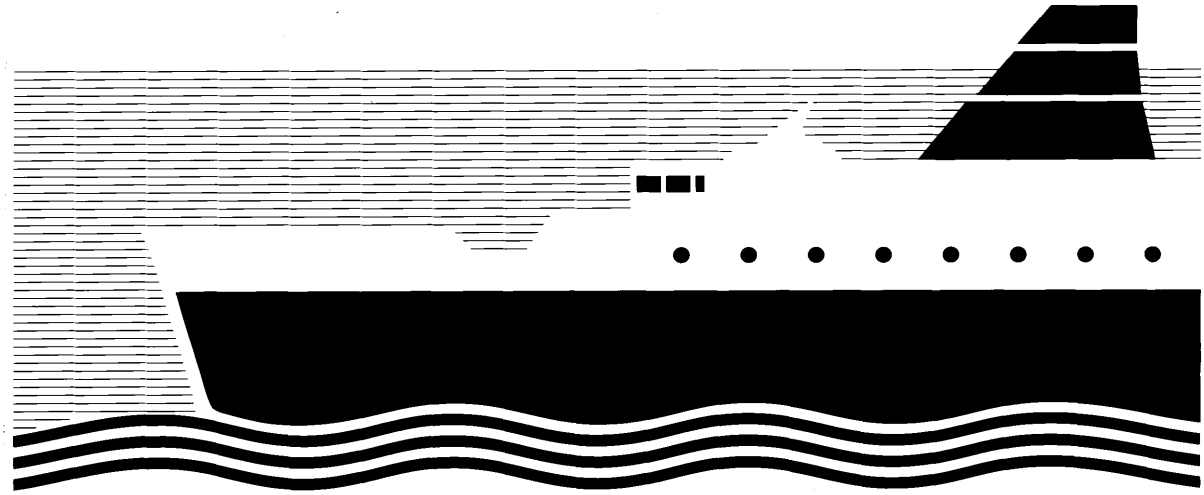
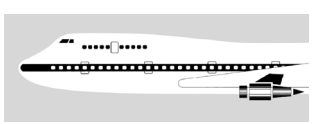
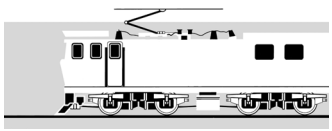


MARINE OCCURRENCE REPORT

03-211 **oil tanker, *Eastern Honor*, grounding, Whangarei Harbour** **27 July 2003**


TRANSPORT ACCIDENT INVESTIGATION COMMISSION
NEW ZEALAND

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

Report 03-211

oil tanker
Eastern Honor

grounding

Whangarei Harbour

27 July 2003

Abstract

On Sunday 27 July 2003 at about 0450, the motor tanker *Eastern Honor* grounded while entering Whangarei Harbour to berth at Marsden Point Oil terminal. The hull in the area of the bow, stern and rudder was damaged.

The *Eastern Honor* subsequently berthed safely at the oil terminal where the cargo was discharged. There were no injuries and no discharge of oil into the environment.

This grounding occurred about 3½ months after a similar incident involving the *Capella Voyager* (TAIC Marine Occurrence Report 03-206).

Safety issues identified for both the *Eastern Honor* and *Capella Voyager* groundings included:

- adequacy of provision of swell data for waters at the entrance to Whangarei Harbour
- adequacy of berthing limitations in adverse swell conditions
- adequacy of knowledge of a vessel's physical movements over the vestigial bar in dynamic conditions.

In view of the safety actions taken by the Maritime Safety Authority, Northland Regional Council, Northport and North Tugz Limited no safety recommendations have been made.

The *Eastern Honor* at Marsden Point oil refinery jetty

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Abbreviations

✠KRS1 – oil tanker 'ESP'(FBC)	vessel's hull built under the supervision of the Korean Register for unrestricted sea service under the enhanced survey programme and having controlled cargo vents
✠KRM1 – UMA COW IGS	vessel's machinery built under the supervision of the Korean Register for unrestricted sea service with unattended machinery spaces, inert gas system and crude oil washing in the cargo tanks
ARPA	automatic radar plotting aid
GPS	global positioning system
KR	Korean Register of Shipping
kt(s)	knot(s)
kW	kilowatt(s)
MSA	Maritime Safety Authority of New Zealand
nm	nautical mile
t	tonne(s)
VHF	very high frequency

Glossary

adaptive autopilot	an autopilot capable of tuning itself and adapting automatically to the ship's characteristics and the prevailing weather conditions, thus reducing operational demands and increasing fuel saving
ARPA	automated system to plot and monitor targets on radar. Used by a watchkeeper to assist in collision prevention
Aframax	an oil tanker of 90 – 105 000 deadweight tonnes able to lift at least 80 000 tonnes of crude oil
ballast	weight, usually seawater, put into a ship to improve stability
bow	the front of a ship
bulkhead	the term given to a wall on a ship
chart datum	zero height referred to on a marine chart
con (conduct)	directing the course and speed of a ship
course	direction steered by a ship
displacement	the amount of fluid, measured in tonnes, displaced by an object floating or immersed in it
doppler log	a device that uses doppler effect to measure a ship's speed
draught	depth in water at which a ship floats
echo sounder	a device for measuring the depth of water below a ship's bottom
frame(s)	the ribs of a ship much like a skeleton
gross tonnage	a measure of the internal capacity of a ship; enclosed spaces are measured in cubic metres and the tonnage derived by formula
helm	the amount of angle that the rudder is turned to port or starboard to steer the ship
heading	direction in which a ship is pointing at any moment
heave	the oscillatory vertical rise and fall, due to the entire hull being lifted by the force of the sea. Also called heaving
knot	one nautical mile per hour
leading lights	light(s) that identify the safest track in a channel. Used by the mariner to monitor and maintain a ship's position within a channel
made fast	tied up, attached
port	left hand side when facing forward
significant wave height	average height of the highest one third of the waves
starboard	right hand side when facing forward
tidal stream	the horizontal movement of the water due to tide
under keel clearance	the clearance between the bottom of a ship and the seabed
wave period	the time taken for two successive crests to pass a fixed point

Data Summary

Vessel Particulars:

Name:	*Eastern Honor*
Type:	oil tanker
Class:	✠ KRS1 – oil tanker 'ESP'(FBC) crude/product, 'ERS' ✠KRM1 – UMA COW IGS
Classification:	Korean Register of Shipping (KR)
Length (overall):	248.0 m
Breadth (extreme):	45.0 m
Gross tonnage:	67 737
Built:	Hyundai Heavy Industries, Korea 1987
Propulsion:	a single Hyundai B&W 6S70MCE direct reversing diesel engine
Service speed:	loaded 14 kts
Owner:	LG – Caltex Oil Corporation
Operator:	Star Tanker PTE Limited
Port of Registry:	Jeju, Korea
Minimum crewing requirement:	18

Date and time:	27 July 2003 at about 0449[1]
Location:	Whangarei Harbour
Persons on board:	crew: 26 passengers: nil
Injuries:	nil
Damage:	The hull in the area of the bow, stern and rudder was damaged
Investigator-in-charge:	Captain I M Hill

[1] All times in this report are New Zealand Standard Time (UTC +12 hours) and are expressed in the 24-hour mode.

1 Factual Information

1.1 History of the event

1.1.1 On Sunday 27 July at about 0450 the Aframax motor tanker *Eastern Honor* grounded in the entrance channel of Whangarei Harbour while the ship was entering the port.

1.1.2 The *Eastern Honor* arrived off the port at about 0230, and the master having been advised earlier by radio that the pilot would not be boarding the ship until about 0430, conned the ship to a position where he considered that it could safely drift until required at the pilot boarding station.

1.1.3 After drifting the master conned the vessel on to the leading line of 320º at a distance of about 3 nm from the Fairway Buoy and steadied the ship onto the leading line course and proceeded slowly towards the port.

1.1.4 The pilot boarded the ship at about 0406 when it was about 1.8 nm from the Fairway Buoy. After completing the master/pilot information exchange, the pilot ran through the standard pilot's passage and berthing plan with the master and second officer.

1.1.5 When the pilot had completed running through the passage plan he assessed the ship's movement and thought that the movement was such that it could berth safely. By about 0422 the ship was about 0.8 nm from the Fairway Buoy and ahead of schedule. After discussion with the master, the pilot conned the vessel in a slow 360º turn to starboard, during which the pilot and master continued to assess the sea state and the ship's movement.

1.1.6 As the *Eastern Honor* completed its turn the pilot steadied the ship up on the leading line and conned the vessel towards the entrance to the channel with the engine on dead slow ahead, which gave a speed over the ground of about 5.7 kts.

1.1.7 As the *Eastern Honor* approached the Fairway Buoy the pilot asked the master if he was happy to proceed with the berthing. The master replied that he was, and asked where the abort line position was. The pilot informed the master that it was before the Fairway Buoy.

1.1.8 The master noticed that as the *Eastern Honor* approached the Fairway Buoy the movement of the ship lessened, but when the ship was about 0.3 nm from the buoy both the pilot and master noted that the ship started pitching. At about 0445 as the ship passed the Fairway Buoy the pitching of the ship lessened.

1.1.9 At about 0449 as the *Eastern Honor* passed over the vestigial bar the pitching of the ship suddenly increased with the ship contacting the channel bottom three times. The pitching of the ship then lessened again until the ship became steady.

1.1.10 The master telephoned the chief engineer in the engine control room and instructed him to check for any damage in the engine room and steering gear. He also sent the chief officer from the bridge to check the ship's hull from the deck and ensure that there was no pollution or damage evident and to organise the sounding of tanks and void spaces.

1.1.11 By this time, as the ship was committed to the channel and as it was handling and responding to the helm normally, the pilot continued to con the ship into port. He requested the masters of the 2 harbour tugs, which were standing by further up the channel to approach the ship and check around the ship's waterline using their searchlights for any evidence of pollution. However, they could see none.

1.1.12 The *Eastern Honor* berthed port side alongside at Marsden Point refinery jetty without further incident. The pilot requested the tug's crews to monitor the draught to ensure that the ship was not sinking by the stern. However, the after draught remained static.

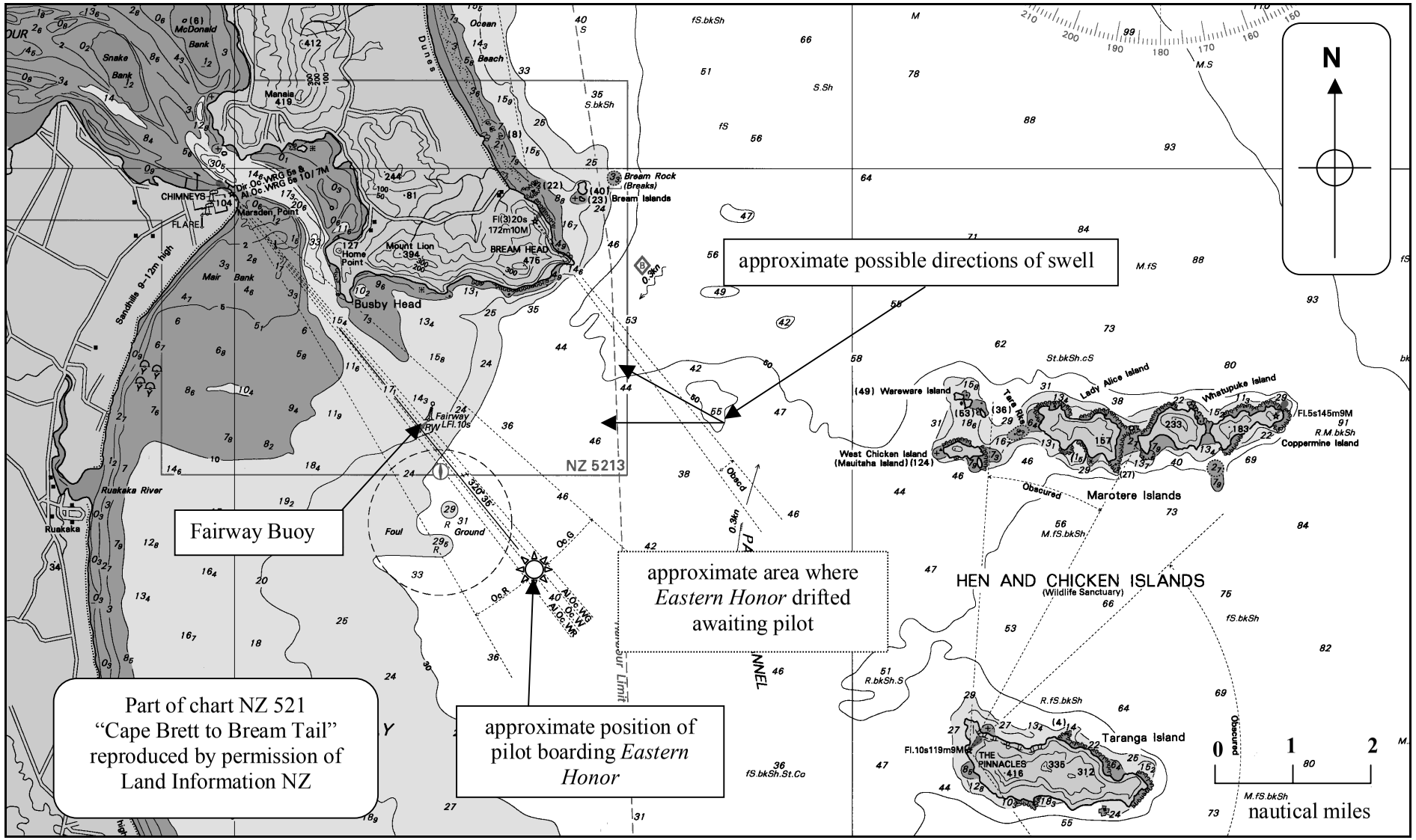

Figure 1
General area of the accident

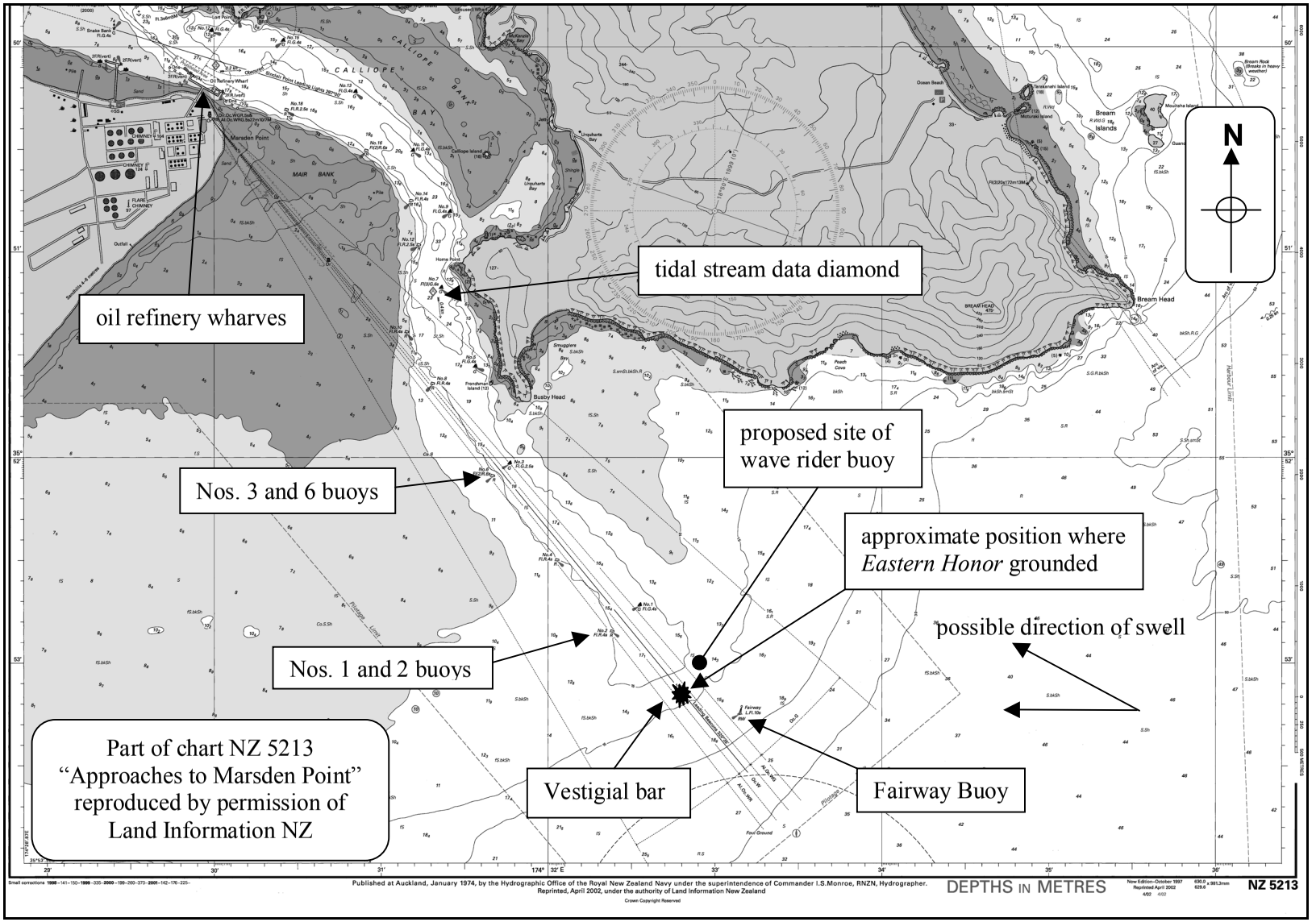

Figure 2
Whangarei approach channel

1.1.13 Divers surveyed the hull but were able to work only during slack water periods owing to the strength of the tidal current flowing past the jetty. A series of inspections confirmed that the damage to the ship was confined to two areas; forward of the collision bulkhead, and to the rudder and after part of the hull bottom.

1.2 Ship and equipment information

1.2.1 The *Eastern Honor* an oil tanker built in Korea in 1987, owned by LG-Caltex Oil Corporation, operated by Star Tanker PTE Limited and managed by Barber Ship Management SDN. BHD. The ship was registered in Korea and had valid certificates issued by or on behalf of that Government and the Korean Register of Shipping.

1.2.2 The *Eastern Honor* had an overall length of 248.0 m and a breadth of 45.0 m, with a gross tonnage of 67 737. It had a mean summer draught of 17.419 m giving a displacement of 152365 t. The ship's arrival draught at Whangarei, prior to the grounding was stated to be 15.24 m even keel giving a displacement of 131 292 t. The ship was carrying about 111 796 t of crude oil.

1.2.3 The ship was powered by a single Hyundai B&W 6S70MCE direct reversing diesel engine, developing 11 940 kW driving a single fixed-pitch 5-bladed propeller giving a loaded service speed of 14 kts. It had a semi-balanced rudder, located directly behind the propeller. The *Eastern Honor* was not fitted with a bow thruster.

1.2.4 The ship was fitted with 2 ARPA radars, which were positioned on the port side of the wheelhouse. Other navigational aids included a doppler log, 2 GPS receivers (one differential), an echo sounder, 3 VHF radios, a gyro compass with repeaters, magnetic compass, weather facsimile machine, navtex receiver, and an adaptive autopilot. All navigational equipment was reported to be functioning correctly at the time of the grounding.

1.2.5 Gyro compass repeaters were positioned at the steering position, on the centreline in the fore part of the wheelhouse, and one on each bridge wing. In addition to the repeaters, both radars had heading readouts on them.

1.2.6 The ship was on a voyage charter to BP who carried out an internal investigation into the grounding. One of the proposals put forward for consideration by all New Zealand Refining Company Limited user companies, was to establish the role of port captain at Marsden Point to provide an overriding authority for ensuring adequate marine assurance in line with world best practice.

1.3 Personnel and port company systems

1.3.1 North Tugz Limited was a new joint-venture maritime services provider for the port of Whangarei. This organisation was formed at the beginning of April 2003 between the original North Tugz, a division of the Ports of Auckland, and Northport Limited a joint-venture between Port of Tauranga and Northland Port Corporation (NZ) Limited formed in 2002. Ports of Auckland had formed North Tugz when it had taken over as the maritime services provider to the Marsden Point refinery in 1999 from the Northland Port Corporation (NZ) Limited.

1.3.2 Four pilots were available in the port of Whangarei. North Tugz Limited employed 3 of the pilots, one of which was also the Marine Manager for North Tugz Limited. The fourth pilot was employed by Northport but was fully incorporated into the working roster of North Tugz Limited. All the pilots were qualified to handle tankers into and out of the Marsden Point oil refinery.

1.3.3 Since the grounding of the *Capella Voyager* on 16 April 2003 (TAIC Marine Occurrence Report 03-206) North Tugz in conjunction with the Maritime Safety Authority (MSA) had set criteria for deep draught vessels entering Whangarei as follows:

- maximum swell height of 1 m
- maximum allowable roll 1º
- a safety margin of 0.9 m in the dynamic under keel clearance calculation
- the charted depth was agreed at 14.6 m until a survey was completed to confirm the depth available
- the introduction of an assessment form for calculating under keel clearance
- introduction of a longer term solution for the provision of suitable instrumentation (wave rider buoy) to assist the pilots in calculating dynamic under keel clearance.

This information was used by the maritime services provider but was not communicated to arriving ships.

1.3.4 The pilot who was conning the *Eastern Honor* at the time of the grounding was employed by Northport. He had gone to sea as a deck officer apprentice in 1967. After gaining his Second Mate certificate in New Zealand he worked on a variety of ships worldwide and studied for and gained a degree in nautical studies from an United Kingdom educational establishment. Returning to New Zealand, he worked at the Auckland Nautical School before gaining his Master Foreign Going certificate in 1982. After gaining his master's certificate he worked at sea for some time before joining the Northland Harbour Board as a marine officer in Opua. Then he trained as a pilot in Whangarei and gained his pilot licence in 1989 and became an unrestricted pilot in 1990. He had recently finished re-familiarisation with berthing procedures at the refinery, as he had not been piloting into the refinery for the previous 2½ years. Prior to that time he had been piloting tankers into the refinery since 1990.

1.3.5 The *Eastern Honor* had a complement of 26 comprising of 20 Korean nationals, 4 Filipino nationals and 2 Indian nationals. At the time of the grounding the master, chief officer, second officer, and helmsman were on the navigating bridge.

1.3.6 The master of the *Eastern Honor* was a Korean national who had gone to sea in 1975 after attending maritime college for 4 years. He had obtained his Master Foreign Going licence in 1983 and was promoted to master in 1987. Throughout his career, the master had sailed on tankers and had joined the *Eastern Honor* in April 2003. It was the master's first visit to Whangarei.

1.4 Damage

1.4.1 While the *Eastern Honor* was at Marsden Point divers carried out a survey on its hull. Damage was found in 2 main areas; forward of the collision bulkhead and on the rudder.

1.4.2 Forward of the collision bulkhead the hull was indented to starboard of the centreline. The indent being about 11 m long, 1.2 m wide and 100 mm deep running fore and aft. Paint was scuffed off an area 14 m long and 4 m wide at the bow.

1.4.3 The paint on the side of the rudder was scuffed to a height of 200 mm from the sole plate indicating that the rudder had dug into the seabed. The sole plate of the rudder was indented between the framing to a depth of about 38 mm. The plating in the area was polished free of paint. However, the steering was not compromised.

1.4.4 An area at the stern of the hull bottom for a distance of 14 m forward and a width of 4 m had been scoured free of paint and deformed to about 10 mm.

1.5 Climatic conditions and tidal information

1.5.1 During the 48 hours prior to the grounding, a low pressure system had moved across to the north of New Zealand and was slowly moving south-east and deepening. The effect of the low

was to produce swell waves, which arrived at Whangarei from an easterly to south-easterly direction (see Figure 3).

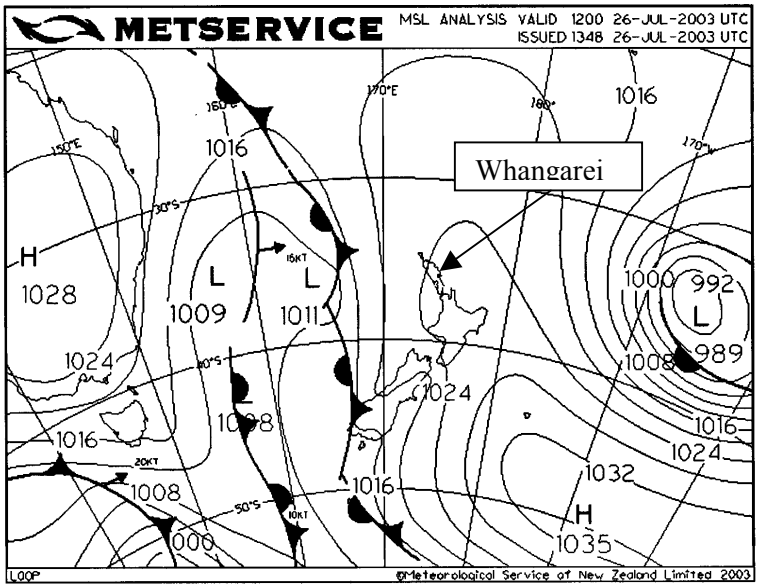

Figure 3
Mean sea level analysis synoptic chart for 0000 27 July 2003

1.5.2 The port of Whangarei is situated on the boundary between two of the New Zealand coastal waters forecast areas, namely Brett and Colville. Coastal waters forecasts are issued by the New Zealand Meteorological service (Metservice) at well-documented regular intervals on Inmarsat 'C', HF and VHF radio via Taupo Maritime Radio. Forecasts and facsimile maps are also available from the Metservice web site and the Metfax service.

1.5.3 The coastal waters forecast issued at 0013, 27 July 2003 was as follows:

> MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND AT 0013HRS 27-JUL-2003 VALID UNTIL MIDNIGHT TONIGHT 27-JUL-2003
> NORTH ISLAND:
> COLVILLE
> Northeast rising to 25 knots in the evening. Sea becoming rough. Easterly swell 3 metres. Fair visibility in a few showers.
> OUTLOOK FOLLOWING 12 HOURS: Northeast rising to 35 knots.
> BRETT
> *GALE WARNING IN FORCE*
> Northeast rising to 25 knots this morning and to 35 knots in the evening. Sea becoming very rough. Easterly swell 3 metres. Poor visibility in evening rain.
> OUTLOOK FOLLOWING 12 HOURS: Becoming northerly 25 knots.

1.5.4 The meteorological notes in the New Zealand Almanac for 2002/2003 stated that coastal weather forecasts are a general indication of average conditions expected in a particular coastal area. The forecasts are for open waters to within 60 nm of the coast and do not apply to enclosed areas such as small bays and harbours. There was no weather forecast specifically for the port of Whangarei.

1.5.5 North Tugz Limited accessed weather data from the Metservice website and the Metfax system on a regular basis. Specific weather data was accessed whenever a critical port operation such as the berthing of deep draught tanker was scheduled. The data received was made available to the duty pilot and other employees.

1.5.6 Since 30 May 2003, following the grounding of the *Capella Voyager* Northport had contracted Metservice to issue wind and wave alerts to Northport when the following forecast conditions were expected within 24 hours:

> wind greater than 33 knots, or combined waves of 2 metres or more when the swell is running from between east and south. The forecast is to be reviewed and updated at least every 12 hours until the qualifying conditions are no longer met.

Northport arranged that the wind and wave alert would be faxed to the Northport gatehouse where the staff would forward it to North Tugz, the duty pilot and other Northport employees.

1.5.7 A wind and wave alert was issued by Metservice to Northport on Thursday 27 July 2003 and was updated at the agreed intervals. The wind and wave alert issued at 2055, 26 July 2003, immediately preceding the grounding, was as follows:

> Wind and Wave Alert
> FOR THE PORT OF NORTHLAND
> ISSUED BY METSERVICE AT 20:55 SATURDAY 26-JUL-2003
> SITUATION AT 1800 hrs:
> A ridge of high pressure over northern New Zealand is slowly moving east. A front should lie west of the North Island by midnight Sunday.
> WARNING FOR PORT OF NORTHLAND:
> WIND: Easterly 10kt, rising to northeast 15kt in the morning and to 25kt gusting 35kt Sunday evening.
> SEA: Rising to 1m occasional 1.5m t=2s in the morning and to 1.5m occasional 2.5m t=3s Sunday evening.
> SWELL: Easterly swell 2.5m occasional 4m t=10s, rising to 3m occasional 4.5m t=11s in the morning.
> SIGNIFICANT COMBINED WAVES: About 2.5m occasional 4m, rising to 3m occasional 4.5m in the morning and to 3.5m occasional 5m Sunday evening.
> NEXT WIND AND WAVE ALERT WILL BE ISSUED AT 10AM SUN 27TH JULY.

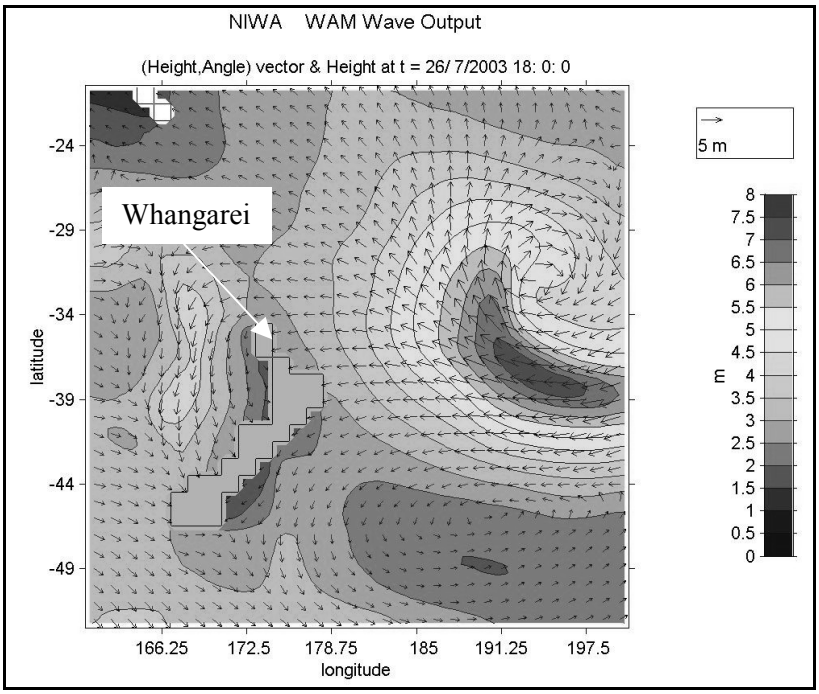

Figure 4
NIWA wave model for 0600 27 July 2003

1.5.8 After the incident the Commission contacted the National Institute of Water and Atmospheric Research (NIWA) who produced a computer generated wave output model for 0600 27 July

2003, which showed an expected wave height of 2.5 to 3.0 m from an easterly direction for the Whangarei area (see Figure 4).

1.5.9 The spring range of tides tabulated in the New Zealand Nautical Almanac for Marsden Point was 2.06 m and the neap range was 1.51 m. The range at the time of the grounding was 1.3 m, and therefore a small neap range tide.

1.5.10 The predicted tide for Marsden Point detailed in the New Zealand Nautical Almanac for 26 / 27 July 2003, was:

Low Water		High Water		Low Water	
2341	0.9 m	0544	2.2 m	1159	0.7 m

Northport used a computer-based tidal programme, which gave a predicted high water of 2.27 m, slightly higher than the Almanac figure.

1.5.11 On 27 July 2003, sunrise was at 0723 and moonrise was at 0546, both of which occurred after the accident. The only available natural light available to observers would have been starlight.

1.5.12 Northland Port Corporation had a recording tide gauge situated at Marsden Point, which gave the following readings for the morning of 27 July 2003. The readings were averaged as the gauge, and therefore the graph was affected by the sea and swell waves present at the time.

High Water		Low Water	
0550	2.28	1130	0.80

1.5.13 The nearest wave rider buoy to Whangarei Harbour was situated about one nm north of the Mokohinau Islands Group, about 26 nm due east from the Whangarei Fairway Buoy. While this buoy was located in open water and was for use by the Auckland Regional Council, the wave data would nevertheless be indicative of swell in the Whangarei area. Analysis of data from the buoy by NIWA has shown that the long term mean wave height at the Mokohinau buoy was 1.2 m, and was only 3 m or greater for 2% of the time. The distance from the wave rider buoy may have modified the actual height and period of the waves, as may have the closeness of the land and the presence of intervening small islands. The readings recorded at the buoy on 27 July 2003 were as follows:

time	significant height (m)	wave period (s)
0400	2.45	11.6
0500	2.63	11.7
0600	2.64	12.2

1.5.14 The master of the *Eastern Honor* estimated the swell at the time the pilot boarded to be about 2 to 3 m from a north-easterly direction. The pilot estimated the swell to be less than a metre from a south-easterly direction from his position on the pilot boat during the trip out to the ship.

1.5.15 Tidal current information contained on chart NZ 5213 for 0441, one hour before high water Auckland, indicated a current flow of about 1.1 kts in a direction of about 005º (T) at a position 35º51'.3 S 174º31'.3 E south-west of buoy No.7 and Home Point (see Figure 2).

1.6 Description of the port

1.6.1 Whangarei Harbour lay at the northern end of Bream Bay. It afforded access to 3 ports, the refinery and deep-water berths at Marsden Point, a cement works wharf at Portland and Port Whangarei.

1.6.2 The harbour was entered from the Fairway Buoy by an outer channel with a least width of 240 m, marked by buoys into the entrance west of Busby Head and through a narrows off Marsden Point.

1.6.3 Between the Fairway Buoy and Nos. 1 and 2 buoys, the first set of buoys in the marked channel, the channel passed over a vestigial bar (see Figure 2), composed of fine sand and broken shell, with a minimum depth of 14.7 m. This depth was obtained from a hydrographic survey that was carried out after the incident. There was anecdotal evidence that the least sounding over the vestigial bar had never been known to be less than 14.8 m. The New Zealand Pilot (Admiralty Sailing Directions NP51) reported that the outer channel had a least reported depth of 14.6 m at the seaward end. The pilots used the promulgated channel depth of 14.6 m for the calculation of under keel clearance (UKC).

1.6.4 From Nos. 1 and 2 buoys that were on the inner side of the vestigial bar, the channel deepened and ran between 2 shallow grounds until abeam of Busby Head where it became more sinuous before the Marsden Point wharves were reached.

1.6.5 The maximum draught for entering the refinery wharves was promulgated as 15.24 m, the same as the declared arrival draught of the *Eastern Honor*; this maximum draught had remained the same since 1964 when the refinery opened at which time it was given as the imperial measurement of 50 feet.

1.7 Pilotage, passage planning and bridge resource management

1.7.1 The normal procedure for the pilotage of deep draught ships to the refinery wharves was for a pilot to board the ship about 2 nm south-east of the Fairway Buoy. Pilots boarded 1 hour 15 minutes before high water at Marsden Point, and thus passed the Fairway Buoy one hour before high water, and arrived at the berth 15 minutes before high water. This timing allowed the ship to berth and tie up with a minimum of tidal current running.

1.7.2 The pilot who was assigned to join the *Eastern Honor* on the morning of 27 July, had piloted a lightly laden fertiliser ship out of the port during the night, disembarking in the region of No.2 buoy at about 0130. After disembarking the ship he watched as it made its way down the remainder of the channel. He made a mental note that the swell had decreased from what it was earlier that night.

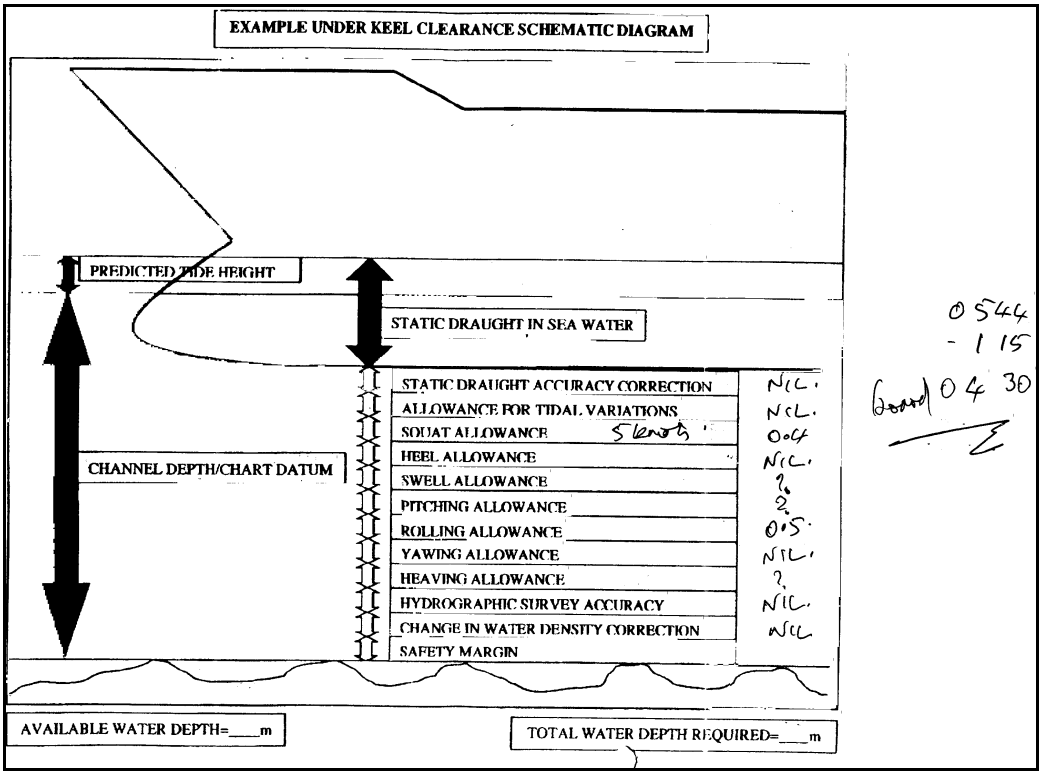

Figure 5
Passage plan additional sheet (not full size)

1.7.3 After disembarking the fertiliser ship, and observing the ship's movement, the pilot was taken back to the tug *Hauraki* where he had a snack and rested for about an hour before the pilot boat took him to the *Eastern Honor*.

1.7.4 To assess the swell and sea state, the pilot had agreed to board slightly earlier than usual at 0415. The pilot boat was able to maintain a good speed on the way to the *Eastern Honor* and the pilot joined the ship earlier than anticipated at about 0406, at a distance of 1.8 nm from the Fairway Buoy.

1.7.5 At that time the *Eastern Honor* was on the leading line. After initial discussion with the master the pilot established the position of the ship and if there were any other vessels in the vicinity. He then held a berthing meeting with the master and the second officer.

1.7.6 At the meeting the master presented the ship's pilotage card with information relating to the manoeuvrability of the ship. The pilot presented the North Tugz pilots passage and berthing guide containing relevant information and a matrix for determining the under keel clearance. The pilot also laid down criteria for challenge and response to his actions by the bridge team.

1.7.7 The navigation team of the Eastern Honor had completed a passage plan for their voyage from the United Arab Emirates to Whangarei. This plan included a basic pilotage section containing details of courses to steer, distances and a section on ship squat.

1.7.8 Since the grounding of the *Capella Voyager*, North Tugz in conjunction with the MSA had amended the standard passage plan to include a sheet for more accurately determining the under keel clearance for a ship in dynamic conditions (see Figures 5 and 6). The MSA indicated that its supplied pro forma was to be amended to suit North Tugz operational needs, However, North Tugz included the pro forma in its entirety.

1.7.9 The additional sheet to the passage plan (see Figure 5) required inputting of the following data:

1. static draught accuracy
2. allowance for tidal variations
3. squat allowance
4. heel allowance
5. swell allowance
6. pitching allowance
7. rolling allowance
8. yawing allowance
9. heaving allowance
10. hydrographic survey accuracy
11. change in water density correction
12. safety margin

1.7.10 The pilot made nil allowances for items 1,2,4,8,10 and 11; he allowed 0.4 m for squat allowance (3), and 0.5 m for rolling allowance (7); items 5,6,and 9 he marked with a question mark as he stated to the master there was no way for him to judge them on a dark night. However, he later stated that the 0.5 m took account of all the sea induced motions. After the grounding, the pilot said that he mentioned all of the components on the form to the master of the *Eastern Honor*.

1.7.11 The pilot later recalled making a calculation the afternoon before the grounding to establish the parameters for the berthing. Although he did not retain the calculation he remembered he calculated that 17.04 m of water was required and that there would be 17.07 m of water available.

1.7.12 Neither the master or the second officer questioned why the pilot did not complete the additional sheet completely at the berthing meeting, nor offered ship specific figures for the pilot to use, they deferred to the pilots explanation.

1.7.13 The pilot completed the original refinery passage and berthing guide with the correct figures, which showed that the ship would have a static under keel clearance of 1.56 m (see Figure 6).

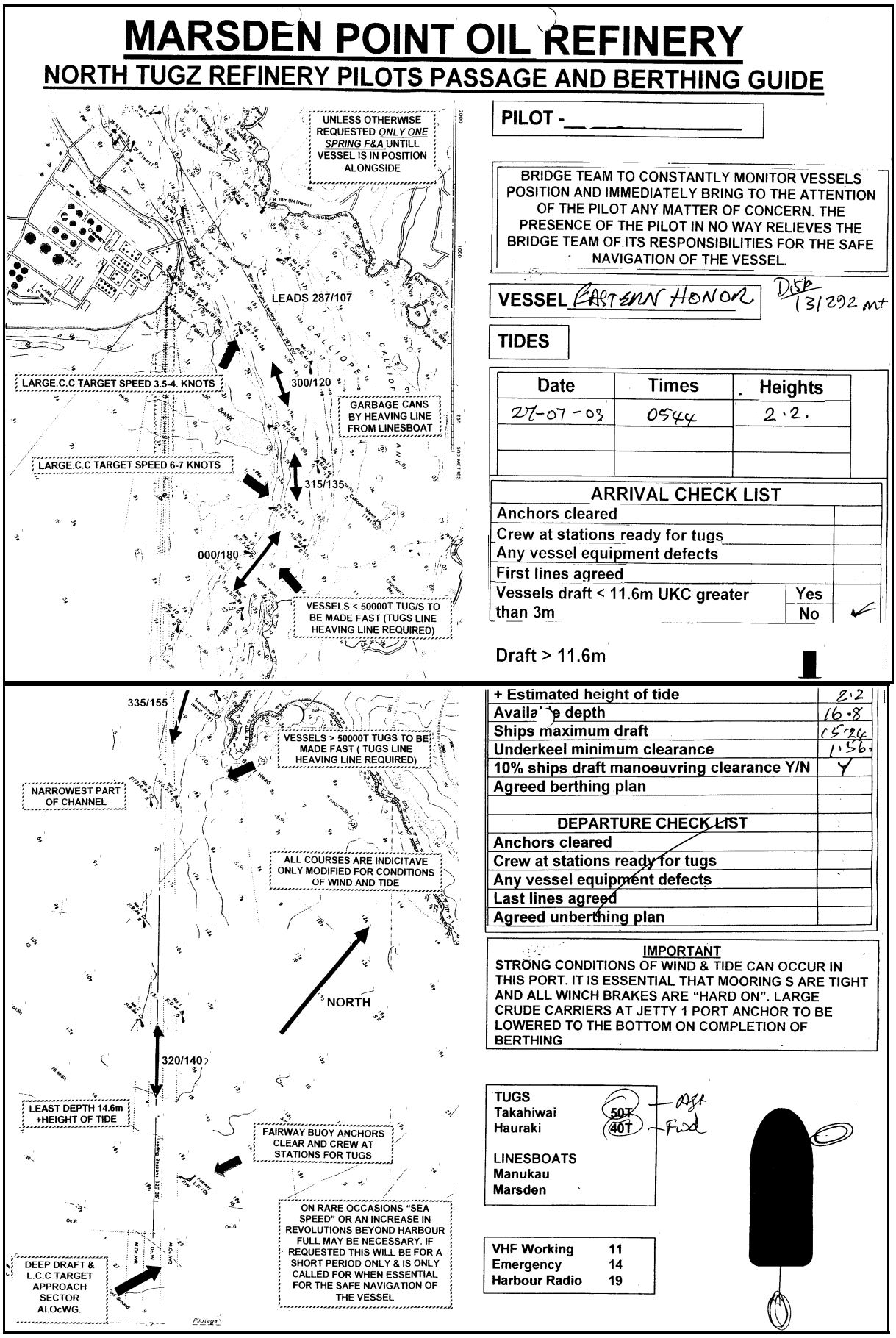

Figure 6
Upper and lower parts of the passage and berthing guide (not full size)

This under keel clearance was marginally greater than the 10% stipulated on the original passage and berthing guide.

1.7.14 On completion of the berthing meeting at about 0422, the Eastern Honor was about 0.8 nm from the Fairway Buoy. The pilot told the master that the ship was ahead of schedule and that the ship would have to make a 360º turn to slow the ship and ensure it passed the Fairway Buoy no earlier than an hour before high water at Marsden Point. The pilot also stated that making the turn gave him more time to assess the sea state to confirm that the berthing would be within the defined entry criteria.

1.7.15 As the ship turned slowly to starboard the pilot carefully observed its movement and was happy that the movement was within his criteria for entering. When the ship was nearly back on its original heading the pilot conned it so that the ship was slightly to starboard of the leading line, towards the Fairway Buoy so that he would be in the deepest part of the channel (see Figure 6). The pilot told the master that he was happy to proceed and asked if the master was also. The master replied in the affirmative. However, the master later said that he was surprised to be asked the question, as the pilot knew the conditions inside the port better than the master. He opined that permission should have been sought from the Harbour Master and the responsibility did not rest with the master.

1.7.16 As the *Eastern Honor* approached the Fairway Buoy, the ship started to pitch noticeably and the master immediately expressed his concern about it to the pilot and asked if the berthing could be aborted. The pilot replied that the ship was too close to the Fairway Buoy to abort as there was insufficient room to swing the ship and he was committed to the channel. However, as the ship passed the Fairway Buoy at about 0445, on schedule, at a speed of about 5.7 kts, the ship's movement lessened and the master's concern eased. At about 0449, when the ship was passing over the vestigal bar the ship's movement suddenly increased and the bridge team including the pilot heard and felt the ship ground 3 times. They all thought that the ship had grounded bodily with more emphasis to the stern.

1.7.17 As the ship was responding normally the pilot continued the passage into port, while the master instigated measures to determine if the ship's hull had been broached.

1.8 Waves and wave actions

1.8.1 Waves are created by wind blowing over water. As they travel away from the area where they are generated they evolve into long, smooth-crested waves called swell waves. Local wind can also generate waves. These are called sea waves and have short, choppy shapes.

1.8.2 Swell waves can travel for long distances in deep water without losing the energy they acquire from the wind. But as they travel into shallow water their shape and direction change. In shallow water, the waves slow down, change direction, the crests bend, and their vertical profile steepens. They eventually become so steep that they become unstable, fall over themselves, breaking and losing most of their energy in the surf zone.

1.8.3 If swell waves are arriving from a direction other than perpendicular to the shallows the waves will bend, trying to conform to the contours of the sea bed. This bending of the waves is known as refraction and results from the inshore portion of the wave being slowed more than the portion still in deep water. This refraction will cause a change in both height and direction in shallow water.

1.8.4 The effect of heave on a ship caused by swell waves is hard to detect and even more difficult to quantify without specialist equipment which is not readily available on ships. The effect of the ship pitching is easier to detect and can be estimated using simple calculations. For the *Eastern Honor* to breach the 10% under keel clearance safety margin the ship needed to pitch by a negligible amount, and for the ship to ground on the bottom of the channel, allowing for squat, a pitch of 0.26º was required. Roll combined with pitch and heave would exacerbate the situation.

2 Analysis

2.1 The pilot's calculations in determining the under keel clearance available to the *Eastern Honor* calculated the static under keel clearance, 0.4 m for squat and a blanket figure of 0.5 m for swell induced motions, although he made reference to all swell induced factors to the master. Had he attempted to quantify the individual swell induced factors, they may have shown that the proposed pilotage was in doubt.

2.2 The master and the bridge team, while employing the techniques of bridge resource management in holding a berthing meeting with the pilot before the commencement of the pilotage, did not question the pilot's affirmation that the pilotage could proceed. Rather they deferred to his knowledge of the local conditions especially as he had transited through the entrance channel to meet the ship.

2.3 The pilot asked several times if the master was happy to proceed, possibly indicating that he was unsure himself and wanting confirmation from the master. The master agreed with the pilot each time he was asked if he was happy to continue. However, considering the cultural differences that existed between the pilot and the bridge team, including the master, it would have been unlikely that a challenge to the pilot's question would have been made.

2.4 The master was on his first visit to Whangarei and had little knowledge of the port and therefore deferred to the pilot's advice throughout, considering the pilot's extensive local knowledge made him best qualified to navigate the ship.

2.5 Bridge Resource Management is specific to the way personnel relate to each other on a ship's bridge. The pilot had, during his berthing meeting, set guidelines for challenge and response to his actions. However, it is unlikely that due to the cultural differences between the pilot and the bridge team, and the large authority gradient that existed between them that they would have robustly challenged his actions.

2.6 North Tugz had amended its standard passage and berthing plan after the grounding of the *Capella Voyager*, as agreed with the MSA, to include allowances for the dynamic effects of the swell on ships. The MSA had provided North Tugz with a pro forma of allowances to be made as a guide for their passage plan. North Tugz had included this form in its entirety, despite the MSA's indication that it be amended for local needs, possibly making the passage plan unwieldy and prone to be incorrectly used. However, some of the allowances could have been entered prior to the pilot embarking the ship.

2.7 At the time of this grounding, North Tugz relied on the pilot's estimation of the swell height because there was no system to provide accurate data on the height of the sea and swell. The pilot considered the swell to be less than one metre and from a south-easterly direction, whereas the master thought the swell was about 2 to 3 m from the north-east. The difference in height of eye of the observers and that the observations were made on a dark night could possibly have lead to the discrepancy.

2.8 North Tugz accessed weather forecasts on a regular basis, but these forecasts apply to open waters within 60 nm of the coast and would provide a general guide only to the swell expected. However, North Tugz had access through a system set up by Northport on 30 May 2003, to wind and wave alert forecasts issued by Metservice. The duty pilot also had access to and was aware of the alerts issued immediately before starting the pilotage. Although not entirely accurate, a combination of these 2 forecasts would have provided a good basis on which to build an estimation of the swell prevailing.

2.9 The wind and wave alert was broadly in line with the swell waves recorded by the Mokohinau wave rider buoy, the swell as forecast in the marine weather bulletin and that as shown by the computer aided model.

2.10 The pilot estimated the swell to be less than one metre in height. A simple calculation to allow for swell may have indicated that entry would have been marginal with any loss of under keel clearance due to the ship rolling or pitching, which could be expected with a sea on the quarter or astern.

2.11 The depth of water in which the trial run towards the Fairway Buoy was made was relatively uniform at about 35 to 40 m and the seabed generally flat. The swell over such a seabed would not necessarily indicate the swell conditions that could be expected in the area around the vestigial bar where the seabed rose from about 35 to 40 m to about 15 m in less than 1 nm causing the form and period of the swell waves to change.

2.12 The *Eastern Honor* had received the latest coastal weather forecasts via Inmarsat 'C'. However, when the master aligned the ship up on the leads he observed that the sea and swell was less than that forecast. He was positive that the ship could make the transit without incident because the swell was low and the pilot voiced no concerns after coming through the swell on the vestigal bar in the pilot boat.

3 Findings

Findings are listed in order of development and not in order of priority

3.1 The motor tanker *Eastern Honor* grounded in the entrance channel to Whangarei when the stern of the tanker fell into troughs behind a series of larger than expected swell waves.

3.2 The pilot had calculated the static under keel clearance and made a blanket allowance of 0.5 m for dynamic conditions other than squat. Inclusion of the required figures in the amended pilotage plan may have shown that the proposed pilotage was in doubt.

3.3 The safety actions instigated after the *Capella Voyager* occurrence (TAIC Marine Occurrence Report 03-206) were not robust enough to ensure that a similar occurrence would not happen again as they relied on the pilot to estimate the swell height by observation in what could be less than optimum conditions.

3.4 There was no way of accurately determining the direction and height of swell waves in the entrance channel at the time of the grounding.

4 Safety Actions

4.1 The Northland Regional Council in conjunction with the MSA, and North Tugz Limited, along with port stakeholders Silver Fern Shipping Limited, BP and New Zealand Refining Company took the following safety actions in addition to the measures taken after the incident involving the *Capella Voyager* (03-206):

- deep draught vessels (those having a static under keel clearance of less than 3.0 m) would be restricted to transiting the channel during daylight only. This was relaxed to allow deep draught vessels to transit at night providing that information regarding swell and wave height, for at least the preceding hour, was relayed directly to the pilot of the deep draught vessel. The swell and wave height information can be obtained from either the motion sensor fitted on the Ports of Auckland survey vessel *Astrolabe* or data from the Tritech altimeter installed on the *Jack Guy* interpreted by a pilot stationed on board
- a dynamic under keel clearance safety margin of 0.9 m was introduced which had to remain intact when all other allowances had been applied
- a comprehensive dynamic under keel clearance calculation to be carried out by the pilot in advance of a deep draught vessel transit based on dynamic criteria for the type of vessel in a swell of less than one metre. A hard copy of the calculation is to be copied to the regional harbourmaster at least 48 hours prior to the planned transit

- with reference to the pro forma supplied to north Tugz by the MSA the squat allowance (3) was set to 0.6 m and the "wave allowances" of pitch, roll, and heave (6,7,9) were combined into a standard allowance of 1.1 m. This was however not to be taken as a "blanket allowance". Although it would apply to most vessels, the pilot would check it against the pro forma components for each vessel
- the criteria for entering the channel were reinforced at a maximum speed of 6 kts, maximum swell height of 1.0 m, maximum roll 1º and no detectable heave
- a new close grid (10 m line spacing) hydrographic survey was carried out which gave a minimum depth of 14.70 m.

4.2 The user companies of the New Zealand Refinery Company facility at Marsden Point self imposed a 20% static under keel clearance interim guidance criterion. This criterion exceeded the limitations imposed by Northland Regional Council et al.

4.3 From 6 August 2003, Silver Fern Shipping Limited instigated a 5-day swell forecast from Metservice, which they made available to all interested parties.

4.4 Since the accident the port operators entered into a contract for the supply of a swell measuring system for deployment near the entrance to the channel.

The New Zealand Notices to Mariners edition 21 of the 17 October 2003, included a preliminary notice number NZ 146(P)/03 that stated:

> A yellow, spherical, wave rider special light-buoy, FL(5)Y 20s, will be established in the approaches to Whangarei Harbour between 14 – 17 October 2003 in position 35º 53'.0S., 174º 32'.9E.

The wave rider buoy was put in place on 29 October 2003, and was transmitting information from that time to a shore station. This information was used to establish a data bank for the computer software that determined a ship's dynamic under keel clearance.

4.5 In view of the safety actions taken by the MSA, Northland Regional Council, Northport and North Tugz Limited, no safety recommendations have been made.

Approved for publication 29 January 2004

Hon W P Jeffries
Chief Commissioner

Recent Marine Occurrence Reports published by the Transport Accident Investigation Commission (most recent at top of list)

03-211	oil tanker, *Eastern Honor*, grounding, Whangarei Harbour, 27 July 2003
03-207	fishing vessel *Solander Kariqa*, fire, 300 nautical miles west of Suva, Fiji, 5 May 2003
03-206	tanker *Capella Voyager*, grounding, Whangarei, 16 April 2003
03-204	restricted limit passenger vessel *Tiger III*, passenger injury, Cape Brett, 18 March 2003
03-203	jet boats *Wilderness Jet 3* and *un-named private jet boat,* collision, Dart River, Glenorchy, Queenstown, New Zealand, 2 February 2003
03-202	launch *Barossa* and trimaran *Triptych*, collision, Hauraki Gulf, 18 February 2003
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01-214	coastal cargo ship *Kent* and passenger freight ferry *Arahura*, close-quarters incident, Tory Channel entrance, 14 September 2001
01-213	commercial jet boat *Shotover Jet 21*, engine failure and collision with rock face, Shotover River, Queenstown, 3 1 August 2001
01-212	fishing vessel *Hans*, sinking, Tory Channel, 19 August 2001
01-211	passenger ferry *Aratere*, lifeboat incident, Wellington, 6 August 2001
01-210	coastal cargo ship *Spirit of Enterprise*, grounding, Manukau Harbour, 28 July 2001
01-208	passenger ferry *Arahura*, machinery space flooding, Cook Strait, 7 June 2001

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