MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

ACCIDENT REPORT

SERIOUS MARINE CASUALTY | REPORT NO 11/2017 | MAY 2017

Grounding of the passenger ferry *Royal Iris of the Mersey* River Mersey, UK 10 July 2016

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SUMMARY

On 10 July 2016, the domestic passenger ferry *Royal Iris of the Mersey* (*Royal Iris*), with 66 passengers and 9 crew on board, grounded on the submerged remains of a mooring dolphin when approaching Eastham locks at the entrance to the Manchester Ship Canal. Both of the ferry's engines stopped but the crew quickly let go an anchor. The ferry's starboard engine was soon re-started but its port engine was disabled. The port propeller, shaft, stern seal and rudder were damaged. A minor flood in the shaft space was contained using onboard equipment and the ferry was able to safely manoeuvre and make fast alongside another vessel on a nearby quay. There were no injuries and there was no pollution.

The MAIB investigation identified that:

- When *Royal Iris* struck the submerged dolphin the bridge team were navigating solely by eye and incorrectly assessed that the ferry was in safe water.
- The adjustment of the ferry's usual approach to Eastham lock to take account of a departing dredger reduced the margin for navigational error.
- The bridge team's attention was focused on the dredger, which led to reduced spatial awareness.
- The crew's actions following the grounding were immediate and effective.
- Elements of the information shown on the Admiralty chart had not been updated and were inaccurate, but this did not contribute to the accident.

Royal Iris of the Mersey

Following the accident, Mersey Ferries Limited, *Royal Iris*'s operator, has provided electronic chart systems on its vessels. In addition, Peel Ports Group Limited (Peel Ports) and the United Kingdom Hydrographic Office have taken steps to improve the accuracy of the charted hydrographic information they provide for the approaches to Eastham locks.

In view of the actions taken no recommendations have been made.

FACTUAL INFORMATION

Narrative

At 1230[1] on 10 July 2016, the passenger ferry *Royal Iris* was on passage towards the Eastham Channel on the River Mersey **(Figure 1)**. Nine crew and 66 passengers were on board the ferry, which was on a scheduled cruise of the Mersey and the Manchester Ship Canal. The master and the mate were on the bridge; the master had the con and stood on the starboard side of the bridge while the mate was on the helm on the centreline. Both were navigating solely by eye, although the depth sounder and radar were operating. The vessel's engineer was also on the bridge. *Royal Iris* was making good a course of 160° at a speed of 7.6kts[2]. The scheduled time of arrival at Eastham locks[3], at the entrance to the Manchester Ship Canal, was 1240.

At 1236, Eastham port control called *Royal Iris* via very high frequency (VHF) radio and informed the bridge team that *Deo Gloria*, a dredger, was leaving Eastham lock at about 1245. The ferry was approaching E4 buoy, 1.8nm from the lock entrance, so the master reduced the ferry's engine speed to delay its arrival time. The tidal stream was flooding to the south and the wind was between 22 and 27 knots from the south-west.

At 1246, Eastham port control informed *Royal Iris*'s bridge team that *Deo Gloria* would be leaving Eastham lock between 5 and 10 minutes later than expected and would be securing on the west wall at the entrance to QEII lock. By that time, the ferry was just over 1nm from the lock. In view of the need to delay approach to the lock even further, the master considered turning the vessel around, but decided against doing so due to the limited width of the navigable channel.

Royal Iris passed the E6 buoy at 1249 at a speed of 6kts while *Deo Gloria* was leaving the lock. By 1251, the dredger was heading towards the west wall at the entrance to QEII lock at a speed of 3kts **(Figure 2)**. The distance between the vessels was about 460m and *Royal Iris* was 560m from the lock entrance. The ferry's master briefed the mate to stay towards the edge of the eastern side of the channel and then to turn towards the lock entrance as soon as the dredger was sufficiently clear to the west to pass '*green to green*'. Accordingly, the mate steered *Royal Iris* towards the eastern side of the channel **(Figure 3)**.

At about 1253, when *Deo Gloria* was sufficiently clear of *Royal Iris*'s starboard bow, the ferry's mate applied starboard helm to steer towards the lock entrance. As he did so, the master moved to the port bridge wing to assess the approach to the lock in relation to the east side of the lock **(Figure 4)**. Seconds later, at 1254, the ferry suddenly heeled over about 5º to starboard. The vessel started to vibrate and both of its main engines stopped. *Royal Iris* had struck an underwater obstruction. The master was uncertain what the ferry had hit; he was aware that the ferry was on the eastern edge of the channel, but assessed that it was between 75m and 150m to the north of a line of derelict dolphins.

[1] All times are UTC +1

[2] All courses and speeds in this report are over the ground.

[3] There are three locks at Eastham of which two are operational. *Royal Iris* was scheduled to use the largest lock, which is the most westerly.

Reproduced from Admiralty Chart BA 3490-2 by permission of the Controller of HMSO and the UK Hydrographic Office

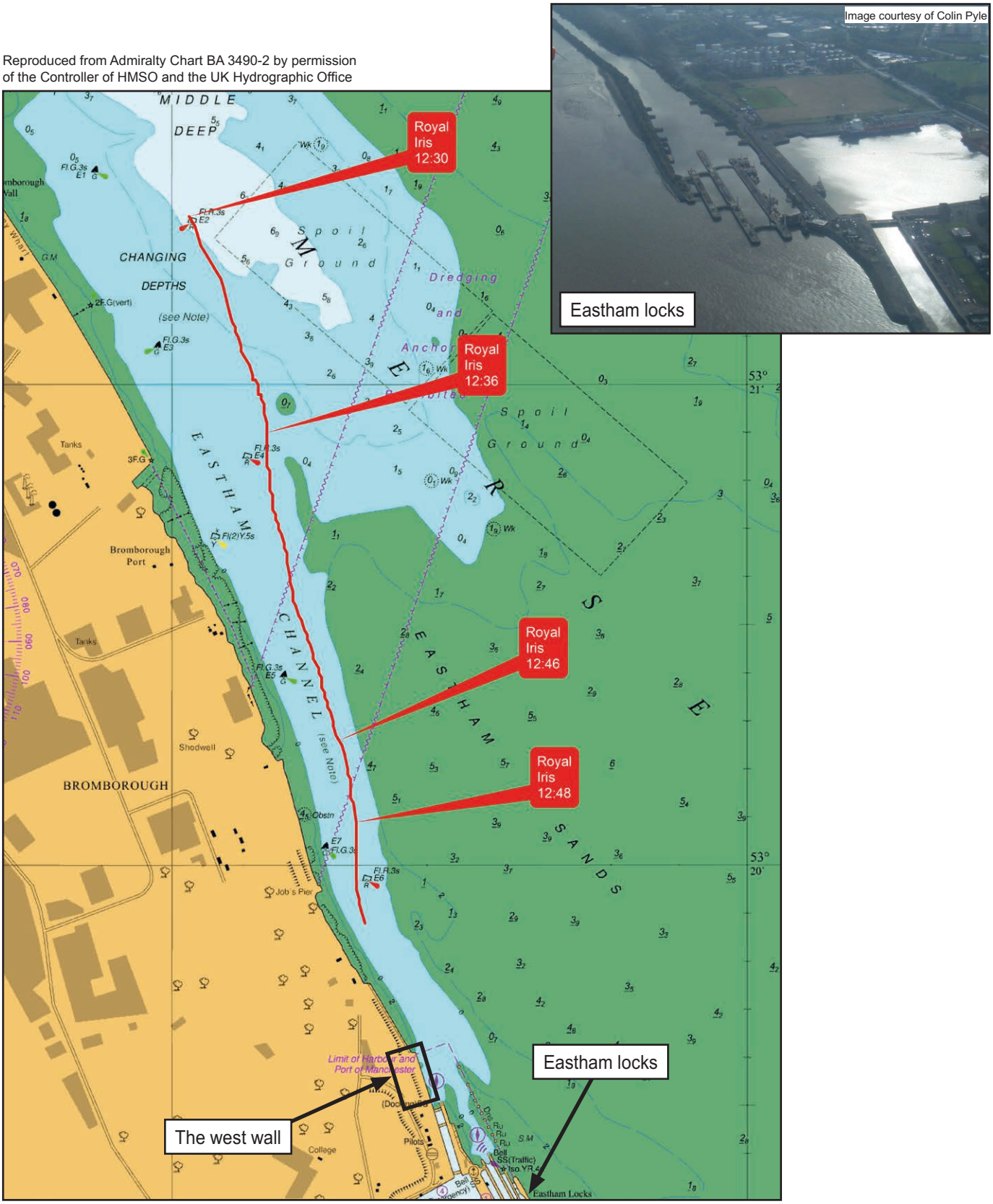


Figure 1: *Royal Iris*'s passage through Eastham channel

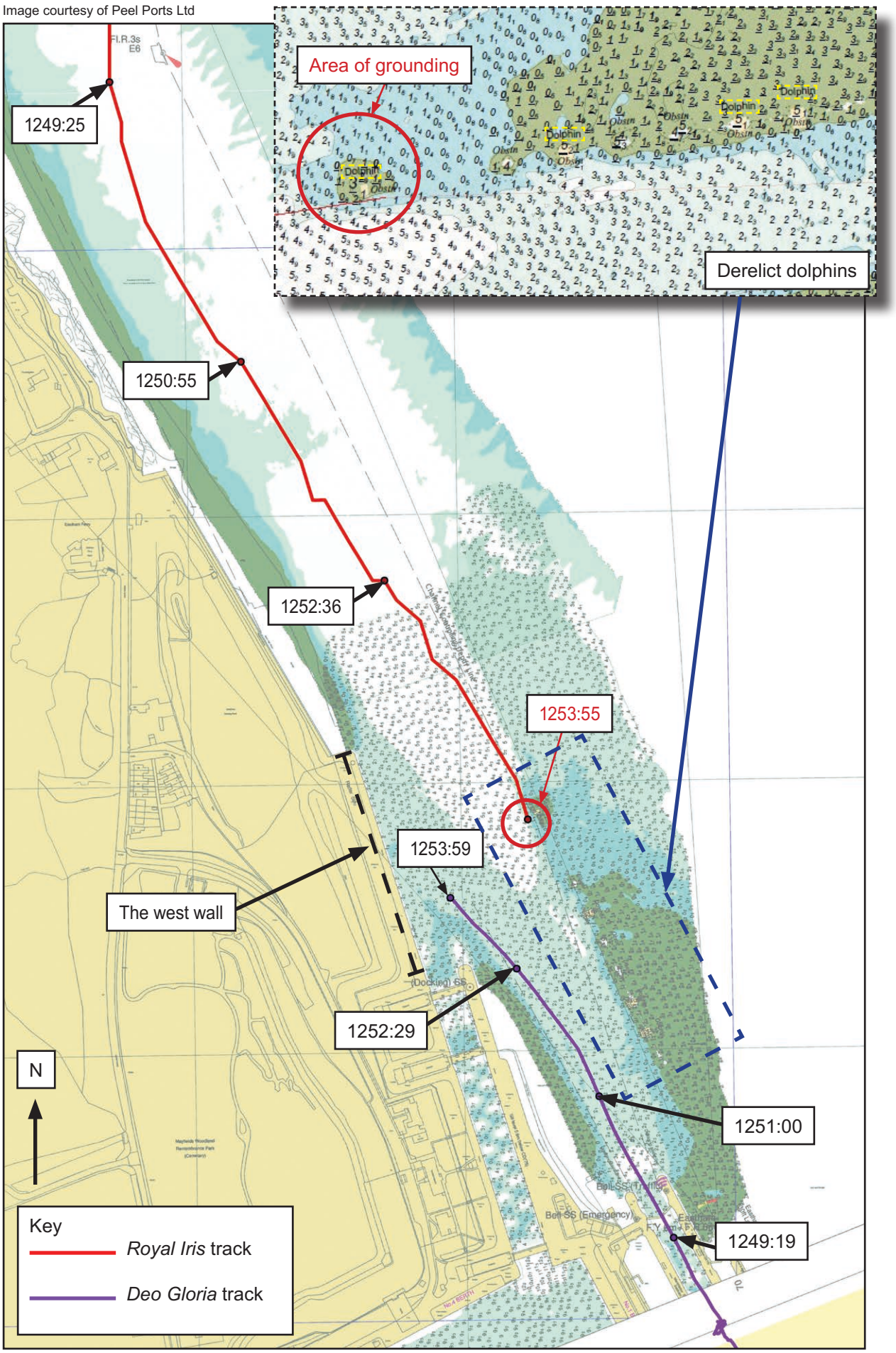


Figure 2: Plot of *Royal Iris* and *Deo Gloria*

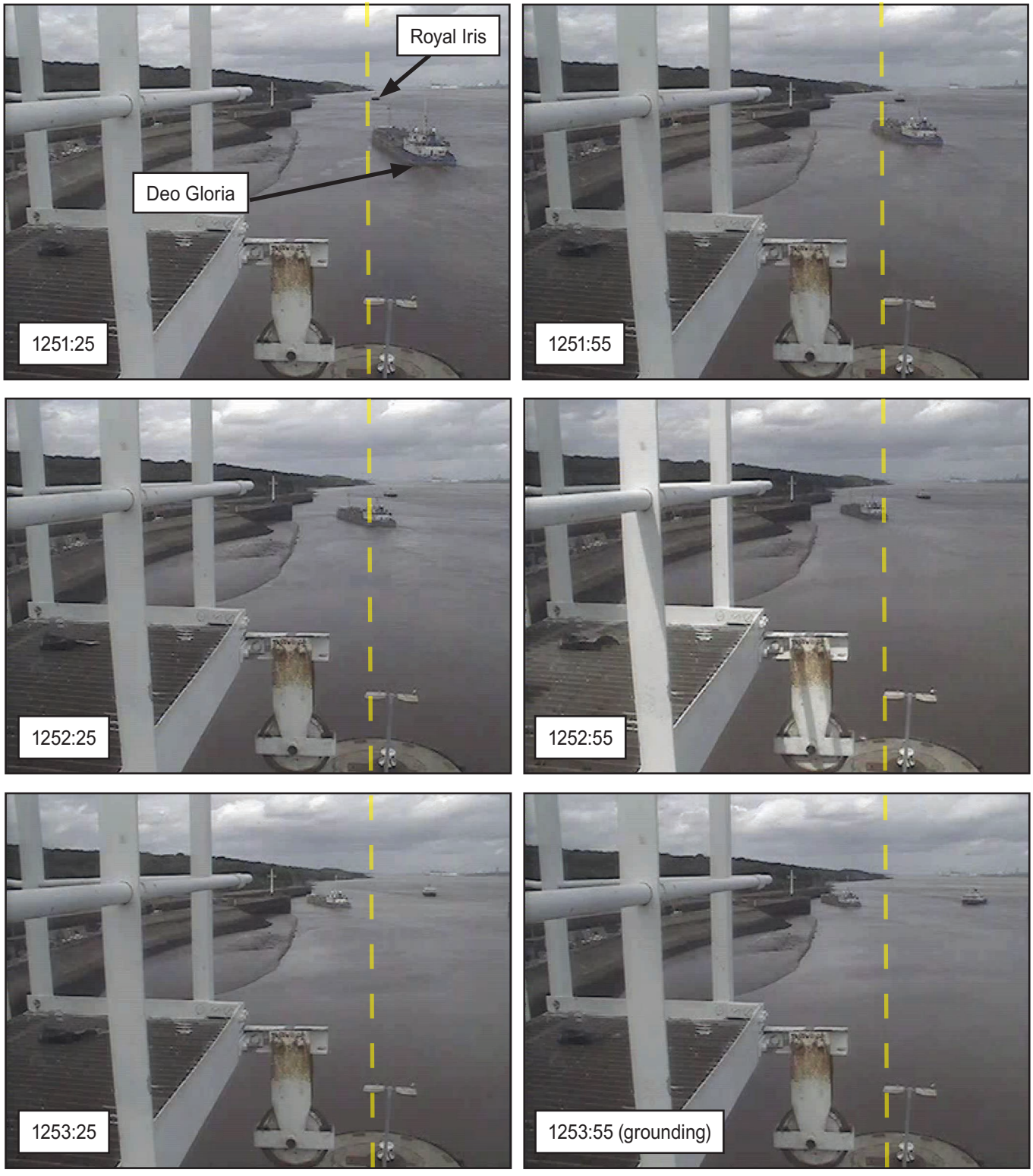


Figure 3: Movement of *Royal Iris* towards the eastern side of Eastham Channel (Yellow pecked line included to help illustrate *Royal Iris*'s drift across the channel)

Post-grounding actions

Royal Iris's engineer immediately went to the engine room and, on the mate's instruction, a deckhand on the fo'c'sle let go the starboard anchor. The anchor was let go with 1.5 shackles of cable. As it took effect, the ferry swung to starboard and stopped off the entrance to the lock. The master informed Eastham port control and Mersey Vessel Traffic Service (VTS) of the accident and the resulting loss of propulsion. He also used the ferry's public address system to inform the passengers of the situation.

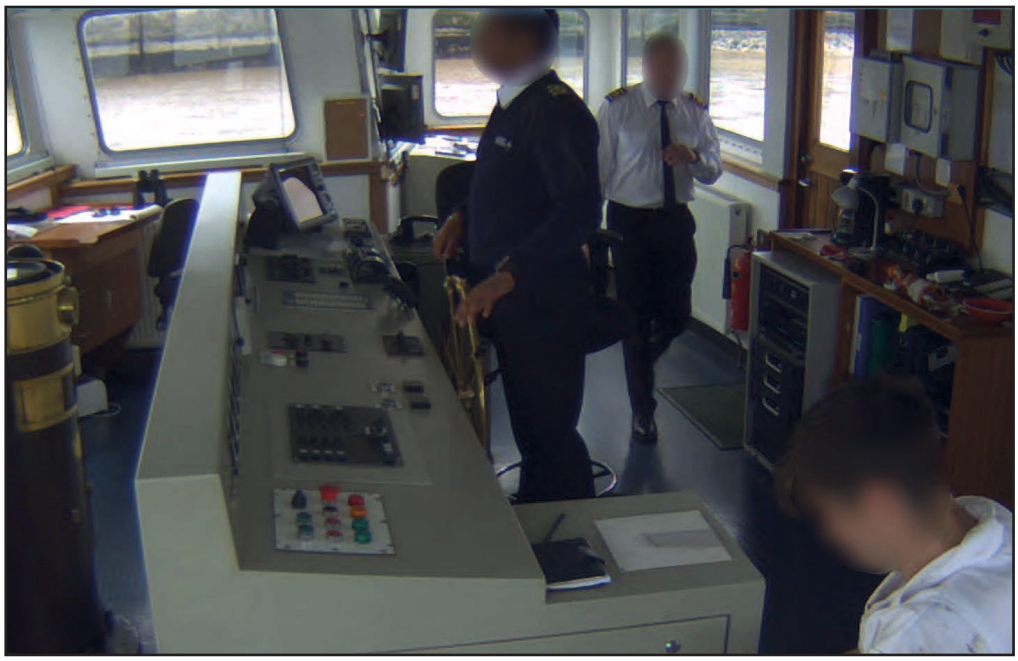


Figure 4: *Royal Iris* bridge at 1253

Meanwhile the engineer attempted to restart the engines. The starboard engine restarted but the port engine did not. The engineer also found that the shaft space was flooded, and used the emergency pump to keep the water level below the threshold of the compartment's watertight door. The master went to the shaft space and saw that the flood was contained, but decided to evacuate the passengers as soon as possible.

The master telephoned Mersey Ferries Limited, and spoke to *Royal Iris*'s designated person ashore, who informed the emergency services. At 1310, a local pilot embarked from a nearby launch to assist. Five minutes later, the ferry weighed anchor and, at 1332, it moored alongside *Deo Gloria* on the west wall. By 1355 all of the passengers had been transferred on board the dredger, from where they were evacuated ashore.

At 1430, *Royal Iris* and *Deo Gloria* shifted into the QEII lock, where the fire and rescue service assisted in the pumping of water from the ferry's port shaft space. During the evening, *Royal Iris* was moored alongside in QEII dock to enable temporary repairs to be completed. The ferry's port side propeller, shaft, stern seal and the rudder were found to have been damaged.

Vessel operation

Royal Iris was one of two, Class IV[4] domestic passenger vessels owned and operated by Merseytravel through Mersey Ferries Limited. The ferry was certified to carry 394 passengers and provided a commuter service between Pier Head (Liverpool), Seacombe and Woodside (Birkenhead) terminals. The ferry was also used for river cruises and for occasional day trips to the Manchester Ship Canal. Its operational draught was 2.5m.

Royal Iris entered service in 1960 but its engines and control systems had been modernised. The ferry was fitted with twin fixed pitch propellers and its service speed was 12kts. The bridge was fully enclosed and navigational aids included X-band radar displays, an automatic identification system (AIS) display and a depth sounder. The radar displays were capable of showing electronic charts, but none had been provided. Admiralty and port authority paper charts of the area were carried on board but these were kept in a drawer and were not routinely referred to during navigation.

Crew

Royal Iris's crew comprised the master, mate, engineer, two deckhands and four service staff. The master and mate each held a Boatmaster Licence (BML) and pilotage exemption certificate (PEC) for the River Mersey. They did not hold PECs for the Manchester Ship Canal[5] but they were allowed to pilot vessels into Eastham locks. Following the accident, the crew were tested by the police for drugs and alcohol; the test results were negative.

[4] Class IV - Passenger ship operating solely in UK categorised waters.

[5] *Royal Iris* was subject to pilotage in both the Mersey and Manchester Ship Canal.

The master was 51 years old and was a UK national. He had worked for Mersey Ferries Limited as a deckhand for 12 years before he was promoted to mate in 2001. He gained his BML in 2005 and had been a master since 2013. The master had completed numerous transits through Eastham lock, including 10 transits during 2016. The master had last transited the lock on 9 July 2016, the day before the accident.

On 10 July 2016, the crew had started work at about 0620 and *Royal Iris* had sailed from Langton Dock, Liverpool, shortly after 0900. Due to tidal constraints the master delayed the ferry's arrival time in Eastham lock to 1300. Consequently, after the passengers were embarked at Seacombe and Liverpool, the ferry headed downriver until about 1130 instead of proceeding directly to Eastham as scheduled by Mersey Ferries Limited.

Lock approach

Eastham locks are usually operated 4 hours either side of high water, which on 10 July 2016 was predicted to be at 1617 with a height of tide of 8.38m. The height of tide at 1254 was 4.14m and the predicted rate of the flooding tidal stream was 1.5kts. From about 3 hours before high water, the flood stream follows the axis of the western riverbank and wall, and then deflects across the lock entrances.

*Royal Iris'*s master was aware of the tidal streams and obstructions off Eastham locks. In keeping with local practice, after passing E6 buoy on a flood tide the master usually aimed to keep his vessel on the western side of the approach channel. The tidal stream was then allowed to set the vessel in line with the lock entrance.

Up to 10 derelict mooring dolphins were sited on the eastern side of the approach channel to Eastham locks **(Figure 2)**. The drying heights of the dolphins varied between 3m and 5m[6]. The most northerly dolphin dried at 3m and was approximately 100m from the nearest adjacent dolphin to the south. The status of the dolphins when the height of tide is 4m is shown at **Figure 5**.

Figure 5: Derelict dolphins in the approach to Eastham locks (height of tide 4m)

[6] On admiralty drying heights are measured above the lowest astronomical tide and are distinguished from depths by being underlined.

Hydrographic information

The Mersey Docks and Harbour Company Limited was the Statutory Harbour Authority (SHA) and Competent Harbour Authority (CHA)[7] for the River Mersey, including Eastham Channel. The Manchester Ship Canal Company Limited was the SHA and CHA for the approaches to Eastham lock. Both harbour authorities were administered by Peel Ports Group Limited (Peel Ports), which in March 2015 had advised the Maritime and Coastguard Agency (MCA) of the authorities' compliance with key aspects of the Port Marine Safety Code (PMSC)[8], in which conservancy[9] is listed among the prime duties.

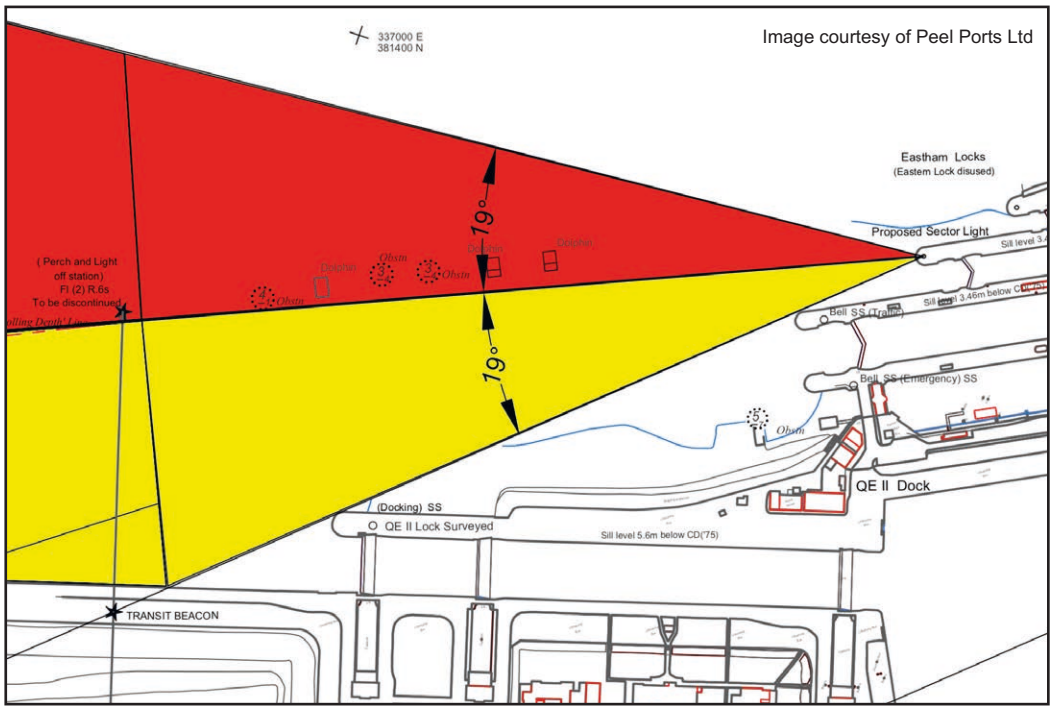


Figure 6: Sector light proposed by Peel Ports Ltd

In 2011, a light on the northerly dolphin was destroyed and was not replaced. Instead, with the approval of Trinity House[10], Peel Ports installed a sector light by the locks to indicate the navigable channel[11] **(Figure 6)**. Prior to the installation of the sector light, Peel Ports advised the United Kingdom Hydrographic Office (UKHO) and Trinity House that it had installed an ISO. YR.4s[12] 'transit' light as an interim measure. It did not later advise them, or issue a local notice to mariners, when the 'transit' light was replaced by the sector light. These oversights occurred during a period of personnel changes within Peel Ports' organisation in Liverpool.

In August 2012, the UKHO issued a New Edition of chart 3490-2, which covered the approaches to Eastham locks. The chart included the 'transit' light and indicated that all of the derelict dolphins remained visible above the water **(Figure 7)**. A proposed draft of the new edition had been sent to Peel Ports for comment, but the port authority did not respond. Subsequently, by agreement, Peel Ports did not provide the UKHO with survey results for Eastham Channel unless there were significant depth changes when notification would be given via Peel Ports' Local Notices to Mariners.

Due to siltation, Peel Ports arranged a weekly survey of the approaches to Eastham locks and the last survey had been carried out on 7 July 2016. A revised chart of the area **(Figure 2)** was emailed to stakeholders the following day and was seen by *Royal Iris*'s master and mate, neither of whom was aware of the sector light.

[7] Competent Harbour Authorities in the UK are those harbour authorities that have been given statutory powers relating to the provision of pilotage in their waters.

[8] The Port Marine Safety Code sets out a national standard for every aspect of port marine safety. Its aim is to enhance safety for everyone who uses or works in the port marine environment.

[9] Conserving the harbour or facility so that it is fit for use and providing users with adequate information about conditions in the harbour or facility.

[10] Trinity House the General Lighthouse Authority (GLA) for England, Wales, The Channel Islands and Gibraltar.

[11] As the local lighthouse authority (LLA), the Mersey Docks and Harbour Company Ltd had a responsibility, among other things, to seek approval from the GLA prior to removing or adding aids to navigation.

[12] ISO indicates "isophase" – a light which shows equal periods of light and dark, YR identifies the colours yellow and red, and 4s equals the total phase period between light and dark in seconds.

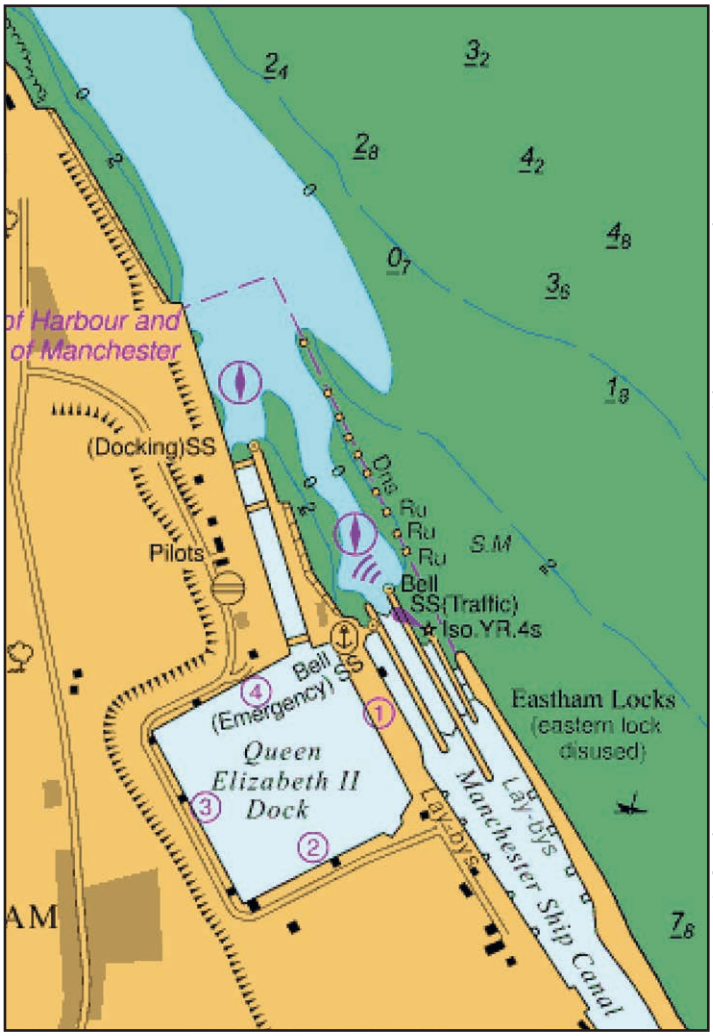
Vessel traffic services

Mersey VTS provided an information service on the River Mersey between the Bar light float and Eastham lock approach. Vessel movements in and out of the Eastham locks was controlled by Eastham port control, which also provided weather and tidal information. Eastham port control was operated by the Manchester Ship Canal Company Limited.

ANALYSIS

Grounding

Figure 2 shows that when *Royal Iris* unexpectedly heeled 5° to starboard and started to vibrate at 1254, the ferry's position was almost coincident with the submerged footings of the most northerly derelict dolphin on the eastern side of the approach to Eastham locks. The height of tide was 4.14m and the dolphin had a drying height of 3m. Consequently, the depth of the water over the dolphin was 1.14m, which was insufficient for *Royal Iris* to pass over with a 2.5m draught. The damage to the ferry's port propeller, shaft, stern seal, and rudder indicates that the ferry's stern swung onto the dolphin following the mate's use of starboard helm to turn the vessel toward the lock entrance.



Reproduced from Admiralty Chart BA 3490-2 by permission of the Controller of HMSO and the UK Hydrographic Office

Figure 7: Extract of Admiralty chart 3490-2

The grounding resulted from several factors coinciding within a 3.5 minute period and limited safe water. These factors included *Deo Gloria*'s close proximity and the slow progress it made towards the west wall, the bridge team navigating by eye in a narrow channel bounded by unmarked dangers, the flooding tidal stream and deviation from the approach to the lock usually adopted by the master. Individually these factors did not constitute a recognizable significant risk, but in conjunction they reduced the margin for any error. When *Royal Iris* grounded, *Deo Gloria* was about to pass 100m down the ferry's starboard side in an area where the channel was only 140m wide and *Royal Iris* was only approximately 40m to the east of the lock axis.

The approach

Royal Iris's master was familiar with and experienced in the approach to Eastham locks via Eastham Channel. Other than re-scheduling the lock entry at the start of the day and the further short delay due to *Deo Gloria*'s departure, *Royal Iris*'s passage as far as the E6 buoy progressed largely as expected, albeit at a reduced speed. The mate steered *Royal Iris* within the buoyed channel while the master adjusted the ferry's speed to balance its arrival time against the need to maintain steerage in the flooding tidal stream. When the master was informed of *Deo Gloria*'s delay, although his decision not to turn the ferry around was possibly influenced to some degree by not wanting to reduce the time available for the Manchester Ship Canal cruise any further, it took into account the narrowness of the channel. Furthermore, the need to pass other vessels in the Eastham Channel was not unusual.

However, because *Deo Gloria* had not departed from Eastham lock by the time *Royal Iris* passed E6 buoy and then the dredger moved slowly towards the west wall **(Figure 2)**, the master had little option but to deviate from his usual approach toward the lock entrance. Instead of keeping close to the west bank after passing E6 buoy, the master told the mate to manoeuvre the ferry further to the east in order to allow the dredger to pass down its starboard side.

Figure 3 shows the ferry's movement to the east during the 2.5 minutes before it grounded. Although the rate of movement might have been greater than intended due to the effect of the wind and tidal stream, the master and mate were not concerned about the ferry's position. Their priority was on closely monitoring their position relative to *Deo Gloria* so that the ferry could be manoeuvred towards the lock entrance as soon as possible.

Positioning monitoring

Royal Iris's master and mate were navigating solely by eye and the ferry possibly still appeared to be close to the west bank due to the height of tide **(Figure 4)**, even seconds before the grounding. As the ferry also remained to the west of the line of the visible dolphins **(Figure 5)**, *Royal Iris* would have appeared to have been in safe water. However, the margin for error was slim and the visual references were misleading. The master's assessment of the position of *Royal Iris*'s grounding indicates that he was aware that the ferry had been on the eastern edge of the channel, but it also shows that he did not appreciate that it was so far to the south. His spatial awareness, and probably that of the mate, had reduced while monitoring *Deo Gloria*. Consequently, he was unaware of the proximity of the hidden danger posed by the submerged dolphin.

In common with similar vessels, navigation by eye was usual practice on board *Royal Iris*. Paper charts were carried but not routinely referred to, and although the ferry was equipped with radar, the plotting of radar parallel indices probably occurred only rarely, if at all. Such practice had previously been successful under normal operating conditions, but in this case, where the difference between success and failure was small, a more accurate means of monitoring the ferry's position was warranted.

Crew response

The response of *Royal Iris*'s crew after the ferry struck the submerged dolphin was immediate and effective. The rapid deployment of the anchor, the re-starting of the starboard engine and the discovery and containment of the flood in the port shaft space were positive actions that safeguarded the vessel and its passengers. The passengers were kept informed of the situation and, although there was no immediate risk to *Royal Iris*, their disembarkation onto *Deo Gloria* at the earliest opportunity indicates that passenger safety was at the forefront of the master's considerations.

Chart accuracy and aids to navigation

The safe passage of a vessel to and from Eastham locks via Eastham Channel is reliant on accurate hydrographic information, particularly in view of the frequently changing depths due to siltation. Therefore, although the area was surveyed regularly, it is of concern that the changed status of the dolphins and the light on Eastham locks was not passed to the UKHO or to Trinity House. A consequence of this omission was that the information regarding these features was inaccurate on the new edition of Admiralty chart 3490 when it was released in 2012. All of the dolphins, which had evidently deteriorated over time, were shown to be permanently visible. In addition, the characteristics of the light on Eastham locks remained as ISO.YR.4s, which is not even a recognised combination.

However, although the UKHO chart's inaccuracies were potentially misleading and warrant correction, they did not contribute to this accident. *Royal Iris*'s master had seen the most recent chart of the area produced on behalf of Peel Ports and he was aware of the status of the dolphins. He was also ignorant of the sector light on Eastham locks, therefore its misrepresentation had no consequence. Nonetheless, these inaccuracies highlight the importance of effective communications between port authorities

and the UKHO and Trinity House. They also highlight the importance of promulgating navigationally important information to mariners and endorse the usefulness of mariners informing the UKHO of any navigationally significant information through Hydrographic Notes[13].

CONCLUSIONS

- *Royal Iris* struck a submerged derelict dolphin when the bridge team were navigating solely by eye and incorrectly assessed that the ferry was in safe water.
- The adjustment of the ferry's usual approach to Eastham lock to take account of the departing dredger reduced the margin for navigational error.
- The bridge team's attention was focused on the dredger, which led to reduced spatial awareness.
- The crew's actions following the grounding were immediate and effective.
- The information shown on the UKHO chart of the area with regard to the status of the dolphins was inaccurate, but this did not contribute to the accident.

ACTION TAKEN

Actions taken by other organisations

Mersey Ferries Limited has:

- Installed electronic chart systems on its vessels.
- Reviewed its safety management system to improve the navigation of its vessels.

Peel Ports Group Limited has:

- Issued a local notice to mariners advising of the sector light at Eastham locks. It has also updated the UKHO and Trinity House on the light's status.
- Suspended the master's PEC for the area until his competency to navigate within the area has been re-assessed.
- Reviewed its aids to navigation database and its risk assessments concerning lock operations in the River Mersey and the Manchester Ship Canal.

United Kingdom Hydrographic Office has:

- Issued notices to mariners advising of the updated status of the derelict dolphins and the status of the navigation light at Eastham locks.

RECOMMENDATIONS

In view of the actions already taken, no recommendations have been made.

[13] Information on Hydrographic Notes can be found at https://www.admiralty.co.uk/maritime-safety-information/hydrographic-notes

SHIP PARTICULARS	
Vessel's name	*Royal Iris of the Mersey*
Flag	United Kingdom
Classification society	Lloyd's Register
IMO number/fishing numbers	8633712
Type	Passenger ferry
Registered owner	Mersey Ferries Limited
Manager(s)	Mersey Ferries Limited
Year of build	1959
Construction	Steel
Length overall	46.45m
Registered length	43.51m
Gross tonnage	464
Minimum safe manning	5
Authorised cargo	394 passengers
VOYAGE PARTICULARS	
Port of departure	Liverpool
Port of arrival	Liverpool
Type of voyage	Domestic
Cargo information	66 passengers
Manning	9
MARINE CASUALTY INFORMATION	
Date and time	10 July 2016 at 1254 (UTC+1)
Type of marine casualty or incident	Serious Marine Casualty
Location of incident	Eastham lock approach 53º19.58'N 002º57.01'W
Place on board	Ship
Injuries/fatalities	None
Damage/environmental impact	Port rudder, propeller and stern seal damaged.
Ship operation	Under pilotage
Voyage segment	Arrival
External & internal environment	Wind SW 22-27 knots. The height of tide was 4.14m and the tidal stream was flooding at 1.5kts. It was daylight with good visibility.
Persons on board	75