KILLALOE
NATIONAL WATER ACTIVITY CENTRE

Tides

Version 1.2

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Introduction to Tides

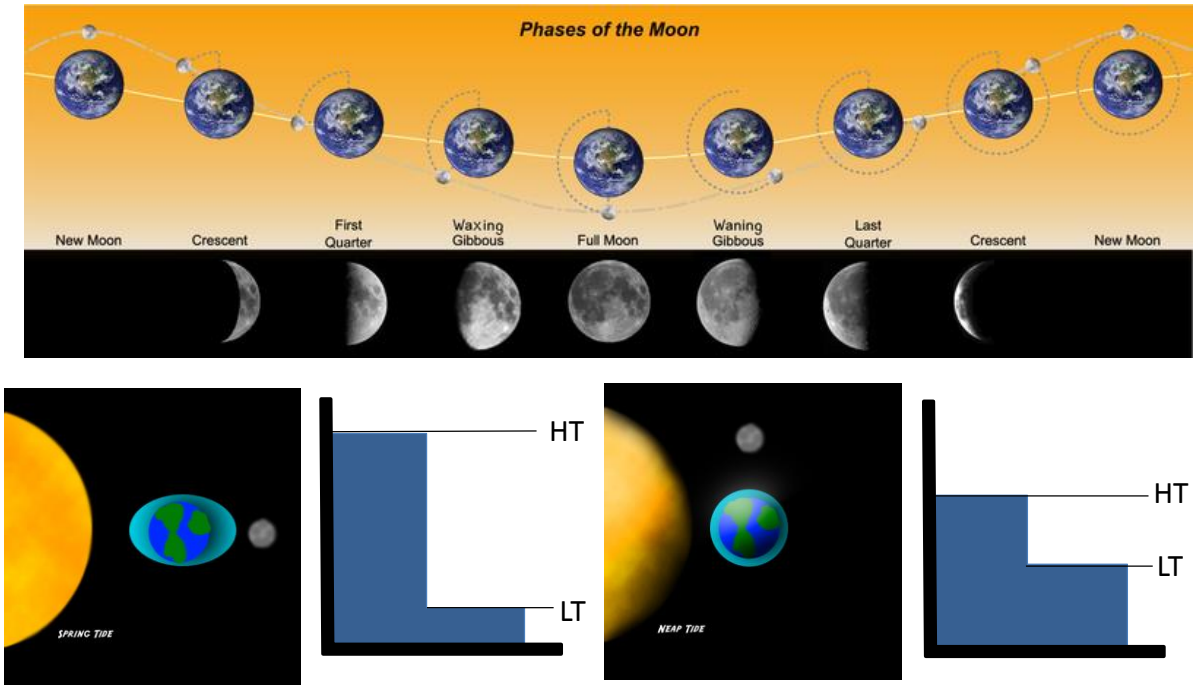


Figure 1: Moon phases and their influence on tides

Why have we tides, and why are tides different over the month ?

Tides are the rise and fall of sea levels caused by the combined effects of the gravitational forces exerted by the Moon, the Sun and the Earth's rotation.

In Ireland the tides are semi-diurnal meaning there are two high tides and two low tides each day. The time and range of the tides at the coast are influenced by the alignment of the Sun and Moon. When the moon sun and earth are in line around the new or full moon the range in tide height between high and low tide is at its highest and these tides are known as "Spring tides" while "Neap tides" occur when the moon and sun are out of line most around a half moon and the tidal range between high and low tide is at its smallest.

These ranges in tide are predicted in Nautical Almanac's. An example can be found at:

Reeds Nautical Almanac

http://www.reedsnauticalalmanac.co.uk/

Rule of Twelfths

- Tidal flow between tides
- Ratio of flow - 1:2:3:3:2:1

Cobh 10/4/2012
02:45 – Low tide 0.1M
08:41 – High tide 4.1M

Tidal range = 4M

4m x 1/12 = 0.33M
4m x 2/12 = 0.66M
4m x 3/12 = 1M

02:45 (Low tide) 0.1 M
03:45 (0.1+0.33) 0.43 M
04:45 (0.43+0.66) 1.09 M
05:45 (1.09+1) 2.09 M
06:45 (2.09+1) 3.09 M
07:45 (3.09+0.66) 3.75 M
08:45 (3.75+0.33) 4.08 M

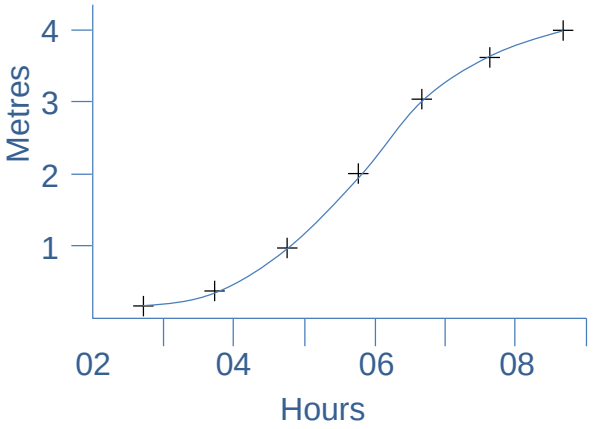


Figure 2: Rule of 12ths

The Rule of Twelfths is a rule of thumb for estimating the height of the tide. It takes into account the fact that the water between High Water (HW) and Low Water (LW) does not withdraw at a linear rate but in fact the greatest flow is at the midpoint between HW and LW.

The rule makes an assumption that the rate of flow of a tide increases smoothly to a maximum halfway between high and low tide before smoothly decreasing to zero again and that the interval between low and high tides is approximately six hours. In the first hour after HW the water level will drop by one twelfth of the range, in the second hour two twelfths, and so on according to the sequence - 1:2:3:3:2:1.

Nautical Almanac

- Cobh – Standard port

COBH LAT 51°51'N LONG 8°18'W

TIMES AND HEIGHTS OF HIGH AND LOW WATERS

JUNE				JULY			
Time	m	Time	m	Time	m	Time	m
1 0453	3.8	**16** 0525	3.9	**1** 0512	3.8	**16** 0007	0.5
1115	0.7	1158	0.4	1135	0.6	0556	3.9
W 1713	3.8	TH 1748	4.1	F 1733	3.9	SA 1229	0.4
● 2335	0.7			● 2358	0.6	1816	4.1
2 0531	3.8	**17** 0020	0.4	**2** 0553	3.9	**17** 0047	0.5
1153	0.7	0610	3.9	1216	0.5	0635	3.9
TH 1750	3.9	F 1244	0.4	SA 1814	4.0	SU 1307	0.4
		1832	4.1			1854	4.0
3 0013	0.6	**18** 0104	0.4	**3** 0038	0.5	**18** 0122	0.5
0607	3.8	0653	3.9	0633	3.9	0711	3.9
F 1231	0.6	SA 1327	0.4	SU 1257	0.5	M 1344	0.5
1827	3.9	1914	4.0	1854	4.0	1930	4.0

- Baltimore – Secondary port

CHARTS AC 2129, 3725, 5623; Imray C56.

TIDES –0605 Dover; ML 2·1; Duration 0610

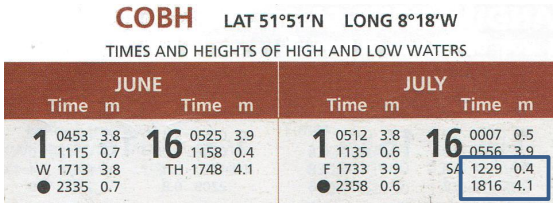
Standard Port COBH (⟵)

Times				Height (metres)			
High Water		Low Water		MHWS	MHWN	MLWN	MLWS
0500	1100	0500	1100	4·1	3·2	1·3	0·4
1700	2300	1700	2300				
Differences BALTIMORE							
–0025	–0005	–0010	–0050	–0·6	–0·3	+0·1	+0·2

Figure 3: Nautical Almanac

In Figure 3 you can see an extract for Cobh and Baltimore. Certain main ports called "Standard ports" have full tidal information for each day as shown for Cobh, while other ports called "Secondary ports" reference a standard port and differences from the standard port are given as shown for Baltimore.

Calculating tide for a Standard Port



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● 2335	0.7			● 2358	0.6	1816	4.1

Cobh

1229 UT LW 0.4 m

1816 UT HW 4.1 m

Figure 4: Standard port - Cobh

What is the tide at Cobh on the 16th July at 17:00 hrs DST (Local time) ?

First get the HW and LW either side of the time the tidal information is required for. 17:00 hrs DST is 1 hour ahead of Coordinated Universal Time (UTC) in the summer months. The almanac works in UTC only so from this point on 17:00 hrs DST will be referred to as 16:00 hrs UTC or 16:00 hrs UT.

From the almanac the time and height of HW and the height of LW is determined and with this a tidal curve like that in Figure 5 can be prepared.

A line (purple dash) is drawn between 4.1 m at the top of the chart and at 0.4 m at the bottom of the chart as extracted from the almanac. The time of HW is put in the box at the centre bottom of the chart and the remaining boxes are filled left and right from that time in 1 hour intervals down and up from the HW time.

On the bottom line 16:00 hrs UT is identified and a line is brought up the chart to the curve, it is then brought at right angles to the purple line and then at right angles to the top of the chart. From the top of the chart the height of the tide at 16:00 hrs UT can be read and this is obviously the tide at Cobh at 17:00 hrs DST.

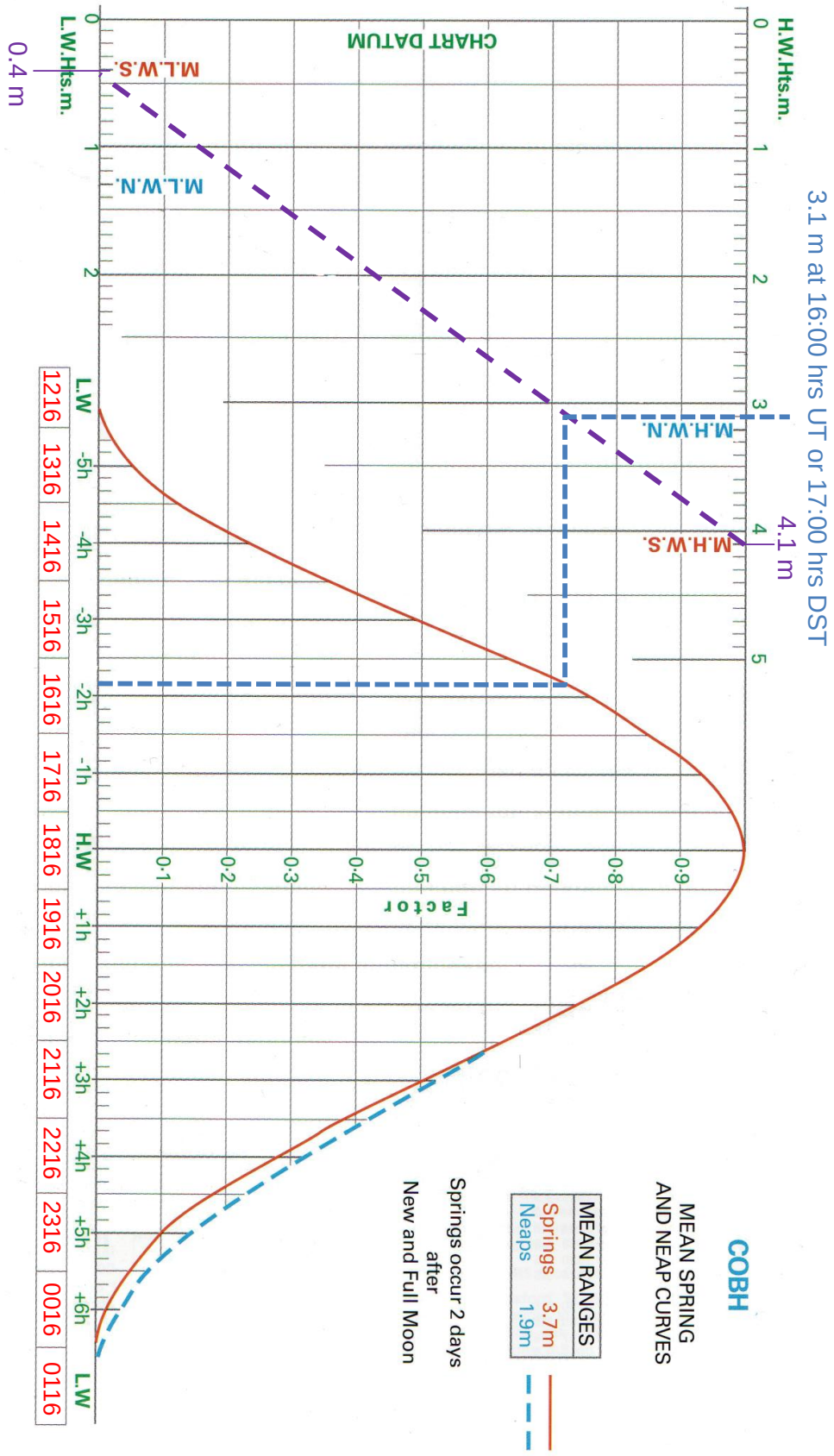
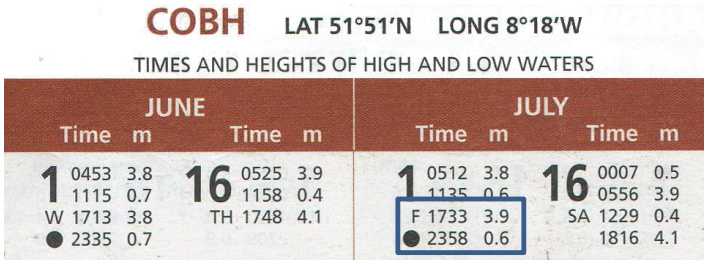


Figure 5: Cobh tidal curve

Calculating tide for a Secondary Port



COBH LAT 51°51'N LONG 8°18'W

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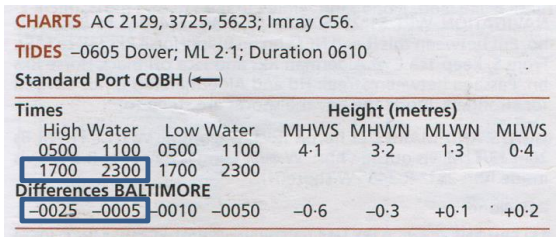
Cobh

1733 UT HW 3.9 m

2333 UT LW 0.6 m



CHARTS AC 2129, 3725, 5623; Imray C56.

TIDES –0605 Dover; ML 2·1; Duration 0610

Standard Port COBH (←)

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0500	1100	0500	1100	4·1	3·2	1·3	0·4
1700	2300	1700	2300				
Differences BALTIMORE							
–0025	–0005	–0010	–0050	–0·6	–0·3	+0·1	+0·2

Baltimore

1700 UT -0025

2300 UT -0005

Figure 6: Secondary port - Baltimore

What is the tide at Baltimore on the 1st July at 17:00 hrs DST (Local time) ?

For a secondary port it is a little more difficult to calculate. Again the working is in UTC so 17:00 hrs DST becomes 16:00 hrs UT.

First get the related HW and LW either side of the time the tidal information is required for from the associated standard port which in Baltimore's case is Cobh.

HW time at Baltimore

Next get the differences at Baltimore for the times around the required time, in this case 17:00 – 23:00 hrs UT.

Create a triangular diagram as shown in Figure 7 with the bottom axis containing the range of differences from -0025 to -0005 and the top axis the range of times from 17:00 – 23:00 hrs UT as extracted from the Baltimore differences in Figure 6. Join 23:00 hrs with -05. Find the HW time at Cobh (17:33 hrs UT on the top axis and from that point draw a line parallel to the line from 23:00 to -05 until it intersects the bottom axis. Now read off the time difference for HW at Baltimore. Therefore HW at Baltimore is at:

17:33 – 23 = **17:10 hrs UT**

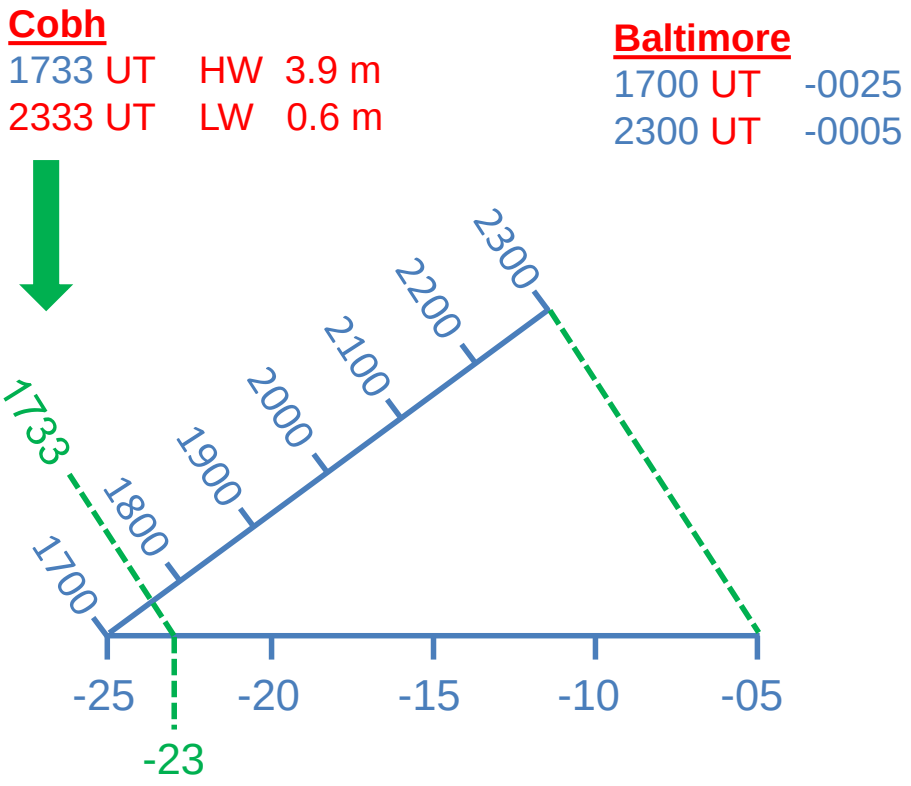
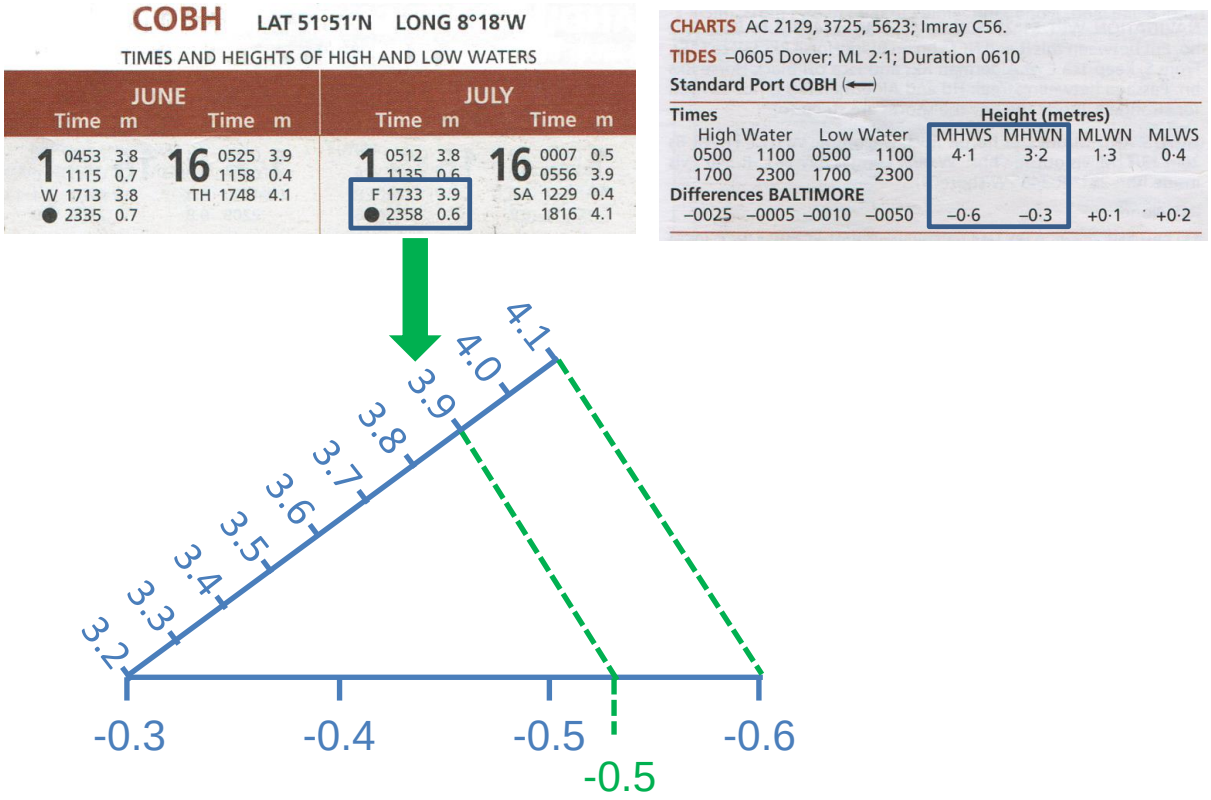


Figure 7: Time of HW at Baltimore

HW at Baltimore

Using a similar triangular diagram the HW and LW can be calculated. Using the MHWS, MHWN (4.1, 3.2) values on the top axis from the Baltimore section and the associated Baltimore differences (-0.6 and -0.3) as the bottom axis by using the HW value for the standard port of Cobh it is possible to draw a line on the graph parallel to the ends to determine the height difference for HW at Baltimore. Therefore HW at Baltimore is:

3.9 – 0.5 = **3.4 m**



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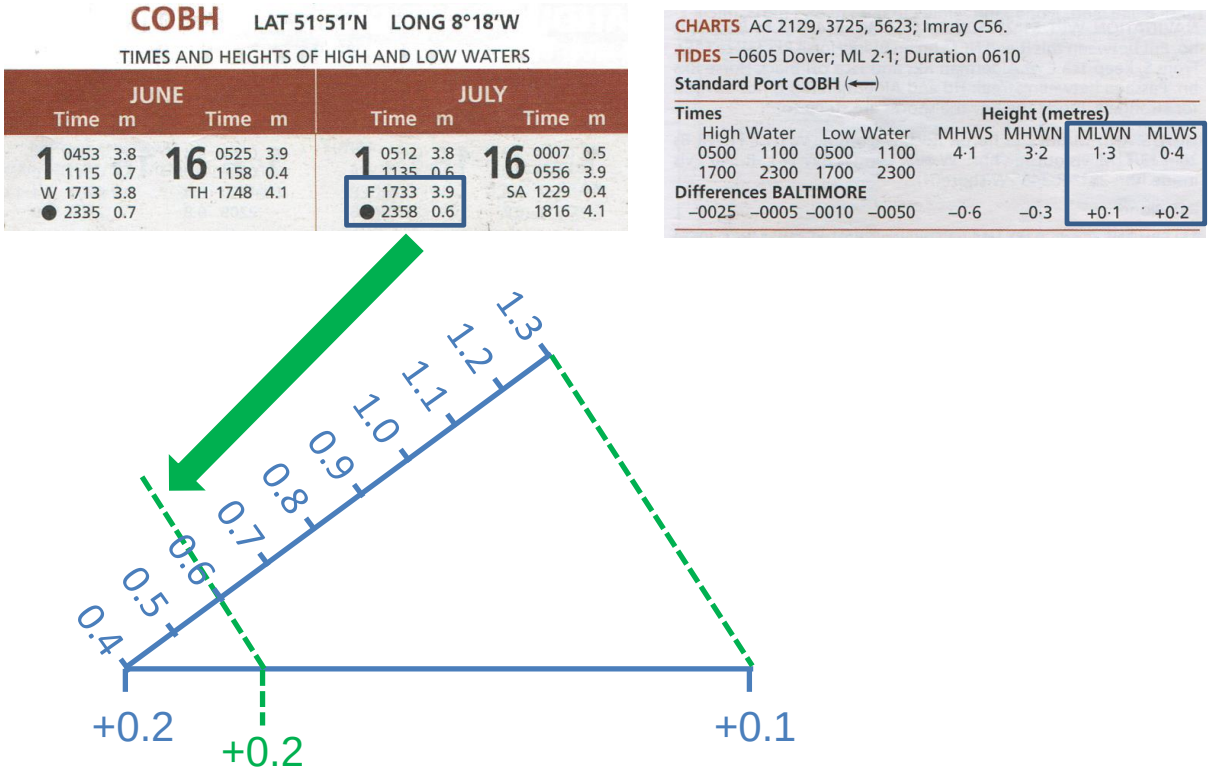
High Water		Low Water		MHWS	MHWN	MLWN	MLWS
0500	1100	0500	1100	4·1	3·2	1·3	0·4
1700	2300	1700	2300				
Differences BALTIMORE							
–0025	–0005	–0010	–0050	–0·6	–0·3	+0·1	+0·2

Figure 8: HW at Baltimore

LW at Baltimore

Using the same process but using the MLWN, and MLWS (1.3, 0.4) and the associated differences at Baltimore (+0.1, +0.2) the LW at Baltimore can be determined. Therefore LW at Baltimore is:

0.6 + 0.2 = **0.8 m**



COBH LAT 51°51'N LONG 8°18'W

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1700	2300	1700	2300				
Differences BALTIMORE							
–0025	–0005	–0010	–0050	–0·6	–0·3	+0·1	+0·2

Figure 9: LW at Baltimore

Baltimore

The information for Baltimore has now been determined and here it is put together in a table.

	LW	**0.8 m**
1710 UT	**HW**	**3.4 m**

Using this information a line can be drawn from 3.4 m to 0.8 m on the top and bottom of the chart. In the boxes at the bottom of the chart times can be inserted either side of 1710. Selecting 16:00 hrs UT a line can be drawn to the curve, across to the tidal line and up to the top of the chart where the water level can be read off for 16:00 hrs UT or 17:00 hrs DST where the level is 3.2 m.

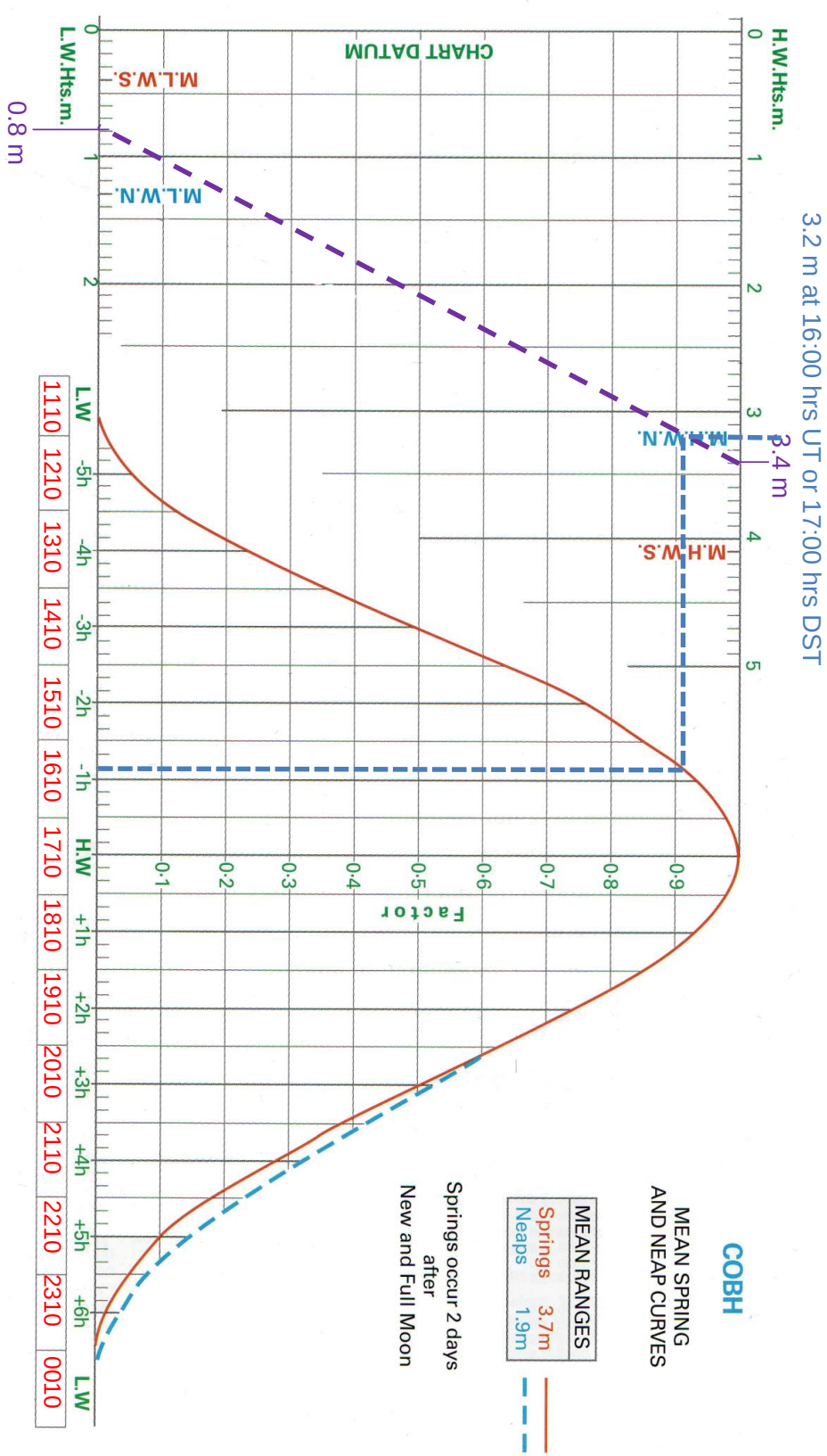

Figure 10: Tidal curve for Baltimore