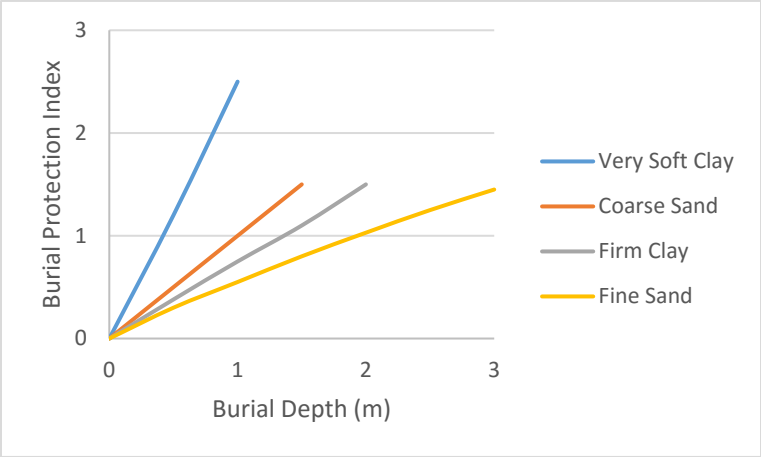
Extract from Crown Estate document, ‘Principles of Cable routeing & spacing’

Burial Protection Index (BPI)

Extract from the Crown Estate, document Principles of Cable Routeing & Spacing (prepared by Red Penguin Associates Ltd) relating cable protection through burial:

Protection of a cable by means of burial can be seen as the most promising method of protection. The only parameter in the design of the burial protection is the burial depth. It has always been recognised that "stronger" seabed soils provide a greater protection than a "softer" soil for a cable buried to similar depth. In 1997 (Mole at al) the Burial Protection Index (BPI) was introduced to account for such soil characteristics. The chart produced by Mole et al is reproduced here. P. Allen gave a further definition of the BPI in 1999.

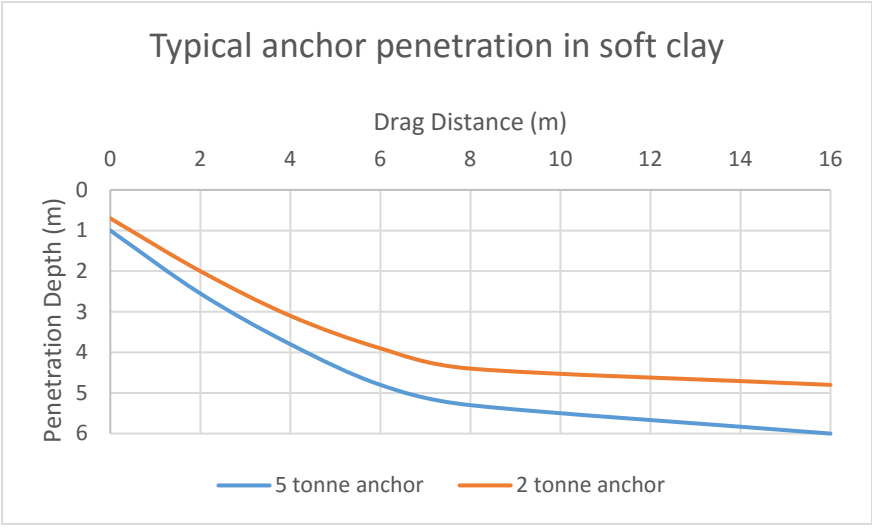


BPI = 1 Depth of Burial consistent with protecting a cable against normal fishing gear only. Would be appropriate to water depths greater than say 100m where anchoring of ships is unlikely, or in areas where shipping and anchoring is effectively prohibited.

BPI = 2 Depth of Burial will provide protection from vessels with anchors up to app. 2 tonnes. This may be adequate for normal fishing activities but would not be suitable for larger ships' anchors.

BPI = 3 Depth of Burial sufficient to protect from anchors of all but the largest ships. Suitable for anchorages and heavily trafficked shipping channels with adjustments made to suit known ship/anchor sizes.

Above basis is used in the proposed protection design with necessary adjustments for the local conditions and method of burial and nature of any backfill soil. [sic]



Extract from Carbon Trust document, ‘Guidance for the preparation of Cable Burial Depth of Lowering Specification CTC835’

Cable Burial Risk Assessment Methodology (CBRAM)[1] has been studied by the Carbon Trust, an independent company who, among other things, help to develop low-carbon technologies including renewable power. This has taken the form of a collaboration with the UK government, Scottish government and industry with the aim of bringing down the cost of offshore electricity. The result is a probabilistic risk assessment process reviewing all probable variables related to cable protection.

8 Probabilistic risk assessment process

8.1 Protection from Shipping

Ships in transit do not anchor under normal conditions; planned anchoring is normally within a designated anchorage area. A vessel anchoring outside a designated anchorage would normally be expected to inspect charts and select a location free of seabed infrastructure; therefore, the risk from anchoring lies in the occasions where a vessel is forced to anchor due to a mechanical failure or the need to prevent a collision.

8.3 Probabilistic Method

In order to determine an acceptable, economically and practically achievable Depth of Lowering it is important to be able to quantify the risk to the cable from all vessels. The probabilistic method proposed is a variation of a method originally proposed by DNV as part of the draft version of Ref 6, it has not been included as part of the final version. A variation of the method was also presented by Dr Claus F. Christensen in 2006, for DNV as part of a presentation on security of cables in the Baltic. The method has been modified to remove as far as possible any qualitative input. This results in the method potentially being very conservative; the impact of choice of factors is discussed in the following sections. The method evaluates the exposure of the cable to external threats by considering the amount of time a vessel spends within a critical distance of the cable and the probability that a vessel might have an incident that requires the deployment of an anchor. The effect of water depth and bathymetric profile is considered very important and is included as a qualitative factor.

The calculation for the probability of a cable strike is given by:

$$P_{strike} = P_{traffic}\, P_{wd} \sum_{1}^{No.\ ships\ in\ Section} \frac{D_{ship}}{V_{ship} \times 8760 \text{ hrs per year}}\, P_{incident}$$

Where:

Ptraffic: probability modifier based on the tolerable level of risk
Pwd: probability modifier for nature and depth of seabed
Vship: ship speed (metre/hr)
Dship: distance travelled by ship in area under consideration (metre) Pincident: probability of incident occurring for that vessel size and type
8670 hrs: factor to annualise the results.

The determinations of the variables are discussed in more detail in the following sections. It is highlighted that this assessment only identifies the probability of an anchor striking a cable.

An anchor strike will not necessarily result in damage to the cable. Cables are constructed with additional armour protection to protect from external aggression. It may be possible for a cable to be struck a number of times without instantaneous critical damage occurring; however, the strike may drag the cable, reducing the depth of burial thus exposing the cable to a higher probability of further strikes. It may also lead to internal weaknesses that result in a future failure. [sic]

[1] Guidance for the Preparation of Cable Burial *Depth of Lowering* Specification CTC835 published by the Carbon Trust February 2015

Stema Barge II anchor calculation

Stema Shipping AS	Stema Barge	Calculation no: 2400 - SR - 016 Sheet 1
[redacted]	**Subject:**	
Date: 13.12.2016 : Rev.	**Calculation of anchor and chain cables according to DNVGL**	
Drwn: [redacted]	**Rules for Ships. Comparison to the components on Stema Barge**	

Check of strength capacity of anchor and chain cables .

The strength to be checked according to the rules: Det Norske Veritas "Rules for classification of ships, Newbuildings, Part 3- Chapter 3- Hull Equipment and Safety", are to be used..

The barge prinsipal dimensions are as follows:

Length over all	135 m
Breadth moulded	42 m
Depth moulded	8 m
Design draft	5,8 m

Se enclosed drawing of the barge: 2400-20-201-01-03-02

Equipment no.

The equipment no. of Stema Barge have to be calculated. This number is basically for determine the weight of anchor and chain which are necessary for Stema Barge.

Equipment no., EN, is given by the formula:

EN =2/3 potential of the displacement summer draft + 2BH + 0,1A

Height from Summer WL to top of deck house: H=2,204m+3,6m+2,4 = H = 8,204 m

Area A, is calculated as the profile of the barge with coamings above the summer load waterline

Coamings	103,8	3,6		373,68 m2
Barge	135	2,204		298 m2
Deck house	30 m2			30 m2
			A =	701 m2

The displacement is calculated as follows:

Draft summer : 8,0m - 2,204 =		8	2,204	D =	5,796 m
Breath mld.				B =	42 m
Length over all				L =	135 m
Gross displacement:LxBxD =	135	42	5,796		32863 m3
Block koefficient Cb =				Cb =	0,981
Net. displacement =		32863	0,981		32239 m3

Weight in ton	32239	1,025		33045 tons
2/3 potential of the weight deplacement is =				1030

Equipment no EN = 1030 + 2*B*H + 0,1A = **EN = 1789**

Anchor

From the table C1 following requirements are given:

HHP anchor weight shall be 2 x 5250kg.

The barge has 1. anchor.

By using "table C3 Equipment reduction", following reqirements is given for one anchor:

The anchor weight to be increased with 40%.:	5250	1,4	7350 kg

Stema Shipping AS	Stema Barge	Calculation no: 2400 - SR - 016 Sheet 2
[redacted]	**Subject:**	
Date: 13.12.2016 : Rev.	**Calculation of anchor and chain cables according to DNVGL**	
Drwn: [redacted]	**Rules for Ships. Comparison to the components on Stema Barge**	

The anchor is of the type HHP.
According to "D.104" the weight from table C1 can be reduced to 75% of the requirements.

Adjusted weight will then be :		7350	0,75	5513 kg

The anchor on Stema Barge is of the same type, HHP , and have a weight of . 8415 kg

Chain cables

From the table C1 following requirements are given:

Stud link chain steel grade NV-K3			Diam.	56 mm
Total length of the chain:				577,5 m

By using 1 chain instead of 2 chains, following reduction of the total length can be done according to the table C3 in the requirements:
Length of the chain can be reduced by 40%.

Ajusted total length		577,5 m	0,6	346,5 m
Weight of the chain:	346,5	71		24602 kg

Stema Barge has one stud-link chain cables in grade U(3)a. This is the same grade as NV-K3.

Total length of chain				275 m
Diameter				76 mm
Weight/m				89,49 kg/m
Weight of the chain:	275	135		37125 kg

Conclusion:

Stema Barge

Weight of anchor	8415 kg
Weight of chain	37125 kg
Total weight	**45540 kg**

DNVRequirements.

Weight of anchor	5513 kg
Weight of chain	24602 kg
Total weight	**30114 kg**

The total weight of anchor and chain on Stema Barge is 15426 kg heavier than the requirements.
This means 51% higher than the required weight. .

The DNV requirements are based on wind speed of 25m/sec. and current speed 2,5m/sec.and good holding ground.
In poor holding ground the holding power of the anchor will be significantly reduced.
In this situation the weight excess will increase the holding power in the poor holding ground.

The length of the chain cables is shorter on Stena Barge than the requirements.
As mentionned the weight is essential and a heavier chain cable will sink deeper into the ground. When the weather is tightening the chain, it is more difficult to rise a heavy chain cable from the ground compared to a light one. That means that more of the chain cable length will remain on the ground.

Stema Shipping UK Ltd ‘rock supply – sea deliveries method statement’

Method Statement

Project	Dover Sea Wall Network Rail Rock Supply – Sea Deliveries
Prepared by	Stema Shipping UK Ltd [redacted]

Revision record	04/04/16	Dover Rev 1 Revised from previous documents

Synopsis

This document outlines the methods that will be adopted by Stema Shipping in handling, transporting and delivering armour stone from Larvik, Norway for coastal protection work at Dover, Kent.

The rocks will be transported from quarry by large sea going flat top barge and self-discharging vessel(s) to a selected transhipment area / anchorage position near to the site. At the anchorage the rocks will be transhipped to a smaller barge, 'Charlie Rock'.

Once loaded with the optimum cargo for the given tide, the 'Charlie Rock' will proceed to the beach to discharge. Discharge will take place over the high tide and the barge will remain afloat during discharge. Depending on the state of the tide an average of 1,500 – 1,800 metric tons will be discharged per tide.

Rocks will be supplied to site using the 24,500ts "Stema Barge" and smaller coasters.

A CAT 385 excavator and a CAT 988 loading shovel will tranship and discharge the rocks.

All work will be carried out in accordance with MMO licence conditions set out (yet to be issued).

1. QUALITY CONTROL, LARVIK QUARRY

Please see attached *'Production and Test Plan 01_16'*.

2. LOADING

The main supply barge the *"Stema Barge II"* and vessels will load at the quarry's dedicated quayside at Svartebukt near the town of Larvik, Norway.

2.1 Loading Barge

The barge is flat-top and fitted with rock fences along all sides and deck protection. The loading takes between two and three days depending on barge and the load out facility. The material is loaded using front-loading shovels accessing the barge by steel ramps laid between the quay and the barge (see picture 1 below). This is feasible due to the relatively small tidal difference and sheltered port conditions. During loading the barge is kept even with the quay by ballasting the barge as required.

2.2 Loading vessels

The vessels used will be fitted with and on-board excavator sitting on a gantry striding the holds. Prior to arrival the quarry / port will move a large 3 sided 'box' onto the loading pier. Once the vessel is in place the rocks will be placed in the box rock and the vessel will retrieve them from here an place on-board using the on board excavator.

2.3 Other

On completion of loading, the barge will, weather permitting, be taken under tow by the main sea tug and proceeds to the agreed anchorage position. A full towage protocol with emergency harbours / shelter locations is in place. Vessels are not weather sensitive on the passage to site.

The location of the anchorage will be agreed with the Contractor, MMO, the Client, and local fisheries interest.

All vessel are fully classed, maintained and suitable for transport of Rock Armour.

Picture 1 Loading barge at Svartebukt

3. Anchorage Seabed Survey,

Prior to the arrival of the first cargo, the agreed anchorage area and the transhipment routes to be surveyed by a recognised survey company (Shoreline). Due to the seabed conditions, a traditional trawl survey will not be not feasible and a side scan sonar survey to be carried out.

The results of this and the method used will be made available to the contractor, client and local fisheries interests. The location of the transhipment 'box' will need to be agreed and need to consider the marine traffic and the numerous wrecks and war graves. Fig 1 below outline a proposed location.

Fig 1

The path of the tow from the transhipment 'box' to the beach will depend on the following factors and as such no fixed route will be set

- Weather (swell conditions)
- Tidal currents
- Marine traffic in the area

4. ANCHORING

On arrival of the barge, the sea towing tug will bring the barges within the agreed anchorage area, once in position the anchor will be dropped. Once the tug and the crew has established the anchor is holding the towline will be released. To ensure the anchor is holding the main sea tug will apply power (with the tide) and drag the anchor into the seabed. All the crafts involved in the operation have dGPS

fitted and the appointed FLO will be invited on-board during the operation to ensure that the barge is well within the designated transhipment box. Vessels will navigate to the agreed location and drop the anchor in place.

The vessels will be on a one point mooring with a minimum of 8 lengths of chain out. All barges and vessels are fitted with high holding delta flipper anchors in line with or exceeding class recommendations.

5. TRANSHIPMENT OF ROCKS OFFSHORE

The "Charlie Rock" will be brought alongside the main barge and/or vessels by the handling tug ("Afon Goch" or similar). The tug tows the barge against the tide and as the barges get close lines are thrown and fastened. Once secure the barges are winched together using the onboard winches. See picture 2 below.

Pic 2, Transhipment from Stema Barge to Charlie Rock

The loading of the transhipment barge will only be carried out in suitable weather conditions. The barge master and/or tug captain and/or the vessel captain will call off the transhipment when the sea conditions offshore are deemed too rough for safe operation.

5.1 On arrival of the supply rock barge from Norway

Once the transhipment barge has been safely secured alongside, steel ramps will be attached between the two barges to allow the excavator and loading shovel to cross over. The steel ramps are put in place using the rock grapple on the excavator and certified lifting gear. Once safely across the plant will remain on board until completion of discharge when the operation will take place in reverse. During loading the areas round the gates are kept free from material to allow space for the excavator. Once the plant is safely across the steel ramps will be removed from the gate opening.

5.2 Transhipping Rocks

Once in place the excavator commence transhipping rocks from the main barge, or in case of vessels the on board excavator, onto the transhipment vessels using a rock grab or bucket. Transhipment normally takes between 3 and 5 hours depending on rock size and volume to be loaded.

The rock grapple used is a five finger 'static' jaw grapple, fitted onto the excavator. The back of the grapple is static on the machine (jaw opening can be adjusted manually) with the front (three fingers) attached to the hydraulic ram. The excavator will pick up the rocks individually and lift them onto the transhipment barge.

The bucket is used on smaller rock only, where applicable and EUL <3t, to minimise risk of losses.

On the Charlie Rock the on-board loading shovel will position the rocks and load the barge to the desired trim. The trim to be decided by one of our Barge Masters who will stay on board the barge at all times during cargo operations. The trim will be made to optimise the loading capacity of the barge to ensure that the optimum quantity for any given tide is brought ashore.

5.3 Other operations taking place during Transhipment

During the loading of the transhipment barge the main barge and vessels will maintain their trim and keep the two barges level by ballasting. On completion of loading, the handling tug will tow the barge to the designated delivery point on the beach.

6. BERTHING AND DISCHARGE

Approximately 2 hours before high water the transhipment barge will leave the transhipment area and proceed towards the beach.

On the approach to the agreed discharge location, the tug will record (digitally) the exact co-ordinates of the passage to and from the beach.

Approximately 200 yards off beach the tug will start to turn and swing back out to sea. As soon as the bow of the barge is heading seawards the tug will take up a position alongside the barge. As soon as the barge is deemed to be in position the crew will drop the bow anchor and the tug push the barge onto the beach. The barge will use the stern 'steering fins' to anchor into the beach. The barge will have a forward trim and as such it is only the stern point that is sitting on the beach. The tug will remain alongside and assist and keep the barge in position as required.

The beach consist of a medium steep sandy / shingle ridge beach approx. 650meters in length (750m from limitations listed below). The steepness of the beach pose no risk for rocks sliding seaward.

Tidal range	Spring tides	5.9 meters
	Neap tides	3.3 meters

Picture 3 below show the barge Charlie Rock at Happisburgh, Norfolk. Spring tidal range at location, 2.1 meters.

The main issues concerning discharge

- All endeavours will be made to get the rocks as close to the position of use as possible.
- All rocks will be discharged in a position where they will be able to be retrieved on the low water following the discharge tide.

The beach is limited by

- Western side; two old steel structures, believed to be redundant beach groins, denoted by the two red lines in picture 4 – all rock will need to be discharge to the east of these though we will try to go between the two.
- Area west of the steel rock groins consist of shallow hard standing chalk outcrop.
- Eastern side, southern water outfall pipe, marked yellow in the pic 4 below.

The barge will need to be a minimum of 30 meters from each of the structure. A safe working method to mark the steel structures and the southern water outfall will be agreed with the contractor prior to commencing work.

The green arrows show the available beach that will be used for rock discharge.

Pic 4

Off-loading will take place using the on-board loading shovel, a CAT 988. The loading shovel collects the stones from the deck and tips them over the stern, please see fig 34below.

A Rigid Inflatable Boat (RIB) will be on board the transhipment barge as safety boat.

7. METHOD NOTE

The above will be carried out under the best suitable weather conditions, superintended by Stema Shipping (UK) Ltd. Beach Master. In the event that the weather is not suitable for berthing, the tug will take the Charlie Rock to sheltered waters and stand by.

All endeavours will be made to distribute the material over the full length of the site requiring close liaison with the contractor to minimise handling.

Steps 3,4,and 5 will be repeated in sequence as required subject to weather and tidal conditions until the delivery requirements of the contractor are completed. Some of the details may be subject to change at short notice i.e. weather , surge tides, or plant failure.

In the event of severe weather conditions the transhipment barge and its tug will leave the site area and seek shelter as necessary (this is covered under document Safety Statement).

8. INITIAL PROGRAM, SUPPLY DURATION AND RESTOCKING

The barge and vessels will do return trips to the rock source until the required quantity has been supplied. It is envisaged based on current rock volume that there will be two barge loads and 5 ship loads of approx. 5,000t

Current program (subject to weather and contract award)

1st barge load early July – to be off site round 20th July
Barge complete discharge round July 30th

Barge depart for 2nd load to Norway

Vessel is loaded so that she is at site on departure of the barge
Vessel do 3 to 4 consecutive voyages

Barge arrive back at site round August 20th

Vessel arrive with a full balance load if required on completion of discharging the barge.

9. CREW TRANSFER

As far as practically possible all crew changes will take place when the transhipment barge is on the beach. The barge will be put in position and the RIB will proceed to the agreed location at the beach or at Dover Port to collect the crew who are about to start the shift. Once safely onboard the crew disembarking will be taken to the same location to disembark. Such operation will only be carried out under suitable weather conditions. Should the weather deteriorate the crew will be taken by the transhipment tug to and from the nearest safe port.

Should it be found that this is not practical due to a shorter than expected tidal window will the crew transfer take place offshore and the crew be brought to a location just off the beach on the tug. The crew will then be transferred to the beach using the RIB. The tug will standby and await the embarking crew to transfer these offshore. Again this only applies when weather allows for such operation to be safely carried out.

In cases of emergency the crew may elect to use the onboard RIB to transfer personnel directly to the shore / nearest port.

10. VESSELS

1.	Tug	(TBC)	Main sea towing vessel
2.	Tug	Afon Goch	Main handling vessel (or similar)
3.	Rock Barge	Stema Barge II	Main Supply Barge
4.	Rock Barge	Charlie Rock	Transhipment barge
5.	Rock Supply Vessel	(TBC)	Self discharging ship
6.	R I B	Avon Searider 5.4 m 60hp Mercury (or similar)	

All the above vessels used in the operations comply with their respective national and international regulations covering classification requirements and safety.

11. PLANT

1.	C A T 988H	Loading shovel
2.	C A T 385ME	360 degree Excavator

12. CONTACT DETAILS STEMA SHIPPING

Site Supervision	[redacted] Site Superintend
Tilbury Office	01375 857890
Mobile	[redacted]
Site Plant / Lifting Supervisor	[redacted]
Mobile	[redacted]
Managing Director	[redacted]
Tilbury Office	01375 857890
Mobile	[redacted]
Email	[redacted]

Afon Goch

Call sign:	MWIP7
Tel:	07901 911361
Email:	afon.goch@onsatmail.com

Afon Cefni

Call sign:	VSYA7
Tel:	07805 734728
Email:	afon.cefni@onstamail.com

Radio Communications

All vessels VHF listening watch CH 16. working CH 8
Hand held VHF radios are carried by all deck hands listening on CH 8 (or other designated channel).

Weather

A weather watch is maintained by receiving the marine call twice daily. (24hr forecast) Similarly a 2-5 day forecast is received and listening to the BBC Shipping forecast at appointed times daily.

Weathernews Inc. weather forecast

Issued November 18th 2345UTC 2016

To Master of SAGA SKY / VRYB8

Good day Captain,

Please be advised that we have sent the Initial Route Plan for your good vessel as below.

1.Status
Initial Route Plan

2.Suggested Route Plan
As conditions and safe navigation permit,
Latest position
RL/ Vl Centre Texel TSS
RL/ Dover Strait
RL/ Greenwich Lightship
RL/ Off Casquets
RL/ Off Ushant
RL/ Off Finisterre
RL/ Tenerife TSS
RL/ Campos Basin Oilfields
RL/ RECALADA

3.Reason
- Master's intentions are well noted and acknowledged. Based on the latest forecast, there is a low pressure system passing the English Channel before vessel sailing out. Strong to near gale force winds are expected. After vessel sailing out of English Channel, there is another low pressure system over UK causing NW'ly near gale winds and over 5m rough waves in the Bay of Biscay.

4.Expected Conditions

Date/Time UTC	Lat/Lon deg/deg	Wind DIR/BF	Sea DIR/(m)	Swell DIR/(m)	SigWave (m)	C/F (kts)
Nov-19 00	53.8N/ 5.9E	SW /4-5	SW /1-2	WNW/1-2	1-2	-3.0
Nov-19 12	52.8N/ 3.8E	SW /4-5	SW /1-2	WNW/1-2	1-2	0.5
Nov-20 00	51.2N/ 1.7E	S /5-6	S /2-3	SW /1-2	1-2	1.8
Nov-20 12	50.3N/ 1.1W	S /6-7	S /3-4	SW /1-2	3-4	-3.4
Nov-21 00	49.6N/ 3.9W	WNW/4-5	WNW/1-2	WSW/1-2	2-3	-0.8

Nov-21 12 48.3N/ 6.3W E /5-6 E /2-3 WSW/2-3 3-4 0.4
Nov-22 00 46.5N/ 7.6W NW /6-7 NW /3-4 NNW/4-5 5-6 0.1
Nov-22 12 44.9N/ 8.9W NW /5-6 NW /2-3 NNW/4-5 5-6 0.1
Nov-23 00 43.0N/ 10.1W NNW/3-4 NNW/1 NNW/4-5 4-5 -0.0
Nov-23 12 40.8N/ 11.0W NNE/4-5 NNE/1-2 NNW/3-4 3-4 0.1
Nov-24 00 38.8N/ 11.8W N /3-4 N /1 NNW/3-4 3-4 0.6
Nov-24 12 36.7N/ 12.7W NNW/3-4 NNW/1 NNW/3-4 3-4 0.3
Nov-25 00 34.6N/ 13.5W WNW/4-5 WNW/1-2 N /2-3 2-3 -0.0

5.Voyage Information
ATD P/S (JADE-WESER P/S) : Nov-18(Fri)/2200LT (UTC+1.0h), Nov-18/2100UTC
WNI's ETA P/S (RECALADA) : Dec-12(Mon)/0700LT (UTC-3.0h), Dec-12/1000UTC
WNI's ETA P/S (NUEVA PALMIRA): Dec-13(Tue)/0630LT (UTC-3.0h), Dec-13/0930UTC
Total Dist. / Time : 6607nm / 592.4h (592.4h - 0h*)
Remaining Dist. / Time : 6607nm / 592.4h (592.4h - 0h*)
Sailing Draft F/A : 5.1m / 6.3m
Remaining Voyage(C/F)/(W/F) : (0.0)/(-0.1)

We would appreciate if you can advise us if you encounter delay in your departure.

If you have any inquiries, please do not hesitate to contact us anytime.

Best regards,
[redacted]
Weathernews Inc.

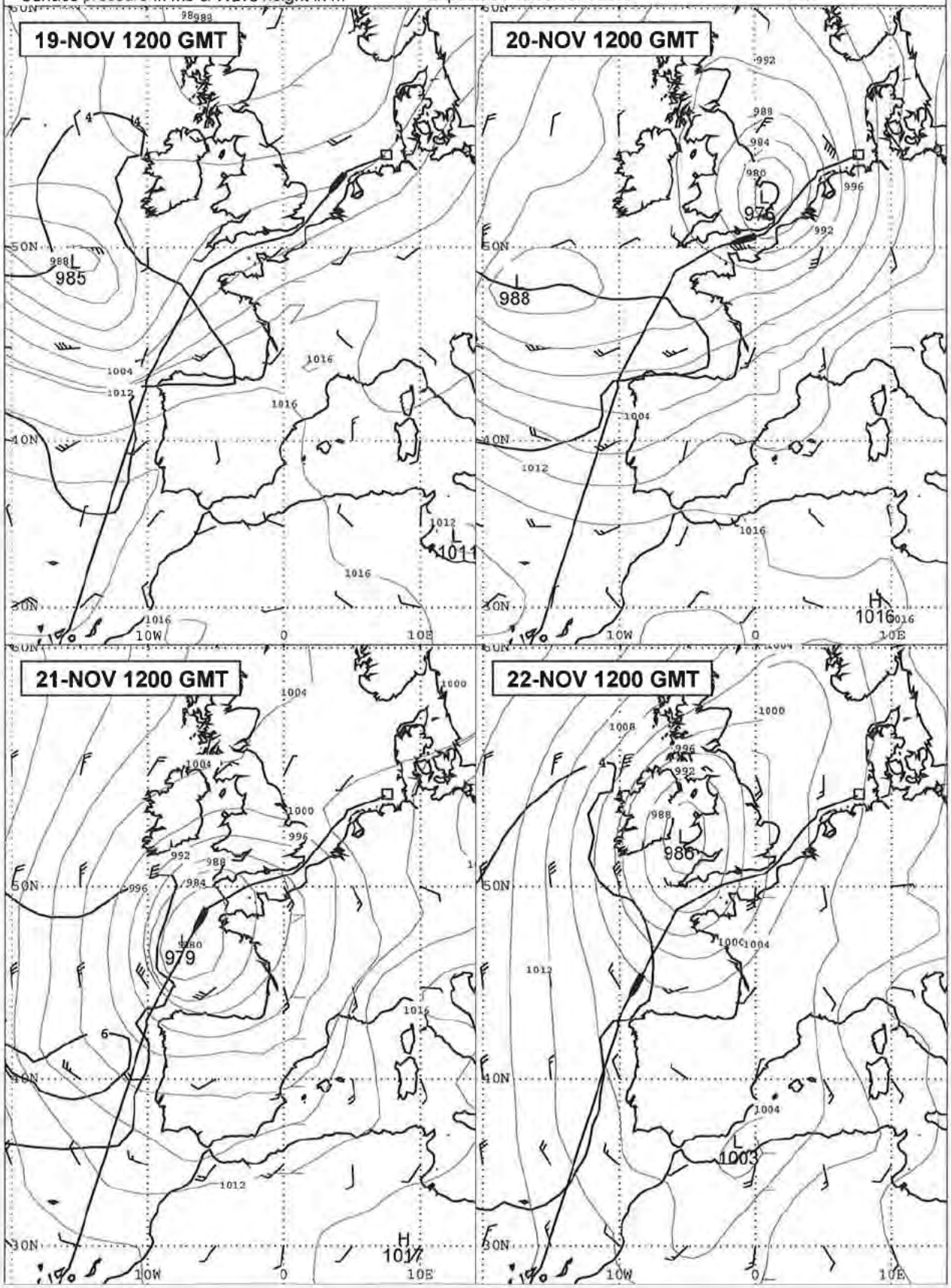
24 hours Telephone Assistance Available : +81-43-212-7211
Weathernews Telex Numbers : 072-88022
contact to WNI : sagawelco@sea.wni.com

Ref No: 0 VRYB8

Master of: SAGA SKY

Surface pressure in mb & Wave height in m — Expected Position of Vessel

weathernews



Met Office forecast

[redacted]

Met Office

Vessel: Saga Sky

Incident date: 20th November 2016

Data report of Shipping forecasts, Gale warnings and Inshore Waters forecasts

MAIB (Marine Accident Investigation Branch)

Author: [redacted]

Senior Scientist: Marine Legal

Met Office reference: msc/04/17/054

[redacted]

Revision History

Version	Date	Author	Detail
1.0	7th April 2017	[redacted]	Senior Scientist

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Contents

1.0 Terms of engagement

1.1 To provide a marine weather report detailing Met Office marine forecasts issued on the 19th and the morning of the 20th November 2016. The report was requested by [redacted] of the Marine Investigation Branch (MAIB) of Southampton, SO15 1GH in his email of 4th April 2017.

2.0 Data and information sources

2.1 Inshore Waters forecasts, Shipping forecasts and Gale warnings held by the Met Office Marine Text Forecast Archive.

3.0 Points to note

3.1 Weather data are collected and exchanged internationally according to universal Time Co-ordinated (UTC) convention. Unless otherwise stated, the times referred to in this report are UTC, which is Greenwich Mean Time (GMT).

3.2 In Section 5.0, with reference to the Inshore Waters Forecasts, the abbreviation, SSW indicates that a strong wind warning is in force

4.0 UK SHIPPING AREA FORECASTS AND GALE WARNINGS

Figure 4.1 Shipping Forecast areas. Areas of interest: **DOVER**

4.1 SHIPPING FORECASTS

AND NOW THE SHIPPING FORECAST ISSUED BY THE MET OFFICE, ON BEHALF OF THE MARITIME AND COASTGUARD AGENCY, AT 0015 UTC ON SATURDAY 19 NOVEMBER 2016 FOR THE PERIOD 0000 UTC SATURDAY 19 NOVEMBER TO 0000 UTC SUNDAY 20 NOVEMBER 2016

THERE ARE WARNINGS OF GALES IN WIGHT PORTLAND PLYMOUTH BISCAY FITZROY SOLE AND SHANNON

THE GENERAL SYNOPSIS AT 1800
NEW LOWS EXPECTED SHANNON 981 AND FAIR ISLE 987 BY 1800 ON SATURDAY

THE AREA FORECASTS FOR THE NEXT 24 HOURS

DOVER
SOUTH OR SOUTHWEST 5 TO 7, DECREASING 4 AT TIMES. MODERATE OR ROUGH, OCCASIONALLY SLIGHT. THUNDERY SHOWERS, OCCASIONAL RAIN LATER. GOOD, OCCASIONALLY POOR

AND NOW THE SHIPPING FORECAST ISSUED BY THE MET OFFICE, ON BEHALF OF THE MARITIME AND COASTGUARD AGENCY, AT 0505 UTC ON SATURDAY 19 NOVEMBER 2016 FOR THE PERIOD 0600 UTC SATURDAY 19 NOVEMBER TO 0600 UTC SUNDAY 20 NOVEMBER 2016

THERE ARE WARNINGS OF GALES IN THAMES **DOVER** WIGHT PORTLAND PLYMOUTH BISCAY FITZROY SOLE AND SHANNON

THE GENERAL SYNOPSIS AT MIDNIGHT
NEW LOWS EXPECTED PLYMOUTH 977 AND HEBRIDES 988 BY MIDNIGHT TONIGHT

THE AREA FORECASTS FOR THE NEXT 24 HOURS

DOVER
WEST OR SOUTHWEST 5 TO 7, OCCASIONALLY 4 AT FIRST, BACKING SOUTH OR SOUTHWEST 6 TO GALE 8, PERHAPS SEVERE GALE 9 LATER. SLIGHT OR MODERATE UNTIL LATER, OTHERWISE ROUGH OR VERY ROUGH,
OCCASIONALLY MODERATE. RAIN OR SHOWERS. MODERATE OR GOOD

AND NOW THE SHIPPING FORECAST ISSUED BY THE MET OFFICE, ON BEHALF OF THE MARITIME AND COASTGUARD AGENCY, AT 1130 UTC ON SATURDAY 19 NOVEMBER 2016 FOR THE PERIOD 1200 UTC SATURDAY 19 NOVEMBER TO 1200 UTC SUNDAY 20 NOVEMBER 2016

THERE ARE WARNINGS OF GALES IN GERMAN BIGHT HUMBER THAMES **DOVER** WIGHT PORTLAND PLYMOUTH BISCAY FITZROY AND SOLE

THE GENERAL SYNOPSIS AT 0600
LOW 250 MILES WEST OF SHANNON 992 EXPECTED NEAR SOUTHAMPTON 969 BY 0600 TOMORROW

THE AREA FORECASTS FOR THE NEXT 24 HOURS

DOVER
SOUTH OR SOUTHWEST 5 OR 6, INCREASING 7 TO SEVERE GALE 9, PERHAPS STORM 10 LATER. MODERATE OR ROUGH, OCCASIONALLY VERY ROUGH LATER. RAIN OR THUNDERY SHOWERS. GOOD, BECOMING MODERATE OR POOR

AND NOW THE SHIPPING FORECAST ISSUED BY THE MET OFFICE, ON BEHALF OF THE MARITIME AND COASTGUARD AGENCY, AT 1725 UTC ON SATURDAY 19 NOVEMBER 2016 FOR THE PERIOD 1800 UTC SATURDAY 19 NOVEMBER TO 1800 UTC SUNDAY 20 NOVEMBER 2016

THERE ARE WARNINGS OF GALES IN DOGGER FISHER GERMAN BIGHT HUMBER THAMES **DOVER** WIGHT PORTLAND PLYMOUTH BISCAY FITZROY SOLE AND LUNDY

THE GENERAL SYNOPSIS AT MIDDAY
LOW JUST WEST OF SOLE 988 EXPECTED HUMBER 974 BY MIDDAY TOMORROW

THE AREA FORECASTS FOR THE NEXT 24 HOURS

DOVER
SOUTH 5 TO 7, INCREASING GALE 8 TO STORM 10, VEERING SOUTHWEST 6 TO GALE 8 LATER. ROUGH OR VERY ROUGH, OCCASIONALLY HIGH LATER. RAIN OR THUNDERY SHOWERS. MODERATE, OCCASIONALLY POOR

AND NOW THE SHIPPING FORECAST ISSUED BY THE MET OFFICE, ON BEHALF OF THE MARITIME AND COASTGUARD AGENCY, AT 0015 UTC ON SUNDAY 20 NOVEMBER 2016 FOR THE PERIOD 0000 UTC SUNDAY 20 NOVEMBER TO 0000 UTC MONDAY 21 NOVEMBER 2016

THERE ARE WARNINGS OF GALES IN DOGGER FISHER GERMAN BIGHT HUMBER THAMES **DOVER** WIGHT PORTLAND PLYMOUTH BISCAY FITZROY SOLE AND LUNDY

THE GENERAL SYNOPSIS AT 1800
LOW SOLE 977 EXPECTED GERMAN BIGHT 977 BY 1800 ON SUNDAY.
NEW LOW EXPECTED FITZROY 982 BY SAME TIME

THE AREA FORECASTS FOR THE NEXT 24 HOURS

DOVER
SOUTH 6 TO GALE 8, VEERING SOUTHWEST SEVERE GALE 9 TO VIOLENT STORM 11, DECREASING 4 OR 5, THEN BECOMING CYCLONIC LATER. MODERATE OR ROUGH, BECOMING VERY ROUGH OR HIGH FOR A TIME. RAIN OR THUNDERY SHOWERS. MODERATE, OCCASIONALLY POOR

AND NOW THE SHIPPING FORECAST ISSUED BY THE MET OFFICE, ON BEHALF OF THE MARITIME AND COASTGUARD AGENCY, AT 0505 UTC ON SUNDAY 20 NOVEMBER 2016 FOR THE PERIOD 0600 UTC SUNDAY 20 NOVEMBER TO 0600 UTC MONDAY 21 NOVEMBER 2016

THERE ARE WARNINGS OF GALES IN TYNE DOGGER FISHER GERMAN BIGHT HUMBER THAMES **DOVER** WIGHT PORTLAND PLYMOUTH BISCAY FITZROY SOLE LUNDY AND FASTNET

THE GENERAL SYNOPSIS AT MIDNIGHT
LOW PLYMOUTH 966 EXPECTED SKAGERRAK 983 BY MIDNIGHT TONIGHT. NEW LOW EXPECTED FITZROY 983 BY SAME TIME

THE AREA FORECASTS FOR THE NEXT 24 HOURS

DOVER
CYCLONIC SEVERE GALE 9 TO VIOLENT STORM 11 AT FIRST, DECREASING 6 TO GALE 8, BECOMING VARIABLE 3 OR 4 FOR A TIME. ROUGH OR VERY ROUGH, OCCASIONALLY HIGH, BECOMING SLIGHT OR MODERATE. RAIN OR THUNDERY SHOWERS. MODERATE, OCCASIONALLY POOR

AND NOW THE SHIPPING FORECAST ISSUED BY THE MET OFFICE, ON BEHALF OF THE MARITIME AND COASTGUARD AGENCY, AT 1130 UTC ON SUNDAY 20 NOVEMBER 2016 FOR THE PERIOD 1200 UTC SUNDAY 20 NOVEMBER TO 1200 UTC MONDAY 21 NOVEMBER 2016

THERE ARE WARNINGS OF GALES IN GERMAN BIGHT HUMBER THAMES **DOVER** WIGHT PORTLAND PLYMOUTH BISCAY FITZROY SOLE LUNDY FASTNET IRISH SEA AND SOUTHEAST ICELAND

THE GENERAL SYNOPSIS AT 0600
LOW SOUTHEAST ENGLAND 970 EXPECTED SWEDEN 990 BY 0600 TOMORROW. NEW LOW EXPECTED PLYMOUTH 979 BY SAME TIME

THE AREA FORECASTS FOR THE NEXT 24 HOURS

DOVER
SOUTHWEST GALE 8 TO STORM 10, BECOMING VARIABLE 3 OR 4, THEN SOUTH 5 OR 6. ROUGH OR VERY ROUGH, OCCASIONALLY HIGH AT FIRST. RAIN OR THUNDERY SHOWERS. GOOD OCCASIONALLY POOR

4.2 GALE WARNINGS

GALE WARNING SATURDAY 19 NOVEMBER 0343GMT 36

DOVER
SOUTHERLY GALE FORCE 8 EXPECTED LATER

GALE WARNING SATURDAY 19 NOVEMBER 0935GMT 37

DOVER
SOUTHERLY SEVERE GALE FORCE 9 EXPECTED LATER

GALE WARNING SATURDAY 19 NOVEMBER 1557GMT 38

DOVER
SOUTHERLY SEVERE GALE FORCE 9 EXPECTED SOON, VEERING SOUTHWESTERLY AND INCREASING STORM FORCE 10 LATER

GALE WARNING SATURDAY 19 NOVEMBER 2104GMT 39

DOVER
SOUTHERLY GALE FORCE 8 INCREASING SEVERE GALE FORCE 9 IMMINENT, VEERING SOUTHWESTERLY AND INCREASING VIOLENT STORM FORCE 11 SOON

GALE WARNING SUNDAY 20 NOVEMBER 0348GMT 40

NONE FOR **DOVER**

GALE WARNING SUNDAY 20 NOVEMBER 1013GMT 41

DOVER
SOUTHWESTERLY VIOLENT STORM FORCE 11 DECREASING STORM FORCE 10 IMMINENT

5.0 INSHORE WATERS FORECASTS

Figure 6.1 Map showing inshore waters' areas around the United Kingdom.

The zone of interest if North Foreland to Selsey Bill

Issued by the Met Office at 0001 UTC on Saturday 19 November 2016

Ser. No. 33

Inshore Waters Forecast to 12 miles offshore
for the period 0000 UTC Saturday 19 November to 0000 UTC Sunday 20 November 2016

General Situation
Low pressure northeast of Scotland will gradually fill to be followed by a brief lull. Later on Saturday another area of low pressure will move quickly across southern England into the North Sea, bringing a period of gales or severe gales and rain to many southern areas.

North Foreland to Selsey Bill - (SWW)
24 hour forecast:
Westerly or southwesterly 4 or 5, occasionally 6 at first, backing southerly 6 to gale 8 later, perhaps severe gale 9 later in west.
Slight or moderate, becoming rough later.
Thundery showers, then rain.
Moderate or good, occasionally poor.

Outlook for the following 24 hours:
Southerly veering southwesterly 7 to severe gale 9, veering westerly or northwesterly 5 or 6 later, then becoming variable 3 or 4.
Rough or very rough, becoming slight or moderate later.
Rain then showers.
Moderate or good, occasionally poor.

Issued by the Met Office at 0500 UTC on Saturday 19 November 2016

Ser. No. 34

Inshore Waters Forecast to 12 miles offshore
for the period 0600 UTC Saturday 19 November to 0600 UTC Sunday 20 November 2016

General Situation
Low pressure north of Scotland will gradually fill, but on Sunday another area of low pressure will move quickly across southern England into the North Sea, bringing a period of gales or severe gales and rain to many southern areas.

North Foreland to Selsey Bill - (SWW)
24 hour forecast:
Westerly or northwesterly 4 or 5, occasionally 6 at first, backing southerly or southwesterly 6 to gale 8, perhaps severe gale 9 later.
Slight or moderate, becoming rough or very rough later.
Rain or thundery showers.
Moderate or good, occasionally poor.

Outlook for the following 24 hours:
Southerly or southwesterly 7 to severe gale 9, veering westerly 4 or 5, becoming variable 3 or 4, then cyclonic 5 to 7 later.
Rough or very rough, becoming slight or moderate.
Rain or showers.
Moderate or good, occasionally poor.

Issued by the Met Office at 1100 UTC on Saturday 19 November 2016

Ser. No. 35

Inshore Waters Forecast to 12 miles offshore
for the period 1200 UTC Saturday 19 November to 1200 UTC Sunday 20 November 2016

General Situation
A deepening Atlantic low is expected to arrive in the western English Channel by midnight tonight, moving northeastwards to be centred in the southern North Sea by Sunday afternoon and then southern Norway by the early hours of Monday. Another Atlantic low is then expected to arrive in the western English Channel by Monday afternoon.

North Foreland to Selsey Bill - (SWW)
24 hour forecast:
Southwesterly 4 or 5, backing southerly 6 or 7, then veering southwesterly 7 to severe gale 9 later.
Moderate, becoming rough, occasionally very rough later.
Showers at first, then rain, thundery showers later.
Moderate or good, occasionally poor later.

Outlook for the following 24 hours:
Southwesterly 6 to gale 8, becoming variable 3 or 4, then southeasterly 5 to 7 later.
Rough or very rough, becoming moderate, occasionally rough later.
Rain or showers.
Moderate or good, occasionally poor later.

Issued by the Met Office at 1700 UTC on Saturday 19 November 2016

Ser. No. 36

Inshore Waters Forecast to 12 miles offshore
for the period 1800 UTC Saturday 19 November to 1800 UTC Sunday 20 November 2016

General Situation
A deepening Atlantic low is expected to arrive in the western English Channel by midnight tonight, moving northeastwards to be centred in the southern North Sea by Sunday afternoon and then southern Norway by the early hours of Monday. Another Atlantic low is then expected to arrive in the western English Channel by Monday afternoon.

North Foreland to Selsey Bill - (SWW)
24 hour forecast:
Southwesterly 5 to 7, backing southerly gale 8 to storm 10, then veering southwesterly 6 to gale 8 later.
Moderate, becoming rough or very rough.
Rain then thundery showers, fair later.
Moderate or good, occasionally poor.

Outlook for the following 24 hours:
Southwesterly 5 to 7, backing easterly 4 or 5, then veering southerly 5 to 7 later.
Moderate or rough.
Fair at first, then rain at times, thundery showers later.
Moderate or good, occasionally poor.

Issued by the Met Office at 0001 UTC on Sunday 20 November 2016

Ser. No. 37

Inshore Waters Forecast to 12 miles offshore
for the period 0000 UTC Sunday 20 November to 0000 UTC Monday 21 November 2016

General Situation
A deep Atlantic low in the western English Channel will move northeastwards to be centred in the southern North Sea by Sunday afternoon and then in southern Sweden by the early hours of Monday. Another deep Atlantic low is expected to arrive in the western English Channel early on Monday.

North Foreland to Selsey Bill - (SWW)
24 hour forecast:
Southerly veering westerly 7 to severe gale 9, increasing storm 10 or violent storm 11 for a time, becoming variable 3 later, then cyclonic 5 or 6.
Rough or very rough, occasionally high at first, becoming slight or moderate.
Rain at times.
Moderate or good, occasionally poor.

Outlook for the following 24 hours:
Cyclonic becoming southerly 5 to 7, occasionally gale 8 later.
Slight or moderate, becoming rough.
Rain then thundery showers.
Moderate or good, occasionally poor.

Issued by the Met Office at 0500 UTC on Sunday 20 November 2016

Ser. No. 38

Inshore Waters Forecast to 12 miles offshore
for the period 0600 UTC Sunday 20 November to 0600 UTC Monday 21 November 2016

General Situation
A deep Atlantic low in southeast England will move northeastwards to be centred in the eastern North Sea by Sunday evening and then in southern Sweden by the early hours of Monday. Another deep Atlantic low is expected to arrive in the western English Channel on Monday morning.

North Foreland to Selsey Bill - (SWW)
24 hour forecast:
Cyclonic gale 8 to storm 10, occasionally violent storm 11 at first in east, becoming west 4 or 5, then variable 3, becoming cyclonic then southerly 5 or 6 later.
Very rough or high, becoming slight or moderate.
Rain at times.
Moderate or good, occasionally poor.

Outlook for the following 24 hours:
Southerly 5 to 7, increasing gale 8 or severe gale 9.
Moderate or rough.
Rain then thundery showers.
Moderate or good, occasionally poor.

Issued by the Met Office at 0500 UTC on Sunday 20 November 2016

Ser. No. 39

Inshore Waters Forecast to 12 miles offshore
for the period 0600 UTC Sunday 20 November to 0600 UTC Monday 21 November 2016

General Situation
A deep Atlantic low in southeast England will move northeastwards to be centred in the eastern North Sea by Sunday evening and then in southern Sweden by the early hours of Monday. Another deep Atlantic low is expected to arrive in the western English Channel on Monday morning.

North Foreland to Selsey Bill - (SWW)
24 hour forecast:
Cyclonic gale 8 to storm 10, occasionally violent storm 11 at first in east, becoming west 4 or 5, then variable 3, becoming cyclonic then southerly 5 or 6 later.
Very rough or high, becoming slight or moderate.
Rain at times.
Moderate or good, occasionally poor.

Outlook for the following 24 hours:
Southerly 5 to 7, increasing gale 8 or severe gale 9.
Moderate or rough.
Rain then thundery showers.
Moderate or good, occasionally poor.

Issued by the Met Office at 1100 UTC on Sunday 20 November 2016

Ser. No. 40

Inshore Waters Forecast to 12 miles offshore
for the period 1200 UTC Sunday 20 November to 1200 UTC Monday 21 November 2016

General Situation
Storm angus will move away northeastwards, taking his very strong winds with him. However another deep, as yet unnamed low, is expected to arrive in the western English Channel on Monday morning, accompanied by gales.

North Foreland to Selsey Bill - (SWW)
24 hour forecast:
Southwesterly 7 to severe gale 9, veering northeasterly 3 or 4, increasing 5 to 7 then becoming southeasterly or cyclonic later.
Very rough or high, becoming slight or moderate.
Rain at times.
Moderate or good, occasionally poor.

Outlook for the following 24 hours:
Southerly or southeasterly 6 to gale 8, perhaps severe gale 9.
Moderate or rough.
Rain then thundery showers.
Moderate or good, occasionally poor.

6.0 QUALITY STATEMENT

6.1 The Met Office is the national meteorological service for the United Kingdom and is a leading member of the World Meteorological Organisation (WMO), which is an agency of the United Nations. In addition to national responsibilities (such as the issue of Shipping Forecasts for waters around UK), the Met Office also has a wide range of global weather analysis and forecasting commitments, for land applications, aviation and the maritime community.

[redacted] 7th April 2017

APPENDIX A GLOSSARY OF TERMS

Table A1 WAVE DEFINITIONS

SEA STATE – WMO Code 3700

Code	Description	Height in metres
0	Calm – glassy	0
1	Calm – rippled	0.1 or less
2	Smooth – wavelets	Over 0.1 to 0.5
3	Slight	Over 0.5 to 1.25
4	Moderate	Over 1.25 to 2.5
5	Rough	Over 2.5 to 4.0
6	Very rough	Over 4.0 to 6.0
7	High	Over 6.0 to 9.0
8	Very high	Over 9.0 to 14.0
9	Phenomenal	Over 14.0

FURTHER COMMENT ON THE DEFINITIONS

In relation to the **state of sea (sea state)** code above, the following guidance is provided within the WMO Manual on Codes (Volume I.1, Part A):

> "These values refer to well-developed wind waves of the open sea. While priority shall be given to the descriptive terms, these height values may be used for guidance by the observer when reporting the total state of agitation of the sea resulting from various factors such as wind, swell, currents and angle between swell and wind, etc"

While sentence one states that the sea state code relates to wind waves, the remainder of the paragraph suggests that it can be used to describe the resultant wave heights associated with both wind waves and swell. As such the above description of **state of sea (sea state)** is considered to be the same as the **significant wave height** and indicates the wave height resulting from the combined effect of wind waves and swell waves. Further information can be found in section 2.

Table A3 BEAUFORT SCALE OF WIND: EQUIVALENT SPEEDS

FORCE	DESCRIPTION	EQUIVALENT SPEED (KNOTS)	
		MEAN	LIMITS
0	CALM	0	Less than 1
1	LIGHT AIR	2	1 – 3
2	LIGHT BREEZE	5	4 – 6
3	GENTLE BREEZE	9	7 – 10
4	MODERATE BREEZE	13	11 – 16
5	FRESH BREEZE	19	17 – 21
6	STRONG BREEZE	24	22 – 27
7	NEAR GALE	30	28 – 33
8	GALE	37	34 – 40
9	STRONG GALE	44	41 – 47
10	STORM	52	48 – 55
11	VIOLENT STORM	60	56 – 63
12	HURRICANE	--	64 and over

FURTHER COMMENT ON THE DEFINITIONS

1 knot = 0.515 metres / sec = 1.85 km hour = 1.16 statute miles / hour

A **Gale (Force 8)** is a mean wind speed in the range 34 to 40 knots. In general, the term 'gale' implies a mean wind speed of 34 knots or above over a period of at least 10 consecutive minutes. The term **Strong Gale (Force 9)** is used when the mean wind speed lies in the range 41 to 47 knots, over a period of at least 10 consecutive minutes.

Met Office
FitzRoy Road, Exeter
Devon EX1 3PB
United Kingdom

Tel (UK): 0370 900 0100 (Int): +44 1392 885680
Fax (UK): 0370 900 5050 (Int): +44 1392 885681
enquiries@metoffice.gov.uk
www.metoffice.gov.uk