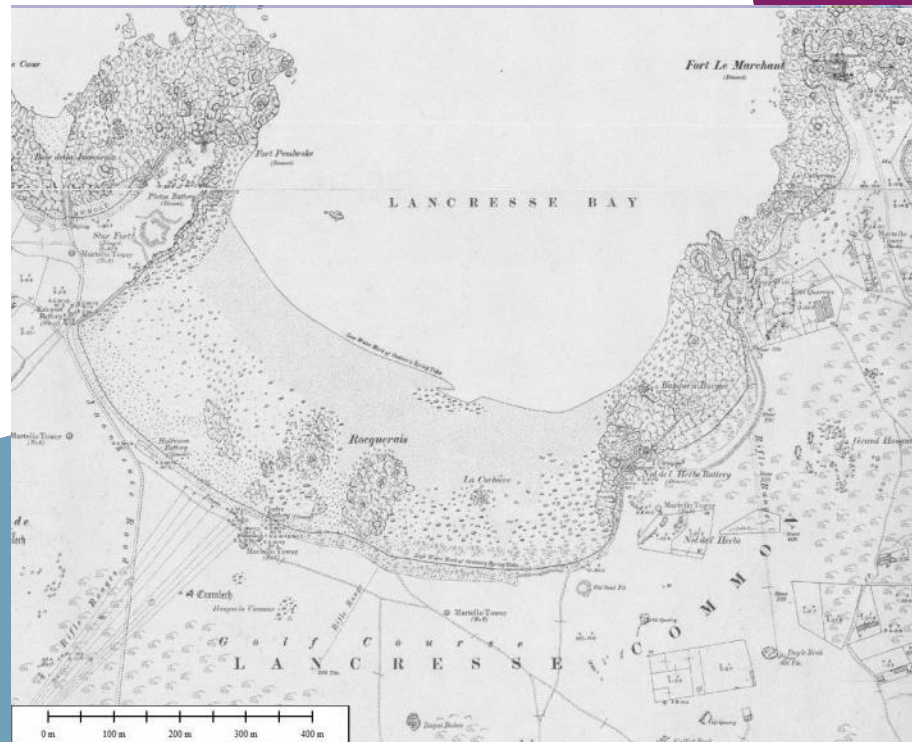


L'Ancrese Bay

Discussion of Future Management

Gregor Guthrie,
22 August 2017



Terms

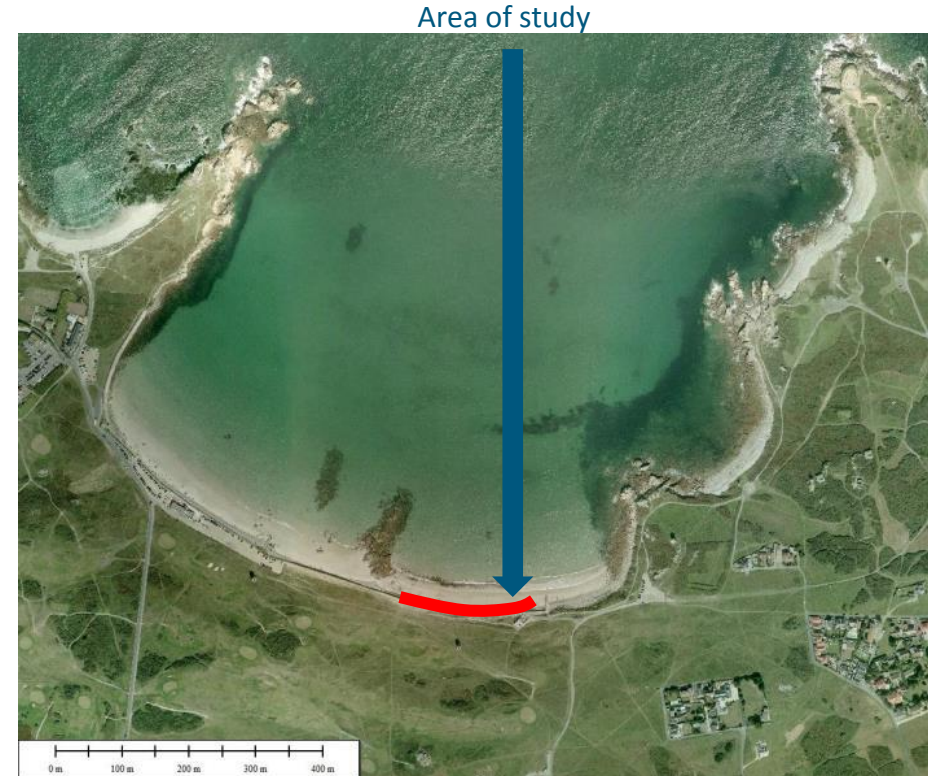
- **Beach Nourishment** – addition of sediment (sand or pebbles) to a beach to increase the level of the beach.
- **Width** – area of the beach between low and high water mark (i.e. the intertidal zone).
- **Scour** – the force of the tide and waves reflected by a structure causes the removal of sand and sediment from the base of the structure, because the sea is not able to flow to it's full extent.
- **Undermining** – erosion at the base of a structure resulting in excavation beneath the structure so as to make it collapse.
- **Toe** - a protective structure at the base of a sea wall to provide additional stability.
- **Accretion** – slow addition of water-borne and wind-borne sediment to existing land.
- **Rock Revetment** – a large sloping structure using stones of a significant weight (3t+). This absorbs wave energy, reducing wave action against a structure and wave overtopping.

Coastal Management is fundamentally about managing change

- Examining the issues and concerns
- Examining the behaviour of the shoreline
- Considering options for management
- Developing the best way forward

At L'Ancrese East:

- Significant issues with erosion
- Deterioration of the beach
- Failing wall
- Longer term issues of sea level rise

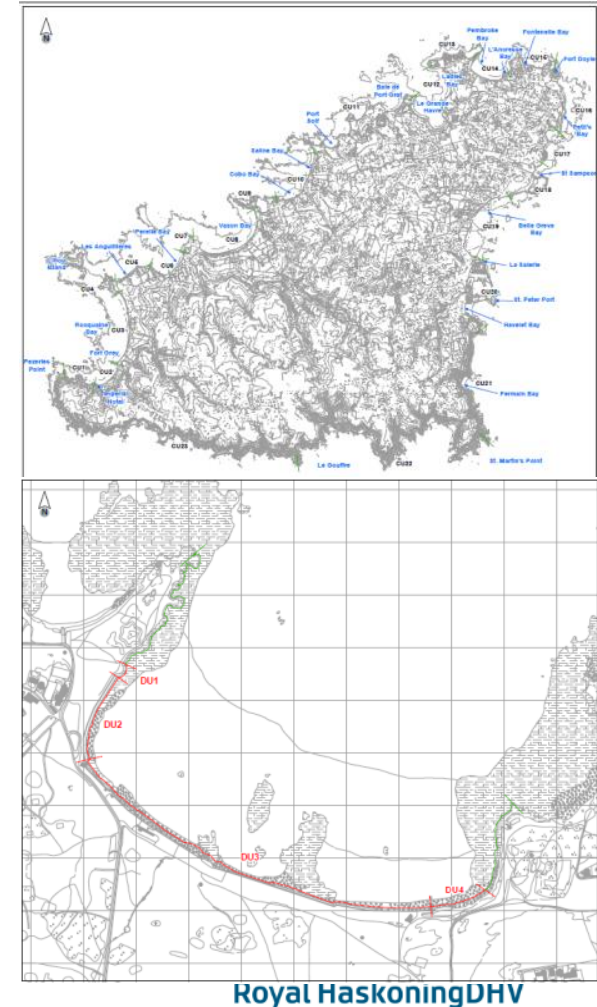


Background to Pembroke Bay

The 2007 Guernsey Coastal Defence Strategy followed on from the Coastal Defence Review in 1999.

The Strategy recommended:

- Defence inspection
- Regular monitoring
- Re-assess flood risk
- Consultation on the preferred option for future management (commenced after 2012 Flood Risk Assessment Studies)



2007 Options for Pembroke Bay

The table below summarises the options put forward for Pembroke in the 2007 Guernsey Coastal Defence Strategy:

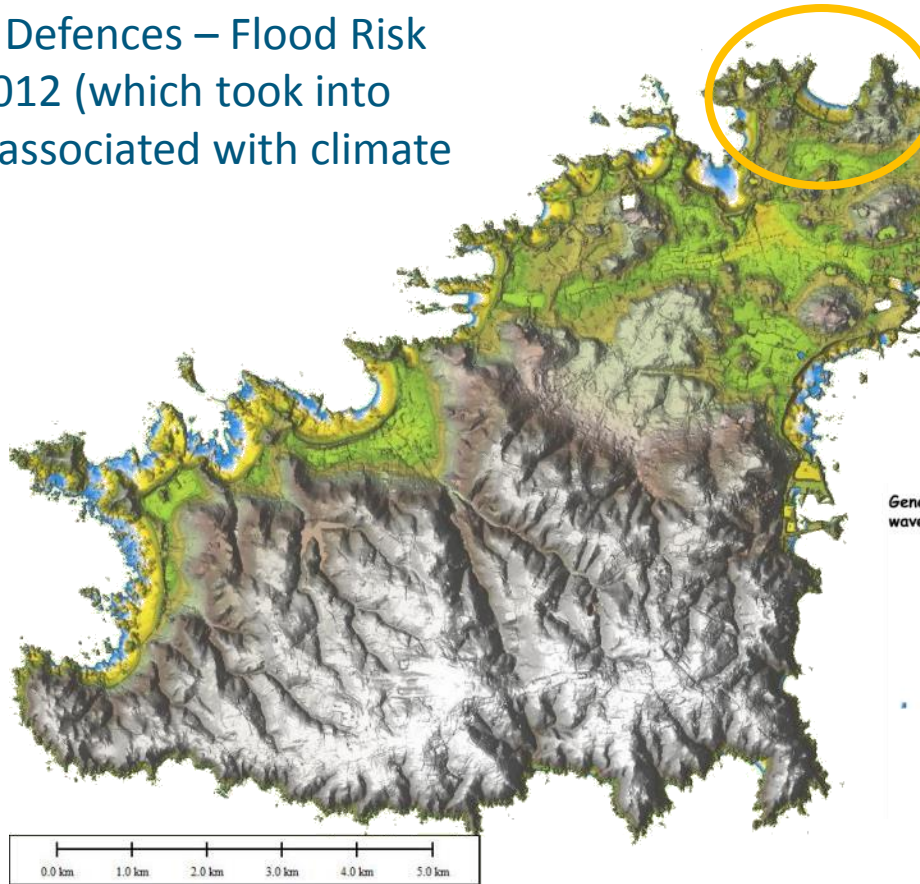
Option	Technical Appraisal	Environmental Appraisal	Economic Appraisal
1 major repairs and rebuilding	<ul style="list-style-type: none">• ensures integrity of defences• long-term commitment to toe strengthening	<ul style="list-style-type: none">• historic significance of defences	not viable
2 beach nourishment	<ul style="list-style-type: none">• ensures integrity of defences• protects toe of wall	<ul style="list-style-type: none">• detrimental impacts on environmental interests• enhances beaches	not viable
3 beach nourishment detached breakwaters	<ul style="list-style-type: none">• ensures integrity of defences• protects toe of wall	<ul style="list-style-type: none">• detrimental impacts on environmental interests• enhances beaches• visual intrusion	not viable
4 managed realignment dune creation	<ul style="list-style-type: none">• unlikely to significantly increase erosion	<ul style="list-style-type: none">• loss of historic defences• opportunity for habitat creation	not viable in the absence of a broader management plan
Do Nothing	<ul style="list-style-type: none">• Loss of assets	<ul style="list-style-type: none">• loss of historic defences• opportunity for habitat creation	viable

These options were re-assessed and expanded in the 2012 Flood Risk Assessment Studies.

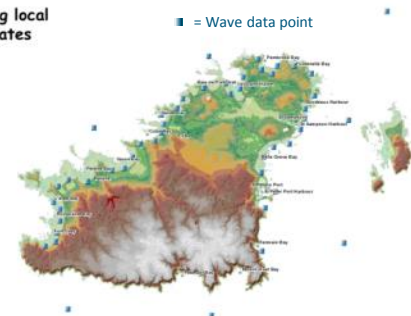
Pembroke Bay – management options

The Guernsey Coastal Defences – Flood Risk Assessment Studies 2012 (which took into account sea level rise associated with climate change) provided:

- Improved data
- Detailed analysis
- Options and costs
- Recommendations



Generating local wave climates



Discussion of the problem



Toe falling
away from
the wall



Wall moving



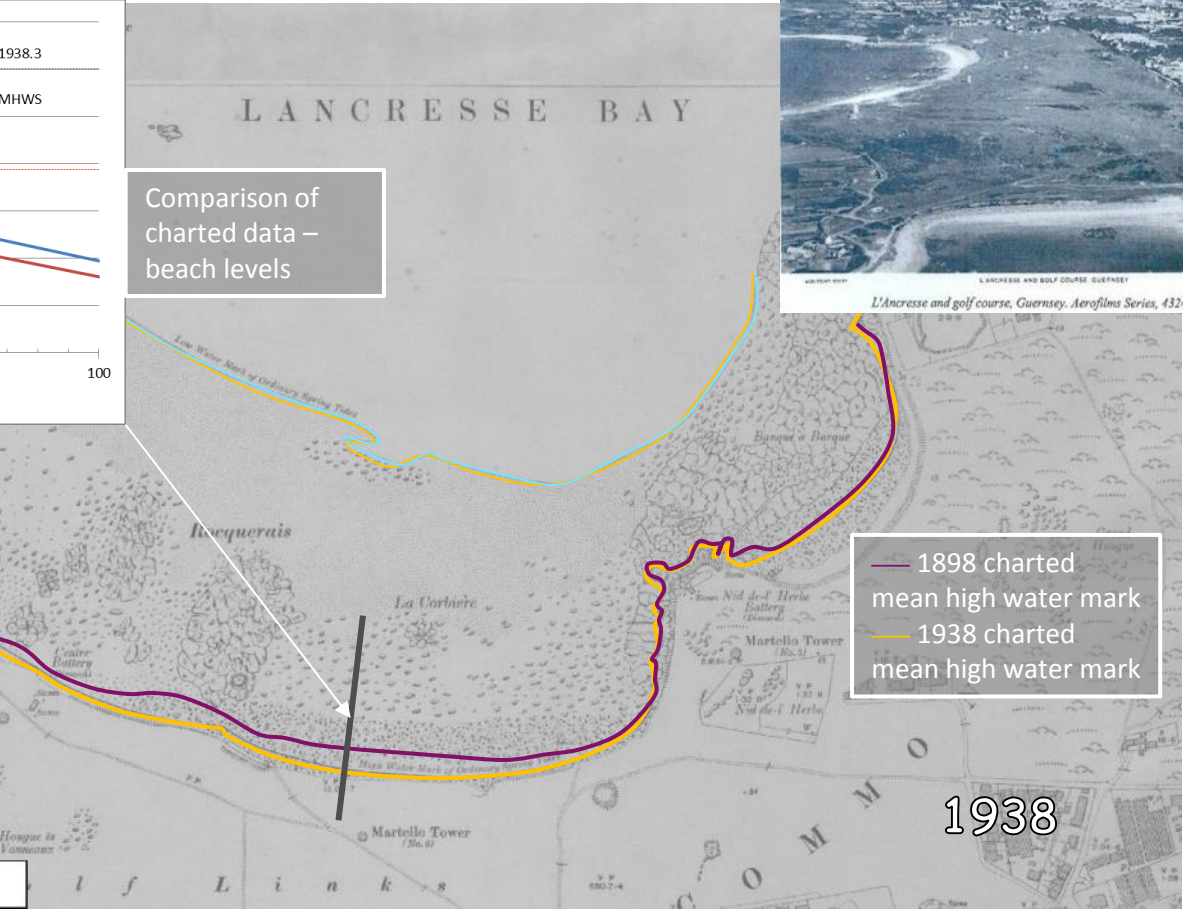
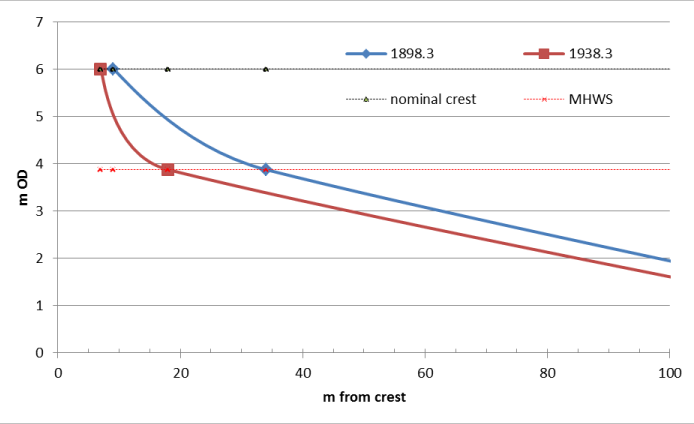
Repair work
being
undermined



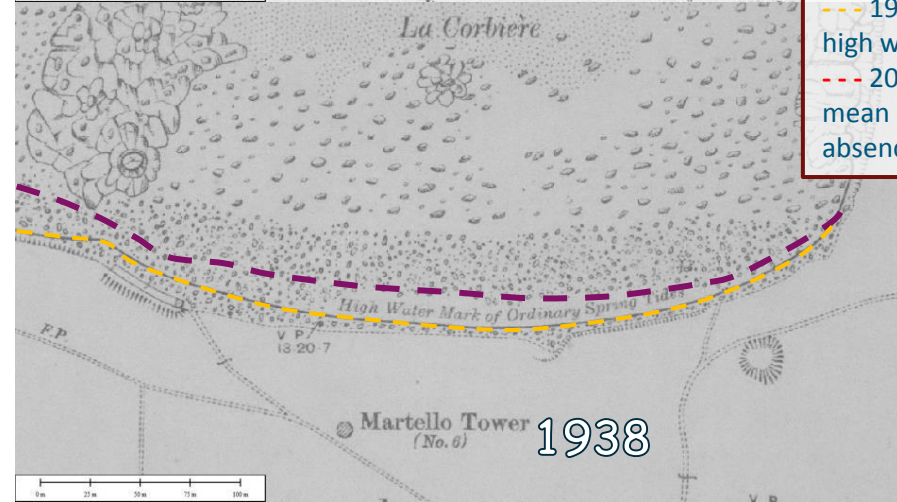
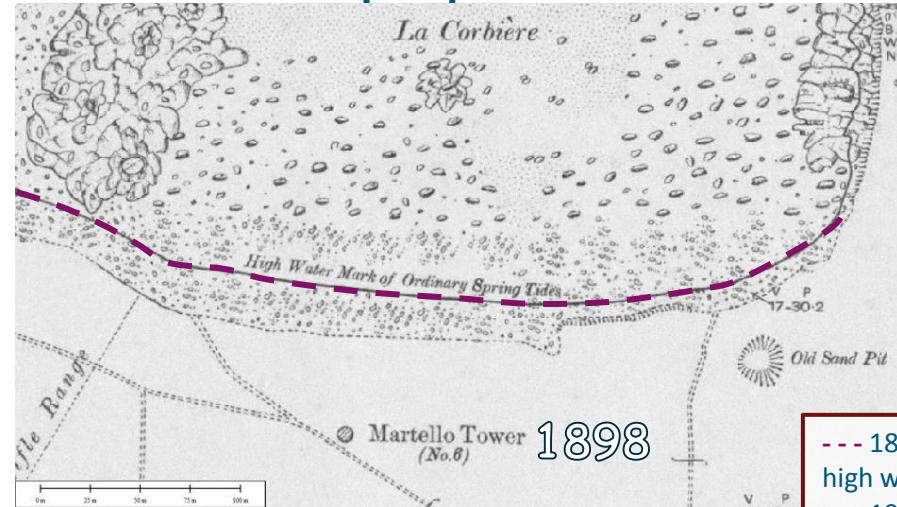
Wave action
causing scour

Royal HaskoningDHV

An historical perspective



An historical perspective

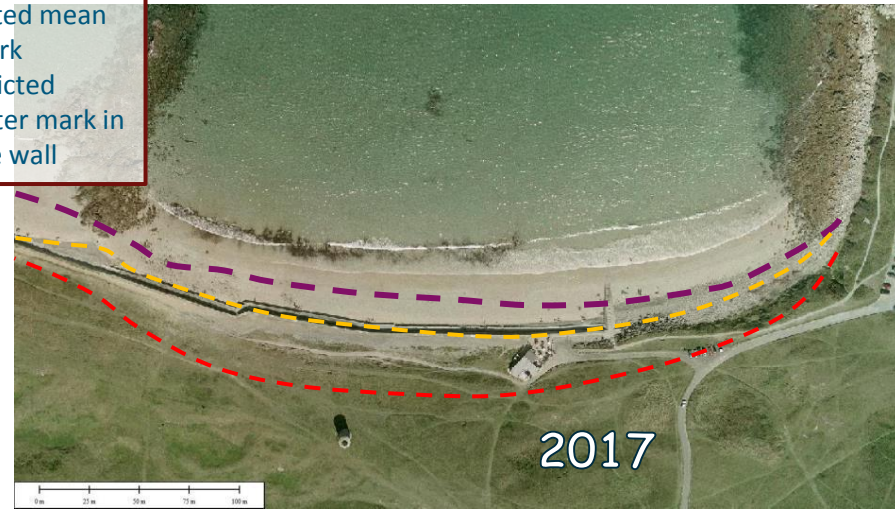


Without the wall:

- The natural coastline might have set back some 30m
- The road to the carpark would have been set back
- The kiosk would not have been built where it has been built

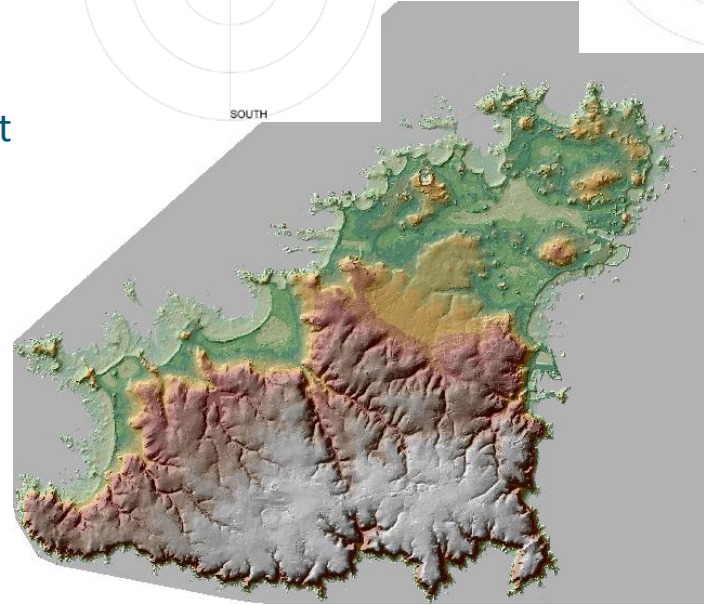
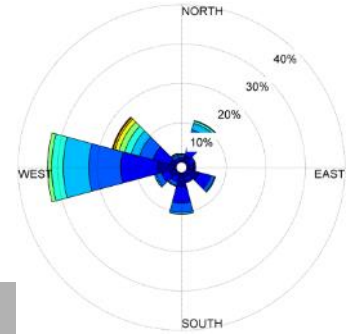
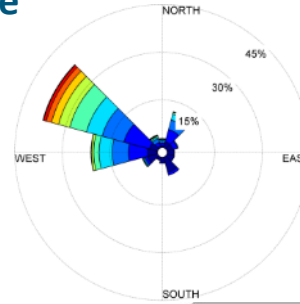
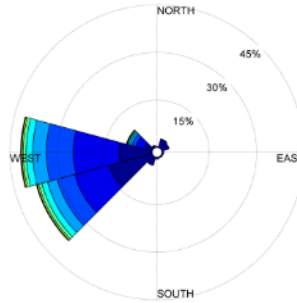


--- 1898 charted mean high water mark
--- 1938 charted mean high water mark
--- 2017 predicted mean high water mark in absence of the wall



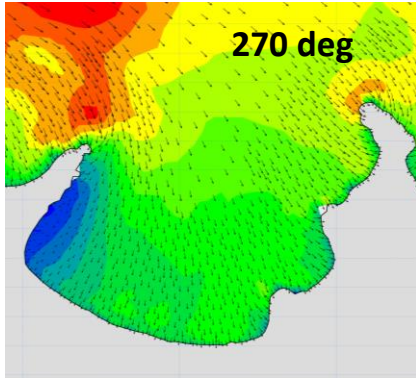
Analysis of the bay – Island Wave Rose Analysis

The length of each coloured spoke in the **directional wave roses** shown relate to the percentage of time that the waves arrive from that particular direction. Each concentric circle represents a different frequency, emanating from zero at the centre to increasing frequencies at the outer circles. Each spoke is broken down into colour-coded bands that show wave height ranges.

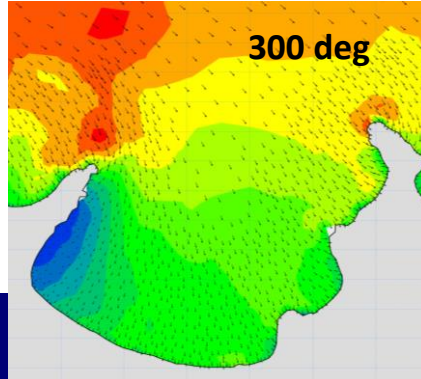


Analysis of the bay - L'Ancrese Wave Modelling

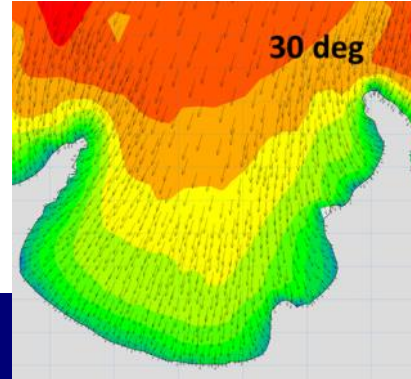
- Degrees indicated in the images below are the direction of waves taken clockwise from North



Western and middle sections of the bay have lower wave action.



Western end of the bay has lower wave action.



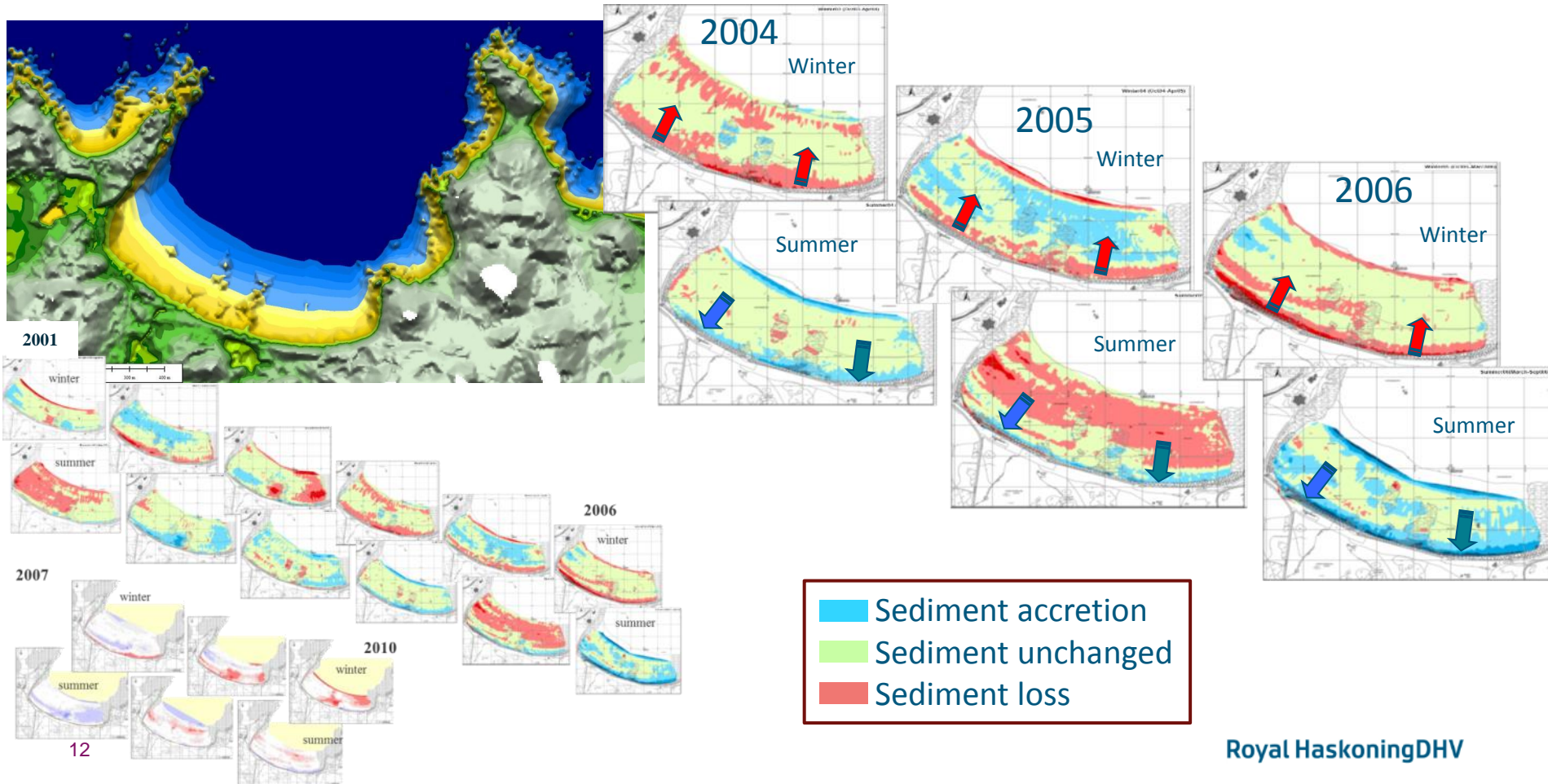
Bay has more even wave action – still higher at eastern end.



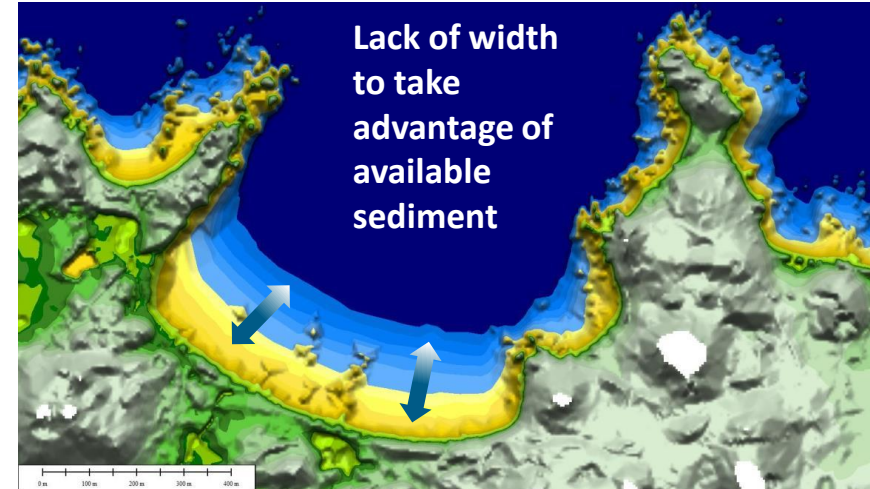
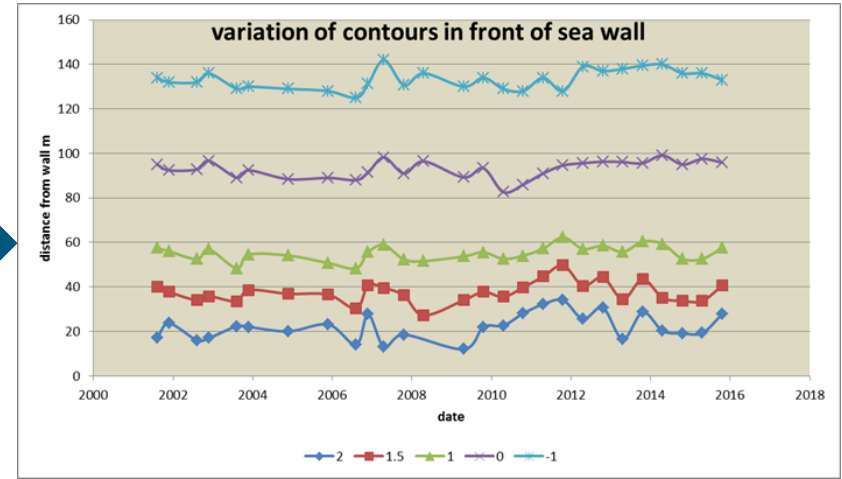
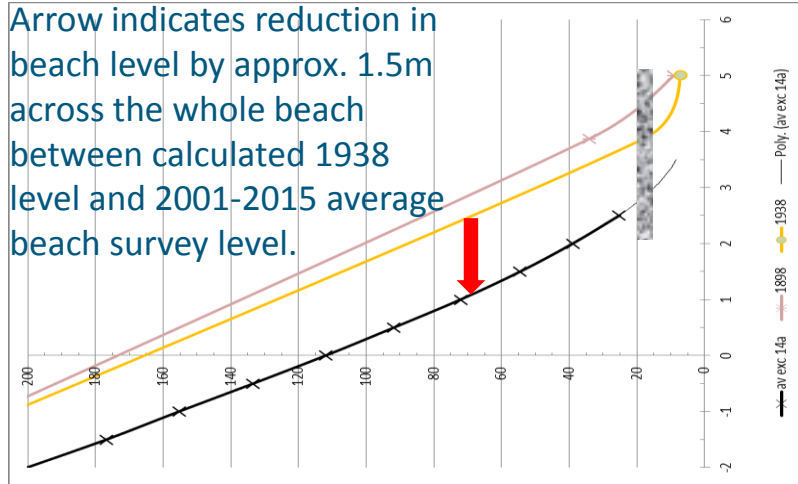
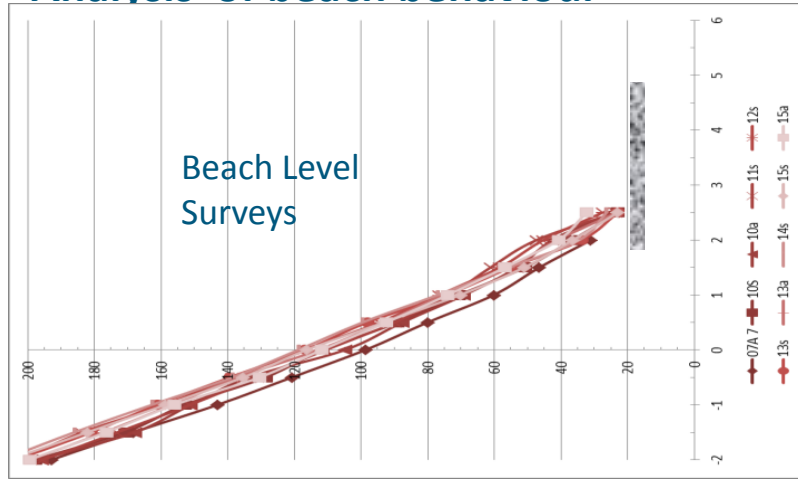
Waves travel along the wall to the eastern end



Analysis of beach behaviour – beach sand level monitoring since 2001



Analysis of beach behaviour



Ongoing repairs and issues at L'Ancrese

Ongoing processes:

- Reduced beach levels
- Increased undermining
- Instability of the apron and the sea wall
- Increased overtopping

Coupled to the fact that the old wall has significant inherent weakness due to its construction leads to ongoing issues (wall falling and cracking) and repairs.



2003



2007



2013



2014

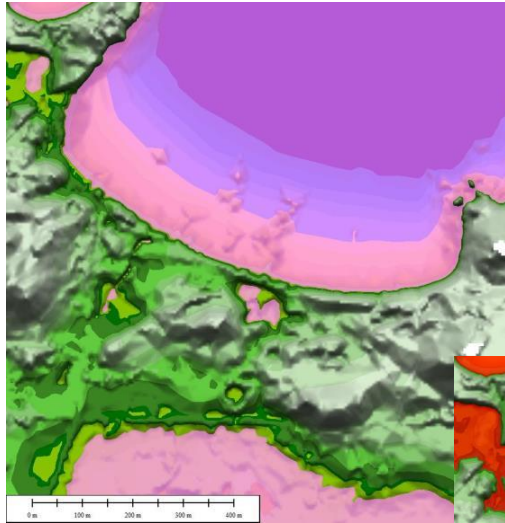


2017

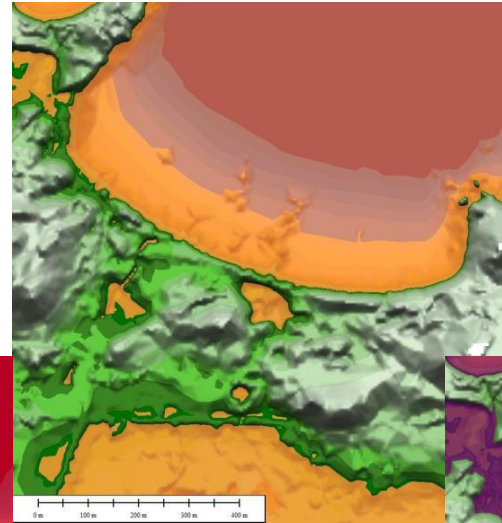


2012 Flood Risk Assessment Studies – No flood risk from Pembroke Bay

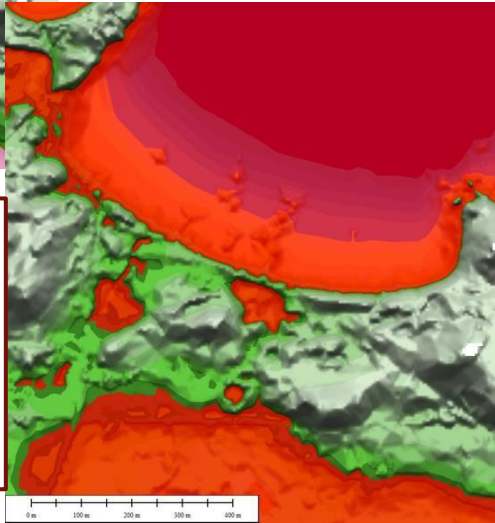
- Investigations modelled potential storm events (1 in 50 and 1 in 100 year events) and the effect of sea level rise. The modelling results are shown below.



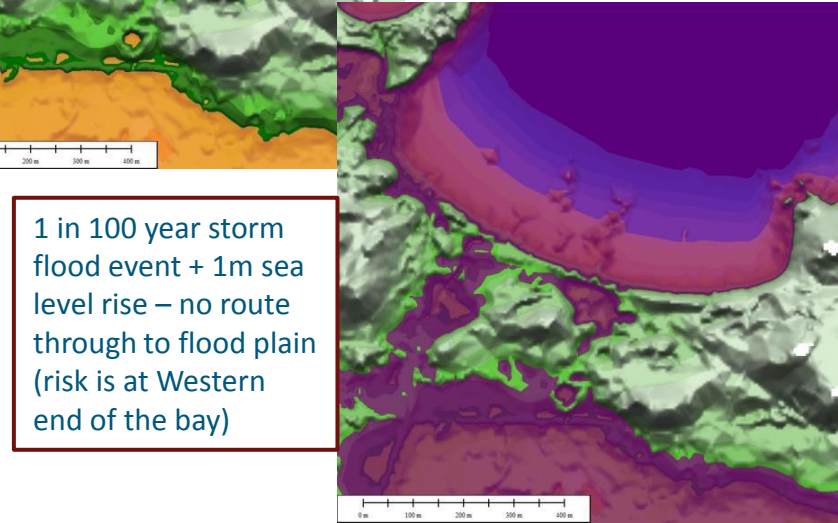
1 in 50 year Storm flood event – no route through to flood plain (natural highland prevents flooding)



1 in 100 year storm flood event – no route through to flood plain (natural highland prevents flooding)



1 in 100 year storm flood event + 0.5m sea level rise – no route through to flood plain (natural highland prevents flooding)



1 in 100 year storm flood event + 1m sea level rise – no route through to flood plain (risk is at Western end of the bay)

2012 Flood Risk Assessment Studies - Outline options L'Ancrese East

Do Nothing - walk away

- Health and safety issues – closure of eastern beach
- Uncontrolled failure – localised severe erosion – closure of coastal path
- Loss of Kiosk
- Loss of slipway
- Longer term risk to road

1. Managing Do Nothing – removal of defences



£665,000

2012 Flood Risk Assessment Studies - Outline options L'Ancrese East

3. Resist change – full height of existing wall rock revetment

- Large impact on the upper beach – will extend out from the existing wall in the order of 25m.
- Reduced amenity and access.
- Potential to provide 50 years defence.

£1,800,000

This option does not address the fundamental problem of lack of width



3a. Resist change – underpinning replacing apron

£1,200,000 (high construction risk)

- Difficult process with already damaged wall

3b. Resist change – (steel sheet piles)

£1,200,000

- Secures the alignment of the wall over the next 40 to 50 year.
 - Major future works would be required, including encasing the wall and assessing erosion and abrasion.
 - Increasing the wall height to address overtopping would be required

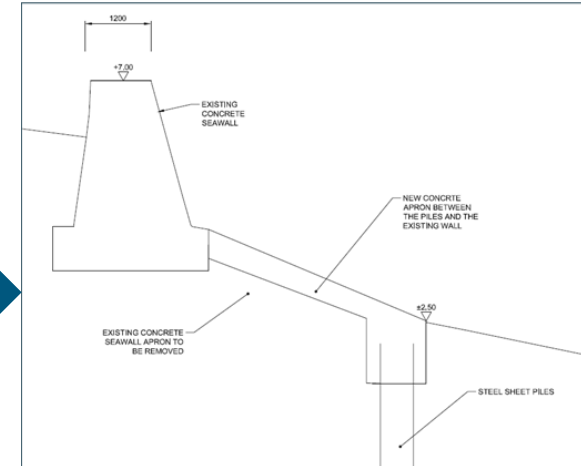


Figure 1 – Diagram to show Option B

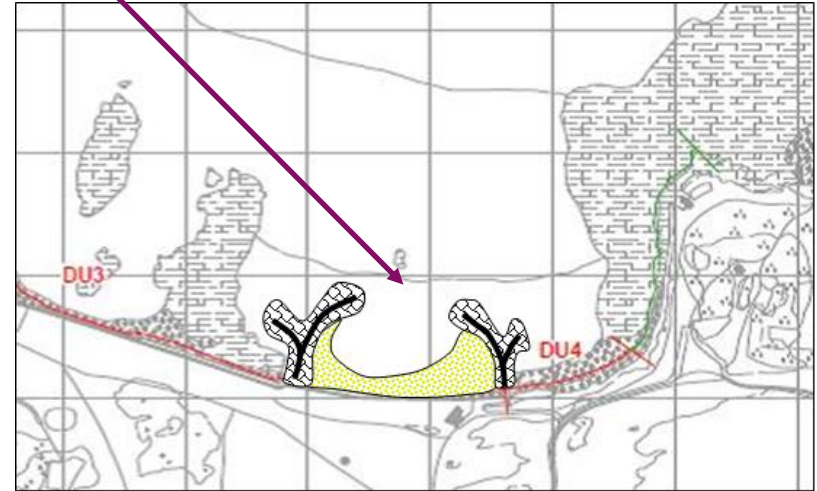
2012 Flood Risk Assessment Studies - Outline options L'Ancrese East

4. Modify beach behaviour – creation of a sub-bay

- Improves beach use
- Builds beach in front of the wall
- Potential to provide 50 years defence.

£2,700,000

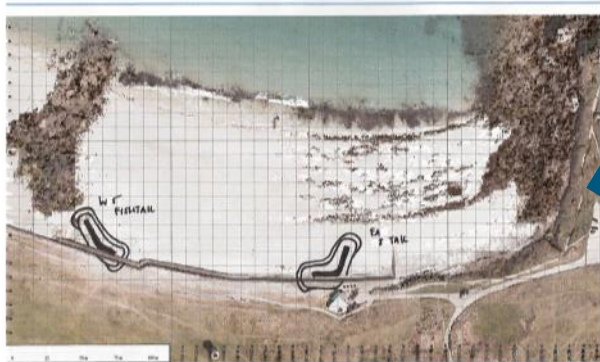
This option looks to address the fundamental problem of lack of width



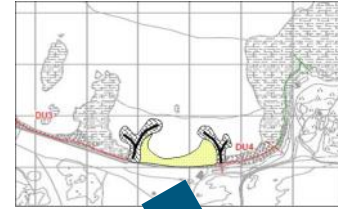
5. Creation of width – Managed realignment

- Limiting erosion
- Protection to slipway and eastern wall.
- Maintaining integrity of the western wall
- Enhanced amenity

£1,015,000



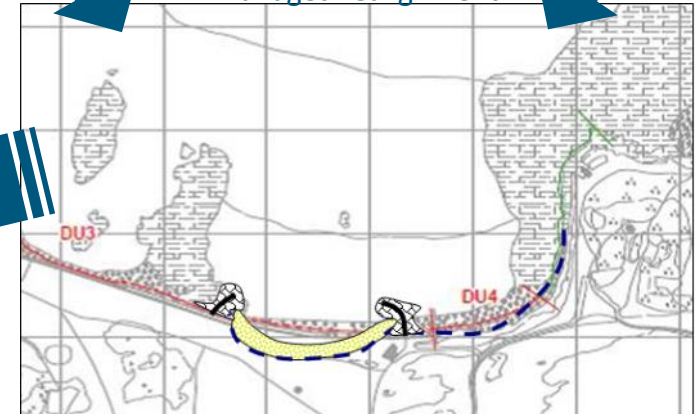
Creation of a sub-bay



Removal of the wall



Combine to give a managed realignment



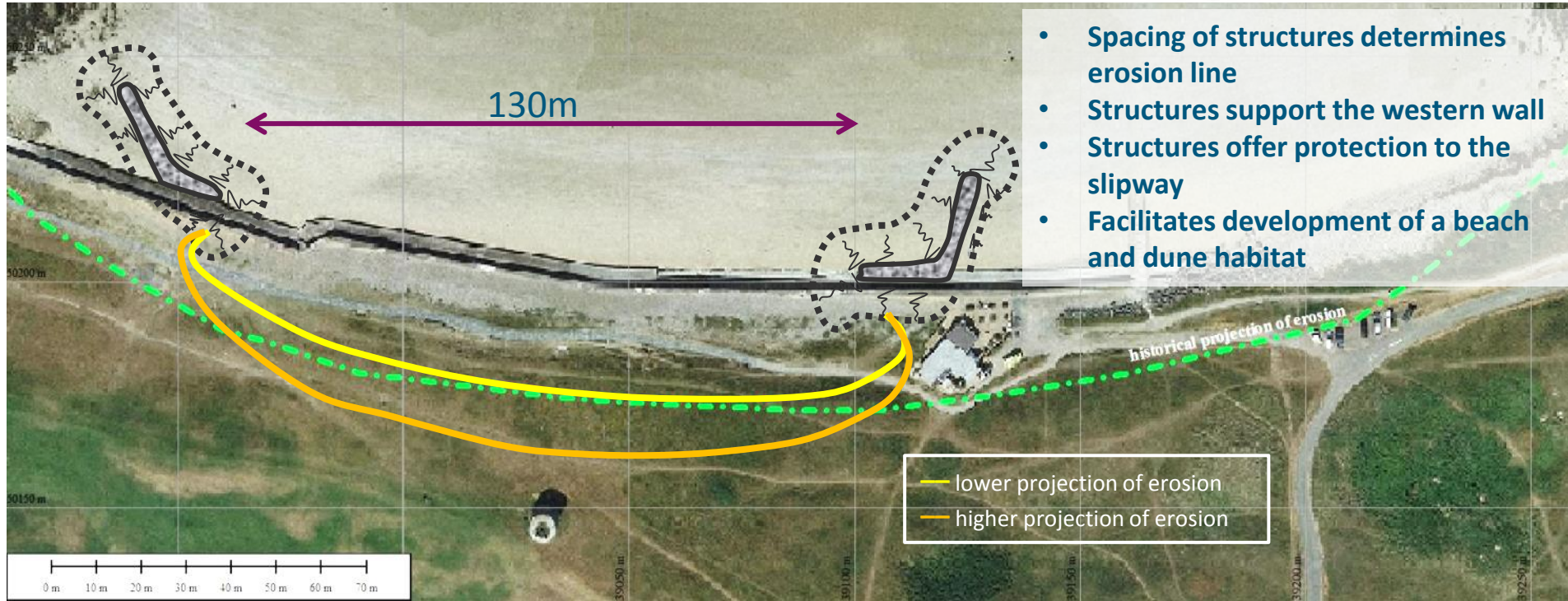
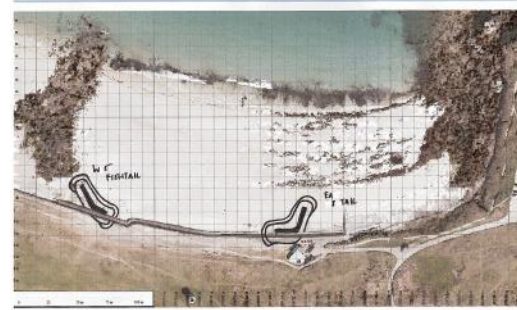
Further development

Option 7b from 2012 study
Royal HaskoningDHV

Detail of the Development

Critical to this development:

- Further analysis of set back and design shape
- Discussions
- Timing in terms of deterioration of anti-tank wall



- Spacing of structures determines erosion line
- Structures support the western wall
- Structures offer protection to the slipway
- Facilitates development of a beach and dune habitat

— lower projection of erosion
— higher projection of erosion

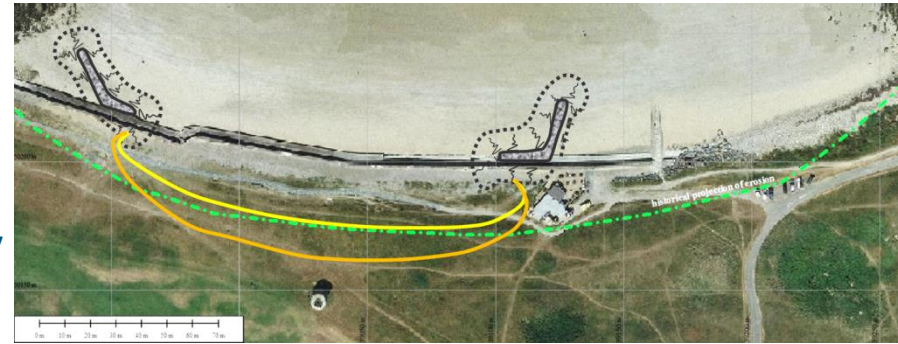
How the failing wall will be managed as part of the realignment:

- Structure emergency works so that material can be incorporated into the final design
- Investigate using part of the existing wall as material within the rock structures
- Establish the order in which to remove panels of the wall



Final development

- Set the framework for emergency works
- Develop potential options for staged delivery
- Consider options associated with the Kiosk



Critically discussing land use issues such as the kiosk, managing the pathways – developing the approach in detail.

Establish control of the shoreline while moving towards a more adaptive approach.