



# Coping with sea level rise uncertainties in the Thames Estuary

## FRMRC2 has produced:

- New insights into the limits to adaptation of the Thames Estuary flood defences to sea level rise.
- New methodology for analysis of uncertainties in flood risk management decisions.

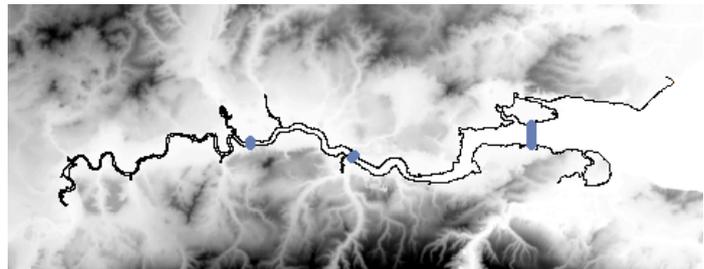
## Intended readership:

- Environment Agency
- GLA, land use planners
- Engineering consultants

## Where to find more information:

- [www.floodrisk.org.uk](http://www.floodrisk.org.uk)

Possible barrier locations

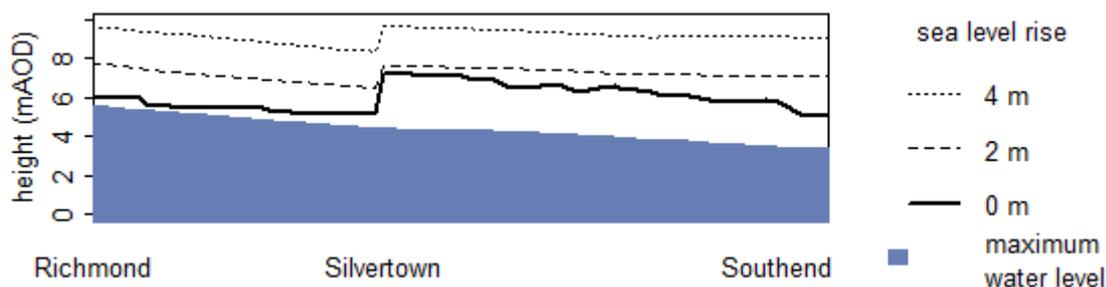


## Summary

In FRMRC the Thames Estuary has been used as a case study in long term decision making under uncertainty. There are severe uncertainties surrounding the rates of sea level rise that should be used for long term planning of tidal defences and land use. Here we explore the implications of the so-called High++ scenario of 2.95m sea level increase in the 21<sup>st</sup> Century and continued sea level rise thereafter. The following flood risk management options have been analysed:

- Defence level raising
- Frequency of barrier closure
- Alternative barrier locations
- Pumping
- Closed barrier with locks

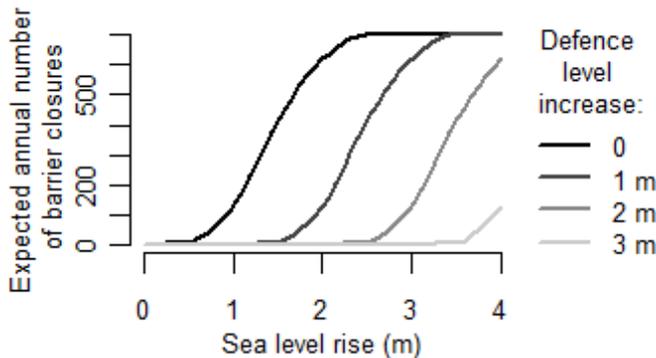
Present and assumed future defence levels along the Thames Estuary



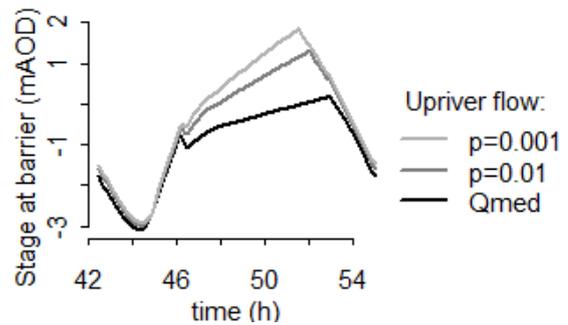
The Environment Agency's TE2100 project found that a small increase in sea level rise can be accommodated by over-rotating the barrier. Earlier closure can also reduce maximum upriver water levels. With increasing sea level rise, the barrier will need to be closed more frequently to protect central London. Frequency of barrier closures can be balanced with upriver defence level raising.



*Barrier closure frequency, for different sea level rise and defence level increase*



*Upriver water level during barrier closure, for different river flow rates*



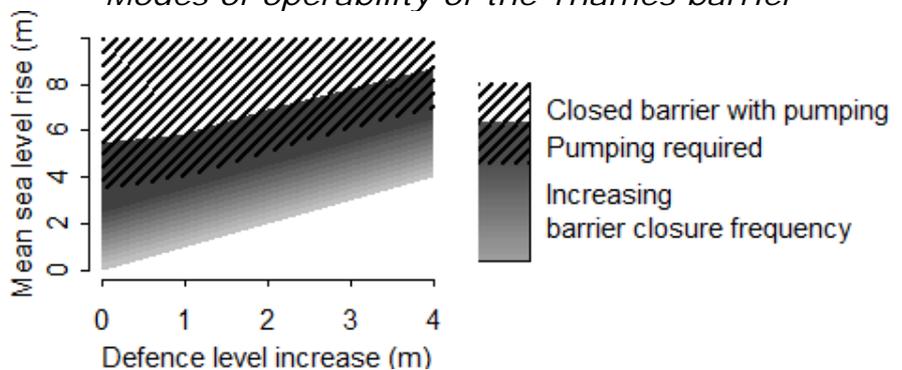
Pumps may be installed to reduce the maximum water level upriver of the barrier during closure and limit the required defence raising through central London. The requirement for pumping depends both on mean sea level, which determines the water levels in the estuary when the barrier is closed, and on river flow, which determines the rate of water level rise.

Eventually pumping is required on every tide and for all river flow rates. When gravity drainage is no longer possible at low tide, the barrier must remain closed, with river transport enabled by locks, and river drainage by permanent pumping.

At alternative, downriver, barrier locations, closure frequency would be the same as present but pumping during high tide will be less effective owing to larger upriver water storage volume.

Permanent closure of the barrier would be required at the same sea level as at the current location.

*Modes of operability of the Thames barrier*



**Research Team**

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FRMRC is an interdisciplinary research consortium made up of partners from universities, government bodies and practitioners supported by:

- Engineering and Physical Sciences Research Council
- Department of Environment, Food and Rural Affairs/Environment Agency Joint Research Programme
- United Kingdom Water Industry Research
- Office of Public Works Dublin
- Northern Ireland Rivers Agency

Data were provided by the Environment Agency and the Ordnance Survey.