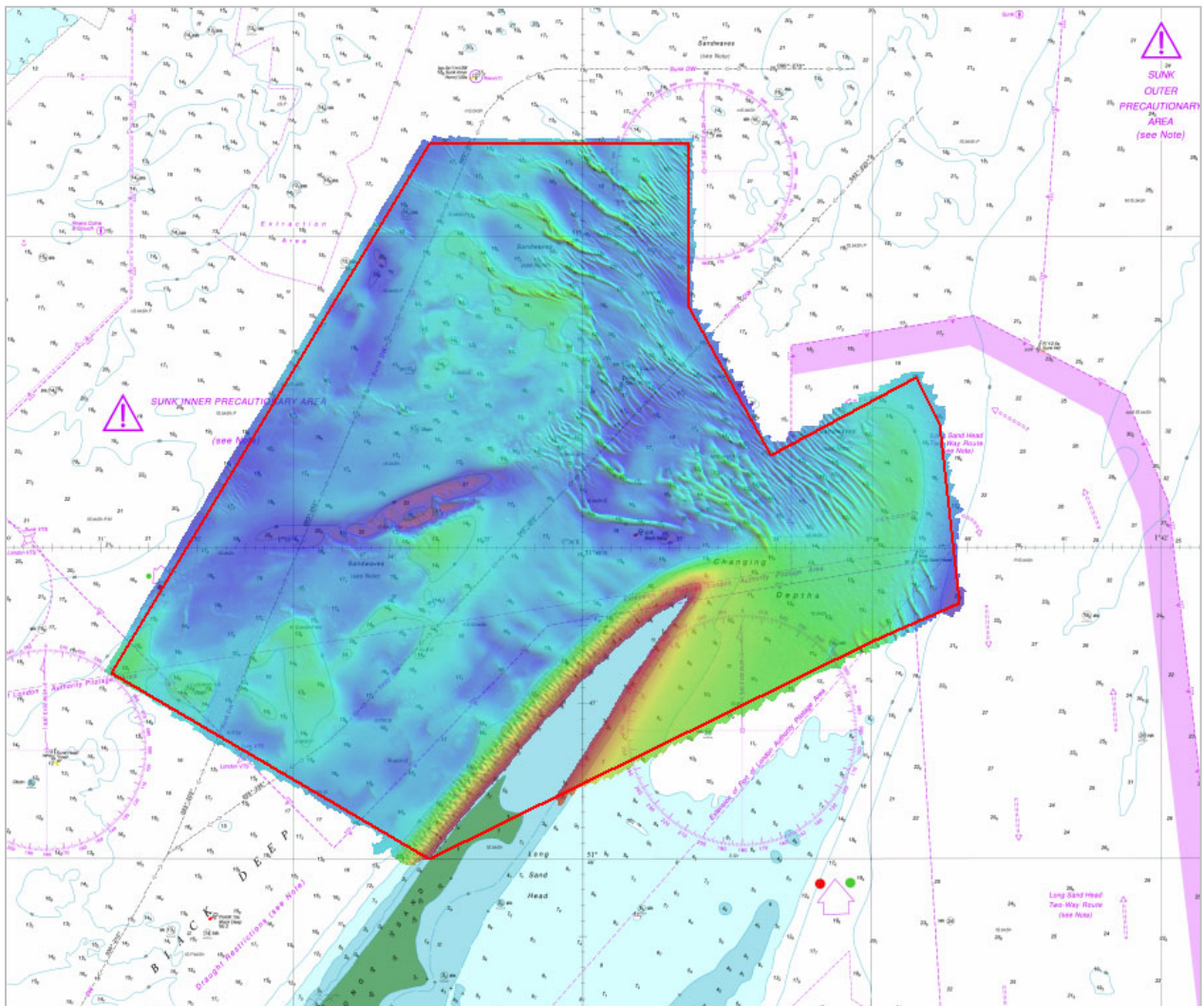




THAMES ESTUARY LONG SAND HEAD

ASSESSMENT ON THE ANALYSIS OF ROUTINE RESURVEY AREA TE5A
FROM THE 2012 SURVEY



THAMES ESTUARY

LONG SAND HEAD

Assessment TE5A/2012

An assessment of the 2012 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, 2012

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 latest full survey was postponed from 2011 due to operational constraints, resulting in a 4 year interval between full surveys.
- 1.2 Vessels drawing up to 14.1 metres draught have been observed following the Sunk Deep Water track, vessels drawing up to 13.0 metres following the Trinity Deep Water track and vessels drawing up to 12.0 metres passing close north of Long Sand Head. Development of London Gateway is likely to result in deeper draught vessels using the Sunk Deep Water track and associated dredging has taken place since 2008 in the south of TE5A.
- 1.3 The main changes that have occurred since 2008 have been over the sandwave field in the northeast of the area and a continued north-eastward migration of Long Sand Head, with the 10 metre contour migrating 1,200 metres over the 4 year period. Generally deeper depths seen over the sandwaves in the 2012 survey may be due to increased sea states during the survey period producing temporal changes.

Reasons for Continuing to Resurvey the Area

- 1.4 The area requires resurveying for the following reasons:
 - 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.
 - Long Sand Head is migrating northeastwards, requiring frequent monitoring.
 - In addition to the above critical areas, sandwaves and ridges across much of the area need resurveying, but less frequently.

Recommendations

- 1.5 It is recommended that area TE5A and adjacent area TE6A are re-schemed to extend the survey frequency of the south-west part of area TE5A, which is subject to little change.
- 1.6 The area to the east of the Long sand Head has shoaled and the re-survey frequency should be increased from 3 years to 1 year by extending the focused survey area.

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.

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 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 D](#). 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 E](#).
- 4.3 TE5A contains licensed aggregate dredging areas and dredged pockets are visible in the survey, with other markings in the area thought to be the result of dredging activities.

5. LONDON GATEWAY PROJECT

- 5.1 The London Gateway terminal on the north side of the Thames Estuary, currently under development, has berth pockets of 17 metres allowing the terminal to be used by Ultra Large Container Ships.
- 5.2 The shipping channel will be dredged from 11 metres to 14.5 metres in the inner channel and 16 metres in the outer channel. Since the 2011 survey, dredging has taken place in the southwest of TE5A as part of the project.

6. SHIPPING IN THE AREA

- 6.1 Bulk Carriers up to 14.1 metres draught are understood to use the Sunk Deep Water track, bound to or from the Medway. These transit the area close to low water, but along the track are constrained by controlling depths of around 14 metres. 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.

- 6.2 Indicative shipping routes from sample AIS data are shown at [Annex B](#). Vessels drawing up to 14.1 metres have been observed following the Sunk Deep Water track, vessels drawing up to 13.0 metres following the Trinity Deep Water track and vessels drawing up to 12.0 metres rounding Long Sand Head.

7. 2008 SURVEY DETAILS

- 7.1 The main survey was conducted from 10 to 16 September. During the period, sea states were generally state 2 to 3. Survey infill lines were run on 28 September.
- 7.2 The survey data was acquired using a Kongsberg 3002D multibeam echosounder system. The survey was referred to ITRF2000 Datum. Ellipsoidal Height to Chart Datum values taken from the Vertical Offshore Reference Framework (VORF) were used within POSPac to calculate the reduced vessel height, from which a filtered tidal curve was derived.
- 7.3 The survey achieved IHO S44 (Edition 4) Order 1 standards.

8. 2012 SURVEY DETAIL

- 8.1 The survey was conducted from 10 October to 5 December 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 experienced over the period when not surveying.
- 8.2 Survey data was acquired using a Kongsberg Maritime EM3000D multibeam echosounder. The height component of the GPS position solution was used to reduce soundings to Chart Datum. Ellipsoidal Height to Chart Datum values were taken from the Vertical Offshore Reference Framework (VORF), with positions referred to ETRF89. The final dataset was in the form of a 1 metre gridded CUBE surface.
- 8.3 The survey achieved IHO S44 (Edition 4) Order 1a standard. The 2012 survey data overlaid on chart 2692 is at [Annex C](#).
- 8.4 Comparison against the 2008 survey shows good agreement away from the mobile bedforms, but with the 2008 surface containing noise not present in the 2012 CUBE surface.

9. DESCRIPTION OF RECENT BATHYMETRIC CHANGE

- 9.1 Colour banded depth plots of the 2008 and 2012 surveys are at [Annexes F](#) and [G](#) respectively and allow visual comparison.
- 9.2 A variability plot showing the depth differences between the 2008 and 2012 surveys is at Annex H. Comparison plots of the 10 and 13 metre contours are at [Annexes I](#) and [J](#).
- 9.3 As shown in the variability plot, the main areas of change are over Long Sand Head and more generally across the north-eastern part of TE5A.

Long Sand Head

- 9.4 The bank is undergoing a long-term northeast migration and the 10 metre contour has migrated 1,200 metres over the 4 year period. Change in depth resulting from this is shown in profile I-J at [Annex E](#). The western flank has receded by 200 metres over the same period.

9.5 Further to the east, the seabed has shoaled, but to a lesser extent, as shown in the variability plot at [Annex H](#) and cross-section A-B at [Annex E](#). In this area depths have reduced by up to around 1 metre and the minimum depth over the outer ridge is 12.8 metres in the 2012 survey within the Long Sand Head two-way Route.

Sunk Deep Water Track

9.6 In the north of the area the minimum depth close to the track is found over an isolated sandwave lying on a low ridge. Figure 1 shows that depths over the sandwave have increased in each annual survey since 2008. Although slightly outside the corridor extending 1 cable either side of the track, the sandwave could form the controlling depth in future if the minimum depth moves nearer to the track.

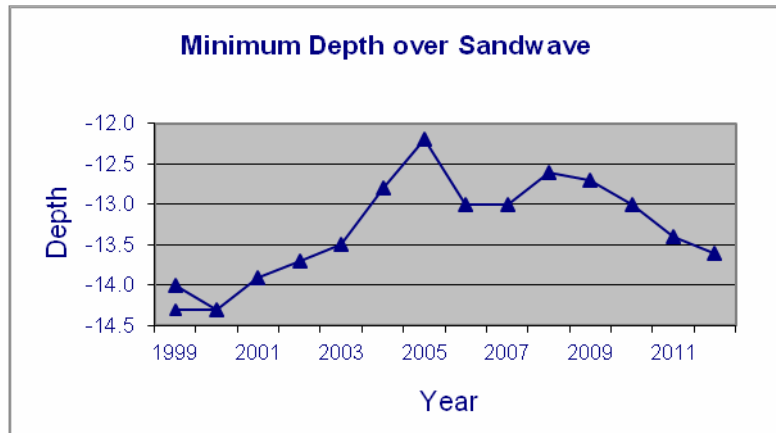


Figure 1: Depths over a sandwave in the north of the area

Trinity Deep Water Track

9.7 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 buoy, where there are sandwaves up to 6 metres in height. Minimum depths over these sandwaves are deeper in the 2012 survey than the 2008 survey, with the minimum depth increasing from 12.1 to 12.5 metres.

Other Areas

9.8 In the north-eastern part of the area extensive sandwaves exist between the Sunk and Trinity Deep Water tracks. Depths over these sandwaves are generally deeper in the 2012 survey, with the minimum depth increasing from 8.8 to 10.2 metres.

9.9 In the south-western part of the area there is little change, although dredging as part of the London Gateway Project has been carried out across a low ridge in the far south of the area. [Annex K](#) shows the longer term change as a variability plot between the 2000 and 2012 surveys.

9.10 Generally deeper depths seen over the sandwaves across the area could be the result of poor weather, with sea state 5 during the period, producing a temporal reduction in height over the sandwaves.

10. IMPLICATIONS FOR SHIPPING

10.1 Depths over sandwaves along the Deep Water tracks are deeper than those surveyed in 2005, although this may be a temporal change due to sea states during the period of the 2012 survey.

10.2 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 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.

11. RECOMMENDATIONS FOR FUTURE SURVEYS

11.1 The south-western part of the area is devoid of large mobile bedforms and subject to little change; as such it is recommended that the resurvey frequency is extended to 12 years, with the exception of a corridor covering the Sunk Deep Water track, which should continue to be resurveyed every 6 years.

11.2 Due to shoaling, the area to the east of Long Sand Head, which is currently surveyed every 3 years, should be re-surveyed more frequently by extending the annual focused survey area.

11.3 The above recommendations should be achieved by transferring part of the area to adjacent re-survey area TE6A, currently re-surveyed every 12 years with focused areas surveyed every 6 years, and by revising the Long Sand Head annual focused area.

11.4 The existing limits of TE5A and adjacent TE6A are shown [at Annex L](#); the proposed limits for these areas are show in [Annex M](#). Although the resurvey interval would be extended from 3 to 12 years for part of the area, the expansion of the Long Sand Head area results in an average annual increase of 10% effort required over areas TE5A and TE6A, an additional 2.2 Sq km per year.

AREA SPECIFICATIONS
(Including Survey History)

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

A	51°.84333N	1°.57333E	F	51°.81333N	1°.66167E
B	51°.84333N	1°.61833E	G	51°.79414N	1°.66500E
C	51°.82583N	1°.61833E	H	51°.79000N	1°.65000E
D	51°.81000N	1°.63250E	I	51°.76667N	1°.57333E
E	51°.81833N	1°.65750E			

Area co-ordinates are referred to WGS84 Datum

AREA SIZE: 8.0 SQ NM (27.6 SQ KM)

SURVEY INTERVAL: 1 yr Focused Area (Deep Water Tracks and Long Sand Head)
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.	1998	M3009	HH090/769/01	s.d
1986	K9848*	H2342/85	s.	1999	M3235	HH090/852/01	s.d
1987	M1118*	H4025/86	s.t.	1999	M3293	HH090/852/01	s.d
1988	M1229*	H6336/87	s.t.d.	2000	M3376	HH090/886/01	s.d
1989	M1380*	H3934/88	s.d.	2001	M3558	HH090/936/01	s.d
1990	M1596*	HH090/495/01	s.d.	2002	M3739	HH090/993/01	s.t.d
1991	M1805*	HH090/516/01	s.d.	2003	M3924	HH091/023/01	s.d.
1992	M1913	HH090/549/01	s.t.d.	2004	M4183	HH091/078/01	m
1993	M2134	HH090/574/01	s.t.d.	2005	M4356	HH091/116/01	m
1994	M2269	HH090/626/01	s.d.	2006	M4565	RSDRA2007000444	m
1995	M2496	HH090/652/01	s.t.d.	2007	M4643	RSDRA2007007601	m
1996	M2671	HH090/690/01	s.d	2008	HI1265	RSDRA2008026409	m
1997	M2815	HH090/743/01	s.d	2012	HI1398	~	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:

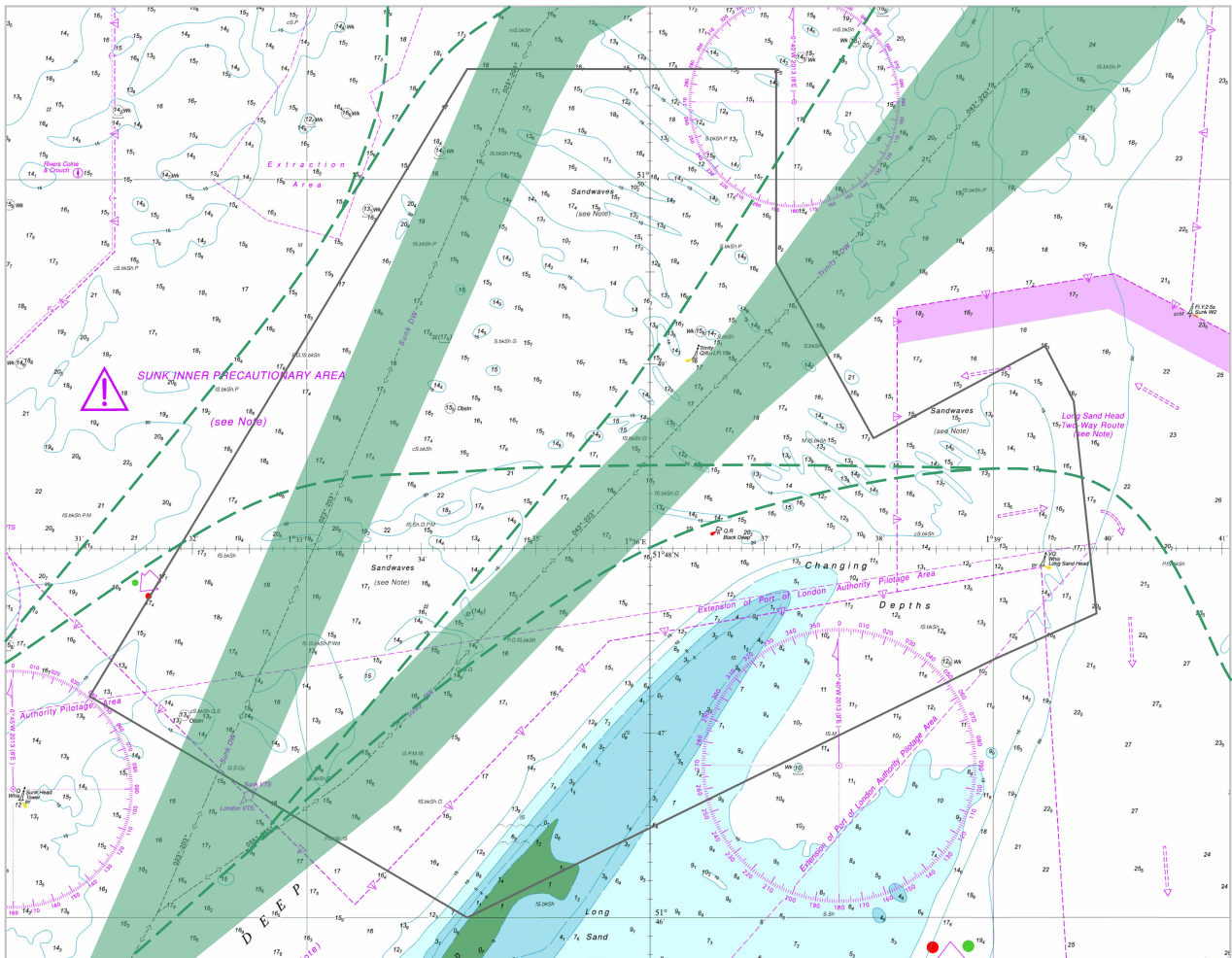
1995	M2496	2005	M4183
1998	M3009	2006	M4565
1999	M3235	2007	M4643
2001	M3376	2008	HI1265
2002	M3558		
2003	M3739		
2004	M3924		

REMARKS:

1985	Area 5A established (H0423/85)
1999	Area extended to cover the Sunk DW track
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
2006	Adjacent area TE5B combined with TE5A
2007	Reduction in extent of the focused areas covering Sunk and Trinity DW tracks

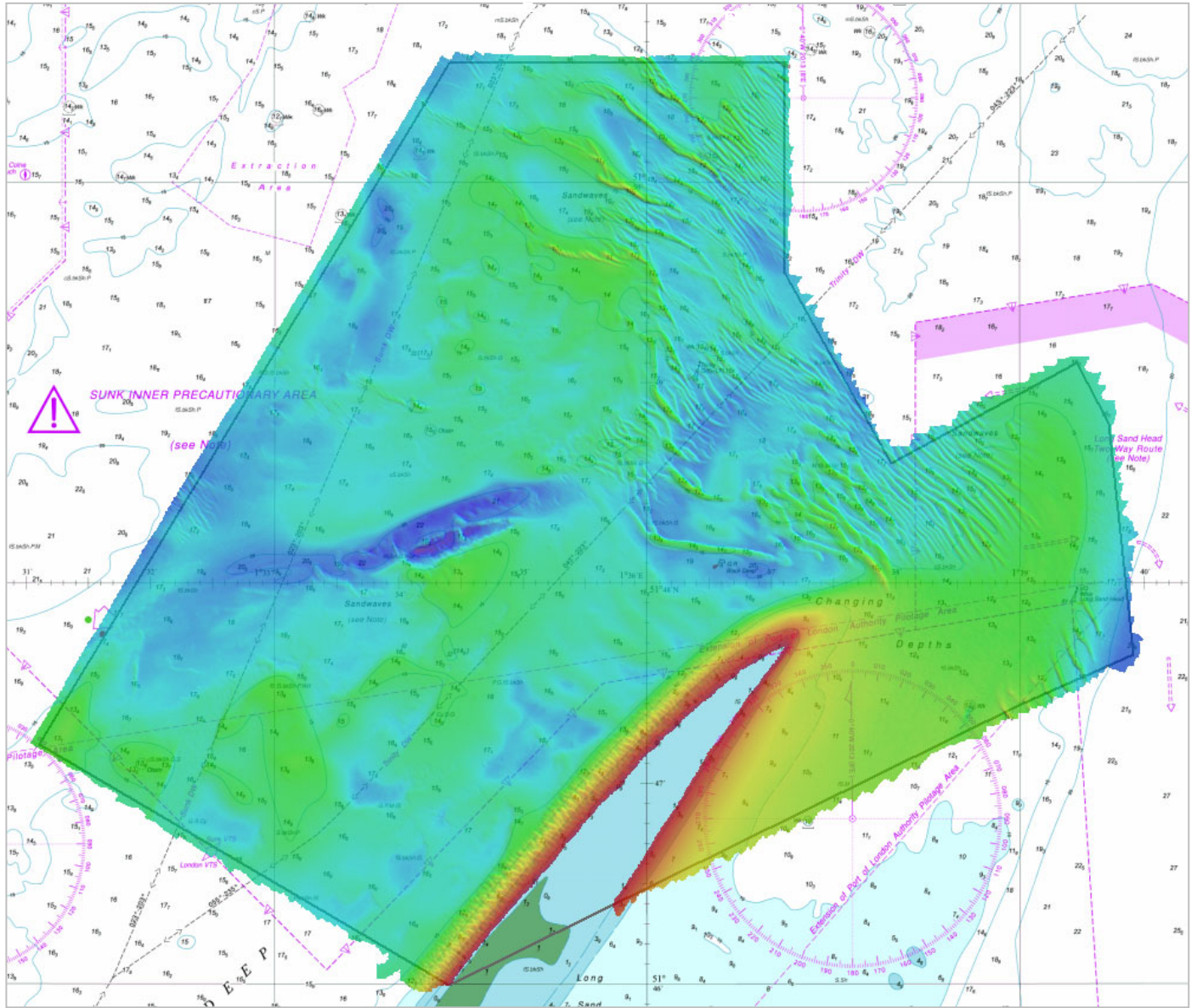
LARGEST SCALE CHART: BA 2692 (1:25,000)

SHIPPING ROUTES

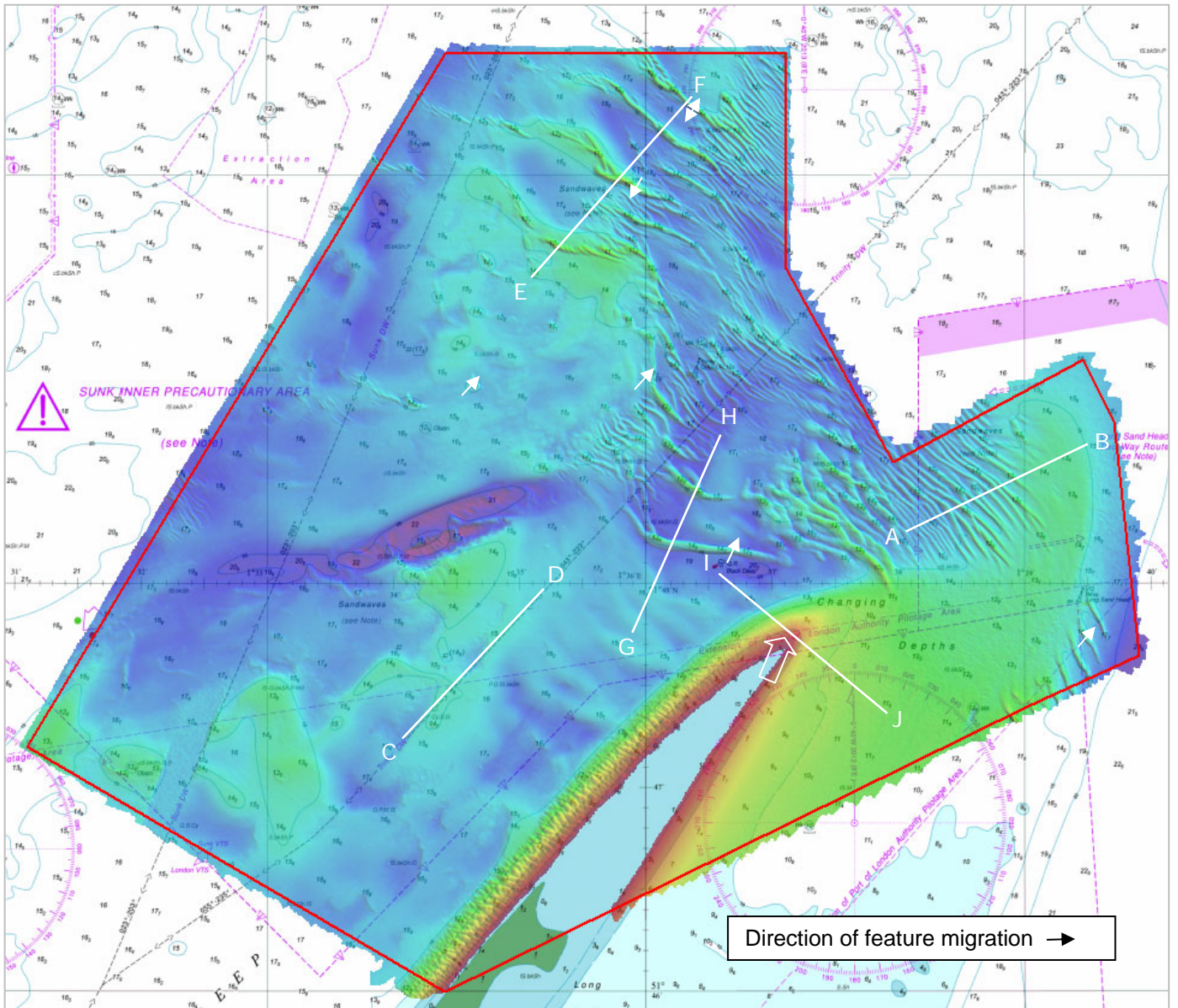


- Main traffic routes
- Other traffic routes

2012 SURVEY OVERLAID ON CHART 2692

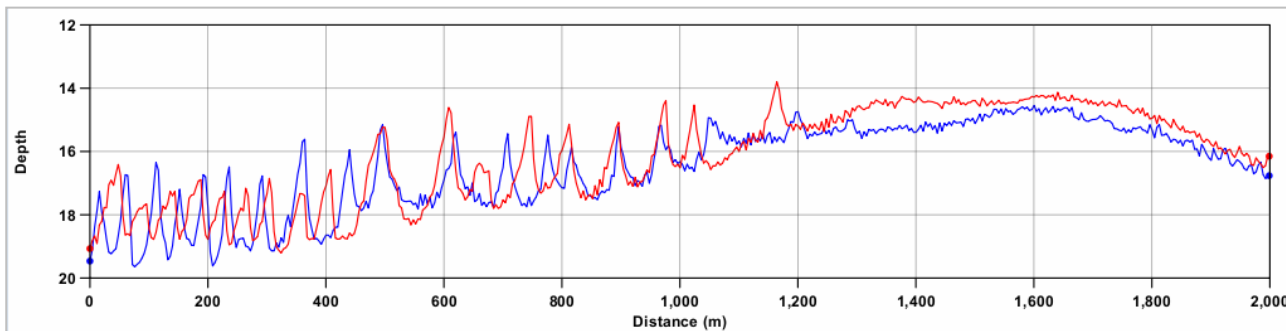


2012 SURVEY SHOWING THE LOCATION OF THE 2008 AND 2012
CROSS SECTION COMPARISONS SHOWN AT ANNEX E

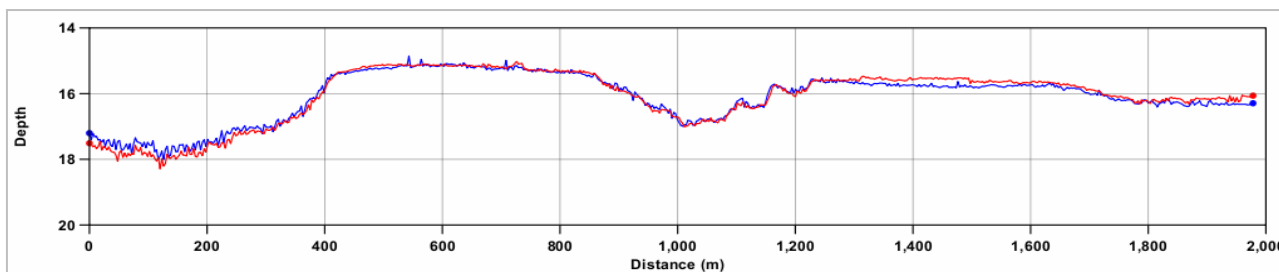


CROSS SECTIONS FROM THE 2008 TO 2012 SURVEYS
 (See Annexe D for locations)

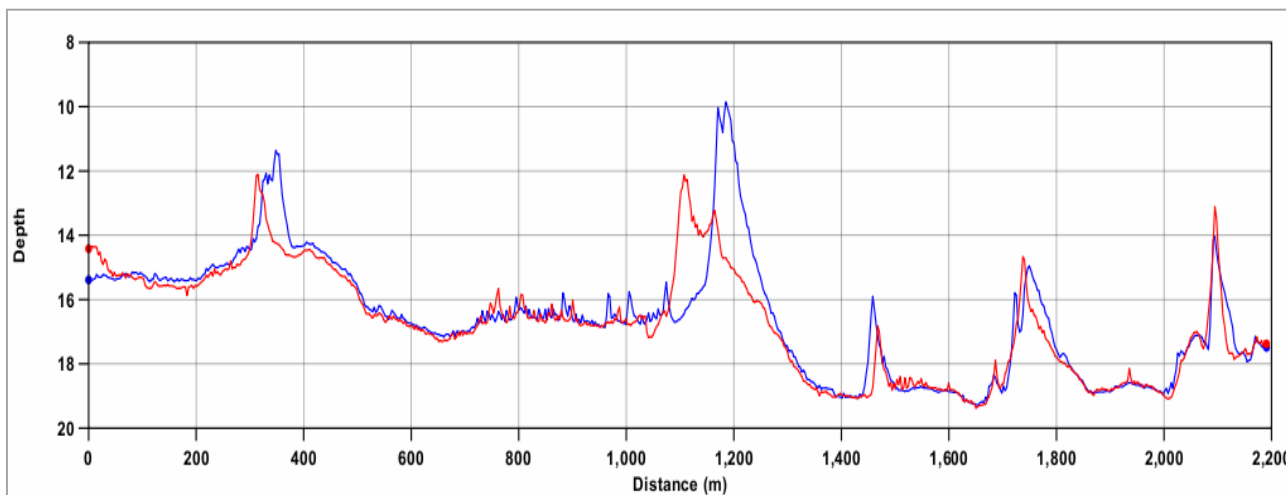
Blue = 2008, Red = 2012



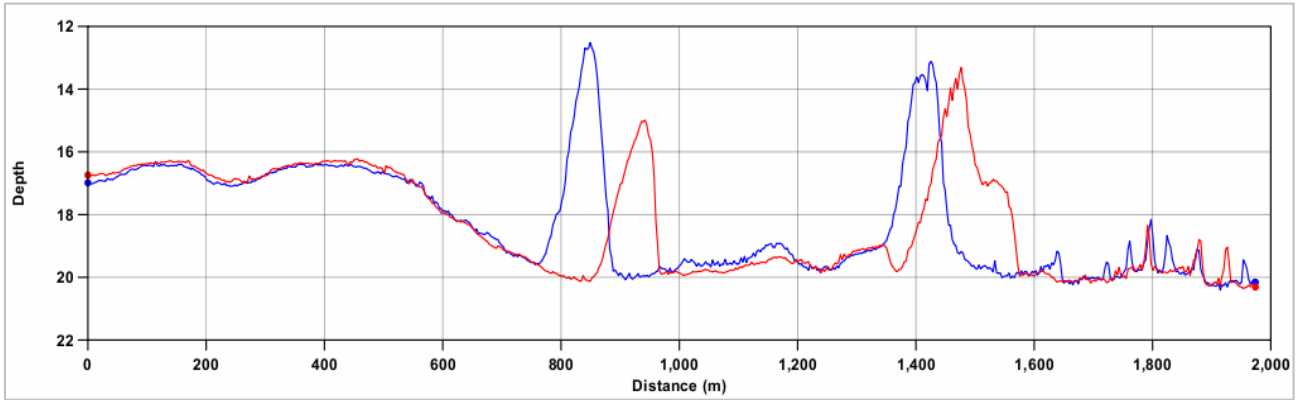
A Profile A-B B



C Profile C-D D



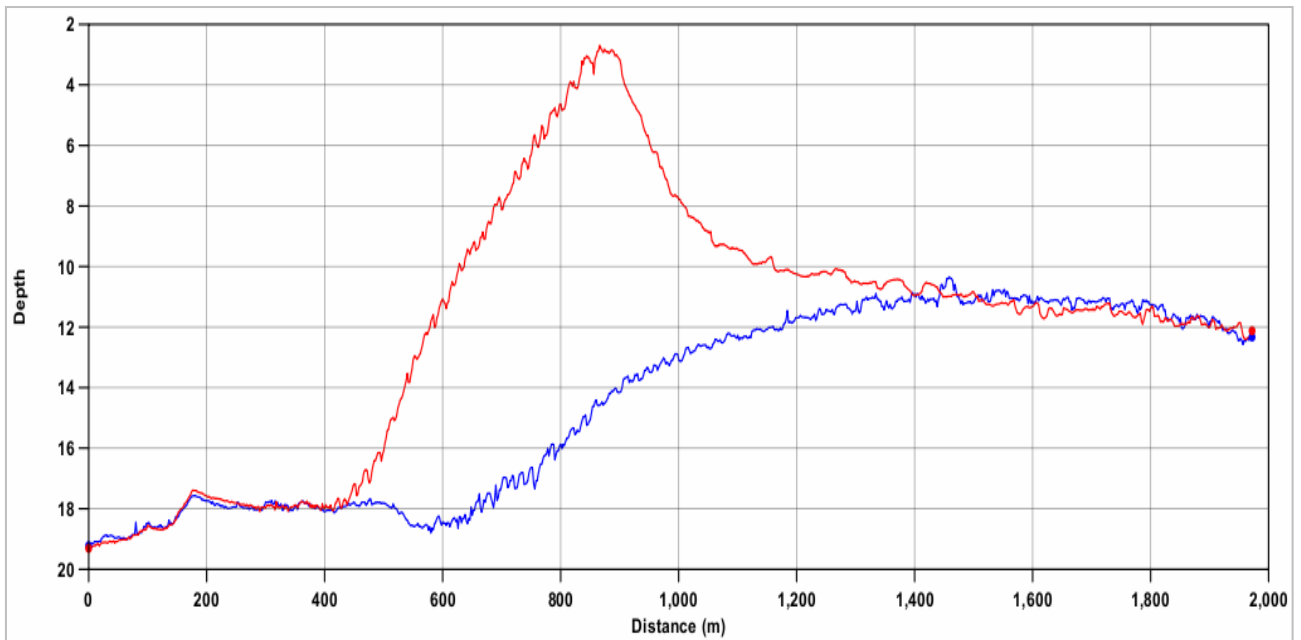
E Profile E-F F



G

Profile G-H

H

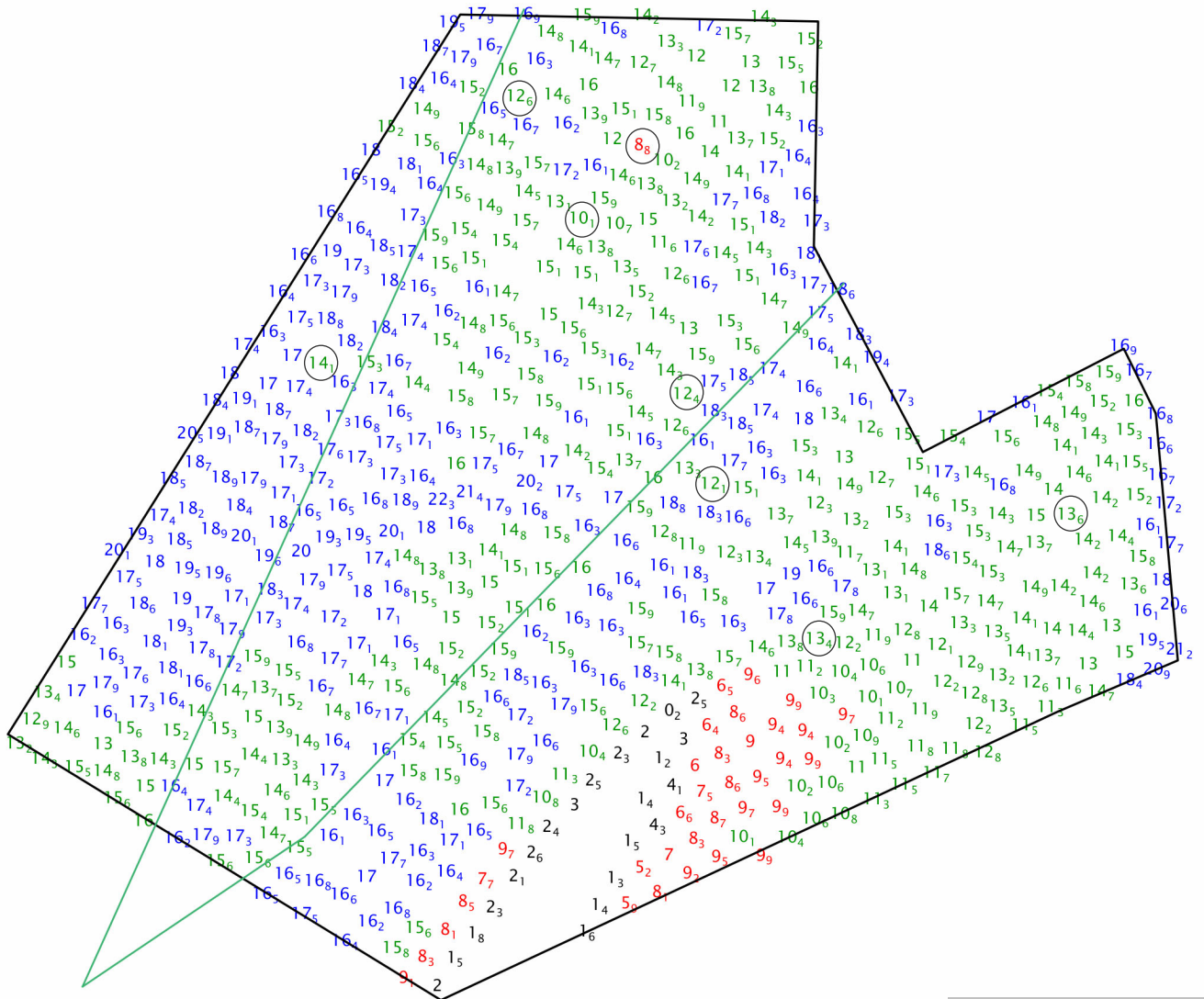


I

Profile I-J

J

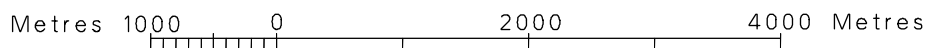
COLOUR BANDED DEPTH PLOT
 FROM THE 2008 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:60,000



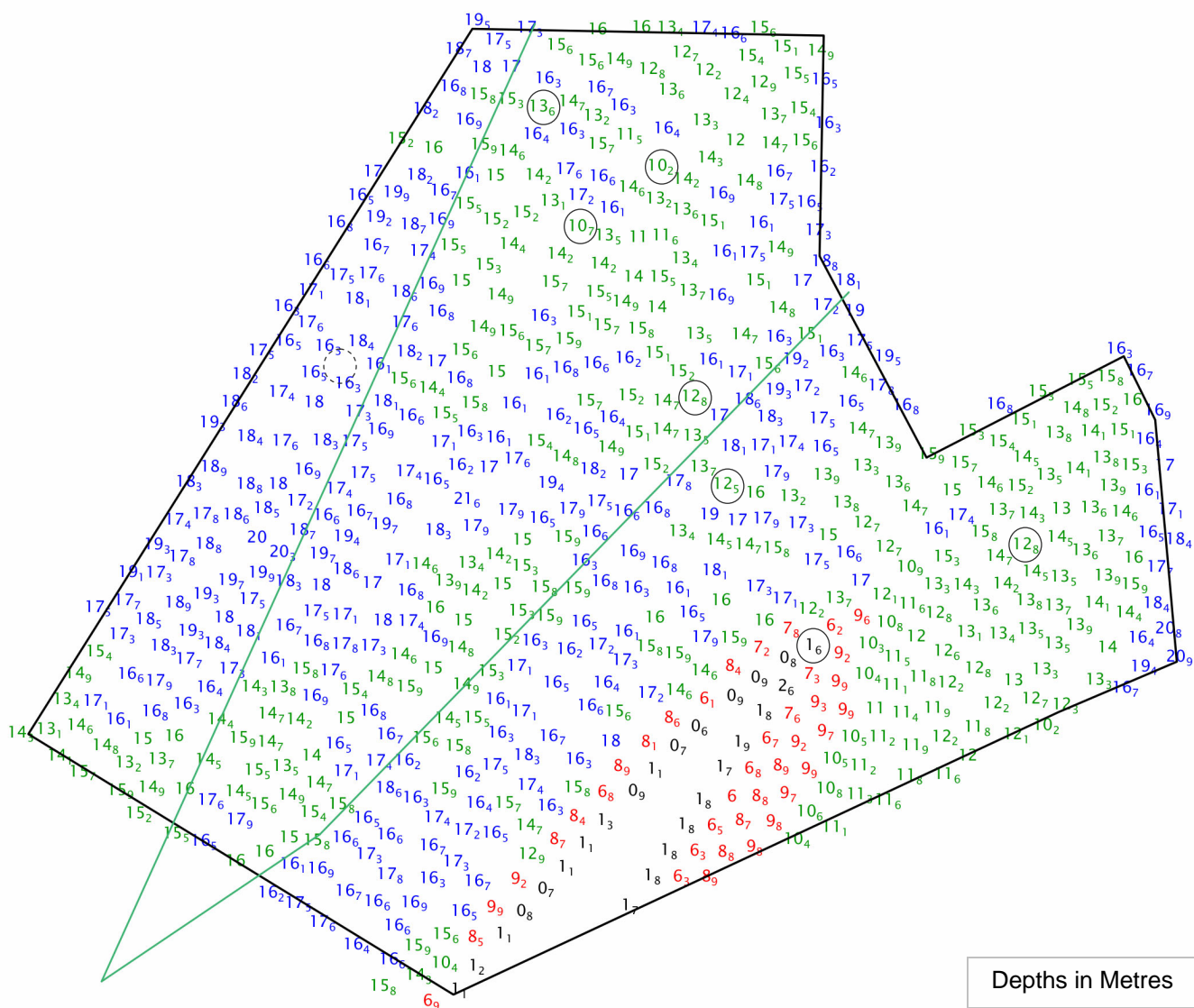
Depths in Metres	
	< 5.0
	5.1 to 10.0
	10.1 to 16.0
	>16.0

○ Selected shoal depths

— Deep Water Tracks



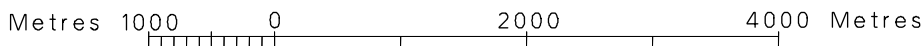
COLOUR BANDED DEPTH PLOT
 FROM THE 2012 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:60,000



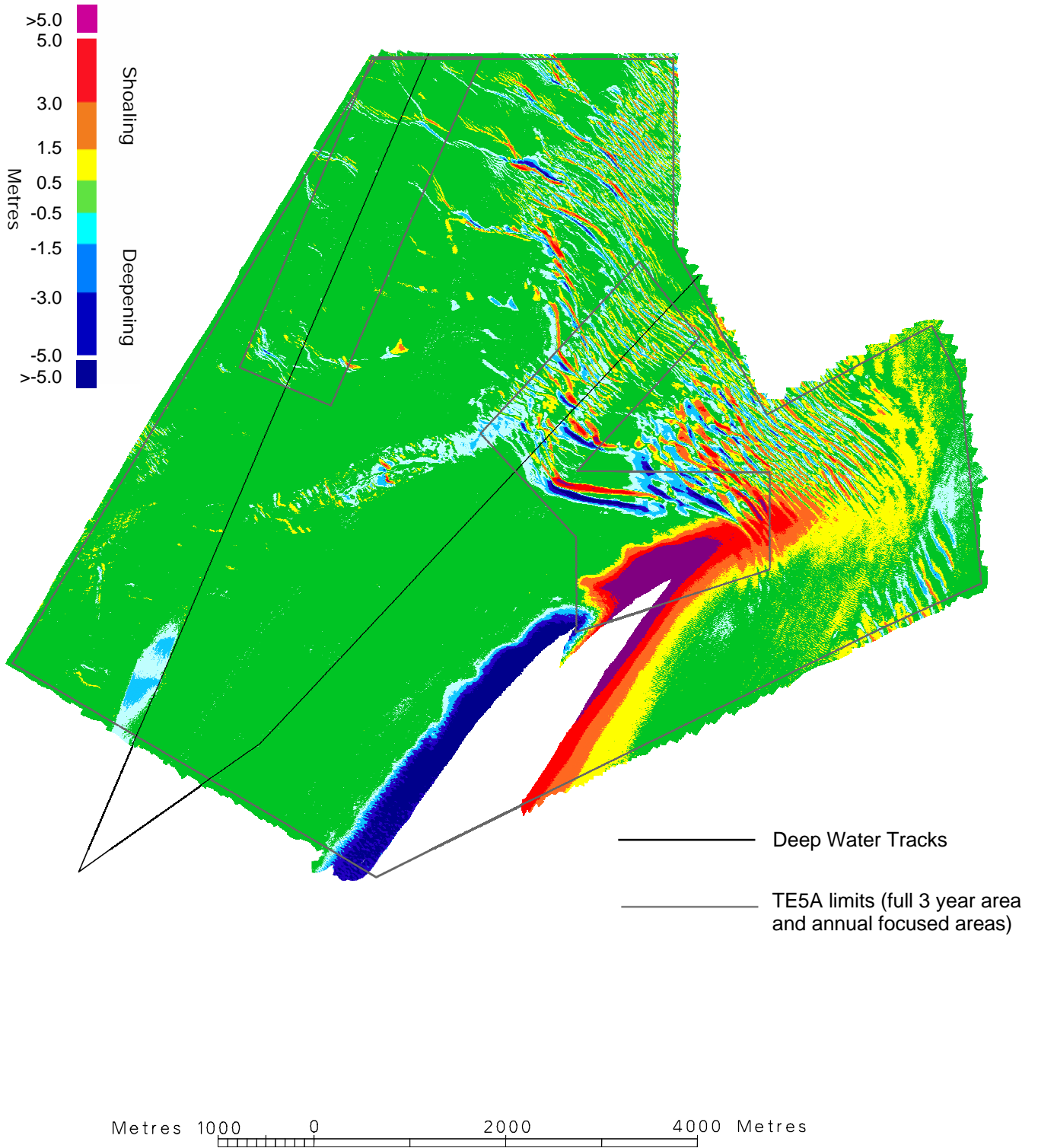
Depths in Metres	
	< 5.0
	5.1 to 10.0
	10.1 to 16.0
	>16.0

○ Selected shoal depths

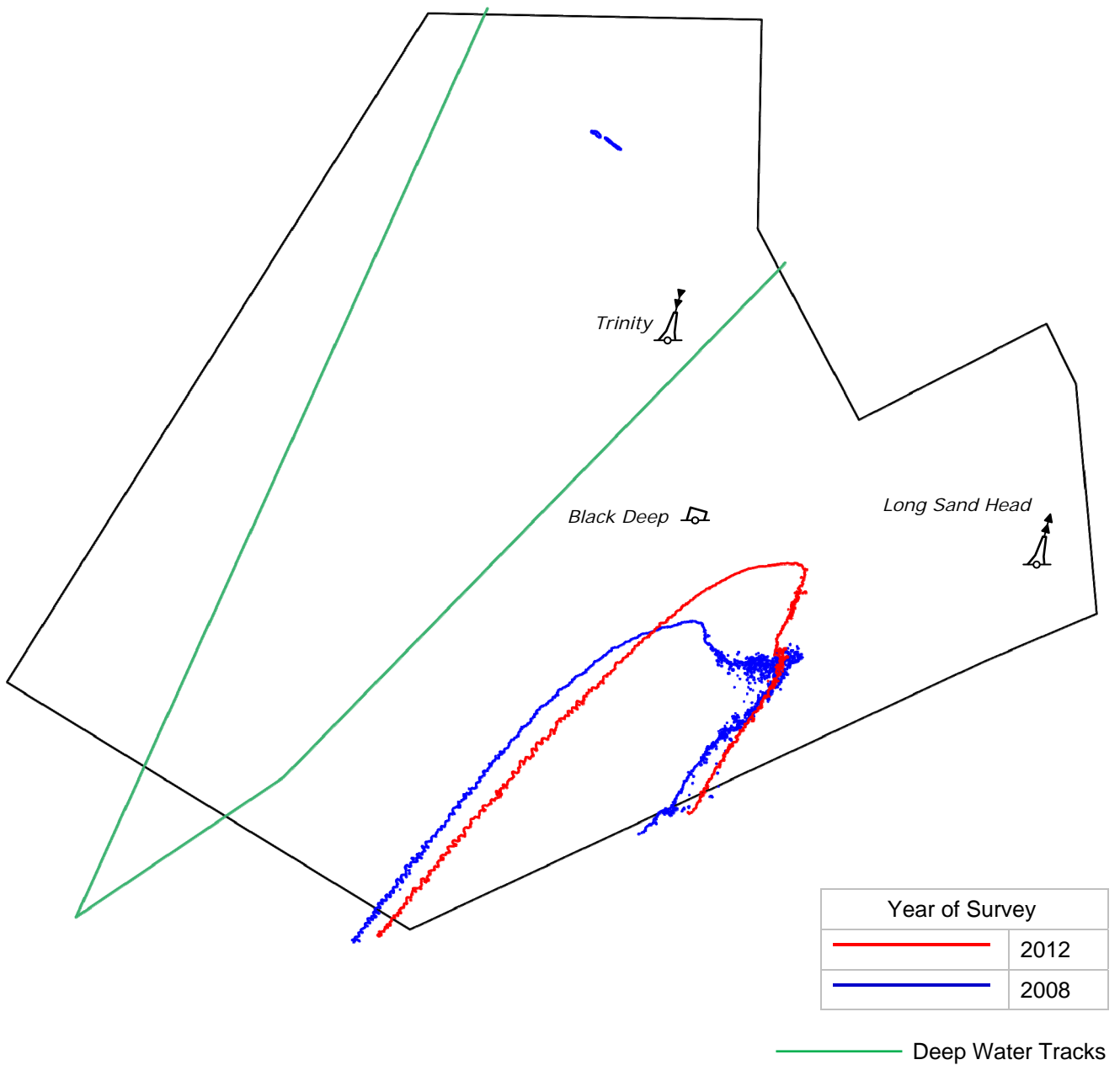
— Deep Water Tracks



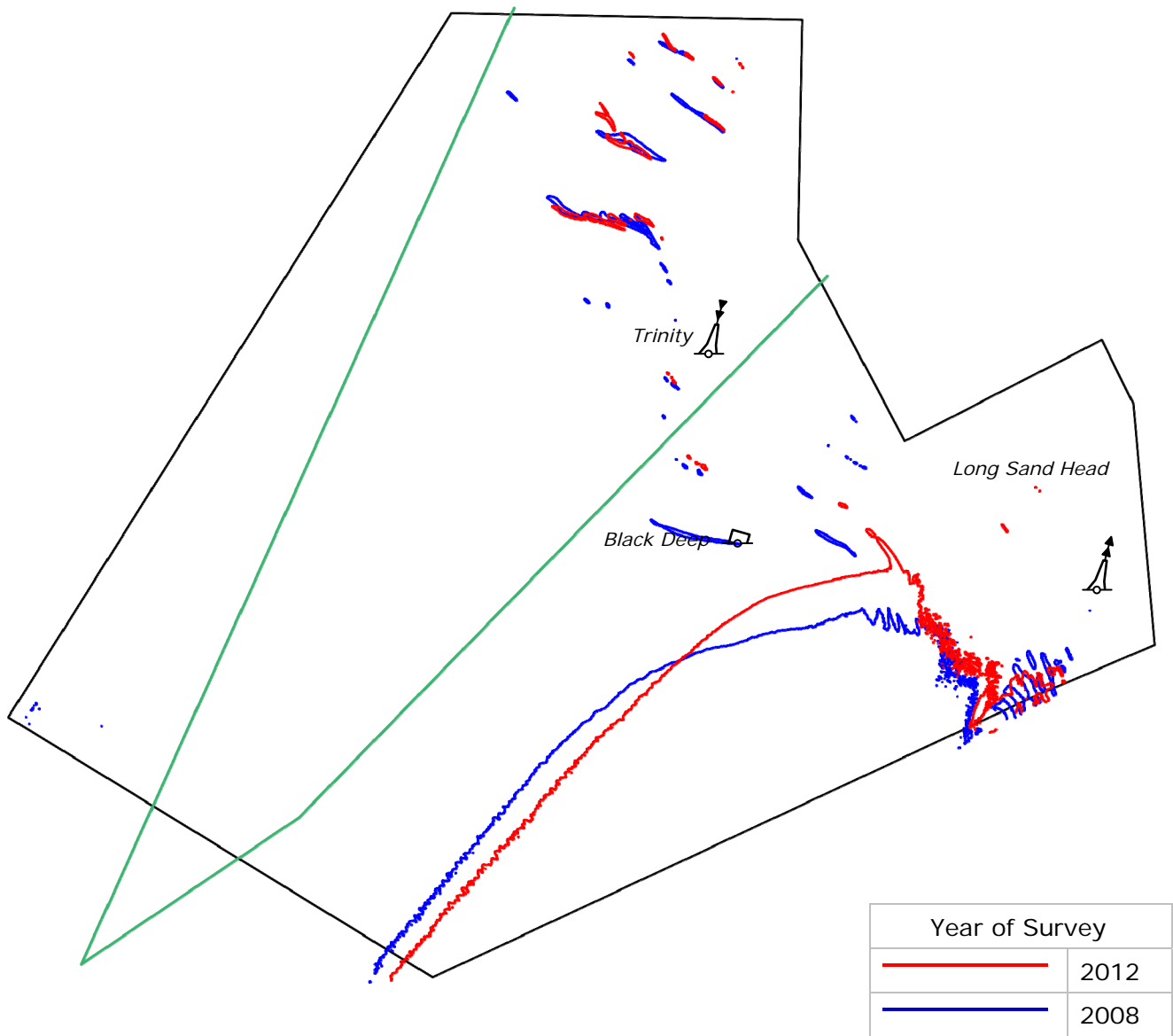
VARIABILITY PLOT SHOWING
BATHYMETRIC CHANGES BETWEEN THE 2008 AND 2012 SURVEYS
SCALE 1:60,000



COMPOSITE DIAGRAM OF THE
10 METRE CONTOUR FROM THE 2008 AND 2012 SURVEYS
SCALE 1:60,000



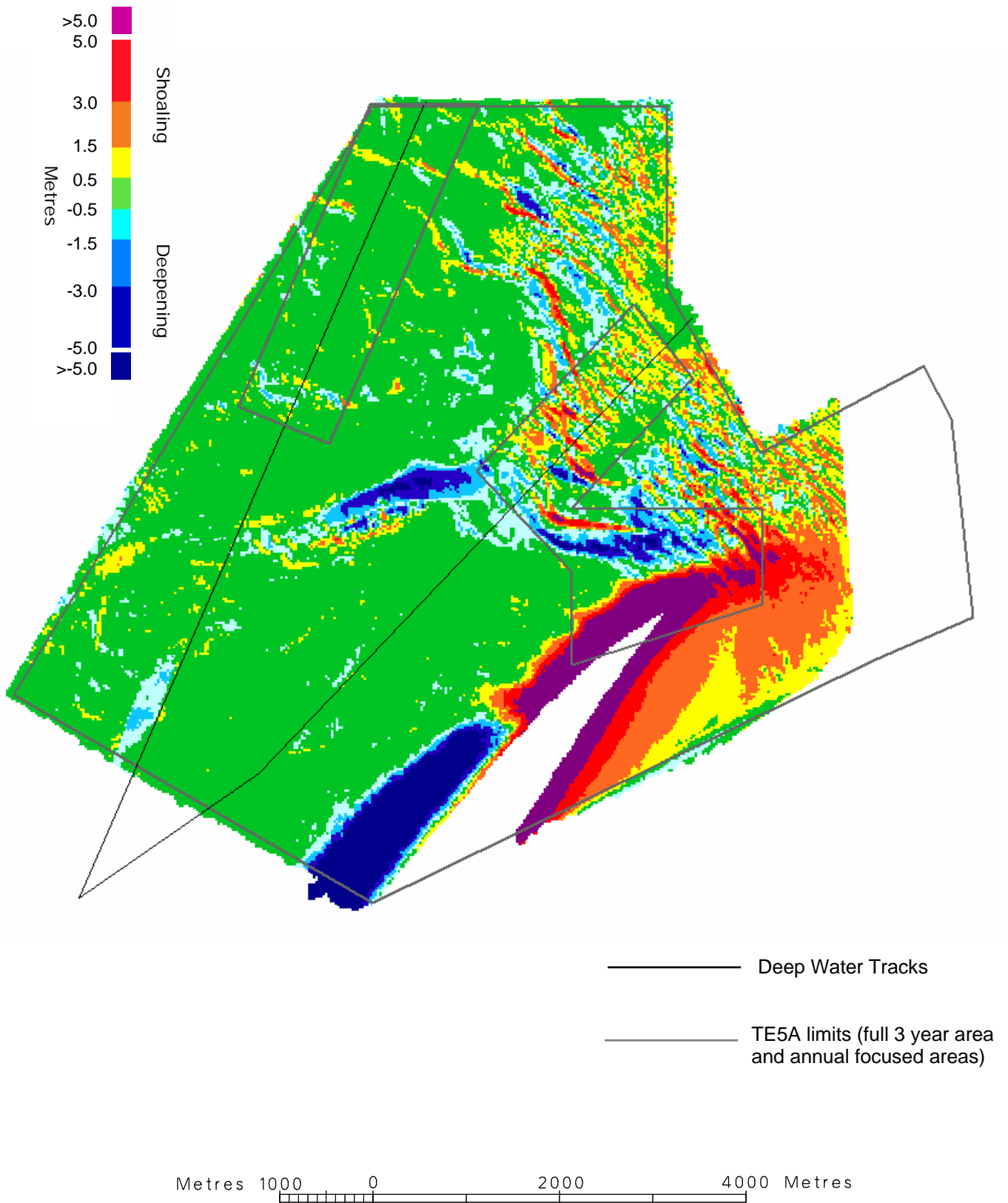
COMPOSITE DIAGRAM OF THE
13 METRE CONTOUR FROM THE 2008 AND 2012 SURVEYS
SCALE 1:60,000



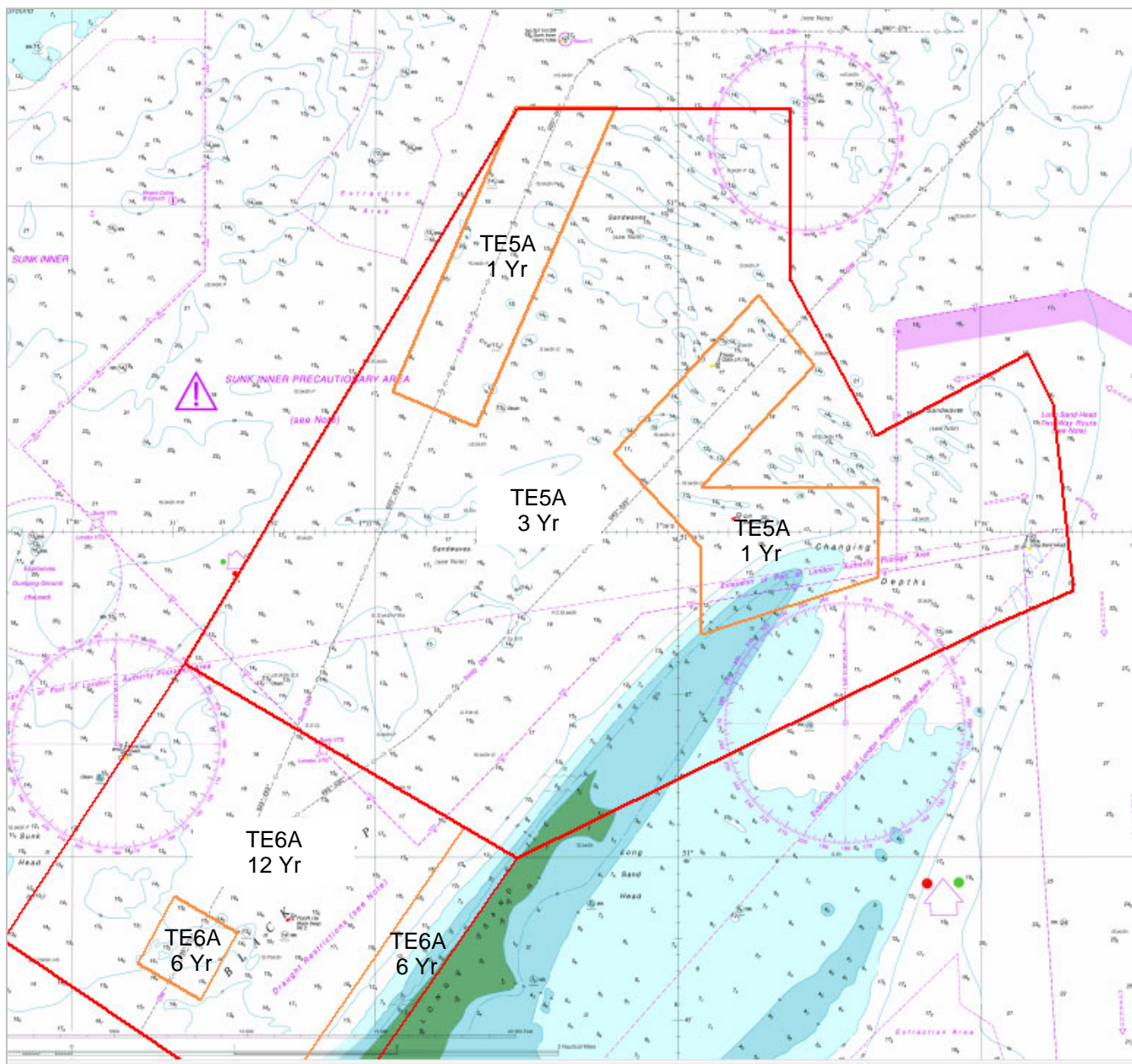
— Deep Water Tracks



VARIABILITY PLOT SHOWING
BATHYMETRIC CHANGES BETWEEN THE 2000 AND 2012 SURVEYS
SCALE 1:60,000



EXISTING LIMITS



PROPOSED REVISED LIMITS

