

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

**MARINE INVESTIGATION REPORT
M15C0028**



**GROUNDING
BULK CARRIER *CWB MARQUIS*
BEAUHARNOIS, QUEBEC
03 APRIL 2015**

Canada

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Le présent rapport est également disponible en français.

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 M15C0028

Grounding

Bulk carrier *CWB Marquis*

Beauharnois, Quebec

03 April 2015

Summary

On 03 April 2015 at approximately 0230 Eastern Daylight Time, the bulk carrier *CWB Marquis* was struck by an ice floe and dragged anchor while anchored at the Pointe Fortier anchorage area, below the Lower Beauharnois lock, Quebec, on the St. Lawrence Seaway. The ice floe pushed the vessel out of the anchorage area and caused it to go aground. The vessel was refloated later that day with the assistance of 2 tugs. There were no injuries or pollution. The vessel sustained minor damage.

Le présent rapport est également disponible en français.

Factual information

Particulars of the vessel

Table 1. Particulars of the vessel

Name of vessel	<i>CWB Marquis</i>
International Maritime Organization (IMO) number	9613941
Port of registry	Winnipeg
Flag	Canada
Type	Bulk carrier
Gross tonnage	24 451
Length overall	225.55 m
Draft at time of occurrence	Forward: 7.95 m Aft: 7.85 m
Built	2012, Jiangshu, China
Propulsion	1 five-cylinder diesel engine (6926 kW) driving a single controllable-pitch propeller
Cargo	28 421 metric tonnes of iron ore pellets
Crew	18
Passengers	6
Registered owner	The Canadian Wheat Board, Winnipeg, Manitoba
Manager	Algoma Central Corporation

Description of the vessel

The *CWB Marquis* (Photo 1) is a dry bulk cargo vessel with 5 cargo holds. The machinery and accommodation spaces are located aft. Propulsion is provided by 1 five-cylinder diesel engine driving a controllable-pitch propeller. Electrical power is supplied by 3 generators, as well as an emergency generator. The vessel is fitted with a 1200 kW bow thruster situated in an enclosed space within the forepeak compartment. The vessel has 3 anchors: 2 forward and 1 at the stern.

Photo 1. *CWB Marquis*



The bridge is equipped with the required navigational equipment, including 3 cm and 10 cm automatic radar plotting aids (ARPA), 2 gyrocompasses, 1 magnetic compass, and 2 very high frequency (VHF) radiotelephones.

The vessel is also equipped with a differential global positioning system (DGPS), a voyage data recorder (VDR), and 2 electronic chart display and information systems (ECDIS).

St. Lawrence River and Seaway

The St. Lawrence River extends over 1197 km, with the western approach connected to Lake Ontario and the eastern approach connected to the Atlantic Ocean by an estuary and the Gulf of St. Lawrence. The St. Lawrence Seaway (hereafter referred to as “the Seaway”) is a system of locks, canals, and channels within the St. Lawrence River that allows vessels to sail from Montréal, Quebec, into the Great Lakes (Appendix A). The Seaway consists of 2 sectors: the Montréal to Lake Ontario (MLO) sector (306 km) and the Welland Canal (44 km) that joins Lake Ontario with Lake Erie.

The Seaway is managed by a partnership between the United States and Canada, through the Saint Lawrence Seaway Development Corporation (SLSDC) and The St. Lawrence Seaway Management Corporation (SLSMC). The SLSDC operates and maintains the portion of the Seaway within the territorial limits of the United States, which includes the Snell and Eisenhower locks located in Massena, New York. The SLSMC, meanwhile, is responsible for the Canadian Seaway facilities, which include the Saint-Lambert, Côte-Sainte-Catherine, Lower and Upper Beauharnois, Iroquois, and Welland locks. The corporations coordinate operational activities, particularly with respect to rules and regulations, overall day-to-day operations, traffic management, safety, environmental programs, operating dates, and trade development programs.

The St. Lawrence River is kept open year-round for navigation from the Gulf of St. Lawrence to the Port of Montréal. The Canadian Coast Guard (CCG) performs traffic management in this portion of the navigation channel, in addition to its standard tasks of icebreaking, vessel escort, flood control, environmental response, and maintenance of aids to navigation. During the winter, CCG icebreakers help keep the drift ice¹ moving in the river between Québec and Montréal. The continual movement of broken ice prevents the formation of ice jams, which pose a risk of flooding in low-lying regions. The icebreakers also break up floes that have broken away from fast ice² and entered the navigation channel, and they escort vessels as required through ice-covered waters.

In the area of the St. Lawrence River between Québec and Montréal, ice can begin forming as early as November and start to melt in early March. This results in a gradual clearing of the navigation channel as the existing ice is carried seaward and not replaced by new

¹ “Drift ice” is a term used to describe any area of ice, other than fast ice, no matter what form it takes or how it is disposed (Source: Fisheries and Oceans Canada, Canadian Coast Guard TP 5064E, *Ice Navigation In Canadian Waters* [revised August 2012]).

² “Fast ice” is ice that is “fastened” or attached to the coastline, the sea floor, or along shoals. Fast ice can develop in place as water freezes, or it can develop when floes of drift ice freeze to the shore.

formations. Decay of the fast ice follows, and fragments may be carried into the channel as the break-up develops. The whole area is normally free of ice by mid-April.

The Seaway's shipping season runs from late March until late December or early January, depending on ice conditions. The ice conditions in the Seaway between Montréal and Lake Ontario are much the same as in the area between Québec and Montréal: ice formation spreads upstream from the Montréal area in early December and reaches the entrance of Lake Ontario in early January. In the spring, the ice break-up progresses downstream from Lake Ontario in the first half of April.³

To assist in the opening and closing of each shipping season, the corporations responsible for the administration and management of the Seaway request icebreaking resources from the Canadian and US Coast Guards. For the 2015 opening, 2 icebreakers were requested, but only 1 was available on the opening day. The second one entered the Seaway the day after the opening.

Opening of the St. Lawrence Seaway

St. Lawrence Seaway management corporations

Each winter, the Seaway management corporations monitor the ice conditions throughout the system to aid in the planning of the next opening date. This monitoring consists of measuring ice thickness in various locations of the Seaway and conducting aerial ice reconnaissance patrols with corporation personnel to compare the current conditions with previous years. SLSMC also consults with external stakeholders (CCG, Environment and Climate Change Canada, National Oceanic and Atmospheric Administration, amongst others) to determine ice conditions in certain areas. The SLSMC monitors a range of environmental indicators and historical data when planning the opening date.

The 2015 opening date was initially set for 27 March. After consultation with vessel owners and also the Great Lakes Pilotage Authority (GLPA) regarding the ice conditions in the Seaway and the Great Lakes, it was decided to postpone the opening to 02 April. Other considerations in postponing the opening date were the number of icebreakers available to assist commercial shipping on the Great Lakes and the time required to prepare the Seaway prior to opening. Vessel owners were concerned that their vessels might incur delays⁴ in transit because the Great Lakes had more ice coverage than usual at that time of year.⁵

³ Sailing Directions, General Information, Great Lakes, CEN 300, 1996, 1st Edition, p. 49 (Ice).

⁴ Ice conditions on the Great Lakes had also been severe in 2014, causing some vessels to be delayed up to 10 days.

⁵ The maximum ice coverage in the Great Lakes for 2015 was 88.8%, which is well above the average figure of 53.2% (Source: Great Lakes Experimental Research Laboratory, available at: http://www.glerl.noaa.gov/data/ice/imgs/IceCoverAvg1973_2015.jpg [Last accessed 26 January 2016]).

In the MLO sector, the management corporations normally request at least 1 icebreaker and 1 air-cushioned vehicle (ACV) from the CCG to prepare the Seaway for vessel traffic. The icebreaker will usually break out a track in the navigation channel and anchorages, as well as escort vessels transiting ice-covered waters as required, while the ACV will clear out the river entrances and areas of lakes that icebreakers cannot access as part of flood control measures.

Canadian Coast Guard

During the opening and closing of the Seaway, the CCG provides icebreaking resources in the Canadian and American portions of the Seaway as requested by the 2 management corporations. The number of vessels provided depends on the severity of the ice conditions and availability of resources. CCG officers can also be assigned to Seaway traffic operations and control centres as liaison officers to disseminate information about ice conditions from the icebreakers to corporation personnel and to communicate the corporations' tasking requirements to the icebreakers.

CCG Ice Operations Centres are in operation for 24 hours a day during the ice season. The Ice Operations Centres are in contact with icebreakers at all times and maintain contact with shipping via CCG Marine Communications and Traffic Services (MCTS) Centres.

The CCG Ice Operations Centre responsible for the St. Lawrence River is located in Montréal and provides services including but not limited to

- monitoring the movement of marine traffic in ice-covered waters;
- undertaking airborne ice reconnaissance (from helicopter or fixed-wing aircraft) to survey ice conditions;
- providing ice charts, ice advisories, and bulletins to marine shipping; and
- providing recommended ice routes so that vessels can navigate safely through or around ice-covered waters.

CCG Ice Operations Centres are staffed with CCG personnel and ice service specialists (ISS)⁶ from the Canadian Ice Service (CIS). The CIS, a division of the Meteorological Service of Canada, works in partnership with the CCG to provide ice information to the marine community and in support of CCG operations, and is funded primarily by the CCG.

ISS work on board CCG icebreakers and in Ice Operations Centres to provide on-site consultation, ice reconnaissance, analysis, and meteorological services. The format of the information they provide can vary depending on requirements, but can include daily ice and weather charts, satellite imagery, and ice bulletins.

⁶ Ice Service Specialists are environmental specialists with technical training in ice identification and coding, meteorology, and ice image interpretation.

During the winter, each ISS is assigned to a specific sector and a CCG helicopter is used for daily ice reconnaissance patrols over the St. Lawrence River below Montréal. These patrols assist in the production of ice charts and the identification of potential hazards, such as fractures in fast ice, the presence of fast ice in the navigation channel, and areas at risk of ice jams. Aerial ice reconnaissance patrols, along with satellite imagery from various sources, are used to provide information about floating ice. Ice charts produced by CIS are made available on the CCG website. The areas relevant to the St. Lawrence Seaway are also made available on the SLSMC website.

Canadian Coast Guard operations in the St. Lawrence Seaway

On 25 March 2015, the CCG and an ISS conducted an ice reconnaissance patrol of the MLO sector with a helicopter based in Trois-Rivières, Quebec. The observations were used to prepare an ice chart of the area that would be used to coordinate icebreaking operations. The same day, the CCG icebreaker *Martha L. Black* and the CCG ACV *Sipu Muin* began icebreaking operations in anticipation of the planned opening of the Seaway on 02 April. The icebreaker broke a track in the Canal de la Rive Sud and in the navigation channel from Saint-Lambert lock to the Lower Beauharnois lock (Appendix B). The *Sipu Muin* cleared the entrance to the Seaway below the Saint-Lambert lock, and then proceeded to Lac Saint-Louis to begin breaking up the fast ice on the lake. The broken ice from the lake would then be carried downstream through the Lachine Rapids and into the St. Lawrence River at Montréal.

On 27 March, the *Martha L. Black* continued operations between the Côte-Sainte-Catherine lock and the Lower Beauharnois lock, including the Pointe Fortier anchorage area. More icebreaking was performed in the anchorage the following morning, and the *Martha L. Black* then proceeded further up the Seaway to break a track in the navigation channel up to the entrance of Lake Ontario.

On 30 March, a CCG navigation officer was assigned as a liaison officer to the SLSMC to help coordinate CCG operations with SLSMC personnel. The liaison officer worked during regular business hours out of the Traffic Control / Operations Centre (hereafter referred to as “Seaway Beauharnois”), which is located at the Saint-Lambert lock and is responsible for the MLO sector.

On 01 April, the *Martha L. Black* returned to Lac Saint-Louis to break up the ice at the entrance of the Lower Beauharnois lock and inside the Pointe Fortier anchorage area, as requested by the SLSMC via the liaison officer. This work was completed by 1750,⁷ and the liaison officer was advised verbally by the *Martha L. Black* that the fast ice in the anchorage area had been broken up and would eventually clear out with the current. The *Martha L. Black* then proceeded to the Côte-Sainte-Catherine lock to await the first vessels to enter the Seaway the next day. At 1815, the liaison officer sent an email to, among others, the

⁷ All times are Eastern Daylight Time (Coordinated Universal Time minus 4 hours) unless otherwise specified.

SLSMC manager of operations and the on-duty supervisor at Seaway Beauharnois to advise that the icebreaker had reported that the fast ice at the Pointe Fortier anchorage area was starting to break away.

Vessel traffic management plan

Prior to the opening of the Seaway on 02 April 2015, the SLSMC operations group developed a vessel traffic management plan for 4 vessels that were scheduled to enter the Seaway in the following order: the *CWB Marquis*, the *Adfines Star*, the *Tundra*, and the *Floragracht*. An opening ceremony was also planned for the morning, which meant that the *CWB Marquis*, the first vessel to enter the Seaway, would remain in the Saint-Lambert lock for the duration of the ceremony.

Following the opening ceremony, the vessels were scheduled to proceed to the Pointe Fortier anchorage area during the afternoon, escorted as required by the *Martha L. Black* from the Côte-Sainte-Catherine lock. The transit time from the Saint-Lambert lock to the anchorage would be approximately 6 hours, including locking at Côte-Sainte-Catherine. The next day, a convoy would be formed to escort the *CWB Marquis*, the *Adfines Star*, and the *Tundra* through the Canal de Beauharnois, into Lac Saint-François, and to the Snell lock. The *Floragracht* would proceed to Valleyfield, Quebec, without icebreaker assistance.

It was decided that the vessels would not proceed further upstream than the Pointe Fortier anchorage for the following reasons:

- The vessels could not travel during the night due to a restriction on night navigation.⁸
- The vessels could not transit or moor at the Beauharnois locks because of planned ice maintenance⁹ on the locks and approach walls.
- The vessels could not proceed as far as the Snell lock, which was 45 nautical miles (nm) away from the Beauharnois locks, during daylight hours.
- The vessels could not use the anchorage on Lac Saint-François because it was considered unsafe: the fast ice on Lac Saint-François is not broken up by the CCG and is instead left to melt in place, with a track being made only in the navigation channel. This is to limit the drift ice in circulation and prevent it from adversely affecting the hydroelectric dam at Beauharnois. The fast ice on this lake is known to be a risk for vessels, as large sections of ice can break off and enter the navigation channel. On 21 December 1995, a bulk carrier made bottom contact on Lac

⁸ During the opening and the closing periods, vessels may be restricted to daytime navigation to mitigate the risks related to ice and poor weather (visibility), as well as the fact that the lighted floating navigational aids may have been decommissioned or not yet recommissioned.

⁹ The St. Lawrence Seaway Management Corporation planned to flush the ice from the lock approaches and scrape the ice off the approach and lock walls.

Saint-François after a large ice floe drifted across the channel and pushed the vessel out of the channel.¹⁰

The anchorage at Pointe Fortier was therefore deemed the best option to maximize transit time; furthermore, the most recent icebreaking work in the anchorage area had been completed the day before.

History of the voyage

On 02 April 2015 at 1243, following the opening ceremony, the *CWB Marquis* exited the Saint-Lambert lock and proceeded upbound to the Pointe Fortier anchorage. It was followed by the *Adfines Star* at 1359, the *Tundra* at 1508, and the *Floragracht* at 1640. These last 3 vessels were foreign-flagged and under the conduct of pilots¹¹ from the GLPA, while the *CWB Marquis* was under the conduct of the master, who held a pilotage certificate. After exiting the Côte-Sainte-Catherine lock at 1448, the *CWB Marquis* was escorted by the *Martha L. Black* to the entrance of Lac Saint-Louis. The other 3 vessels proceeded without escort as the ice conditions were favourable in the navigation channel.

The *Martha L. Black* then proceeded to the approach wall of the Lower Beauharnois lock and eventually, after being authorized by Seaway Beauharnois, transited the locks and moored at the wall of the Upper Beauharnois lock at 2009.

The *CWB Marquis* arrived at the Pointe Fortier anchorage at 1730 and dropped anchor north of the navigation channel, 0.45 nm south of Pointe Fortier. The port anchor was used with 3 shackles¹² of chain in the water, and the vessel was on a heading of approximately 240°true (T). The master issued night orders for the bridge watch personnel requesting to be advised if the anchor dragged. The master and the engine room were also to be called once Seaway Beauharnois had given the vessel its one-hour notice for departure and details about the next day's transit.

The *Adfines Star* arrived at 1735 and dropped anchor 0.77 nm south by west of Pointe Fortier, approximately 0.22 nm upriver of the *CWB Marquis*, as the *Adfines Star* was scheduled to be the first vessel of the next day's convoy.

At 2005, the *CWB Marquis* had swung on its anchor chain, putting it closer to the *Adfines Star*. The master of the *CWB Marquis* weighed anchor and repositioned the vessel 0.12 nm further to the northeast. The vessel was re-anchored using the port anchor and 3 shackles of chain in the water.

¹⁰ Transportation Safety Board of Canada (TSB) Marine Occurrence M95C0118 (*Kapitonas Mesceriakov*).

¹¹ During the opening and closing periods, vessels in the Seaway have 2 pilots on board. This is because ice conditions and weather can make trips longer than usual, and because the lighted floating navigational aids may be decommissioned or not yet recommissioned.

¹² 1 shackle of chain is equal to 27.43 metres.

During the transit of the 3 vessels that were under the conduct of pilots, the pilots contacted Seaway Beauharnois by VHF radiotelephone several times to request authorization to proceed farther up the Seaway than the anchorage at Pointe Fortier. In their requests, the pilots referenced the remaining hours of available daylight, the good weather, and the fact that the vessels could depart sooner in convoy with the icebreaker the next day. Seaway Beauharnois advised that there was a restriction on night navigation, that the hands-free mooring system¹³ was not operational and there were no personnel available to tie up the vessels in the locks, and that the traffic plan was for the vessels to anchor. The vessels could not be locked or tied up on an approach wall due to planned ice maintenance at the locks that night. At 2010, the supervisor at Seaway Beauharnois agreed to begin locking the vessels at the Lower Beauharnois lock 2 hours earlier the next day, at 0400 instead of 0600, in the following order: *Adfines Star*, *CWB Marquis*, *Tundra*, and *Floragracht*.

The *Tundra* arrived at 2051 and anchored 0.9 nm south-southwest of Pointe Fortier, closer to the entrance of the Lower Beauharnois lock. The *Floragracht* arrived at 2157 and dropped anchor in the navigation channel, 0.75 nm east-southeast of Pointe Fortier (Appendix C).

At 2212 the tug *La Prairie*,¹⁴ which was en route to the Beauharnois locks to perform ice maintenance, advised Seaway Beauharnois that it would have to turn around and return to the Côte-Sainte-Catherine lock. The tug was 3.2 nm from calling-in point 3 (Pointe Moulin, Lac Saint-Louis, approximately 3 nm below Pointe Fortier anchorage) and had encountered an ice floe in the channel that it could not break or get through. Seaway Beauharnois acknowledged the message and advised the supervisor. Shortly afterward, Seaway Beauharnois requested that the tug return to the Canal de la Rive Sud and perform icebreaking work in the areas of the canal that the icebreaker could not reach.

On 03 April at 0000, the officer of the watch (OOW) and the helmsman on the *CWB Marquis* began their watch. At the time, the vessel's heading was 031°T and the winds were light and variable. In the early hours of the watch, the winds increased, blowing from the southwest at 20 knots. The winds caused the *CWB Marquis*, the *Adfines Star*, and the *Tundra* to swing on their anchors so that their bows were pointing into the wind.¹⁵ By 0200, the winds had increased to 30 knots.

At approximately 0211, the *Adfines Star* was struck by an ice floe, pushing the vessel from its position until the anchor chain was fully extended and prompting the pilots on board to prepare the vessel for departure earlier than scheduled.

¹³ A hands-free mooring system uses vacuum pads mounted on vertical rails, rather than steel mooring lines, to secure vessels inside the lock.

¹⁴ *La Prairie* is a commercial tug based in Montréal that The St. Lawrence Seaway Management Corporation hired to assist in the opening of the Seaway.

¹⁵ The *Floragracht* was less affected by the winds because it was anchored in the navigation channel, and the current kept it aligned with the channel.

About 20 minutes later, an ice floe¹⁶ struck the *CWB Marquis*, causing it to drift eastward in line with the *Floragracht*, which was located 0.73 nm astern of the *CWB Marquis*. The OOW and the helmsman on the *CWB Marquis* felt the vessel shudder, and the OOW checked the vessel's position on the radar and ECDIS.

At 0237, having observed that the ice floe was pushing the *CWB Marquis* and that the vessel was dragging anchor, the OOW phoned the master in his cabin and advised him that a big floe of ice had struck the vessel and that the vessel was slowly dragging anchor. The OOW stated that the vessel was not in immediate danger and that it was dragging toward the navigation channel. The master acknowledged the OOW, and it was agreed that the master was to be advised if the situation changed. During this conversation, which lasted approximately 1 minute, the vessel changed direction, dragging anchor north-northeast at a speed of 0.4 knot.

At 0244, the OOW called the master again and requested that he come to the bridge as the vessel was now dragging anchor toward shallow water. The master ordered the OOW to call the engine room and have the engines prepared; this was done immediately.

The master arrived on the bridge at 0248, at which time the engines were ready and control had been transferred to the bridge. The master ordered the OOW to go forward and prepare to weigh anchor. At 0252, the master informed Seaway Beauharnois that the vessel was dragging anchor with an ice floe pushing the vessel toward shallow water and that it would try to weigh anchor and move back into the navigation channel. Seaway Beauharnois acknowledged the message.

Upon arriving forward, the OOW advised the master that the ice floe was still pushing against the vessel and pinning the anchor chain against the hull. At 0255, the master ordered the OOW to weigh the anchor and then began using the vessel's engine and rudder to manoeuvre so as to free the chain. Shortly after, the OOW reported that there was too much strain on the chain and that the windlass was overloaded; the chain would heave up only a bit at a time. The OOW continued to weigh anchor slowly while directing the master's manoeuvres.

At 0308, the master reported to Seaway Beauharnois that they were still trying to weigh anchor and the ice floe was still pushing the vessel toward shallow water. The ice floe was approximately 0.25 nm (463 metres) long and was positioned halfway between the *CWB Marquis* and the *Adfines Star*. At about the same time, the ice floe made contact with the *Floragracht*, causing it to drag anchor to the northeast. Meanwhile, the *Adfines Star* weighed anchor and reported to Seaway Beauharnois that it was proceeding to the Lower Beauharnois lock.

At 0323, the *CWB Marquis* advised the *Floragracht* by VHF radiotelephone that the *CWB Marquis* was dragging anchor because of an ice floe and was weighing anchor, which

¹⁶ It is not known with certainty whether this was the same floe that struck the *Adfines Star*.

might require the vessel to back up close to the *Floragracht*. The *Floragracht* responded that it too was dragging anchor because of an ice floe and it was in the process of weighing anchor. However, even with the engines at full power, the *Floragracht* was being pushed toward shore by the ice floe. At 0350 the *Floragracht* nearly went aground but was able to weigh anchor. The *Floragracht* then had enough sea room east of the ice floe to go around it. At 0436, the *Floragracht* advised Seaway Beauharnois that it was going to anchor closer to the entrance of the Lower Beauharnois lock.

On the *CWB Marquis*, the chief officer and the company superintendent¹⁷ were summoned to the bridge by the master and were debriefed on the situation. By 0332, the anchor was aweigh. This was reported to Seaway Beauharnois, and the master manoeuvred the vessel to free it from the ice floe. At this time, the vessel was outside the anchorage area and approaching a 10-metre depth. The master continued to manoeuvre the vessel in the limited sea room available, but the ice floe continued to push the vessel toward shore and at approximately 0345 the vessel went aground (Appendix C).

Events after the grounding

Immediately after the grounding, the master of the *CWB Marquis* advised Seaway Beauharnois of the incident, then ordered the ballast tanks to be sounded and attempted to free the vessel from its position. At approximately 0424, the master ordered the engines to be shut down and all 3 anchors dropped to prevent the vessel from shifting position. At this time, the vessel was 0.42 nm east-southeast of Pointe Fortier.

At 0457, the *Tundra* left the anchorage and proceeded to the Lower Beauharnois lock. The *Adfines Star* and the *Tundra* were escorted by the *Martha L. Black* further up the Seaway, while the *Floragracht* proceeded on its own to Valleyfield.

The ice floe drifted slowly with the wind and current, and became lodged in the navigation channel near calling-in point 3.

The *Sipu Muin* arrived on Lac Saint-Louis later on in the morning and tried to break up the ice floes in the navigation channel, but was unable to do so. It was noted at the same time that the fast ice conditions on the lake, southeast of the anchorage, had changed since the previous day: a large portion of the fast ice was no longer there. The CCG icebreaker *Amundsen* arrived on scene in the afternoon and broke up the ice floes in the channel.

The *CWB Marquis* remained aground for approximately 14 hours, until it was refloated with the help of 2 tugs at 1800. It was inspected by a surveyor from the vessel's classification society and an SLSMC inspector. The vessel was subsequently authorized to continue its voyage to Hamilton, Ontario, where it would undergo an underwater survey.

¹⁷ The superintendent was employed by Algoma Central Corporation and was on board along with other representatives of the company for the occurrence voyage.

Damage to the vessel

The vessel sustained minor damage in way of the No. 2 starboard ballast tank. Two frames and some sections of shell plating were slightly distorted.

Environmental conditions

Environment and Climate Change Canada issues marine weather forecasts every 12 hours. The forecast issued for the Cornwall to Montréal area at 0300 on 02 April 2015 called for light winds changing to southeasterly in the morning, then calming again in the afternoon. The winds would then change to southwesterly and increase to 15 to 25 knots during the evening. Showers were predicted for the evening and overnight, and fog patches were expected to develop overnight and dissipate in the morning of 03 April.

The next forecast, issued at 1500 on 02 April, also called for light winds increasing to southwesterly at 15 to 25 knots during the evening, then dropping to light winds on Friday afternoon. Showers were predicted for the evening and overnight, and fog patches were expected to develop overnight and dissipate in the morning of 03 April.

At the time of the occurrence, the weather was overcast with periods of rain, and visibility was approximately 10 nm. The winds were light until around 0040 on 03 April, when they became southwest blowing at 10 to 15 knots. Ten minutes later, they increased to 15 to 20 knots. At 0200, the winds gusted up to 30 knots for a period of approximately 30 minutes, and then decreased to 20 knots. The air temperature at that time was 7° C. The sunset on 02 April was at 1923, with nautical twilight¹⁸ ending at 2029. On 03 April, nautical twilight began at 0526 and sunrise was at 0631.

The CCG icebreaking operations on Lac Saint-Louis were approximately 30 to 40 percent complete, with work in the Beauharnois and Baie des Cascades sectors having just begun. On 02 April at 1654, the *Martha L. Black* reported that the anchorage area was free of ice except for some broken ice on the western side. According to the ice chart published on 31 March, the shore fast ice southeast of the anchorage was in excess of 70 cm thick.

Following the occurrence, the CIS was asked to determine the ice conditions present on Lac Saint-Louis on 02 April. CIS examined photos taken by a fixed-wing aircraft on 31 March; satellite imagery taken on 01, 03, 04, 05, and 07 April; and an ice chart produced by CIS on 06 April. Its interpretation of this data concluded that the ice conditions present on 02 April consisted of fast ice on the whole lake, except for broken ice in way of the navigation channel and anchorage area. The ice was rotten and decayed, and the fast ice along the shore was breaking up.

¹⁸ Nautical twilight is defined as beginning when the geometric centre of the sun is 12° below the horizon.

The currents in the anchorage area are variable and may set in more than one direction. There are generally wide eddies in the anchorage areas northwest of the navigation channel that flow in a counterclockwise direction. The current is usually 0.1 to 1 knot, depending on the flow into Lac Saint-Louis.¹⁹

The SLSMC confirmed that there had been no change in water levels on Lac Saint-Louis in the 24-hour period before the grounding. Hydro-Québec confirmed that, during the same time period, there had been no change in the water flow rate at the hydroelectric dam east of the Beauharnois locks.

Vessel and personnel certification

The *CWB Marquis* carried all required certificates for a vessel of its class and intended voyage. The crew members of the *CWB Marquis* were all properly certified for their positions on board. When the vessel arrived in Montréal in December 2014, the master and crew disembarked, rejoining the vessel a few days before the opening of the Seaway.

The master held a Master Mariner certificate of competency and had sailed on various Algoma Central Corporation vessels since 1984 and as master since 2006. He joined the *CWB Marquis* on 31 October 2014 in China, where he took command of the new vessel. He had experience in ice navigation on the Great Lakes and in the St. Lawrence River.

The OOW obtained a Watchkeeping Mate certificate of competency in 2006 and had sailed on various Algoma Central Corporation vessels since 2006. He had experience in ice navigation on the Great Lakes and in the St. Lawrence River.

The master and the OOW each held a pilotage certificate in accordance with the *Great Lakes Pilotage Regulations*, which meant that they could act as pilots on board the *CWB Marquis* for the occurrence voyage.

Both the master and the OOW were certified by Transport Canada as medically fit and they met the requirements of the *Marine Personnel Regulations* with regard to hours of work and rest.

Anchoring in the presence of ice

The CCG manual *Ice Navigation in Canadian Waters* is intended to provide masters and watchkeepers on vessels operating in ice in Canadian waters, including the Arctic, with the information they need to understand the hazards when navigating in ice.

¹⁹ Sailing Directions, St. Lawrence River, Montréal to Kingston, (CEN 301), Second Edition, 2010, p. 17.

With regard to anchoring, the manual states that “anchoring in the presence of ice is not recommended except in an emergency...”²⁰

Other references on the subject provide similar advice. For example, *The Ice Navigation Manual* does not recommend anchoring in ice, as the pressure of the ice on the vessel will drag the anchor, and states that vessels anchoring in open ice require a careful watch to be kept for any heavy ice approaching the vessel.²¹

The *CWB Marquis* had standing instructions for navigation officers to follow in various situations that could arise during the course of their watch. These included instructions for operations in ice, but did not specifically address anchoring in the presence of ice. The instructions for what to do if the vessel started dragging anchor was to “call engine room immediately to put engine room on standby, call master immediately, and anchor party.”

The St. Lawrence Seaway Management Corporation

Operational structure

The SLSMC has a Vice-President, Operations, who is responsible for Engineering, Operations and Maintenance, and Safety for the MLO and Welland sectors of the Seaway. Each sector has a General Manager of Regional Engineering and a General Manager of Operations, both of whom report to the Vice-President, Operations (Appendix D). The General Manager, Operations, for the MLO sector was responsible for developing the vessel traffic management plan for the opening day of the Seaway.

Supervisors in Seaway Traffic Control /Operations Centres, such as Seaway Beauharnois, are responsible for the vessel traffic controllers and operations coordinators who communicate with the vessels transiting the Seaway and operate certain bridges in the system remotely. The supervisors, traffic controllers, and coordinators work 12-hour shifts, with the supervisor reporting to the General Manager of Operations responsible for the sector. The manager works regular business hours and is on call outside of these hours. During the opening and closing periods, the Operations Centre staff provides daily updates to the General Manager of Operations, or his or her representative, to help establish the vessel traffic management plan.

Seaway Handbook

The Seaway Handbook contains both the SLSMC’s Seaway Practices and Procedures established under Section 99 of the *Canada Marine Act* and the SLSDC’s *Seaway Regulations* established pursuant to the *Saint Lawrence Seaway Act* of 13 May 1954, as amended. Some provisions relevant to this occurrence include

²⁰ Fisheries and Oceans Canada, Canadian Coast Guard, TP 5064E, *Ice Navigation in Canadian Waters* (revised August 2012), paragraph 4.6.3(q).

²¹ Toomey, Lloyd, House, and Dickins, *The Ice Navigation Manual*, 1st edition, London: Witherby Seamanship International Ltd, 2010.

- “Every ship shall comply promptly with transit instructions given by the traffic controller or any other officer.”²²
- “Every ship prior to departing from a port, dock or anchorage shall report to the appropriate Seaway station its destination and its expected time of arrival at the next check point.”²³
- “[Every ship shall report] any hazard, dangerous situation or malfunctioning aid to navigation which had not been published in a notice to mariners.”^{24 25}

The St. Lawrence Seaway Management Corporation Operational Plan for the Opening and Closing Periods

In 2010, the SLSMC developed an *Operational Plan for the Opening and Closing Periods* to provide guidance on how the SLSMC and supporting agencies operate and communicate throughout these periods. The objectives as stated in the plan include, among others, to support shipping and move commercial traffic through the Seaway in an efficient manner when ice is prevalent and to meet customer expectations of a safe and efficient transit.²⁶

Because there is a restriction on night navigation during the opening and closing periods, the practice is to move vessels as far as possible each day, placing them in a good position to move at first light; these movements are referred to as the vessel traffic management plan. Among other criteria, the operational plan requires ice conditions and icebreaker availability to be considered to ensure that vessels are moved safely: “If ice conditions are not stable (free flowing ice; ice jams, risk of large sheets or floes detaching from shore), ships may be restricted day or night and/or may need icebreaker escort to safely proceed in areas deemed critical.”²⁷ The ability to move vessels through the system also requires “the operational conditions at the locks [to be] monitored hourly with an intent to maintain use of lock walls and anchorage areas as long as possible” and the lock facility to be kept “free of ice and be prepared for ship transit well in advance of its arrival at the lock.”²⁸

According to the operational plan, the Traffic Control / Operations Centres “conduct a daily and ongoing review of current conditions in their respective regions and areas of authority, [which is] to include but [is] not limited to determining ice conditions/coverage, transit

²² The St. Lawrence Seaway Management Corporation, *Seaway Handbook*, Part III, paragraph 27.

²³ *Ibid*, Part IV, paragraph 65(2).

²⁴ *Ibid*, Part VI, paragraph 84(e).

²⁵ The *Canada Shipping Act, 2001*, Section 112 requires masters of Canadian vessels to give notice to all vessels in the vicinity and the prescribed authorities on shore of any hazard encountered, including dangerous ice.

²⁶ The St. Lawrence Seaway Management Corporation, *St. Lawrence Seaway Management Corporation Operational Plan for the Opening and Closing Periods*, Section 1, “General Information.”

²⁷ *Ibid*, Section 3, “Traffic Management and Transit Limitations.”

²⁸ *Ibid*.

limitations, operational conditions, traffic volume, weather conditions, ice breaker/escort requirements, and condition of navigational aids.” For the SLSMC, the General Manager, Operations, is a key point of contact for the Traffic Control / Operations Centres and is to be notified “if conditions change such that the traffic management plan cannot be maintained” so that a new plan or course of action can be determined.²⁹

²⁹ Ibid.

Analysis

Events leading to the grounding

On 02 April 2015, the opening day of the St. Lawrence Seaway's 2015 shipping season, 4 upbound vessels were required to stop and anchor for the night at the Pointe Fortier anchorage, located below the Beauharnois locks. The Canadian Coast Guard (CCG) was still engaged in icebreaking operations at the time, and although the anchorage area itself was free of ice, much of the surrounding waters were covered in fast ice.

An ice floe that had broken off from the fast ice drifted into the anchorage, where it made contact with the *Adfines Star*. The pilots on board were alerted and the vessel was prepared in order to weigh anchor. However, neither Seaway Beauharnois nor the other vessels at anchor were informed of the ice floe.

Twenty minutes later, a floe drifted into the *CWB Marquis*, and the vessel began dragging anchor in the direction of the *Floragracht*. The officer of the watch (OOW) on the *CWB Marquis* advised the master that the vessel was dragging anchor because of an ice floe, that the vessel was going toward the navigation channel, and that it was not in any danger. However, the *CWB Marquis* was in fact dragging anchor toward another vessel, and it was not possible to predict how long the ice floe would push against the *CWB Marquis* or what effect this would have.

Seven minutes after the first call to the master, the OOW called the master again requesting him to come to the bridge: the ice floe was still pushing against the vessel and the vessel was now dragging anchor in a northerly direction toward the shore.

When the master arrived on the bridge, he sent the OOW forward with a deckhand to weigh anchor. For the next 35 minutes, the master manoeuvred the vessel under the OOW's direction in an attempt to reduce the tension on the anchor chain. However, the vessel continued to be pushed toward the shore. The anchor was eventually weighed, but there was not enough time or sea room available to manoeuvre the vessel back toward the navigation channel, and the vessel went aground.

Plan to use the anchorage

Operations such as the opening of the Seaway involve planning, proper allocation of resources, implementation, effective risk management, and monitoring of progress. Executing the plan in a safe and timely manner requires awareness of variables and conditions that may have an impact on the plan and require adaptations to be made.

The operations personnel for the Montréal / Lake Ontario (MLO) sector of The St. Lawrence Seaway Management Corporation (SLSMC) had developed a vessel traffic management plan to move the vessels as far up the Seaway as possible on opening day and place them in a good position to continue their transit the next day. The SLSMC operational plan required

the vessels to be moved in a safe and efficient manner when ice was prevalent and for ice conditions and icebreaker availability to be taken into consideration.

The vessels could not moor at the Beauharnois locks and approach walls on 02 April 2015 due to planned maintenance. Therefore, the vessel traffic management plan deemed it necessary to stop the 4 vessels in the Pointe Fortier anchorage area for the night. However, there were shortcomings in the plan and the operation:

- The ice in the anchorage area itself had been broken up and most of the broken ice had been carried downstream by the current, but fast ice remained in the surrounding waters.
- The weather forecast stating that the winds were forecasted to increase from the southwest that night was not taken into account.
- The icebreaker *Martha L. Black* was directed to spend the night of 02 April above the Beauharnois locks to await the convoy the next day, and it was not in a position to assist the 4 vessels at the anchorage if required.
- The *Floragracht* was authorized to transit up to Lac Saint-Louis in darkness despite the restriction on night navigation.
- Anchoring a vessel in the presence of ice is not a recommended practice according to the CCG manual *Ice Navigation in Canadian Waters*.
- Historically, the Pointe Fortier anchorage area had not been used for overnight anchoring on the opening day of the Seaway.³⁰

There were also signs of potentially unstable ice conditions before the occurrence. On the evening of 01 April, the CCG liaison officer relayed a report stating that the fast ice at the anchorage was starting to break away. After the 4 vessels arrived at the anchorage on 02 April, the tug *La Prairie* reported a large floe of ice in the navigation channel. However, despite these reports, the SLSMC did not modify or reassess the suitability of the original vessel traffic management plan.

The shortcomings in the SLSMC's vessel traffic management plan and implementation contributed to the eventual grounding of the *CWB Marquis*.

³⁰ The St. Lawrence Seaway Management Corporation records indicate that, since 2005, the Pointe Fortier anchorage area had not been used as an overnight anchorage for vessels in transit on the opening day of the Seaway. It had, however, been used as an overnight anchorage 2 or 3 days after the Seaway opened (in 2007 and in 2014).

Findings

Findings as to causes and contributing factors

1. Four vessels were required to stop for the night and anchor at the Pointe Fortier anchorage area. The area was mostly free of ice, but fast ice was present in the surrounding waters and strong winds were forecasted.
2. An ice floe broke off from the fast ice during the night and, under the influence of the current and winds, drifted into the anchorage where the 4 vessels were anchored.
3. One of the vessels was struck by an ice floe and promptly weighed anchor; however, neither Seaway Beauharnois nor the other vessels at anchor were advised of the ice floe adrift in the anchorage.
4. An ice floe later came into contact with the *CWB Marquis*, which began dragging anchor. The officer of the watch advised the master of the situation and stated that the vessel was not in any immediate danger.
5. The *CWB Marquis* began dragging anchor toward shore with the large ice floe still pushing against it; however, the pressure of the ice on the anchor chain prevented the anchor from being weighed immediately.
6. A combination of the delay in responding after the *CWB Marquis* began dragging anchor and the time it took to weigh anchor resulted in the *CWB Marquis* going aground outside the anchorage area.
7. The shortcomings in The St. Lawrence Seaway Management Corporation's vessel traffic management plan and implementation contributed to the eventual grounding of the *CWB Marquis*.

Other findings

1. The *Floragracht*, which was anchored near the *CWB Marquis*, was also struck by an ice floe and nearly went aground, but did not report the incident to Seaway Beauharnois.

Safety action

Safety action taken

Transportation Safety Board of Canada

On 10 December 2015, the Transportation Safety Board of Canada (TSB) issued Marine Safety Information letter (MSI) 14/15 to inform The St. Lawrence Seaway Management Corporation (SLSMC) of the risks of anchoring in the presence of ice.

Algoma Central Corporation

As a result of this occurrence, Algoma Central Corporation advised the SLSMC, by letter, that in future their vessels would secure at available lock approach walls for the night rather than anchoring in the presence of ice, even if this meant the vessels losing their place in the queue.

The following amendment was also made to Algoma Central Corporation's safety management system for both their dry bulk and tanker fleets with regards to anchoring in the presence of ice:

- Anchoring in the presence of ice is not recommended except in an emergency. If such anchoring is deemed necessary it should only be carried out after a full assessment of the risk factors involved. The pressure of ice on the vessel will result in the vessel dragging anchor. Vessels having to anchor in or near open pack ice conditions must maintain a careful watch for any heavy ice approaching the vessel. Vessels navigating in the Seaway during ice conditions are to secure at safe berths or lock approach walls rather than anchoring in the presence of ice as part of any Seaway traffic management direction.

The St. Lawrence Seaway Management Corporation

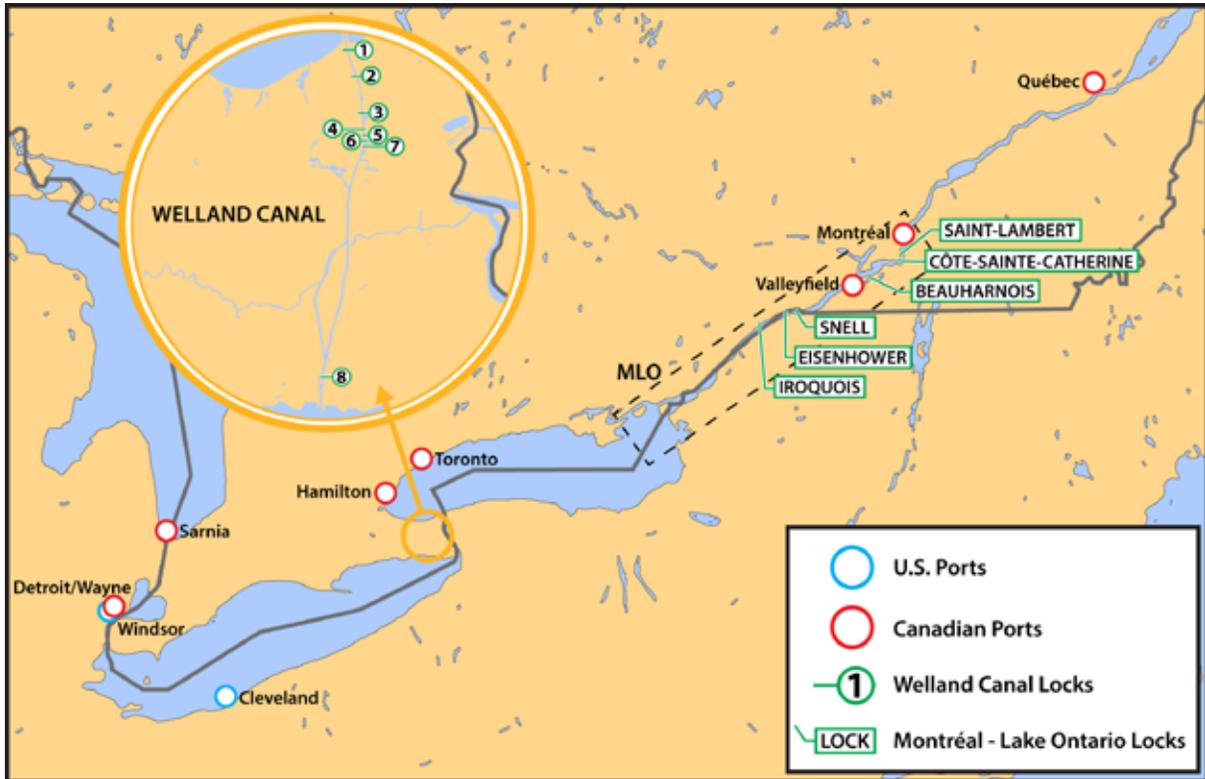
The SLSMC added the Canadian Coast Guard manual *Ice Navigation in Canadian Waters* to their winter process toolkit, and a link to the document has been added to the Great Lakes St. Lawrence Seaway System website in the Commercial Shipping section.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 08 June 2016. It was officially released on 28 June 2016.

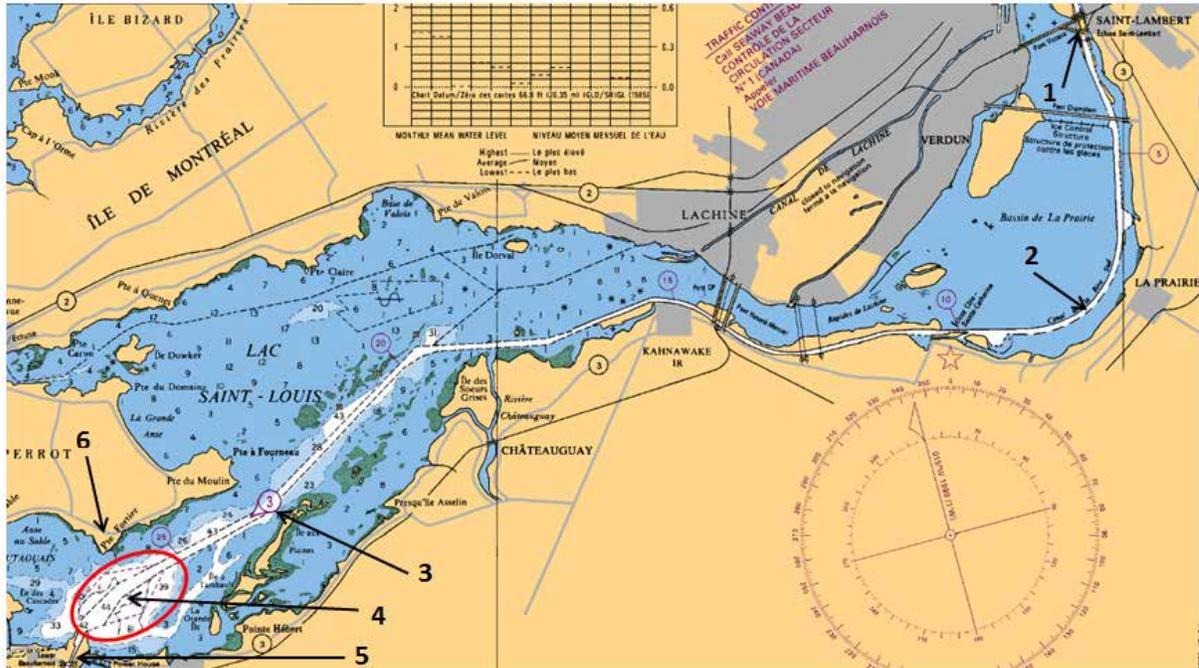
Visit the Transportation Safety Board's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. In each case, the TSB has found that actions taken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

Appendices

Appendix A – St. Lawrence Seaway



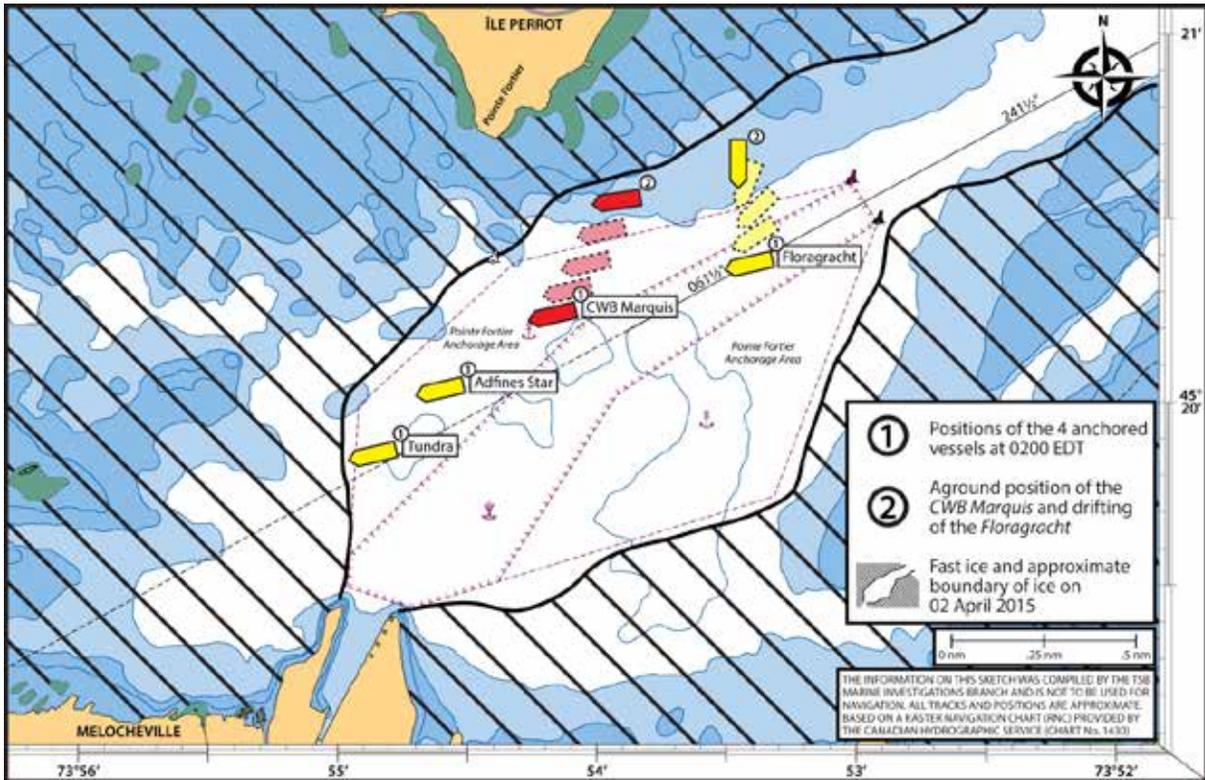
Appendix B – St. Lawrence Seaway (Saint-Lambert to Beauharnois)



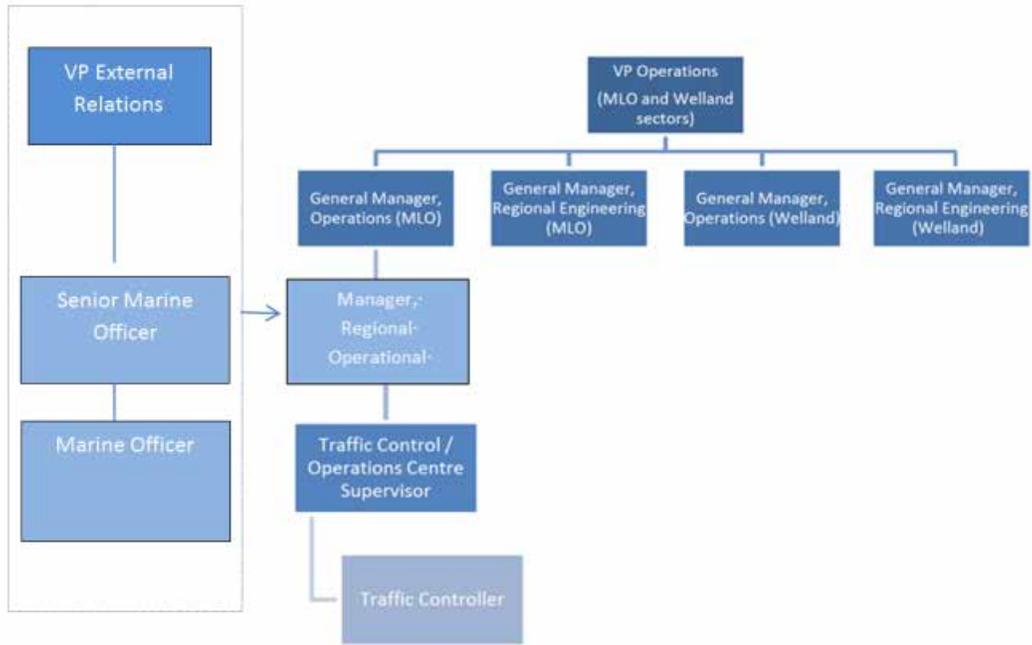
Legend

- 1 Saint-Lambert lock
- 2 Canal de la Rive Sud
- 3 Calling-in point (CIP) 3
- 4 Pointe Fortier anchorage area
- 5 Lower Beauharnois Lock
- 6 Pointe Fortier

Appendix C – Area of occurrence (with vessel movement)



Appendix D – The St. Lawrence Seaway Management Corporation organizational chart



Source: The St. Lawrence Seaway Management Corporation