



Options for Flood Risk Management on the Thames Estuary

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Development of the Options

High Level Options

- Several climate change scenarios

- Demonstrate how climate change can be managed

Consultation Options

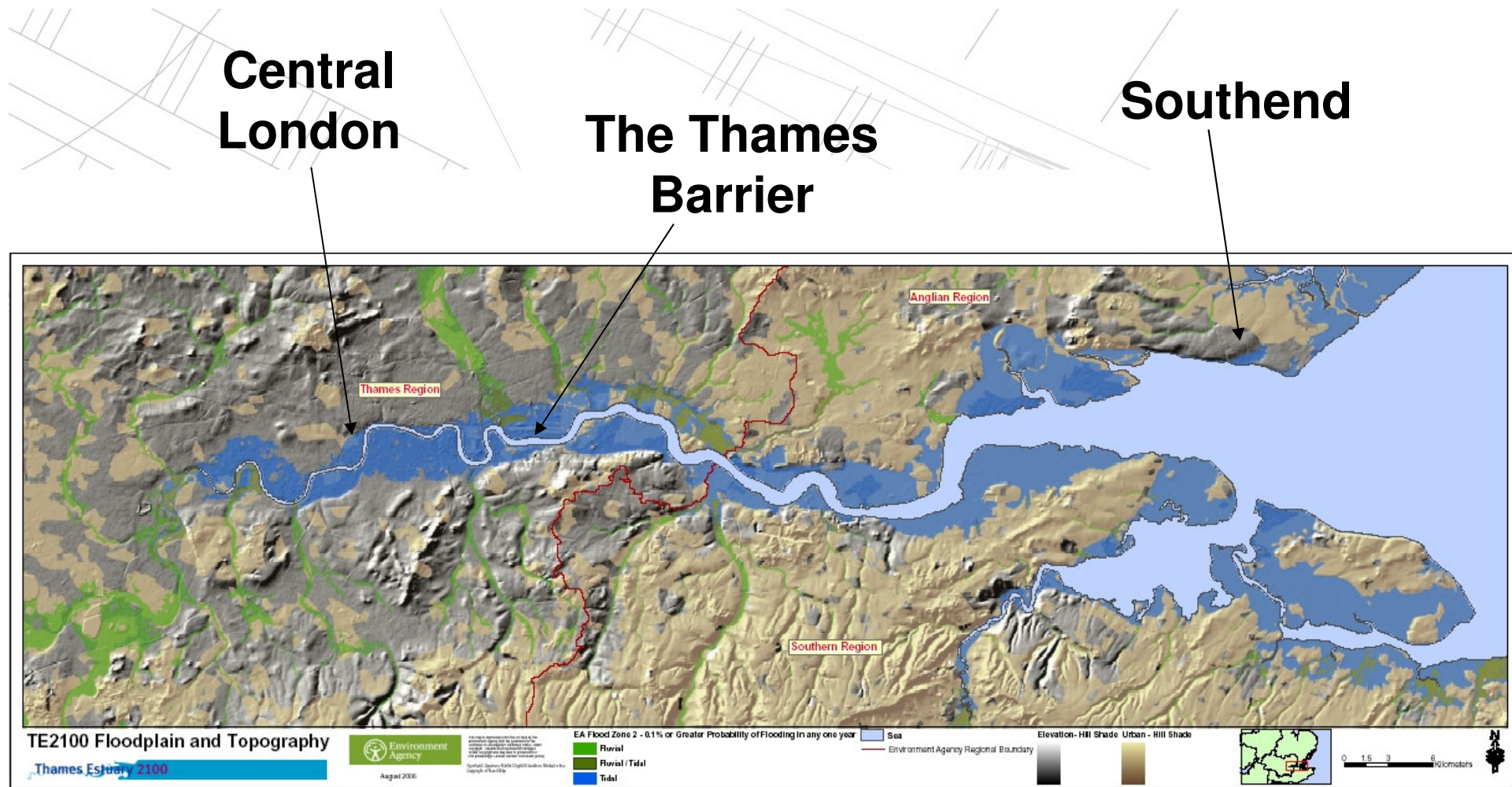
- Designed for one climate change scenario

- Adaptable

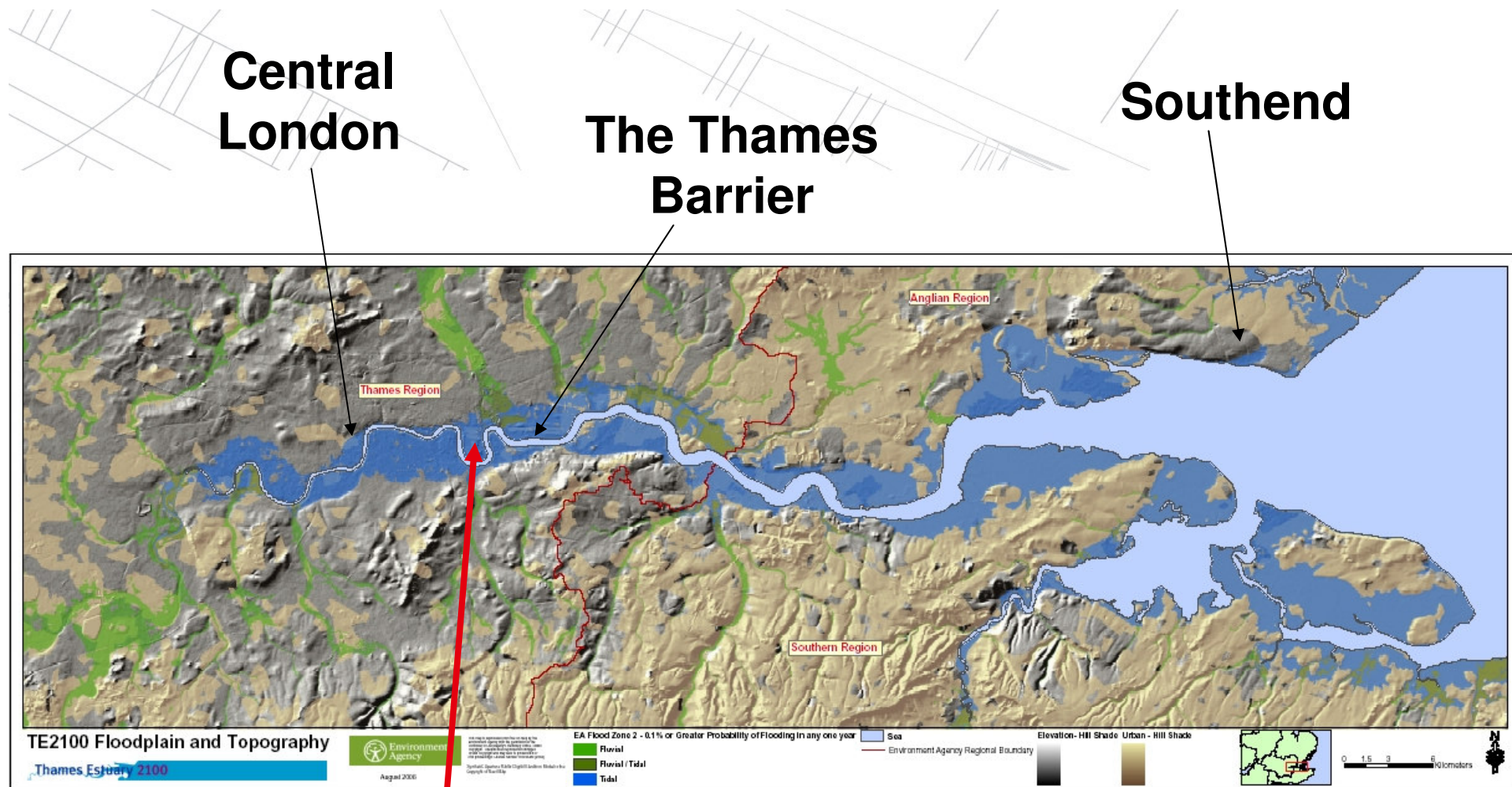
- Defence deterioration, repair and replacement

- Feasible designs

The Thames Estuary

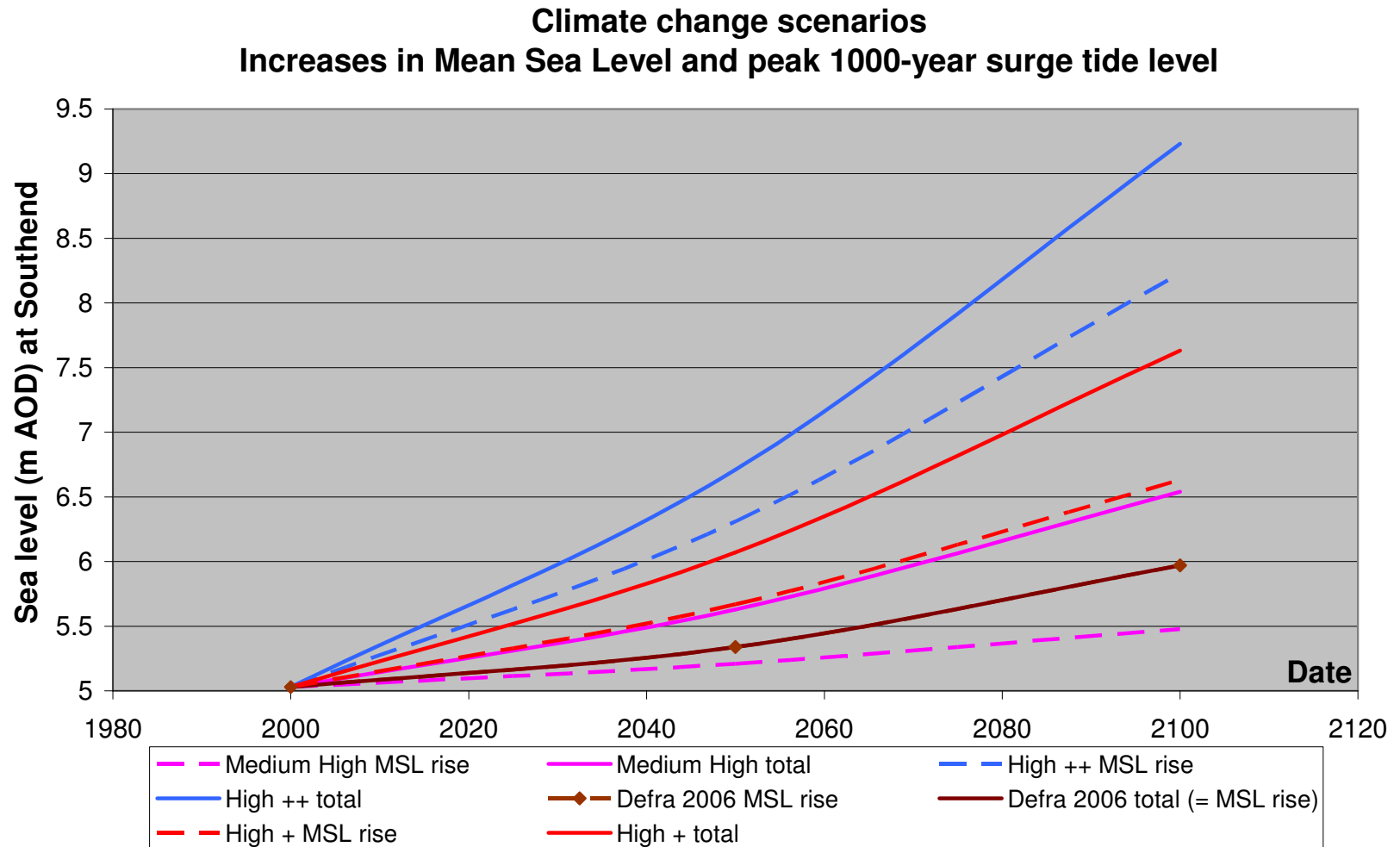


The Thames Estuary



**YOU ARE
HERE**

TE2100 scenarios for sea level rise



Main responses to flood risk

Over-rotate / improve Thames Barrier

New barriers / barrages / throttles

Raise defences / new defences

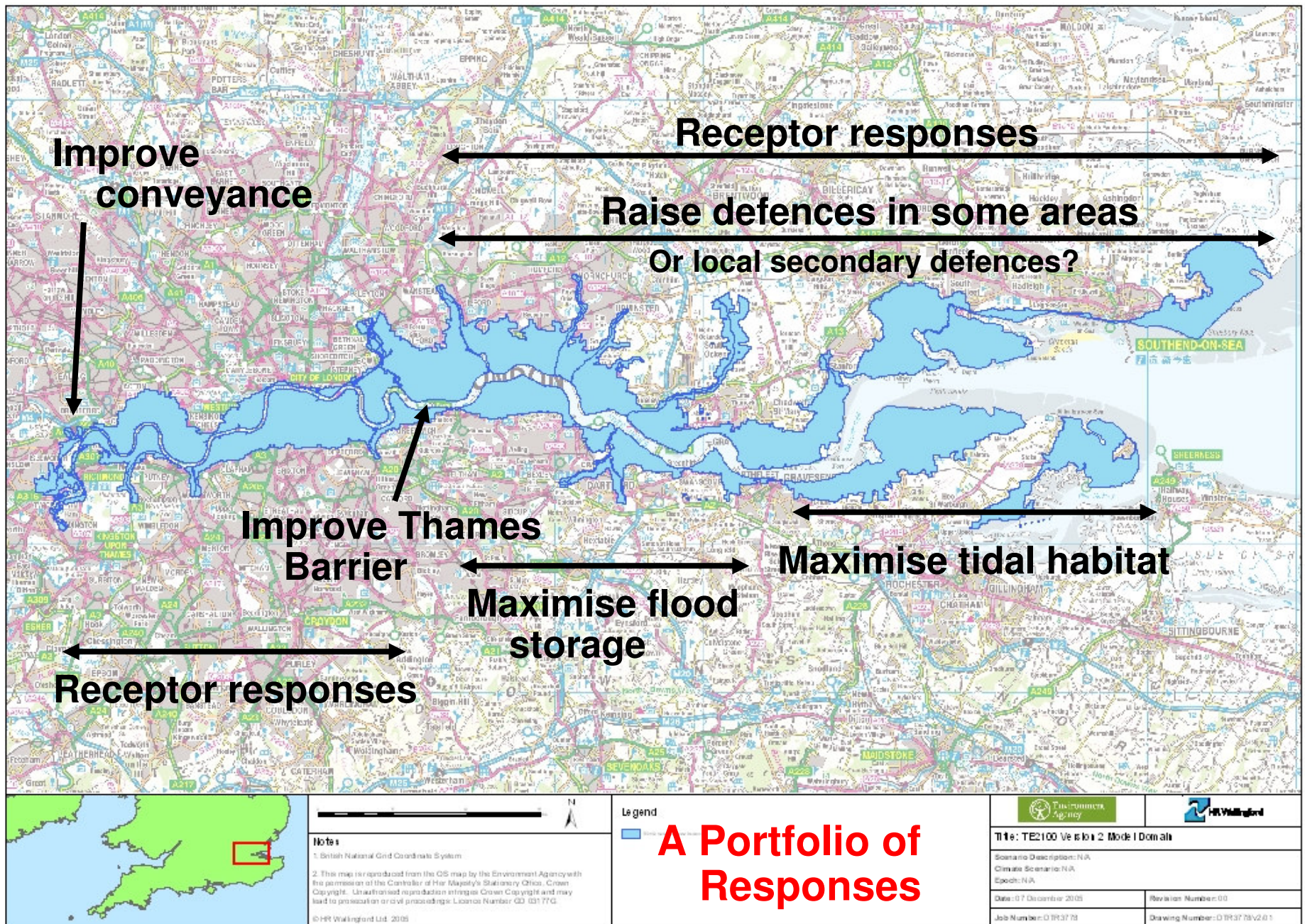
Storage of floodwater

Floodplain Management

Flood incident management and recovery

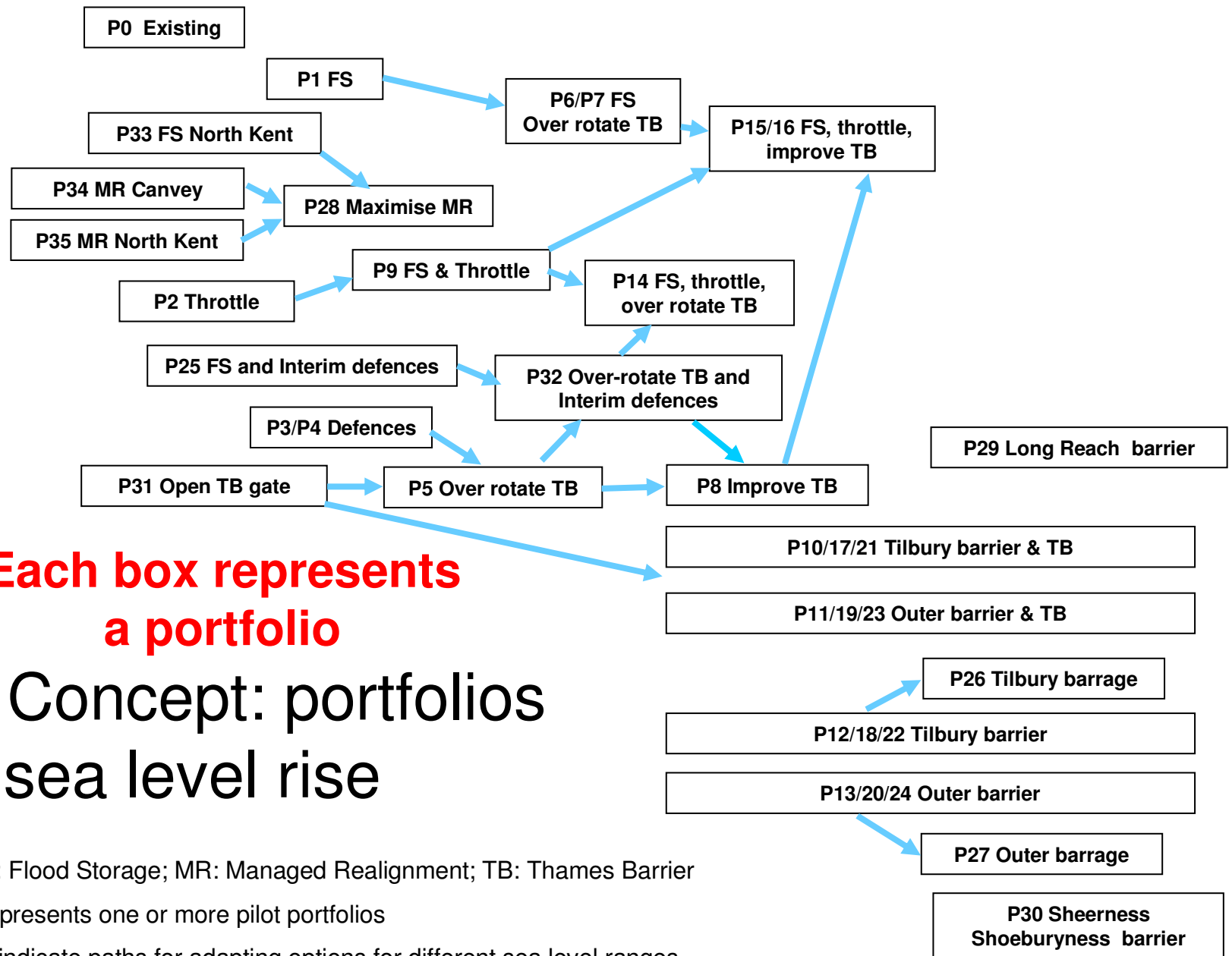
Existing and new development

Responses to fluvial flooding (West London, tributaries)

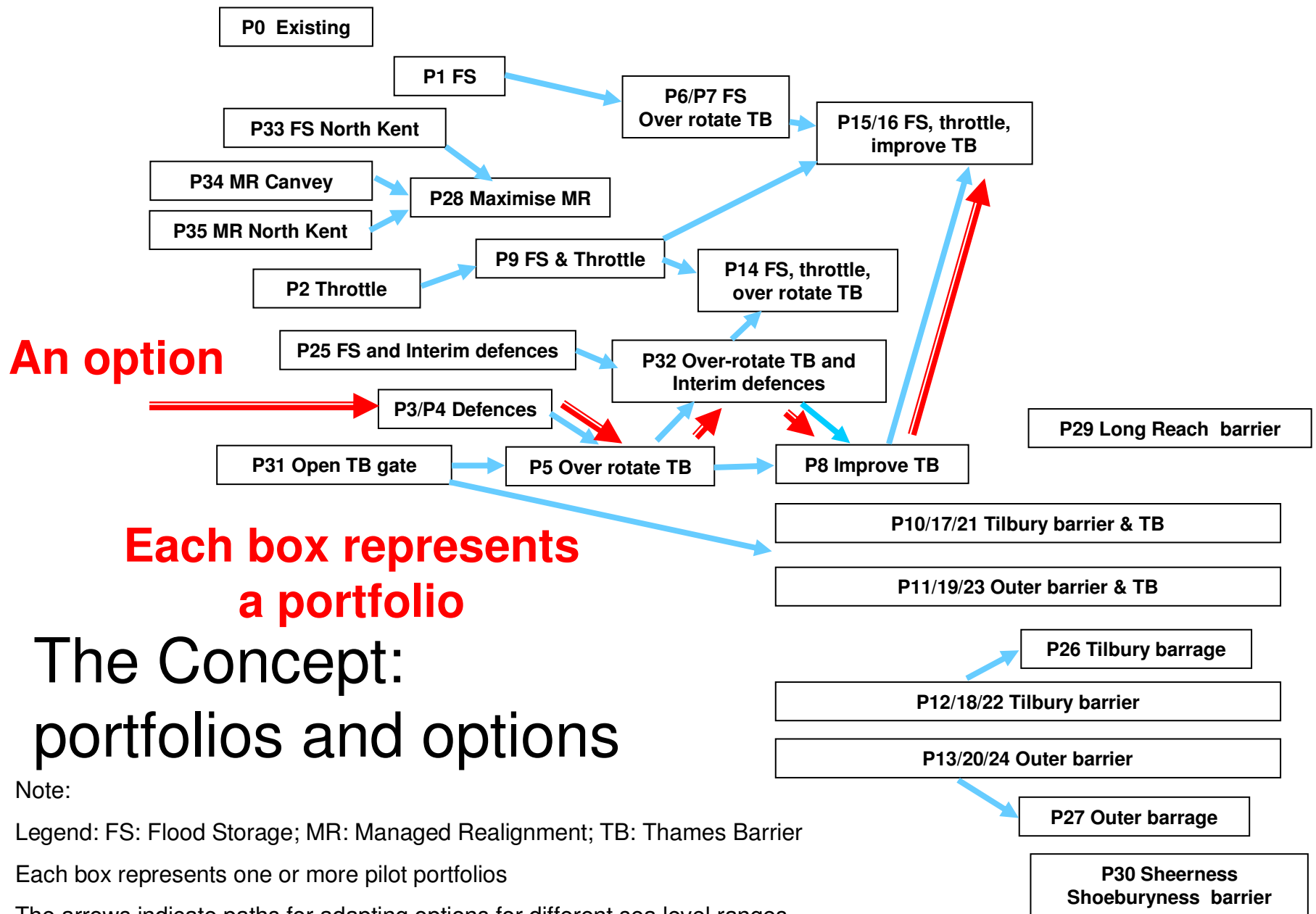


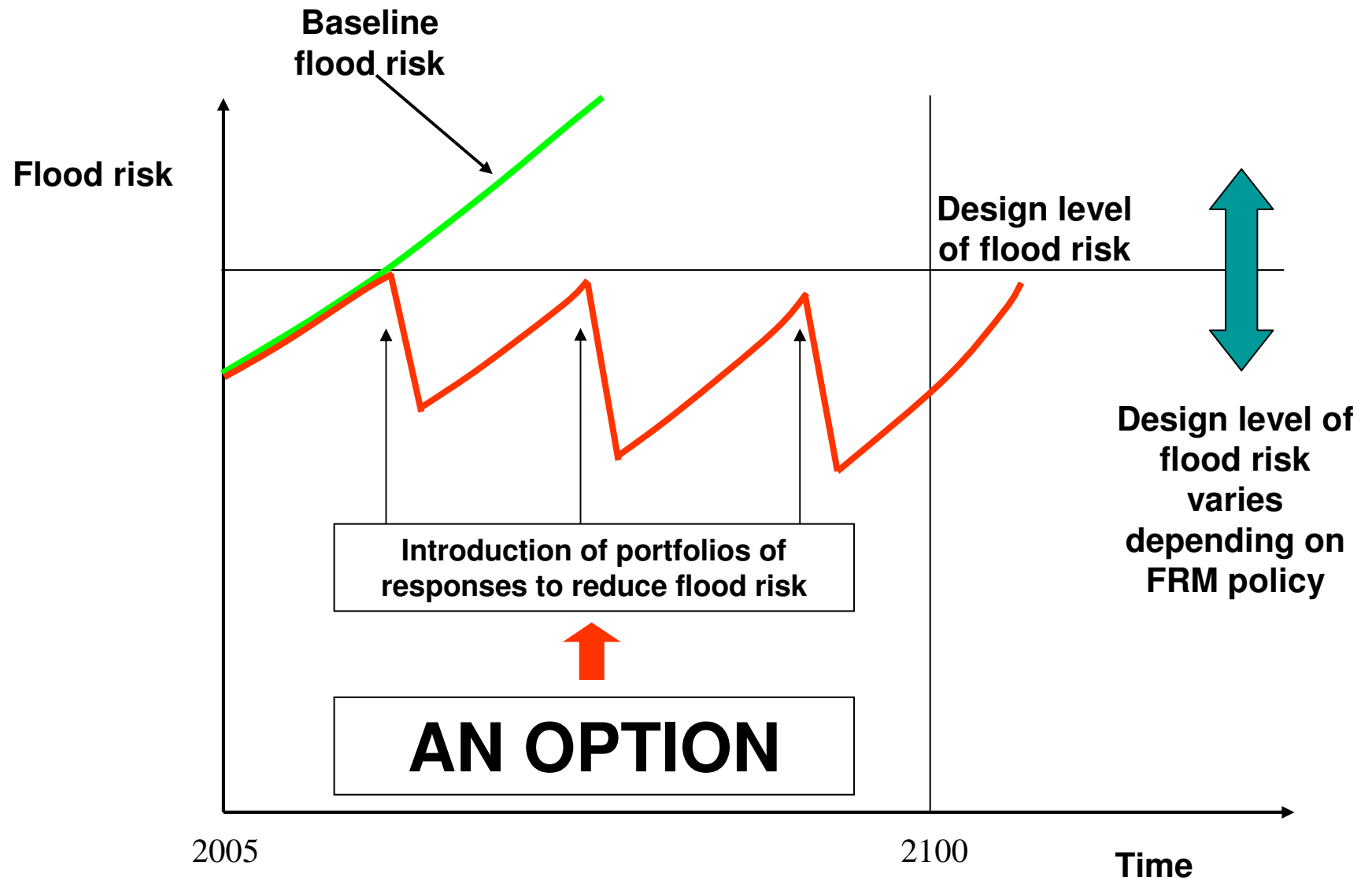
Maximum sea level rise:

0m 1m 2m 4m 6m

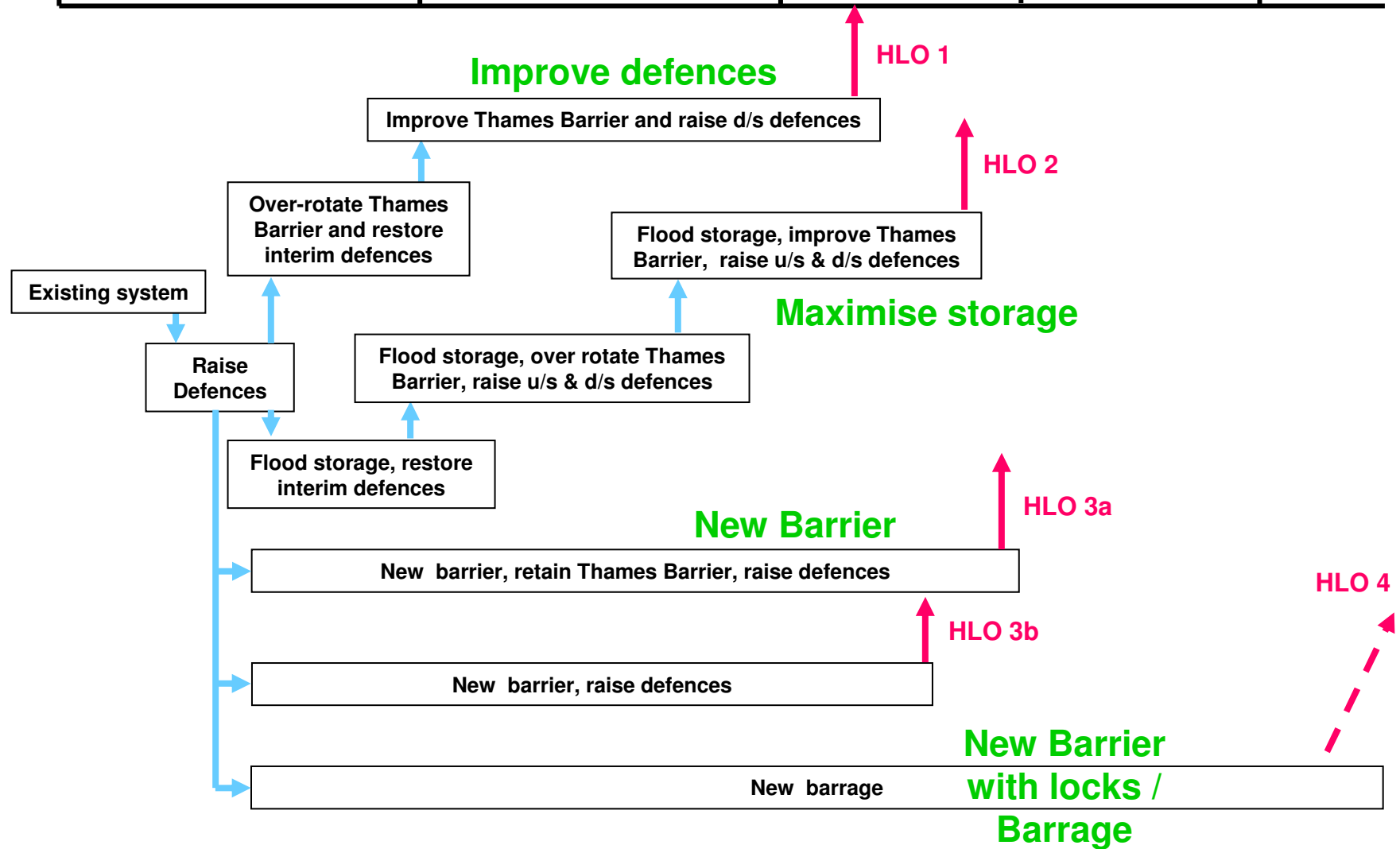


Maximum sea level rise:





Maximum sea level rise:



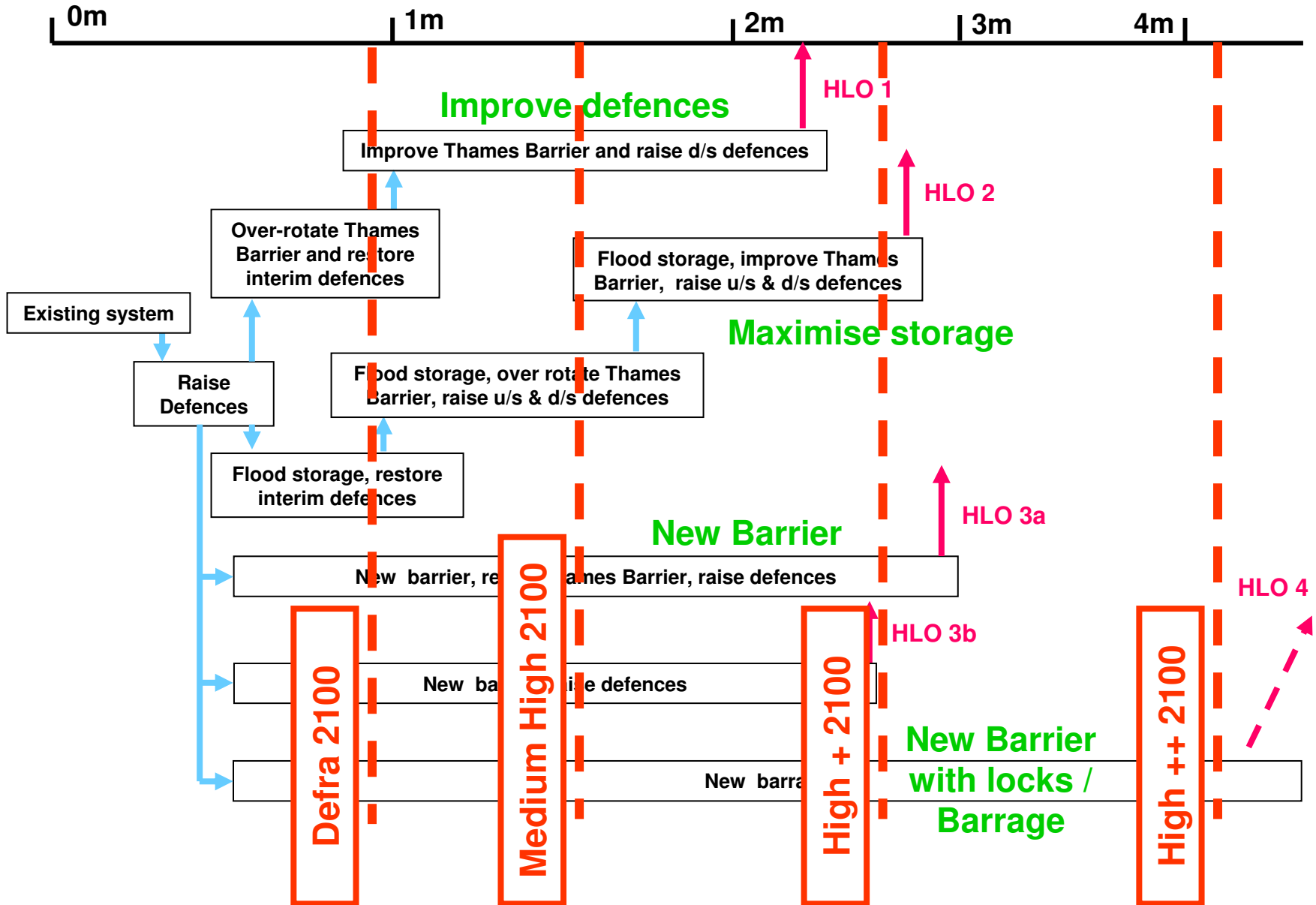
Note:

Each box represents one or more portfolios of responses

The arrows indicate paths for adapting options for different sea level ranges

The High Level Options

Maximum sea level rise:



Note:

Each box represents one or more portfolios of responses

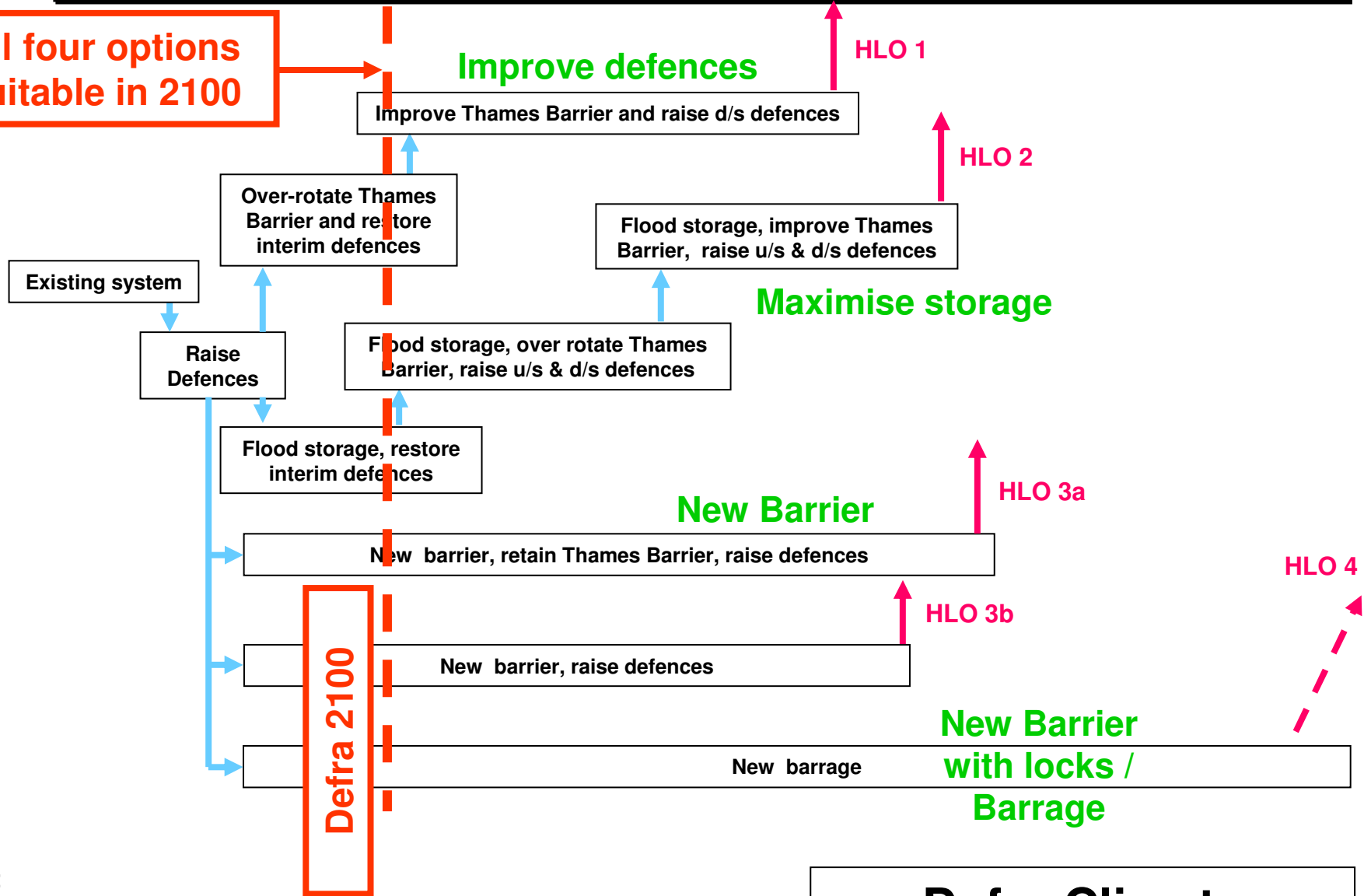
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The High Level Options

Maximum sea level rise:



**All four options
suitable in 2100**



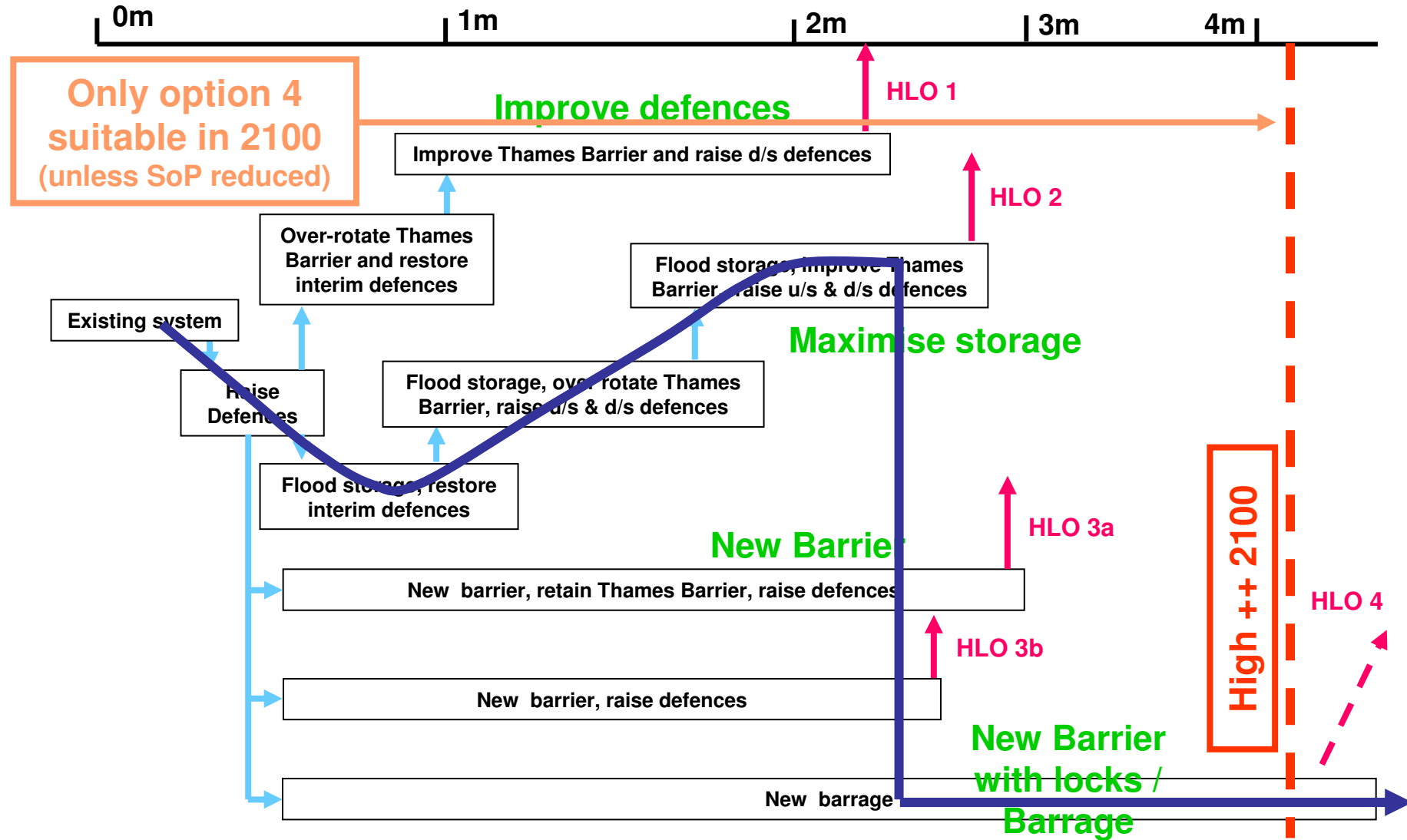
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**Defra Climate
Change Scenario**

Maximum sea level rise:



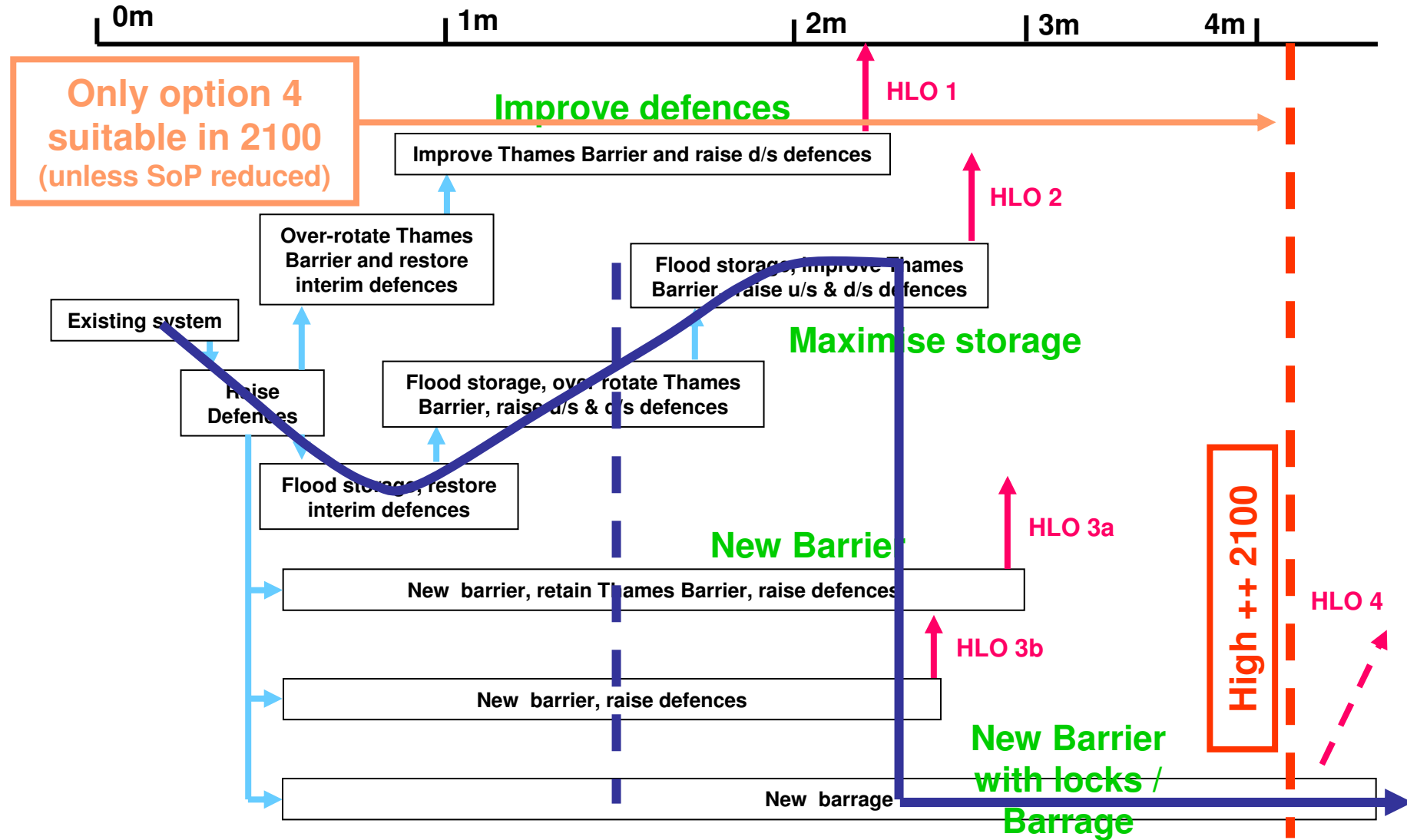
The final plan could be a combination of options

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Maximum sea level rise:



The final plan could be a combination of options

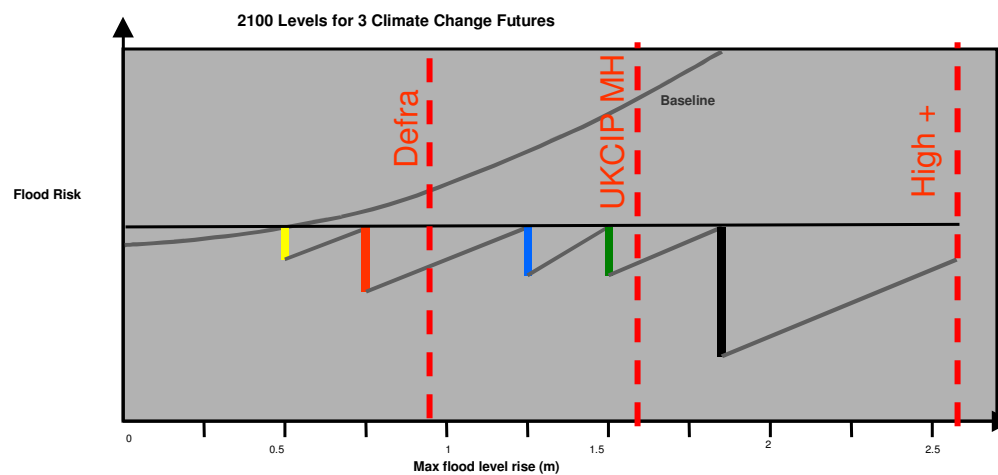
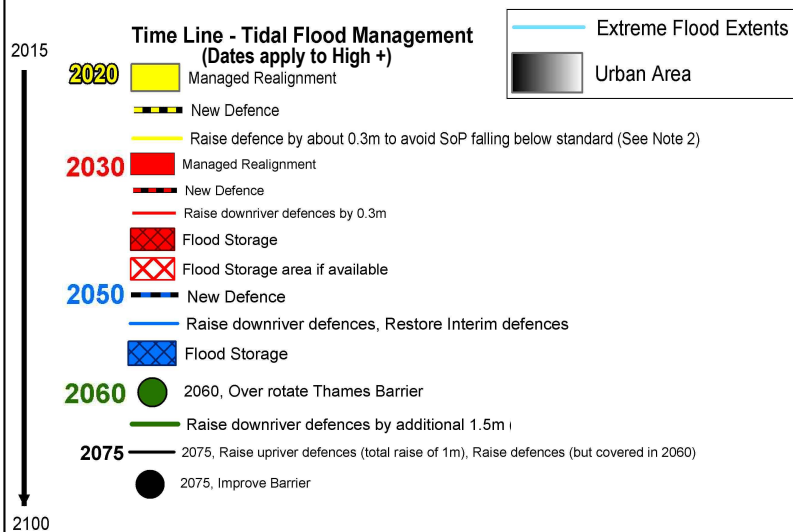
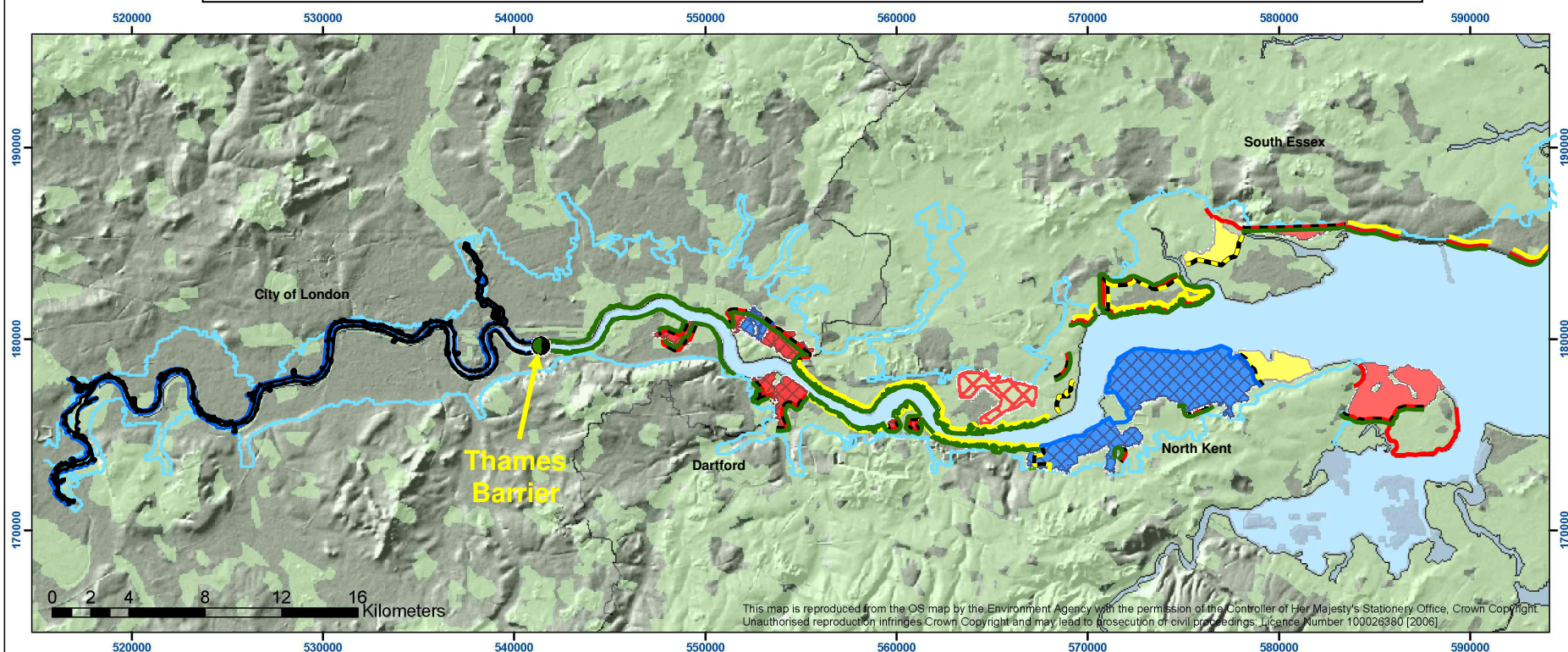
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The arrows indicate paths for adapting options for different sea level ranges

High++ Climate
Change Scenario

HLO: 2 - Floodplain storage approach (3 Climate Change Futures)



The 'Drivers' of change

Climate

Asset condition (and deterioration)

Socio economic conditions

The physical environment

Public attitudes and expectations

'Drivers' can be represented by 'indicators'
(things that can be measured)

Thresholds, lead times and decision points

Indicator value

(e.g. sea level rise)

Threshold value of indicator when intervention is needed

Decision point
based on best estimate

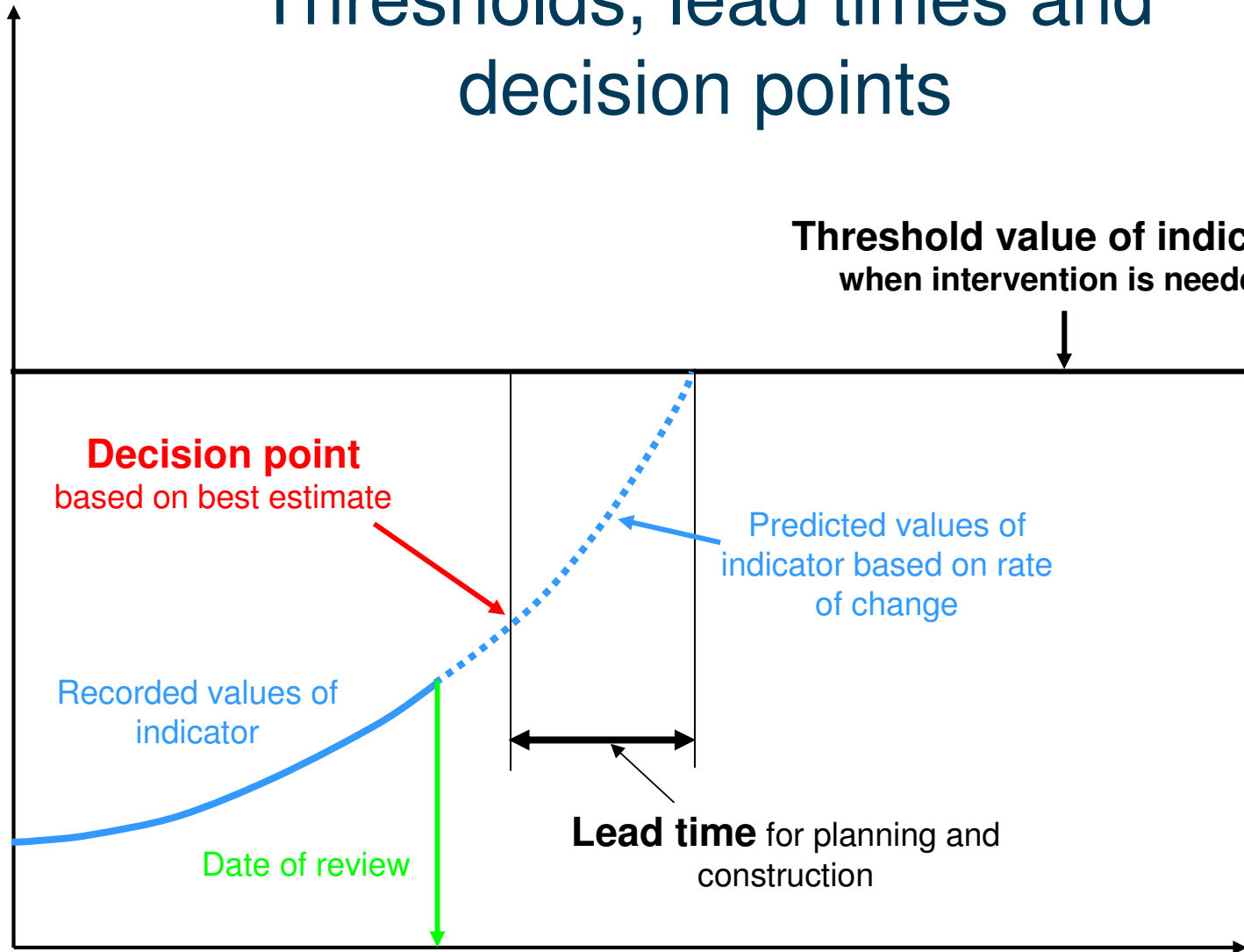
Predicted values of indicator based on rate of change

Recorded values of indicator

Date of review

Lead time for planning and construction

Time



Thresholds, lead times and decision points

Indicator
value

(e.g. sea
level rise)

Threshold value of indicator
when intervention is needed

Decision point
based on best estimate

Decision point taking
account of uncertainty

Recorded values of
indicator

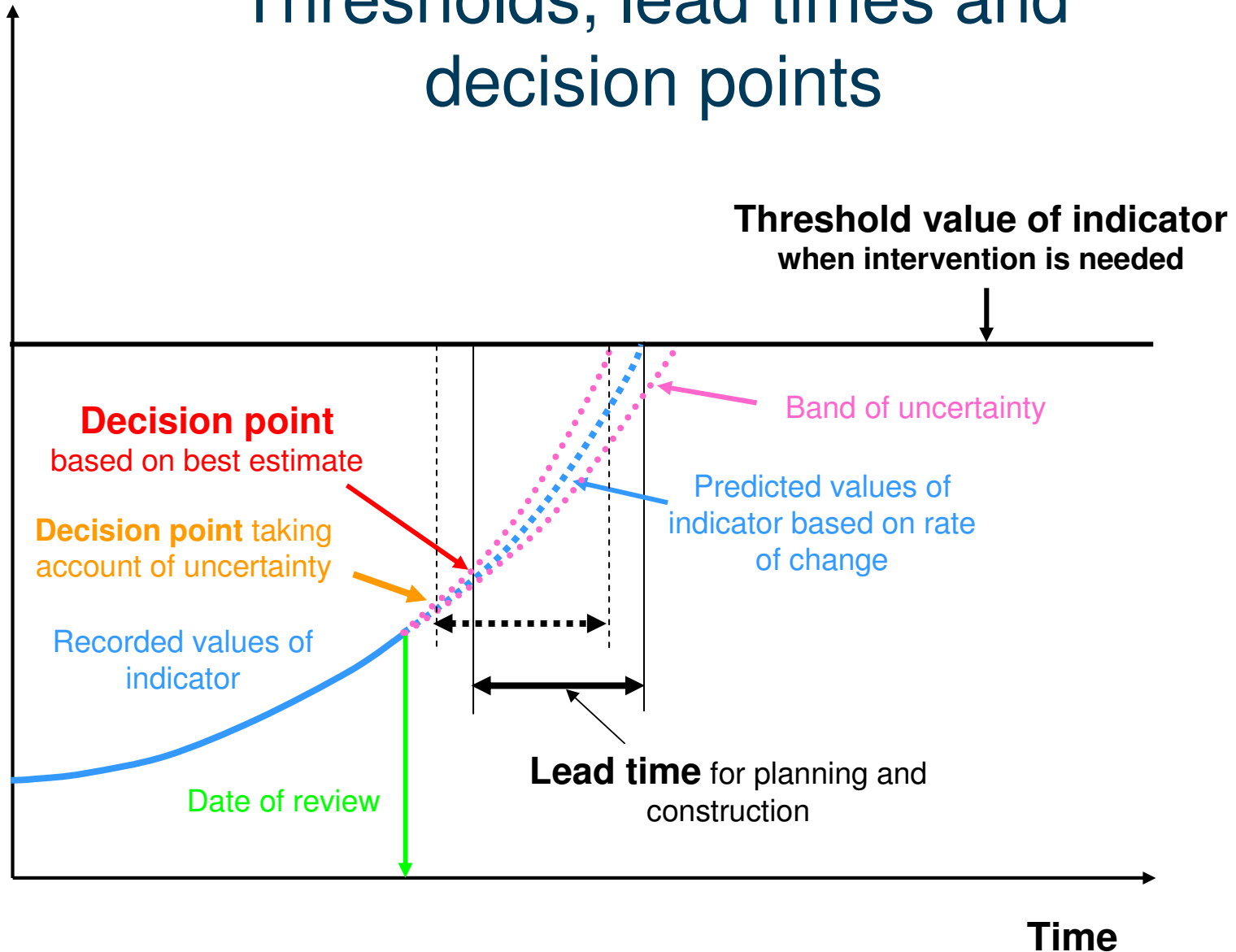
Date of review

Band of uncertainty

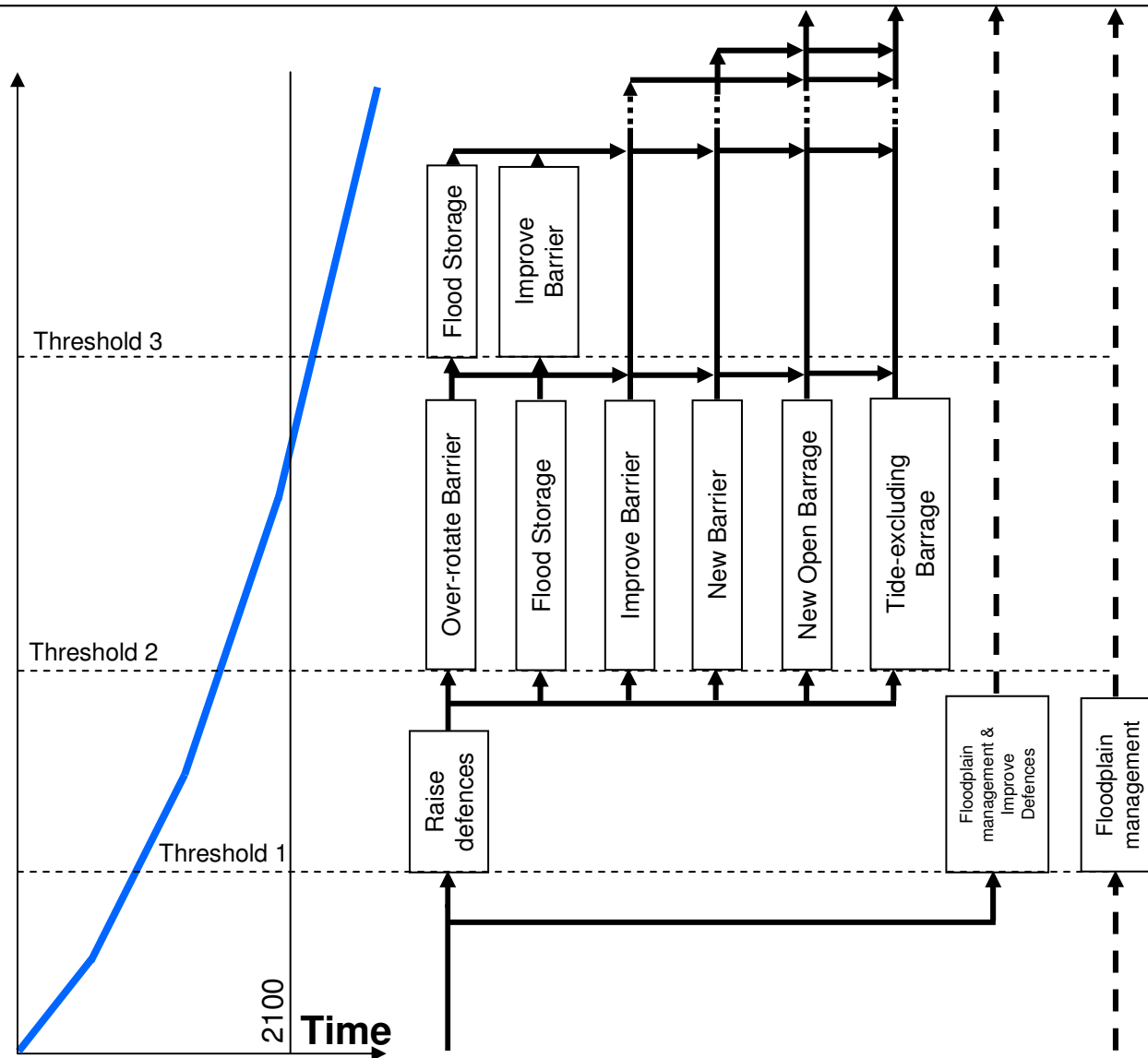
Predicted values of
indicator based on rate
of change

Lead time for planning and
construction

Time



Maximum sea level



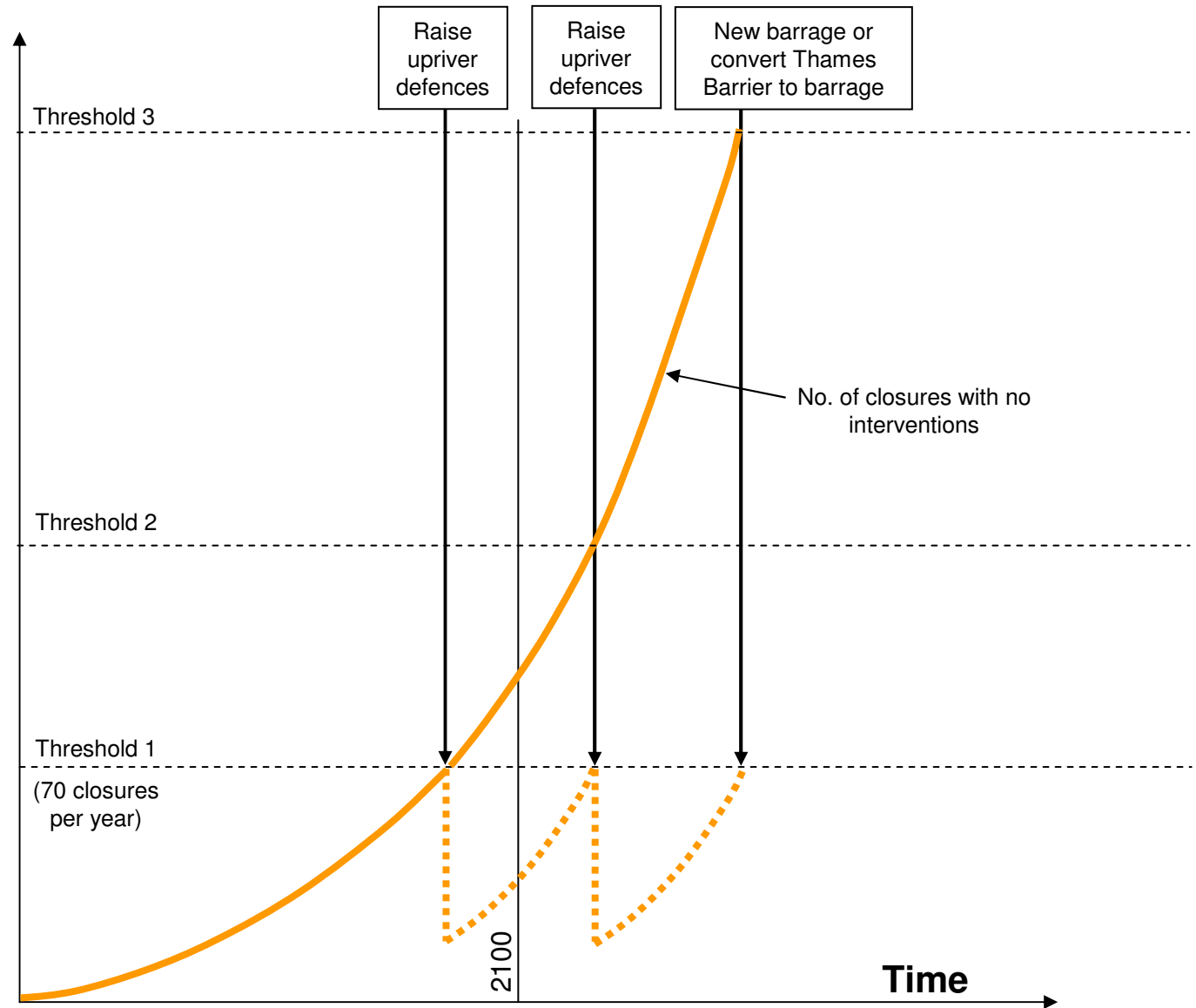
Threshold 1: Limit of present system

Threshold 2: Limit of Thames Barrier

Threshold 3: Limit of Thames Barrier with over-rotation or flood storage

**Responses for increases in
maximum sea level (from
Thames Barrier downriver)**

**Annual number of
closures of the
Thames Barrier**
(depends on Mean Sea
Level rise)



Note:

The portfolios of responses are designed to keep the annual number of closures below 70.

Thus the actual number of closures follows the dotted brown lines.

**Impact of Mean Sea Level increase on
defences upriver of the Thames Barrier**

An option

Intervention 1	
Intervention 2	
Intervention 3	
Intervention 4	
Intervention 5	
Intervention 6	
Intervention 7	
Intervention 8	
Intervention 9	

Main Assumptions

Policy Iteration B (P5 introduced in 2080)
 Defra climate change
 70 Barrier closures per year
 Perfect forecasting accuracy
 New infrastructure: London Gateway port
 1050ha habitat needed by 2100

Option	Indicators	Epoch																		
		2000	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2110	2120	2130	2140	2150	2160	2170	2180
Option 1	Extreme tidal WL					Raise d/r defences				Improve TB and raise downriver defences										
	Extreme tidal WL						Trial flood storage area (Aveley)													
	Thames flow																			
	Barrier closures										Raise u/s 0.5m			Raise u/s 0.5m				New barrage		
	New port																			
	Habitat area																			

Each coloured bar represents a response (or portfolio of responses)
 All the coloured bars make up an option

An option

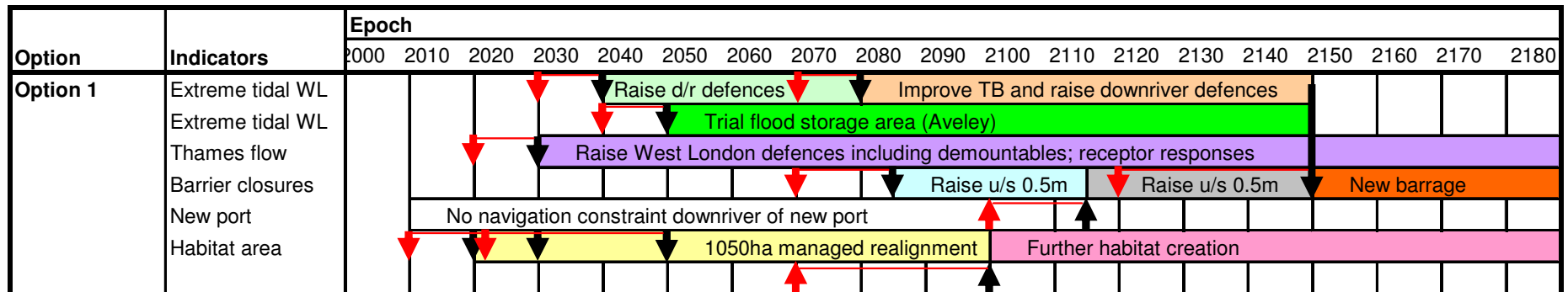
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Main Assumptions

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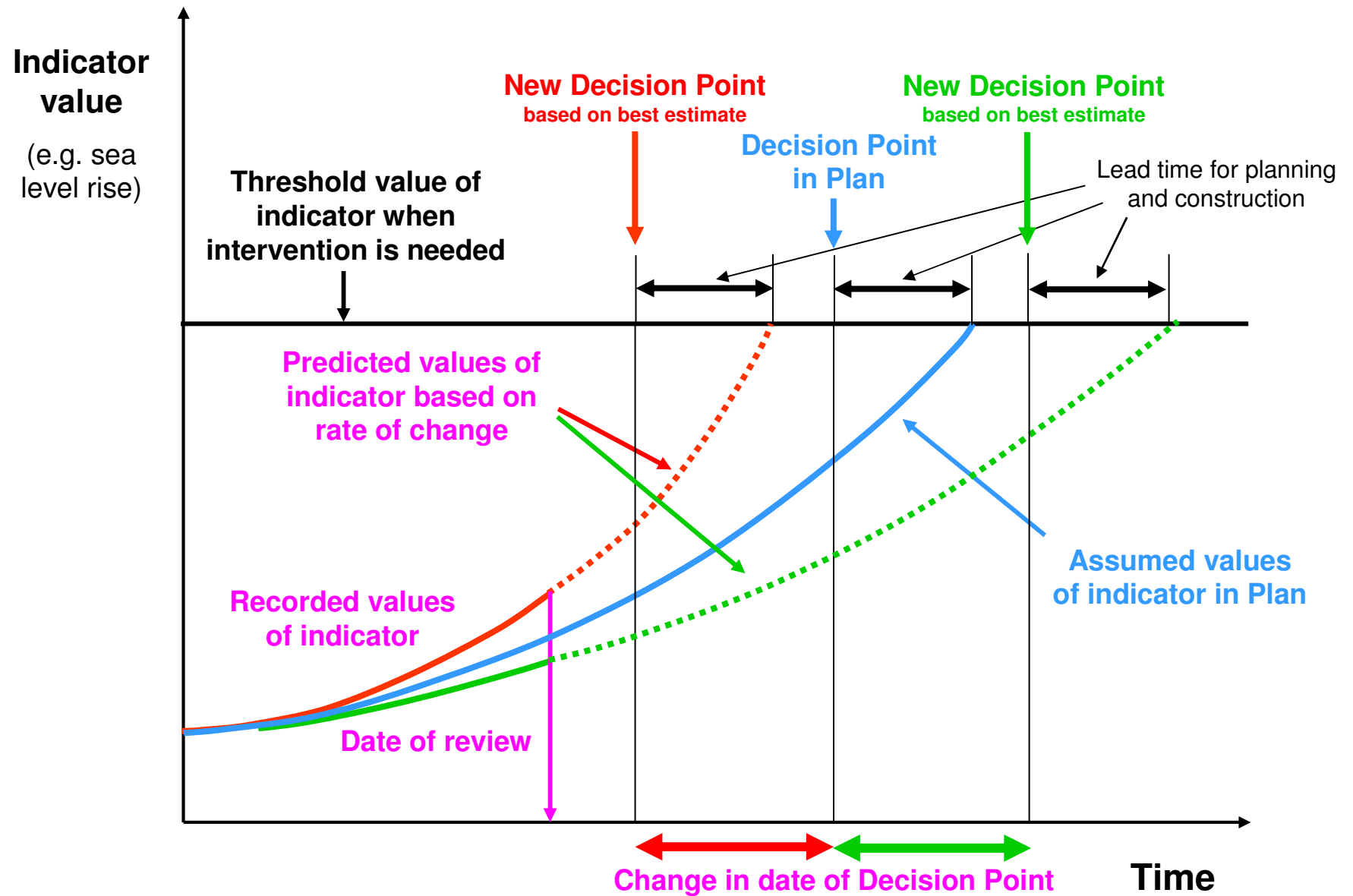
Legend

↓ Implementation point
 ↓ Decision point



Each coloured bar represents a response (or portfolio of responses)
 All the coloured bars make up an option
 The diagram shows the timing of decisions for a complete option

Impact of change on Decision Points



Intervention 1	
Intervention 2	
Intervention 3	
Intervention 4	
Intervention 5	
Intervention 6	
Intervention 7	
Intervention 8	
Intervention 9	

Main Assumptions

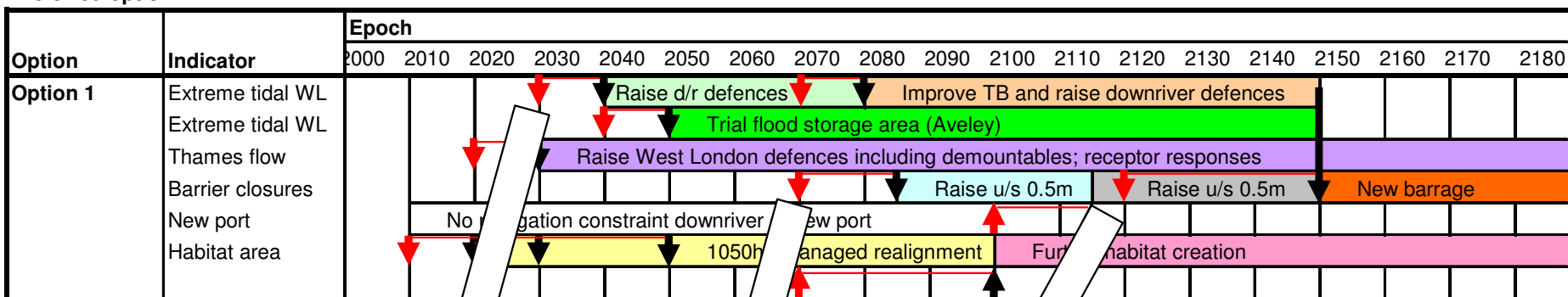
Policy Iteration B (P5 introduced in 2080)
 Defra climate change
 70 Barrier closures per year
 Perfect forecasting accuracy
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Updated option

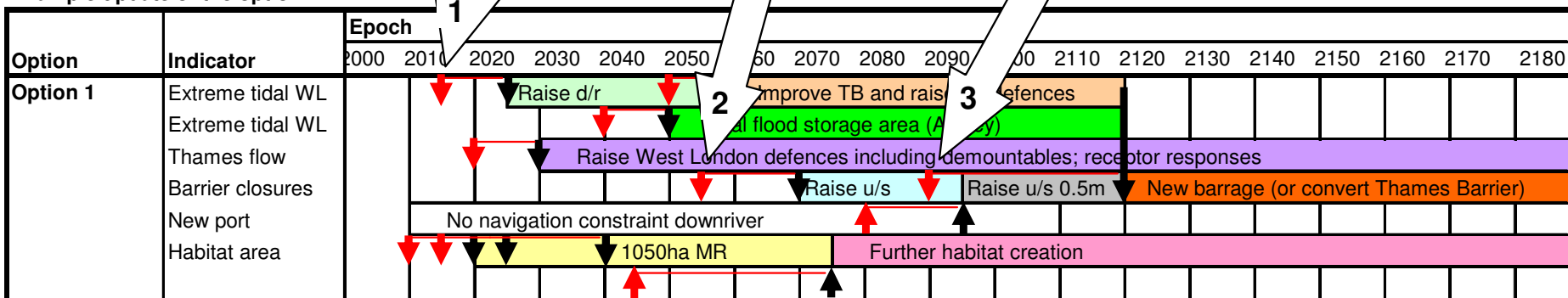
Legend

↓ Implementation point
 ↓ Decision point

Preferred option



Example update of the option



Effect of monitoring is to change decision dates

Change could affect timing of interventions or (if change is large), choice of option

Adaptation

Changes in timing of interventions

Changes in choice of interventions

Adaptable interventions

- Defence foundations for future raising

- Alternative defence alignments

- Future conversion of structures

‘Precautionary’ land use planning:

- Safeguard land for Flood Risk Management

- Space for future improvement

Monitoring (examples)

Mean Sea Level / Maximum surge tide level

Fluvial flood flows

Annual number of Barrier closures

Condition of defences

Area of habitat

Extent/value of development

Public attitudes

Plus updated predictions of change and Government
Guidance

The current Estuary-Wide Options

1. Improve defences
2. Tidal flood storage
3. New Barrier: 2 locations
4. New Barrier with locks: 3 locations

Floodplain management and other local options are covered in the PMU options

Final Plan may include a combination of options

All options include:

Managed realignment

Local responses for fluvial flood risk:

West London

Tributaries

Floodplain management

Creating a better place

Local Area (PMU) options....

Achieve requirements for estuary-wide options

Cover other sources of flooding (e.g. tributaries, drainage systems)

Include floodplain management

Include opportunities to create a better place

Floodplain management

Flood forecasting & warning

Pre-event measures including emergency planning

Spatial planning for existing development

- Community based measures

- Safe havens, high level access

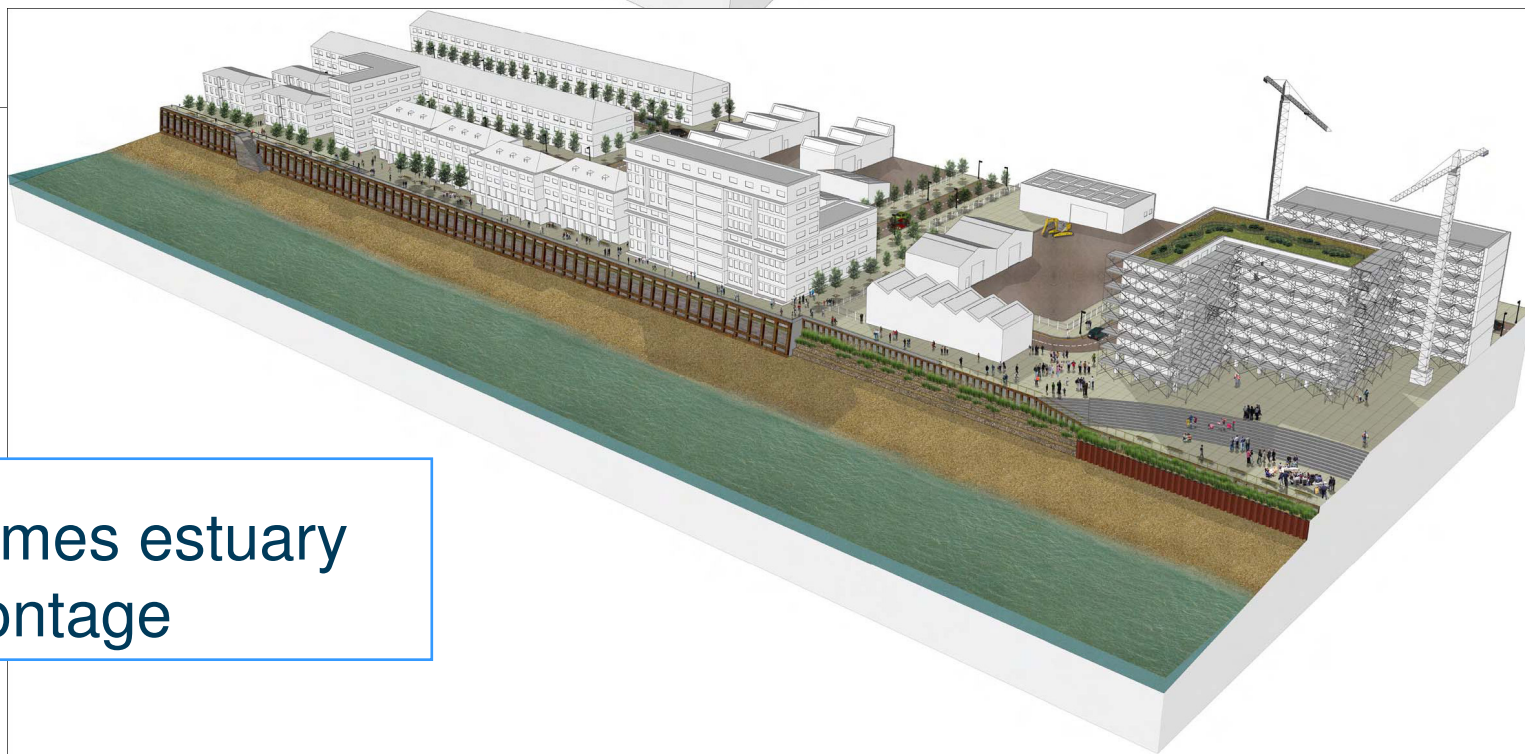
- Secondary defences

Spatial planning for new development

- Development layout

- Resilient construction

- Move vulnerable development

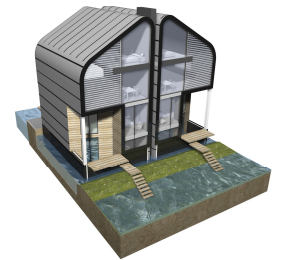
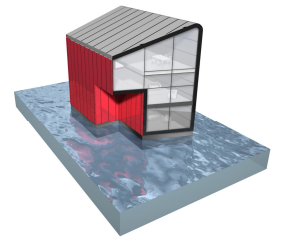
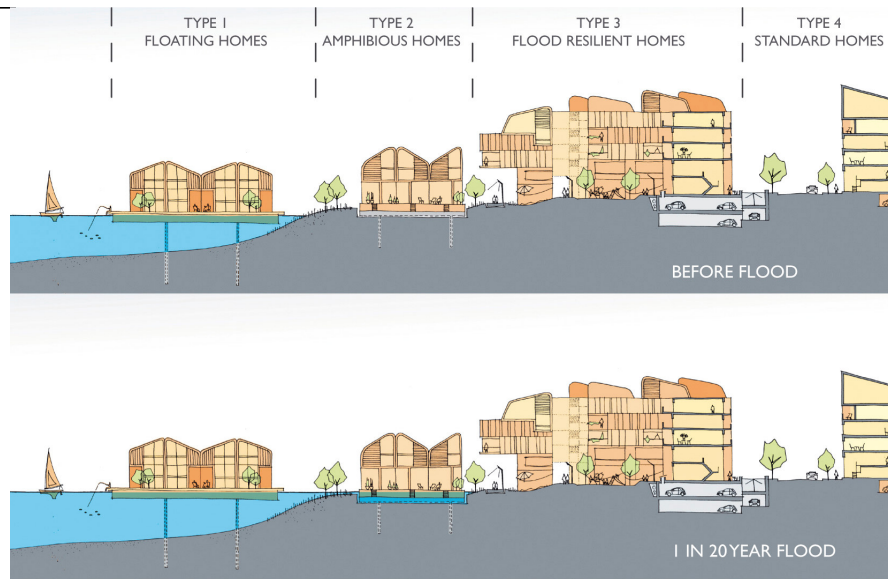


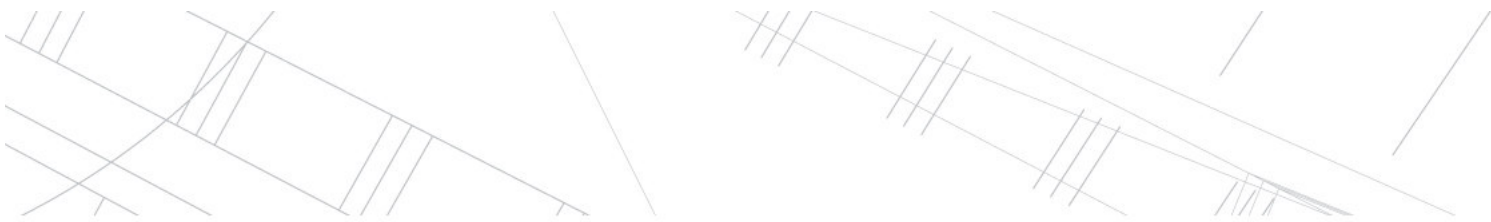
The Thames estuary
frontage

The floodplains

An example from the Netherlands

Dordrecht Floodproof Pilot © Baca Architects





The End

Thank you