

Thames Estuary Tidal Power Report

1. Introduction

The PLA is undertaking a study on the potential for the use of tidal turbines in the river Thames. Generally tidal turbines are limited by tidal velocities, the depth of water or the location they are to be placed as there are many other obstructions and uses for the river.

For this assessment we have only focused on velocities at 1m/s as this in general is the minimum velocity that tidal turbines will start working at. Depths, operations and environmental zones have not been assessed but the authorised navigational channel has been included to show how this limits the usable area of river for development.

2. Methodology

Most tidal turbines can only start to operate in a minimum flow velocity of 1m/s. Using the joint PLA, EA and HR Wallingford 2D numerical flow model created using the PLA's riverbed survey data we are able to predict the flow speeds and direction over multiple tide cycles. (For more information on the model please refer to <http://www.pla.co.uk/Environment/Understanding-the-Thames-Estuary-Development-of-a-numerical-flow-model>)

For this study we used the average velocity magnitude to provide the most representative tidal velocities in a normal spring-neap tidal cycle. We then interrogated this data to show the areas where the tidal velocity exceeded the 1m/s threshold at any given time within the tide cycle, if it exceeded this it was given the value 1 or if it was below it was given the value 0. These values were then added together over the whole of 5 tide cycles and divided by the amount of data steps within that time frame; this gave the percentage value that each point on the river remained above 1m/s. This percentage value could then be used to create a map indicating the amount of time the flow would exceed the 1m/s threshold within a given time frame such as one day (24 hours).

The Thames is a heavily used river for commercial and recreational purposes amongst others and therefore has a designated navigation channel as well as many operational wharfs. The PLA navigational safety policy states no obstruction to navigation should be placed within 15m of the authorised channel to allow the margins to be used by recreational vessels. It was therefore decided to create a 15m exclusion buffer around the channel from Richmond down to Crayfordness. Downstream of Crayfordness this authorised channel buffer has been widened to 20m between Crayfordness and Northfleet, 50m between Northfleet and Mucking and 130m between Mucking and the estuary. This was to represent the leeway needed by the different vessels that navigate in the different areas of the river. These buffers were overlaid on top of the flow map using a geographic information system (GIS) which allowed further analysis against the PLA's navigational charts.

The whole area of the river was then separated into 6 separate chart areas at a scale of 1:40000 at A3 and published to PDF to allow easy viewing of the data outside of the GIS system.

3. Results

3.1. Reach 1

Reach 1 spans from Richmond Lock to Chelsea and shows almost no tidal velocities above 1m/s. The few places these do occur are around anthropogenic objects such as bridges and are often strongest in the central arches within the main authorised channel.

3.2. Reach 2

Reach 2 extends from Chelsea to North Greenwich and actually shows velocities exceeding 1m/s especially around Vauxhall and Blackfriars where flow speed is 1m/s for more than 14 hours per day. These flows are almost entirely contained within the authorised channel or between bridge arches.

3.3. Reach 3

Reach 3 covers the area from North Greenwich to Coldharbour Point and is slightly less active than reach 2. The area of greatest time at 1m/s is through the central spans of the Thames Barrier for about 11 hours of the day but again this lies well within the navigation channel. An area of potential is at Jenningtree point where we observe flows at 1m/s or above for about 10 hours of the day and is outside of the channel but this would require further study and a review of operational piers and moorings in the area.

3.4. Reach 4

Reach 4 spans from Coldharbour Point to Tilbury and the majority of the channel reaches 1m/s flow for 4 hours or more per day. The greatest length of time is observed at Broadness where flows are at 1m/s for up to 16 hours of the day. Most of this flow is again within the authorised channel but there are potential areas observed outside the channel at Stoneness and Broadness with the area between these two also showing flows of 1m/s for about 6 hours a day outside the channel.

3.5. Reach 5

Reach 5 spans from Tilbury to Holehaven and again the higher flows generally follow the main navigation channel. There are areas outside the authorised channel that do show flows of 1m/s with the greatest of these seen within Gravesend reach showing a max of 9 hours of 1m/s flow.

3.6. Reach 6

Reach 6 spans from Holehaven to the Yantlet Flats again the flows at 1m/s occur around the main channel but as the river is significantly wider in this location the time the river flows at 1m/s are reduced to a maximum of 6 hours per day in the entire reach.

4. Discussion

The aim of this study was to provide an overview image of the expected flows within the tidal Thames. From studying the results within each of the reaches it is clear that the majority of flow occurs within the main authorised channel of the river and therefore are unsuitable for any development in terms of tidal energy.

A few locations were identified as showing flows of 1m/s for a reasonable time outside of the authorised channel however any applicant would have to consider water depths, operational berths, moorings and protected sites that have not been assessed within this study in considering these locations.

This assessment was also run using a 2m/s threshold which indicated the river outside of the channel does not reach this speed of flow. Blackfriars bridges in central London does reach 2m/s but is already significantly constrained and at threshold for migrating fish so this area has been discounted.

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