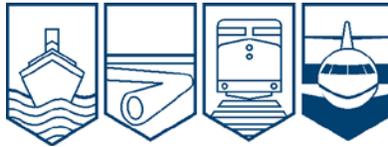


Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**MARINE INVESTIGATION REPORT
M12C0058**



GROUNDING

**ROLL-ON/ROLL-OFF PASSENGER VESSEL *JIIMAAN*
APPROACHING KINGSVILLE HARBOUR, ONTARIO
11 OCTOBER 2012**

Canada

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Marine Investigation Report M12C0058

Grounding

Roll-on/roll-off passenger vessel *Jiimaan*
Approaching Kingsville Harbour, Ontario
11 October 2012

Summary

On 11 October 2012, at approximately 1340 Eastern Daylight Time, the passenger vessel *Jiimaan* grounded while approaching the ferry terminal in Kingsville, Ontario. The 34 passengers and crew remained on board until the vessel was refloated at approximately 1308 the next day, after which time the *Jiimaan* was escorted to the port of Leamington, Ontario. There was no pollution, damage, or injuries.

Ce rapport est également disponible en français.

Factual information

Particulars of the vessel

Name of vessel	<i>Jiimaan</i>
Official number	814082
IMO number	9034298
Port of registry	Chatham, Ontario
Flag	Canada
Type	Roll-on/roll-off passenger ferry
Gross tonnage	2807
Length ¹	61.11 m
Draught at time of accident	Forward: 3.12 m Aft: 3.42 m
Built	1992, Port Weller Shipyards, Ontario
Propulsion	Twin diesel engines, twin screw, 2896 kW brake horsepower
Maximum vehicle carriage	40 automobiles
Maximum complement	399
Registered owner	Ministry of Transportation for Ontario
Manager	Owen Sound Transportation Company

Description of the vessel and operations

The *Jiimaan* is a roll-on/roll-off passenger vessel of steel construction (Photo 1). The bridge is fitted with the required navigational equipment, including 2 radars, an electronic charting system (ECS), and an echo sounder. The vessel has a single vehicle deck with space for 40 automobiles. Day-use accommodations include a cafeteria and passenger lounge (Appendix A).



Photo 1. *Jiimaan*

The *Jiimaan* provides passenger ferry service between Pelee Island and the ports of Leamington and Kingsville. In general, for the first half of the

¹ Units of measurement in this report conform to International Maritime Organization Standards or, where there is no such standard, are expressed in the International System of units.

navigation season, the *Jiimaan* sails between Leamington and Pelee Island, and for the second half of the navigation season, it sails between Kingsville and Pelee Island, a crossing of approximately 90 minutes. However, the vessel will divert between ports as necessary depending on environmental conditions, most notably when high winds pose a risk to the safety of the docking procedure at either location. On 01 August 2012, the *Jiimaan* switched to Kingsville as its scheduled destination dock. Prior to this date, the vessel was diverted to Kingsville from Leamington on 3 occasions due to weather.

The vessel has 2 complete teams of officers and crew who work a 1 week on/1 week off schedule.

Description of the port of Kingsville

The port of Kingsville is located in the shallow western basin of Lake Erie. As such, the port's channel is exposed to silting, caused by a combination of westerly winds and water circulating lake-bottom material, mainly sand and silt. In the southwestern portion of the channel, there is a naturally-occurring sandbar that expands over time and encroaches into the harbour channel. Prior to the occurrence, the channel had last been dredged in the spring of 2010; however, since that time, the sandbar² had extended into the centreline of the harbour channel (Appendix B). The sandbar reduced the width of the navigable channel, preventing any deep-draught vessels from entering or leaving the port following the charted range line of 308° true (T) (Appendix C).

The tendency for silting to impact operations at the port of Kingsville was well known to local port users, generally consisting of bulk cargo lake freighters, a fishing fleet, and the Owen Sound Transportation Company (OSTC) ferries. A private green port-hand buoy was placed by the port manager to mark the eastern extremity of the sandbar and local port users became accustomed to seeing the buoy at the start of each navigation season. In 2012, the lake freighters continued voyages into the Kingsville harbour until 27 August, cancelling further calls to the port because of insufficient water depth in the approaches. At the time of the occurrence, the port-hand buoy was located on the side of the channel normally allocated for starboard-hand buoys.

History of the voyage

On the evening of 10 October 2012, the master of the *Jiimaan* cancelled the last-scheduled transit from Kingsville to Pelee Island, which was due to depart Kingsville at 1800, due to high winds from the west at 35 to 39 knots and waves of about 3 to 4 m outside the Kingsville breakwall. The weather forecast indicated that conditions would improve overnight, so the master planned to depart Kingsville early the following morning in order to re-establish the vessel's normal schedule.

By the morning of 11 October, the westerly winds had reduced to about 15 knots. The *Jiimaan* departed Kingsville for Pelee Island at 0600³ on its first round trip of the day, passing close by

² A survey of the harbour channel conducted on 17 April 2012 shows a sandbar extending into the centreline of the channel.

³ All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours), unless otherwise stated.

and east of the port-hand buoy to enter the Kingsville ferry terminal (Appendix C) on the return voyage. At 1000, the vessel departed Kingsville for its second round trip of the day. The vessel departed Pelee Island at 1212; 18 passengers had been counted upon loading and 16 crew members were also on board. The vessel was carrying 10 passenger vehicles, 2 grape rigs,⁴ 2 transport trucks, and one recycling truck.

Prior to departing, the master and mate determined that the 25 to 28 knot southwesterly winds experienced earlier in the day at Pelee Island were likely to remain the same and decided to sail. The vessel followed the documented voyage plan,⁵ which required the vessel to sail from Pelee Island west dock on a course of 355°T. The master, mate, and an ordinary seaman (OS) were on the bridge for the crossing, with the mate steering. After crossing Lake Erie, the vessel proceeded on a northwesterly heading, sailing parallel to and east of the marked channel leading into Kingsville harbour. The bridge team planned to pass the port-hand buoy, alter to port, and then make a sharp turn to starboard in order to berth at the ferry terminal dock.

Arrival preparations began when the vessel was approximately 0.5 nm from the ferry terminal. The vessel's speed was reduced from 11 to approximately 4.5 knots, with the mate continuing to steer using the centre console. The master took up a position at the starboard steering console in preparation for the final docking manoeuvre. Another OS⁶ stationed on the bow provided the bridge with clearing distances to the port-hand buoy. The master took over the steering from the mate at the starboard console. The mate then turned on the echo sounder and visually monitored depths while also monitoring the radar and providing speed and course updates to the master.

As the *Jiimaan* approached the port-hand buoy, the vessel was being set to starboard due to the prevailing winds. The bridge team estimated that the vessel would pass the port-hand buoy with a clearance of 2 to 3 m. However, when the vessel was almost abeam of the buoy, its position was further east than intended. The *Jiimaan* entered the shallows northeast of the channel and went aground. The master reacted by increasing propulsion and port rudder; however, the vessel's speed continued to drop until all headway was lost. At 1340, the vessel grounded 0.07 nm (130 m) southeast of the Kingsville harbour entrance in position 42°01.48' N, 082°43.79' W. The grounded position of the vessel's stern was approximately 30 m outside of the charted channel.

Events following the grounding

Soon thereafter, the port anchor was let go, and at 1402, the starboard anchor was let go. The vessel remained hard aground without any swing or shift in position. At 1410, the grounding was reported to Marine Communications and Traffic Services (MCTS)⁷ in Sarnia, and the master requested assistance to disembark the passengers. The tanks were sounded and it was determined that the hull was not breached. Soundings were also taken by lead line: the water depths were measured at 3.66 m forward and 3.20 m aft, with the least depth recorded as 3.0 m

⁴ A tractor towing one or more open wagons loaded with wine grapes.

⁵ Passage Plan #3 is found in Chapter 4.8.10 of the OSTC Safety Management Manual, Standard Operating Procedures. The plan does not provide port entry guidance.

⁶ On the vessel, this OS was referred to as the spotter.

⁷ MCTS, which is operated by the Canadian Coast Guard, provides marine safety communications and manages the movement of vessel traffic.

abeam to starboard. Passengers were initially informed that the vessel had grounded by means of a public address announcement. Once the situation had been assessed, a passenger briefing was held; passengers were told that the vessel had grounded and that they were not in any danger.

At 1433, the Canadian Coast Guard (CCG) tasked the CCGS *Cape Dundas* to provide assistance to the *Jiimaan*. Approximately an hour later, the Canadian Coast Guard auxiliary vessel *Colchester Guardian* was similarly tasked. The CCG made an attempt to evacuate a crew member to assess the feasibility of a passenger evacuation, but the evacuation was unsuccessful due to the weather conditions and, at 1743, the vessels stood down. The catering crew subsequently arranged makeshift overnight accommodations for the passengers in the lounge area and the vessel remained aground overnight.

At 0825 the following day, the *Colchester Guardian* returned to the grounded vessel and, at 0900, the salvage tug *Wyoming* arrived to assist with salvage operations. An inspection of the vessel and an underwater survey were carried out. The No. 2 centre ballast tank was pumped out, and a tow line was secured to the *Jiimaan's* port quarter. At 1210, the on-board safety video was played, covering the vessel safety procedures, the location of lifejackets and proper method for donning them, and the location of muster stations. At approximately 1230, the anchors were weighed and towing operations commenced. At 1256, the on-board safety video was played again. The vessel was refloated at 1308 and proceeded under its own power and under escort toward Leamington with all passengers and crew on board. Throughout the refloating operations, passengers were free to move about the interior of the vessel. While en route, the main engine's rpm⁸ was temporarily reduced due to a cooling system problem. The vessel was secured in Leamington and passengers disembarked at 1430.

A post-grounding sounding survey conducted on 17 October determined that the least water depth along the range line was 1.7 to 1.8 m (Appendix D). On 06 November, the CCG noted that the least water depth along the range line was about 2 m and that the range line no longer marked the best water depth coming into the harbour.

Environmental conditions

At the time of the occurrence, the visibility was good and the winds were from the southwest at 27 to 30 knots. The seas were approximately 2 to 3 m and the Kingsville port water level gauge at station 12065⁹ indicated that the water level was 0.007 m above chart datum. Wind speeds reduced the following morning to below 9 knots and visibility remained good throughout the refloating operations. Water levels on Lake Erie are subject to fluctuations due to seasonal variations and the seiche effect;¹⁰ in the 24 hours prior to the occurrence, the water level had fluctuated from a low of 0.068 m below chart datum at 2100 on 10 October to a high of 0.514 m above chart datum at 0600 on 11 October.

⁸ Revolutions per minute.

⁹ Past and predicted water level readings are available to the public via telephone and via the Canadian Hydrographic Services website at http://www.waterlevels.gc.ca/c&a/recent-forecast_e.html. Last accessed 20 February 2014.

¹⁰ A seiche effect can occur when extended periods of strong winds from a steady direction cause the water level to rise at one end of the lake and drop at the other.

Vessel certification

The *Jiimaan* carried valid operating certificates issued by Transport Canada Marine Safety and Security (TC), including an inspection certificate for a complement of 399 persons, a Canadian Oil Pollution Prevention certificate, and a Radio Inspection certificate. In addition, the vessel carried a valid Load Line certificate issued by TC indicating a minimum freeboard of 1.387 m, which corresponded to a moulded draught of 3.280 m. The minimum freeboard was permanently marked on the sides of the vessel's hull. The vessel also complied with TC requirements for subdivision and damage stability, which were conditional on the vessel maintaining a maximum draught of 3.280 m.

Personnel certification and experience

The master held a Master Mariner certificate of competency. He had a total of about 33 years of sailing experience, including approximately 10 years as master of ocean-going freighters, and had 9 seasons of experience with OSTC as master of the *Jiimaan* on the Kingsville to Pelee Island route.

The mate held a Chief Mate, Near Coastal certificate of competency and had worked for OSTC since 2007, serving one season as mate on the *Pelee Islander* before becoming mate on the *Jiimaan* in May 2008.

Vessel management

Ministry of Transportation for Ontario

The *Jiimaan* is owned by the Ministry of Transportation for Ontario (MTO), which contracts the OSTC to manage and operate the vessel on its behalf. The MTO sets the schedule and the fares, and serves as the liaison between OSTC and the Kingsville Non-Profit Port Management Corporation (KNPPMC), which is the entity responsible for the Kingsville port facilities (including the buildings, land, and piers). Concerns with respect to the condition of the port are communicated by OSTC to MTO for resolution with the KNPPMC. The MTO is listed as the vessel's authorized representative.

Owen Sound Transportation Company

The OSTC is a corporation owned by the Province of Ontario and is under contract to the MTO to provide year-round transportation services to Pelee Island. During the navigation season, OSTC operates a ferry service using the *Jiimaan* and a second vessel, the *Pelee Islander*. OSTC is responsible for the day-to-day operation and maintenance of the vessels.

OSTC also owns and operates 2 other vessels that provide seasonal ferry service. The *Chi-Cheemaun* provides service from Tobermory to Manitoulin Island on Georgian Bay, and the *Niska 1* operates between Moosonee and Moose Factory Island on the Moose River in northern Ontario.

OSTC's executive management is based in Owen Sound, and a manager oversees the day-to-day ferry operations and related terminal operations from either Leamington or Kingsville, depending on which port the vessel is scheduled to use at the time. The vice

president of operations is the designated person ashore (DPA) for the OSTC's safety management system (SMS). A DPA provides a link between a company's top management and personnel on board. The responsibility and authority of the DPA should include monitoring the safety and pollution-prevention aspects of the operation of each vessel and, as required, ensuring that adequate resources and shore-based support are provided.¹¹

Port Divestiture Program

The federal government's Port Divestiture Program was initiated in 1995 and involved transferring control of regional ports¹² from the federal government to provinces, municipal authorities, community organizations, private interests, and other groups. The process required local port interests to form a legal entity and negotiate the transfer with TC, who would in turn provide relevant information concerning environmental, technical, engineering, and property or leasing issues. In most cases, TC transferred the port, facilities, and harbour bed. In some cases, not all port components were transferred; this was referred to as a partial divestiture. Kingsville is 1 of 26 regional ports nationwide yet to be fully divested.¹³

Port management

The port of Kingsville was partially divested in 1999, at which time the port facilities, along with the bed of the inner harbour, were divested to the Town of Kingsville and Portco,¹⁴ who subsequently leased the facilities to the KNPPMC. The remainder of the harbour bed remained the property of TC.

Other entities involved in safety-related port activities in Kingsville included the following:

- The TC regional office, which conducted port inspections of Kingsville annually. These inspections consisted of a visual site visit by an engineer; however, TC was unable to provide documented reports of these inspections.
- The Department of Fisheries and Oceans/Canadian Coast Guard (DFO/CCG), which maintained 4 lights related to navigation in the port: the Kingsville West Pier light, the Kingsville Ferry Wharf light, and the Kingsville Entrance range lights.
- The Department of Fisheries and Oceans/Canadian Hydrographic Services (DFO/CHS), which published navigation charts for the port.

At the time that the port was divested, there was no specific consideration given to how information related to the safety of navigation was to be communicated to all stakeholders.

With divestiture, the KNPPMC took over the maintenance of the port facilities, such as the buildings and property and piers, including the contracting of dredging operations on an

¹¹ *International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention*, 2010, Section 4.

¹² Pursuant to TC's *National Marine Policy* of 1995, ports were classified into 3 categories: national, regional/local, and remote.

¹³ Transport Canada, "Partial Divestitures," 30 April 2012, <http://www.tc.gc.ca/eng/programs/ports-partialdivestitures-194.htm>. Last accessed 20 February 2014.

¹⁴ Portco is a corporation made up of Kingsville port users.

as-needed basis for individual port users. The cost of dredging was shared between KNPPMC and the MTO. In 2006, CHS contacted Southwest Sales¹⁵ to gather information about water depths in preparation for a new edition of chart 2181, *Harbours of Lake Erie*. Southwest Sales reported that dredging in the port was undertaken every 2 to 3 years, as needed, and that sounding surveys were carried out each spring.

A sounding survey conducted on behalf of KNPPMC in 2009 indicated that the sandbar had extended into the navigable channel and east of the range lights on which to steer. The survey indicated the least water depth of 2.6 m and showed the position of the port-hand buoy as east of the range line. The channel was dredged in the fall of 2009, and again in the spring of 2010. The 2010 post-dredging survey indicated a dredge grade depth of 5.5 m.

Private port-hand buoy

The KNPPMC placed a private port-hand buoy (Photo 2) to mark the eastern extremity of the sandbar that naturally occurs in the southwestern portion of the harbour channel. As the sandbar expanded, the buoy was periodically repositioned. The buoy normally remained in place throughout the winter and, after having been positioned at the beginning of the 2012 operating season, was not moved again prior to the occurrence.



Photo 2. Port-hand buoy

At the time of the grounding, the buoy in use was approximately 1.0 m in height and 30 cm in diameter; it was observed in position 41°01.46' N, 082°43.80' W (Appendix C). The buoy was not marked as private and did not display the owner's identification information as required by regulation. There was no documentation to indicate that TC was informed of the port-hand buoy. Neither CCG nor CHS was aware of the buoy.

Owen Sound Transportation Company communication regarding port conditions

The *Jiimaan* began its regularly scheduled operations into Kingsville for the 2012 season on 01 August. On 08 August, one of the masters sent a photograph of the port-hand buoy to the manager. It was forwarded to the OSTC Chief Executive Officer (CEO) the same day, with a message stating that both masters had concerns about the location of the buoy and the degree of silting that had occurred. The message also requested that the MTO look into dredging the harbour in the near future.

Also on 08 August, in response to the request of the manager, the CEO contacted the MTO to inquire about dredging and instructed the manager to consult with the masters of the *Jiimaan* and *Pelee Islander* to determine if it was safe to keep operating into Kingsville and advise of the decision. The CEO informed the manager that, if the masters believed it was not safe to operate into Kingsville, they could amend the vessels' itineraries so that they would sail into the port of Leamington for the remainder of the season.

¹⁵ Southwest Sales is a member of KNPPMC and contracts out the dredging of the port.

The manager consulted with the masters and advised the CEO on 15 August that they would continue using Kingsville, but would monitor the situation. The decision of the masters was based on the fact that the bulk carriers, with their deeper draughts, had been accessing the port. On 22 August, the manager visited the Southwest Sales office in the port of Kingsville to inquire about the availability of sounding information for the port. The April 2012 soundings were provided; the manager took copies and provided them to the 2 vessels that same day (Appendix B).

Procedures for monitoring vessel draughts

The *Jimaan* was fitted with a system to remotely sense the draught of the vessel; however, this system was not relied on by the crew, as it consistently reported draughts that were deeper than those read from the dock using the vessel's draught marks. Although the crew had posted information on the bridge to enable reconciliation of the difference between the remote sensing system and the draught marks on the hull,¹⁶ the practice on board was for the mate to visually verify that the vessel's load line mark was not submerged on those trips where the cargo load was thought to be heavier than normal. The instances of these visual verifications were not recorded, nor were the draught measurements taken from the remote sensing system.

OSTC's ship management manual (part of the SMS) contained a section on deck management procedures, which described various procedures relating to the management of the deck through the daily ferry cycle. With respect to loading procedures, the manual advised that "the vessel is to be loaded with due regard to stability, list and trim" and to "verify draught and stability to bridge when required" in preparation for departure. In addition, the corresponding departure checklist included the item "vessel trimmed, stable and ready to depart."

The ship management manual also included a section on standard operating procedures (SOP) to prepare for departure and instructed bridge crew to "verify that the loaded conditions reflect the normal range of operating conditions" on completion of loading and ballasting. The SOP additionally outlined the items to be recorded by bridge crew in the deck log book and the official log book. With regards to the latter, the SOP instructed bridge crew to record information concerning freeboard and load lines, as well as draughts on departure and arrival.

Voyage planning

A well-documented voyage or passage plan provides a comprehensive, step-by-step description of how each voyage proceeds from berth to berth. Preparing a voyage plan involves ensuring there is sufficient sea room or under-keel clearance throughout the voyage for the safe passage of the vessel and anticipating all known navigational hazards and adverse environmental conditions.

The OSTC SMS included bridge management procedures indicating that passage plans for the intended voyage were to be prepared and reviewed with the officers involved in navigation and that, throughout the crossing, passage plans were to be reviewed continuously by the officer in charge of the bridge. The bridge management procedures further indicated that, in view of the

¹⁶ This notice was dated 28 May 2007 and indicated that, when the vessel's load line mark was at water level, but not submerged, the mean draught according to the draught marks was 3.28 m, whereas the mean draught according to the remote sensing system was 3.36 m.

regular passages made by the ferries, passage planning had been “standardized to ensure uniformity of operations,” and that navigators were “to use the numbered passage plan appropriate to the voyage to supplement hydrographic charts.”¹⁷ A total of 4 passage plans were included: 2 for the respective to/from transits between Pelee Island and Leamington and 2 for the respective to/from transits between Pelee Island and Kingsville. The passage plan from the Pelee Island west dock to the port of Kingsville stated only that the course to steer on leaving Pelee Island west dock was 355°T. The passage plan did not describe the course change necessary to proceed into Kingsville Harbour via the dredged channel.

The OSTC SMS also included several checklists to guide deck department operations. The start-up checklist for bridge crew included a line item that stated “prepare voyage plan for intended voyage,” and the underway checklist included an item that stated “voyage plan in place.” A numbered list, entitled “voyage plans,” had been posted on the bridge of the *Jiimaan*. For the transits between Pelee Island and Kingsville/Leamington, the information provided was consistent with the passage plans in the SMS. Neither the voyage plans in the numbered list nor the SMS passage plans contained any guidance regarding entry into the harbour. The list also included navigational information for 6 additional routes. Prior to departure, the master normally recorded the relevant voyage plan and checklist number for each departure in the deck log book. Also recorded in the log book were details of the weather conditions: wind direction and speed, visibility and barometric pressure. Water level gauge data was not collected or recorded.

When a scheduled voyage was cancelled, delayed, or diverted, the master would complete an “Extraordinary Report” to document the circumstances/reason for the change as well as any corrective action taken (if necessary) and the prevailing weather conditions. In some instances, these reports also included information about the sea state or a remark indicating that water levels were low.

Charts and publications

At the time of the occurrence, the *Jiimaan* carried a paper copy of CHS chart 2181, which indicated a maintained channel entering the port of Kingsville and included a note cautioning mariners of silting. CHS corrections had been applied to the copy of chart 2181 on the *Jiimaan*, with the exception of one related to light characteristics at the port of Leamington. The port-hand buoy was not plotted on the *Jiimaan*'s chart, nor was it plotted on the sounding survey carried on the bridge at the time of the occurrence. The vessel had an ECS that displayed a current version of chart 2181 in the vector format on the occurrence voyage. Data from the ECS was downloaded and used to plot the vessel track for the occurrence voyage and the previous arrival at Kingsville that morning (Appendix C).

The *Jiimaan* carried the latest reprint¹⁸ of sailing directions¹⁹ for the Welland Canal and Lake Erie that cautioned those entering Kingsville harbour that the depths may be less than charted. The reprint also requested that mariners report dangers such as shoaling.

¹⁷ *Jiimaan* Safety Management System, “Passage Plans,” Section 4.8.7.1.

¹⁸ The sailing directions were originally issued in 1996 and the 2012 reprint did not contain substantive changes from the original edition.

¹⁹ Department of Fisheries and Oceans, Canadian Hydrographic Services, *Sailing Directions, Welland Canal and Lake Erie*, 1st Edition, 1996, CEN303, corrected to monthly edition No. 12/2011.

Voyage data recorder

In addition to bridge audio, the voyage data recorder (VDR) on the *Jiimaan* was capable of recording such parameters as date and time, position, speed, gyrocompass, very high frequency (VHF) radiotelephone communications, radar, echo sounder information, the status of hull openings, steering, propulsion, and responses. Data recorded by the VDR could be saved by pressing the emergency backup key on the VDR keypad. The VDR is capable of recording for 12 hours before it begins to overwrite data.

In this occurrence, the bridge team did not press the emergency backup button to save the data within 12 hours of the grounding, although the master was instructed to do so. As a result, the USB storage device provided to TSB investigators approximately 20 hours after the occurrence contained no data and all the data on the VDR hard drive pertaining to the occurrence had been overwritten.

Plans and procedures for mustering and accounting for passengers

Muster list

The vessel had a muster list posted on the bridge, assigning a fire and emergency station as well as a boat/raft station to crew members (Appendix E). The responsibilities specific to passenger safety included on the muster list were assigned to one of the catering crew members and consisted of the duty to “direct and muster passengers on the promenade deck.”

Evacuation plan

The vessel had an evacuation plan, dated March 2008, available on the bridge; it was signed by both masters and was approved by OSTC management. The plan outlined the steps to be followed by crew members once the emergency alarm signal was sounded. These included

- mustering the crew,
- readying the emergency boats,
- readying the passenger evacuation chutes,
- standing by the life raft launch position,
- assisting passengers to don lifejackets, and,
- evacuating passengers by way of the evacuation chutes.

With respect to passenger mustering and accounting, the plan instructed crew to

- direct and assist passengers to proceed to the embarkation deck²⁰ in an orderly manner using crowd control skills;
- ensure that all passengers were directed to and mustered on the embarkation deck in the vicinity of the escape chutes for disembarking the vessel; and,

²⁰ On the *Jiimaan*, the embarkation deck is the promenade deck, which is identified in Appendix A.

- ensure, by counting the number of passengers being transferred to the life rafts, that the certified capacity of each life raft was not exceeded.

Emergency response manual

The OSTC Emergency Response Manual (ERM) formed a part of the SMS and had the stated objective of ensuring that all elements for a successful emergency response were in place. The manual consisted of 3 sections: the contingency plan, shipboard emergency response, and drills and exercises.

The contingency plan established a dedicated management and support group ashore and provided a set of crisis management procedures outlining, among other things, shore-side considerations and actions to assist masters and terminal managers in handling major emergencies, including the evacuation of passengers if deemed necessary by the master. With respect to the passengers, the introduction to the crisis management procedures noted that

these ferries carry [a] significant number of people who may find themselves in a crisis situation in unfamiliar surroundings and without training. Until evacuated, the demands of handling the passengers will deplete shipboard resources that can be brought to bear on handling the initial crisis.

The shipboard emergency response section of the ERM provided guidance to the ship management team via a series of procedural checklists. The checklists outlined actions to be taken in response to various situations including grounding, fire, collision, structural failure, excessive list, and disabled vessel. The checklists were also intended to be used as an event log of the response activities. The checklists related to groundings and fires included a line where the master could record whether or not an alarm was sounded. The items in these checklists relating to passenger safety consisted of lines for the master to record whether or not the passengers had been mustered and evacuated, and lines to record the number of injuries, fatalities, and missing passengers. The manual also provided guidance for passenger relations. Specifically, to avoid a panic situation, the manual suggested that passengers be assembled for a briefing or, if necessary, mustered at the disembarkation points to explain the emergency teams' activities and to assure passengers that there is sufficient lifesaving equipment on board.

According to the drills and exercises section of the ERM, drills were the responsibility of masters and terminal management, and were intended to train staff, evaluate equipment performance, and test and evaluate specific operational aspects of OSTC's Emergency Response Plan. Exercises were the responsibility of shore-side management, and were intended to evaluate procedures and staff performance. This section of the ERM also included some further instruction with respect to the preparation, conduct, and reporting of both drills and exercises.

Training in passenger vessel safety management

To meet regulatory requirements,²¹ all of the vessel's officers and crew members had taken a TC-approved training course in passenger vessel safety management. The objective of this course was to provide crew members with an understanding of measures necessary for the safe

²¹ *Marine Personnel Regulations*, SOR/2007-115, Section 229.

operation of passenger vessels. The course also covered familiarization, basic safety training, and competencies to cope with hazards and emergencies on passenger vessels to the extent appropriate for each crew member's function on board.²²

The course was provided on board the vessel using a combination of instructor presentations, videos, participant discussions, practical exercises, and demonstrations using shipboard equipment. Participants were also provided with a student manual. The course elaborated on general principles and then covered vessel-specific material on a range of topics, including crowd management, muster list duties, vessel familiarization, effective communication with passengers, handling of casualties, assistance for persons with disabilities, crisis management, and human behaviour in emergencies. Topics specific to passenger safety on roll/on-roll/off vessels were also covered.

Drills

Boat and fire drills were conducted on a regular basis on board the *Jimaan* in order to practise the duties assigned in the vessel's muster list and evacuation plan. The drills generally involved a fire and preparation for abandonment scenario and were conducted with crew members only. During a drill, several catering crew members simulated tasks related to the mustering of passengers.

On occasion, drills incorporated specific tasks or scenarios outside the scope of a typical boat and fire drill. In the 2012 operating season, the crew practised responding to the following scenarios: man overboard, deployment and testing of an evacuation chute, a medical emergency, pollution, confined space rescue, and security procedures. At times, the drills incorporated duties related to passenger management and safety. For example, on one occasion, 2 crew members gave a demonstration to other crew members on how to don a lifejacket and then led them to the embarkation area and explained the operation of the evacuation chute.

Drills were documented in 2 formats. The first was a drill report, which was used for recording basic information (date, summary, and any observations) regarding the drill. The other was an emergency muster checklist, in which was recorded the time that each of the tasks on the muster list were performed during the drill, as well as the time of other events, such as when the "fire" was reported, when the "prepare to abandon" order was given, and when the chutes, life rafts, and emergency boats were ready. The checklist also included a space to record the crew head count, as well as any "missing" crew.

Regulatory requirements for passenger safety procedures and drills

There are 2 regulations within the *Canada Shipping Act, 2001* regarding procedures and drills for passenger mustering and accounting in an emergency situation: the *Life Saving Equipment Regulations* and the *Fire and Boat Drills Regulations*.

The *Life Saving Equipment Regulations* require every passenger vessel to "have an evacuation procedure for the safe evacuation of the complement from the ship within 30 minutes after the

²² "Passenger Vessel Safety Management," Great Lakes International Marine Training and Research Centre Student Training Manual, Georgian College.

abandon-ship signal is given.”²³ TC marine safety inspectors (MSIs) verify that the documented procedure is on board during their annual inspection, but they do not assess the procedure for adequacy.

The *Fire and Boat Drills Regulations* were amended in 2010 to require that the muster list of a passenger vessel include the assignment of emergency duties that crew need to perform in relation to the passengers.²⁴ The regulations specify certain duties to be included in the muster list, such as

- warning passengers of the emergency;
- ensuring passengers have donned their lifejackets correctly;
- assembling passengers at their designated muster stations;
- locating passengers who are unaccounted for and rescuing them;
- keeping order in the passageways and stairways; and,
- ensuring that a supply of blankets is taken to the survival craft.

Furthermore, the master of a passenger vessel is required to ensure that procedures are in place for locating passengers who are unaccounted for and rescuing them during an emergency,²⁵ and that crew members practise their passenger safety-related duties during drills.²⁶ When these new requirements entered into force, they were published in the *Canada Gazette* and presented at regional and national meetings of the Canadian Marine Advisory Council. TC did not develop or promulgate guidelines to assist industry and inspectors with the appropriate interpretation and implementation of the amendments.

During the annual inspection of a vessel, TC verifies that the documented muster list is on board and witnesses the conduct of a drill, ensuring that the tasks and duties specified on the muster list are performed; however, they do not verify that the muster list contains the information required by regulation.

The evacuation plan and muster list were verified on board and a satisfactory drill was observed on 28 March 2012 at the last annual inspection prior to the occurrence.

Safety management systems

The objectives of the International Safety Management (ISM) Code adopted by the International Maritime Organization (IMO) are to ensure safety at sea, prevent human injury or loss of life, and avoid damage to the environment. These are addressed by implementing safe practices in vessel operations and promoting a safe working environment by establishing safeguards against all identified risks and by continuously improving the safety management skills of personnel ashore and on board vessels.²⁷

²³ *Life Saving Equipment Regulations*, Section 111.

²⁴ *Fire and Boat Drills Regulations*, SOR/2010-83, Section 7(2).

²⁵ *Ibid.*, Section 12.

²⁶ *Ibid.*, Sections 24 and 25.

²⁷ *International Safety Management Code and Revised Guidelines on Implementation of the ISM Code by Administrations*, 2010 Edition.

The ISM Code, which applies to all SOLAS convention²⁸ vessels over 500 gross tonnes and all passenger vessels, requires companies and vessels to develop and implement an SMS. Operators for whom the ISM Code does not apply may choose to voluntarily adopt it. Once a company has complied with the requirements of the ISM Code, it is issued a document of compliance (DOC) by a recognized institution or organization, such as a classification society or the government of the flag state. As well, upon verifying that the company and its shipboard management are operating in accordance with the approved SMS, the vessel is issued a safety management certificate (SMC).

A company should ensure that the SMS operating on board a particular vessel includes elements that address the unique operations and configurations of that vessel. Accordingly, the SMS should include procedures to prepare for and respond to emergency situations that could be expected to arise on a particular vessel.

International Safety Management Code and risk assessment

In 2010, risk assessment methodologies were introduced into the ISM Code when IMO Resolution MSC.273(85) entered into force. With this amendment, Section 1.2.2.2 of the ISM Code states that “[s]afety management objectives of the company should...assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards...”²⁹ The International Association of Classification Societies (IACS) has provided a guidance document³⁰ for auditors in interpreting the Code. With respect to Section 1.2.2.2 of the ISM Code, the document states:

Although it is not often referred to as such, the development and implementation of a documented safety management system is an exercise in risk management. The drafting or amendment of written procedures involves looking at the company’s activities and operations identifying what could go wrong, and deciding what should be done to try to prevent it. The documented procedures are the means by which the controls are applied.³¹

For specific guidance on risk assessment methods, the guidance document refers auditors to another IACS document entitled “A Guide to Risk Assessment in Ship Operations,” which notes that the ISM Code leaves it to the company to select risk assessment methods appropriate to its needs.³² It also describes the characteristics of effective risk assessment methods:

- While methods may be more or less formal, they must be systematic to be effective. In other words, there must be an assessment process in place that can be consistently applied.

²⁸ The International Convention for the Safety of Life at Sea applies only to those vessels on international voyages whose countries (including Canada) are signatories to the convention.

²⁹ *International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention*, 2010, Section 1.2.2.2.

³⁰ International Association of Classification Societies, *Guidance for IACS Auditors to the ISM Code*, Recommendation No. 41, Revision 4, December 2005.

³¹ *Ibid*, page 8.

³² International Association of Classification Societies, *A Guide to Risk Assessment in Ship Operations*, IACS Recommendation No. 127, June 2012.

- The results of a risk assessment must be documented so that there is evidence of the decision-making process being applied.
- Risk should be reduced to a level that is as low as is reasonably practicable. This level is achieved when all reasonably practicable mitigating measures for identified hazards are in place.
- Those involved in the risk assessment should be those most familiar with the operation.
- Risk assessments must be updated as required, with new or infrequent activities being specific triggers for a risk assessment.³³

Owen Sound Transportation Company safety management system

Although not required by regulation, the Owen Sound Transportation Company (OSTC) had voluntarily adopted the ISM Code and had an SMS in place since 1998. The SMS was audited annually by the classification society, Lloyd's Register. The most recent DOC was issued to OSTC by Lloyd's Register on 05 September 2008 and was valid until 28 September 2013. Prior to the occurrence, it had last been validated on 12 December 2011.

The *Jiimaan* had a safety management certificate (SMC) issued by Lloyd's Register on 08 June 2012; it was valid until 30 May 2017.

Both the DOC and the SMC had been periodically verified as required, indicating the SMS complied with the ISM Code.

Reporting procedures

Within OSTC's SMS, there were 2 types of reporting procedures:

- Extraordinary reports, which were intended to ensure OSTC management was made aware of specific types of events³⁴ in a timely manner. The procedure required that the master make a verbal report as soon as possible, followed by a written report.³⁵
- Non-conformance reports, which were intended to document non-conformities with SMS procedures, incidents, near misses, or situations that could have resulted in an accident or injury. Non-conformance reports could be raised by anyone and were to be logged on board the vessel and tracked by the DPA.³⁶

OSTC executive management also espoused an "open door policy," indicating that safety concerns could be raised at any time.

³³ Ibid.

³⁴ These events include death, fire, theft, breach of security, diversion to respond to an SOS, diversion for adverse weather, medical evacuation, oil pollution, weather delay, weather cancellation, police contact, unruly customers, vandalism, third party inspectors, breakdown of equipment, damage to the vessel, or security equipment failure.

³⁵ OSTC Safety Management System Manual, "Communication Procedures," Section 201.

³⁶ Ibid, Section 206.

Classification Society audits of Owen Sound Transportation Company safety management system

Since 1998, Lloyd's Register had been conducting periodic audits of OSTC for ISM compliance. These included audits of shore-side operations (office-based audits) for the validation of a DOC to the company, and shipboard audits for the validation of a SMC to a specific vessel.

For OSTC, a typical ISM audit (whether office or shipboard) involved a one-day site visit, which consisted of

- an initial briefing where the scope of the audit was communicated to senior managers or the master;
- a review of relevant documents;
- interviews with senior managers (for office-based audits) and crew members (for shipboard audits); and,
- observation of various aspects of vessel operations (for shipboard audits).

In its guidance document for auditors, IACS points out that "[a]uditing is a sampling process, and is not exhaustive in nature. Issuance of certification is based upon verification that the sample is in compliance with the ISM Code."³⁷ Auditors have discretion to allocate audit time on certain aspects of the code.

According to Lloyd's Register, for a company to comply with Section 1.2.2.2 of the ISM Code, there must be an initial risk assessment for the company's operations, specifications of when risk assessments will be conducted (e.g., what will trigger a new risk assessment), and documentation indicating that identified risks have been mitigated (i.e., that operational controls are in place).

Owen Sound Transportation Company document of compliance audit

At the last annual audit of the company's DOC on 12 December 2011, 2 non-conformities were noted. One was related to a required pollution prevention certificate that the vessel did not hold, while the other was related to Section 1.2.2.2 of the ISM Code: "While reviewing the companies [sic] SMS it was observed that the risk assessment to its ships, personnel and environment and establish appropriate safeguards had not been completed."

On 08 March 2012, the company submitted a description of the corrective action taken to Lloyd's Register, indicating that the risk assessment had been conducted and that training for accident investigation/risk assessment was to be conducted. A copy of the risk assessment was attached, and OSTC indicated that the risk assessment would be included in the company's SMS manual. The document listed a number of "risks" and provided an estimation of their likelihood and impact. The specified "risks" were as follows: collision with another vessel, structural failure, collision with a structure, grounding, pollution, fatality, fire/explosion, injury, security incident, steering failure, and human error.

The document also provided a list of high-level mitigating measures to counter these risks. For example, in the case of a grounding, the identified mitigating measures were drills, training,

³⁷ International Association of Classification Societies, *Guidance for IACS Auditors to the ISM Code*, Recommendation No. 41, Revision 4, December 2005, p.3.

watchkeeping procedures, checklists, and investigation. These risks and mitigations were not linked to the intended operations of the specific vessel. At the time of the occurrence, the risk assessment section had not been integrated into the SMS manual and one person at OSTC, the DPA, had received formal training in risk assessment procedures.

The company's corrective action plan for the second non-conformity was accepted on 14 March 2012. It was verified and closed out at the following audit on 17 December 2012.

Previous occurrences and recommendations

SMS

The Transportation Safety Board (TSB) has repeatedly identified the need for domestic vessels to have effective SMS, an issue that has been on the TSB's *Watchlist* since 2010. The Board has noted that effective oversight of SMS by TC is not always provided and that SMS is not required of some companies.³⁸ To address this safety issue, the Board also noted that

[s]trong initiatives are required to address the issue of risk awareness and risk mitigation – both of which can be addressed through a formal, systematic approach to safety. TC, vessel operators, and marine management companies must work together to ensure that operating risks are identified and reduced to a minimum through the introduction of effective SMS.³⁹

The addition of this item to the *Watchlist* was the result of a number of investigations⁴⁰ where the Board found hazards and risks in the operation of the vessel that had either not been identified or not been addressed by the operator. Previous occurrence investigations⁴¹ have also addressed shortcomings whereby the SMS did not identify hazards associated with an operation, resulting in a lack of mitigation strategies for these hazards.

Procedures and drills for mustering and accounting for passengers

Following an occurrence in May 2003 involving a fire on a cargo deck on the roll/on-roll/off passenger ferry *Joseph and Clara Smallwood*, a TSB investigation⁴² revealed that crew members did not possess the knowledge or skills to adequately perform their emergency duties, and the TSB subsequently expressed its concern about the adequacy of passenger safety procedures and training.

During the March 2006 sinking of the roll/on-roll/off passenger ferry *Queen of the North*, 2 passengers remained unaccounted for following evacuation procedures and were never recovered. The TSB investigation⁴³ found that those responsible for passengers had difficulties

³⁸ Transportation Safety Board *Watchlist*, http://www.tsb.gc.ca/eng/surveillance-watchlist/marine/2012/marine_2.asp Website confirmed accessible as of report release date.

³⁹ Ibid.

⁴⁰ TSB Investigation Report Nos. M06F0024 (*Picton Castle*), M10C0043 (*River Rouge*), M11W0091 (*FW Wright and Empire 40*).

⁴¹ TSB Investigation Report Nos. M06W0052 (*Queen of the North*), M09W0141 (*North Arm Venture*).

⁴² TSB Investigation Report No. M03N0050 (*Joseph and Clara Smallwood*).

⁴³ TSB Investigation Report No. M06W0052 (*Queen of the North*).

establishing and reconciling the total count and identifying those missing. The Board subsequently recommended that

[t]he Department of Transport, in conjunction with the Canadian Ferry Operators Association and the Canadian Coast Guard, develop, through a risk-based approach, a framework that ferry operators can use to develop effective passenger accounting for each vessel and route.

Recommendation M08-01

The TSB investigation also noted that drills did not cover the full range of skills necessary to muster and control large numbers of passengers. Given the risks associated with poorly coordinated preparations for evacuating large number of passengers, the Board recommended that

[t]he Department of Transport establish criteria, including the requirement for realistic exercises, against which operators of passenger vessels can evaluate the preparedness of their crews to effectively manage passengers during an emergency.

Recommendation M08-02

As part of TC's response to these recommendations, the *Fire and Boat Drills Regulations* were amended to require that the muster list duties for passenger vessels include locating passengers who are unaccounted for in an emergency and rescuing them. The amendment also required that procedures and realistic drills relating to these duties be implemented. The Board assessed the responses to both recommendations as Fully Satisfactory in July 2010.

In August 2007, the roll/on-roll/off passenger vessel *Nordik Express* struck Entrée Island, Quebec, damaging its hull below the waterline. The subsequent TSB investigation⁴⁴ identified several shortcomings with respect to duties relating to passenger safety, including the following:

- the bridge crew did not sound an alarm, leaving the crew members responsible for passenger safety to improvise their response;
- the emergency duty lists did not address tasks related to the preparatory stages of an evacuation; and,
- a passenger count was not performed.

⁴⁴ TSB Investigation Report No. M07L0158 (*Nordik Express*).

Analysis

Events leading to the grounding

During the 2012 navigation season, the *Jiimaan* began its regularly-scheduled operations into the port of Kingsville at the start of August. On 11 October, on the first voyage of the day, the master followed the same practice that had been employed by vessels entering the port of Kingsville that season. This involved steering the *Jiimaan* off the range and leaving the charted channel to pass, as close as was practicable, east of the installed port-hand buoy. The buoy, which was intended to indicate the eastern limit of the silting, was along the eastern charted limit of the approach into the port.

On the occurrence trip into the port, the master allowed the vessel to pass further east of the port-hand buoy than on previous trips. This brought the vessel into shallower water and the vessel ran aground.

Perception of risk associated with port conditions

In this occurrence, the practice of departing from the marked channel in order to enter the port of Kingsville had become standard due to silting and had been in use, off and on, for many years. The *Jiimaan* had been using it successfully to navigate into the port in previous seasons as had many other vessels with greater draughts. Each successful passage may have served to decrease the crew's perception of the risk associated with the shoals to the northeast.

Communication and coordination of safety-related port activities

The safe and successful operation of a port involves various entities that each fulfill their mandated roles while also recognizing that their actions may have an effect on the others involved.

In this occurrence, there were at least 4 main entities involved in port operations:

- TC
- Department of Fisheries and Oceans/Canadian Coast Guard (DFO/CCG)
- Department of Fisheries and Oceans/Canadian Hydrographic Service (DFO/CHS)
- Kingsville Non-Profit Port Management Corporation (KNPPMC).

Although TC conducted annual on-site inspections at Kingsville, there was no information to indicate whether any navigation safety-related conditions were identified and communicated. While KNPPMC informed CHS that dredging was taking place "as needed," they did not clarify the extent to which the channel silted in-between dredgings. Furthermore, no notice about the extent of the silting and private buoy used to mark it was communicated to TC, CCG or OSTC. At the time that the port was partially divested, there was no specific consideration given to the communication of port safety-related information. As a consequence, the depictions of the approach to Kingsville Harbour on chart 2181 and in the sailing directions did not reflect the actual conditions.

If safety-critical activities in ports are not coordinated among the entities involved, and safety-related information is not communicated to port users, the navigational safety of the port may be at risk.

Accuracy of aids to navigation

To enable safe navigation, it is essential that aids to navigation provide clear and accurate guidance to mariners. In the port of Kingsville, the CCG range lights marked 308° true (T); however, due to the silting in the channel, they no longer marked the best approach into the port. Regular port users disregarded the range lights and instead used the private port-hand buoy to navigate around the silted area. However, for vessels unfamiliar with the port, the placement of the port-hand buoy resulted in contradictory navigational information. Neither the limitations with respect to the use of the range lights, nor the placement of the port-hand buoy was reported to the CCG. Without up-to-date information about the status of aids to navigation, there is a risk that a vessel may not be able to navigate safely.

Voyage planning

A well-documented voyage plan is essential for taking into consideration conditions that could present a risk to the vessel, including depth of water and weather. Preparing a voyage plan involves ensuring that there is sufficient sea room or under-keel clearance throughout the voyage for the safe passage of the vessel and anticipating all known navigational hazards and adverse environmental conditions. As a voyage is executed, it should be monitored for safe progress using all available means, including navigational aids. Depths should be monitored during landfall and port arrivals, and any planning information that contrasts with actual sailing conditions should be remarked for future voyage plan development or other corrective reporting.

With respect to voyage planning, the OSTC bridge management procedures called for the use of the standardized passage plans that were included in the procedures. These plans provided only minimal guidance for general passage; for example, the passage plan (also referred to as the voyage plan on board) for the transit between Pelee Island and Kingsville only provided the information necessary to navigate the vessel as far as the approach to Kingsville Harbour and offered no guidance to the master on navigating the approaches or on entering or exiting the port.

On a regular basis, the master was required to take into account numerous factors when making his approach to Kingsville, such as fluctuating water levels, silting, and wind speed. However, the bridge team did not take into consideration all the information necessary to ensure sufficient water depths for the safe arrival of the vessel in the port, including up-to-date water level and bottom sounding data. Although the checklists in the SMS referred to the tasks of preparing and implementing a voyage plan, the procedures did not clarify the company's expectations regarding voyage planning beyond the requirement to adhere to the simplified passage plans provided. Furthermore, they did not establish relevant safety parameters such as minimum under-keel clearance and maximum wind speed or a requirement for these parameters to be documented and monitored throughout the voyage.

The implementation of a voyage planning procedure that respects established industry guidelines⁴⁵ would ensure that voyage plans are well-documented, that they are consistently applied, and that they are clearly understood by both management and shipboard personnel. Further, such a procedure would ensure that the guidance provided is adequately detailed and relevant to the operation and that feasible safety limits are set and monitored throughout the voyage, thereby reducing risk to the safety of the vessel and its complement.

Procedures following the grounding

Notification of emergency

During an emergency, the safety of passengers, who are unfamiliar with the vessel and its emergency procedures, is dependent upon the prompt and appropriate action by those crew members assigned to perform passenger safety-related duties. These duties are carried out under the instruction of the bridge team. On the *Jiimaan*, as with most vessels, procedures and training dictated that these duties be commenced when signalled by an alarm bell.

In the early stages of this occurrence, no alarm was sounded and the bridge crew focused their immediate attention on assessing the status of the vessel, advising passengers and other crew members of the grounding by means of a public address announcement. Similarly, there was no mustering of passengers prior to the refloating operation. Without initiating the muster list or evacuation plan duties, passengers and crew were not in a state of preparedness in the event that the situation took a turn for the worse.

Procedures and drills for mustering and accounting of passengers

In an emergency situation, crew members must make decisions and take actions in a high-stress environment; they may be simultaneously encumbered by a heavy task load and may have little previous experience in emergency situations. On a passenger vessel, crew are additionally challenged by the need to manage large numbers of people of varying ages and abilities, each of whom are in an unfamiliar environment and may be reacting differently to the crisis situation.

If crew have practised their passenger safety-related duties in accordance with comprehensive and documented procedures, the risk to passengers is reduced and the likelihood of a successful emergency response is increased.

Although not a factor in this occurrence, there were shortcomings with the documented passenger safety management procedures in place on board the *Jiimaan*, specifically with respect to the preparatory phases of abandoning ship. The investigation identified that the muster list assigned one crew member to passenger safety-related duties. Furthermore, the muster list, the evacuation plan, the emergency response plan, and the passenger safety training manual did not offer any relevant details such as

- how and by whom all spaces of the vessel would be searched and cleared of passengers;
- who would be responsible for assisting people with injuries or disabilities;

⁴⁵ Industry guidelines for voyage/passage planning include the *Bridge Procedures Guide*, developed by the International Chamber of Shipping as per IMO Resolution A.893(12) and the *International Convention for the Safety of Life at Sea* (1974, as amended).

- how a head count of passengers at the muster station would be accomplished and reconciled with the number of passengers on board; and,
- how and by whom any missing passengers would be located and rescued.

While some of the aforementioned tasks were addressed in the passenger safety management training and in shipboard drills, the procedures were not documented; as such, the company had no means to ensure that all these duties would be practised on a consistent basis, if at all. Documenting such procedures also provides a tool to evaluate the crew's performance during a drill, train new crew members, and refine and improve the procedure itself. A well-documented procedure fosters a shared operational understanding and makes it easier for crew members to familiarize and refresh their understanding of it. Furthermore, the only participants in drills on board the *Jiimaan* were crew members; consequently, the crew were not able to practise their passenger management duties in a realistic way.

Without comprehensive, documented procedures and realistic drills for mustering and accounting for passengers, there is a risk that crew will not be able to effectively carry out these duties when required to in an emergency.

Adequacy of regulatory oversight

Previous TSB investigations⁴⁶ have identified deficiencies and associated risks in the preparedness of the crew of Canadian passenger vessels to muster and account for passengers in an emergency situation. In response to TSB recommendations to address the issue, TC made regulations requiring that the muster list of a passenger vessel include tasks specific to passenger safety and that procedures be developed to carry out those tasks.

In this occurrence, a documented muster list and evacuation procedure was kept on board the *Jiimaan* and this was verified by TC MSIs during annual inspections, fulfilling the requirements for certification of the vessel. However, the documents in use on board the *Jiimaan* included none of the specific passenger safety-related duties or procedures required by the regulations, with the exception of "assembling the passengers at their designated muster stations."

Without effective TC oversight to ensure compliance with respect to passenger safety-related emergency procedures, there is a risk that these important initiatives will be ineffective in achieving their intended purpose.

Safety management systems and the silting hazard at Kingsville

Safety management is an ongoing process that involves identifying hazards, assessing risks, and putting measures in place to maintain risk at the lowest practicable level. Although OSTC had voluntarily adopted an SMS and been audited for compliance with the International Safety Management (ISM) Code, the SMS did not provide for a systematic process to proactively identify hazards and assess and mitigate risks. It did not describe, for example, who should participate in and be responsible for the risk assessments, when and how they should be done, or how they should be documented.

⁴⁶ TSB Investigation Report Nos. M03N0050 (*Joseph and Clara Smallwood*), M06W0052 (*Queen of the North*) and M07L0158 (*Nordik Express*).

As such, there was no risk assessment conducted prior to resuming operations for the 2012 season. Such a process would have provided an opportunity for an assessment of the risks associated with silting in the Kingsville approaches, allowing measures be put in place prior to the *Jiimaan's* first trip into the port that year.

The second opportunity to properly assess and mitigate the risks associated with silting came when one of the masters of the *Jiimaan* communicated his concerns about the location of the port-hand buoy to OSTC management on 08 August. The company's response was supportive of taking necessary action to address the hazard: the chief executive officer (CEO) clearly communicated that the vessel could operate from Leamington if the masters deemed Kingsville to be unsafe.

However, without a process in place to ensure that the hazards had been fully identified and the risks and mitigating measures documented, this response essentially placed the onus of determining the port's suitability on the collective judgment of the vessels' masters. Within OSTC, only the designated person ashore (DPA) had received instruction in the conduct of risk assessments. This limited training, combined with the lack of a defined process in the company's SMS, meant that the masters' decision-making process was largely unstructured. The latest depth sounding information was not available at the time of the consultation with the masters and, as such, there was no means by which a reliable assessment of under-keel clearance could have been completed. The decision to continue using the port of Kingsville was largely based on the fact that bulk carriers, with their deeper draughts, had been able to access the port.

While it is reasonable to expect a vessel master to determine if a port is suitable for the arrival of his or her own vessel, in this occurrence the lack of a systematic procedure for risk assessment did not allow OSTC management to understand the basis for the masters' decision or to satisfy themselves that all reasonable measures had been put in place to effectively manage risk.

The result of these discussions was that operations into Kingsville remained status quo; no additional measures were put in place to deal with the silting in the harbour. Without a risk assessment process in the company's SMS, the decision to continue operating into Kingsville did not include an effective analysis of the identified hazards.

Adequacy of safety management system audits

Risk assessment

Compliance with most of the elements of the ISM Code requires some form of risk assessment, enabling procedural mitigations to be defined. The wording of Section 1.2.2.2 in the ISM Code was modified in 2010 to require all identified risks to be assessed. However, the process and scope for risk assessments remain at the discretion of the organization.

To address this issue, the International Association of Classification Societies (IACS) has provided guidance for auditors, acknowledging that while there are many ways to conduct a risk assessment, the process identified should be systematic, well documented, and updated frequently. It should also contribute to mitigating identified hazards and involve operational staff.

The absence of risk assessment in OSTC's SMS was noted by Lloyd's Register during its 2011 audit. In response, OSTC developed a risk assessment chapter for inclusion in its SMS manual. However, the chapter, when compared to the risk assessment principles described in the IACS guidance, did not actually provide a systematic process for risk assessment. Instead, it presented a description of possible outcomes associated with vessel operations that were referred to as "risks" (e.g., fire, grounding), and did not identify the specific hazards that could contribute to these outcomes. Since these hazards were not identified, targeted measures to reduce the likelihood of these outcomes could also not be identified. Finally, the chapter presented a one-time risk assessment, rather than a process for the conduct of risk assessments; as such, it was unlikely to involve operational staff and be updated frequently.

The company's proposed risk assessment did not reflect the principles for an effective risk assessment process as described by IACS. However, the document was acceptable to the classification society when conducting the ISM audit.

Voyage planning and draught monitoring

Section 7 of the ISM Code requires companies to establish procedures for the preparation of plans and instructions for key shipboard operations. The IACS guidance for auditors⁴⁷ specifies that this section of the Code applies to any operation that is safety-critical and provides the examples of passage planning and loading.

OSTC's voyage planning procedures did not contain any guidance or direction for entering and leaving harbour, contained only minimal guidance for general passage, and did not establish minimum safety parameters such as under-keel clearance. The procedures also did not elaborate on the expectations of the company as to the scope and documentation of voyage plans. Furthermore, although OSTC's SMS contained procedures for checking and recording the vessel's draught prior to departure, this was not the practice. Despite the periodic audits of the vessel conducted by Lloyd's Register since 1998, these issues were not identified.

Passenger safety

One of the objectives of the ISM Code is that "the safety management system should ensure compliance with mandatory rules and regulations."⁴⁸ Furthermore, Section 8 of the Code requires companies to establish procedures to respond to emergency shipboard situations. The IACS guidance advises auditors to obtain objective evidence to determine whether emergency response planning is effective. For a passenger vessel, a key element of any emergency response is the management of passenger safety. As such, emergency response plans on passenger vessels must be sufficiently detailed to ensure that all tasks necessary to prepare passengers for an evacuation are covered.

In this occurrence, the muster list, evacuation plan, emergency response plan, and passenger safety training manual offered no guidance or procedures with respect to the preparatory phases of abandoning ship, such as mustering and accounting for passengers. Although Lloyd's

⁴⁷ International Association of Classification Societies, *Guidance for IACS Auditors to the ISM Code*, Recommendation No. 41, Revision 4, December 2005, page 28.

⁴⁸ *International Safety Management Code for the Safe Operation of Ships and for Pollution Prevention*, 2010, Section 1.2.3.1

Register had conducted audits of the vessel since 1998, deficiencies with respect to the passenger safety procedures were not identified, and the documents were accepted.

In summary, third-party SMS audits were ineffective at ensuring that OSTC had the capacity to perform risk assessment to the level required by the ISM Code and IACS guidance documents; that fundamental nautical procedures (voyage planning) were adequate; that other procedures (draught monitoring) were being performed; or that passenger-safety procedures were being followed. When audits do not effectively assess an organization's capability to meet the safety objectives and functional requirements of SMS, as defined in the ISM Code, there is a risk that the benefits of SMS will not be realized.

Voyage data recorder

The purpose of a voyage data recorder (VDR) is to create and maintain a secure, retrievable record of information indicating the position, movement, physical status, and command and control of a vessel for the period covering the most recent 12 hours of operation. Objective data is very helpful for accident investigators seeking to understand the sequence of events and identify operational problems and human factors issues.

In this occurrence, the emergency backup key on the VDR keypad was not pressed within the 12 hours after the grounding to save the data. The VDR continued recording, and the data for the grounding was overwritten. If bridge recordings are not available to an investigation, this may preclude the identification and communication of safety deficiencies to advance transportation safety.

Findings

Findings as to causes and contributing factors

1. At the time of the occurrence, the Kingsville range was not usable due to silting in the channel approaches, requiring the *Jiimaan* to proceed out of the marked channel to enter the harbour and east of the port-hand buoy marking the edge of the channel silting.
2. The master allowed the vessel to pass further east of the buoy than on previous voyages. Given the limited margin of error east of the buoy, this brought the vessel into shallower water and the vessel subsequently ran aground.
3. Each successful passage may have served to decrease the crew's perception of the risk associated with the shoals to the northeast.
4. The absence of a risk assessment process within the company's safety management system (SMS) resulted in the risks, associated with deviating from the charted channel in response to the silting at the port of Kingsville, not being identified and mitigated.

Findings as to risk

1. If safety-critical activities in ports are not coordinated among the entities involved, and safety-related information is not communicated to port users, the navigational safety of the port may be at risk.
2. Without up-to-date information about the status of aids to navigation, there is a risk that a vessel may not be able to navigate safely.
3. If audits do not effectively assess an organization's capability to meet the safety objectives and functional requirements of SMS, as defined in the International Safety Management (ISM) Code, there is a risk that the benefits of SMS will not be realized.
4. If voyage planning procedures are not well-documented or understood by both management and shipboard personnel and do not provide adequately detailed and relevant guidance with feasible safety limits that are continuously documented and monitored, there is an increased risk that bridge teams will not account for all factors that may affect the safety of the voyage.
5. Without an alarm bell or other direction from the bridge crew, or where passengers are not mustered, there is a risk that the complement will not be in a state of preparedness should the situation escalate to one where an emergency evacuation is deemed necessary.
6. Without comprehensive and documented procedures and drills to muster and account for passengers, there is a risk that crew members will not be able to effectively carry out these duties.
7. Without effective TC oversight to ensure compliance with respect to passenger safety-related emergency procedures, there is a risk that these important initiatives will be ineffective in achieving their intended purpose.

8. If bridge recordings are not available to an investigation, this may preclude the identification and communication of safety deficiencies to advance transportation safety.

Safety action

Safety action taken

Transportation Safety Board

On 23 October 2012, the TSB issued Marine Safety Advisory Letter (MSA) 04/12 to the Department of Fisheries and Oceans concerning the accuracy of the Canadian Hydrographic Services (CHS) published chart 2181 for the port of Kingsville, Ontario. The letter indicated that the main channel marked on the chart had become unusable over time due to silting and noted that the CHS may wish to ascertain the condition of the channel with a view to alerting mariners. A copy of the letter was also sent to Transport Canada (TC), the Owen Sound Transportation Company (OSTC), the Ministry of Transportation for Ontario, and the Town of Kingsville.

On 06 May 2013, the TSB issued MSA 02/13 to the OSTC, a copy of which was also sent to TC and Lloyd's Register, North America Inc., concerning the implementation of procedures and associated drills on board OSTC vessels in order to ensure that crew members are adequately prepared to perform these duties.

Transport Canada

On 05 June 2013, TC advised its regional directors of programs to review all public ports and the waters surrounding public port facilities in their regions to ensure that water depths reflect what is represented on the navigational charts and in sailing directions. TC advised that, where necessary, regional managers should advise CHS to make changes to charts/sailing directions to reflect the fact that the depth of water is less than what is reported or to go as far as to remove the indication that there is a maintained (dredged) channel in the port. In addition, regional managers were instructed to, where necessary, advise the Canadian Coast Guard (CCG) to issue a Notice to Shipping and Notice to Mariners.

Owen Sound Transportation Company

In response to MSA 02/13, the OSTC advised the TSB in July 2013 that it had implemented plans and procedures to improve mustering and accounting for passengers on all OSTC operated vessels, including the *Jiimaan*. The immediate mustering of passengers is now mandatory for all emergency situations, and tasks for the searching for, evacuating, and counting of passengers have been assigned to specific crew members. Passenger management and evacuation drills were held on board the *Jiimaan* in May and June 2013. Fire and boat drills have also been expanded to include a sweep and search of all vessel spaces as well as the water around the vessel. The drills are also conducted during normal voyages with the participation of passengers.

OSTC has also developed and implemented water level monitoring procedures. The masters of the *Jiimaan* and *Pelee Islander* are required to record the water level readings from the Kingsville water gauge prior to every departure and to contact the operations office for further guidance if the water levels drop more than 20 cm. Cross track limit lines corresponding to the boundaries of the Kingsville approach channel were also added to the vessel's electronic charting system (ECS) and the operational status of the VDR is checked and recorded in the master's shift

change report. OSTC management sent a memo to vessel officers reminding them of the requirement to perform appropriate voyage planning prior to the commencement of sailing each day and incorporating specifically the Regulations 34 and 34-1 of STCW Chapter V as well as the Voyage Planning Guidelines of SOLAS Chapter V, Annex 25. Corresponding amendments to the company's SMS Voyage Planning Policy and Procedure are also in progress.

In March 2013, 28 OSTC employees, including 13 Pelee Island Transportation navigation and engineering officers and the Pelee Island Transportation Services Manager, participated in Risk Management and Incident Investigation training. The company's Safety Management Committee is working to develop the Risk Assessment section of the SMS, including the identification of all existing or new procedures that require amendments to include risk assessment tools and the amendment of procedures to reflect the ongoing nature of the risk assessment process. OSTC has also approved the purchase of risk assessment software.

Safety concern

Regulatory oversight of passenger safety emergency procedures

There are many reasons to have effective procedures for the mustering of and accounting for passengers in an emergency situation. Passengers, unlike crew, are untrained and unfamiliar with a vessel and its emergency procedures. They can vary in numbers, in states of awareness, in physical abilities, and in how each responds individually to an emergency situation. Crew members have the challenging task of determining whether everyone is accounted for in an emergency situation. If not, search operations need to begin immediately. Mustering passengers is necessary whether the abandon ship order is given or not. Even if the emergency is brought under control, it is critical that any injured passengers are found quickly and given aid.

Over the last 10 years, the TSB has highlighted deficiencies in shipboard procedures relating to the pre-evacuation stage of an emergency⁴⁹ and has issued recommendations⁵⁰ aimed at improving passenger safety. As part of TC's response to these recommendations, the *Fire and Boat Drills Regulations* were amended in 2010 to require, among other things, that passenger vessel muster list duties include the task of locating and/or rescuing passengers who are unaccounted for in an emergency. The amendment also required that procedures and realistic drills relating to these duties be implemented. The Board assessed the responses to both recommendations as Fully Satisfactory.

In this occurrence, the vessel's muster list and evacuation procedures did not contain the specific measures called for by the new regulations. Furthermore, it was found that TC marine safety inspectors are not required to verify and assess muster lists and evacuation plans for compliance and adequacy. TC has also not developed or promulgated guidelines to assist industry and inspectors with the interpretation and application of the new regulations. As a consequence, there is a risk that non-compliance with regulations for passenger safety-related duties or procedures may go unidentified, increasing the likelihood that the response to an emergency situation will be ad hoc.

⁴⁹ TSB Investigation report Nos. M03N0050 (*Joseph and Clara Smallwood*), M06W0052 (*Queen of the North*) and M07L0158 (*Nordik Express*).

⁵⁰ TSB Recommendations M08-01 and M08-02 following the striking and subsequent sinking of the *Queen of the North*, TSB Marine Investigation Report No. M06W0052.

Regulations intended to improve safety are most effective when they are clearly understood and fully implemented. The onus to comply with regulation lies with the vessel owners and operators, masters, and crews; however, regulatory oversight is essential to not only provide guidance and interpretation to the industry, but also to verify compliance and enforce it.

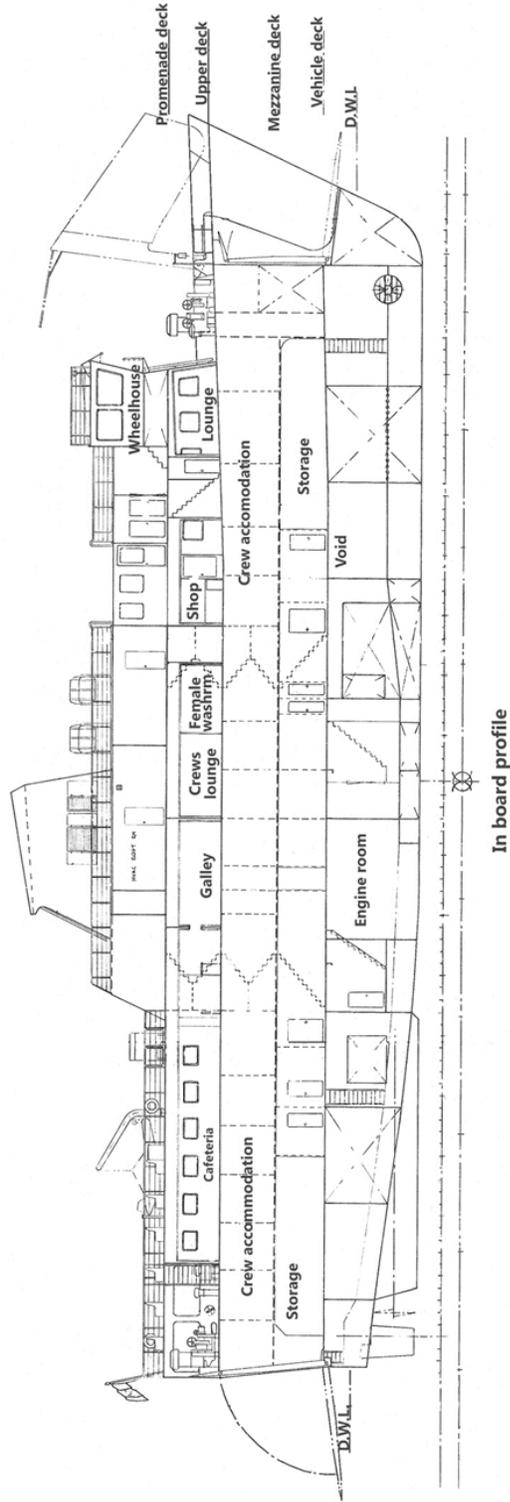
The Board is concerned that, if TC marine safety inspectors do not assess muster lists and evacuation plans for compliance and adequacy and TC does not provide interpretive guidelines, compliance with passenger safety regulations may be inadequate, thereby negating the potential safety benefits of such regulations.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 29 January 2014. It was officially released on 10 March 2014.

Visit the Transportation Safety Board's website (www.tsb.gc.ca) for information about the Transportation Safety Board and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

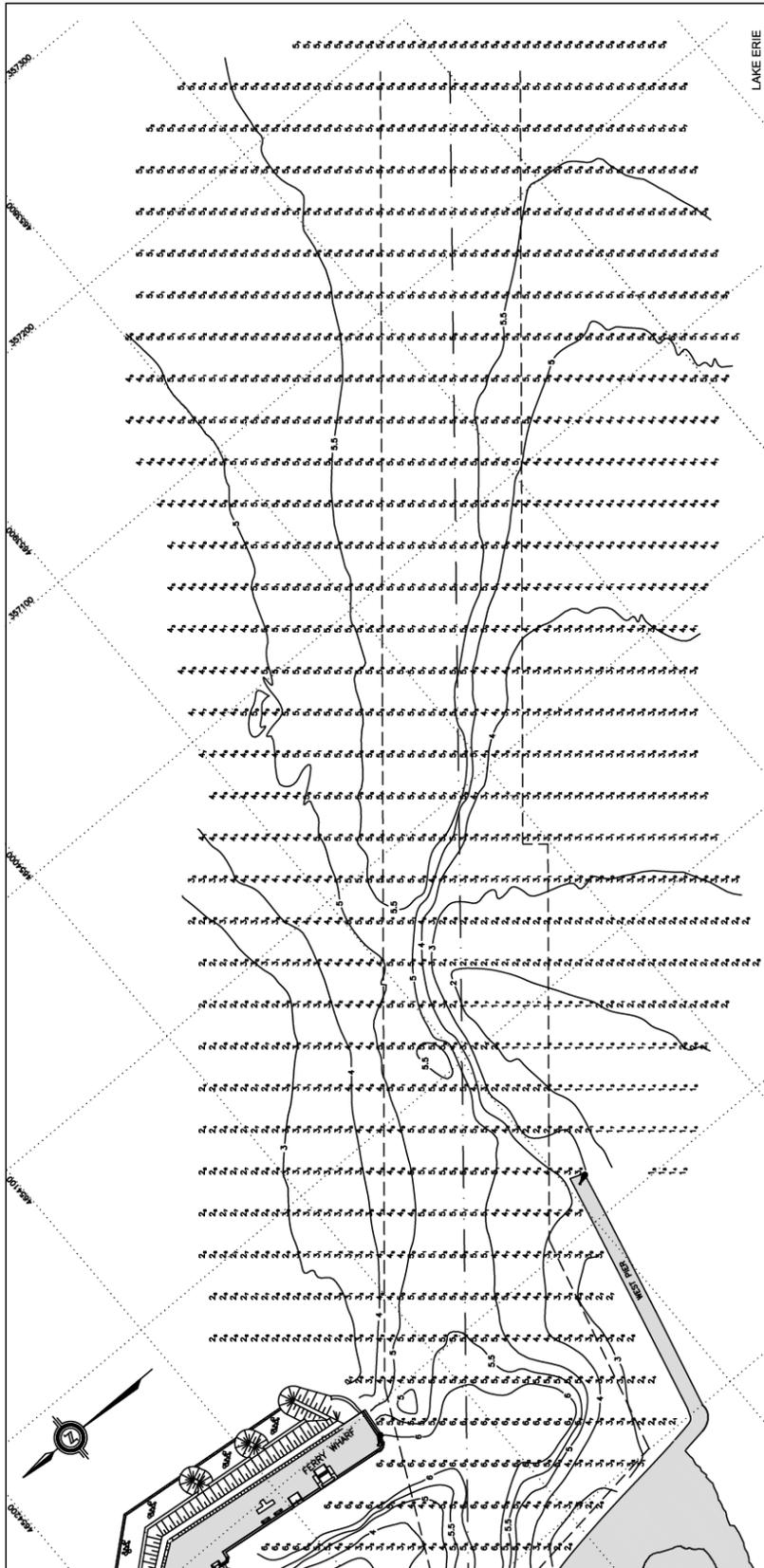
Appendices

Appendix A – General arrangement



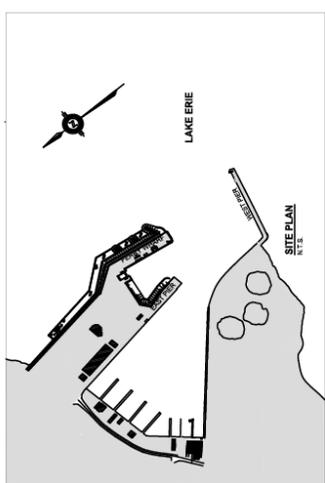
Source: Owen Sound Transportation Company

Appendix B – April 2012 sounding survey

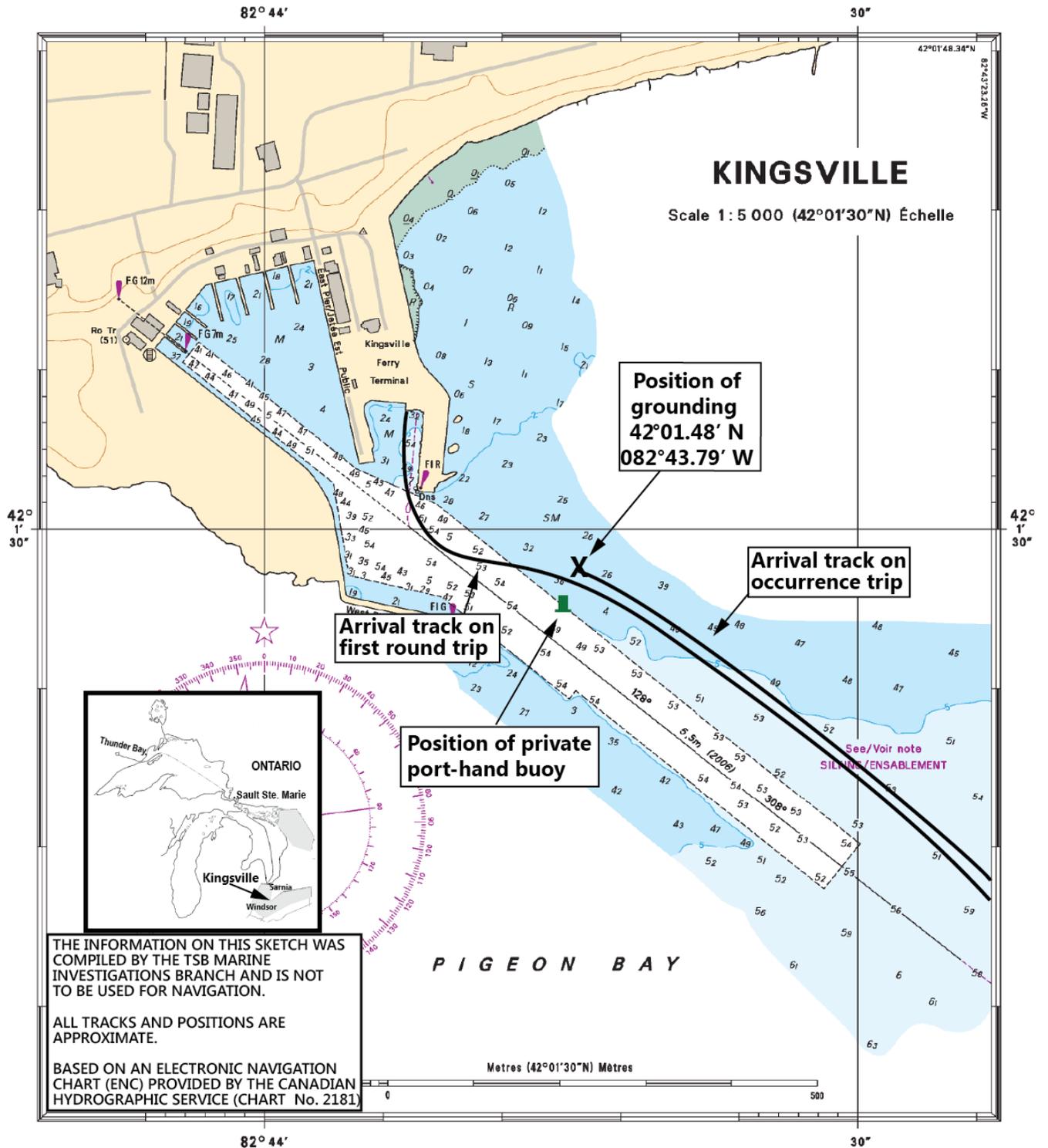


- LEGEND:**
- CHANNEL LIMITS
 - RANGE LINE
 - SUBMERGED DEPTH CONTOUR 5.4m SOUNDING DEPTH BELOW CHART DATUM
 - 5₄ NAVIGATION LIGHT
- NOTES:**
1. SOUNDINGS WERE TAKEN ON APRIL 12, 2012.
 2. SOUNDINGS ARE SHOWN IN METRES BELOW CHART DATUM.
 3. CHART DATUM FOR LAKE ERIE IS 173.8 METRES ABOVE SEA LEVEL (IGLD 1985).
 4. WATER LEVEL AT TIME OF SURVEY WAS 0.75 METRES ABOVE CHART DATUM.
 5. VERTICAL CONTROL ESTABLISHED FROM CHS GAUGE KINGSVILLE.
 6. COORDINATE GRID REFERS TO UTM ZONE 17.
 7. POSITIONING SYSTEM - HEMISPHERE N30
 8. SOUNDING - RECON NAVISOUND 110
- * THE SOUNDING INFORMATION REPRESENTS RESULTS OF THE SURVEY MADE ON THE DATES SPECIFIED AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS AT THAT TIME.

• Soundings are valid only for the date and time they were taken.
 • This plan is NOT FOR NAVIGATION
 • If the vessel is a pleasure craft, the skipper/samanship, navigators use updated hydrographic charts for navigation of their vessels.

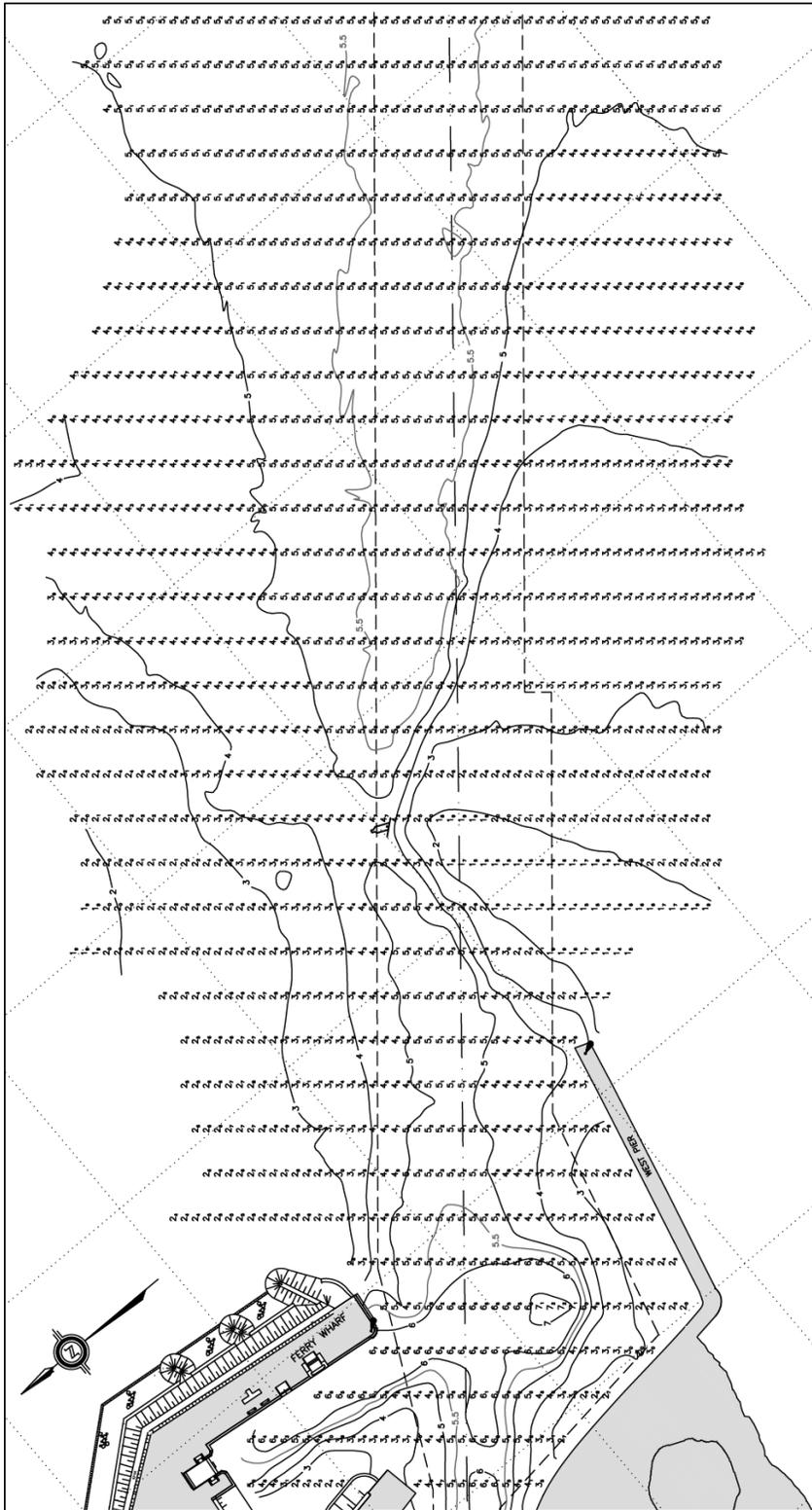


Appendix C – Area of the occurrence



Track data obtained from the electronic charting system (ECS) on board the *Jiimaan*.

Appendix D – Post-occurrence sounding survey



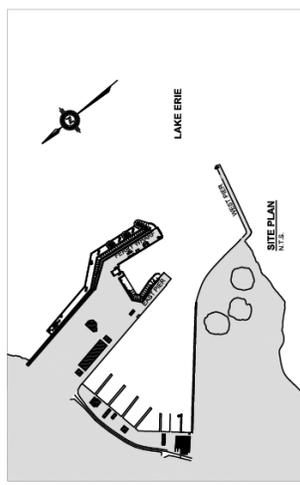
NOTES:

1. SOUNDINGS WERE TAKEN ON OCTOBER 16, 2012.
 2. SOUNDINGS ARE SHOWN IN METRES BELOW CHART DATUM.
 3. CHART DATUM FOR LAKE ERIE IS 173.5 METRES ABOVE SEA LEVEL (IGLD 1985).
 4. WATER LEVEL AT TIME OF SURVEY WAS 0.18 METRES ABOVE CHART DATUM.
 5. VERTICAL CONTROL ESTABLISHED FROM CHS GAUGE KINGSVILLE.
 6. COORDINATE GRID REFERS TO UTM NAD83 ZONE 17.
 7. POSITIONING SYSTEM - HEMISPHERE R320
 8. SOUNDING - RESON NAVISOUND 110
- * THE SOUNDING INFORMATION REPRESENTS RESULTS OF THE SURVEY MADE ON THE DATES SPECIFIED AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS AT THAT TIME.

LEGEND:

- CHANNEL LIMITS
- RANGE LINE
- SUBMERGED DEPTH CONTOUR
- 5.4m SOUNDING DEPTH BELOW CHART DATUM
- NAVIGATION LIGHT
- BUOY LOCATION

- Soundings are valid only for the date and time they were taken.
- This plan is NOT FOR NAVIGATION
- In the ordinary practice of good seamanship, navigators use updated hydrographic charts for navigation of their vessels.



Appendix E – Muster list

Transcription of muster list posted on *Jiimaan's* aft wheelhouse wall:

Duties and Responsibilities		
Rank	Fire And Emergency Station	Boat/Raft Station
Captain	In command on bridge.	In command on bridge and in charge of evacuation operation.
Mate	In charge at scene.	Lower starboard emergency boat. Entry controller Stbd Chute
Service Aid #1	Directs and musters passengers on prom deck. CLOSE VENTS AND DOORS ON PORT MEZZANINE DECK.*	Directs passengers. Lowers PORT emergency boat. Entry controller port chute.
Service Aid #2	Place hatch between galley and cafeteria. Close fire doors and vents cafeteria area and port mezzanine deck.	Deploys STARBOARD chute and second person down chute. Assists STARBOARD platform leader.
Mechanical Assistant	As directed by Engineer.	Operates life raft release at bridge wing STARBOARD side.
Seaman #1	FIRST FIRE TEAM. Bring breathing apparatus and fireman's equipment to scene and assists Mate.	STARBOARD emergency boat crew. Goes down in STARBOARD Zodiac. Assists platform leader with life rafts.
Seaman #2	FIRST FIRE TEAM. Bring breathing apparatus and fireman's equipment to scene and assists Mate.	PORT emergency boat crew. Goes down in PORT Zodiac. Assists platform leader with life rafts.
Seaman #3	SECOND FIRE TEAM. Bring breathing apparatus and fireman's equipment to scene and assists Mate.	STARBOARD emergency boat coxswain. Goes down in STARBOARD emergency boat and marshals life rafts. Assists as needed at platform.
Seaman #4	SECOND FIRE TEAM. Bring breathing apparatus and fireman's equipment to scene and assists Mate.	PORT emergency boat coxswain. Goes down in PORT emergency boat and marshals life rafts. Assists as needed at platform.
Cook	Close galley and mess doors and vents. Assists with vents in upper deck area. First aid kit to scene.	PORT platform leader. First person down PORT chute. In charge life raft control at PORT platform.
Service Aid #3	Assists in closing vents on upper deck area. Brings stretcher to scene.	Deploys PORT chute and second person down chute. Assists PORT platform leader.
Service Aid #4	Closes vents and doors on STARBOARD mezzanine deck. Close vents on prom deck and funnel.	STARBOARD platform leader. First person down STBD chute. In charge life raft control at STARBOARD platform.
Seaman #5	Assists closing vents on prom deck and funnel. CLOSE VENTS & DOORS IN VEHICLE DECK/ FWD & AFT WINCHING STATIONS*)	Assist Mate as required.
Service Aid 5	On bridge	Operates life raft release at bridge wing PORT side.
Chief Engineer	In charge in engine room. Assigns duties as necessary.	In charge engine room. Joins Mate after evacuation of engine room.

Notes: Passengers Area is Located on Upper Deck and Promenade Deck

* denotes a sentence that is a handwritten addition.