

Port Everglades, Florida Workshop Report

Introduction

A Port Risk Assessment Workshop was conducted for the Port Everglades on July 26-27, 2000. This workshop report provides the following information:

- Brief description of the process used for the assessment;
- List of participants;
- Numerical results from the Analytic Hierarchy Process (AHP)¹;
- Summary of risks and mitigations discussion, and
- Port Profile for Port Everglades.

Strategies for reducing unmitigated risks will be the subject of a separate report.

Assessment Process

The risk assessment process is a structured approach to obtaining expert judgments on the level of waterway risk. The process also addresses the relative merits of specific types of Vessel Traffic Management (VTM) improvements for reducing risk in the port. Based on the Analytic Hierarchy Process (AHP), the port risk assessment process uses a select group of experts/stakeholders in each port to evaluate waterway risk factors and the effectiveness of various VTM improvements. The process requires the participation of local Coast Guard officials before and throughout the workshops. Thus the process is a joint effort involving waterway users, stakeholders, and the agencies/entities responsible for implementing selected risk mitigation measures.

This methodology employs a generic model of port risk that was conceptually developed by a National Dialog Group on Port Risk and then translated into computer algorithms by the Volpe National Transportation Systems Center. In that model, risk is defined as the sum of the probability of a casualty and its consequences. Consequently, the model includes variables associated with both the causes and the effects of vessel casualties. Because the risk factors in the model do NOT contribute equally to overall port risk, the first session of each workshop is devoted to obtaining expert opinion about how to weight the relative contribution of each variable to overall port risk. The experts then are asked to establish scales to measure each variable. Once the parameters have been established for each risk-inducing factor, each port's risk is estimated by putting into the computer risk model specific values for that port for each variable. The computer model allows comparison of relative risk and the potential efficacy of various VTM improvements between different ports.

¹ Developed by Dr. Thomas L. Saaty, et al, to structure complex decision making, to provide scaled measurements, and to synthesize many factors having different dimensions.

Report Documentation Page				Form Approved OMB No. 0704-0188	
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1. REPORT DATE JUL 2000		2. REPORT TYPE		3. DATES COVERED 00-00-2000 to 00-00-2000	
4. TITLE AND SUBTITLE Port Risk Assessment Port Everglades, FL				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Coast Guard Academy ,31 Mohegan Avenue ,New London ,CT,06320-8103				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 31	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

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The following is a list of stakeholders/experts that participated in the process:

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Numerical Results

Book 1 – Risk Categories (*Generic Weights Sum to 100*)

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Immediate Consequences	Subsequent Consequences
19.2	17.9	12.3	6.3	24.0	20.3

Analysis:

Book 1 begins the process of weighting the national port risk model. The participant teams contribute their knowledge, using the AHP process, to provide weights to the six major risk categories. The contribution to the national model by the Port Everglades participants is as listed above. These participants felt that Immediate Consequences was the largest driver of risk. Waterway Configuration was a significantly lower influence.

Book 2 - Risk Factors (*Generic Weights*)

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Immediate Consequences	Subsequent Consequences
19.2	17.9	12.3	6.3	24.0	20.3

% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Volume of Passengers	Economic Impacts
15.1	4.6	3.7	1.2	6.8	3.1
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Channel Width	Volume of Petroleum	Environmental Impacts
4.1	2.1	5.2	2.6	8.4	4.8
	Vol. Fishing & Pleasure Craft	Tide and River Currents	Channel & Bottom	Volume of Chemicals	Health & Safety Impacts
	4.9	2.0	1.2	8.8	12.4
	Traffic Density	Ice Conditions	Waterway Complexity		
	6.3	1.4	1.3		

Analysis:

Book 2 further refines the weighting for the national port risk model. The participants examined the importance to port safety for each of the 20 risk factors and provided the above results to the national model. They determined that the following factors contribute the most to overall risk under each of the six major categories:

- Fleet Composition: High-Risk Deep Draft Vessels contribute the highest amount of risk.
- Traffic Conditions: Traffic Density contributes the sixth-highest amount of risk.
- Navigational Conditions: Visibility Conditions contributes the seventh-highest amount of risk.
- Waterway Configuration: Channel Width is the most important contributor to risk in this category.
- Immediate Consequences: The Volume of Chemicals contributes the third-highest amount of risk, the Volume of Petroleum contributes the fourth-highest amount of risk and the Volume of Passengers contributes the fifth-highest amount of risk.
- Subsequent Consequences: Health and Safety Impacts contribute the second-highest amount of risk.

Book 3 Factor Scales - Condition List (*Generic*)

	<i>Scale Value</i>
Wind Conditions	
a. Severe winds < 2 days / month	1.0
b. Severe winds occur in brief periods	2.8
c. Severe winds are frequent & anticipated	4.9
d. Severe winds occur without warning	9.0
Visibility Conditions	
a. Poor visibility < 2 days/month	1.0
b. Poor visibility occurs in brief periods	2.5
c. Poor visibility is frequent & anticipated	4.7
d. Poor visibility occurs without warning	9.0
Tide and River Currents	
a. Tides & currents are negligible	1.0
b. Currents run parallel to the channel	2.3
c. Transits are timed closely with tide	5.0
d. Currents cross channel/turns difficult	9.0
Ice Conditions	
a. Ice never forms	1.0
b. Some ice forms-icebreaking is rare	2.2
c. Icebreakers keep channel open	5.1
d. Vessels need icebreaker escorts	9.0
Visibility Obstructions	
a. No blind turns or intersections	1.0
b. Good geographic visibility-intersections	2.4
c. Visibility obscured, good communications	5.0
d. Distances & communications limited	9.0

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Channel Width

- | | |
|---|-----|
| a. Meetings & overtakings are easy | 1.0 |
| b. Passing arrangements needed-ample room | 2.8 |
| c. Meetings & overtakings in specific areas | 6.4 |
| d. Movements restricted to one-way traffic | 9.0 |

Bottom Type

- | | |
|--|-----|
| a. Deep water or no channel necessary | 1.0 |
| b. Soft bottom, no obstructions | 1.8 |
| c. Mud, sand and rock outside channel | 4.9 |
| d. Hard or rocky bottom at channel edges | 9.0 |

Waterway Complexity

- | | |
|--|-----|
| a. Straight run with NO crossing traffic | 1.0 |
| b. Multiple turns > 15 degrees-NO crossing | 2.7 |
| c. Converging - NO crossing traffic | 4.9 |
| d. Converging WITH crossing traffic | 9.0 |

Passenger Volume

- | | |
|---|-----|
| a. Industrial, little recreational boating | 1.0 |
| b. Recreational boating and fishing | 3.1 |
| c. Cruise & excursion vessels-ferries | 6.0 |
| d. Extensive network of ferries, excursions | 9.0 |

Petroleum Volume

- | | |
|---------------------------------------|-----|
| a. Little or no petroleum cargoes | 1.0 |
| b. Petroleum for local heating & use | 2.7 |
| c. Petroleum for transshipment inland | 5.3 |
| d. High volume petroleum & LNG/LPG | 9.0 |

Chemical Volume

- | | |
|---------------------------------------|-----|
| a. Little or no hazardous chemicals | 1.0 |
| b. Some hazardous chemical cargo | 2.4 |
| c. Hazardous chemicals arrive daily | 5.2 |
| d. High volume of hazardous chemicals | 9.0 |

Economic Impacts

- | | |
|-----------------------------------|-----|
| a. Vulnerable population is small | 1.0 |
| b. Vulnerable population is large | 3.5 |
| c. Vulnerable, dependent & small | 5.4 |
| d. Vulnerable, dependent & large | 9.0 |

Environmental Impacts

- | | |
|--------------------------------------|-----|
| a. Minimal environmental sensitivity | 1.0 |
| b. Sensitive, wetlands, VULNERABLE | 3.1 |
| c. Sensitive, wetlands, ENDANGERED | 5.8 |
| d. ENDANGERED species, fisheries | 9.0 |

Health and Safety Impacts

- | | |
|--|-----|
| a. Small population around port | 1.0 |
| b. Medium - large population around port | 2.6 |
| c. Large population, bridges | 5.6 |
| d. Large DEPENDENT population | 9.0 |

Analysis:

The purpose of Book 3 is for the participants to calibrate a risk assessment scale for each risk factor. For each risk factor there is a low (Port Heaven) and a high (Port Hell) severity limit, which are assigned values of 1.0 and 9.0 respectively. The participants determined numerical values for two intermediate qualitative descriptions between those two extreme limits. On average, participants from this port evaluated the difference in risk between the lower limit (Port Heaven) and the first intermediate scale point as being equal to 1.6; the difference in risk between the first and second intermediate scale points was equal to 2.7; and the difference in risk between the second intermediate scale point and the upper risk limit (Port Hell) was 3.8.

Book 4 - Risk Factor Ratings (*Port Everglades*)

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Immediate Consequences	Subsequent Consequences
11.8	26.6	14.2	29.5	17.0	16.5

% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Volume of Passengers	Economic Impacts
5.7	5.7	3.6	4.4	5.8	5.3
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Channel Width	Volume of Petroleum	Environmental Impacts
6.1	5.8	2.1	7.4	8.7	7.4
	Vol. Fishing & Pleasure Craft	Tide & River Currents	Bottom Type	Volume of Chemicals	Health & Safety Impacts
	7.1	7.5	9.0	2.5	3.8
	Traffic Density	Ice Conditions	Waterway Complexity		
	8.0	1.0	8.7		

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Analysis:

This is the point in the workshop when the process begins to address local port risks. The participants use the scales developed in Book 3 to assess the absolute level of risk in their port for each of the 20 risk factors. The values shown in the preceding table do NOT add up to 100. Based on the input from the participants, the following are the top risks to port safety in Port Everglades (in order of importance):

1. Bottom Type (9.0)
2. Waterway Complexity (8.7)
2. Volume of Petroleum (8.7)
4. Traffic Density (8.0)
5. Tide and River Currents (7.5)
6. Channel Width (7.4)
6. Environmental Impacts (7.4)
8. Volume of Fishing and Pleasure Craft (7.1)

Book 5 - VTM Tools (*Port Everglades*)

Fleet Composition		Traffic Conditions		Navigation Conditions		Waterway Configuration		Immediate Consequences		Subsequent Consequences	
% High Risk Deep Draft		Volume Deep Draft		Wind Conditions		Visibility Obstructions		Volume of Passengers		Economic Impacts	
10	1.4	14	0.6	19	-0.5	12	0.7	15	0.2	13	0.7
IRR	ALERT	RA		RA		RA	ALERT	RA		RA	ALERT
% High Risk Shallow Draft		Volume Shallow Draft		Visibility Conditions		Channel Width		Volume of Petroleum		Environmental Impacts	
6	2.2	11	0.9	18	-0.3	8	2.0	9	1.8	7	2.1
IRR		RA		RA		IRR	ALERT	RA		OTH	
		Vol. Fishing & Pleasure Craft		Tide & River Currents		Bottom Type		Volume of Chemicals		Health & Safety Impacts	
		2	3.2	5	2.4	1	3.6	20	-0.5	17	-0.1
		IRR		IDI		OTH		RA		RA	
		Traffic Density		Ice Conditions		Waterway Complexity					
		4	2.6	16	0.0	3	3.1				
		IRR	ALERT	RA		IDI	ALERT				

Legend:

See the **KEY** (below). Rank is the position of the Risk Gap for a particular factor relative to the Risk Gap for the other factors as determined by the participants. Risk Gap is the variance between the existing level of risk for each factor determined in Book 4 and the average acceptable risk level as determined by each participant team. Negative numbers imply that the risk level could INCREASE and still be acceptable. The teams were instructed as follows: *If the acceptable risk level is equal to or higher than the existing risk level for a particular factor, circle RA (Risk Acceptable). If the mitigation needed does not fall under one of the VTM tools, circle OTH (Other) at the end of the line. Otherwise, circle the VTM tool that you feel would MOST APPROPRIATELY reduce the unmitigated risk to an acceptable level.*

The tool listed is the one determined by the majority of participant teams as the best to narrow the Risk Gap. An **ALERT** is given if no mathematical consensus is reached for the tool suggested. Below are the tool acronyms and tool definitions.

KEY		RA	Risk Acceptable	IDI	Improve Dynamic Nav Info
Risk Factor		IAN	Improve Aids to Navigation	VTIS	Vessel Traffic Information System
		ICM	Improve Communications	VTS	Vessel Traffic System
Rank	Risk Gap	IRR	Improve Rules and Regulations	OTH	Other – Not a VTM Solution
Tool	ALERT	ISI	Improve Static Navigation Info		

Analysis:

The results shown are consistent with the discussion that occurred about risks in the Port Everglades area. For 9 of the 14 risk factors for which there was good consensus, the participants judged the risk to be at an acceptable level already due to existing mitigation strategies.

No consensus alerts occurred for the following risk factors. Votes were split as shown:

- % High Risk Deep Draft – RA (5), IRR (5), ISI (1), VTIS (2), VTS (1)
- Traffic Density – RA (4), IRR (5), VTIS (2), OTH (3)
- Visibility Obstructions – RA (6), IAN (4), ICM (1), VTIS (3)
- Channel Width – RA (3), ICM (1), IRR (4), IDI (2), VTIS (1), VTS (1), OTH (2)
- Waterway Complexity – RA (1), IAN (2), IRR (1), ISI (1), IDI (3), VTIS (2), VTS (1), OTH (3)
- Economic Impacts – RA (7), OTH (7)

Summary of Risks

Scope of the port area under consideration: The participants defined the geographic bounds of the port area to be discussed.

1. Approach to Port Everglades begins 1 NM east of sea buoy.
2. Offshore anchorages to the north of the entrance channel.
3. Outer Bar Channel, Turning Basin, North Extension north to 17th Street Bridge, South Extension, and ICW south to and including Dania Cut Off Canal and Port Lau Dania.

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RISK FACTORS	RISKS	MITIGATIONS
<u>Fleet Composition</u>		
% High Risk Deep Draft Cargo & Passenger Vessels	Today: • 12,000 ship movements per year in deep draft category; 30% presented risk due to size of ship • General grouping of potential problems affect 60 to 70% of ships in this group: 1. Age of ship 2. 30% due to draft 3. Drug and alcohol abuse 4. Maneuvering characteristics • High quality low risk ships: 1. Very few Category I vessels. 2. Category II vessels boarded once a year regardless of whether good or bad quality. 3. Passenger ships are boarded quarterly and are Category III and IV • Majority of cargo ships are Category II or higher, less than 10 deficiencies per year average • Large ships with crew issues: language, knowledge • 85% of cargo vessels are deep draft • Port Everglades experience at least one ship with a mechanical problem each day; 10 % have mechanical problems • Tanker crew: competency problems represent 15% 1. Do not conform to STCW 2. Language barrier significant problem for foreign flag tankers • Container ships predominantly foreign flag • Maneuvering characteristics. Older ships designed to go fast at sea, not turn or otherwise maneuver at slow speed. Two passenger ships use port that fit this category. Maersk has some container ships that fit this category. Considered a very high risk. For these ships, tugs for assist are of marginal value in checking . • Note: large vessels, even in good condition, are considered risks because of the restricted size of the waterway	Existing mitigations: • Most cruise ships are less than 2 years old • Large tankers with competent crews • Large passenger ships with competent crews • Tugs used with 70% of ships which use port New mitigation: • Not discussed

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RISK FACTORS	RISKS	MITIGATIONS
Fleet Composition (Continued)		
% High Risk Shallow Draft Cargo & Passenger Vessels	Today: • 90% of recreational boaters do not have good knowledge, especially through cut • 100% of the jet ski recreational craft show poor judgment/knowledge • Sea-Tow and Offshore Towing tow 4,000 boats per year • Recreational boats including jet skis: 1. Estimated that 25 to 30% are of questionable competence and at risk based on law enforcement boardings; ignorance of operators affecting operations in entrance channel and turning basin 2. 50% of boats have safety or other regulation deficiencies 3. Once per day recreational boat puts itself at risk with Sun Cruz catamaran 4. Recreational boaters do not perceive themselves as causing risk or in danger 5. Jet skis slap the hull of passenger vessels 6. Alcohol related accidents estimated at 25 to 30% of total 7. Pilots report at least one incident during each ship movement and have to assure captain that his ship must keep going straight and the recreational boat will have to move. Cases where engines breakdown and people jump into the water 8. Limited access to ocean. Next access is Haulover Inlet to south and Hillsboro Inlet to the north 9. Lots of educational courses available, but few are taken 10. Material condition of recreational boats is poor; frequently break down; pilot boats have to tow them out of the way 11. Recreational boats ignore speed signs • Water-taxi boats do not present a particular risk • Coastal freighters do not present a particular risk • Fishing boats: not specifically discussed	No mitigation factors were discussed.

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RISK FACTORS	RISKS	MITIGATIONS
<u>Traffic Conditions</u>		
Volume of Deep Draft Vessels	Today: - Weekends 4 to 6 cruise ships line up to depart within 2-hour period - Estimate 20 minute transit for deeper draft tankers - Arrivals also—several ships jockey for entrance within small window of time - Container ships: size limited by depth of channel - Number of tank ship transits; CITGO sees seasonal changes rather than growth. - Draft for tankers restricted to 38 feet except for Berth 5, which is 39 feet - No commercial fisheries in port Trends: - Traffic levels growing at 5 to 10% per year - Tonnage, length and beam as well as draft will be a significant factor to consider - LOA approaching 1200 feet - Cruise ships now seasonal; next summer will have year-round schedule. Increasing ships from 1 to 3 berthed in Port Everglades - Port-wide trend is slow increase in volume; 112 million bbls now - Number of ships does not change but size of ships is increasing - Trend for shallow draft inter-island freighters is to be displaced by larger ships which berth in Port Everglades - Pier 12 may accommodate passenger vessels	Existing mitigations: - Pilots coordinate departure and arrival times and order for ships - Discussion to dredge channel to 42 feet - One-way traffic for tankers New mitigation: - Not discussed

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RISK FACTORS	RISKS	MITIGATIONS
<u>Traffic Conditions</u> (Continued)		
Volume of Shallow Draft Vessels	Today: Caribbean coastal vessels, offshore fishing vessels, OSVs, ferries • OSVs for fuel only; no rigs offshore • 3,000 movements per year. • Very little commercial fishery activity in Port Everglades	No mitigation factors were discussed.

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RISK FACTORS	RISKS	MITIGATIONS
Traffic Conditions (Continued)		
Volume of Fishing & Pleasure Craft	Today: • Recreational boat activity increasing. 44,000 registered watercraft in Broward County • Launch areas: Many are trailered in. Launch sites include: 15th Street ramp, John Lloyd Park ramp, Dania Cut Off Canal in Harbor Town. Dry storage at Hot Water Canal. • Transits through port waterways to entrance • Seasonal (especially during winter months) • Major sight seeing; transits from north and south ICW Trend: • Recreational boating increases 5 to 10 percent per year • Trend is 16 to 26 foot size	Level of risk is for this factor is not considered to be at an acceptable level. Existing mitigations: • Fees from boat registration to fund education programs • Speed regulations • On water presence of law enforcement, especially during movement of ships • Educational pamphlets available for recreational boaters • USCG Auxiliary conducts recreational boating programs • Children under 15 cannot operate a boat or jet ski without mandatory training/license • Web available courses • Mandatory boating safety card after 1. Second violation 2. First criminal violation • Mandatory boating safety cards provide proof of experience for people who rent boats New mitigations: • Establish exclusion zones for jet skis • Improve communications infrastructure between law enforcement agencies on background checks • County ordinance for jet ski defining where they can and cannot operate; specifically address distance from port and distance from ships

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RISK FACTORS	RISKS	MITIGATIONS
Traffic Conditions (Continued)		
Traffic Density	Today: • Congestion area at times: 1. Small boats: Any major holiday; winter season with snow birds; Winter Fest Boat parade, Air-Sea Show (May), Boat shows (test-drive boats), Mini lobster season (July), fishing tournaments 2. Sunrise every Saturday and Morning at boat traffic which is also when inbound cruise ships come in 3. Long spring/summer/fall for weekend boaters 4. Fishing boats run entrance channel for fishing and diving; best fishing is on the range 5. High recreational boat traffic 1400 to 1600 daily including sport fishermen 6. Major ship congestion at sea buoy due to single ship transit through entrance channel and approaches 7. Mega-yachts not piloted; increasing traffic throughout Port. Significant congestion at 17th Street Bridge and North Extension and Dania Cut	Level of risk for this port is considered to be at an acceptable level with the exception of the recreational boaters whose knowledge is questionable. Existing mitigations: • Mandatory speed requirements • Permits and other special arrangements for special marine events • Pilots place second pilot boat on scene to clear path for commercial traffic • Local notice to mariners reporting special events • Quarterly Harbor Safety Committee meetings • Loud whistles • Aids to navigation to contain traffic flow • Seven tenths of mile precautionary area around sea buoy • Raising air draft of 17th Street Bridge to reduce openings and distribute recreational traffic density • There is congestion in cruise ships on Friday, Saturday, and Sunday but there is good orchestration and coordination of movement through harbor master's office New mitigation: • Utilize facilities 7 days a week rather than highly concentrated during 2 or 3 days during the week

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RISK FACTORS	RISKS	MITIGATIONS
<u>Navigational Conditions</u>		
Wind Conditions	Today: • By and large a low wind area, but when high winds do blow, create significant problems for ship movements • Moderate to strong winds 20-25 knots for deep draft vessels. Occur in thunderstorms as well as predictable fronts. • Occasional cold fronts, weekly, in winter with 25 knot sustained winds. Well predicted. • Summer SE winds 9 to 12 knots • Winter months 20 to 25 knots NE sustained; 30% of the time, greater than 25 knots another 10%. • Summer unpredictable afternoon thunderstorms with microbursts that include tornadoes; 3 days per week on average during summer • Onshore wind with outgoing tide in entrance channel at jetties creates 4 to 6 foot waves and 4 knot current • Winter: northerly winds, cross channel	No mitigation factors were discussed

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RISK FACTORS	RISKS	MITIGATIONS
<u>Navigational Conditions</u> (Continued)		
Visibility Conditions	Today: • Fog: not much of a problem; occurs 2 days per year • Visibility poor during thunderstorms; visibility to zero; during summer thunderstorms – 15 to 30 minutes; unpredictable - even a short “white out” period creates high risk in entrance channel and maneuvering in port	Existing mitigation: • Short run enables ships to wait out a microburst New mitigation: • None discussed

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RISK FACTORS	RISKS	MITIGATIONS
Navigational Conditions (Continued)		
Tide and River Currents	Today: • Significant current through 17th Street Bridge on ebb tide • Cross current of 2 to 2.5 knots between entrance and sea buoy. For large ships, that represents 25% of approach speed which affects course and set. Can be north or south depending upon where Gulf Stream is. Can shift three times in the course of one transit. • At sea buoy and beyond can be 5 knots. • Sea buoy cross current makes approach to channel difficult at times. Sometimes get a counter current to the south! Sometimes get counter currents at lower depths. Ship hull responds to stronger current • Jetties on a flood tide have two cross currents- inner to south, outer is to north which creates turning vortex. Can set boats on beach at light #12 • Heavy rains in summer create stronger than normal ebb tides • Water management areas also impact ebb tide flow: Dania Cut and New River • Tankers create swirls in basin as they enter tank slips; goes from 1.5 knot at one end to 0 current at other. • Turning notch at Dania Cut. Confined area with both tidal and man-made currents which can be unpredictable 1.2 million gallons of water in and out at power generation plant	Level of risk for this port is considered to be acceptable. Existing mitigations: • Doppler current meter outside Buoy #2. Goes to pilot office, which relays information to pilots • University weather buoy 3 miles offshore • Range (help detect drift left/right in the channel) • Local knowledge of pilots and other port users • Tug assistance available New mitigations: • Install additional real time current meters in selected parts of the port • Coordinate with Water Management district for opening floodgates. • Raise height of lower range light
Ice Conditions	• Not applicable for Port Everglades.	

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RISK FACTORS	RISKS	MITIGATIONS
<u>Waterway Configuration</u>		
Visibility Obstructions	Today: - Blind corners: - North of USCG station at Buoy #9 - North of restaurant at _____ - Dania Canal junction with ICW 17th Street Bridge - Knuckle in ICW at Berths 25 and 26 - Jetties for low bridge boats and recreational boats - Background lights - Interfere with sea buoy, entrance channel buoys for approaching ships	Existing mitigations: - Existing bridge-to-bridge radio communications - Range lights adequately visible New mitigation: - None discussed

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Port Risk Assessment Port Everglades, FL

RISK FACTORS	RISKS	MITIGATIONS
<u>Waterway Configuration</u> (Continued)		
Channel Width	Today: • 500 feet outside jetties • 450 feet inside jetties • ICW is 500 feet • Commercial traffic one-way only	Level of risk is acceptable for this port. Existing mitigations: • One-way traffic • Tug assistance available • VHF/FM communications between ships • Exclusive use of waterway when a tanker is moving • Pilot station controls vessel movements through communications with pilots on board transiting ships • Harbor Master utilizes pilot and tug information to manage port movements • Ocean-going yachts read and comply with Coast Pilot requirements to get Harbor Master permission before entering the port New mitigation: • None discussed

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RISK FACTORS	RISKS	MITIGATIONS
Waterway Configuration (Continued)		
Bottom Type	Today: • Hard rock (oleolithic limestone) banks, very sheer and unforgiving. Vertical walls, blasted from outside jetties into and through the port • Anchor holding poor to non-existent • Cable crossing areas: Buoy #3, just inside breakwaters across Inner Bar Cut, north extension below 17th Street Bridge, just south of knuckle in ICW, outside and below port, extensive restricted area due to cables • Channel depth and width limit use of port by new generation large ships • DGPS accuracy in this area is not sufficient. Plus/minus 3 meter accuracy on a 1000-foot ship is not adequate; channel is narrow enough to not be error tolerant	Risk is considered acceptable today. Existing mitigations: • Pilots • Tug services • Range with sector light • Aids to navigation • Nautical charts are adequate • High water transits of large ships • Tide tables reasonably accurate for existing traffic New mitigations: • Real time current meter at sea buoy • Raise height of lower range light (view blocked by tankers in berths) • Proposed dredging of outer channel to 700-foot, 500-foot channel in Entrance Cut • Real time tide gage information as larger ships are brought into port

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RISK FACTORS	RISKS	MITIGATIONS
Waterway Configuration (Continued)		
Waterway Complexity	Today: • One 90-degree turn in main channel • Converging waterways: 1. ICW and Dania Cut 2. Turning notch 3. Main port at entrance 4. Basin in Port Lau Dania • Crossing traffic: 1. North and southbound traffic at sea buoy 2. Southbound traffic tries to stay close in to dodge Gulf Stream 3. Convergence of multiple traffic patterns at sea buoy 4. Convergence of multiple traffic patterns in port basin	Risk level is high but considered acceptable today. Existing mitigations: • .7 NM Precautionary Area as a buffer around sea buoy to keep southbound traffic away from entrance to Port Everglades and anchorage • Good buoyage • Pilotage requirements in place for most commercial traffic • Florida Marine Research Institute has created public boater education guides for Broward and Dade Counties. • USCG patrols • Florida Fisheries and Wildlife patrol craft • Harbor Master coordinates arrivals and departures of deep draft ships • VHF/FM communications • Speed control for recreational and commercial traffic • Mandatory education for boat operators based on age • Voluntary boating safety courses are available • Regulator signs posted throughout the port New mitigations: • Expand moving safety zones to additional type and size vessels • Mandatory training and education levels for recreational boat operators • News events to inform boating public on restricted capabilities of large ships in restricted areas • County ordinance to establish moving safety zone around deep draft ships (500 feet ahead, 100 feet abeam and astern)

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Port Risk Assessment Port Everglades, FL

RISK FACTORS	RISKS	MITIGATIONS
<u>Immediate Consequences</u>		
Volume of Passengers	Today: • Passenger vessels move 3 million passengers a year 1. Number of crew and passengers ~3000+ in one hull 2. Sight seeing cruises up to 149 3. Daily Seascape cruises - 500 daily 4. Head boats - charter boats with 49 people Trends: • Water taxi traffic increasing (tourists) • Size of cruise ships increasing • Increasing cruise boats with 600+ in one hull	No mitigation factors were discussed.

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Port Risk Assessment Port Everglades, FL

RISK FACTORS	RISKS	MITIGATIONS
Immediate Consequences (Continued)		
Volume of Petroleum Cargoes	Today: • 800 tank ship movements per year; 2 to 3 per day of which 30% are seagoing tank barges (200,000 bbls) and integrated tug and barge (ITB) • Still some “senior” tankers with single hulls • Barges not yet double hull	Existing level of risk is acceptable. Existing mitigations: • Licensing and training for tankermen • Mandatory booms during all petroleum transfers • Contingency clean up capability • Public Safety department at port has First Responder Capability • Salvage capabilities are within 20 minutes • Vessels and facilities have response plans • Port, county and USCG have contingency plans • Design of port’s petroleum berths enables isolation of spill; booms on scene ready to deploy • One-way traffic • Double hull • Juniper class buoy tender stationed in _____ has response capability • Active spill coop; MSRC ship in Miami; active drills and exercises New mitigation: • None discussed

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Port Risk Assessment Port Everglades, FL

RISK FACTORS	RISKS	MITIGATIONS
<u>Immediate Consequences</u> (Continued)		
Volume of Hazardous Chemical Cargoes	Today: • Less than 10% of cargo tonnage is HAZMAT and comes as container cargo • Nuclear powered Navy ships • One facility for HAZMAT: One propane barge per week, berth 11. Risk: T-bone collision from entrance channel if ship loses steering. Passenger terminal is just north and adjacent to LPG terminal.	Existing mitigations: • Standby tug required for LPG • LNG prohibited from port • Risk study done before decision made as to where the barge should be moored

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Port Risk Assessment Port Everglades, FL

RISK FACTORS	RISKS	MITIGATIONS
<u>Subsequent Consequences</u>		
Economic Impacts	Today: - Hurricane-induced port closure - Predicted events - Logistics requirements can be anticipated and addressed - If external trucker strike: immediate effects for wharfage, storage, laborers - Oil terminals. Inventory of product reserve from 1 to 6 days depending upon last delivery. Airport shut down within 1 week. - In general: 1-week period before cargo delivery shortages felt - Just in time inventory management - Cruise ships: impact is immediate-especially on a Saturday or Sunday. If inbound a particular problem with autos in storage, air reservations and hotel space wherever they are taken, logistics returning them to Port Everglades - Freight: depends on product - Special commodities - Reefer cargoes within a week - Containers could arrive by other routes	Existing mitigations: - Hurricane contingency planning in place - Salvage capabilities are within 20 minutes

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RISK FACTORS	RISKS	MITIGATIONS
Subsequent Consequences (Continued)		
Environmental Impacts	Today: • Spawning grounds and nurseries for crustaceans • Ft Lauderdale beach recreation • Manatee areas everywhere especially during cold weather in Hot Water Canal • Aquatic preserve • Entire ICW mangrove areas • Turtle nesting areas • Groundings in approaches • Three tiers of reefs parallel coast offshore at 30-60-90 foot depths • Diving and fishing activities	Existing mitigations: • Oil spill committee • Trained people • On scene response equipment • Booming strategies in contingency plans • Effectiveness: unknown in terms of having had a real spill. Have conducted drills and exercises • Annual preparatory drill • For tank vessels: 1. Licensing and training for tankermen 2. Mandatory booms during all petroleum transfers • Contingency clean up capability • Public Safety department at port has First Responder Capability • Port, county and USCG have contingency plans • Design of ports petroleum berths enables isolation of spill. Booms on scene ready to deploy • No idea what to do with manatees in event of an oil spill. They loiter in vicinity of power plant out-fall canal

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Port Risk Assessment Port Everglades, FL

RISK FACTORS	RISKS	MITIGATIONS
<u>Subsequent Consequences</u> (Continued)		
Health and Safety Impacts	• Resident population: 10,000 • Drinking water not an issue; piped from elsewhere. • Sewer line at 17th Street Bridge • Power plant cooling water intake • Tank farm is second largest on east coast. Disaster there will impact port activity	No mitigation factors were discussed.

Port Everglades Port Profile

Vessel Traffic Management Profile Presently in Place

❖ ***Aids to Navigation (USCG and Private)***

- *Lighted & Unlighted – Fixed & Floating:* USCG maintained.
- *Electronic Aids (GPS, DGPS, RACON, AIS, EAIS):* GPS and DGPS used in Pilot Boat and available on ships, Morse (A) RACON, & PEL SECTOR LIGHT.
- *Traffic Separation Schemes (TSS) –IMO:* None
- *Regulated Navigation Areas (RNA) – USCG:* Precautionary Area at channel entrance, Restricted Area South of channel entrance, two offshore anchorages, and 4 cable areas.

❖ ***Vessel Traffic Systems (VTIS/VTIS):*** Traffic competently handled by Harbor Master coordinated with pilots.

❖ ***Situation Awareness (Each Ship)***

- *Own Ship's & Other Ship's Position:* Handled by Pilot, VHF communication and visual sighting.
- *Other Ship's Intentions:* Through pilot radio communication with other vessel.
- *Environmental Conditions:* Warning of dangerous microbursts comes from airport Doppler radar via the Harbor Master's office. Manatees occasionally encountered in vicinity of docks slowing or temporarily halting docking/undocking procedures.

Port Everglades Port Profile

Waterway Navigational Attributes

- ❖ **Ship Channel Complexity:** Large vessels transiting narrow channel with rocky sides encounter strong cross winds and currents, short stopping distances for large and deep draft vessels, safety of other vessels in port surging alongside due to “piston effect” and need for speed, traffic density, swirling currents in inner channel and basin.
- ❖ **Converging or Crossing Traffic:** High volume – including non-piloted commercial vessels, private mega-yachts and recreational craft.
- ❖ **Ship Channel Configuration:** Manmade outer and inner channels are straight with rocky sides and bottom.
- ❖ **Ship Channel Traffic:** 11,000 piloted commercial movements per year, major and minor commercial vessels with highest number of recreational vessels in the Nation.
- ❖ **Recreational and Local Fishing Activity:** High volume, frequently impeding commercial traffic.
- ❖ **Bottom:** Rock, poor holding for emergency anchoring situations.
- ❖ **Currents:** Outer channel – dangerously strong cross currents that vary in strength and are unpredictable in direction. In harbor – current swirls of varying characteristics, both horizontally and vertically causing random counter currents.
- ❖ **Wind:** Moderate to strong easterly, although possible from all directions during frontal passages. Severe and shifting during frequent thunderstorms and microburst - often times at gale strength.
- ❖ **Visibility:** Generally good, except when driving rain reduces visibility. Occasional early morning fog.

Port Everglades Port Profile

Planned and Anticipated Changes

❖ ***Planned Infrastructure Developments:***

- Construction of 1-3 additional cruise terminals.
- Construction and expansion of new petroleum berths.
- Construction of 2-3 new vehicle parking garages and the enlargement of 2 current facilities.
- Addition of 1 and possibly 2 rail mounted container gantry cranes at Southport.
- Replacement of the 2 current rail mounted container gantry cranes at Midport with 3 new panamax fully electric cranes.
- Development of 271 acres of container/rail yard at Southport.
- Portwide deepening of the harbor to include 53' depth at the outer bar, 50' in the inner channel, turning basins, and alongside the berths at Southport.
- Deepening of Midport and Northport turning basins, slips, and berths.
- Widening and deepening of the Dania Cutoff Canal to 310' and 28' respectively.
- Continued roadway improvements and expansions.
- Development of a dedicated transportation system linking the Port and Ft. Lauderdale airport.

❖ ***Changes in levels and/or nature of waterway activities:***

- Vessel movements anticipated increasing 5-10% per year for the next 10 years.
- Port and waterways must accommodate larger ships, particularly cruise and container in excess of 1,300 LOA in the years ahead.
- Greater congestion expected from private boaters and other commercial vessel traffic.

❖ ***Forecast Traffic Levels:*** 5-10% growth per year in numbers of vessels handled.

❖ ***USCG Regulations to Be Implemented:*** None.

❖ ***Changes under Consideration, but not Committed:*** Any of the items identified in ***Planned Infrastructure Developments*** are subject to modification in scope and numbers based upon the results of a full master plan review which is currently being conducted by a Port contracted master planner.