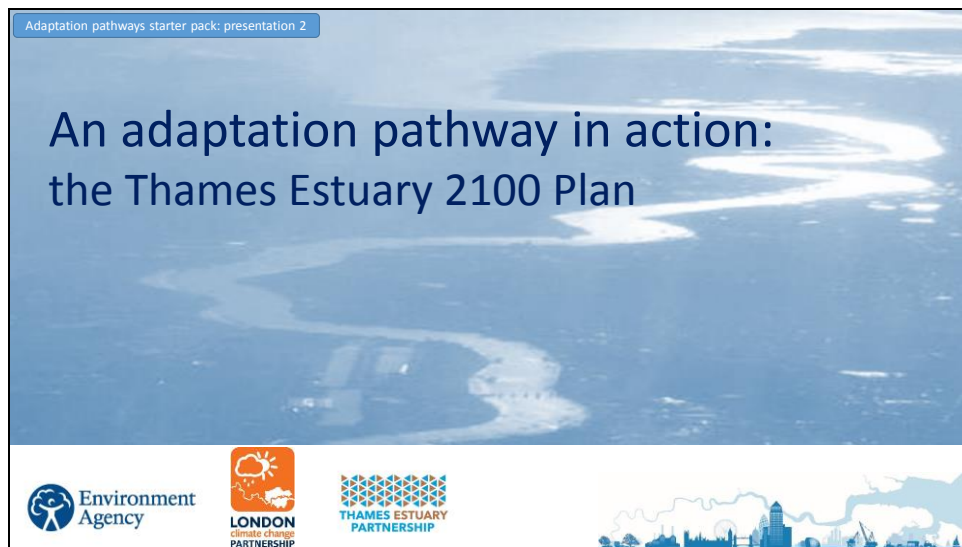


Slide 1



An adaptation pathway in action: the Thames Estuary 2100 Plan.

This presentation follows on from a general introduction to adaptation pathways. We will use a case study to see how the principles introduced in the previous presentation work in reality.

Our case study uses a world-leading, real life example: the Thames Estuary 2100 Plan.

The presentation will serve to introduce the adaptation pathway in the Plan to those working in the Thames Estuary. And we hope that it will help organisations and communities elsewhere think about what to consider for their own adaptation projects.

Slide 2



The Thames Estuary 2100 Plan sets out how the Environment Agency and its partners can work together to manage tidal flood risk in the Thames Estuary, adapt to a changing climate, and plan for the future of the riverside, today and into the next century.

The Plan will affect not just the tidal River Thames itself, but its tidal tributaries and its floodplain too. As well as managing flood risk, the Plan aims to improve the riverside environment, protect the social, cultural and commercial value of the estuary, and enhance and restore the estuarine ecosystems.

Amy Pryor from the Thames Estuary Partnership explains why this approach works for people and wildlife:

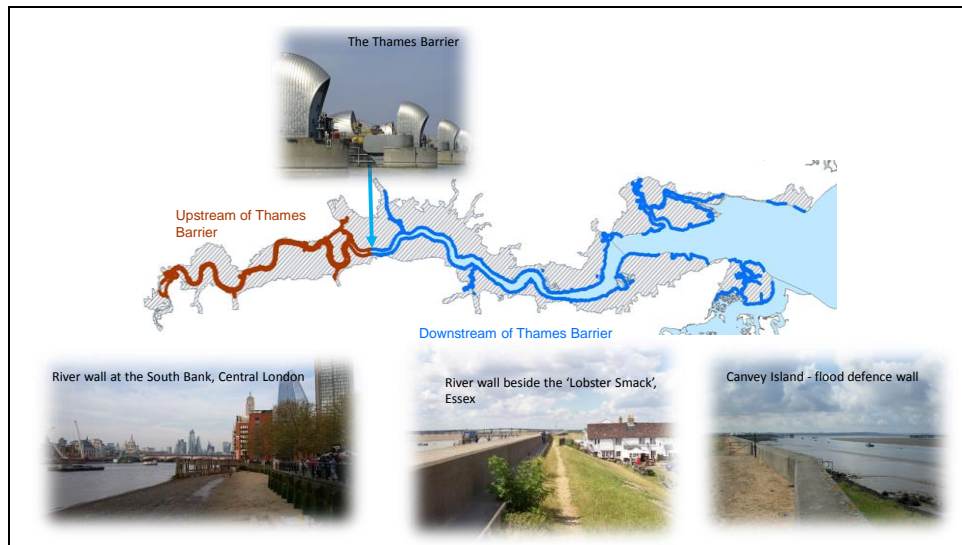
“If we are to navigate the uncertainty of the climate crisis and enable resilient Thames communities, we need to work collaboratively and inclusively based on sound climate science. The Plan enables us to do so. By planning adaptively for changing climate projections and including nature based solutions, we ensure that Thames communities will benefit not only from increased security but also from better places to live and work whilst making space for wildlife to thrive on land and in the water. If we work together, adapting as we know more, we will ensure future generations will be resilient and ready to weather whatever may come their way.”

Slide 3



The Plan covers the whole extent of the tidal Thames, starting at Teddington in west London, running right through Central London and out through Essex and Kent to the North Sea at Sheerness and Shoeburyness. The communities, businesses and buildings in the floodplain are at risk of tidal flooding...

Slide 4



..which is managed using a complex network of defences along both banks, including 9 major barriers, over 300km of walls and embankments, and hundreds of other structures (such as flood gates, outfalls and pumps). These defences all work together to protect the Thames Estuary from regular tidal flooding...

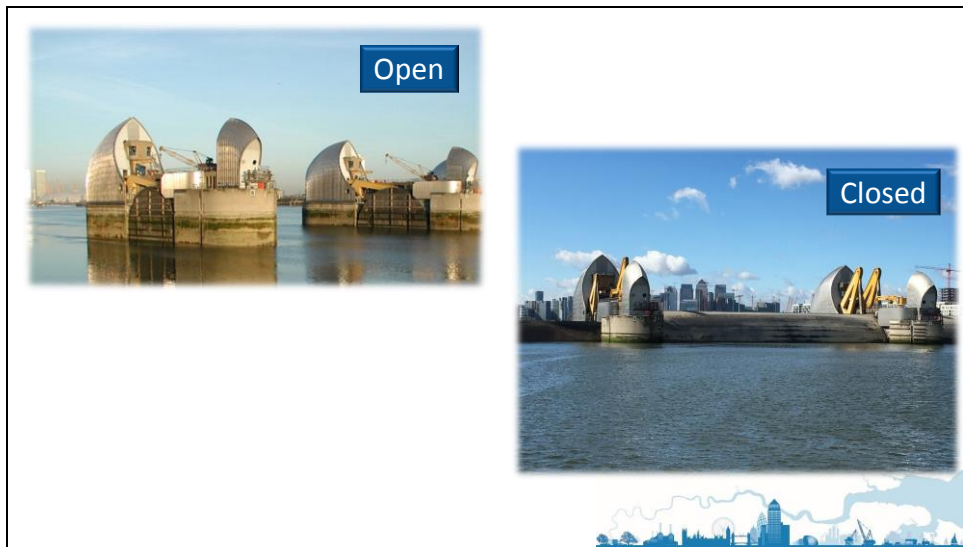
Slide 5



...with the Thames Barrier protecting central London against exceptionally high storm tides.

Climate change, population growth and ageing flood defences mean that tidal flood risk will increase over time, unless the risk is carefully managed. And so the Thames Estuary 2100 Plan is needed to manage flooding into the future and to deal with the added challenge of rising sea levels from climate change.

Slide 6



To understand the adaptation pathway in the Thames Estuary, it's important to understand the role of the Thames Barrier.

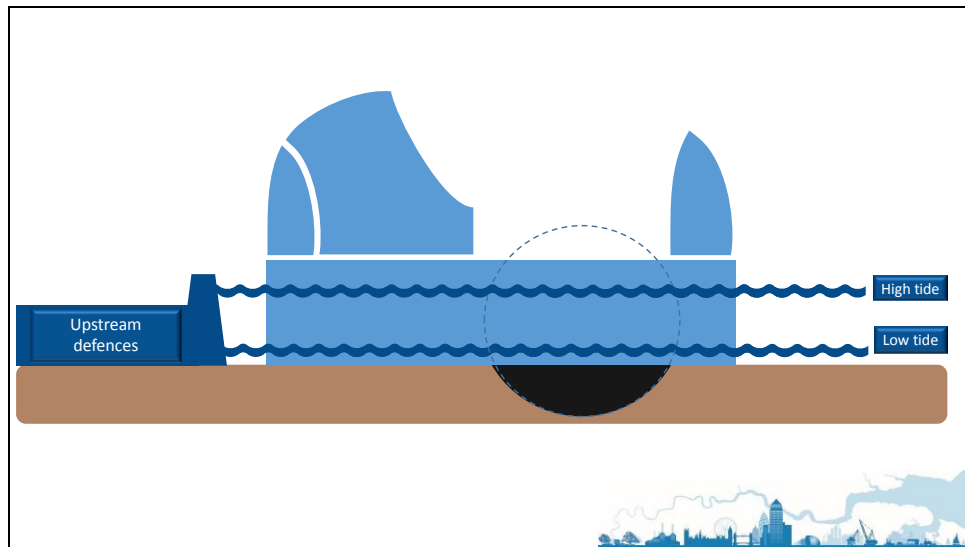
The Thames Barrier is used to manage water levels upriver - through central London. Downriver, fixed flood defences and other tidal barriers are used to manage flood risk. Together they allow the tidal Thames to be managed as 1 system.

The Thames Barrier consists of a set of moveable gates that lie flush with the riverbed when the barrier is OPEN.

When the barrier is CLOSED, the gates rotate into a vertical position, stopping the high tide from moving up river beyond the barrier.

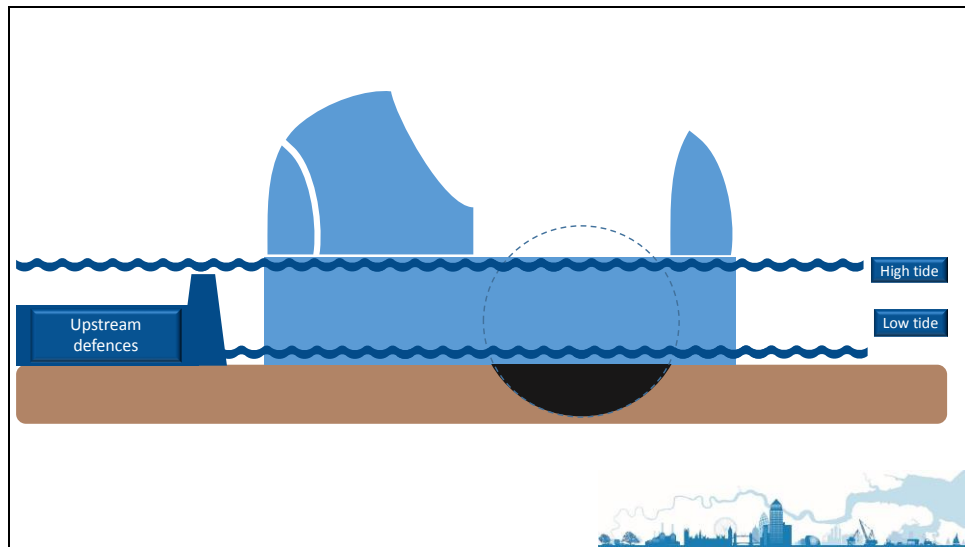
Let's take a closer look at how this affects water levels.

Slide 7



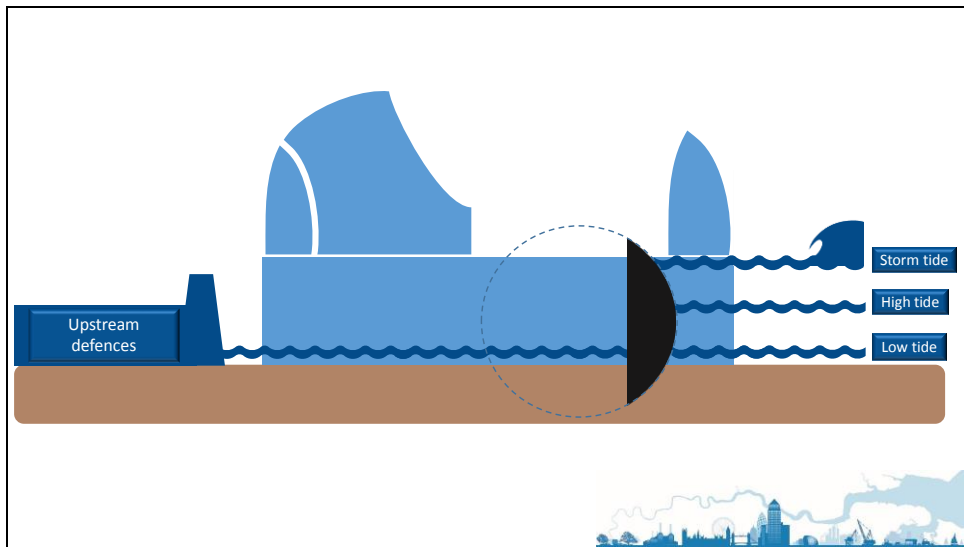
In this diagram, the barrier gate, in black, lies flush with the riverbed so the barrier is open. The water level is the same upstream and downstream, and fluctuates every day with the tides. The upstream defences are effective against the majority of high tides.

Slide 8



As sea levels rise, however, tides will be higher than they are now, so the upstream defences will need to be raised up higher - to avoid flooding on most high tides, when the barrier is open.

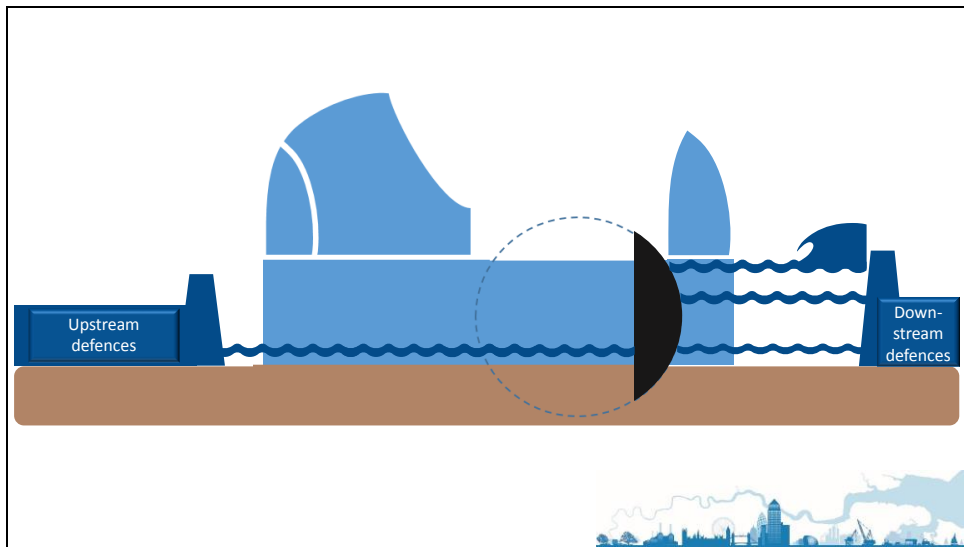
Slide 9



When the barrier is CLOSED, the gates swing upwards to prevent very high tides, or storm tides, from coming up river. These storm tides would overwhelm the upstream defences, which are designed for normal tidal levels.

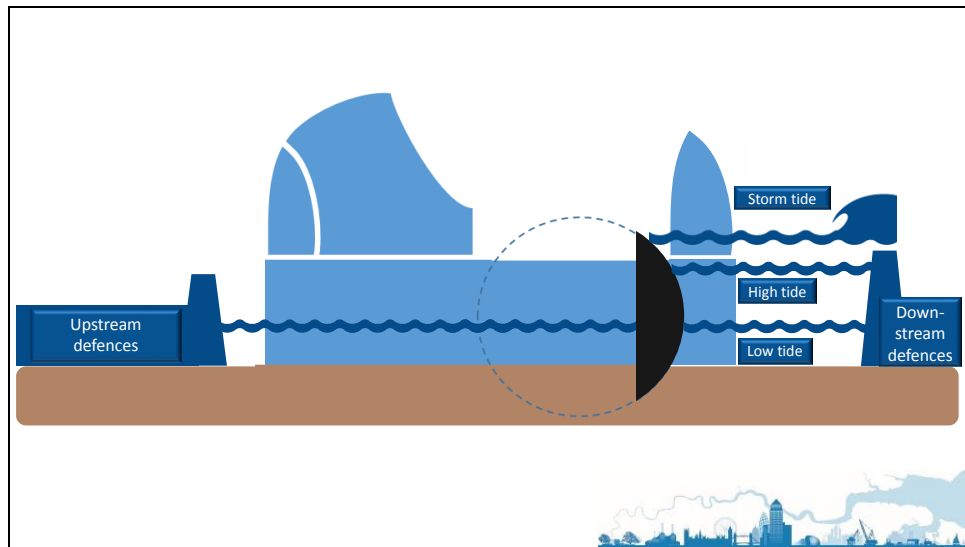
The water level downstream is much higher than it is upstream, because the barrier is doing its job of keeping the storm tide out, and the water that would have moved up the Thames stays downstream of the barrier.

Slide 10



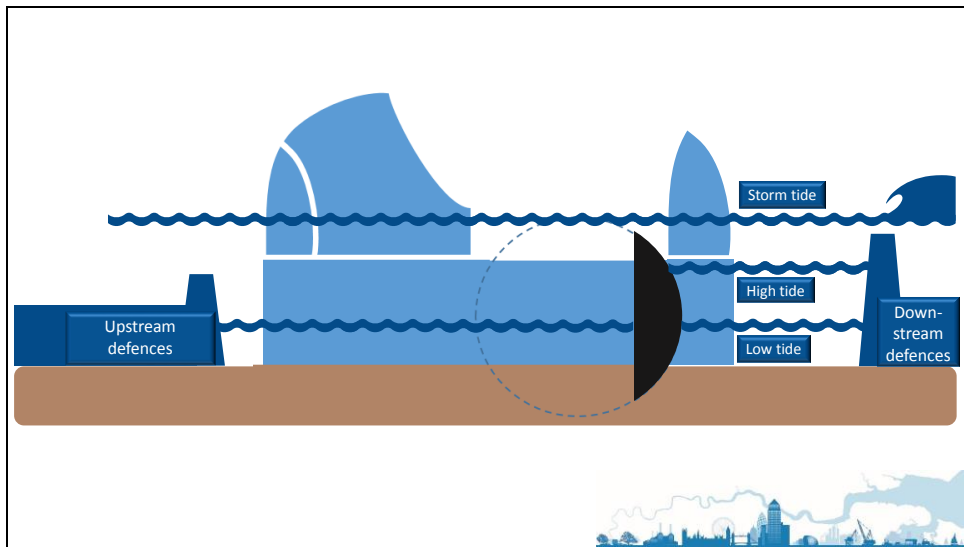
As a result, the downstream defences have to be higher than the upstream defences.

Slide 11



As sea level rises further, when the barrier is closed, the downstream defences will need to be higher than they are now, to protect against the higher storm tides that will come with climate change.

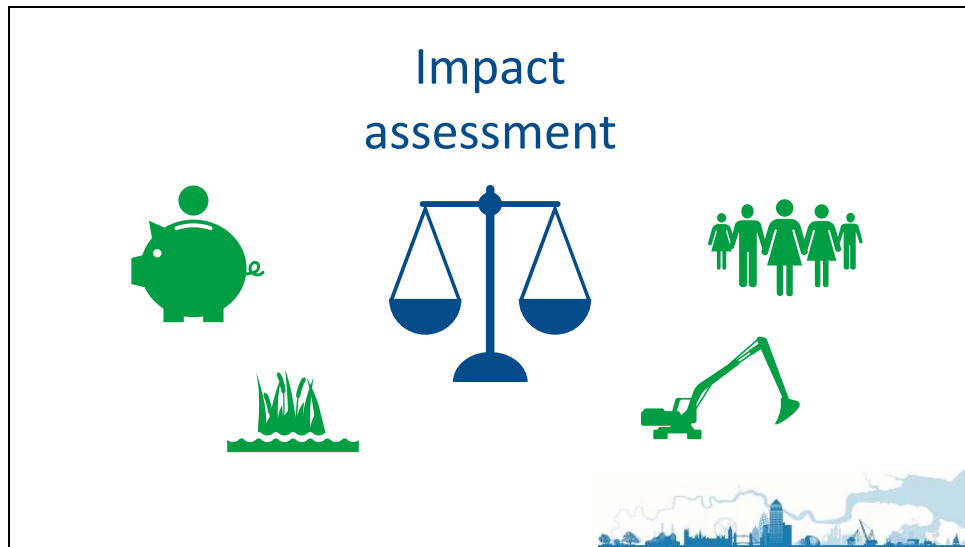
Slide 12



And eventually the sea level could get too high for the existing Thames Barrier.

The Thames Estuary 2100 Plan uses an adaptation pathway approach to manage these future changes in flood risk. It includes alternative pathways that make the Plan adaptable for more than 4m of sea level rise. All of the pathways would result in an upgraded or replacement Thames Barrier, upgraded defences along the Thames, and improved planning policies for the future of riverside boroughs - allowing for climate change and aiming for longer-term benefits for communities.

Now let's look at the adaptation pathway itself.



In developing the Thames Estuary 2100 Plan, many options were considered initially, and weighed up according to their economic impacts, environmental impacts, social impacts, and technical impacts.

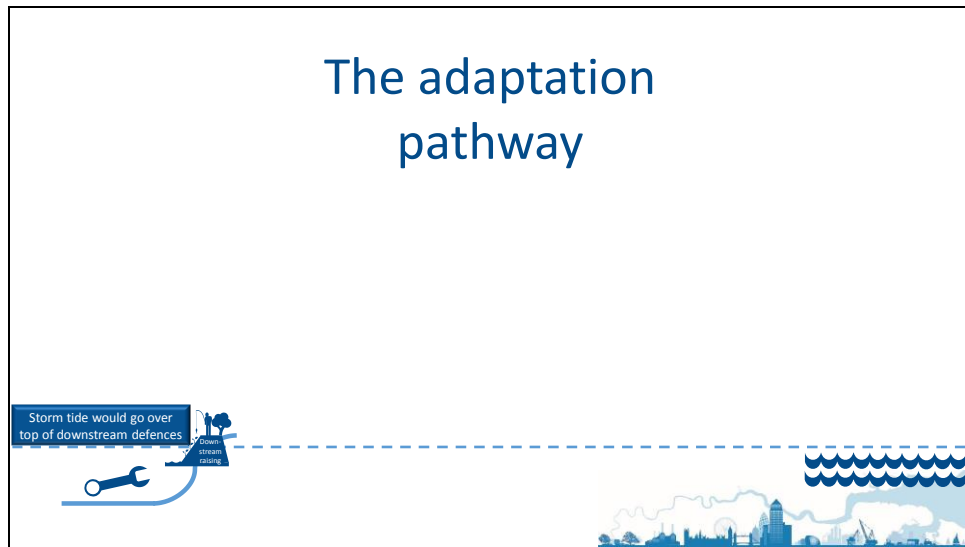
Several options were investigated but then ruled out – either because they were not effective for managing flood risk, had unacceptable environmental impacts, very high costs, or had unacceptable impacts on navigation.

There were 4 remaining options for pathways.

The Thames Estuary 2100 Plan maps out these pathways – sequences of actions – and identifies decision points for managing flood risk in the Thames Estuary as sea level rises, by raising the defences and eventually choosing between pathways.

Let's look at the different phases of the Plan as it moves along the pathway.

[See fact sheet 3 for more about the options appraisal and assessment]



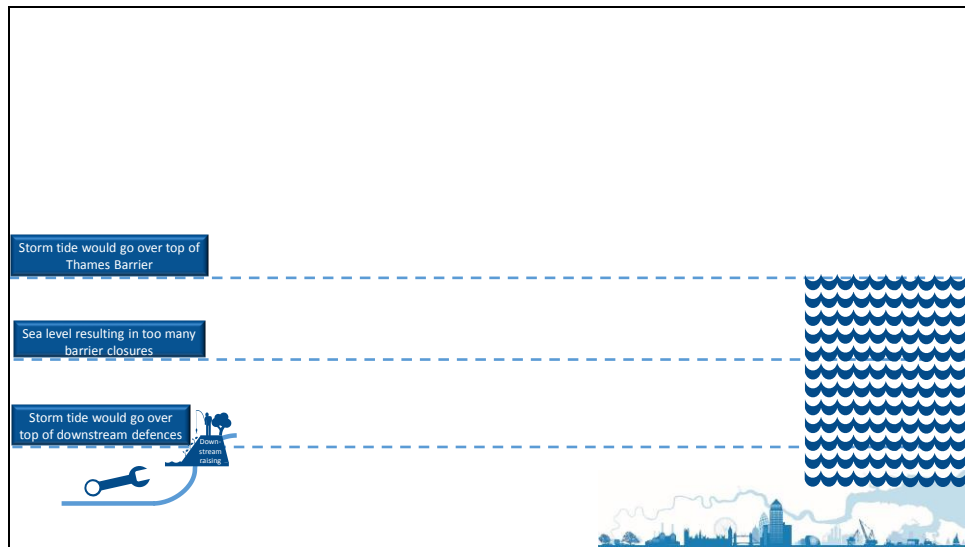
Initially, all of the pathways follow the same course.

While sea levels are still close to present day levels, the existing defences are maintained and improved. Some of the ageing flood defence structures in the Thames Estuary are in poor condition, or are deteriorating due to sea level rise – so maintenance is needed during this phase, to ensure that they continue to protect the communities in the estuary.

As sea level rises further, the storm tides will be higher. Before sea level crosses the threshold where storm tides would go over the top of the defences, the downstream defences will have to be raised in height. (Note that this applies to many but not all of the downstream defences.)

At this stage the Thames Barrier is still high enough to protect central London, so no upstream defence raising is required.

Slide 15

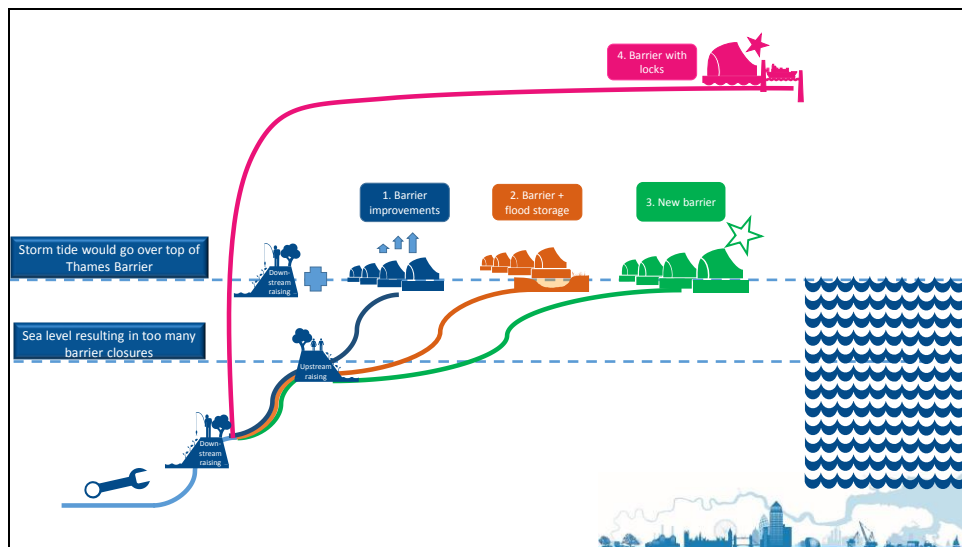


The 2nd and 3rd thresholds are likely to be reached in quick succession, and will require decisions to be taken at the same time.

One threshold is the sea level that would result in the Thames Barrier having to close too often, to prevent the highest normal tides – not just storm tides - going over the top of the upstream defences. It will not be possible to maintain the barrier properly if it closes too frequently, and it could become unreliable.

The other threshold is the level where a storm tide would go over the top of the existing Thames Barrier, requiring a major intervention to decide on the future of the Thames Barrier and implement the decision. The decision will be based on both cost-benefit analysis and environmental impact assessment.

Slide 16



And so the route splits into separate pathways.

If the Thames Estuary is facing rapid sea level rise, towards the upper bounds of current predictions, it is likely that a barrier with locks will be the best option at this stage. It would function quite differently from the existing barrier, since it would be designed to close on many high tides as well as storm tides. Because it would be closed so often, locks would be needed to allow boats through.

On the other hand, if sea level rise is slower or is predicted to reach lower levels, then a pathway involving a barrier designed to function like the existing one – remaining open on normal high tides, but closing for storm tides – would be the best option. In this case, the fixed flood defences upstream need to be raised to cope with the higher tides. And the future of the barrier could involve either:

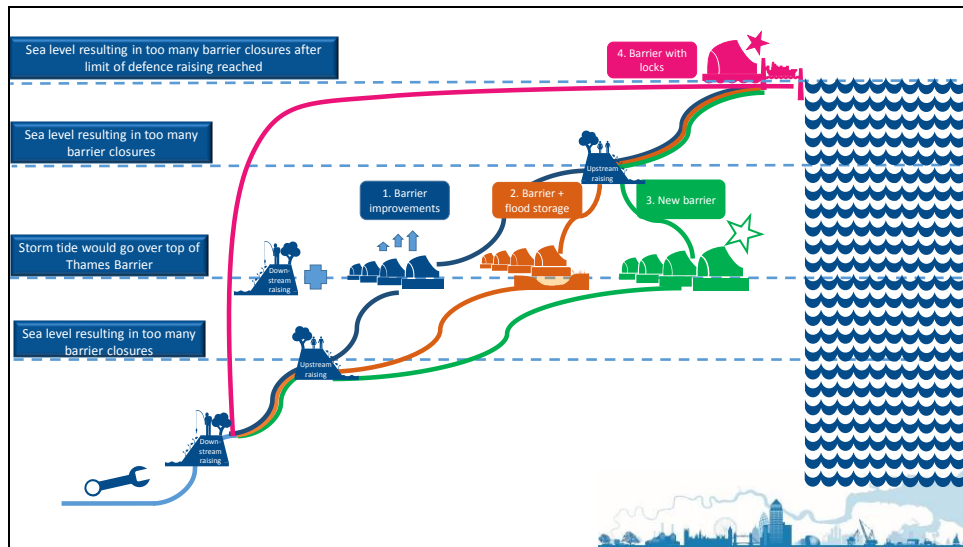
- improvements to the existing barrier itself;

- tidal flood storage, as well as a new or improved Thames Barrier - flood storage areas would store tidal waters and reduce the level during storms;

- or a new barrier in a new location, farther downstream than the current barrier.

No matter which of the 4 pathways is taken, it will be accompanied by a 2nd phase of raising the downstream defences.

Slide 17

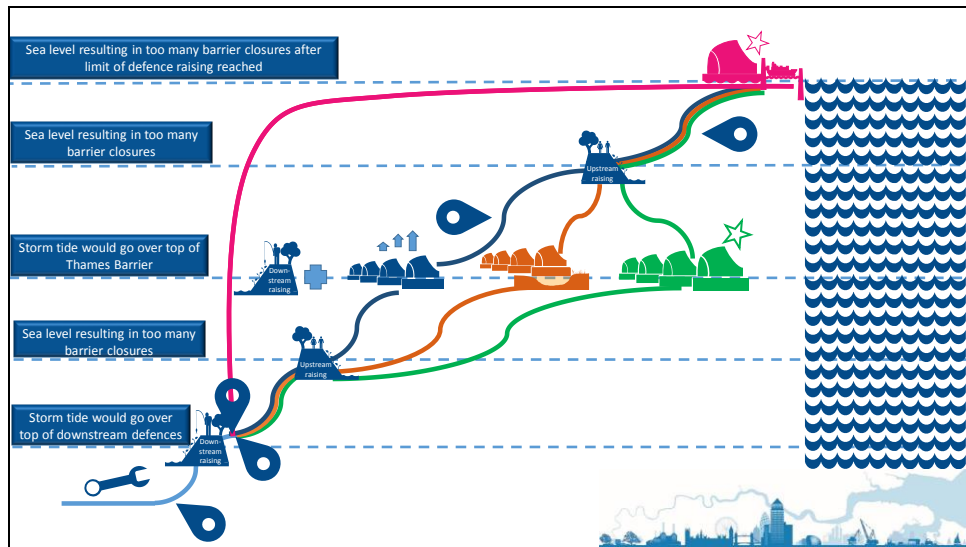


And later, a 2nd stage of raising the upstream defences may be needed as sea level continues to rise towards a new threshold where the barrier would again have to start closing on normal high tides.

Raising the upstream and downstream defences will reshape the riverside, creating big opportunities to make it more attractive, accessible, and a better place for wildlife to thrive.

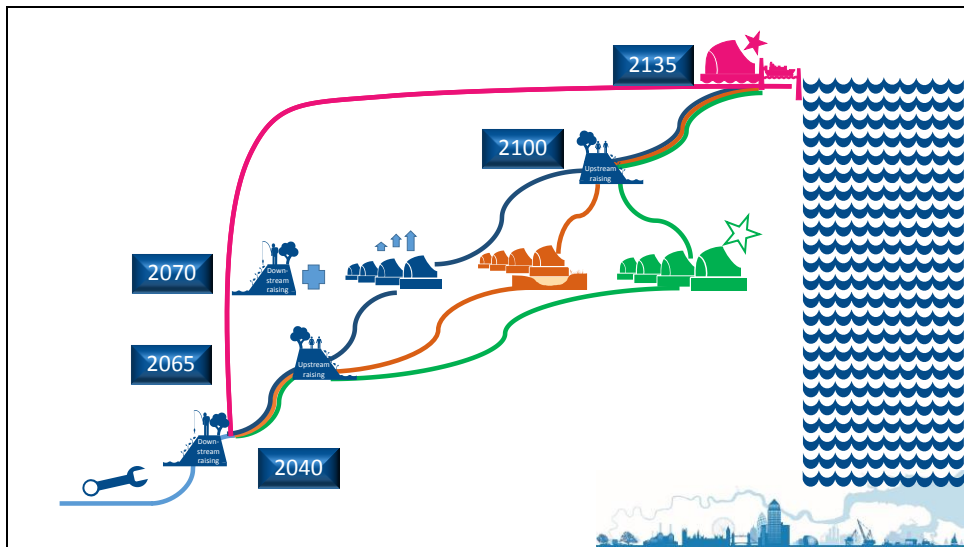
But it will not be advisable to raise the upstream defences by more than 1 metre in total. So after the 2nd stage of upstream defence raising, when another threshold starts to approach where sea level would result in too many barrier closures, the last step along the pathway will be to convert the barrier to one with locks that is designed to close on normal high tides.

Slide 18



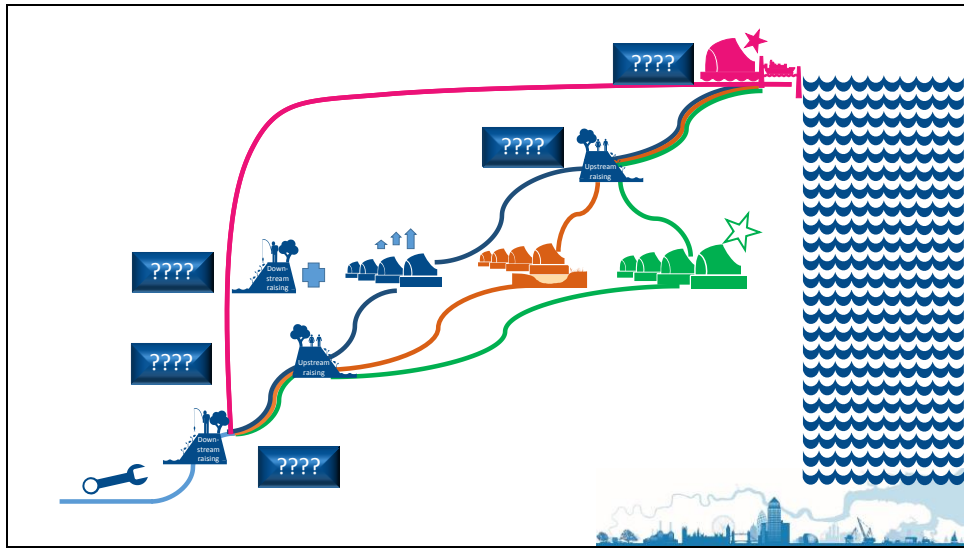
Each threshold has a decision point several years - even decades - in advance of the threshold, because there is a long lead in time for work of this nature. It can't all be done at once, and time is needed for design and construction, so that the work can be completed in time.

[See fact sheet 4 for more about the options and thresholds in the adaptation pathway]

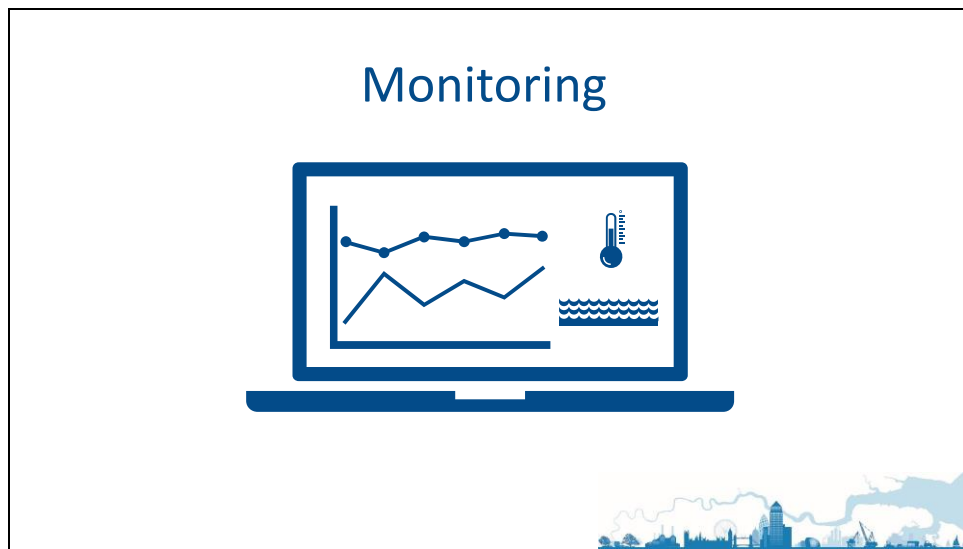


Not only are there different pathways, but the timings adapt too. The published Plan includes deadlines by which the interventions will be needed. But it's important to understand that the dates in the Plan are based on the rate of change in sea level set out in the climate change projections.

Slide 19a



If new climate change projections, or monitoring of the actual rate of change in sea level, show that things are changing more rapidly, or more slowly, then those decision dates could change significantly.

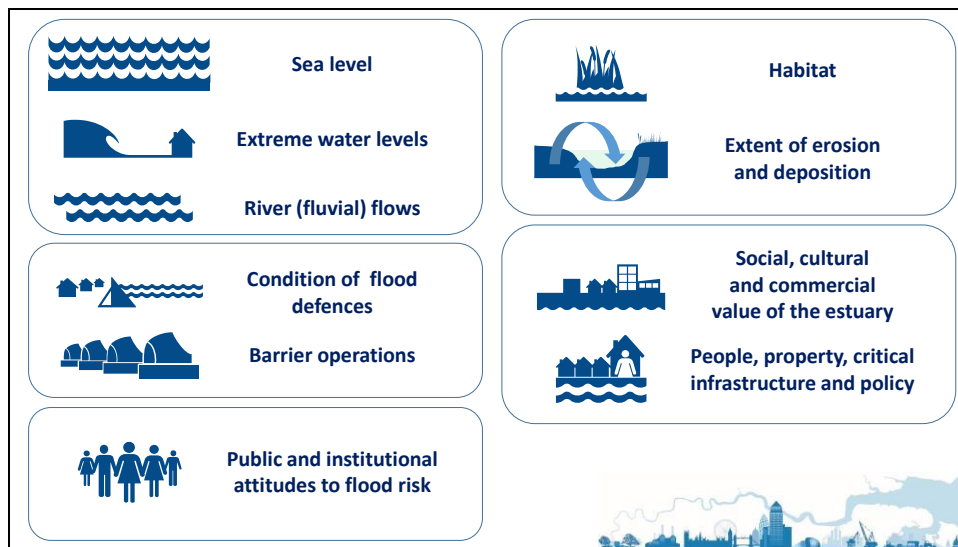


This is one of the strengths of the adaptation pathway approach, because monitoring can indicate when the thresholds are approaching, so that the necessary changes can be made in time, or delayed if they are not needed yet.

Monitoring helps us understand how the estuary is changing and ensure the Plan is adapted accordingly.

So what is being monitored for the Thames Estuary 2100 Plan?

Slide 21



There are 10 monitoring indicators in the Plan.

3 of the indicators involve water levels, 2 look at aspects of the ecology and geomorphology of the estuary, and 2 indicators are about the flood risk management structures themselves. Then there are 2 indicators covering development and the use and value of the estuary. And finally, the 10th monitoring indicator is about attitudes to flood risk.

The monitoring indicates whether the estuary is changing in the way the Plan projected. If it is not, the interventions recommended in the Plan may be needed at an earlier or later date. They will also help to determine whether or not to shift between pathways, alongside other information. And the indicators also help to identify changes that may positively or adversely affect the ability to deliver the Plan.

All of these 10 indicators change over time and will affect decision making about the plan. So it's important to keep them under review to enable informed, evidence-based decisions to be made when they are needed.

[See fact sheet 5 for more about monitoring]



This is done through periodic reviews of the Plan:

5 year reviews of the monitoring indicators establish a picture of changes in the estuary and can trigger a full review if need be.

And every 10 years, there is a full review of the entire Plan. Full reviews bring together the latest evidence, data, expertise and collective knowledge. They look at what has changed in the estuary, review the impact assessment and, if necessary, revise the recommendations in the Plan.

The review results in the publication of an updated Plan, drawn up by the Environment Agency working collaboratively with the public and partner organisations and landowners along the Thames Estuary.

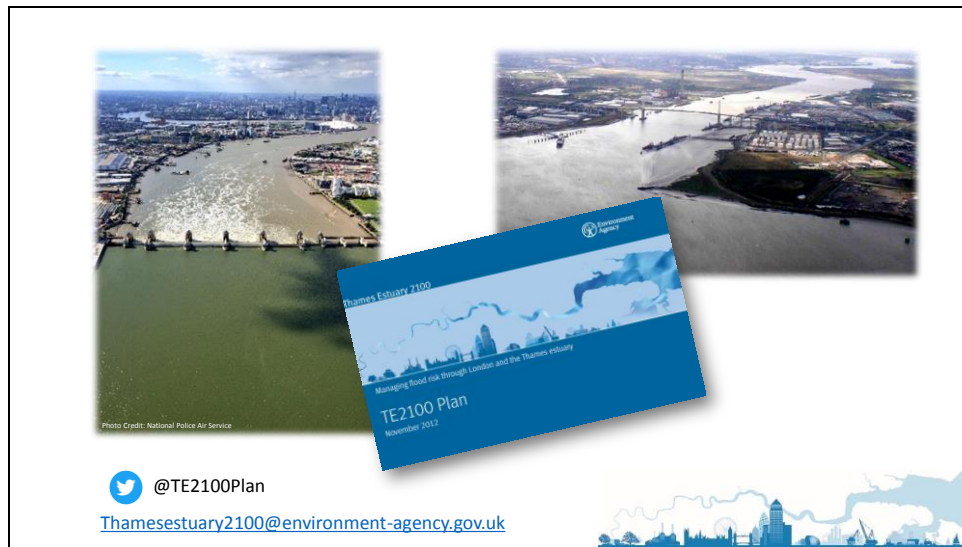
The Plan is signed off at a range of different levels: by the Thames Estuary 2100 Board, the Thames Estuary 2100 Advisory Group, and at the level of Government.

So every 10 years, at the end of each Review, and after sign-off, an updated Plan will be published, ensuring that it stays relevant and responsive.

Reviewing, funding and putting the Plan into practice over the course of many decades is a collaborative effort between many landowners, organisations, and the communities they serve: ongoing collaboration and shared ownership of the Plan is and always will be an essential part of its success.

[See fact sheet 6 for more about decision making in collaboration]

Slide 23



This presentation has looked at the adaptation pathway used in the Thames Estuary 2100 Plan.

The pathways in the Plan lay out alternative courses of action to protect communities in the Thames Estuary from flooding into the next century and beyond, enhancing the riverside environment, and taking the right steps at the right time to adapt to changes in sea level resulting from climate change.

We hope that it has helped stakeholders in the Thames Estuary understand the pathway in the Plan.

And we hope that this example will help others working elsewhere consider how to select options for different climate scenarios, assess their impacts, identify thresholds, determine decision points, monitor and review as they develop their own adaptation projects.

Using the adaptation pathway approach, together we can plan confidently to face the challenge of an uncertain future and adapt to climate change.

To find out about progress and reviews of the Plan as they happen, follow the Plan on Twitter, or email Thamesestuary2100@environment-agency.gov.uk .

[See fact sheet 7 for more about the Thames Estuary 2100 Plan]