Coastal change in a changing climate:

Achieving sustainable development in areas susceptible to coastal changes

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Introduction

- Cause… and effect
- Response… and retreat? Or, realign and re-profile, plan and adapt?

Contents

- Sea level rise and UKCP18
- Sea level rise uncertainties
- Evidence: a case study from Newlyn
- Storminess and wave climate
- ‘Coastal change’ - what/why/where?
- Shoreline Management Plans – where evidence meets policy

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UKCP18 – what is it?

- Provides a range of climate change projections and tools to access climate data – published October 2018
- Delivered by the Met Office in partnership with EA, using outputs from a suite of global and regional climate models
- Provides Global, European and UK projections
- Effectively supersedes UKCP09
- Marine projections include sea level rise, storm surge and wave climate

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UKCP18 sea level rise projections: headlines

- Sea levels continue to rise up to and beyond the end of the 21st century

- Rate of rise is non-uniform around the UK
  - For SE England, SLR expected up to 1.15 m under the high emission scenario (by 2100)
  - For NE England, SLR expected up to 0.9 m under the high emission scenario (by 2100)

- By 2300, SE England can expect an increase in sea level of between 0.5 m to 2.2 m under the low emissions scenario and between 1.4 m and 4.3 m under the high emissions scenario

- Extreme water levels with a current 0.01% chance of occurring in any one year (1:10,000) could occur every year by 2300

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UKCP18: comparison to previous understanding

- Increased SLR projections compared with UKCP09
- UKCP09 forecast 0.2 to 0.5m by 2100 under the medium emissions scenario; whereas UKCP18, under the same emissions scenario forecasts 0.4 to 0.8m
-
- UKCP18 increases are consistent with results from IPCC's 2013 assessment
- UKCP18 provides new exploratory SLR projections out to 2300

UKCP18 'representative concentration pathway'		UKCP09 equivalent Scenario
RCP 2.6	=	mitigated emissions (not in UKCP09)
RCP 4.5	=	low emissions
RCP 6.0	=	medium emissions
RCP 8.5	=	high emissions

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UKCP18 – how do results relate to current guidance?

- Existing Environment Agency guidance allows for sea level rise in the range of 0.7 to 1.0 m by 2100

Table 3 sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline)

Area of England	1990 to 2025	2026 to 2055	2056 to 2085	2086 to 2115	Cumulative rise 1990 to 2115 / metres (m)
East, east midlands, London, south east	4 (140 mm)	8.5 (255 mm)	12 (360 mm)	15 (450 mm)	1.21 m
South West	3.5 (122.5 mm)	8 (240 mm)	11.5 (345 mm)	14.5 (435 mm)	1.14 m
North west, north east	2.5 (87.5 mm)	7 (210 mm)	10 (300 mm)	13 (390 mm)	0.99 m

- The range in EA allowances is similar to UKCP18 upper estimates due to our precautionary position taken following publication of the IPCC 5th assessment
- UKCP09 H++ scenario provided a plausible upper estimate of sea level rise from 0.9 to 1.9m by 2100
- Existing guidance is still valid under UKCP18 – but under review
- Further refinements likely, but changes expected to be minor

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Uncertainty and the potential contribution of melting ice sheets

- Remains the largest source of uncertainty in projecting future SLR
- Global SLR exceeding 2m (by 2100) lies within the 90% uncertainty bounds for a high emission scenario
- This is more than twice the upper value put forward by the IPPC in the Fifth Assessment Report

Ice Sheet contributions to future sea-level rise from structured expert judgement; (PNAS; May 2019) https://www.pnas.org/content/116/23/11195

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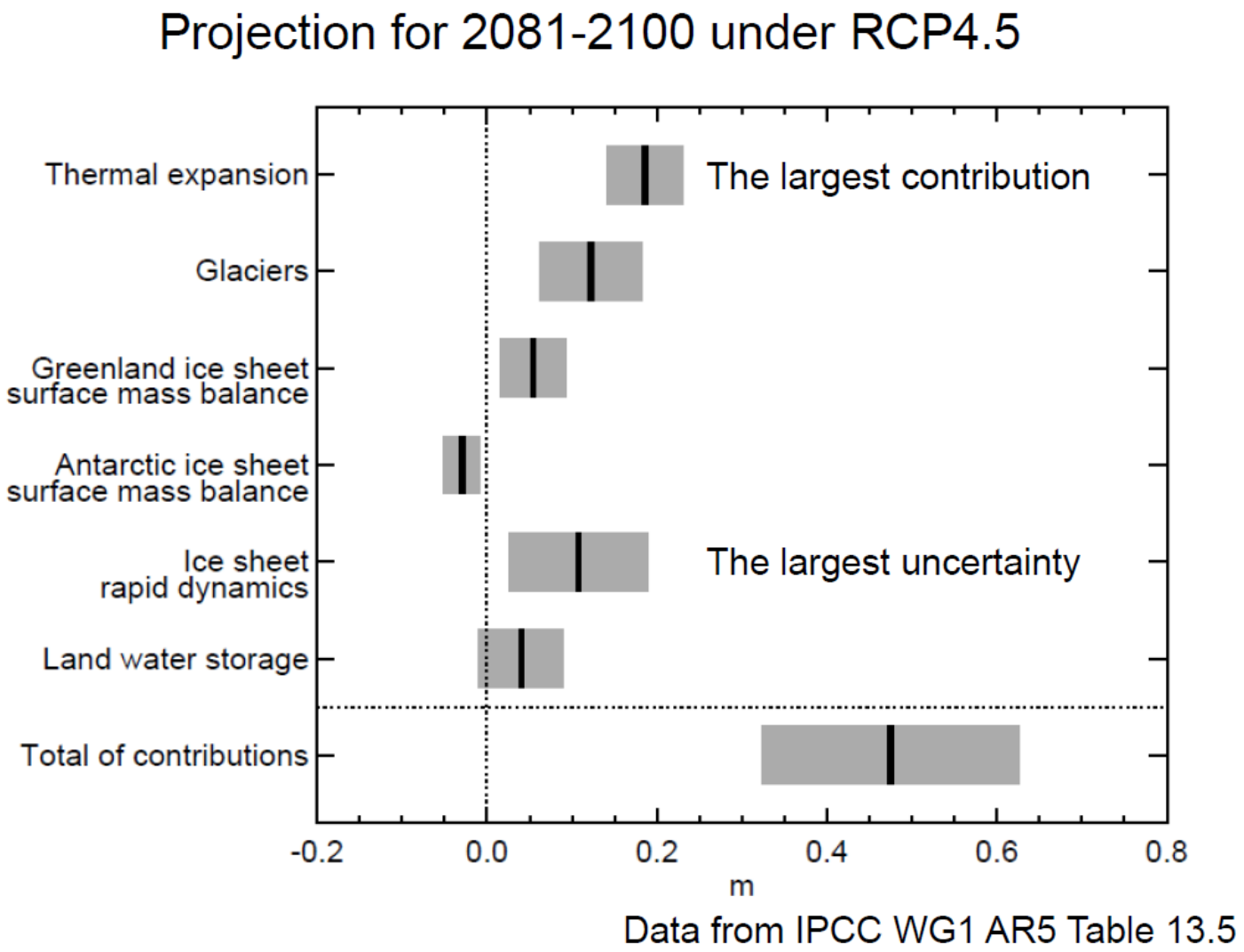
Factors contributing to global sea level rise*



* For UK SLR, isostatic changes (land movements) are also a significant factor, which dictate that difference in total SLR between north and south

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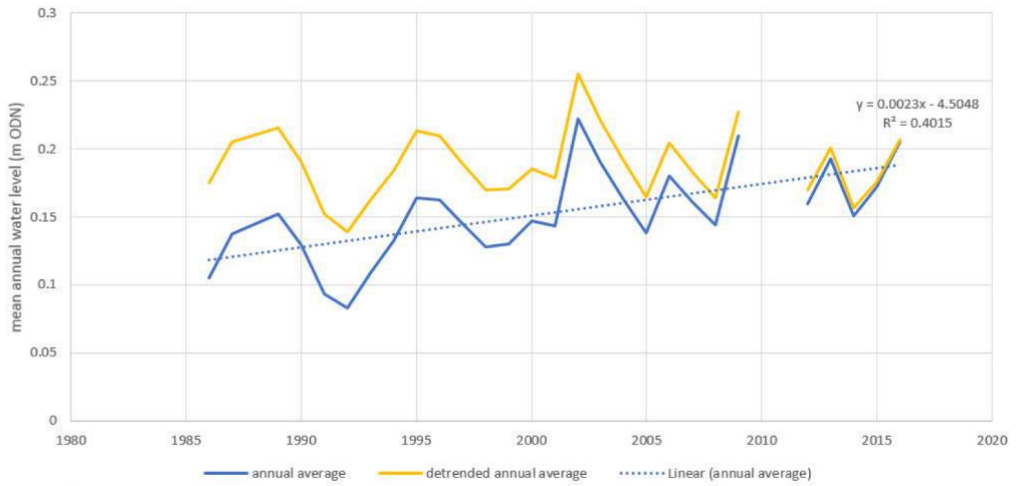
Newlyn mean sea level record

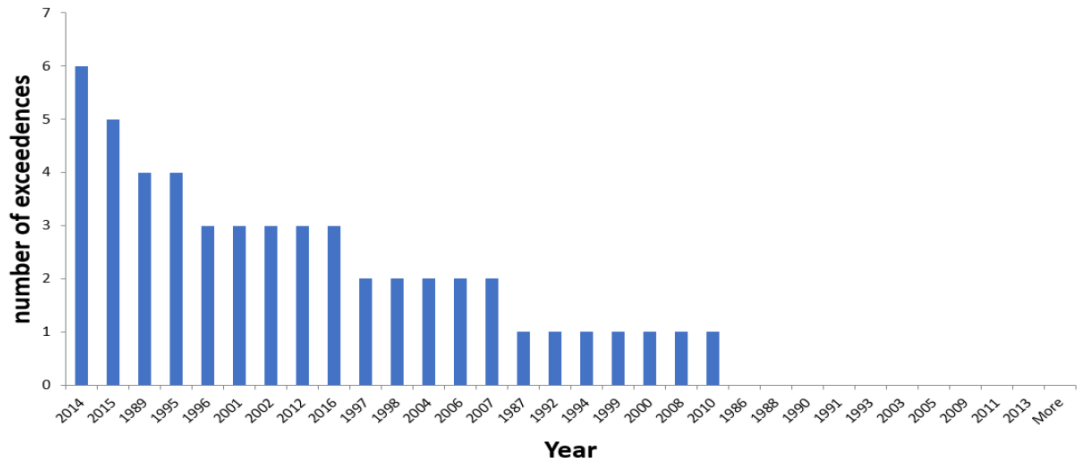
- Newlyn has UK's longest sea level time series (1915 - present)
- Annual increase in mean sea level at Newlyn (1981 to 2016) = 2.3mm/yr
- This supports current precautionary 3.5mm/yr allowance for planning
- Between 1985 and 2016 sea level increased by approx. 7cm

Figure 11: Mean annual water levels - with and without mean sea level rise trend



Source: NTSLF, MML

Figure 8: Number of exceedances of the 1:1-year RP water level (3.13m ODN) per year (31 years of data, 51 exceedances)



Source: NTSLF

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Increasing storminess – what does it mean?

- On average, weather events currently defined as ‘storms’ will be experienced more frequently
- Individual storm events will have potential to become more intense/severe
- More storm clustering (of the type experienced during winter of 2013/14)

What does UKCP18 say?

- Future increased storminess will not add to individual extreme tide levels
- 30-35% increase in winter rainfall - winter rainfall associated with deep areas of low-pressure – (suggesting an increase in unsettled or stormy weather)

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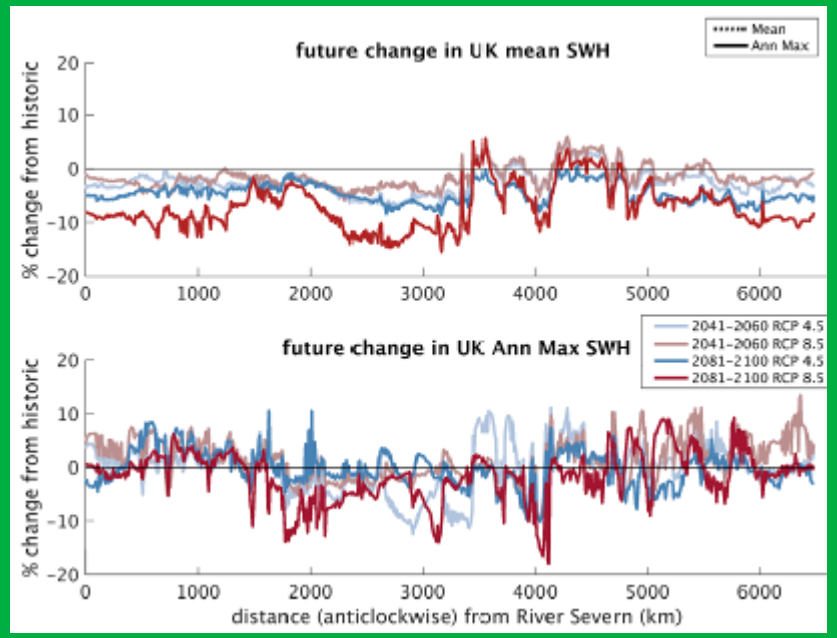
What does UKCP18 say about storminess and future wave climate?

- 10-20% decrease in mean significant wave heights around most of UK coastline of 10-20% over the 21st century
- 10-20% increase in mean maximum wave heights over the 21st century
- Signal for increased maximum wave heights particularly clear for SW England



At present, advised to use existing guidance for climate change allowance:

Applies around all the English coast	1990 to 2055	2056 to 2115
Offshore wind speed allowance	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%
Extreme wave height allowance	+5%	+10%
Extreme wave height sensitivity test	+10%	+10%

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How do we define ‘Coastal Change’ and Coastal Change Management Areas?

- NPPF: physical changes to the shoreline, through the process of erosion, coastal landslip, permanent inundation or coastal accretion
- NPPF: A Coastal Change Management Area (CCMA) will only be defined where rates of shoreline change are *significant* over the next 100 years, taking account of climate change

- Typical signals for pressurised coastal systems undergoing change:
  - » Erosion of hard or soft cliffs
  - » Loss of mobile sediments – lowering beaches and cliffing dunes
  - » Coastal squeeze - narrowing of intertidal area, loss of upper shore vegetation
  - » Increasing frequency of tidal inundation
  - » Frequent and reoccurring damage to defences

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Where are we seeing coastal change?

- Everywhere!
- But for coastal management and planning, scale, context and consequence of change are key (i.e. the significance of change)

Mevagissey

- **Spatial scale:** how widely is an area being affected?
- **Temporal scale:** how quickly is change happening?
- **Mechanism:** is change event-driven, unpredictable…or a more constant and steady process?
- **Context:** what are characteristics of the receptor area?
- **Consequence:** what impact does the change have on people, wildlife and landscape?

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Storm inundation – Penzance

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Defences under attack - Newlyn

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Collapsing cliffs at Newquay

Fears over crumbling cliff after latest landslip in to

BY MIKE SMALLCOMBE

Concerns are growing over the safety of Newquay's crumbling clifftops following the latest incident in the town.

Last month, part of a cliff collapsed under a balcony in a garden overlooking Newquay Harbour. The landslip appeared to leave part of the balcony hanging in mid-air behind the Fore Street home.

For years the town council, residents and local businesses have been concerned over development in prime clifftop areas, due to rockfalls and detrimental effects on the appearance of the area.

The issue has been subject to several petitions, the latest of which was created in August, calling on the government to protect Newquay's clifftop areas and garnering more than 400 signatures.

There have been several incidents of rock falls in Newquay in recent years.

In September a holidaymaker who parked his car outside a holiday let above the town's Fly Cellars returned to find it buried under a pile of rocks.

Six weeks earlier a young family were forced to flee for their lives when the cliff started to crumble beneath them on to the beach between Great Western and Towan.

In November 2016, part of the cliff above Tolcarne beach collapsed onto the road below, and in February 2015, some 100 tonnes of debris fell on to the access road to Great Western Beach, closing it for months.

The numerous incidents have added weight to the arguments of campaigners who are calling on the authorities to prevent development so close to the cliff edge.

Several plots along Newquay's clifftops are currently the subject of planning applications, with developments in the Island Crescent area dominating the agenda.

On December 19 planners turned down a retrospective application for a luxury clifftop house which is under construction in the back garden at 20 Island Crescent, but is not in keeping with the agreed planning permission.

A developer has also this week resubmitted plans to convert the historic former Trebarwith Hotel.

The plans have now been scaled back, with the developer proposing to demolish the old hotel and build a five-storey block with six townhouses, nine apartments, a detached bungalow and a car park.

Developers are rushing to submit their applications before new clifftop development planning policies come into effect this year.

St Austell and Newquay MP Steve Double has welcomed the decision to turn down the latest planning application on Island Crescent.

He said: "I would like to pay tribute to the hard work put in by local residents, including the Protect Newquay Clifftops group, who have devoted many hours voluntarily to campaigning for applications such as this to be refused."

» The 100-tonne landslip at Great Western beach in 2015 closed the access road

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Road links under pressure

Maenporth, Cornwall

Torcross - Slapton, Devon

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Hemsby - Norfolk

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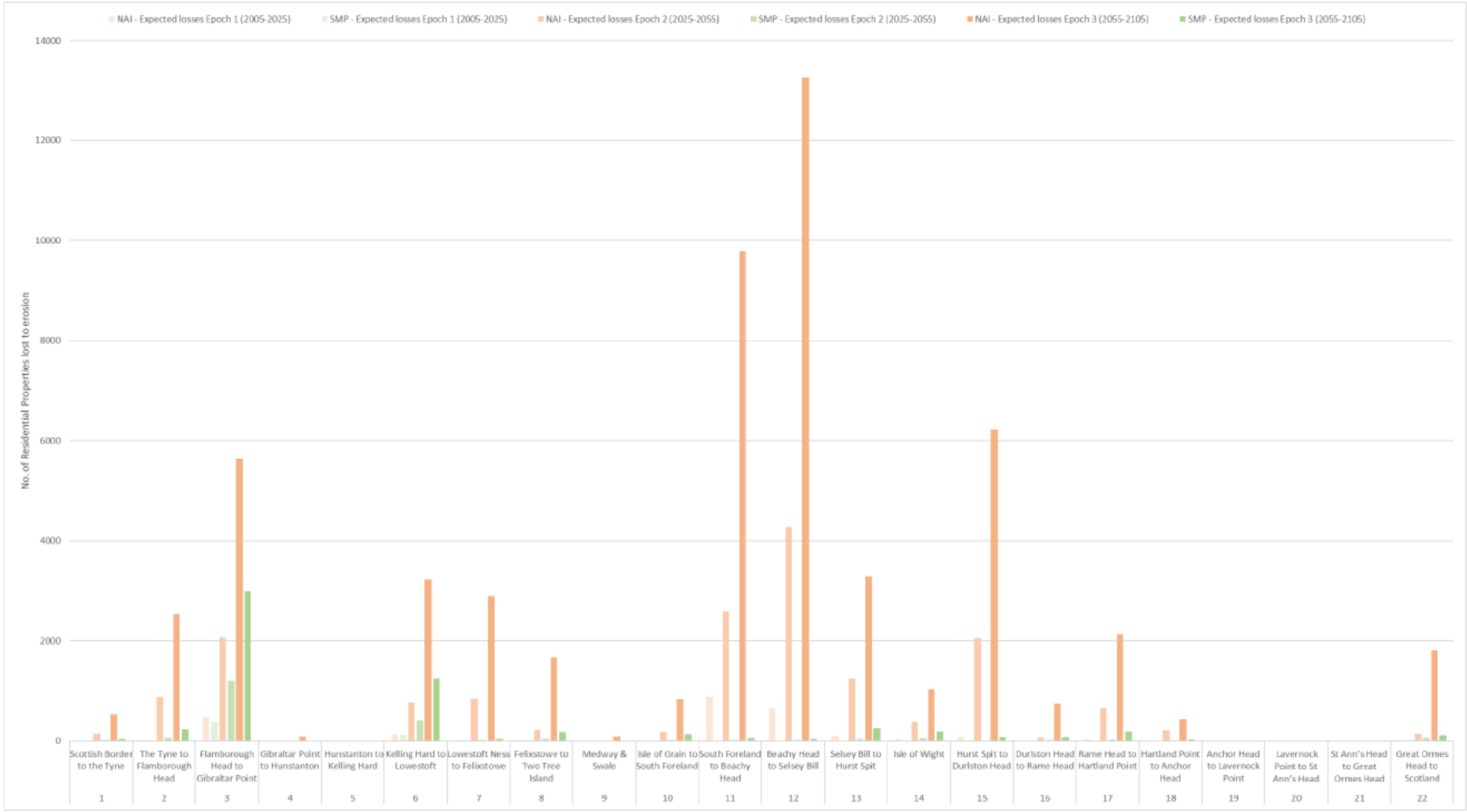

Note: SMPs 20 and 21 have been excluded from the analysis as they cover Wales.

Figure 3-2 Coastal erosion - Summary results: Expected erosion losses by a given epoch: Residential properties.

Source: GIS-based assessment of coastal flood and erosion risk in England – Method Statement, Sayers & Partners 2018

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Shoreline Management Plans – where evidence meets policy

- Broad-scale risk assessment of flooding and erosion at the coast
- Underpinned by coastal processes evidence and mapping of future risks
- Plans split coast into broad ‘Management Areas’ and smaller ‘Policy units’
- Coastal processes are primary evidence steering policy for each unit
- Establishing a shoreline position, which is technically, environmentally and economically sustainable is primary objective
- Using the baseline year of 2005, policy is set across three time periods (epochs) to extend the guidance out to 2105:
  - Epoch 1: 2005 – 2025 (20 years)
  - Epoch 2: 2025 – 2055 (30 years)
  - Epoch 3: 2055 – 2105 (50 years)
- SMPs also advocate locations likely to be considered CCMAs under NPPF guidance, to guide implementation by Local Planning Authorities

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Mounts Bay SMP2 Policy

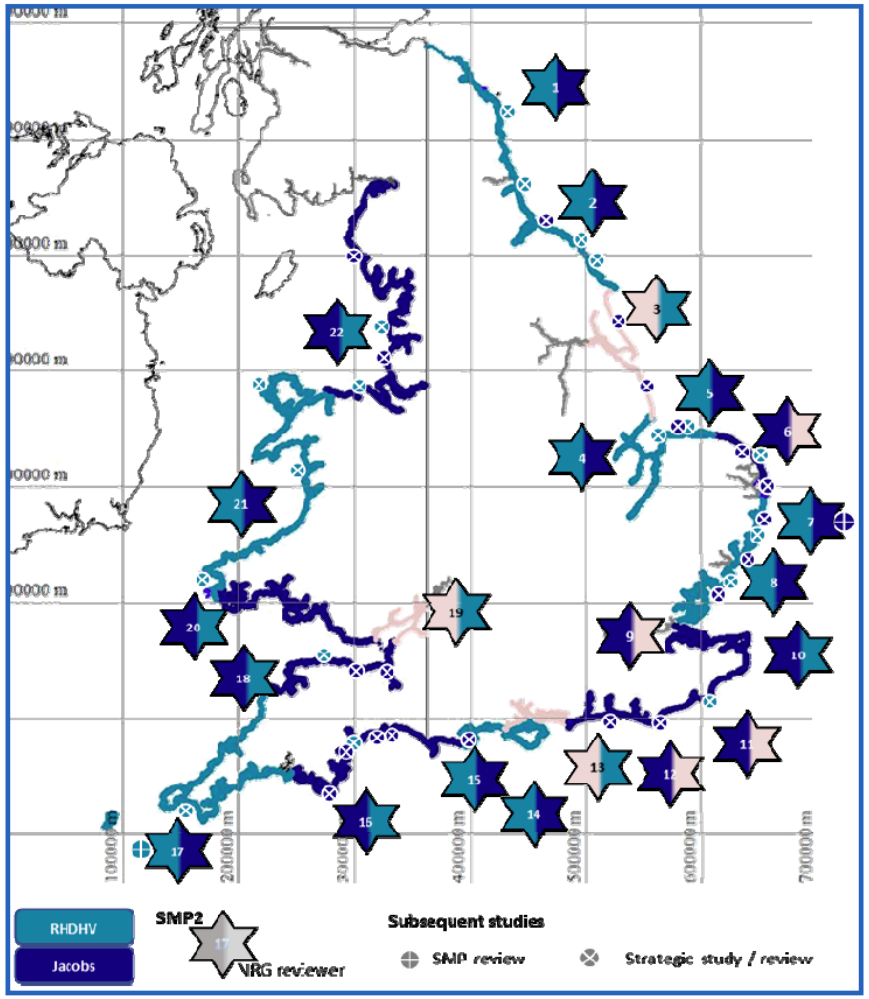
Policy Development Zone	8
Management Areas	19, 20, 21
Policy Units	19.1, 19.2, 19.3, 16.4a,19.4b,19.5,19.6, 20.1, 20.2, 20.3, 21.1, 21.2, 21.3

SMP2 Policy Units (Marazion to Newlyn)

Policy Unit	Location	Epoch 1	Epoch 2	Epoch 3	Rationale
19.1	Undefended coast & Mount	NAI	NAI	NAI	Facilitate naturally functioning coast
19.2	Venton Cove	NAI	NAI	NAI	Facilitate naturally functioning coast
19.3	Marazion Town	HTL	HTL	HTL	Maintain current protection to people & property
19.4a	St MM Causeway	HTL	NAI	NAI	Maintain only for short term
19.4b	St MM Harbour	HTL	HTL	HTL	Maintain Harbour as critical link to Mount (esp. following loss of causeway in future)
19.5	Marazion West	HTL	HTL	HTL	Maintain current protection to people & property
19.6	Marazion Marsh	HTL	HTL	HTL	Protect SPA
20.1	Longrock	HTL	MR	MR	Adapt frontage to reduce coastal squeeze & manage risks sustainably
20.2	Eastern Green	HTL	MR	MR	Adapt frontage to reduce coastal squeeze & manage risks sustainably
20.3	Chyandour	HTL	HTL	HTL	Maintain protection to people, property & railway
21.1	Penzance Docks & Harbour	HTL	HTL	HTL	Maintain current protection to docks, harbour & northern promenade
21.2	Wherrytown	HTL	MR	MR	Adapt frontage to reduce coastal squeeze & manage risks sustainably
21.3	Newlyn	HTL	HTL	HTL	Maintain protection to people, property and harbour

Shoreline Management Plan refresh: 2019 - 21

- 22 SMP2s covering England and Wales
- Most current SMP2s adopted between 2010 – 2012
- In 2018 UK Committee on Climate Change concluded many of the policies were unaffordable or undeliverable
- Current SMP ‘refresh’ programme will focus on ensuring they are technically reliable and more accessible to planners and other users



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Living on the edge – challenges in coastal areas

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Challenges presented in coastal areas due to a changing climate

- Coastal erosion.
- Flooding and storm damage (frequency, severity, extent).
- Inter-tidal and coastal habitat loss (coastal squeeze).
- Deterioration of water quality in estuaries and sea (e.g. combined sewer overflows, run-off).

- Major economic and social implications too!

Funding for flood & coastal defences

- Partnership Funding approach.
- Proportion of Flood Defence Grant in Aid based on the outcomes of a scheme.
- Filling the funding gap…
  - Government growth or infrastructure fund?
  - Community Infrastructure Levy?
  - Section 106 agreements?
  - Working in partnership with other infrastructure or service providers?
- All SMP policy options have cost implications
  - Indicative policy recommendations but un-costed

National Planning Policy Framework & Planning Practice Guidance

Climate change

- Mitigation and adaptation informed by long-term implications of coastal change, flood risk, water supply, biodiversity, landscape etc…

Flooding

- Sequential and Exception Tests.
- Development safe over its development lifetime without increasing flood risk elsewhere.
- Provides wider sustainability benefits.

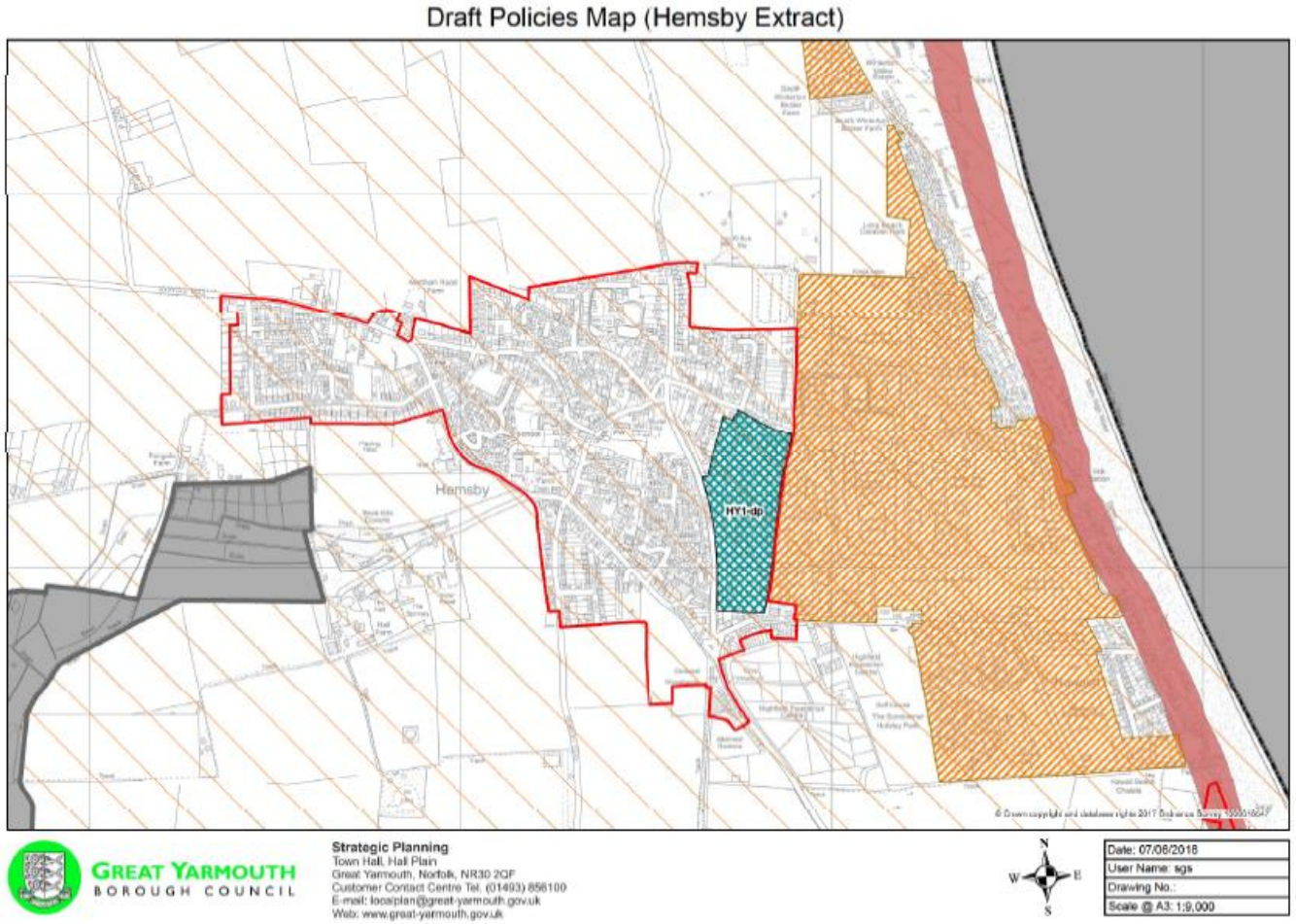
National Planning Policy Framework & Planning Practice Guidance

Coastal change

- Integration of terrestrial and marine planning.
- Coastal Change Management Areas (CCMAs)
  - ‘any area likely to be affected by physical changes at the coast’
- Identify appropriate uses.
  - Safe over its lifetime without an unacceptable impact on coastal change
  - Provide wider sustainability benefits.
  - Time limited permissions?
- Make provision for relocation of existing development away from coastal change areas.

Local policy responses – Hemsby, Norfolk

- Great Yarmouth Draft Development Policy and Site Allocation DPD



- Policy E-1: Manage new development in CCMAs
- Policy E-2: How proposals to relocate away from a CCMA will be considered

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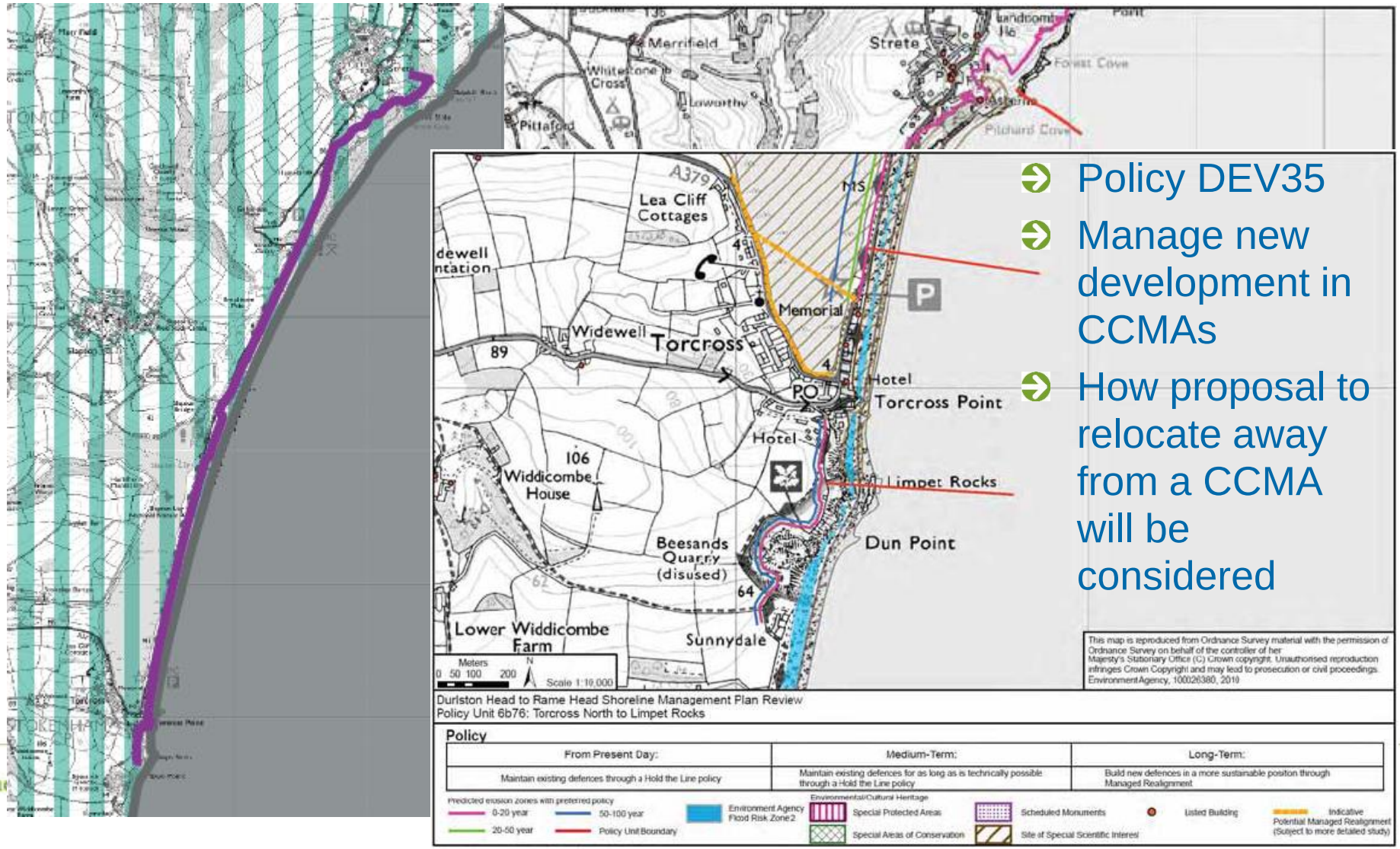
Local policy responses – Torcross-Strete, Devon

- Plymouth and South West Devon Joint Local Plan



- Policy DEV35
- Manage new development in CCMAs
- How proposal to relocate away from a CCMA will be considered

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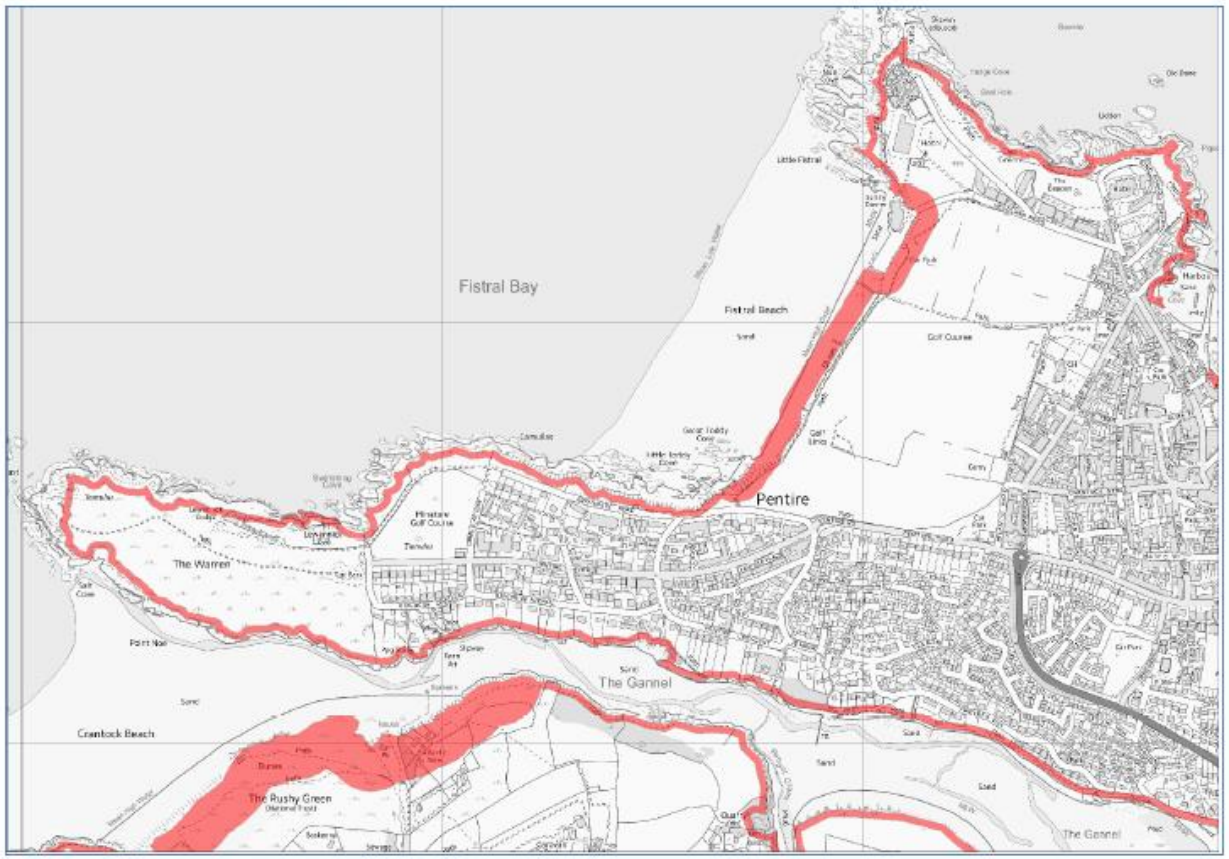
Local policy responses – Newquay, Cornwall

Fistral Bay Coastal Erosion Zone – Anticipated 100 year erosion line plus 10m buffer



- Newquay Neighbourhood Plan allocates almost entire coastline as CCMA.
- Policy to manage new development in locations vulnerable to coastal erosion.

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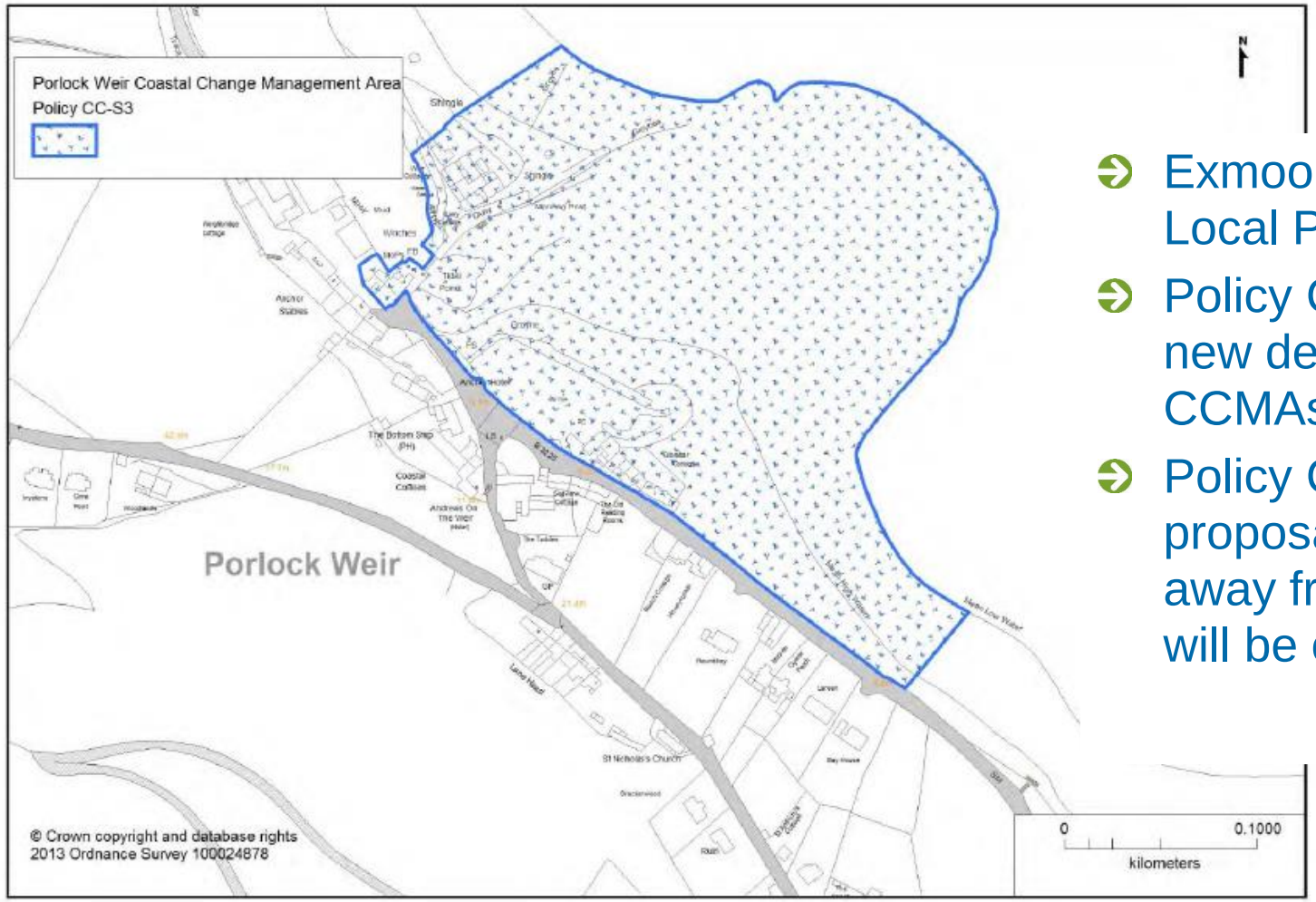
Local policy responses – Porlock Weir, Exmoor

Map 5.1 Porlock Weir Coastal Change Management Area



- Exmoor National Park Local Plan.
- Policy CC-S3: Manage new development in CCMAs.
- Policy CC-S4: How proposals to relocate away from a CCMA will be considered.

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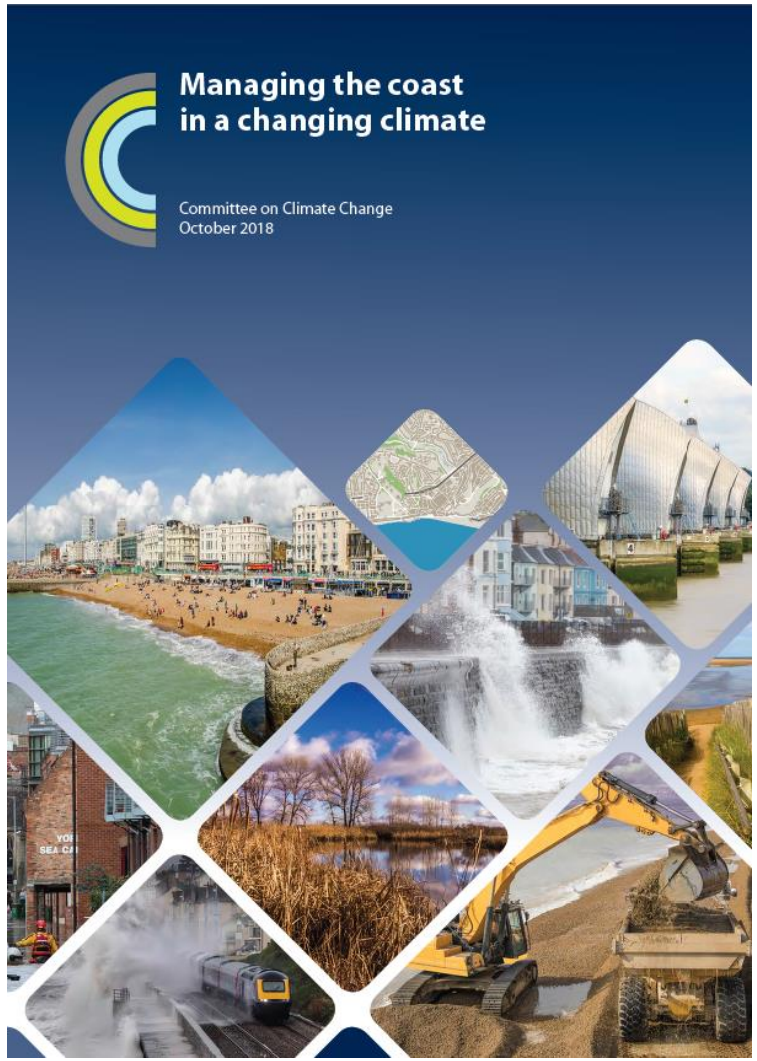
Is the existing approach fit for purpose?



- Complex patchwork of legislation, policy and responsibilities at the coast.
- SMPs are non-statutory plans and contain unfunded proposals.
- No compensation for losses from coastal erosion for homeowners.
- Local Plans are not fully accounting for coastal risks…
  - Up to a third of local plans in coastal areas do not evidence the SMPs
  - Plan periods are not aligned with SMPs
  - CCMAs rely on a narrow interpretation – no consideration of ‘hold the line’
  - Land for the relocation of property, infrastructure and habitats not allocated.

The future: achieving sustainable coastal development

- Improve communication of evidence on scale and implications of future coastal flooding and erosion.
- Legislation and policy from DEFRA/MHCLG needs to be specific, longer-term, evidence-based and monitored.
- Provision of long-term funding/investment…
  - Amended or new funding mechanism
  - Facilitate adaptation, relocation and compensation
- Plans to manage and adapt the coast should be realistic and sustainable.
- A broader, more holistic approach to designating CCMAs.

What will our coastal towns and villages look like in 50 or 100 years?

Policy for coastal management needs to reflect the increasing pressures from climate change, which mean that the status quo cannot be maintained in all locations. Major coastal assets, such as cities and critical infrastructure will require investment in higher standards of protection as sea levels rise. Long-term plans to adapt to changes are required everywhere. Managed realignment and the restoration of natural coastal adaptation offers benefits that people value and is most feasible in areas of low population density, but still requires investment, facilitation and monitoring.

The status quo cannot be maintained everywhere forever