

High Tides 2015

Forecast high tides and their potential impacts

October 2014

High astronomical tides (also known as “spring tides”) will be at their greatest over the next 12 months. The increase in the size and number of high natural tides this coming year means that there is a small, but elevated increase in the risk of coastal flooding.

What's at risk?

Approximately 1,400 properties are at risk from extreme or severe flooding (a 0.1% or 1 in 1000 chance flood occurring in any one year) in the Severn Estuary. Significant properties at risk include Dunstalls Sewage Works and Lakefield C of E Primary School in Frampton-on-Severn. Large portions of the A48 in Gloucestershire, and the Gloucester-Cardiff rail line between Newham and Broadoak, and just west of Minsterworth are also prone to flooding of this magnitude.

Approximately 150 properties are at risk from extreme or severe flooding in the Wye Estuary.

Generally, there are agricultural and Environment Agency owned defences on both banks of the Severn Estuary, however the Gloucestershire side of the Wye Estuary is undefended.

Why are the tides so high this year?

An astronomic tide is the regular and predictable movement of water caused by the way that the Sun, Moon and Earth move in relation to each other. The astronomical tides are notably high during 2014 and 2015 because we are reaching the peak of the 18.6 year tidal cycle in September 2015. This peak sees the position of the Sun, Moon and Earth align such that they combine to create a greater than average force over the tides. This means they are higher than the average for the 18.6 year period.

However, the weather conditions that generate a tidal surge, or extreme waves on the west and south coasts, will continue to be dominant factors influencing coastal flood risk.

When are the tides at their highest?

High astronomic tides alone do not cause a significant coastal flood risk. Significant coastal flooding is dependent on the combined effect of high natural tides as well as coastal surges and high wave conditions that low pressure systems often generate.

High astronomic tides can pass without incident, but even a moderately high astronomic tide when combined with a large coastal surge can result in severe widespread flooding.

This was the case on 5th December 2013 on the East Coast and on 3rd January 2014 on the West Coast. The highest natural tide of 2013 (occurring between 21st and 23rd August), however, passed without incident due to the absence of any tidal surge.

The table below notes all the key dates when high astronomical tides are forecast throughout 2015.

| | Newport | | Sharpness | | Max Severn Bore Star rating in set <small>(from http://www.severn-bore.co.uk/2015_times.html)</small> |
|------------------------|-------------------------|-----------------|-------------------------|-----------------|---|
| | Highest tide in set (m) | Warnings needed | Highest tide in set (m) | Warnings needed | |
| 22-23 January | 7.3 | Alert | 9.9 | - | 3 |
| 19-22 February | 7.5 | Warning | 10.4 | Alert | 5 |
| 20-23 March | 7.5 | Warning | 10.4 | Alert | 5 |
| 18-20 April | 7.2 | Alert | 10.0 | - | 4 |
| 30-31 August | 7.5 | Warning | 10.2 | Alert | 4 |
| 28-30 September | 7.6 | Warning | 10.4 | Alert | 5 |
| 27-29 October | 7.4 | Alert | 10.2 | Alert | 4 |

How do the tides compare to last winter and other years?

The table below shows maximum natural high tide levels (tide level in mAOD without weather generated surge) for 2013-2015.

It shows that the highest natural tide in 2015 is about 25cm higher than experienced in 2013 at Avonmouth. This increase in the difference in the underlying astronomic tide is important but less significant than weather effects on tide levels. All tide levels are either increased or decreased by the effects of the weather creating a tidal surge. Typically the difference in water level caused by the weather can be between 20cm and 30cm. On 3rd January 2014 the tidal surge increased the water level by 0.86m at Avonmouth. On the 5th December the tidal surge increased the water level by up to 2m on the East Coast.

| | Highest tide forecast in 2013 (m) | Highest tide forecast in 2014 (m) | Highest tide observed in 2014 [3rd January] (m) | Highest tide forecast in 2015 (m) |
|------------------|-----------------------------------|-----------------------------------|---|-----------------------------------|
| Avonmouth | 14.4 | 14.7 | 15.1 | 14.7 |
| Sharpness | 10.1 | 10.4 | 10.6 | 10.4 |
| Newport | 7.2 | 7.5 | 8.0 | 7.6 |

Surge forecasting

There are a number of weather factors which determine the extent of coastal flooding, including the height of the astronomical tide, the storm surge and the wind direction and strength. Varying wind velocity and atmospheric pressure will cause the actual tide height to be different from the published astronomical tide height. The difference between the astronomical height and the actual tide height is called the surge. Surges can be positive (adding to the tide height) or negative (reducing the tide height). Large positive surges can result in the overtopping of defences.

Surges in the UK are caused when a deep depression tracks across the Atlantic Ocean from west to east causing:

- Lowering of atmospheric pressure – for each 1mb drop in pressure, sea levels can rise by 1cm.
- Increasing wind speeds which push the surface of the sea forward causing the water to form a large 'bulge'.

Around the UK almost all locations are susceptible to surges, but estuaries and coastal geographies that allow funnelling are particularly vulnerable – such as the Severn Estuary.

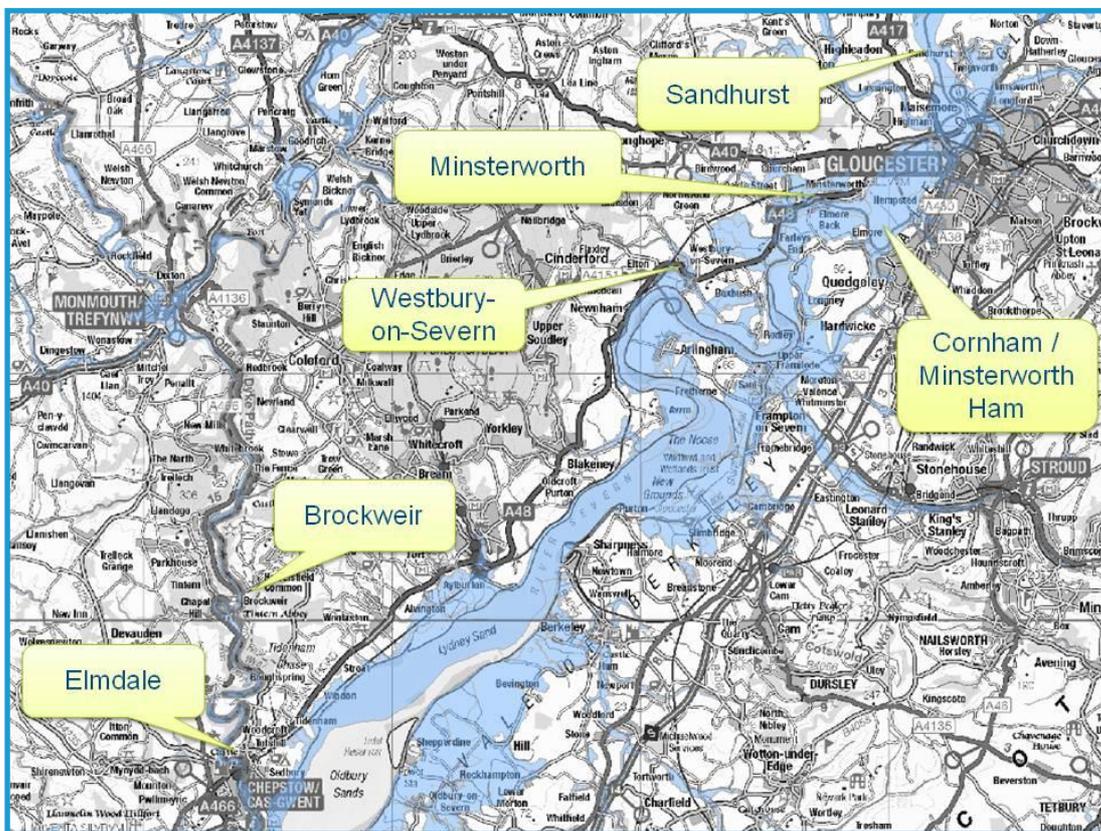
It is worth noting that the overall confidence in the weather and surge forecasts for the days ahead is likely to be in the following ranges:

- 5-8 days: >5-10% (very low)
- 4-5 days: 5-15% (very low/low)
- 3-4 days: 20-30% (low/moderate)
- 1-2 days: 30-50% (moderate)
- 0-1 days: 40-70% (moderate/high)

What was the scale of tidal flooding in 2014?

On 3rd January 2014, 27 properties were flooded from the high tide and tidal surge on the Severn and Wye Estuaries. Some locations in the upper Severn Estuary were affected due to high tides meeting high fluvial water. The map below shows the area that could be flooded from a 0.1% or 1 in 1000 chance of occurring in any one year flood and the communities that were affected on 3rd January.

Tidal flooding on the Severn and Wye Estuaries also occurred in 1st February and 2nd March 2014. The UK was subject to a conveyor-belt of Atlantic low pressure systems during winter 13/14 which increased the chance of a surge coinciding with a high tide.



customer service line
03708 506 506

incident hotline
0800 80 70 60

floodline
0345 988 1188
0845 988 1188

www.gov.uk/environment-agency

The table below highlights the highest tide-surge combinations during 2014:

| | 3rd January | 1st February | 2nd March | 12th August |
|-----------------|-------------|--------------|-----------|-------------|
| Avonmouth | 15.06m | 14.76m | 14.94m | 14.74m |
| Sharpness | 10.63m | 10.53m | 10.70m | 10.56m |
| Epney | 7.56m | 7.30m | 7.14m | 6.46m |
| Minsterworth | 6.16m | 6.08m | 5.98m | 5.13m |
| Gloucester | 4.05m | 4.24m | 3.78m | 2.70m |
| Newoprt | 8.01m | 7.86m | 7.91m | 7.77m |
| Tintern | 9.11m | 8.71m | 8.69m | 8.49m |
| Wind speed* | 20.25mph | 14.25mph | 13.75mph | 34mph |
| Wind direction* | SW | SW | SSW | ENE |
| Surge height** | 0.86m | 0.26m | 0.44m | 0.54m |

*mean wind speed and direction at Avonmouth over the course of the event; **surge height measured at Avonmouth

History of flooding

A significant tidal flooding event occurred during December 1999 on the Severn when a one metre surge combined with a high tide, producing levels of 10.71m at Sharpness. The following areas were reported to be affected:

- Minsterworth – 19 properties flooded
- Elmore Back – 5 properties flooded
- Waterend – 9 properties flooded
- Logney – 8 properties flooded

The most recent significant tidal flood event occurred on 3rd and 4th January 2014, where a surge of 0.8m coincided with a relatively high tide. The level at the Sharpness gauge reached 10.6m. Defences at Westbury-on-Severn, Longney and Minsterworth were overtopped. The following communities were affected:

- Minsterworth – 6 properties flooded
- Sandhurst – interaction with fluvial levels caused 12 properties to flood plus A147 closed
- Brockweir – 8 properties flooded
- Elmdale – 2 properties flooded (outbuildings and garages)

Severn Bore

The shape of the Severn estuary is such that the water is funnelled into an increasingly narrow channel as the tide rises, thus forming the large wave. The Severn bore **is not** the high tide - this follows shortly after.

The Severn Bore does not affect the way we respond to flood incidents, but many on lookers, surfers and other water enthusiasts, which may cause public safety concerns if the river is already full there is a danger that the bore could wash over the bank, endangering the onlookers.

MORE INFORMATION CAN BE FOUND IN THE GLOUCESTERSHIRE MAFP

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