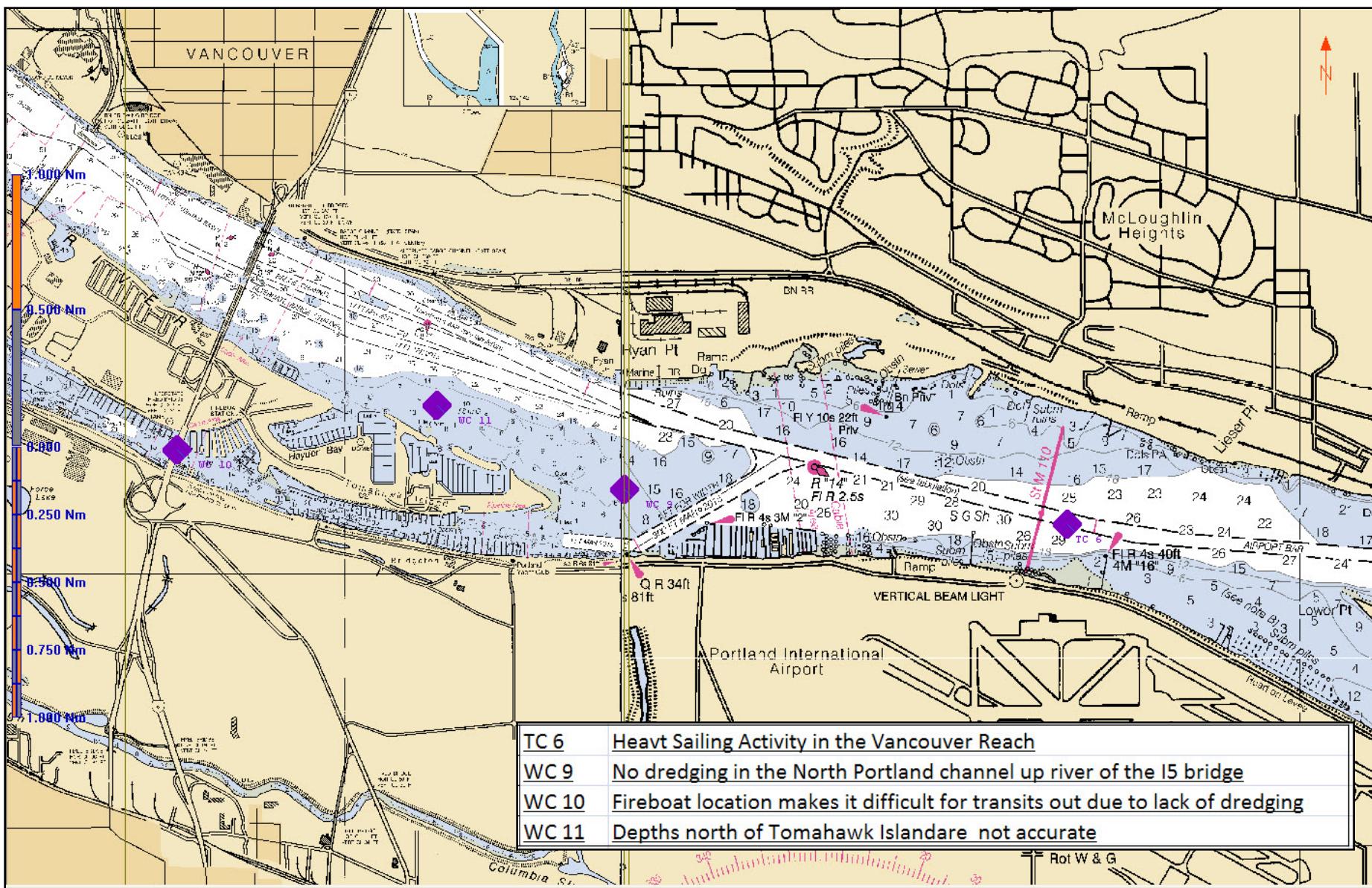
Appendix E - Figure 7 - Saint Helens



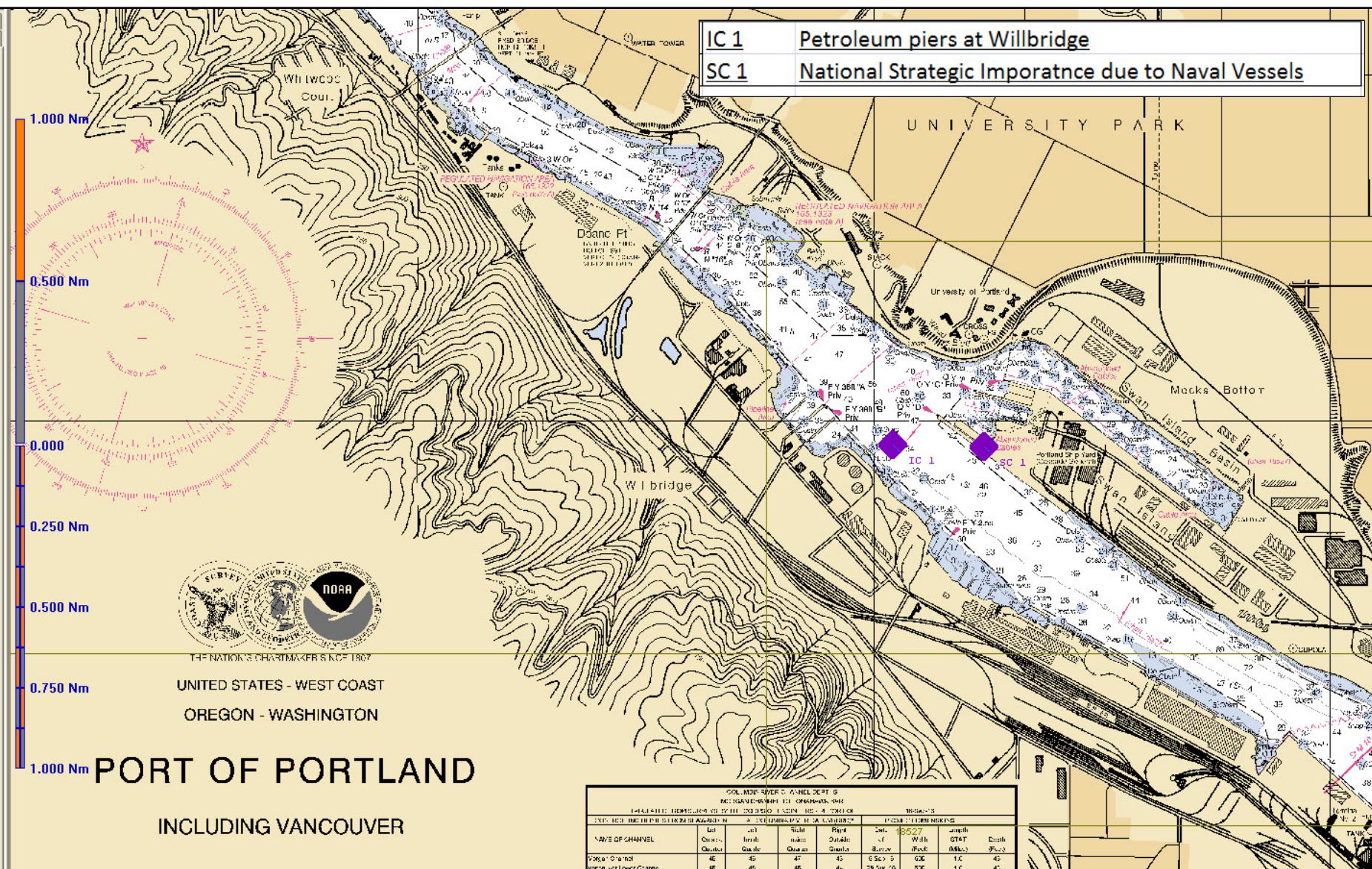
Appendix E - Figure 8 - Columbia River / Willamette River Junction



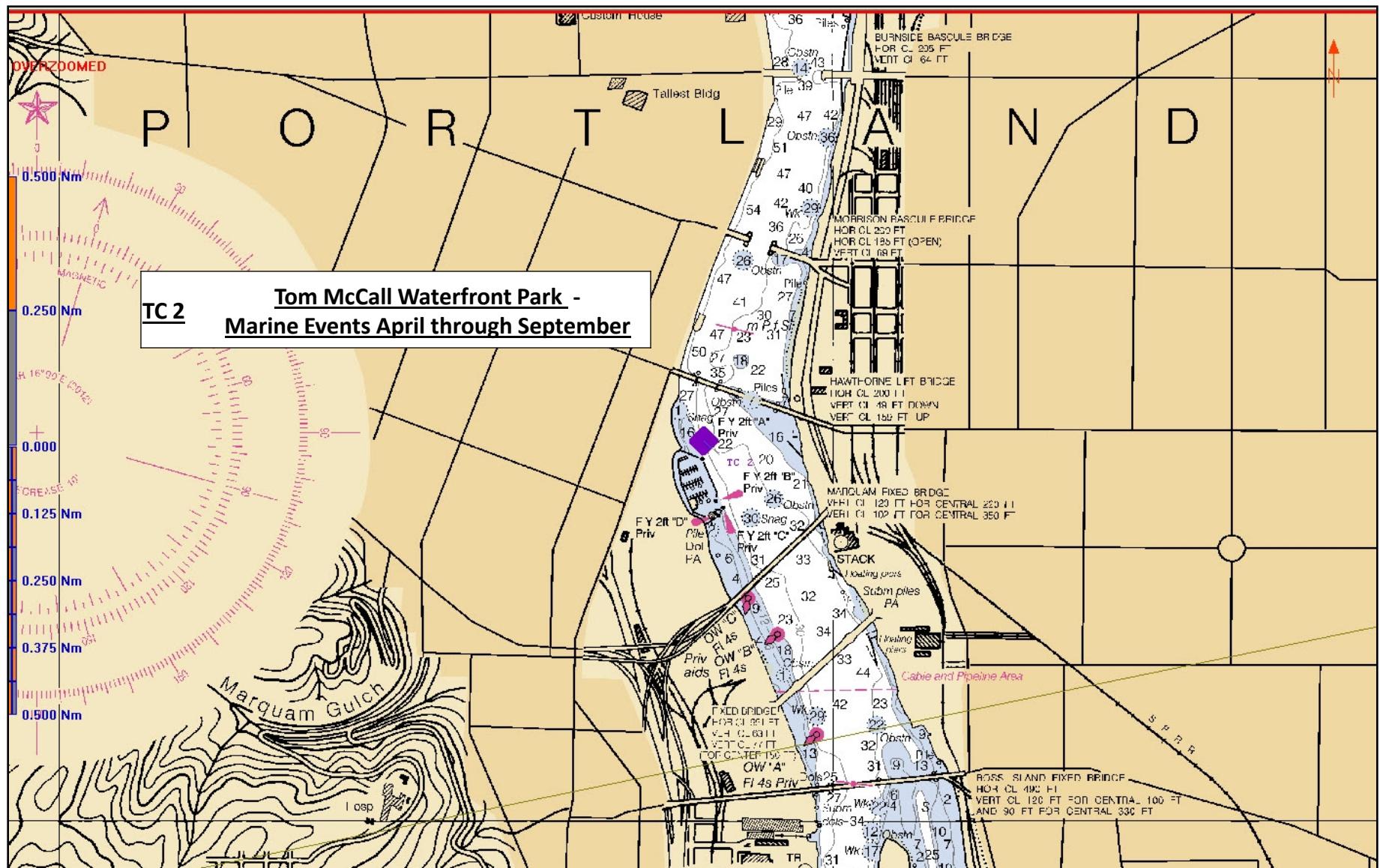
Appendix E - Figure 9 - Columbia River - Portland



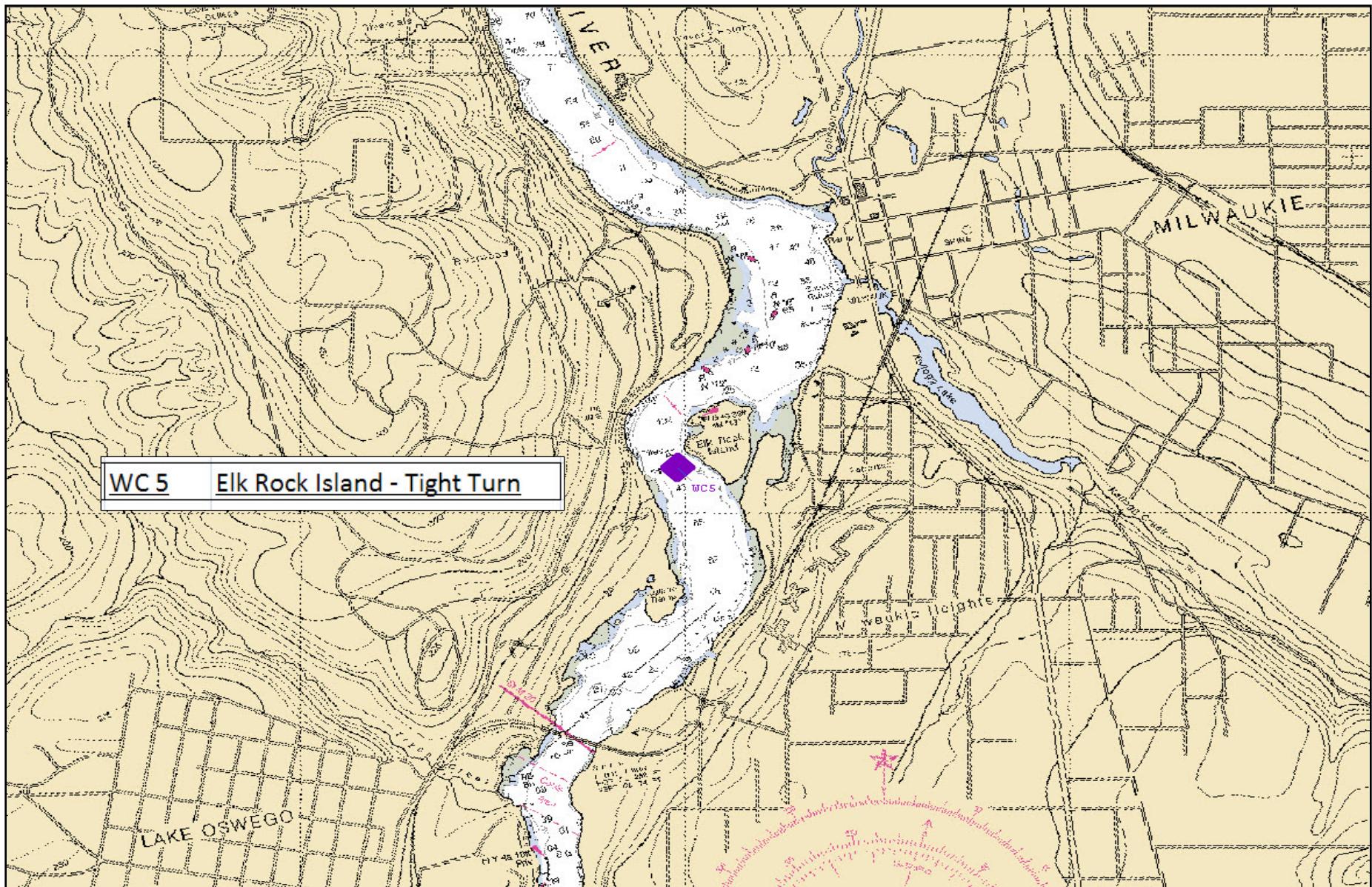
Appendix E - Figure 10 - Port of Portland



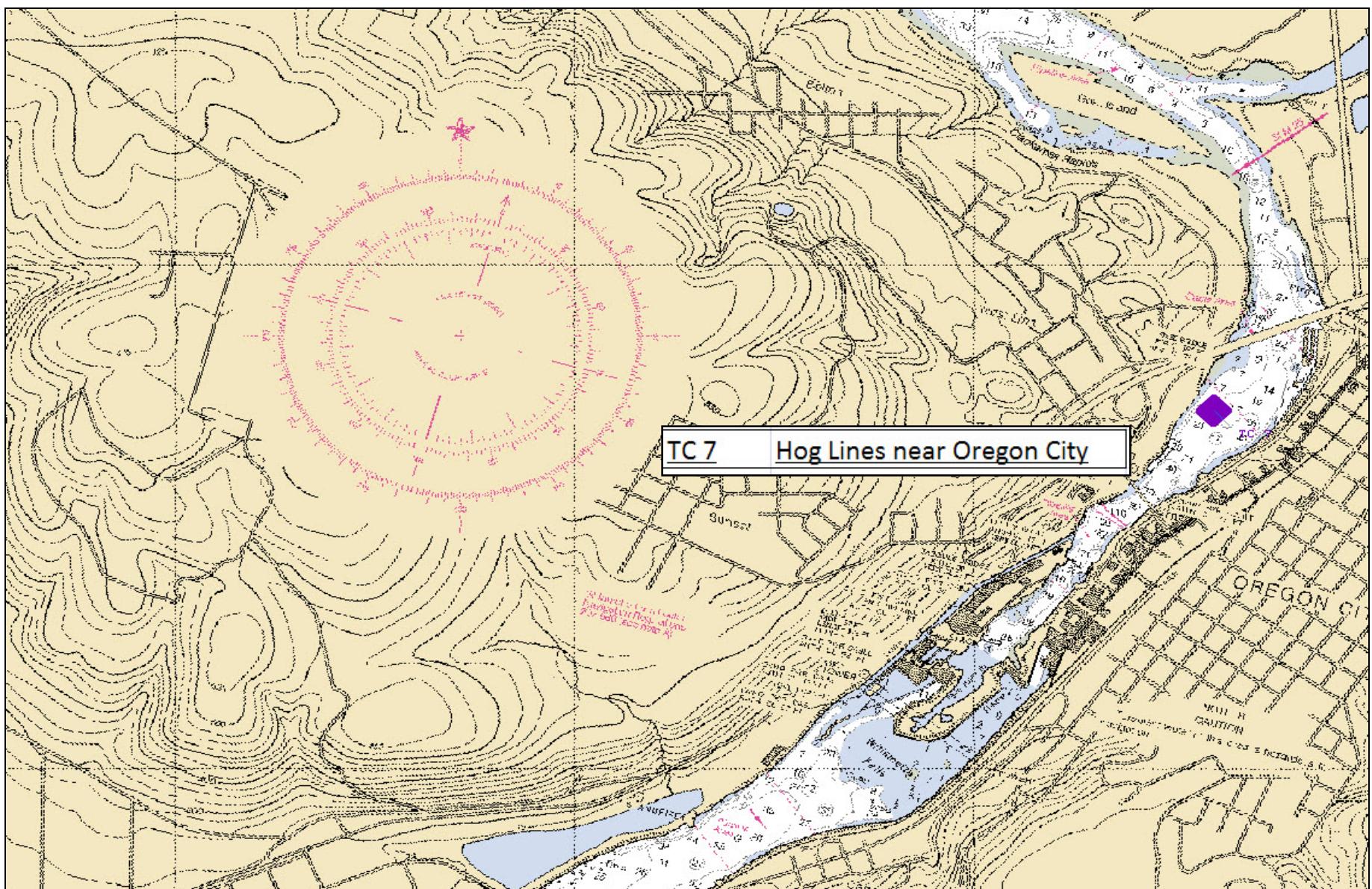
Appendix E - Figure 11 - Portland City Center



Appendix E - Figure 12 - Willamette River - Elk Rock Island



Appendix E - Figure 13 - Oregon City



Appendix F

References / Best Practices

Vessel Operations	Navigation Safety	Statistics
Oregon State Marine Board https://www.oregon.gov/OSMB/Pages/index.aspx	U.S. Navigation Rules http://www.navcen.uscg.gov/?pageName=navRuleChanges	Recreational Boating Safety - Accident Statistics http://www.uscdboating.org/statistics/accident_statistics.php
American Canoe Association http://www.americancanoe.org/	USCG Auxiliary -Requirements -Recreational Boats http://www.cgaux.org/boatinged/classes/2011/bss.php	U.S. Army Corps of Engineers - Vessel Transit Statics http://www.navigationdatacenter.us/
US Coast Guard - Vessel Inspection Regulations http://www.ecfr.gov/cgi-bin/ECFR?page=browse	State-Specific Boating Safety Requirements http://www.americasboatingcourse.com/lawsbystate.cfm	The American Waterways Operators http://www.americanwaterways.com/
U.S. Army Corps of Engineers General Regulatory Policies - Permitting http://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Federal-Regulation/	National Oceanic and Atmospheric Administration Safe Boating Weather Tips http://www.nws.noaa.gov/om/brochures/safeboat.htm	Oregon Recreational Boating Accidents Statistics https://www.oregon.gov/OSMB/SiteCollectionDocuments/AccidentFatalityStats/2015AccidentStats.pdf
	Life Lines Brochure - Safety Tips That Could Save Your Life http://www.americanwaterways.com/commitment_safety/life_lines.pdf	