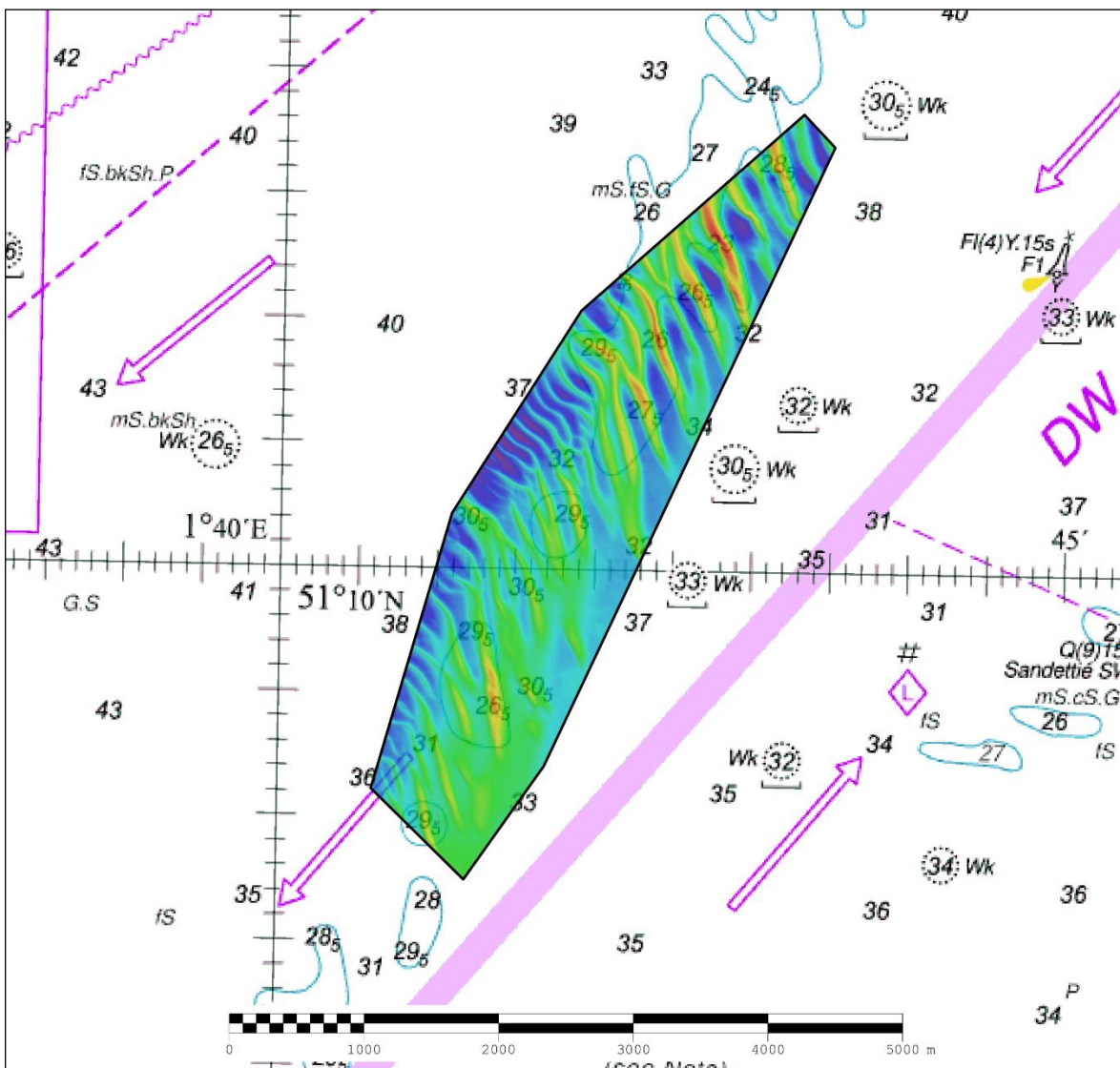




DOVER STRAIT TAIL OF THE FALLS (C1) ASSESSMENT DWR C1/2016

An assessment of the 2016 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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TAIL OF THE FALLS, DWR-C1, 2016

1. EXECUTIVE SUMMARY

The Area and Recent Changes

- 1.1 DWR C1 lies in the south-west bound lane of the Dover Strait Traffic Separation Scheme (TSS) and covers part of a Deep Draught Route (DDR), which comprises of a recommended track and safety corridor extending 0.5 nautical miles either side of the track.
- 1.2 Area DWR C1 is surveyed annually, while adjacent area C3 to the north is surveyed every 3 years and C2 to the south every 6 years. All three areas were surveyed in 2012 and fully reported on. This report examines the annual survey conducted in 2016 (HI1523) and compares this against the survey in 2015 (HI1484).
- 1.3 The bathymetry in the area has experienced only minor changes since the 2015 survey. Sandwaves in the west of the area continue to migrate northwards by up to 50m, while sandwaves near the eastern limit have migrated southwards by between 20 and 30m.
- 1.4 The controlling depth is similar at 23.6ms in 2016, compared with 23.4m in 2015; and remains along the main sandwaves in the north of the area.
- 1.5 Data from AIS in 2016 indicates the largest draught vessel to navigate the area is 23.1m.

Reasons for Continuing to Resurvey the Area

- 1.6 Depths in the area remain hazardous to deep draught vessel navigating the area and therefore require continued monitoring through annual resurveys.

Recommendations

- 1.7 Given the location of the area in relation to the DWR and the draught of vessels navigating the area, C1 should remain on the annual survey interval.
- 1.8 Sandwaves in the north of the area continue to encroach on the eastern limit of the survey area, as observed in previous reports, so the recommended changes from the 2015 report remain valid and should be carried forward to the next survey.

2. 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 all interested parties through the UKHO website, before being presented to the Civil Hydrography Working Group. When approved, the recommendations are incorporated into the Routine Resurvey Programme.
- 2.3 The Admiralty Chart extracts, other graphics and tables in this Report are included for illustrative purposes only and are NOT TO BE USED FOR NAVIGATION.
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3. AREA HISTORY

3.1 Summary of Surveys:

Year	Survey	Reference	Data	Year	Survey	Reference	Data
1988	M1239	H6345/87	s.t.d	2003	M3925	HH091/024/01	s.t.d
1989	M1436	H3937/88	s.d	2004	M4172	HH091/079/01	s.d
1990	M1607	HH090/491/01	s.d	2005	M4278	HH091/120/01	m
1991	M1779	HH090/518/01	s.d	2006	M4628	HH091/159/01	m.t
1992	M1925	HH090/551/01	s.t.d	2007	M4647	HH091/226/01	m
1993	M2150	HH090/577/01	s.d	2008	M4647	HH091/226/01	m
1994	M2295	HH090/632/01	s.d	2008	HI1270	200826415	m
1995	M2511	HH090/648/01	s.d	2009	HI1294	200929529	m
1996	M2672	HH090/691/01	s.d	2010	HI1339	201018827	m
1997	M2839	HH090/745/01	s.t.d	2011	HI1368	2011112084	m
1998	M3051	HH090/772/01	s.t.d	2012	HI1399	2012131314	m
1999	M3251	HH090/853/01	s.d	2013	HI1434	2013-261942	m
2000	M3411	HH090/889/01	s.d	2014	HI1460	2014-157511	m
2001	M3584	HH090/933/01	s.d	2015	HI1484	2015-83470	m
2002	M3747	HH090/991/01	s.d	2016	HI1523	2016-181431	m

Key: s = sonar sweep, t = seabed texture tracing, d = digital data, m = multibeam digital data
Single-beam surveys (prior to 2004) conducted at 1:25,000 scale

3.2 Summary of historical recommendation enacted

Year	Remarks
1984	Area C established
1986	Report divides area C into new areas: C; C1; C2 and C3.
1991	Area C removed, and limits of areas C1, C2 and C3 amended.
1997	Sandwave Analysis Report (HA107/042/003/02) (Parts of C1 & C3) – examining 5 surveys conducted over a 1 month period.
2001	Maintain interval and limits
2002	Reduce east and west limits in deeper waters. Continue annual resurvey.
2003	Reduce east and west limits in deeper waters. Agreed with recommendation given in 2002 report. Continue annual resurvey.
2004	Survey area was reduced following recommendations in 2002 and 2003 reports. Annual resurvey interval maintained.
2010	Extend western extent of area, continue annual resurvey
2012	western extent of survey area extended following recommendation from 2010 report.
2015	Maintain annual interval. Extend eastern extent of area to monitor eastward expansion of 30m contour. Following a review of the 2015 report, area DWR C1 was extended north to encompass the southern tip of DWR C3.

4. DESCRIPTION OF THE AREA

- 4.1 DWR C1 lies in the southwest bound lane of the Dover Strait Traffic Separation Scheme (TSS) and covers part of a Deep Draught Route (DDR), which comprises of a recommended track and a safety corridor extending 0.5 nautical miles either side of the track.
- 4.2 The area covers a section of large sandwaves that extend south-westwards from Tail of the Falls. These sandwaves dominate the area and run in a broad swathe from the north-east corner of DWR C1 to the southern border, with the largest sandwaves up to 15m in height. Depths in the area range from 23.73m to 42.41m.
- 4.3 Area Covered: 1.92 SQ NM (6.6 SQ km) as shown in Figure 1 below.

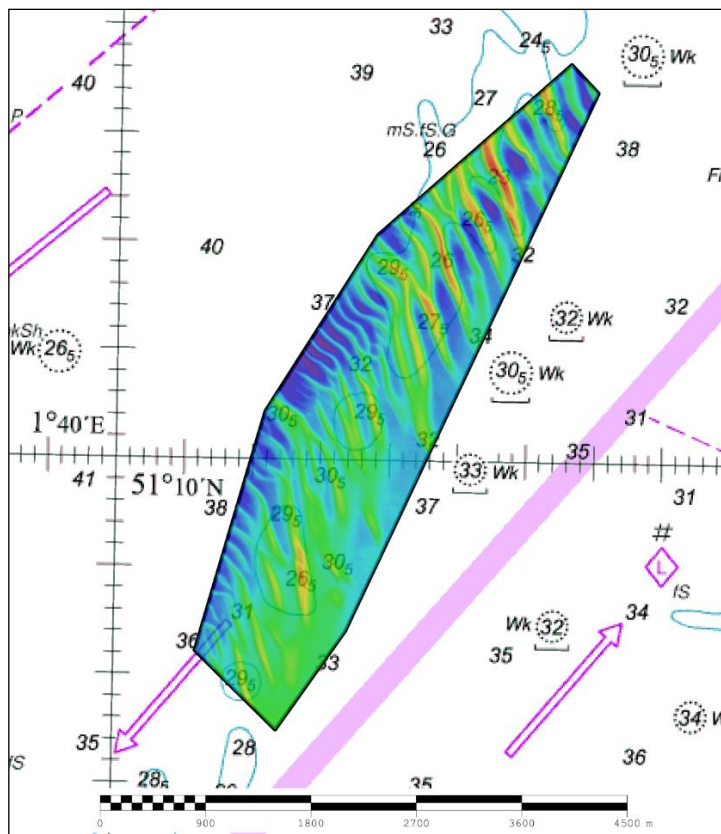


Figure 1 – 2016 survey data sun-illuminated view overlaid on BA Chart 323

- 4.4 The geographic limits at the time of resurvey are shown in the Table 3 below and coordinates are in Decimal Degrees referenced to WGS84:

Point	Latitude (N)	Longitude (E)
A	51.19717	1.72150
B	51.19500	1.72483
C	51.15333	1.69500
D	51.14567	1.68667
E	51.15167	1.67667
F	51.17016	1.68480
G	51.18383	1.69817

- 4.5 Survey interval at time of resurvey: 1 yr
- 4.6 Largest scale chart: BA323 (Scale 1:75,000)

5. SHIPPING IN THE AREA

- 5.1 Shipping data from satellite AIS data for 2016 of vessels larger than 2000GT shows the maximum draught vessel to transit through the area was 23.1m.

6. REFERENCE SURVEY DETAIL

- 6.1 The last historical Routine Resurvey Programme survey to be undertaken was in 2015 under HI1484 and has been used as the reference to compile this assessment. The survey was conducted on the 21st August 2015 during sea states of smooth to slight (2 to 3). Weather downtime reported prior to survey operations.
- 6.2 The survey data was acquired using multibeam echo-sounder system. The primary reference position system used GNSS and was supplemented by a dynamic GNSS Precise Point measuring system. The survey is referred to the International Terrestrial Reference Frame 2005 (ITRF05) datum.
- 6.3 Observations from GNSS 3D positioning were combined with the UKHO Vertical Offshore Reference Frame (VORF) to reduce depths to Chart Datum. The final deliverable was a 1m resolution CUBE (Combined Uncertainty and Bathymetry Estimator) surface.
- 6.4 The survey was validated by UKHO and met IHO S44 (5th Edition) Order 1a standards.
- 6.5 The Report of Survey for this survey is available upon request from the UKHO and the validated bathymetric surfaces are available to download from INSPIRE portal and MEDIN Bathymetry Data Archive Centre.

7. COMPARISON SURVEY DETAIL

- 7.1 The latest survey undertaken as part of the CHP Routine Resurvey was in 2016 under HI1523. Survey operations were conducted on the 30th and 31st July 2016 under sea states of smooth to slight (2 to 3). No weather downtime was reported during survey operations.
- 7.2 The survey data was acquired using multibeam echo-sounder system. The primary reference position system used GNSS and was supplemented by a dynamic GNSS Precise Point measuring system. The survey is referred to the European Terrestrial Reference System 1989 (ETRS89) datum.
- 7.3 Observations from GNSS 3D positioning were combined with the UKHO Vertical Offshore Reference Frame (VORF) to reduce depths to Chart Datum. The final deliverable was a 1m resolution CUBE (Combined Uncertainty and Bathymetry Estimator) surface.
- 7.4 The survey was validated by UKHO and met IHO S44 (5th Edition) Order 1a standards.
- 7.5 The Report of Survey for this survey is available upon request from the UKHO and the validated bathymetric surfaces are available to download from INSPIRE portal and MEDIN Bathymetry Data Archive Centre.

8. DESCRIPTION OF RECENT BATHYMETRIC CHANGE

8.1 The Variability Plot shown in Figure 2 shows the general changes in depths measured between the 2015 and 2016 surveys, with arrows indicating the general direction of sediment movement. Sandwaves along the south-west of the area have continued to migrate northwards, as observed in the 2015 report. The speed of migration has however increased from 30m per year in 2014-2015, to between 40 and 50m per year in the 2015-2016 period, as shown by the Profile Comparison A-B in Figure 3.

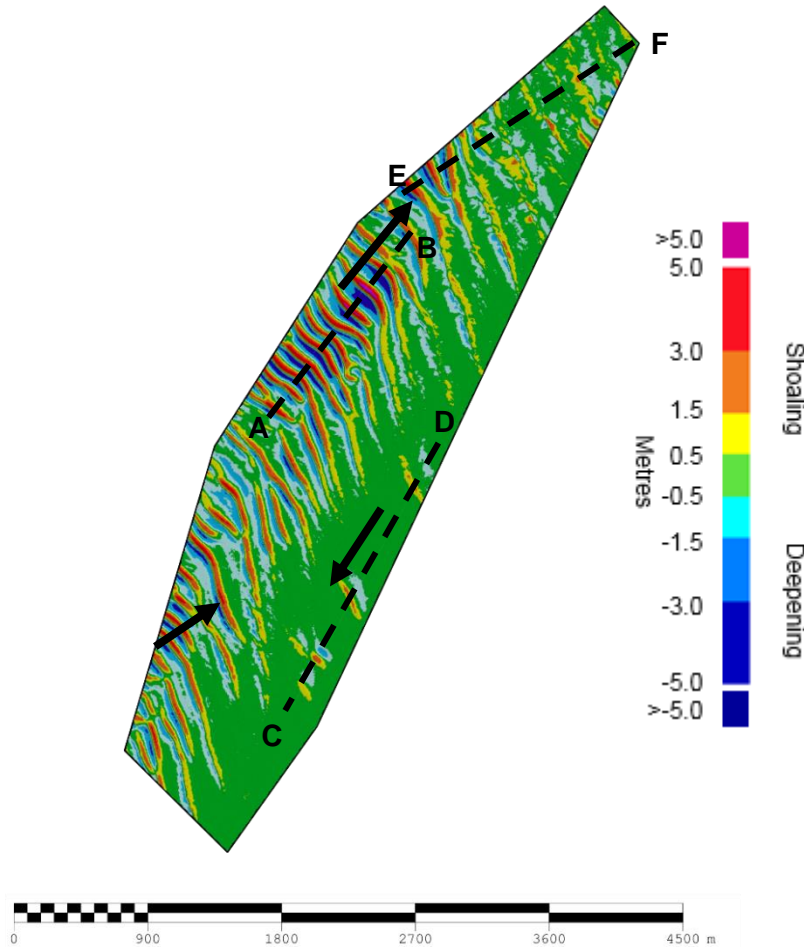


Figure 2 – Variability Plot showing Bathymetric Changes between the 2015 and 2016 Surveys

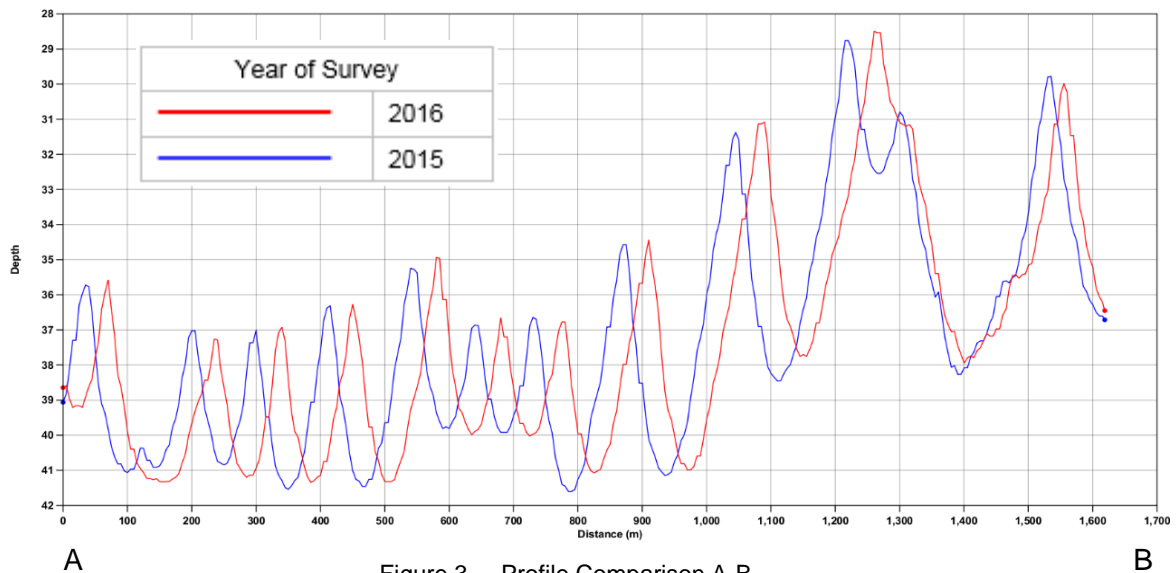
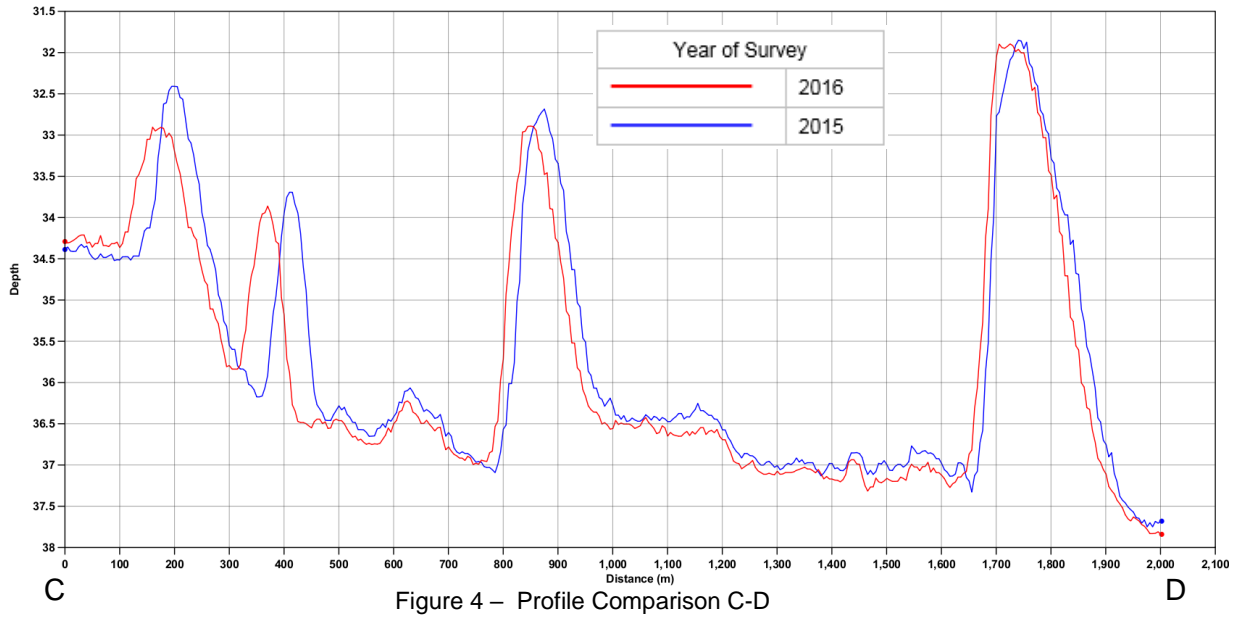
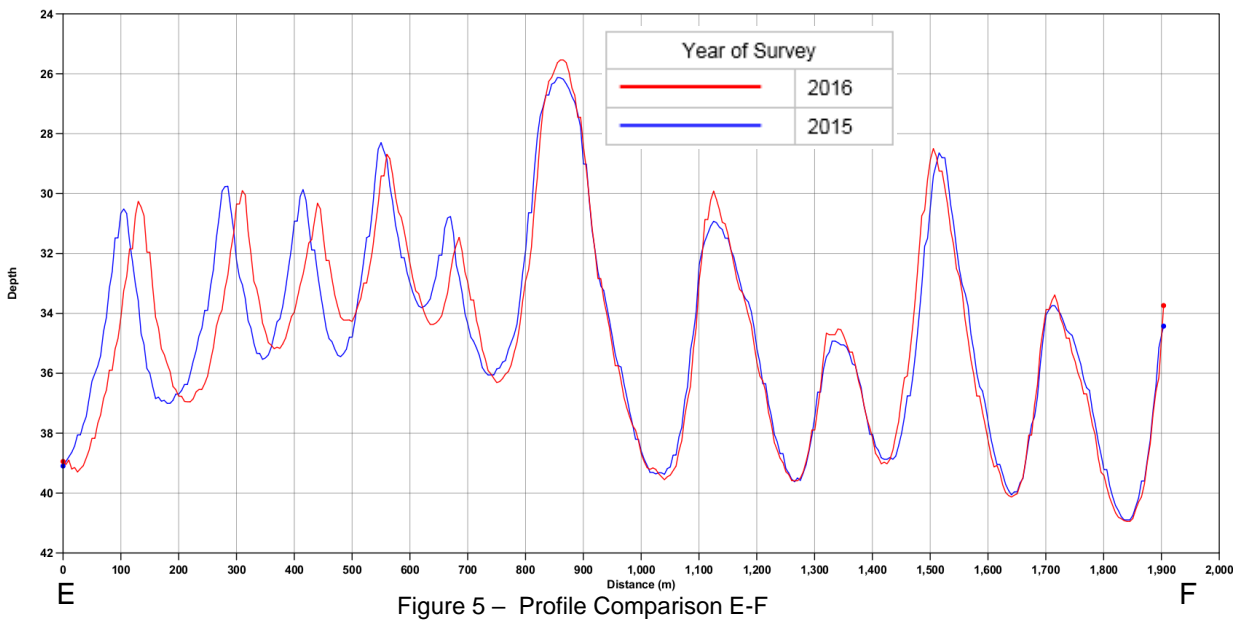


Figure 3 – Profile Comparison A-B

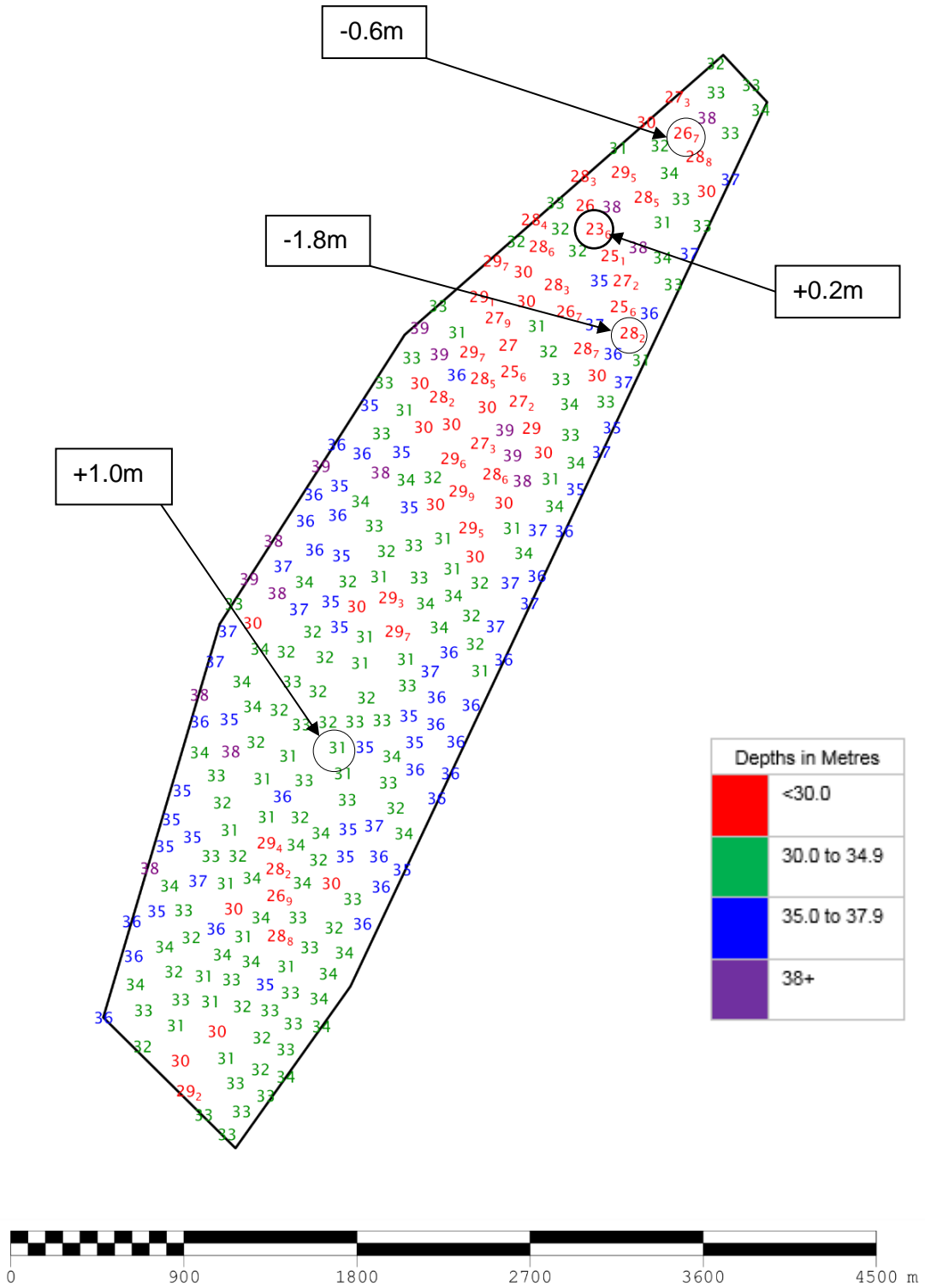
8.2 Along the eastern side of the area, the 2016 shows southwards migration of sandwaves, as illustrated by the Profile Comparison C-D; again, following the trend observed in the 2015 report.



8.3 In the north of the area, very little migration of sandwaves can be seen in the 2015-2016 survey period. This is illustrated in Figure 5, which also shows some increase in the amplitude of sandwaves in the area.



8.4 The controlling depth in the 2016 survey is 23.6 meters, located along the main sandwave in the north of the area and circled in bold in Figure 6. This compares to 23.4m in the 2015 survey, along the same sandwave. In the north of the survey area, depths have generally decreased along sandwaves; compared with the south, where depths along sandwaves have generally increased.



Depth changes indicated above are from the closest corresponding 2015 sounding available. Hence depth differences will be from different positions from the 2016 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. Positive values (+) represent deepening. Negative values (-) represent seabed depths becoming shallower.

Figure 6 – Colour Banded Depth Plot from the 2016 Survey with selected depth changes since the 2015 survey

9. IMPLICATIONS FOR SHIPPING

9.1 Depths in the area remain potentially hazardous to shipping, with the controlling depth of 23.6m offering very little clearance for the largest vessels transiting through the area, with registered draughts of up to 23.1m.

10. RECOMMENDATIONS FOR FUTURE SURVEYS

10.1 Given the location of the area in relation to the DWR and the draught of vessels navigating the area, C1 should remain on the annual survey interval.

10.2 Following a review of the 2015 report, the DWR-C1 area was extended northwards to encompass the southern limit of area C3. This will improve coverage of the main sandwave in the area which extends north beyond the current limit of C1, and should be utilised for future surveys.

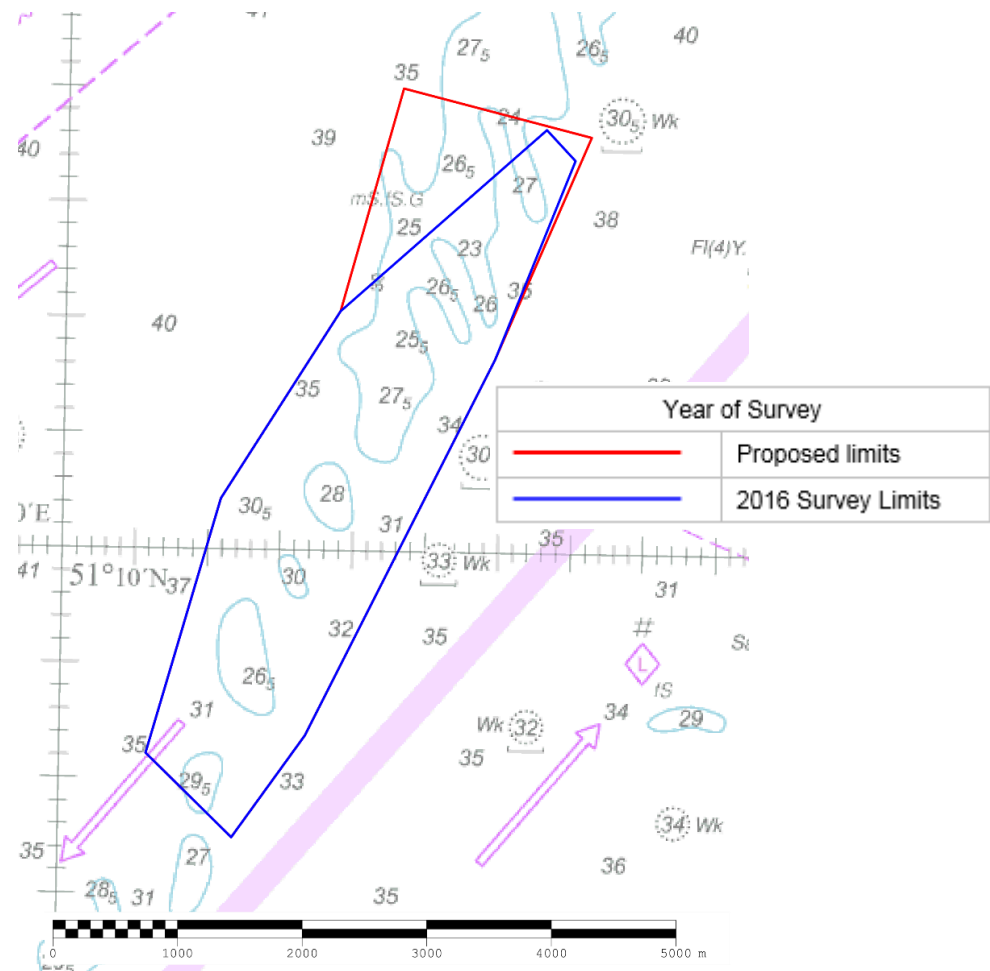


Figure 7 – Future survey limits of area DWR-C1 (current limits given in Blue; future limits given in red)

The coordinates of the adjusted survey area limits for the annual focused area DWR C1 are shown below.

DWR C1 total area: 2.35 SQ NM (8.06 SQ km)

A	51.20000N	1.70500E
B	51.19667N	1.72667E
C	51.18049N	1.71599E
D	51.15312N	1.69492E
E	51.14567N	1.68667E
F	51.15167N	1.67667E
G	51.17016N	1.68480E
H	51.18383N	1.69817E