

The River Trent - And Its Tides

Summary and Conclusion

1/ The river’s tides should be thought of as a “pulse” or “wave” that takes 12 hours to complete a cycle of low/high/low. It travels up the Humber Estuary into the River Trent, with its “peak” slowly catching up with the “trough” ahead of it. Thus, the period of “Flood tide” gets shorter.... The period of “Ebb tide” gets longer.

2/ While daily climatic conditions may have some affect, the two components that most affect the river height and currents are the tide, and the amount of “Fresh” – the “above normal” level of water in the river from inland rains.

3/ In the north, at the lower end of the river, the predominant factor affecting a craft will be the tide, but its strength and height diminish all the way to Cromwell lock. In the south, or upper reaches of the tidal river the “Fresh” can occasionally become the dominant feature, especially for low power craft.

3/ The tides are broadly predictable months in advance, the level of “Fresh” less so and while problems are rare in the summer months, the skipper of any craft on the river does well to watch the weather conditions and Flood Warnings issued by the Department of the Environment. The skipper of any “low power craft” should seek the advice of the Lock Keeper and be prepared to postpone a voyage if the “Fresh” levels are high, even if other higher power or more experienced skippers decide to sail.

IMPORTANT: The Canal and River Trust do NOT close the tidal River Trent because of flood conditions. While the Lock Keepers will give ADVICE if asked, the Trust see the safety of his craft as being the responsibility of the Skipper. This is a commercial river, and from Gainsborough to the sea is NOT under CRT authority anyway but is the responsibility of the Hull Harbour Authority (Associated British Ports).

Introduction To The River Trent “Tides”

Distances from Nottingham (miles)	
	36 Newark
Cromwell Lock	42
	53 Dunham
Torksey Lock	57
	67 Gainsborough
West Stockwith	72
Keadby Lock	85 Scunthorpe
The Humber Estuary (Not recommended for low power boats)	

The only difference between the River Trent above Cromwell Lock (about 5 miles north of Newark), and the 45 miles below Cromwell lock - its tidal!

Google tells us the River Trent is the third longest river in the UK, (behind the River Seven and River Thames) but is the longest if you count the “Humber” section (which, according to Google, is not a river, but “only” an estuary) For the “nerdy”, in terms of “Mean Flow” it might be the 4th largest river in the UK, discharging, on average 89m³/sec (That’s a swimming pool full every 10 seconds or less!) That’s less than the Rivers Tay, River Bann (in Scotland and N. Ireland where it rains a lot), it’s also less than the River Severn, but quite a bit more than the Thames. That won’t have helped you much - *Except to point out your inland boat insurance probably doesn’t cover you for estuaries.*

Size apart, like all tidal rivers, our river, about twice a day the river level rises, and then falls, with a corresponding change in direction of flow...simple?

For the newcomer to the tidal river, like crossing a busy road, before you do it for the first time you need to know something of the "flow" and take some time to consider how to do it safely! But once you have done it once, you will (hopefully), still take care and treat it with respect, but you will wonder what you were worried about!

This document is an amateur but expanded "explanation" of the river's "flow". Better diagrams and photos (and perhaps simpler text!) are available in John Lowers book (Available from the Chesterfield Canal Trust bookshop) and is strongly recommended!



The Basics About Tides - That You (Probably) Already Know!

Any tide, anywhere, is the result of the gravitational pull of the Sun, and more particularly the Moon, on the world's oceans. A "full moon" or a "new moon", when the three bodies (Sun, Earth and Moon) align in space, give big tides (called "Springs"), and two weeks later, a half-moon when the three bodies are in a triangle, gives smaller tides (called "Neaps").

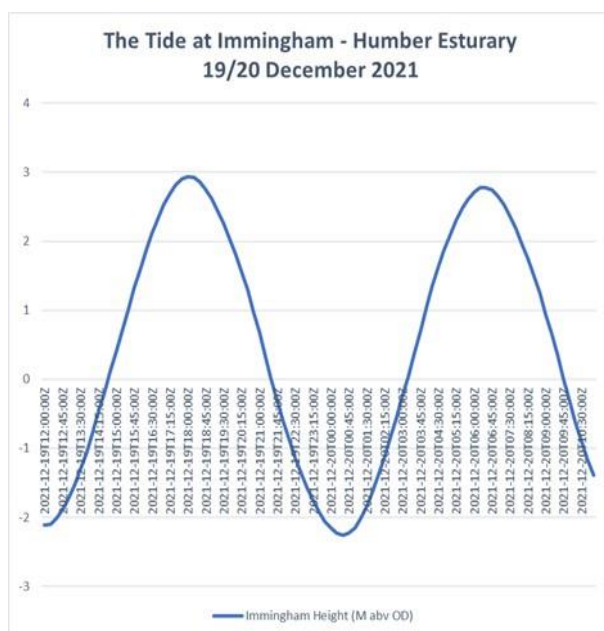


Fig A -This is the height of the tide (meters) at Immingham for 24 hrs on 19/20th Dec 2021. (This day had "weak spring" tides.)

The Earth rotates under those two "heavenly bodies" and hence twice a day, the water level drops, the tide "goes out", then a little over 6 hours later it "comes in" again. Easy??

It gets more complicated when the edges of the "ocean" get more complex, or other factors come into play. In our case its the 90 miles of twisting river between the North Sea and on, up to the Cromwell Lock near Newark, via the enormous Humber Estuary. It takes the first of the rising tide the best part of 11 hours to reach Cromwell Lock – but only around 5 hours for the High Water to make the same journey behind it. Nothing of this "battle up the river" except the rivers direction of flow is immediately apparent to the onlooker. Its all very slow and undramatic. But to the boater it's much more confusing, and more important!

The "Shape" of the Tide – Immingham to Keadby

To illustrate how the tide works in Humber Estuary and up into the River Trent, the actual water level gauge readings are recorded here for Immingham, Keadby, Gainsborough and Torksey for an average day in December 2021. (Unfortunately, there is no such facility at Cromwell Lock) On the day you choose to venture onto the Trent, these numbers may be slightly higher, or slightly lower – but the principles will be the same. AS LONG AS THE RIVER IS NOT IN OR APPROACHING "FLOOD ALERT" CONDITIONS.

Fig A for Immingham shows a conventional “tide curve”. For 6 hours the tide “floods” into the Humber Estuary, and for 6 hours – it “ebbs” out again. It takes 12 hours to complete a cycle (its actually about 12.5 hrs which is why the tide today is about an hour later than yesterday).

However, for the tide to progress up the Humber Estuary above Hull, and then into the River Trent, the rising tide must “battle” up the river both against:

- the (slight) slope of the land, and;
- the outflow from the river.

As the tide in the Estuary starts to overcome the river, its momentum builds, and the “high water” will advance at a significantly faster rate than did the “first of the flood”. Thus, the first of the rising tide – known as the “Flood” - is slowly overtaken by the “High Water”. This changes the shape and nature of our “tide curve”

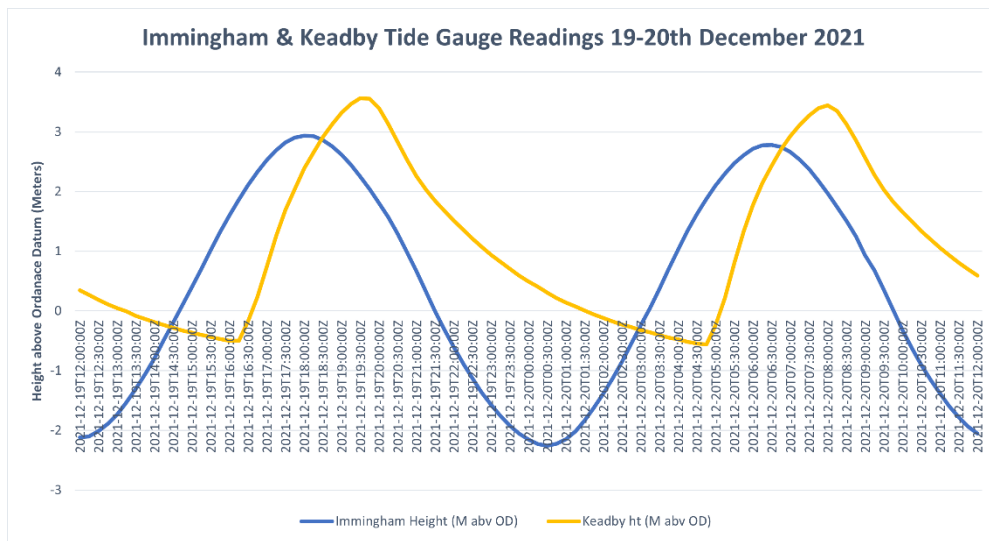


Fig B – The Low Water and “Flood” at Keadby (Tide shown in yellow) are about 4 hours later than at Immingham (shown in blue) But the “High Water” at Keadby (Tide shown in yellow) is only about 1.5 hours later than it was at Immingham (shown in blue), Thus the “rising tide” in Keadby only lasts about 3.5 hours and the “falling tide” lasts 8.5hrs

While none of the shape can be easily seen while standing at any one location because this is a relatively minor “height change” over a relatively long period, it may be useful to think of each tide as a “pulse” or as a “wave” moving up the river. Its shape changing as it goes. As it passes, the boater is waiting to catch the ebb or flood side of that wave to progress up, or go down the river.

More complicated - Although the waves actual difference in height from “peak” to “trough” may diminish as it goes up the river (the “tidal range”), the speed of change may increase (i.e. the graphic lines get steeper). The steeper the line, the faster the river current is likely to be, (though the amount of water trying to come down the river also has an effect and can in extremes stop any inflow current), thus the incoming tide at Keadby is generally “faster” than outgoing ebb..... but the rate of change significantly diminishes towards the change of tide (the lines get less steep!) – particularly the last hours of the ebb tide at Keadby – a useful fact if heading there!

Important facts about these diagrams:

1/ You may hear Lock Keepers or other boaters saying, “The tide does 12mph” (or 15mph or similar)*. *Such talk is somewhat alarming to a new skipper of a boat that does less than 6mph??* But it is meaningless in real terms. The actual “river flow” the boater will see is very variable on a number of factors, but it is the steepness of the lines of these graphs which will determine the “tide” influence on that speed. The actual river flow speed, a product of the tide AND the “Fresh”, probably approaches 4-5mph at its maximum outside times of the river flooding its banks, and passages are timed for boats to cope with this. (It is exhilarating for the average narrowboater to have a “Speed App” on your phone to give you your speed over the ground!).

*(The speed they are describing is the “average” speed the top of the tide (the peak of our wave) as it progresses up the river from Keadby. It is VERY variable anyway, but on this day, the peak travelled at an average of 23mph from Immingham to Keadby, but only 10mph from Gainsborough to Toksey. While the “Flood” only achieved about 8 or 9 mph all the way to Torksey....)

2/ The heights given are converted to meters above “Ordinance Datum” (“mean” sea level for UK) and is used here to base all the four gauges on a consistent standard. This is NOTHING to do with the depth of water in the river under your boat. Mariners generally use “Chart Datum” for navigation purposes, (“lowest” sea level at locality) but the conversions for this change significantly with your position in the river. *There are several different “datums” used along the river, and the boater always needs to be careful of this if discussing “depths”.* **Electronic charts with “Sonar overlays” in particular must be used with EXTREME caution as to accuracy of depths indicated.**

3/ While “Immingham” is referenced here as representing the Humber Estuary because of its tide gauge, the “Standard Port” for calculating passage times on the river is the nearby “Hull (Albert Dock)”

<p>IMPORTANT: These tide diagrams are taken from gauges belonging to the Environmental Agency (EA). They are flood control meters which are NOT intended for boaters use. The EA are much more concerned about accuracy at the top of the tides than at the bottom, and errors may occur that are not highlighted or obvious. The gauges each use give different “datums” for each location (Which have been corrected for this document). The reference to “normal” river levels on the web pages that display this information simply refers to the level at which the river is staying within its banks, so the prudent skipper will NOT use the reference to “normal” as meaning the river is “Safe” for him to proceed.</p>
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Keadby to Gainsborough – The Tides Progress

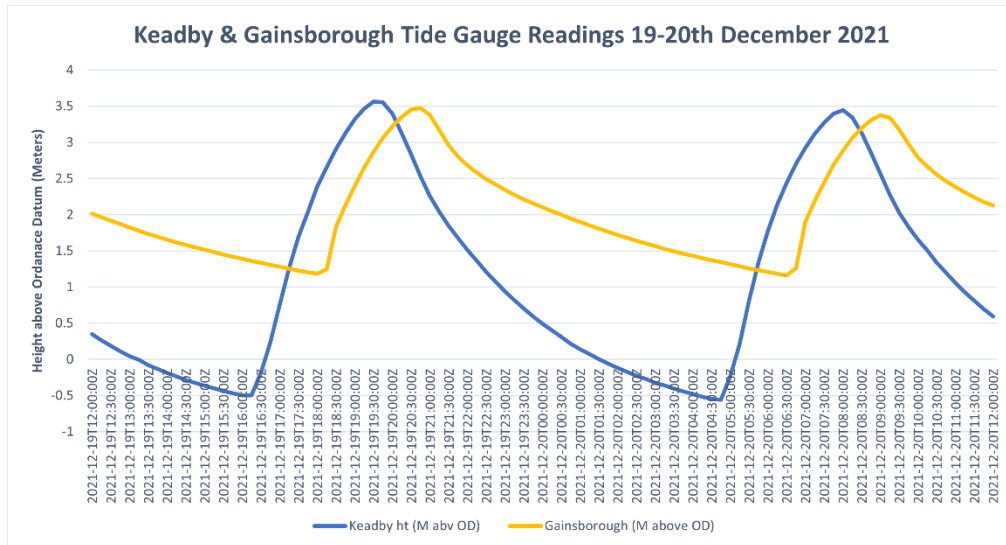


Fig. C – The Keadby tide (Blue line) and Gainsborough tide (Yellow line) Unfortunately there is no gauge at West Stockwith

The riverbed continues to rise, continuing to reduce the tide “range” and slow the speed of the tide passing up the river as its strength starts to wane, but the “High Water” continues to slowly overhaul the “Flood” ahead of it such that the period of rising tide is now about 2.5hrs, and the ebb, the falling tide extends, to about 10hrs.

The early flood tide leaving Keadby is probably the strongest *tidal* influence on the river flow but approaching high water it gradually slacks off a little. (The graphic is less steep) For this reason, skippers heading only to lock up out of the river at West Stockwith from Keadby are usually recommended to stay in Keadby for the first hour of the flood so that the river flow at Stockwith is more manageable.

There is usually a short period of “slack water” at high water, with little or no flow in the river, but the only time this is of much benefit to the skipper is for arrival at West Stockwith from Keadby, but even this is an uncertain target. There are only rarely more than a few minutes of “slack water” at “Flood”.

While the river can and does “flood its banks” after periods of prolonged and heavy rain inland (the “low powered” boater should check for these warnings and probably avoid the river at such times), lesser rain quantities can still cause greater than normal river flow which the lock keepers will give you as “Fresh at Cromwell” (See a separate document in the Group Files on “Fresh”). It is from Gainsborough up stream that the effect of “Fresh” can now start to be most felt, and this is particularly true of the section from Torksey to Cromwell.

Trentlink – Safe Navigation on the Tidal River Trent



Three narrowboats released onto the River Trent just above West Stockwith in 2018. Shortly after their departure the river “overtopped” its natural banks (marked by the bushes). There was a “Flood Alert” in force (but presumably nobody read it?), and this departure should probably not have happened. BUT CRT WILL NOT CLOSE THIS RIVER, and this departure was the decision of the skippers. These boats will likely have had a VERY uncomfortable trip to Torksey as the flood tide will have been short lived and weak, while the river flow that then turned against them will have been strong. (At Torksey they probably found the flood gates were closed preventing access anyway)

It is this type of, very preventable, journey that has led to scare stories around the Inland waterways about the Trent tides.

The Aegre (or Aegir)

The “Aegre” is a “tidal bore”, At a maximum of around 1.4m high, it is somewhat smaller than its more well-known cousin the “Severn Bore” which often makes the headlines with surfers and paddle boarders hitching a ride for many miles up the River Severn. This wave passing is an “instantaneous” change of direction of the tide caused by strong flood tides and strong opposing river currents.

On the River Trent, these waves only happen when:

1. The high tide at Hull (Albert Dock) is around 8m or above, ABOVE CHART DATUM (This is a large spring tide)
2. At the time of the first of the “Flood” (So the river is at its lowest immediately before the bore passes. (Boats preparing to lock down onto the river on that “Flood” will not have been released into the river even under normal conditions)
3. They are at their maximum between Keadby and Gainsborough and are generally “killed” by the Gainsborough Road bridge though some traces may remain to Torksey.

While a spectacle to watch, Aegre waves are best avoided on an inland craft if possible, but emergencies aside, it is only if a boat remains at Gainsborough pontoon mooring through a low water, that a boat following the guidance in these documents is likely to be exposed to such a wave.

If you are caught on the river, it is wise to be in the centre of the river and pointing towards the wave as it passes.

Gainsborough to Torksey – The Tide Progresses

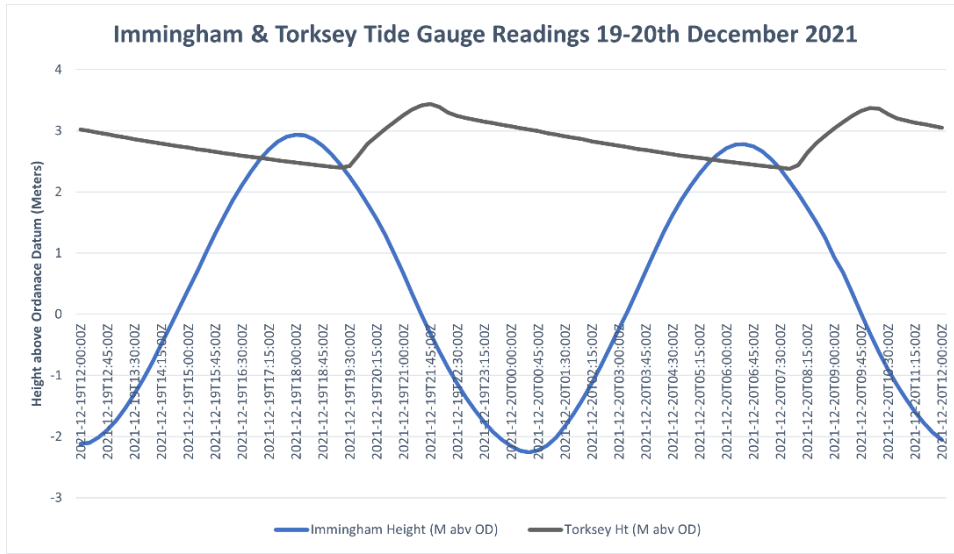
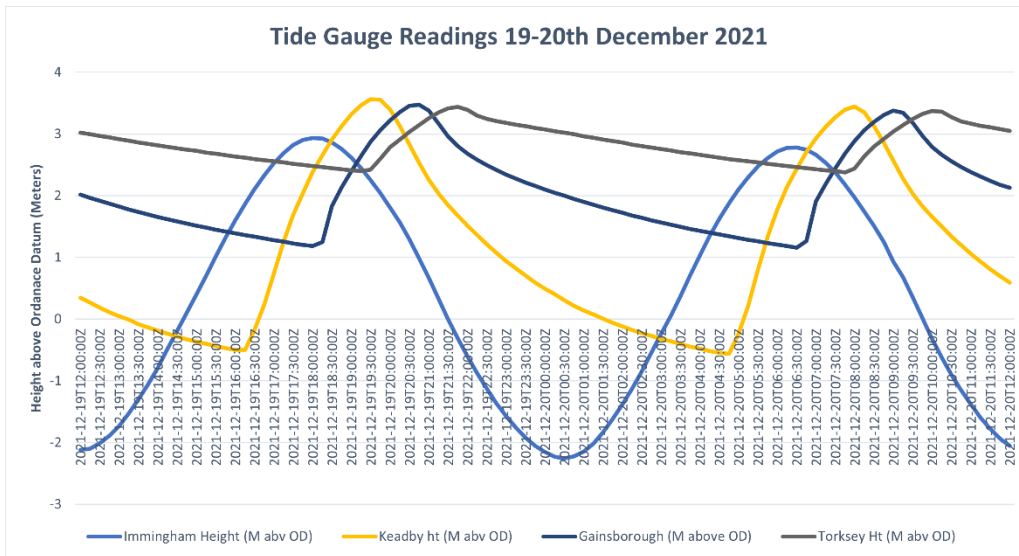


Fig D The “original” tide shape at Immingham (In Blue) and the shape of that same tide at Torksey (in Black)

Some 7.5 hours after “The Flood” of this particular tide started to push its way up the river from Immingham, it reaches Torksey, a distance of some 62 miles, and a “climb” of some 5 meters. Behind it the “High Water” has travelled the same distance in just 3.5hrs, Our wave is slowing down now as the tide enters the upper reaches. From Gainsborough to Torksey the boater will still find some sharp river bends where turbulence will mark that the tide has not yet lost all his power, but overall, the tide is weaker (the Torksey graphic lines are not so steep).



This graphic shows all these four tide gauges for this same tide, against the consistent height datum, and illustrates how the “Flood” is having to climb up the river (Almost 5 meters in this case from Immingham to Torksey, and the effect this has on the speed of advance of the flood. The “High Water” behind makes better speed, hence the very apparent short “Flood Tide” at Gainsborough and Torksey. Note how “Low water” at Gainsborough nearly matches the next “High Water” at Immingham.

Tides Progress to Cromwell Lock

With no “level gauge” recording heights at Cromwell the exact nature of the tide compared with the rest of the river is not easy to confirm, but the front of our “wave” of tide likely continues up the river from Torksey reaching Cromwell Lock about 2.5 hrs later, while the flood still attempts to catch up – so the tide has really lost much of its influence by the time it reaches Cromwell, with a “flood tide” that lasts only about an hour, and will raise only 0.5m to 1m.

Here though, the amount of water in the river coming from rainfall inland is a more critical consideration. While the tide alone allows considerable flexibility for even low power vessel movements around Cromwell (especially on the weaker “Neap” tides), the volume of the water in the river means that the prudent skipper will fully discuss his plans with the Cromwell Lock keeper over the couple of days before he is due to depart Cromwell.



Cromwell Lock and its impressive weir seen from the air, looking downstream. The lock offers usual CRT facilities and has a pontoon mooring just before the approaches (seen at bottom of this shot) and another below the lock. There are numerous higher moorings on the approach walls. The tide has limited effect here, but the rate of flow of water over the weir can be very significant and is impressive even at “normal” flow rates.

Photo courtesy of John Evans

The Effect of Increased River Levels From Inland Rainfall:

floodline@environment-agency.gov.uk <floodline@environment-agency.gov.uk>
Sun, 26 Dec at 16:29
A Flood Alert has been issued by the Environment Agency.

Flood Alert in force: River Trent from Cromwell Weir to Gainsborough.

Flooding is possible for: River Trent from Cromwell Weir to Gainsborough including The Flood Road, A156, Dunham Road and Gainsborough Road.

Be prepared.

River levels are forecast to rise at the Torksey river gauge as a result of recent heavy rainfall. Consequently, flooding of roads and farmland is possible from early on Monday morning, 27/12/2021. Areas most at risk are Church Laneham to Rampton Road. Flooding of properties is not forecast at this point. We are closely monitoring the situation. Please avoid using low-lying footpaths near local watercourses and plan driving routes to avoid low-lying roads near rivers, which may be flooded.

This message will be updated tomorrow morning, 27/12/2021, or as the situation changes.

To check the latest information for your area

* Visit the GOV.UK website to see the current flood warnings, view river and sea levels or check the 5-day flood risk forecast: <https://check-for-flooding.service.gov.uk/target-area/034WAB424>

A typical “Flood Alert” for the tidal Trent issued by the Environment Agency. These can be found on many websites, It is free to sign up to receive warnings from “Floodline”

Relatively rare in the summer months, but high levels of rainfall in the River Trent’s catchment area can (unsurprisingly!) lead to higher water levels than “normal” in the river. This “extra” is known locally as “Fresh” and is measured (in feet) by the lock keeper at Cromwell and passed to other locks when its applicable. (See document “Fresh” in Group Files for more detail). Readings of “2 feet of Fresh” are considered almost advantageous to the boater by the TBA “Chart” booklet, as they increase the level of water over the shallow patches, but this extra water in the river also affects the flow of the river, and the shape of the tides:

The newcomer on a low powered craft is recommended to enquire at the level of “Fresh” at Cromwell if rainfall has been heavy. Low levels of “Fresh” are unlikely to lead to Flood Warnings, and this increase in river current is generally said to have diminished to “half” by the time the boater reaches Torksey, and to have “disappeared” by the time he reaches Gainsborough. Such levels can be expected to “slow” the passage from Torksey to Cromwell, but probably not prevent the voyage.

Higher levels of “Fresh” will indicate the river may be heading for “Flood” conditions, in which case the tide as described in the early sections of this document will start to be affected. The levels reached by “low water” will raise significantly, and while there will still be a “flood tide” which will raise the level of the river, the actual river current within that “flood” will be much weaker, and significantly, much shorter in duration. (The incoming flow may totally disappear in flood conditions)

BOATERS MUST BE AWARE.... if you are leaving any lock to head upstream, when you enter the lock, the river will be at “low tide” – it may not APPEAR to be in “flood condition” but may be so! Lock Keepers SHOULD warn you of this condition, but this should not be relied upon. If you enter the river in these conditions the river may overtop its natural banks at the top of the tide, and the incoming tide you are relying on to make easy passage may be weaker, and shorter than was planned.

River flow levels - In Conclusion

Serious flood conditions are thankfully rare in summer. They are predictable and noticeable, and should anyway, be alerted to you by the lock keeper. But because a skipper of high-power sea going cruiser decides it has no problem in setting out – the circumstances for a low power boat, with little knowledge of the river may entirely justify a delay. Be aware, as stated previously, the CRT lock keepers DO NOT CLOSE the navigation of this commercial river as happens on rivers such as the Soar. But because its “open” does not mean it is suitable for your planned passage. *Take advise if in doubt.*

The last page of this document contains a traditional “Red/Yellow Green” river gauge which the inland boaters will be accustomed to on non-tidal rivers and may be used to supplement information from the lock keepers. Obviously, such a board will not work on the tidal Trent, so the water level for this “virtual” board must be taken from the Environment Agencies Flood Gauge at North Muskham – just above Cromwell lock and non tidal:

[Click here for North Muskham EA Flood Gauge](#)

Lastly – Two other “Nerdy” facts on the Trent Tides!

1/ In the river, low water and the start of flood are NOT necessarily the same time! Nor does the highest level of tide occur just as the tide starts to ebb! In the river the height of tide may start to change anything up to an hour, but frequently 20 mins, before the direction of flow changes.... This rarely has any affect on the visiting boater except advance or delay the time he leaves a lock (Anybody consulting the Admiralty Tide tables for Keadby will notice the “Low water” times are significantly different to when you can leave on “Flood”.)

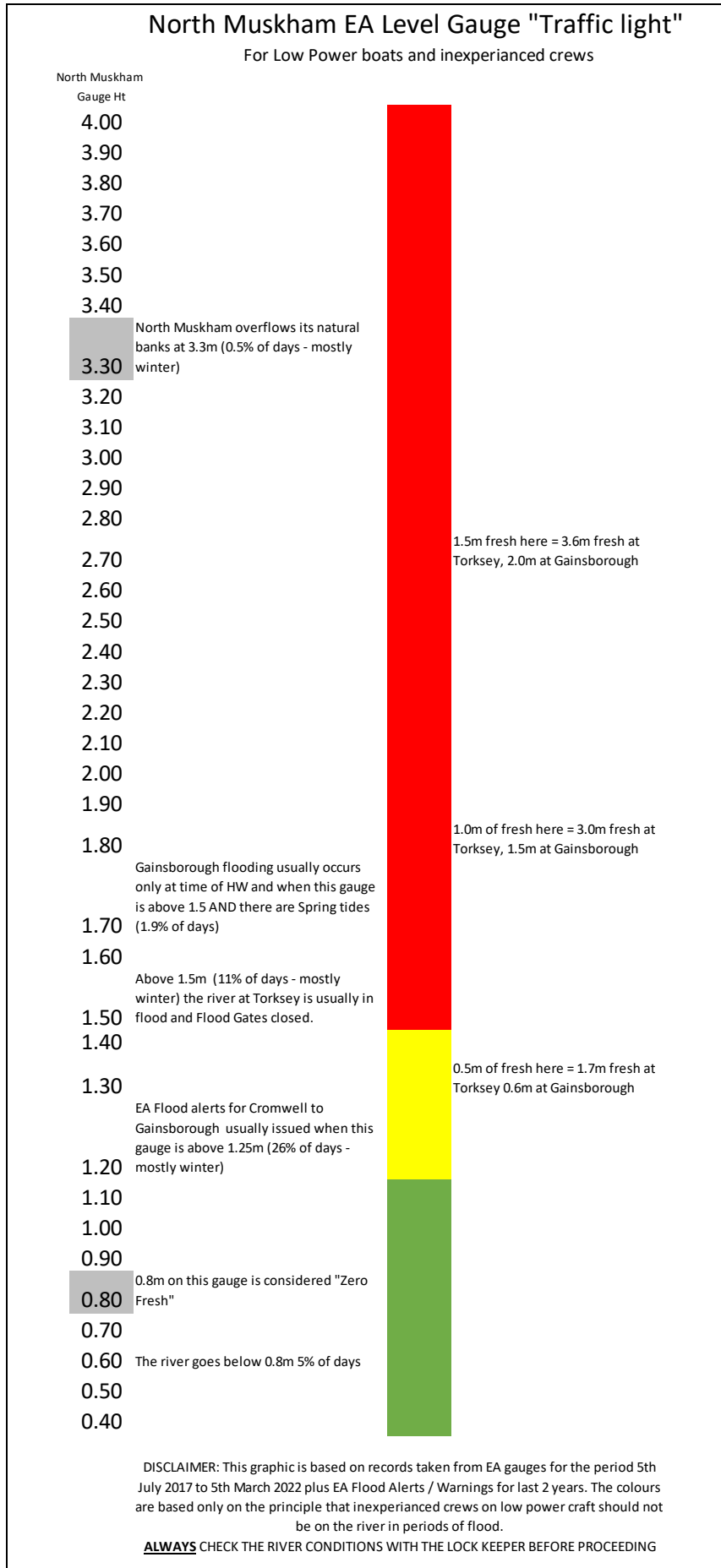
2/ Skippers familiar with tide theory will expect that “low water - springs” are considerably lower than “low water – neaps”. Springs are supposed to be the BIG tides... But in the river, this is NOT the case. While “High Water – Springs” certainly are bigger than their “neap” equivalent, this is NOT true of “low waters” which sees little difference between the two, indeed, the neap low water may be the one that gives most problem with entry over the lock cills.... But even a small amount of “Fresh” in the river will likely disguise this problem.

Bottom Lines:

- If in doubt – Ask!
- If still in doubt – don’t go on the river until your comfortable!

Like Crossing the road – once you have done it once, you will wonder what the fuss was about!

Trentlink – Safe Navigation on the Tidal River Trent



Disclaimer: All Information on the Group is given in good faith but is used entirely at your own risk.