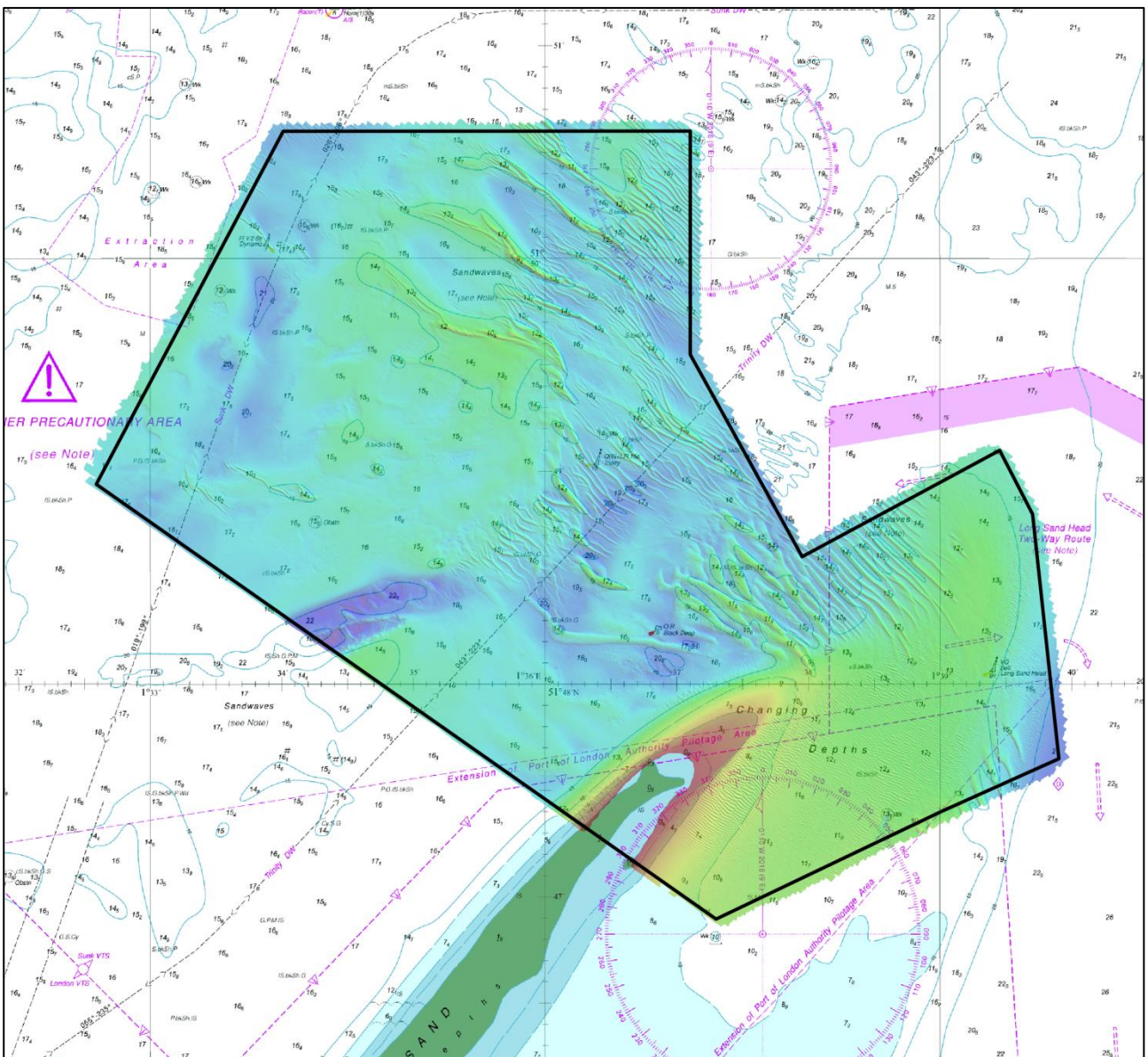




THAMES ESTUARY LONG SAND HEAD

ASSESSMENT ON THE ANALYSIS OF ROUTINE RESURVEY AREA TE5A FROM THE 2015 SURVEY



ENGLAND – THAMES ESTUARY
LONG SAND HEAD
Assessment TE5A/2015

An assessment of the 2015 hydrographic survey of the area: to monitor recent seabed movement; to identify any implications for shipping; and to make recommendations for future surveys.

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LONG SAND HEAD, TE5A, 2015

1 EXECUTIVE SUMMARY

The Area and Recent Changes

- 1.1 Area TE5A is fully surveyed every 3 years, with intervening annual surveys focusing on two critical areas within TE5A. This assessment covers the triannual survey 2015
- 1.2 Vessels drawing up to 16 metres draught have been observed following the Sunk Deep Water track and Trinity Deep Water track, and vessels drawing up to 10.4 metres passing close north of Long Sand Head.
- 1.3 The main changes that have occurred since 2012 have been:
 - a) A slight shoaling and north-eastward migration of the sandwaves of between 30 to 40 metres near the Sunk Deep Water Route.
 - b) The continued north-eastward migration of Long Sand Head, with the 10 metre contour migrating 450 metres over the 3 year period. This is a notably smaller movement than that seen between the 2008 and 2012 surveys, even accounting for the 4 year gap.
 - c) The northeastward migration of the sandwaves near the Trinity deep water route by between 40 to 70 metres.

Reasons for Continuing to Resurvey the Area

- 1.4 The area requires resurveying for the following reasons:
 - a) Depths in TE5A form the controlling depths for vessels using the Trinity Deep Water Track and potentially the Sunk Deep Water Track, where sandwaves lying close to the track corridor could impinge on the route.
 - b) Long Sand Head is migrating northeastwards in to the area covered by the Long Sand Head two-way Route, As a result of the changing bathymetry MCA are currently putting in a proposed amendment to the Long Sand Head Two Way Route at IMO Sub-Committee on Navigation, Communications, Search & Rescue (NCSR) and hence requiring frequent monitoring.
 - c) In addition to the above critical areas, sandwaves and ridges across much of the area need resurveying, but less frequently.

Recommendations

- 1.5 No changes to the survey scheme are required at present.

2 INTRODUCTION

- 2.1 This Assessment is produced by the United Kingdom Hydrographic Office (UKHO), on behalf of the Ministry of Defence (MOD), and for the Maritime and Coastguard Agency (MCA), on behalf of the Department for Transport (DfT).
- 2.2 Analysis of the Routine Resurvey Areas forms part of the Civil Hydrography Programme and the reports are made available to members of the Committee On Shipping Hydrography (COSH) through the UKHO website, before being presented to the Civil Hydrography Working Group. When approved, the recommendations are incorporated into the Routine Resurvey Programme. The report is governed by a Memorandum of Understanding between the DfT (including the MCA) and the MOD (including the UKHO).

3 HISTORY

- 3.1 TE5A was established in 1985 with an annual re-survey frequency, following re-organisation of the Thames re-survey scheme. Details of the area, including the survey history, are at Annex A.
- 3.2 The limits of TE5A were extended to cover the Sunk Deep Water Track in 1999. In January 2004, the COSH approved revised limits, expanding area TE5A into TE6A, whilst reducing the frequency of surveying in the remaining TE6A area from 1 to 3 years. It also approved a strategy of surveying the more critical areas within TE5A annually (corridors along the Sunk and Trinity Deep Water tracks and across Long Sand Head), whilst reducing the survey frequency of the remaining area to 3 years.
- 3.3 In 2006 adjacent area TE5B, also fully surveyed every 3 years, was combined with area TE5A. In 2007 the extent of the focused areas covering the Sunk and Trinity Deep Water tracks were greatly reduced, due to the lack of notable short term change across much of the area.
- 3.4 Following the 2012 survey, the main TE5A survey area was reduced in size (the southwestern portion being reassigned to TE6A, to be surveyed at 12-yearly intervals). The western limit of TE5A was extended westwards by 260 to 440 metres. The focused survey areas were expanded, to include the area east of Long Sand Head. The 2012 and 2015 survey limits are shown in Figure 1 below.

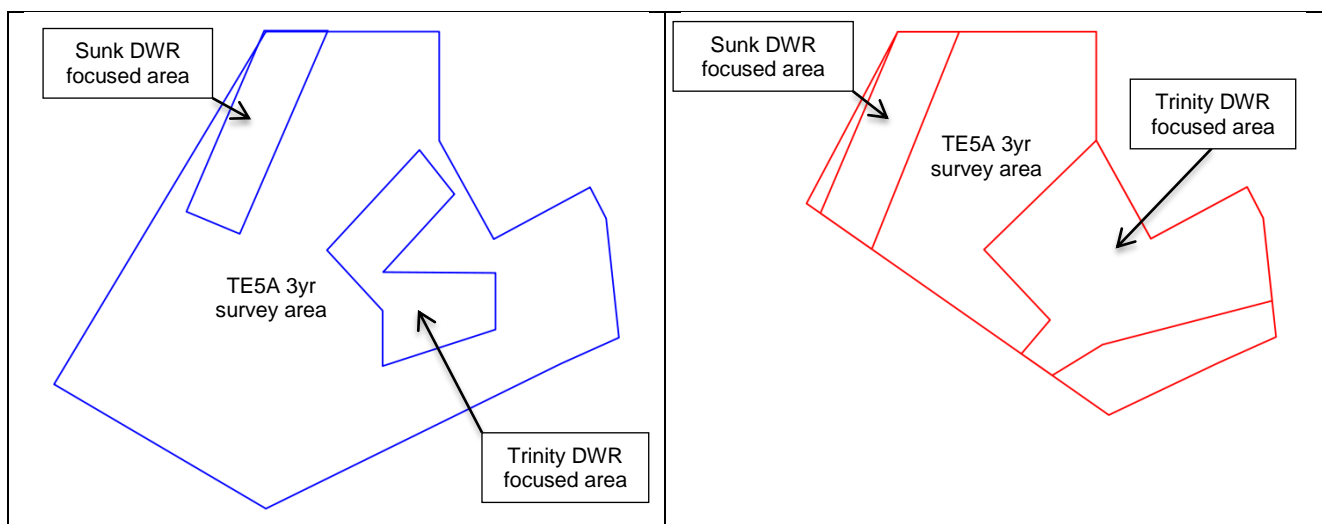


Figure 1: TE5A main and focused survey areas. Left (blue): 2012 limits. Right (red): 2015 limits.

4 DESCRIPTION OF THE AREA

- 4.1 TE5A covers the approaches to Black Deep, an important route into the Thames Estuary and Medway for deep draught vessels. Long Sand Head lies mainly to the southeast, but its northwest limit falls within the area. Area limits and shipping routes are shown at Annex B.
- 4.2 Numerous sandwaves lie across the area, particularly in the north and east, where a sandwave field extends north-westwards from Long Sand Head. These complex sandwaves with bifurcated crests are up to 6 metres high and are both symmetrical and asymmetrical in form. A chart note warns mariners of their presence and the possibility of encountering shallower water than charted. The implied sediment transport, based on sandwave asymmetry and migration, is shown at Annex C. The sandwaves are part of a large area of sandwaves and megaripples which lie between Long Sand Head and South Ship Head to the north. Cross-sections across selected areas are at Annex D.

5 SHIPPING IN THE AREA

- 5.1 Sample shipping data for 2015 indicates use of Sunk and Trinity deep water tracks by vessels over 14 metres draft bound to or from the Medway, and occasional use by vessels of up to 16 metres draft. These transit the area close to low water, but along the track vessels are constrained by controlling depths of around 14 metres.
- 5.2 Vessels drawing up to 12 metres have previously been reported rounding Long Sand Head, although in the 2015 shipping data the deepest draft indicated in this area was 10.4 metres.
- 5.3 To reduce the risk to deep draught vessels resulting from traffic congestion, passage through Black Deep is normally restricted to vessels with a draught of over 6 metres.
- 5.4 Indicative shipping routes from sample AIS data are shown at Annex B.

6 2012 SURVEY DETAIL

- 6.1 The survey HI1398 was conducted from 10th October 2012 to 5th December 2012 in conjunction with other re-survey areas and with days lost due to bad weather. Sea states 2 to 4 were generally experienced in the survey area during data gathering, with sea state 5 stated over the period when not surveying.
- 6.2 Survey data was acquired using a Kongsberg Maritime EM3000D multibeam echosounder. The height component of the GPS position solution was used to reduce depths to Chart Datum. Ellipsoidal Height to Chart Datum values were taken from the UKHO Vertical Offshore Reference Framework (VORF), with positions referred to European Terrestrial Reference Frame 1989 (ETRF89). The final dataset was in the form of a 1 metre resolution CUBE (Combined Uncertainty and Bathymetric Estimator) surface.
- 6.3 The survey was validated by the UKHO and met IHO S44 (5th edition) Order 1a standard.

7 2015 SURVEY DETAIL

- 7.1 Survey HI1483 was conducted from 15th August 2015 to 3rd October 2015 in conjunction with other re-survey areas and with days lost due to bad weather.
- 7.2 Survey data was acquired using a Kongsberg Maritime EM2040C multibeam echosounder. The height component of the GPS position solution was used to reduce depths to Chart Datum. Ellipsoidal Height to Chart Datum values were taken from VORF, with positions referred to ETRF89. The final dataset was in the form of a 1 metre resolution CUBE surface.
- 7.3 The survey was validated by the UKHO and met IHO S44 (5th edition) Order 1a standard.

8 DESCRIPTION OF RECENT BATHYMETRIC CHANGE

- 8.1 Colour banded depth plots of the 2012 and 2015 surveys are at Annex E and Annex F respectively and allow visual comparison.
- 8.2 A Variability Plot showing the depth differences between the 2012 and 2015 surveys is at Annex G and Comparison Plots of the 10 and 13 metre contours are at Annex H. Both of these show the main areas of change are over Long Sand Head and more generally across the north-eastern part of TE5A.

Sunk Deep Water Track

- 8.3 Close to the Sunk Deep Water Track, the shoalest depths are 15.4 metres (in the south of the area and just west of the Dynamo buoy), and 15.5 metres approximately 550m from the track

at the northern part of the TE5A. These depths are highlighted in Annex G, with the equivalent depths from 2012 highlighted in Annex E.

8.4 Variation in depth along the Sunk Deep Water Track is shown in Annex D, profile A – B.

8.5 Depths close to the Sunk Deep Water Route have generally increased since 2008 – see Figure 2 for details.

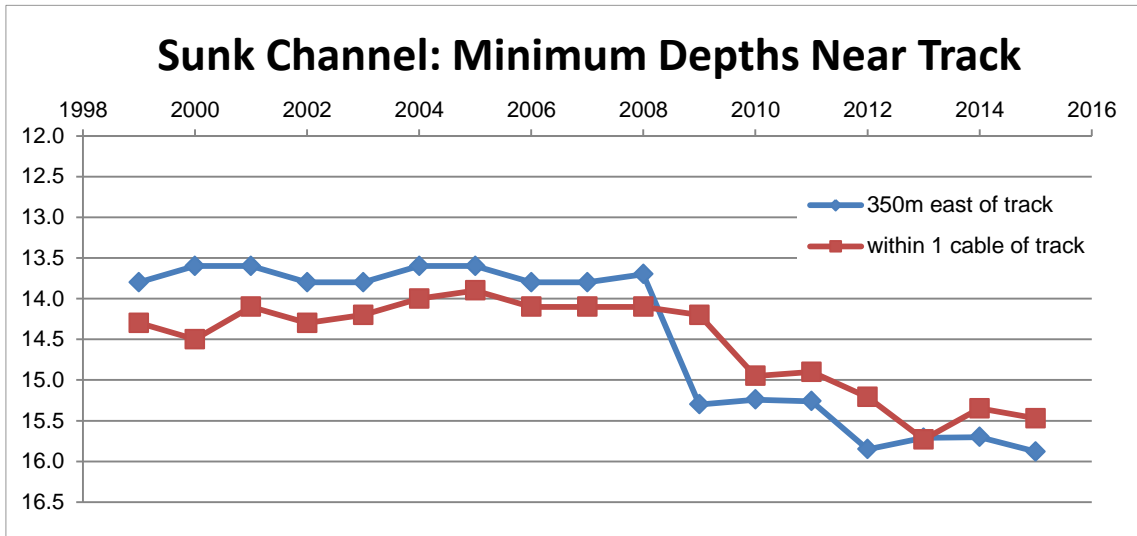


Figure 2: Depths close to Sunk DWR

Trinity Deep Water Track

8.6 Much of the Trinity Deep Water track passes over relatively flat and featureless seafloor. The exception to this is in an area south of Trinity south cardinal buoy (Figure 3), where there are sandwaves up to 6 metres in height. Minimum depths over these sandwaves are slightly shoaler in the 2015 survey than the 2012 survey, with the minimum depth decreasing from 12.5 to 12.4 metres. The locations of the shoalest depths in 2012 and 2015 are highlighted in Annexes E and F.

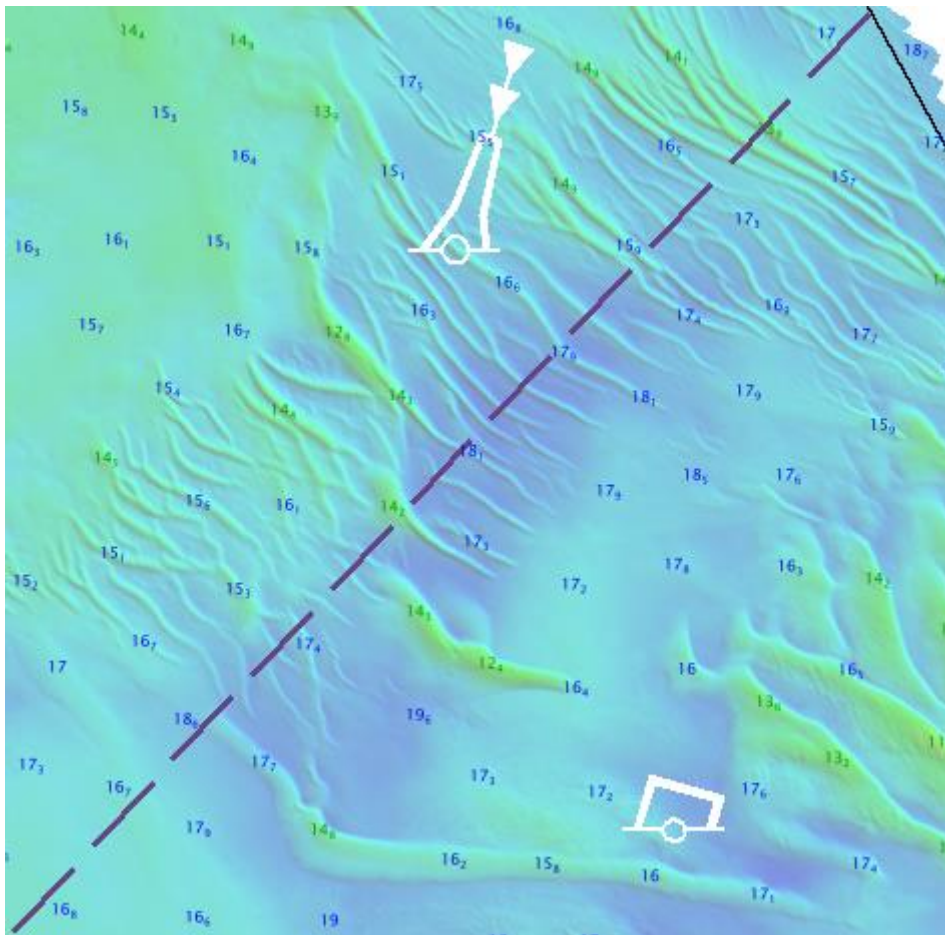


Figure 3: Sandwaves south of Trinity buoy. Dashed line indicates Trinity DWR.

- 8.7 Depth profiles for the Trinity Deep Water Route area are in Annex D: profile E – F follows the track itself, and profile G – H through the shoalest sandwaves.

Long Sand Head

- 8.8 The bank is undergoing a long-term northeast migration. The apex of the 10 metre contour has migrated 450 metres northeastwards, while the east face of the bank has expanded 290 metres southeastwards over the 3 year period. Change in depth resulting from this is shown in profile I – J at Annex D. The western flank has receded by 50 metres over the same period. This represents a reduced rate of change compared with that shown between 2008 and 2012.
- 8.9 Further to the east, the seabed has shoaled, but to a lesser extent, as shown in the variability plot at Annex G and cross-section K – L at Annex D. In this area depths have reduced by up to around 1 metre and the minimum depth within the Long Sand Head two-way Route is 12.3 metres in the 2015 survey, compared with 12.8 metres in 2012. The locations of the shoalest depths in 2012 and 2015 are highlighted in annexes E and F.

Other Areas

- 8.10 In the north part of the area extensive sandwaves exist between the Sunk and Trinity Deep Water tracks. Depths over these sandwaves are generally shoaler in the 2012 survey, with the minimum depth shoaling from 10.2m to 9.2m. Profile C – D in Annex D shows the depth variation in this area. The locations of the shoalest depths in 2012 and 2015 are highlighted in annexes E and F.
- 8.11 The 2012 assessment described dredging taking place in the far southwest of the survey area. This location has been reassigned to TE6A, so is not detailed here.

9 IMPLICATIONS FOR SHIPPING

- 9.1 Depths over sandwaves along the Sunk Deep Water tracks are shoaler than those surveyed in 2012, while those along the Trinity DWR are deeper. In both cases, the changes are less than 0.5 metres.
- 9.2 Long Sand Head, as marked by the 10 metre contour, has continued to develop, extending north-eastwards into deep water and towards the route from Long Sand Head north cardinal buoy into Black Deep. Further to the east, the area delimited by the 15 metre contour and forming the north east limit of Long Sand has shoaled and further shoaling would be of potential concern to shipping using the Long Sand Head two-way Route and need to be considered in any MCA proposed to amendment to the Long Sand Head Two Way Route at IMO NCSR.

10 RECOMMENDATIONS FOR FUTURE SURVEYS

- 10.1 It is recommended that the limits and frequency of the focussed and triannual surveys remain unchanged.

AREA SPECIFICATIONS
(Including Survey History)

REGION: Thames Estuary**NAME:** Long Sand Head**AREA:** TE5A **LIMITS:**

Point	Latitude D.D (N)	Longitude D.D (E)	Point	Latitude D.D (N)	Longitude D.D (E)
01	51.84331	1.56680	06	51.81333	1.66167
02	51.84333	1.61833	07	51.79417	1.66500
03	51.82583	1.61833	08	51.79000	1.65000
04	51.81000	1.63250	09	51.78160	1.62160
05	51.81833	1.65750	10	51.81567	1.54314

Area co-ordinates are referred to WGS84 Datum

AREA SIZE: 9.5 SQ NM (32.5 SQ KM)**SURVEY INTERVAL:** 1 yr Focused Area (Deep Water Tracks and Long Sand Head) and 3 yr Full Area**SURVEYS:** Conducted at 1:25,000 scale (not applicable to multibeam surveys)

Year	Survey	Reference	Data	Year	Survey	Reference	Data
1985	K9654*	H2341/84	s.	1986	K9848*	H2342/85	s.
1987	M1118*	H4025/86	s.t.	1988	M1229*	H6336/87	s.t.d.
1989	M1380*	H3934/88	s.d.	1990	M1596*	HH090/495/01	s.d.
1991	M1805*	HH090/516/01	s.d.	1992	M1913	HH090/549/01	s.t.d.
1993	M2134	HH090/574/01	s.t.d.	1994	M2269	HH090/626/01	s.d.
1995	M2496	HH090/652/01	s.t.d.	1996	M2671	HH090/690/01	s.d.
1997	M2815	HH090/743/01	s.d.	1998	M3009	HH090/769/01	s.d.
1999	M3235	HH090/852/01	s.d.	1999	M3293	HH090/852/01	s.d.
2000	M3376	HH090/886/01	s.d.	2001	M3558	HH090/936/01	s.d.
2002	M3739	HH090/993/01	s.t.d.	2003	M3924	HH091/023/01	s.d.
2004	M4183	HH091/078/01	m	2005	M4356	HH091/116/01	m
2006	M4565	RSDRA2007000444	m	2007	M4643	RSDRA2007007601	m
2008	HI1265	RSDRA2008026409	m	2012	HI1398	RSDRA2012000117404	m
2013	HI1433	RSDRA2013000244604	m	2014	HI1459	RSDRA2013000244604	m
2015	HI1483	RSDRA2013000244604	m				

KEY: s = sonar sweep, t = seabed texture tracing, d = digital data, m = multibeam digital data,
* = 12,500 scale

REPORTS: 1997 Latest survey included M2671**ASSESSMENTS:**

1995	M2496	2003	M3739	2008	HI1265
1998	M3009	2004	M3924	2012	HI1398
1999	M3235	2005	M4183	2013	HI1433
2001	M3376	2006	M4565	2014	HI1459
2002	M3558	2007	M4643	2015	HI1483

REMARKS:

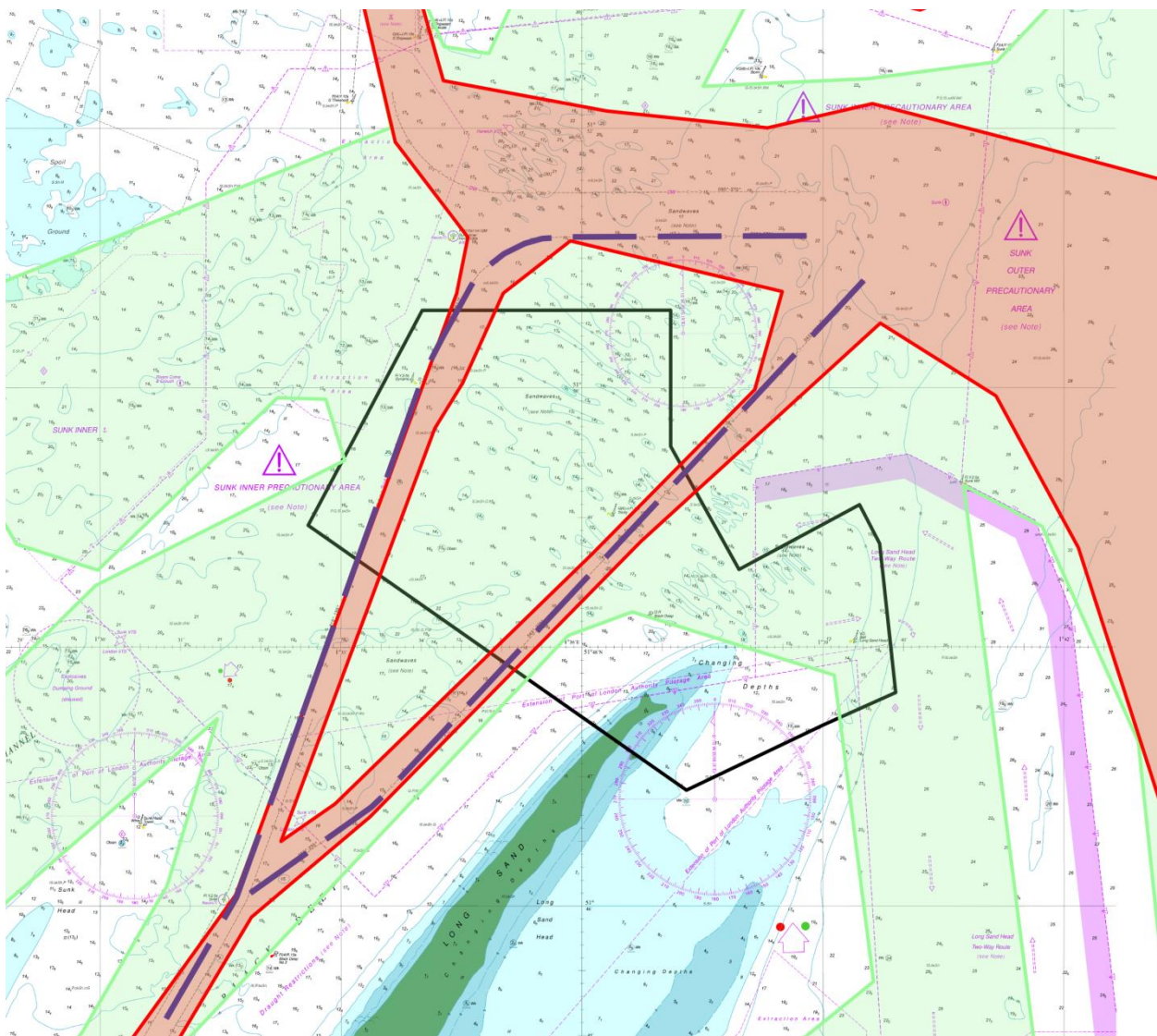
1985		Area 5A established (H0423/85)
2000		Area extended to cover the Sunk DW track
1999	2003	Area expanded to take on part of Area TE6A. Focused annual surveying of the Deep Water Tracks and Long Sand Head. Remainder of the area to be surveyed every 3 years
2000	2006	Adjacent area TE5B combined with TE5A
2001	2007	Reduction in extent of the focused areas covering Sunk and Trinity DW tracks
2002	2012	Reduction in extent of main survey area; increase in size of focused survey areas.

LARGEST SCALE CHART: BA 2692 (1:25,000)

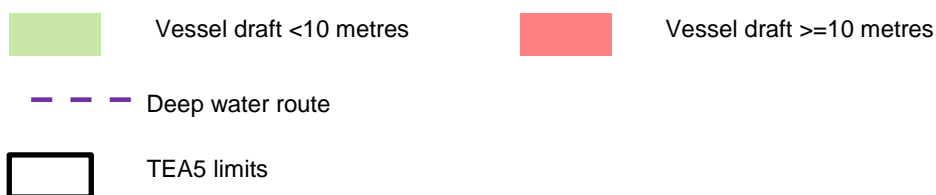
SHIPPING ROUTES

The image below shows the main areas frequented by vessels of draft 10 metres and greater (red) and under 10 metres (green), based on satellite AIS data for FY 2015/2016

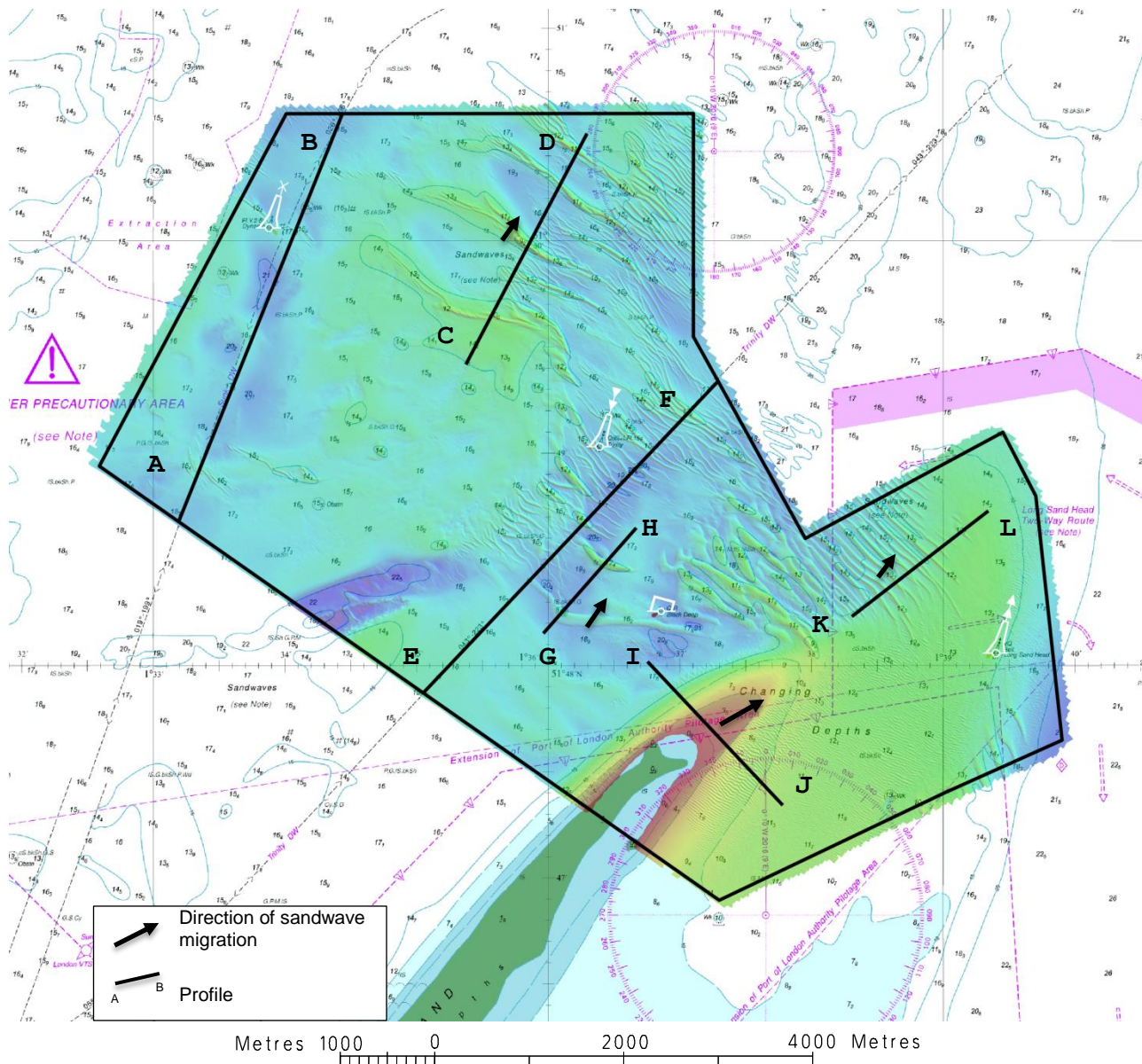
- Vessels of 10 metres draft and greater tend to follow the Trinity DWR.
- Vessels of 10 metres draft and greater tend to keep to the east of the Sunk DWR
- Vessels of <10 metres draft commonly traversed the areas between the DWRs and to the northeast of Long Sand bank.
- 10 metres draft and greater vessels were occasionally seen very close to the Long Sand bank. (Not shown in image)



Data from satellite AIS data for FY2015/2016 for vessels larger than 2000 GT.



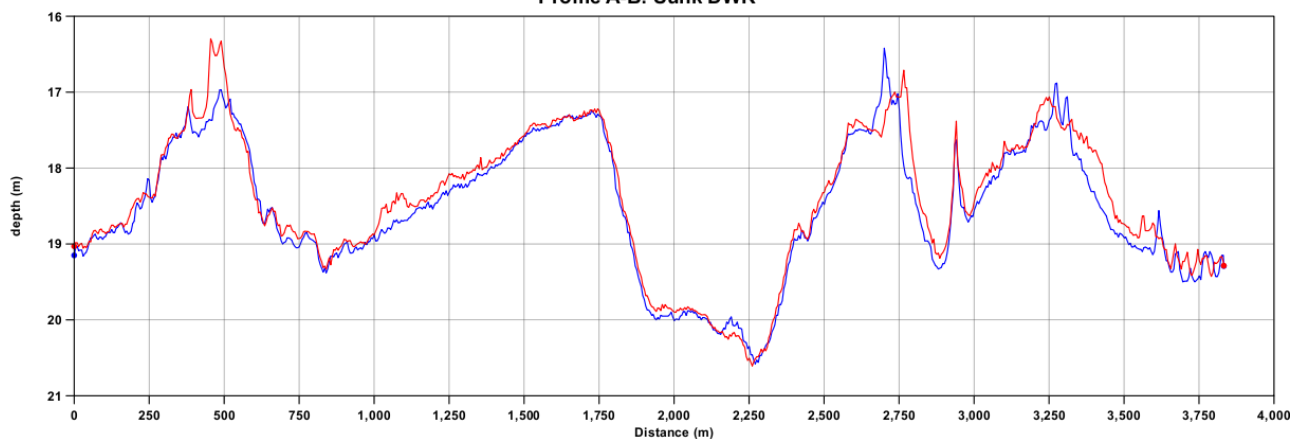
2015 SURVEY OVERLAID ON CHART 2692
 WITH LOCATIONS OF CROSS SECTION COMPARISONS
 (Shown at Annex D)



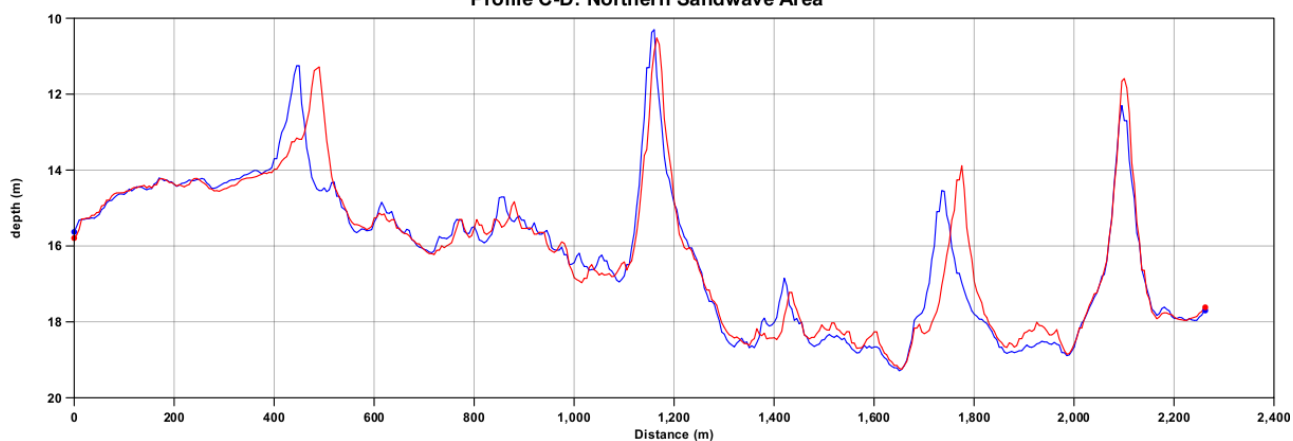
PROFILE COMPARISONS FROM THE 2012 AND 2015 SURVEYS

(See Annex C for Locations)

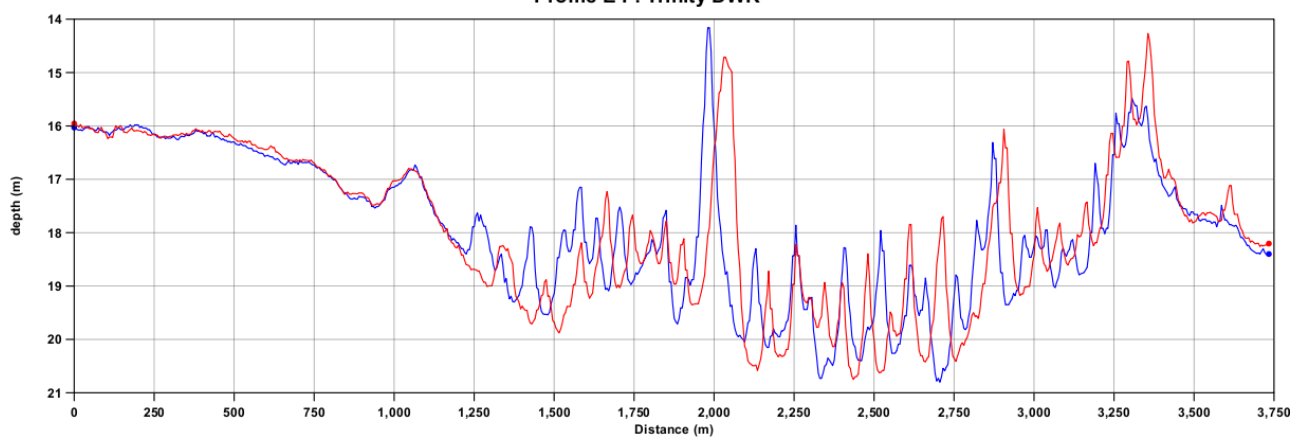
Profile A-B: Sunk DWR



Profile C-D: Northern Sandwave Area

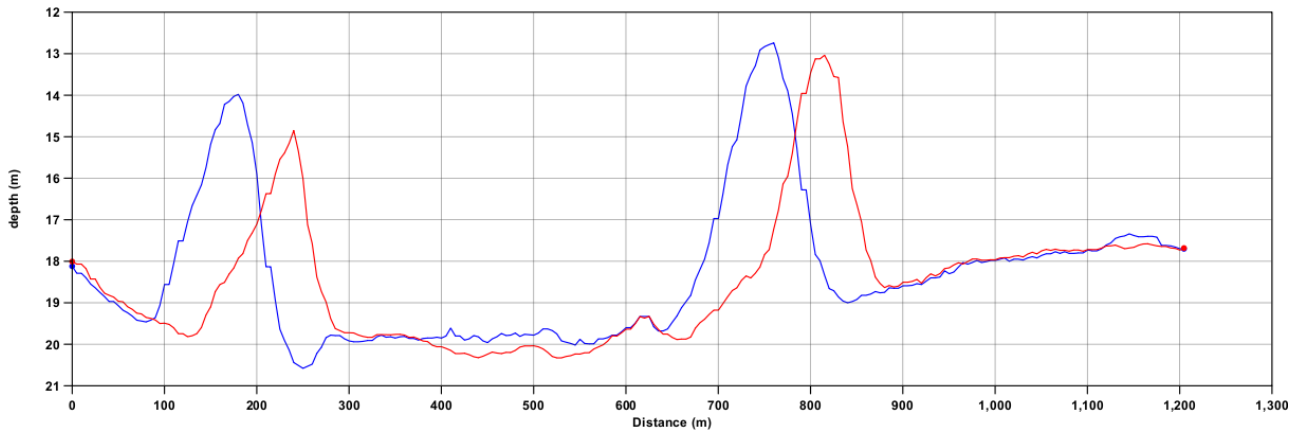


Profile E-F: Trinity DWR

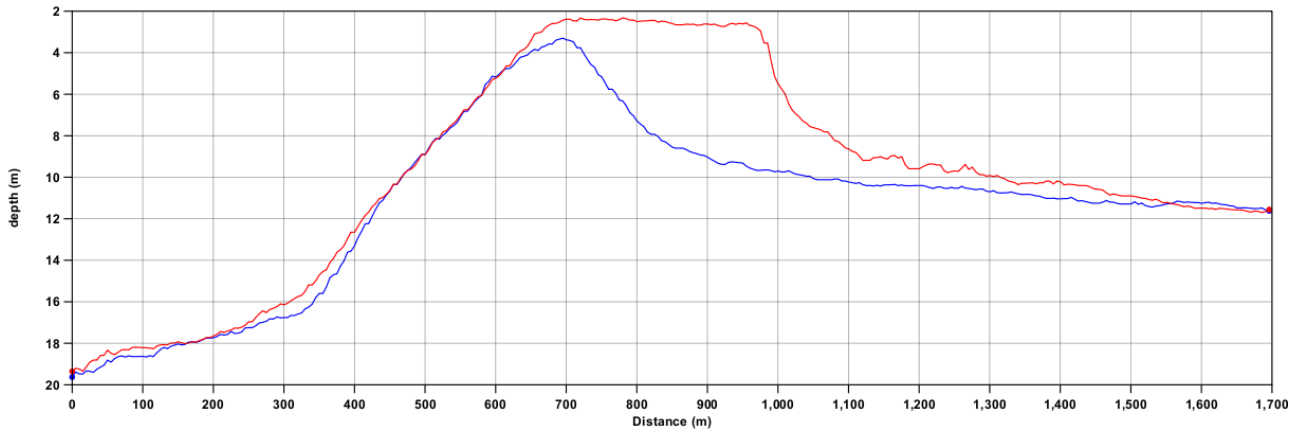


Year of Survey	
—	2015
—	2012

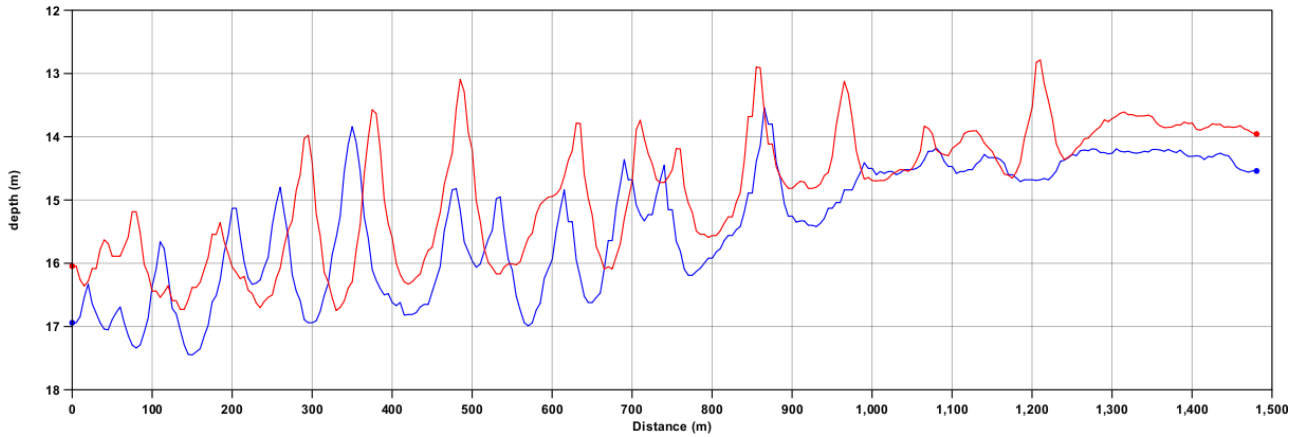
Profile G-H: Trinity Sandwave Area



Profile I-J: Long Sand Bar

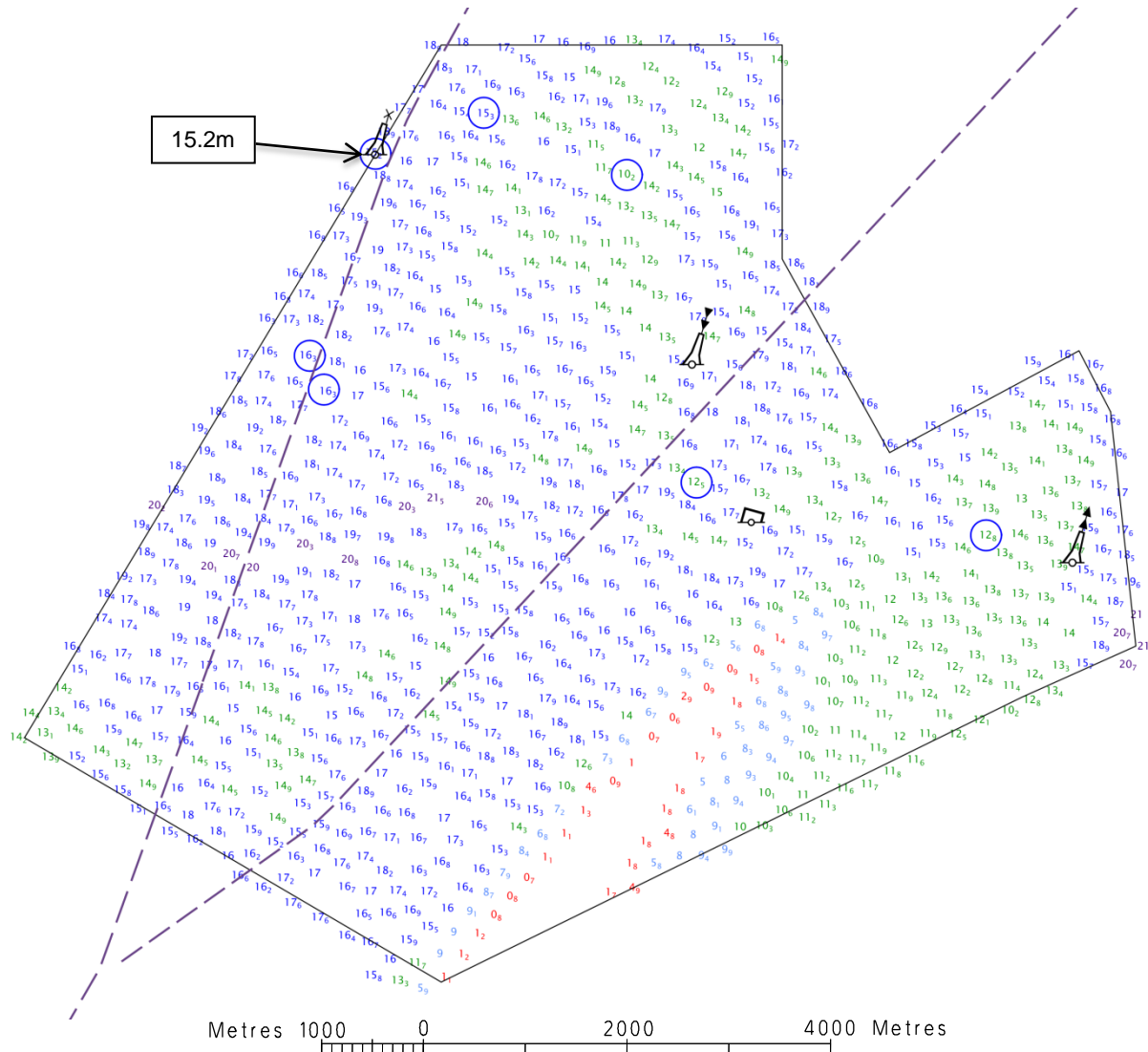


Profile K-L: Northeast Sandwave Area



Year of Survey	
—	2015
—	2012

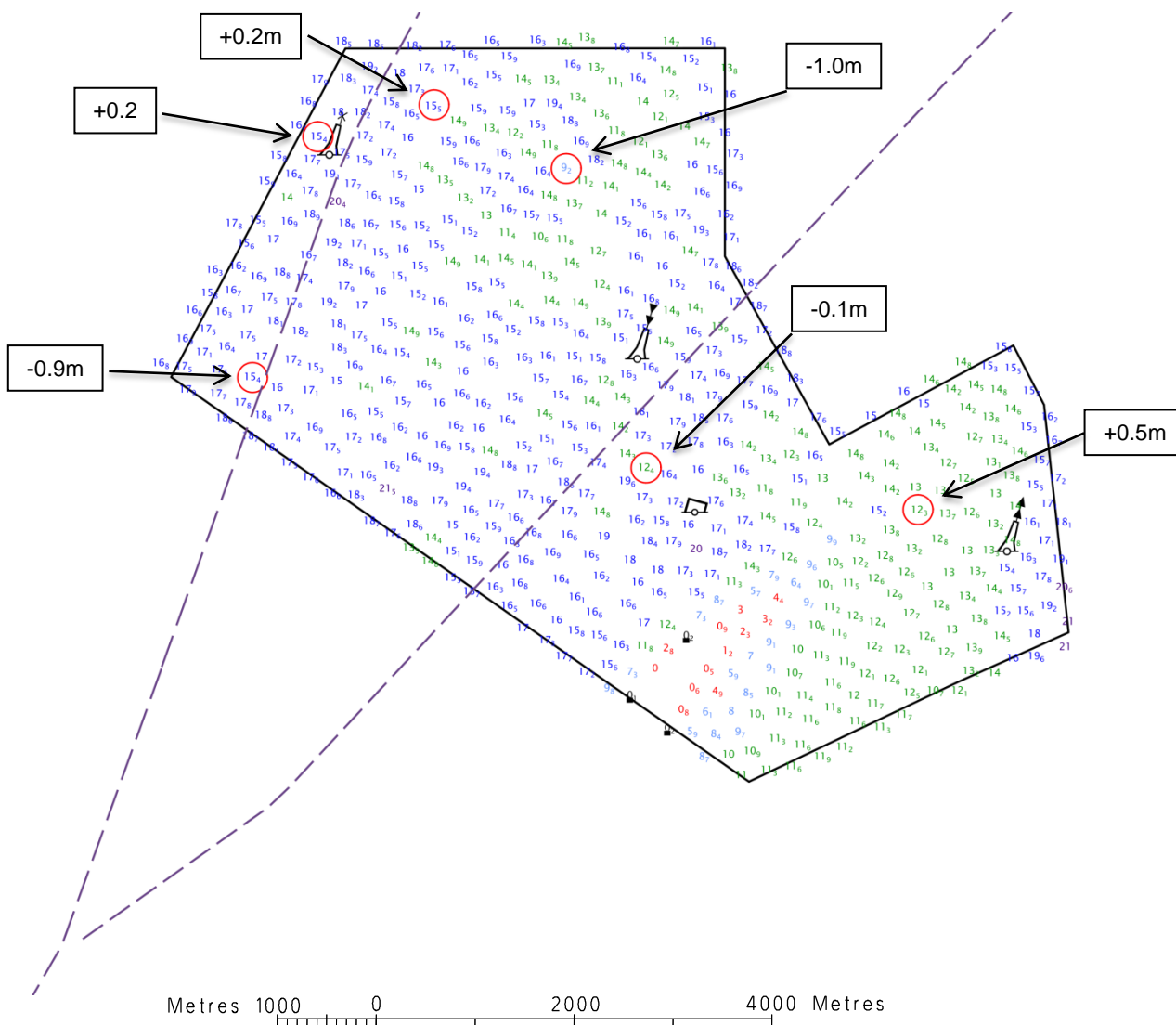
COLOUR BANDED DEPTH PLOT FROM 2012
 SHOWING SELECTED DEPTHS
 SCALE 1:75,000




- Selected shoal depths
- Deep Water Route
- TEA5 limits (2012)


Depths in Metres	
	Drying
	0 – 5
	5 – 10
	10 – 15
	15 – 20

COLOUR BANDED DEPTH PLOT FROM THE 2015 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:75,000








 Selected shoal depths

 Deep water route

 TEA5 limits (2015)

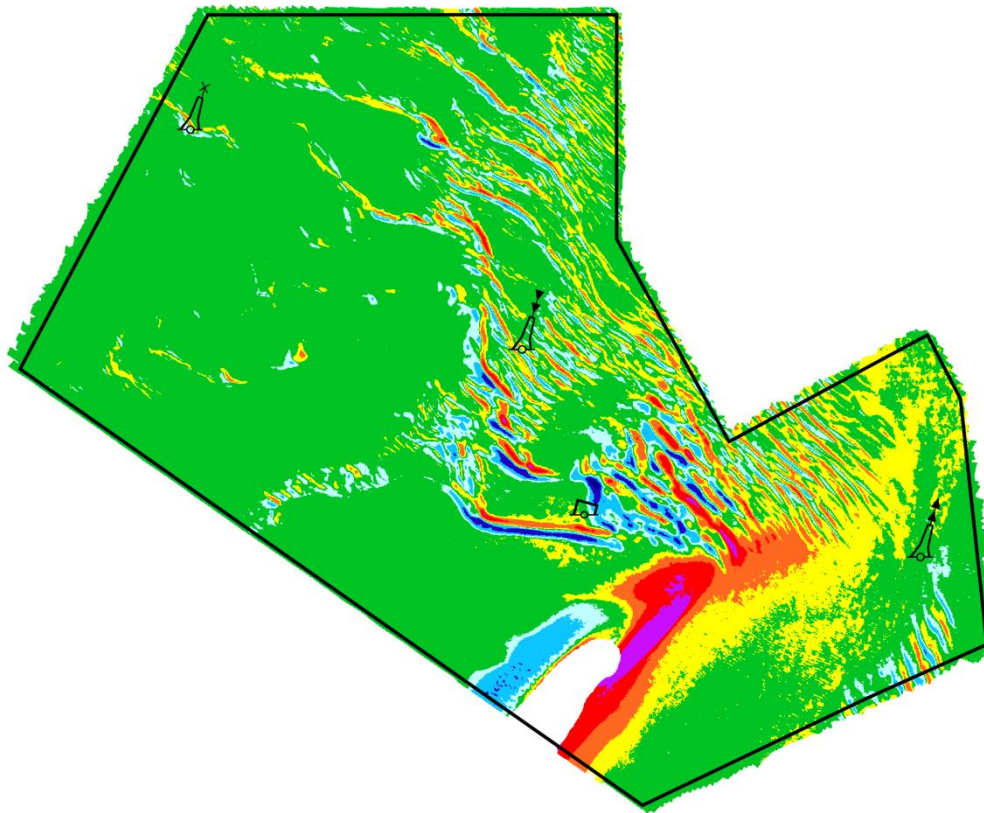
 -1.0 Depth change

Depths in Metres	
	Drying
	0 – 5
	5 – 10
	10 – 15
	15 – 20

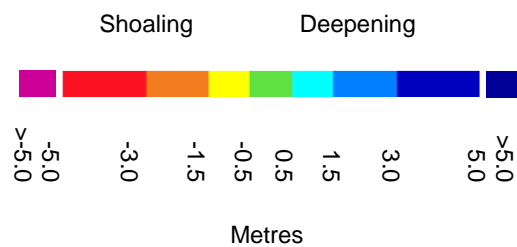
Deepening + Positive value / Shoaling - negative value

Depth changes indicated above are from the closest corresponding 2012 sounding available. Hence depth differences will be from different positions from the 2015 sounding selection as an automatic shoal bias sounding selection tool has been utilised which produces a representation of the shoal values in a data set.

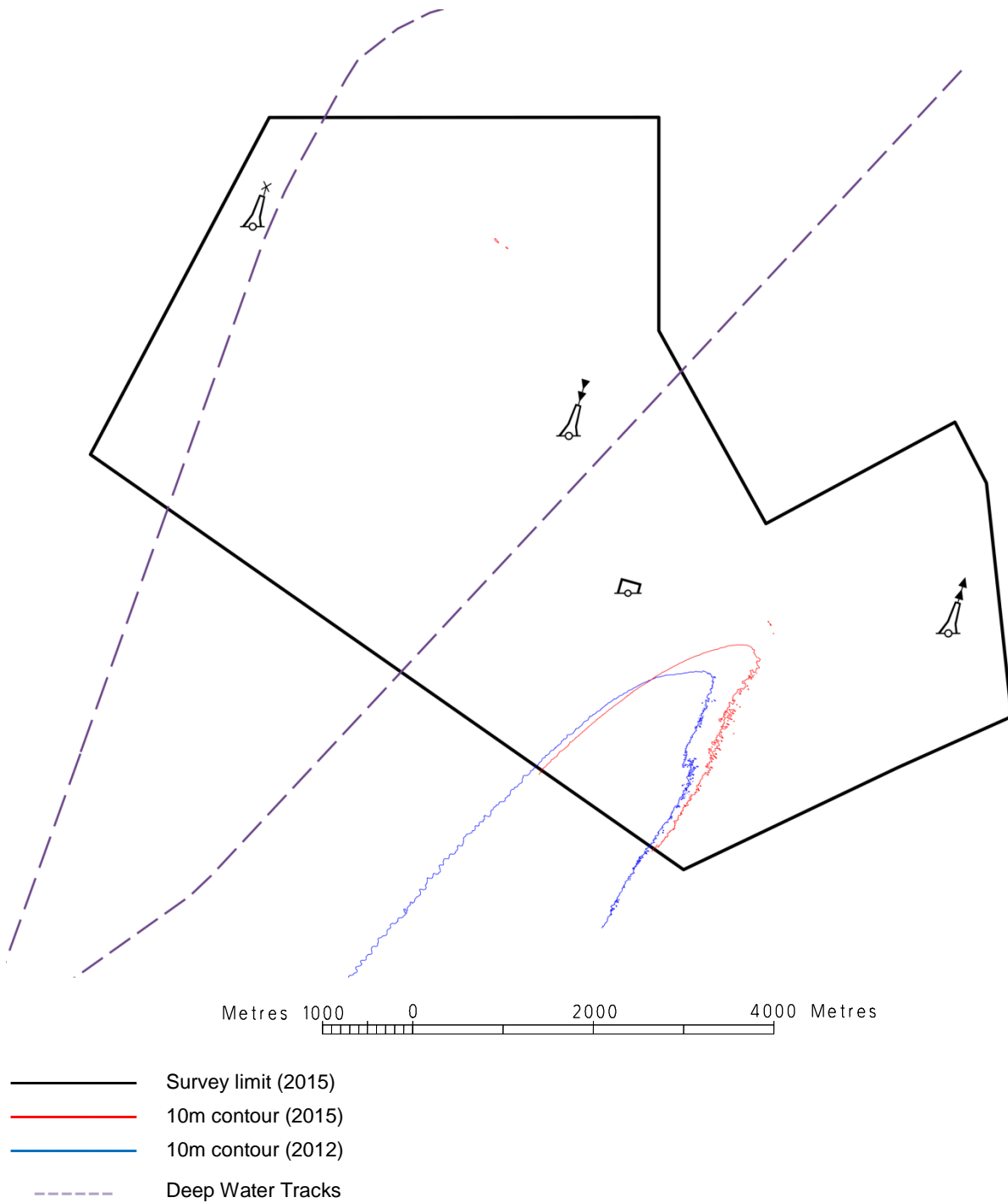
VARIABILITY PLOT SHOWING BATHYMETRIC CHANGES
BETWEEN THE 2012 AND 2015 SURVEYS
SCALE 1:75,000



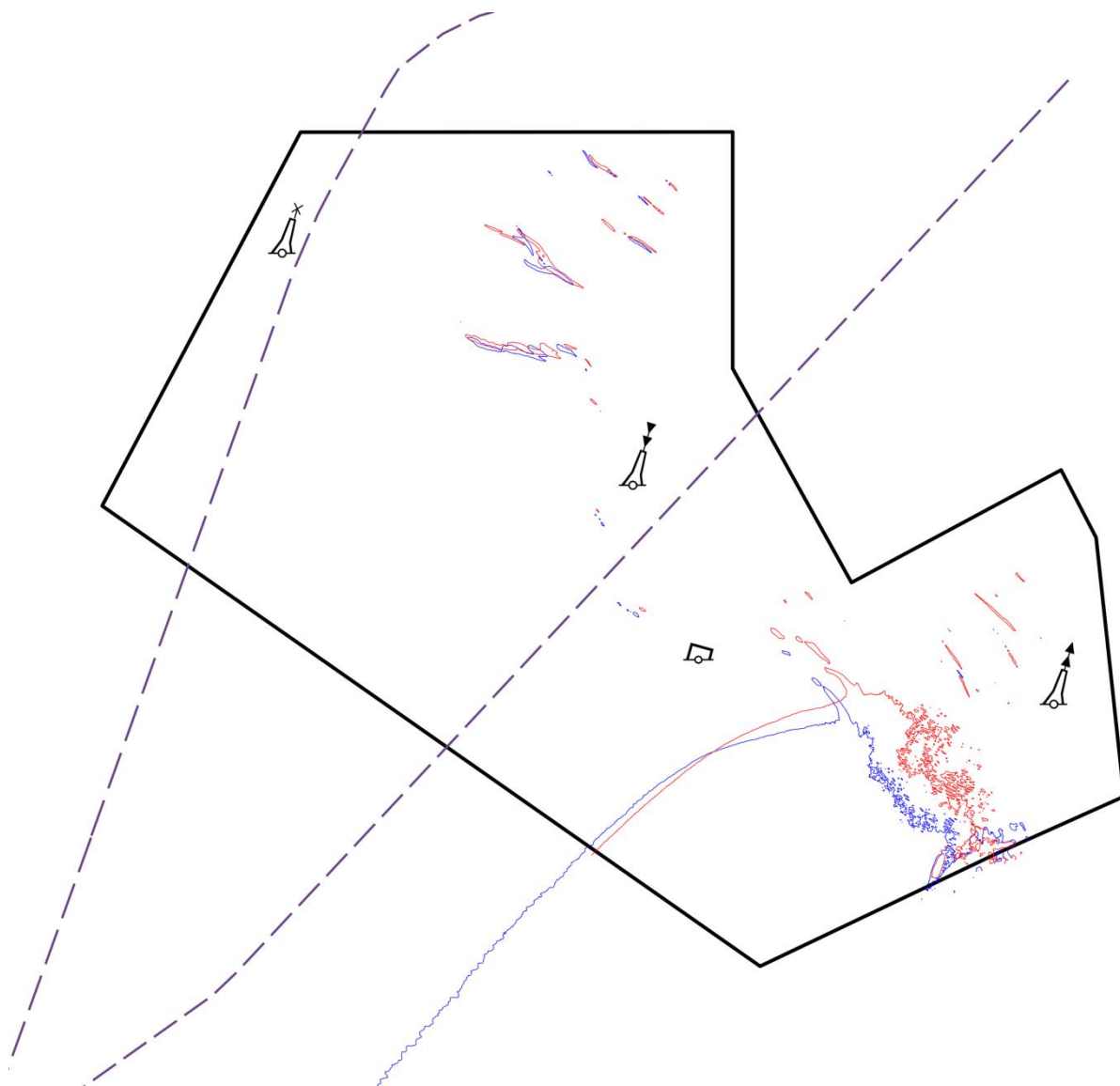
Metres 1000 0 2000 4000 Metres



COMPOSITE DIAGRAMS OF CONTOURS FROM THE 2012 AND 2015 SURVEYS

**Composite Diagram of the 10 metre Contour from the 2012 and 2015 Surveys Scale
1:75,000**

**Composite Diagram of the 13 metre Contour from the 2012 and 2015 Surveys Scale
1:75,000**



Metres 1000 0 2000 4000 Metres

- Survey limit (2015)
- 10m contour (2015)
- 10m contour (2012)
- - - Deep Water Tracks