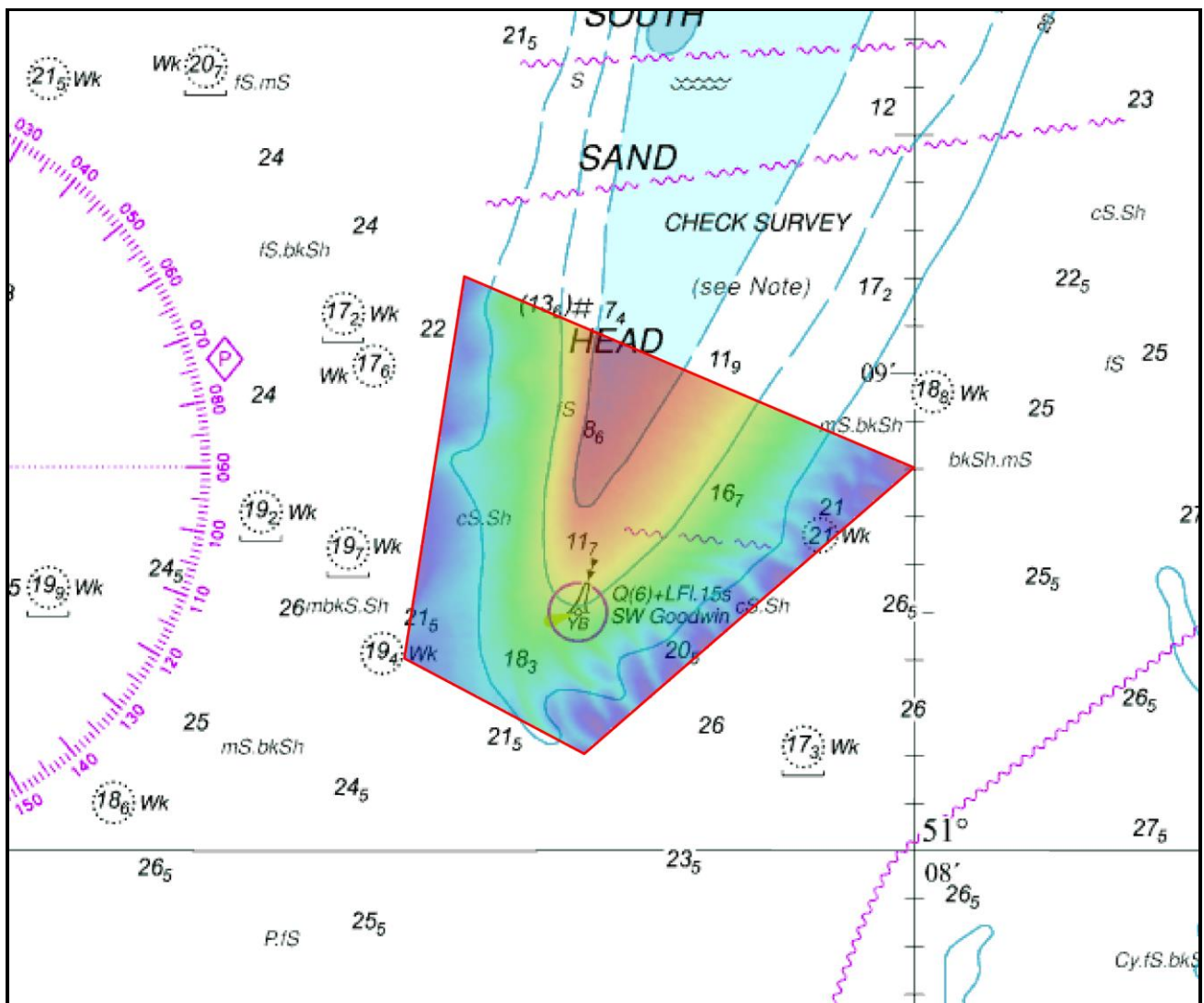




GOODWIN SANDS SOUTH SAND HEAD

ASSESSMENT ON THE ANALYSIS OF ROUTINE RESURVEY AREA GS1
FROM THE 2015 SURVEY



ENGLAND – GOODWIN SANDS

SOUTH SAND HEAD

Assessment GS1/2015

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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SOUTH SAND HEAD, GS1, 2015

4 EXECUTIVE SUMMARY

The Area and Recent Changes

- 1.1 Area GS1 covers the southern limit of Goodwin Sands and is currently surveyed every 3 years.
- 1.2 South Sand Head has undergone moderate change since last surveyed, with the 10 metre contour extending south-westwards by 230 metres and a general deepening of depths on the top of the bank by 1 to 2 metres.
- 1.3 The southern limit of the bank is marked by SW Goodwin south cardinal buoy, which lies just south of the 15 metre contour.

Reasons for Continuing to Resurvey the Area

- 1.4 South Sand Head forms the southern limit of the Goodwin Sands. Although avoided by shipping and marked by SW Goodwin south cardinal buoy, the southern limit of the bank requires monitoring due to the continued migration of the bank.

Recommendations

- 1.5 Considering the changes occurring in the area of South Sand Head and in view of the South Westerly migration of sediment, it is recommended to revise the GS1 re-survey area by moving it south and increase the size by 0.11 sq NM (0.30 sq km) to enable full coverage of future seabed changes. The remaining area after moving GS1 should be transferred to GS4 survey area. GS4 is surveyed on a 3 yearly check line basis with full surveys conducted every 12 years. The proposed new limits are shown at Annex K. Due to the slowing of the migration of the 10m contour and general deepening of the area it is further recommended that the frequency of survey is reduced to 4 years.

5 INTRODUCTION

- 2.1 This Assessment is produced by the United Kingdom Hydrographic Office (UKHO) for the Maritime and Coastguard Agency (MCA).
- 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).

6 HISTORY

- 3.1 South Sand Head forms the southern limit of Goodwin Sands and extends towards the coastal routes that lie to the south and east of Goodwin Sands.
- 3.2 Between 1947 and 1968 surveys were generally conducted at two yearly intervals. Between 1969 and 1975 surveys were conducted annually. In 1976 the area was reviewed for these periods. Based largely on contour comparisons, it was considered that the bank had retained a very similar shape from 1958 to 1975 and proposed that future surveying should be conducted on open line spacing. Due to dredging operations close to the north of the area, it was thought that surveys should continue annually for the following two years.

- 3.3 A further examination in 1980, looking at 4 surveys conducted between 1976 and 1979, concluded that the area was more complex than originally thought. It recommended that normal line spacing should be used in future surveying, although extending the survey period to 3 years. Since then the limits have been revised to take into account changes in the bank limits.
- 3.4 The resurvey area GS1 coverage was revised in 2012, transferring the northernmost part to the adjacent GS4 resurvey area and reducing the Western width of the area to focus on South Sand Head.
- 3.5 Area Specification and survey history shown at Annex A.

7 DESCRIPTION OF THE AREA

- 7.1 Area GS1 covers South Sand Head, which forms the southern tip of South Calliper, which in turn forms the southern part of the Goodwin Sands. It covers an area 0.59 SQ NM (2.01 SQ KM), the geographical limits of area GS1 are given at Annex A.
- 7.2 Asymmetrical sandwaves lie at the Southeast base of the bank with average wavelength of 130 metres and average heights between 2 metres to 3 metres showing a general migration towards the southwest (230 degrees), with ripples and mega-ripples overlying much of the bank ranging from 0.1 metres to 0.3 metres wavelength and 0.3 metres to 1 metre wave heights, showing a similar direction of migration (222/42 degrees).
- 7.3 An image of the 2015 survey overlaid on chart BA 1828, Dover to North Foreland (1:37,500) is shown at Annex C.

8 SHIPPING IN THE AREA

- 8.1 The available sample shipping data shows that the area of South Sand Head is avoided by shipping traffic, with the majority of vessel movements passing well to the South and East, either en-route to or from Dover or through the main Strait of Dover channel. Shipping using Gull Stream, which lies to the northwest, passes to the west of the area, with vessels using the area to the north of GS1 as an anchorage area. Overview of general shipping routes in relation to South Sand Head shown at Annex B.

9 2012 SURVEY DETAILS

- 9.1 The main survey was conducted on 5th and 6th December, with wreck investigations carried out on 18th December. Sea states 3-4 were generally experienced while on site, although between 6th and 18th December fieldwork was not possible in this or other survey areas on several days due to weather conditions.
- 9.2 Survey data was acquired using a Kongsberg Maritime EM3000D MBES. The primary horizontal reference was provided by an Applanix POS MV system together with GPS data from C&C Technologies C-Nav 2050 system and referred to the European Terrestrial Reference Frame 1989 (ETRF89) Datum.
- 9.3 The UKHO supplied Vertical Offshore Reference Frame (VORF) and GPS height were used to reduce depths to Chart Datum (CD).
- 9.4 The final dataset was in the form of a 1 metre gridded Combined Uncertainty & Bathymetry Estimated (CUBE) surface and was validated by the UKHO and found to meet IHO S-44 (5th Edition) Order 1a Standard.

10 2015 SURVEY DETAILS

- 10.1 The GS1 area survey was conducted between the 30th August to the 2nd September. Sea states during surveys were generally 3-4, however at times fieldwork was not possible due to unfavourable conditions between the 31st August to the 1st September.
- 10.2 Data acquisition was conducted on board MV Morven using a Kongsberg EM2040C (Dual Head) MBES. The primary horizontal reference was provided by a V5 Applanix POS MV system together with GPS data from C&C Technologies C-Nav 3050 system and referred to the International Terrestrial Reference Frame 2005 (ITRF05) UTM zone 31N.
- 10.3 Vertical reference positions were obtained using post processed GPS derived heights together with the UKHO supplied Vertical Offshore Reference Frame (VORF) to reduce heights to Chart Datum (CD).
- 10.4 The final dataset was in the form of a 1 metre gridded Combined Uncertainty & Bathymetry Estimated (CUBE) surface and was validated by the UKHO and found to meet IHO S-44 (5th Edition) Order 1a Standard.

11 DESCRIPTION OF RECENT BATHYMETRIC CHANGE

- 11.1 Colour banded depth plots of the 2012 and 2015 surveys are at Annexes E and F. A variability plot showing the depth differences between the 2012 and 2015 surveys is at Annex G. The variability plot shows any changes that have occurred to the bank since last surveyed.
- 11.2 Comparison plots of the 10, 15 and 20 metre contours from the 2012 and 2015 surveys are at Annexes H, I and J respectively.
- 11.3 South Sand Head has undergone only slight change since last surveyed. The 10 metre contour has extended south-westwards by 230 metres, while at the same time shifting marginally to the west. However the depth of the bank has become generally deeper, possibly due to the sediment spreading out more than previous years, with less build up on the top of the bank. This can be seen in the Colour Banded Depth Plot of the 2015 survey Annex F, where the shoalest selected sounding is 8.1 metres, compared to the shoalest depth in 2012 of 7 metres.
- 11.4 The southwest migration of the 10m contour has been occurring since at least 2003, with the rate of migration over 3 years being 430 metres (2003-2006), 540 metres (2006-2009) 600 metres (2009-2012), however, this years survey indicates a significantly reduced rate of migration at 230 metres (2012-2015). In total a migration of 1,800 metres over 12 years of surveys has been observed, but it is indicated that the rate of migration is reducing. The expansion is shown in cross-section A-B (2003-2015) at Annex D.

12 IMPLICATIONS FOR SHIPPING

- 9.1 Although the bank has undergone notable migration, it continues to be adequately marked by SW Goodwin south cardinal buoy and lies away from the indicative shipping routes. As such the changes have no direct impact on shipping.

13 RECOMMENDATIONS FOR FUTURE SURVEYS

- 10.1 Considering the current extents of the area, the 3 year re-survey area GS1 should be moved to the south and increased by 0.11 sq NM (0.30 sq km) to allow for coverage of possible future sediment migration to the Southwest of the current area. Due to the slowing of the

migration of the 10m contour and general deepening of the area it is further recommended that the frequency of survey is reduced to 4 years.

- 10.2 It is recommended to transfer the remaining area to the adjacent GS4 (South Calliper) survey area which is surveyed less regularly with full surveys every 12 years, and check line surveys every 3 years, with the next full survey due in 2017.
- 10.3 For further details of the revised area limits of the adjacent area GS4 please refer to the 2015 summary assessment for South Calliper & Goodwin Knoll (Assessment GS4/2015)
- 10.4 The proposed revised limits are shown, together with positions shown at Annex K.

AREA SPECIFICATIONS
(Including Survey History)

REGION: Goodwin Sands**NAME:** South Sand Head**AREA:** GS1

LIMITS:
 a) 51° 09.20'N 001° 28.50' E
 b) 51° 08.80'N 001° 30.00' E
 c) 51° 08.20'N 001° 28.90' E
 d) 51° 08.40'N 001° 28.30' E

AREA SIZE: 0.59 SQ NM (2.01 SQ KM)**SURVEY INTERVAL:** 3 yrs**PREVIOUS SURVEYS:** (conducted at 1:25,000 scale (not applicable to multibeam surveys))

Year	Survey	File Ref	Data	Year	Survey	File Ref	Data
1975	K7392	H4577/73		1991	M1777	HH090/511/01	s.t.d
1976	K7646	H4845/75		1994	M2308	HH090/630/01	s.d.
1977	K7742	H1934/76		1997	M2902	HH090/737/01	s.t.d.
1978	K8003	H1962/77		2000	M3448	HH090/893/01	s.d
1979	K8222	H1937/78	.	2003	M3930	HH090/1027/01	s.d
1980	K8552	H1938/78		2006	M4566	-	m
1981	K8629	H1951/80	s.t	2009	HI1294	SDRA200929529	m
1985	K9655	H2342/84	s.	2012	HI1399	SDRA2012131314	m
1988	M1266	H6343/87	s.t.d				

KEY: t = seabed texture tracing, d = digital data, m = multibeam digital data

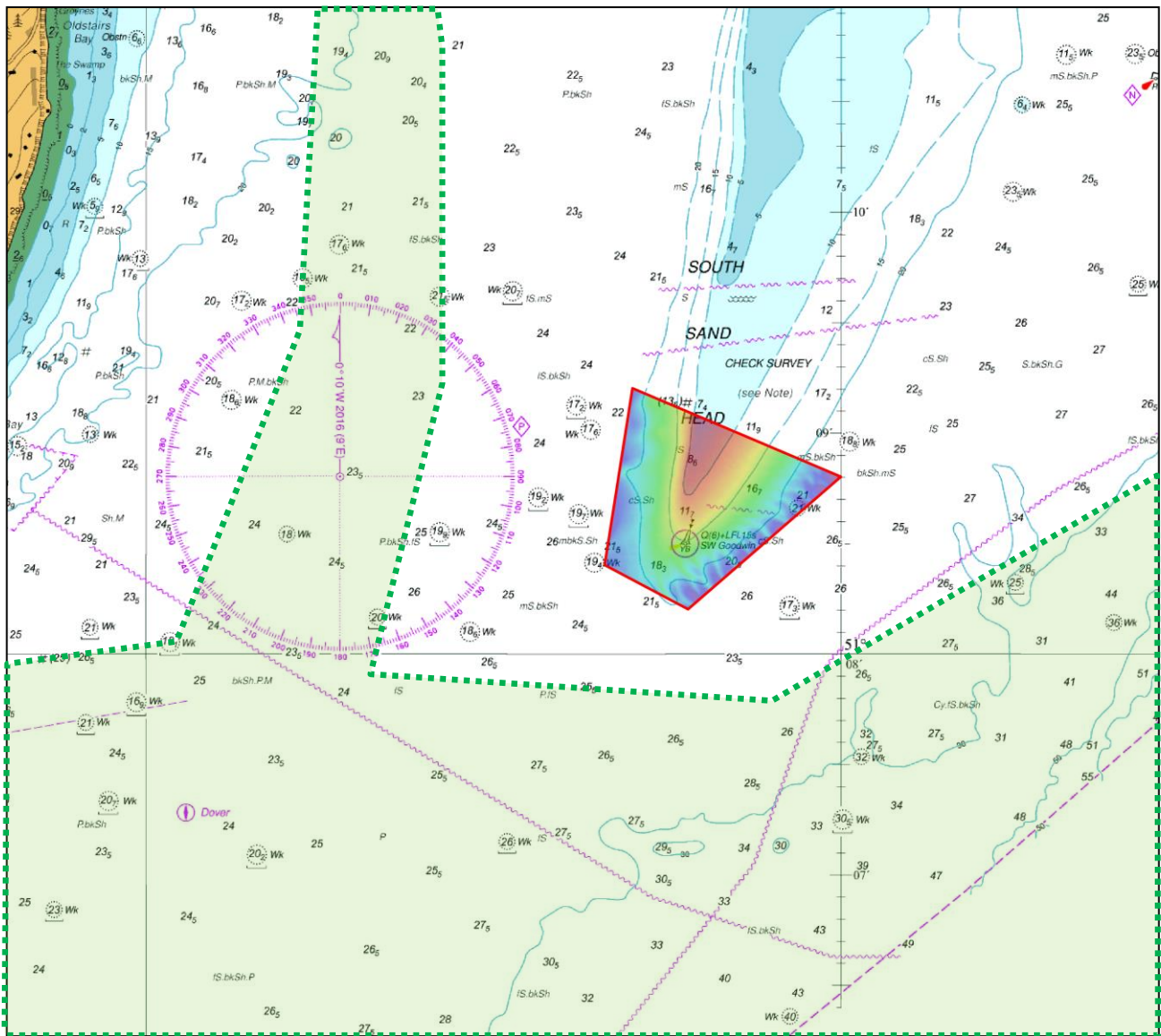
REPORTS: 1980 Latest survey included K8222 (H1934/76)
 1981 Latest survey included K8629 (H1934/81)
 1999 Latest survey included M2902 (HA145/010/019/01)

ASSESSMENTS: 2004 Assessment of the 2003 Survey
 2007 Assessment of the 2006 Survey
 2010 Assessment of the 2009 Survey
 2013 Assessment of the 2012 Survey

REMARKS: 1976 Report covering old area B (H1934/76)
 1980 New Area B established (HA3913/80)
 1999 Report changes area limits and identifier to GS1.
 2012 Report changes area limits for GS1 (See assessment GS1/2012)

LARGEST SCALE CHART: BA 1828 (1:37,500)

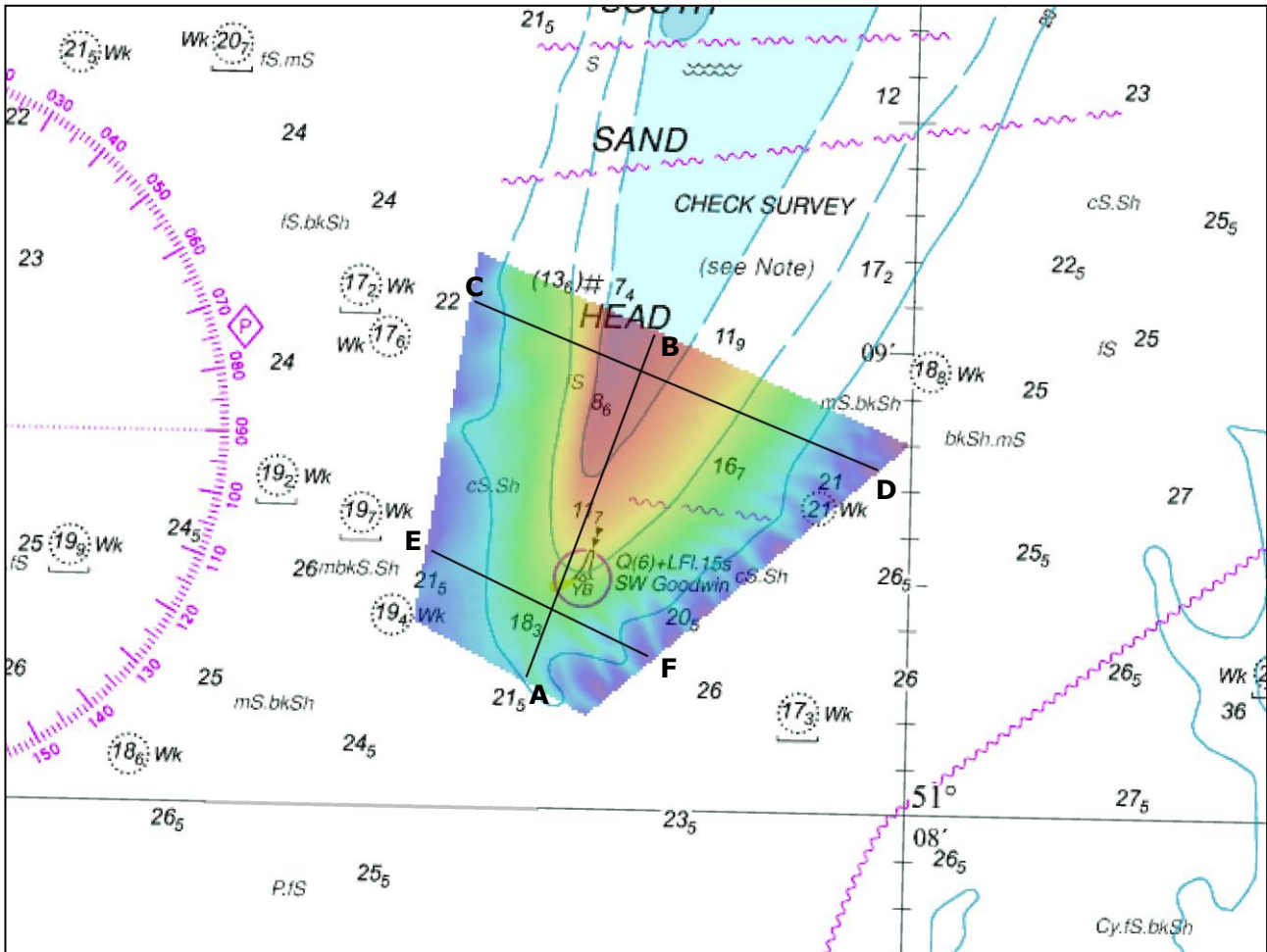
SHIPPING ROUTES



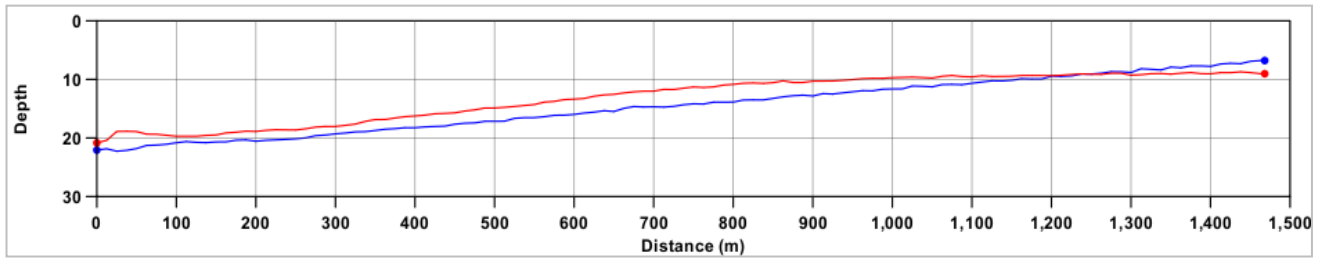
Indicative shipping routes near area GS1

Note: Data from satellite AIS data for FY2015/2016 of vessels larger than 2000GT

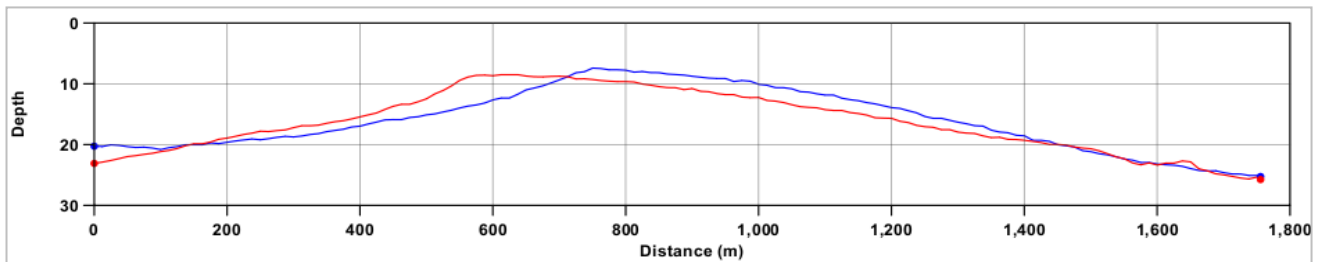
2015 SURVEY OVERLAID ON CHART BA 1828,
DOVER TO NORTH FORELAND
WITH LOCATIONS OF CROSS SECTION COMPARISONS
(Shown at Annex D)



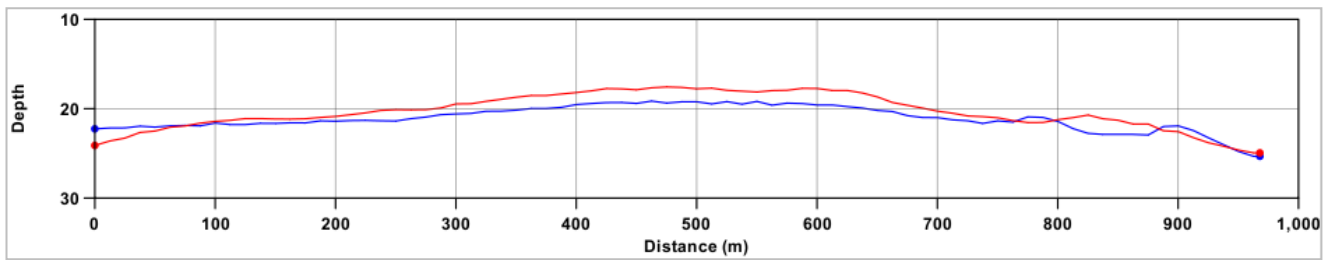
CROSS SECTION COMPARISONS
(See Annex C for locations)



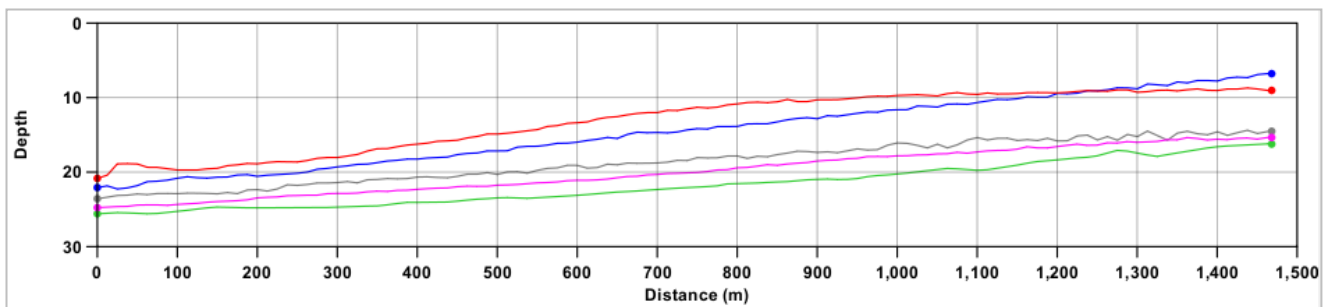
A Profile A-B B



C Profile C-D D



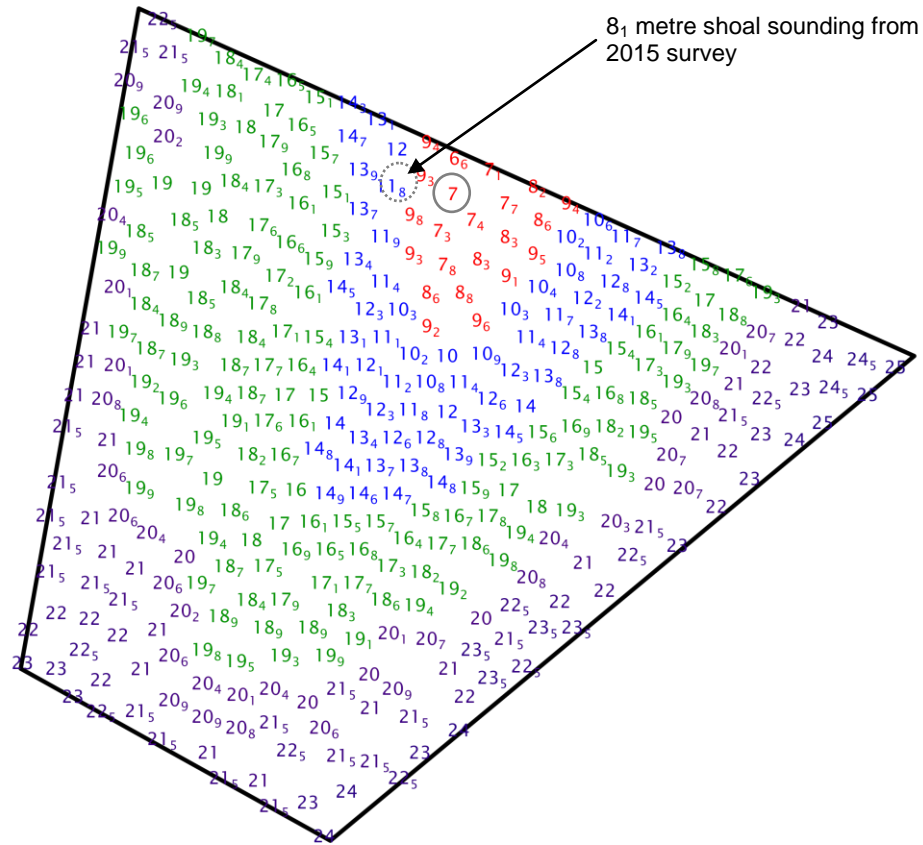
E Profile E-F F



A Profile A-B B

Year of Survey	
—	2015
—	2012
—	2009
—	2006
—	2003

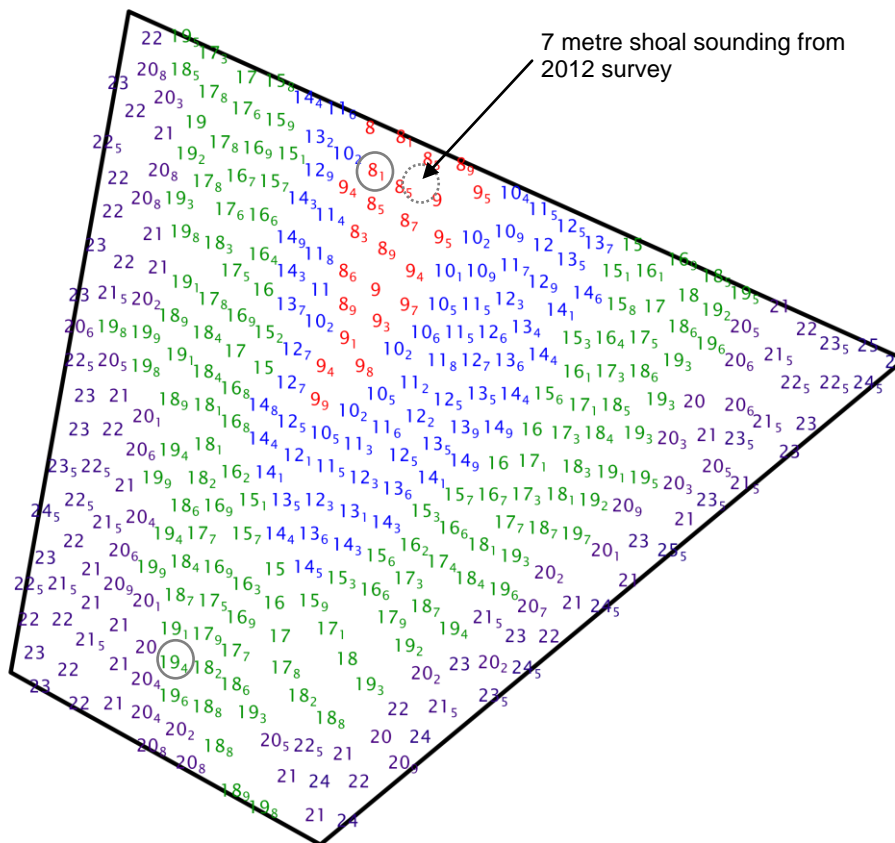
COLOUR BANDED DEPTH PLOT
 FROM THE 2012 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:10,000



Depths in Metres	
	3.0 to 4.9
	5.0 to 9.9
	10.0 to 14.9
	15.0 to 19.9
	20.0 to 30.0

○ Selected depth comparisons

COLOUR BANDED DEPTH PLOT
 FROM THE 2015 SURVEY
 SHOWING SELECTED DEPTHS
 SCALE 1:10,000

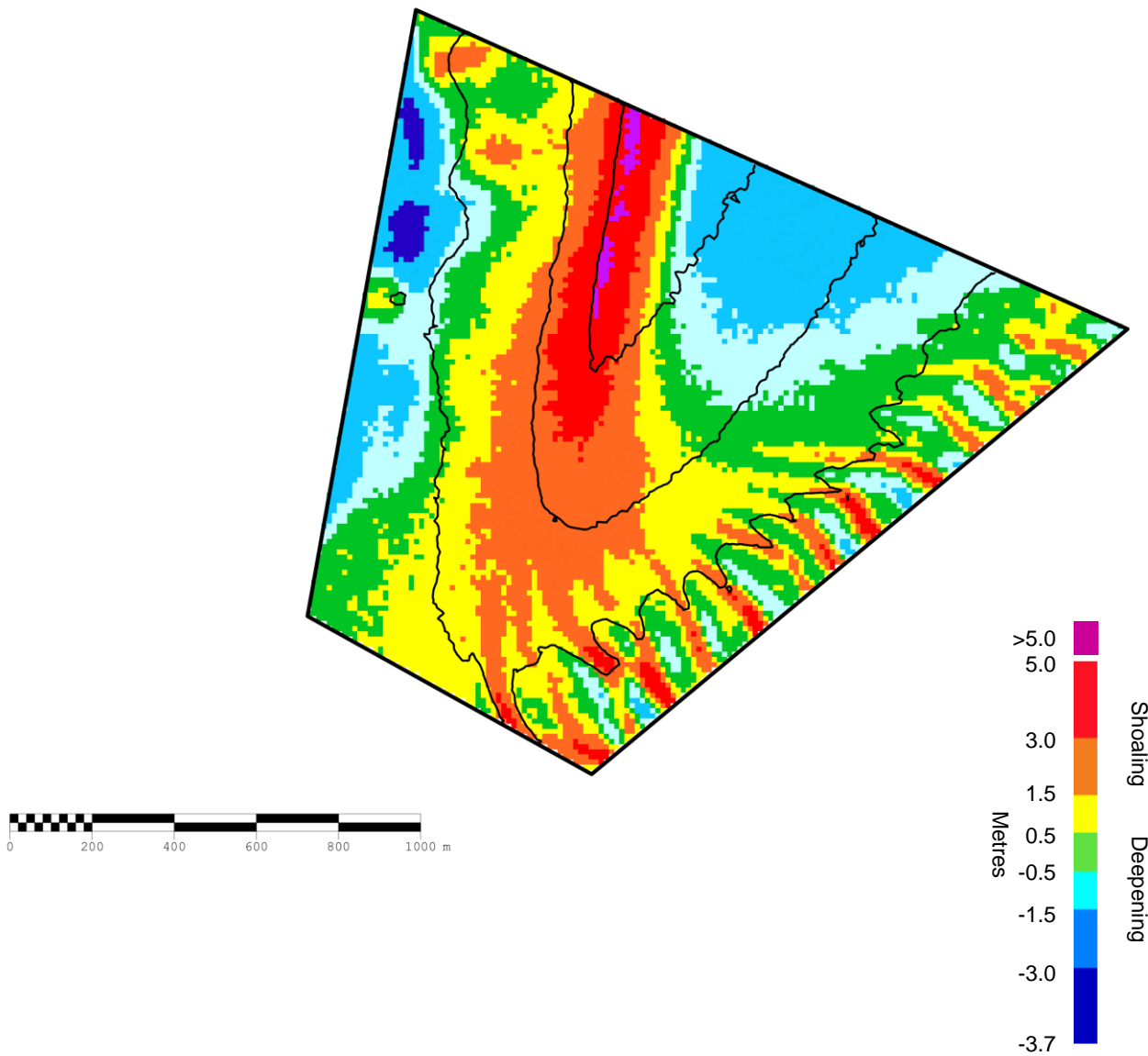


Depths in Metres	
	3.0 to 4.9
	5.0 to 9.9
	10.0 to 14.9
	15.0 to 19.9
	20.0 to 30.0

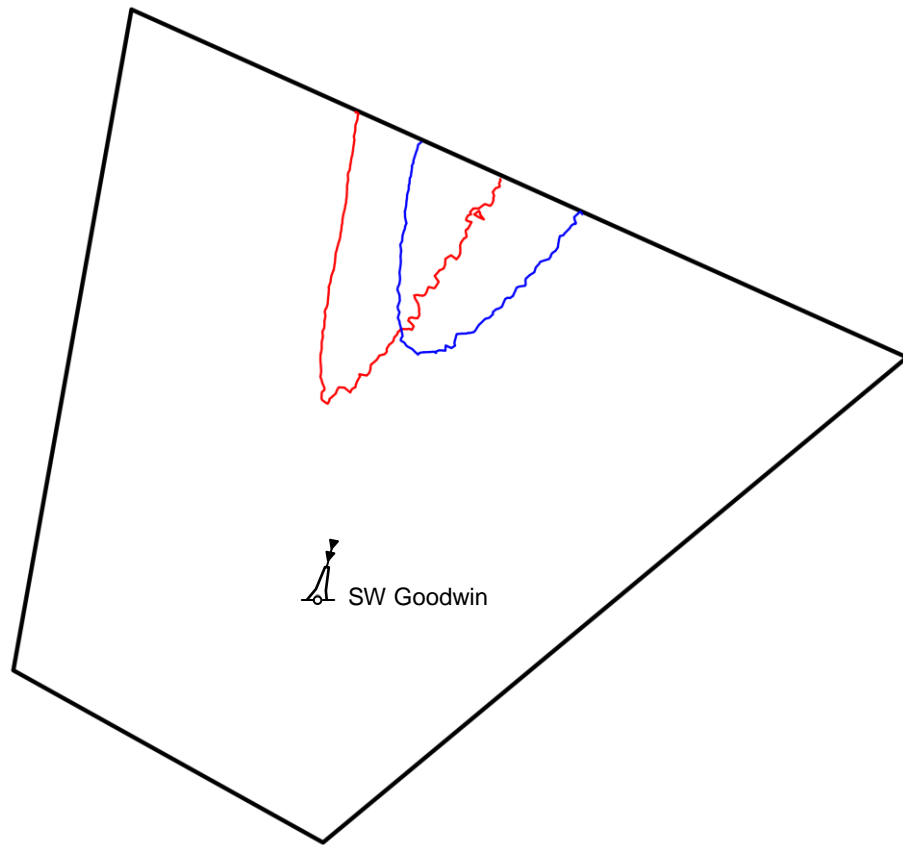
○ Selected depth comparisons



Note: depth changes indicated are for the same location as the sounding derived from the 2015 survey data. Hence values may not match the difference between the soundings shown in historical survey data and 2015 depth plots as shoal bias sounding selection will select different positions that best represent the shoal values in a data set

VARIABILITY PLOT SHOWING
BATHYMETRIC CHANGES BETWEEN THE 2012 AND 2015 SURVEYS
AND CHARTED CONTOURS FROM THE 2012 SURVEY
SCALE 1:10,000

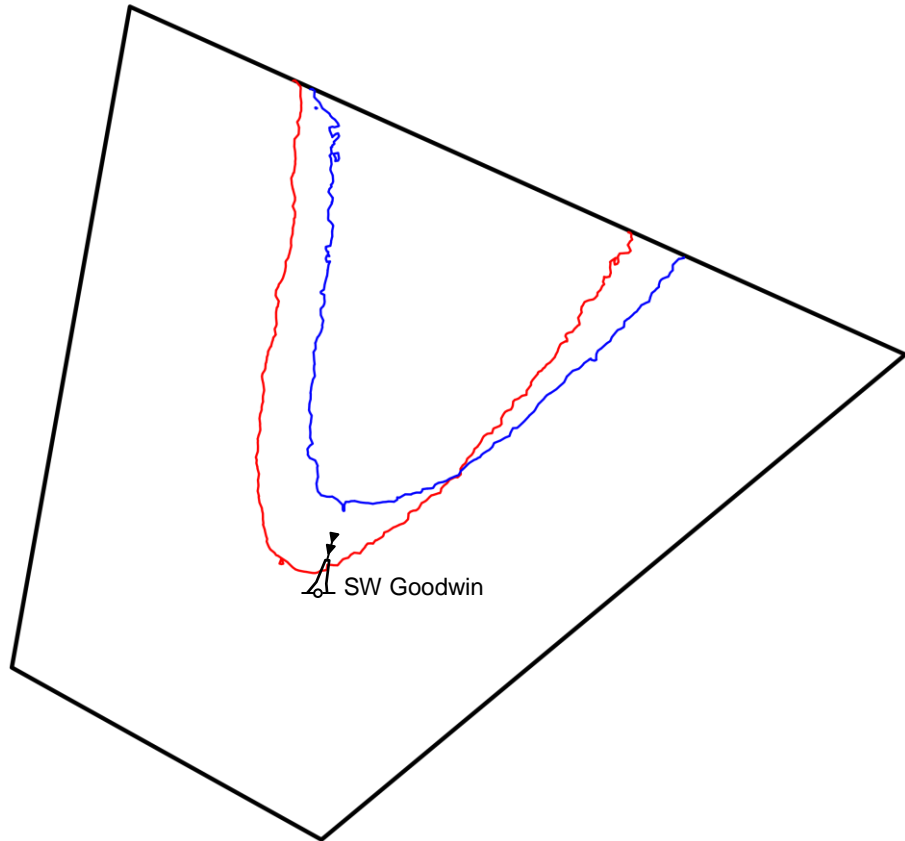




COMPOSITE DIAGRAM OF THE
10 METRE CONTOUR FROM THE 2012 AND 2015 SURVEYS
SCALE 1:10,000



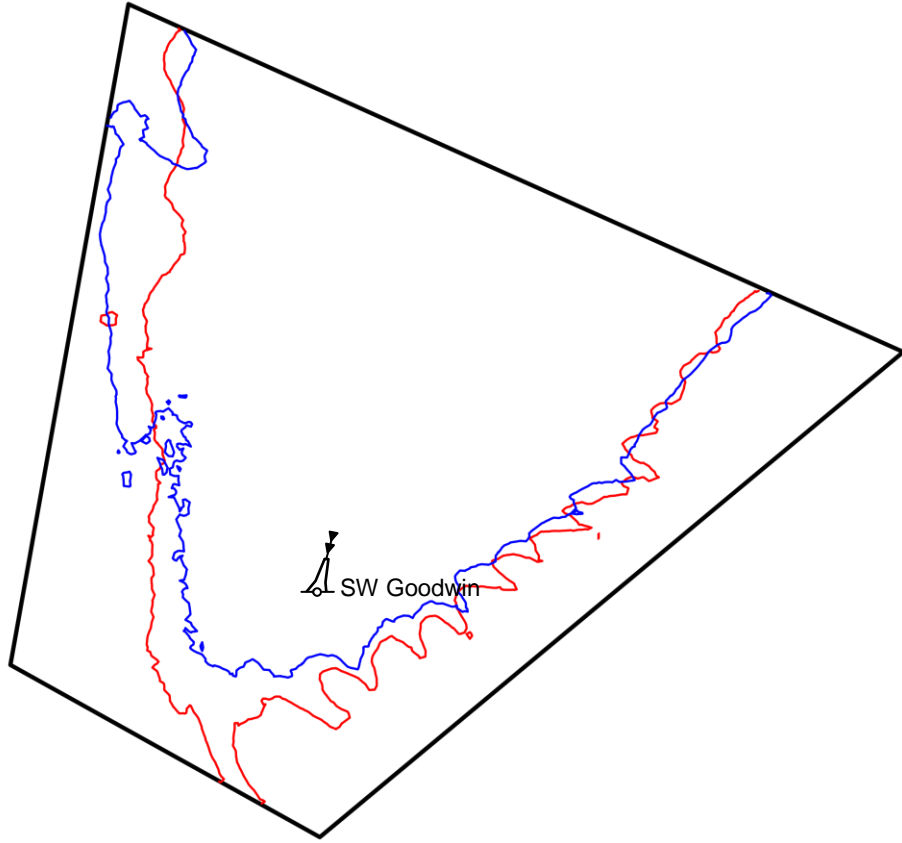
Year of Survey	
	2012
	2015



COMPOSITE DIAGRAM OF THE
15 METRE CONTOUR FROM THE 2012 AND 2015 SURVEYS
SCALE 1:10,000



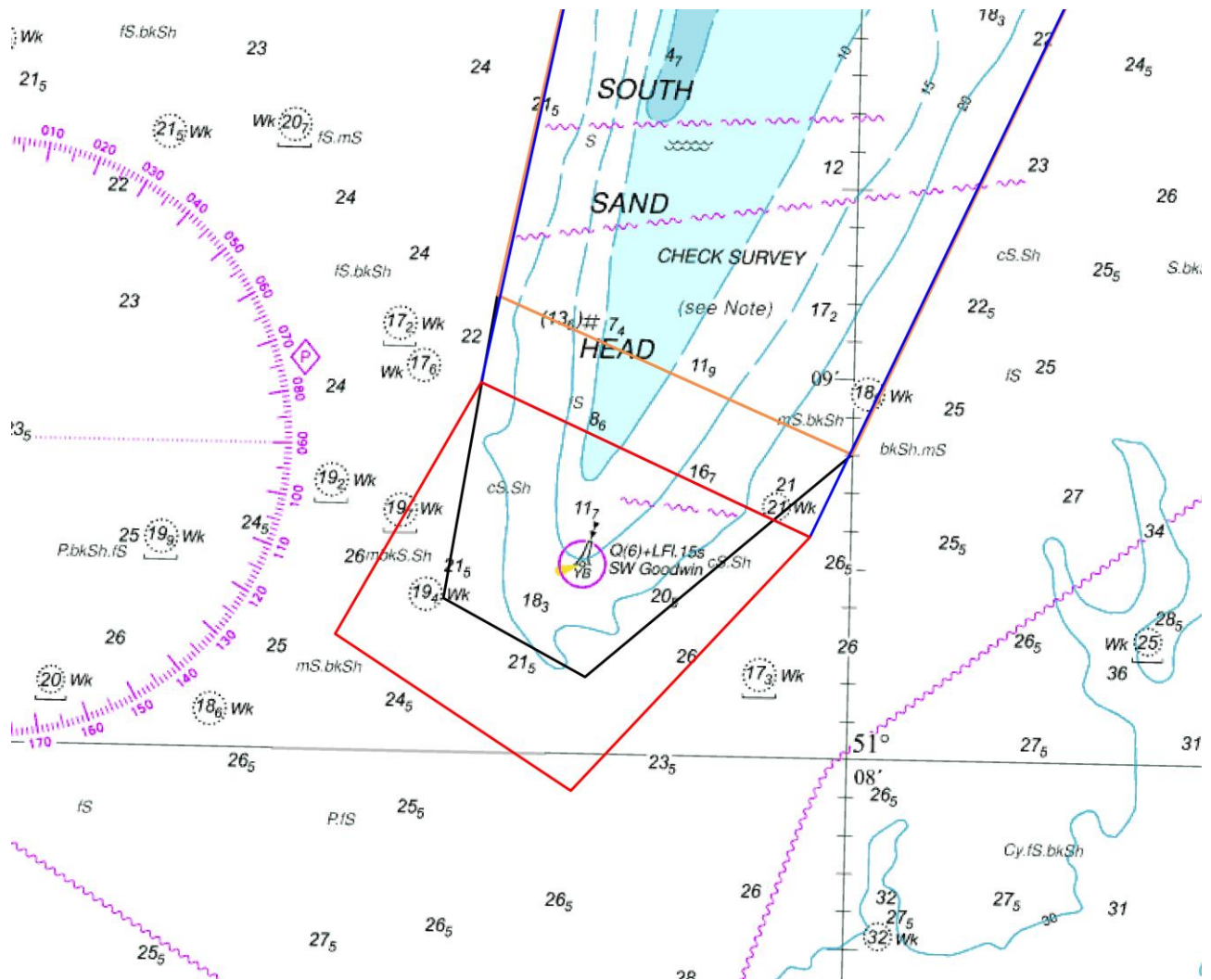
Year of Survey	
	2012
	2015





COMPOSITE DIAGRAM OF THE
20 METRE CONTOUR FROM THE 2012 AND 2015 SURVEYS
SCALE 1:10,000



Year of Survey	
	2012
	2015

PROPOSED REVISED LIMITS



	Proposed Limits for GS4 (South Calliper)
	Existing Limits for GS4 (South Calliper)
	Proposed Limits for GS1
	Existing limits for GS1

The coordinates for the adjusted survey area GS1 are shown below and describe a total area of 2.42km² (0.70 NM²),

	Latitude	Longitude
a	51-08.97 N	001-28.44 E
b	51-08.58 N	001-29.83 E
c	51-07.90 N	001-28.85 E
d	51-08.30 N	001-27.85 E