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consultants architects engineers

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Slapton Ley: A Vision for the Future

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The Project Team consisted of:

Daniel Leggett – Royal Haskoning – Geomorphologist
Peter Thornton – Royal Haskoning – Scientist / PM
Kit Hawkins – Royal Haskoning – Scientist
Julian Carolan – Royal Haskoning – GIS Specialist

With thanks to:

Robin Toogood – South Devon AONB Officer
Simon Dunsford – English Nature (now Natural England)
Nick Binnie – Slapton Ley Reserve Manager
Andy Pratt – Slapton Ley FSC Manager

PROJECT AIMS

The key aims of the project were:

1. identifying the extent of seawater penetration within the Leys in the event of a permanent breakdown (breach) of the shingle.

2. identify measures to ensure the continuation of the freshwater SSSI features that would be lost in the event of a permanent breakdown of the shingle bar.

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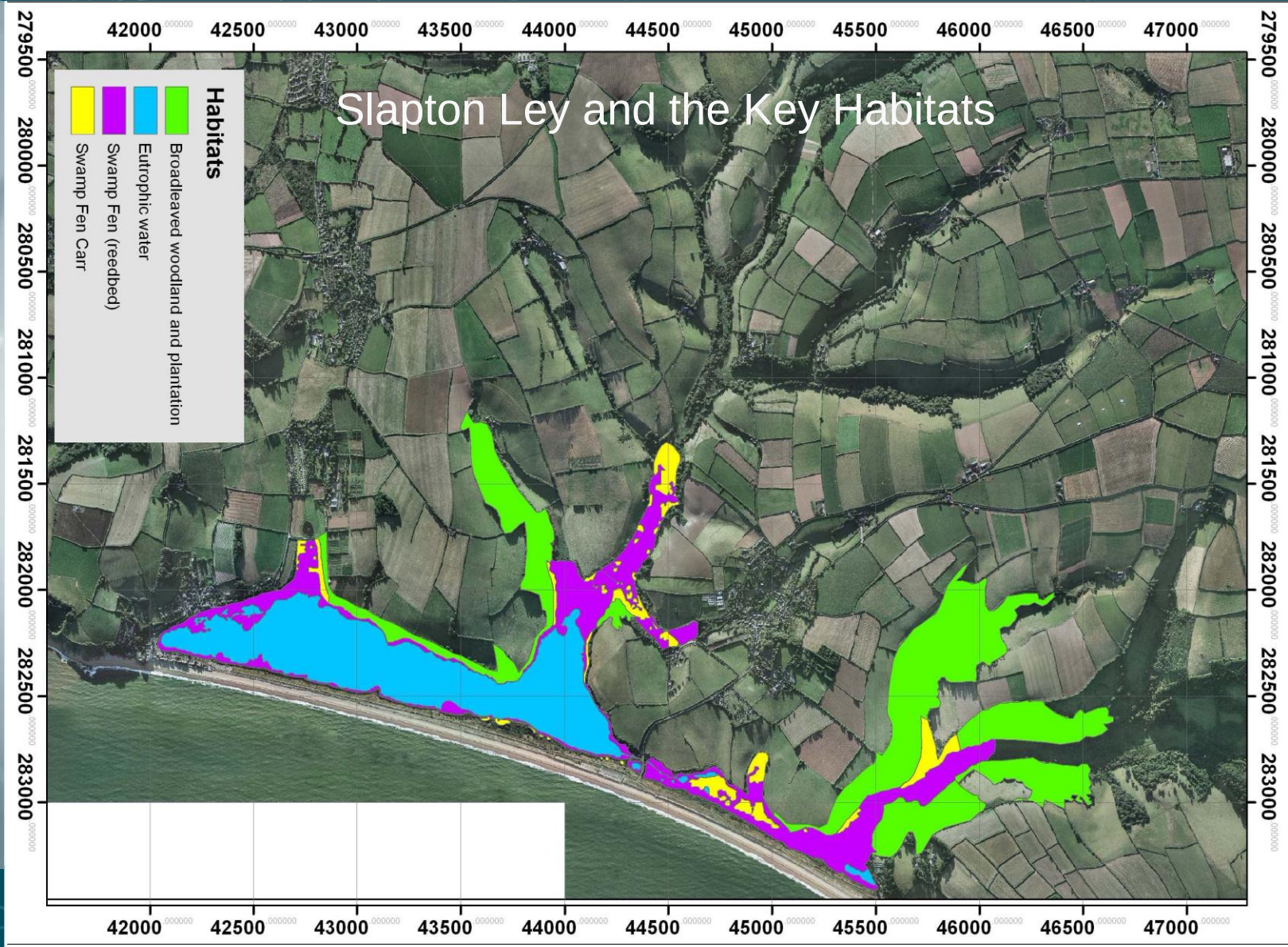

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A wide range of data were used in the study, in particular:

- LiDAR data.
- Bathymetric survey data of the Lower Ley.
- Hydrological (flow, rainfall, tidal, etc) data from a wide variety of publications and sources.
- Geomorphological studies published by Pethick (2001), Lee (2003), Massey (2004) and Scott Wilson (2004).
- Ecological and habitat data from Slapton Ley National Nature Reserve.
- Water quality data from Slapton Ley NNR and FSC.

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Figure showing bathymetric features of the leys and breach location

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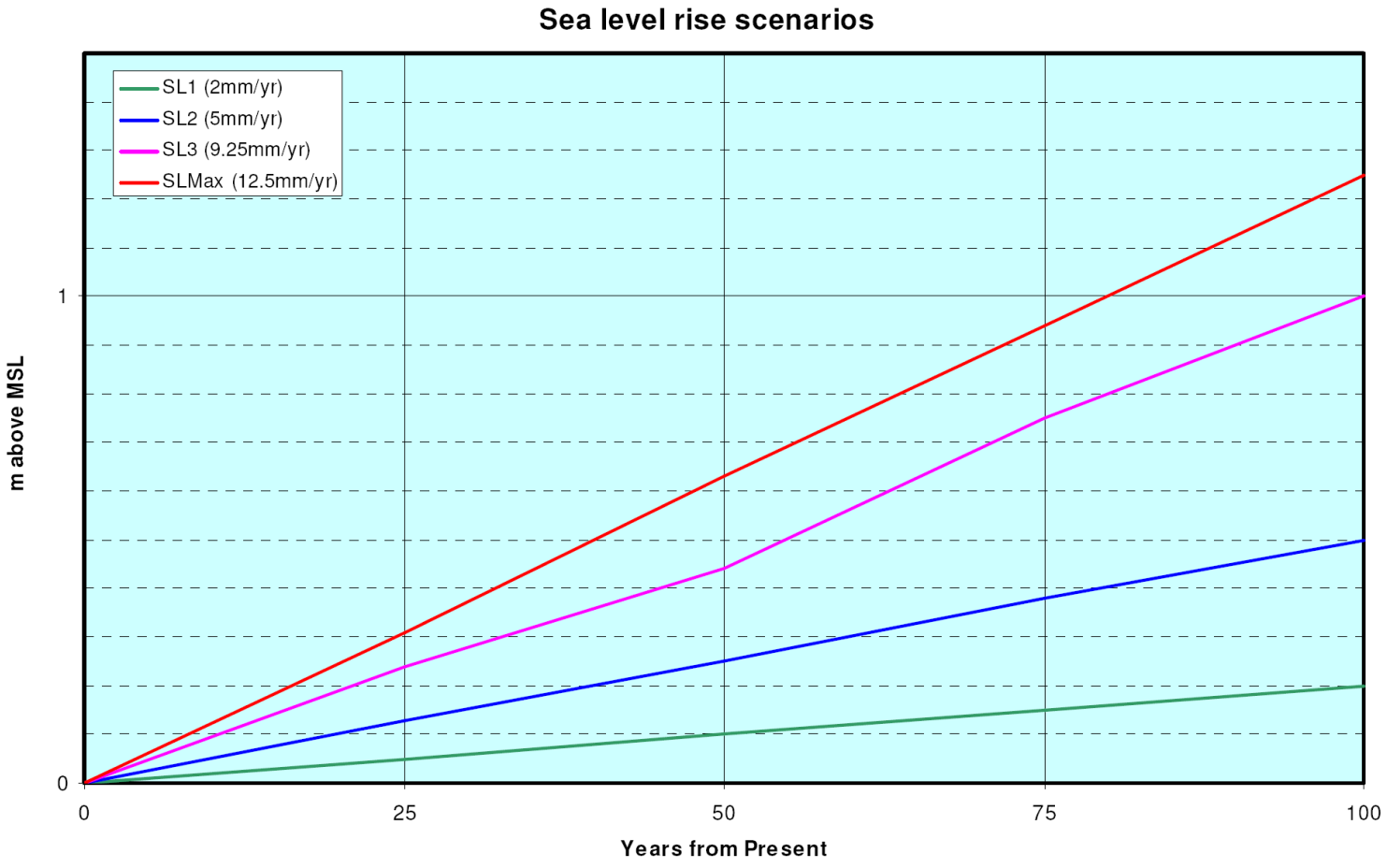
The initial basis was to assume a breach, and following analysis of barrier widths and heights, the breach location used in the study was in Stokeley Bay. The study then looked at the effect of seawater inundation for a number of sea level rise scenarios (including the current sea level), as shown in the graph below.



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Tables showing MHWS and HAT under the scenarios (m above ODN)

Scenario	Annual rise	MHWS for year (mODN)			
		25 (2030)	50 (2055)	75 (2080)	100 (2105)
Current	na	+2.28	+2.28	+2.28	+2.28
SL1	2mm/year	+2.33	+2.38	+2.43	+2.48
SL2	5mm/year	+2.41	+2.53	+2.66	+2.78
SL3	Variable (8.5-10mm/year)	+2.52	+2.72	+3.03	+3.28
Maximum	12.5mm/year	+2.59	+2.91	+3.22	+3.53

Scenario	Annual rise	HAT for year (mODN)			
		25 (2030)	50 (2055)	75 (2080)	100 (2105)
Current	na	+2.68	+2.68	+2.68	+2.68
SL1	2mm/year	+2.73	+2.78	+2.83	+2.88
SL2	5mm/year	+2.81	+2.93	+3.06	+3.18
SL3	Variable (8.5-10mm/year)	+2.92	+3.12	+3.43	+3.68
Maximum	12.5mm/year	+2.99	+3.31	+3.62	+3.93

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Various outputs were obtained from the GIS data and various data to inform the study from the work undertaken. This included:

- Tidal prism values for all scenarios and tide levels.
- Associated breach widths with each tidal prism.
- Areas and depths of inundation water for all scenarios on all tide states.
- Areas of habitat types inundated (or lost) as a result of each scenario.

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Figure showing the volume of seawater within the Lower Ley in the various sea level rise scenarios

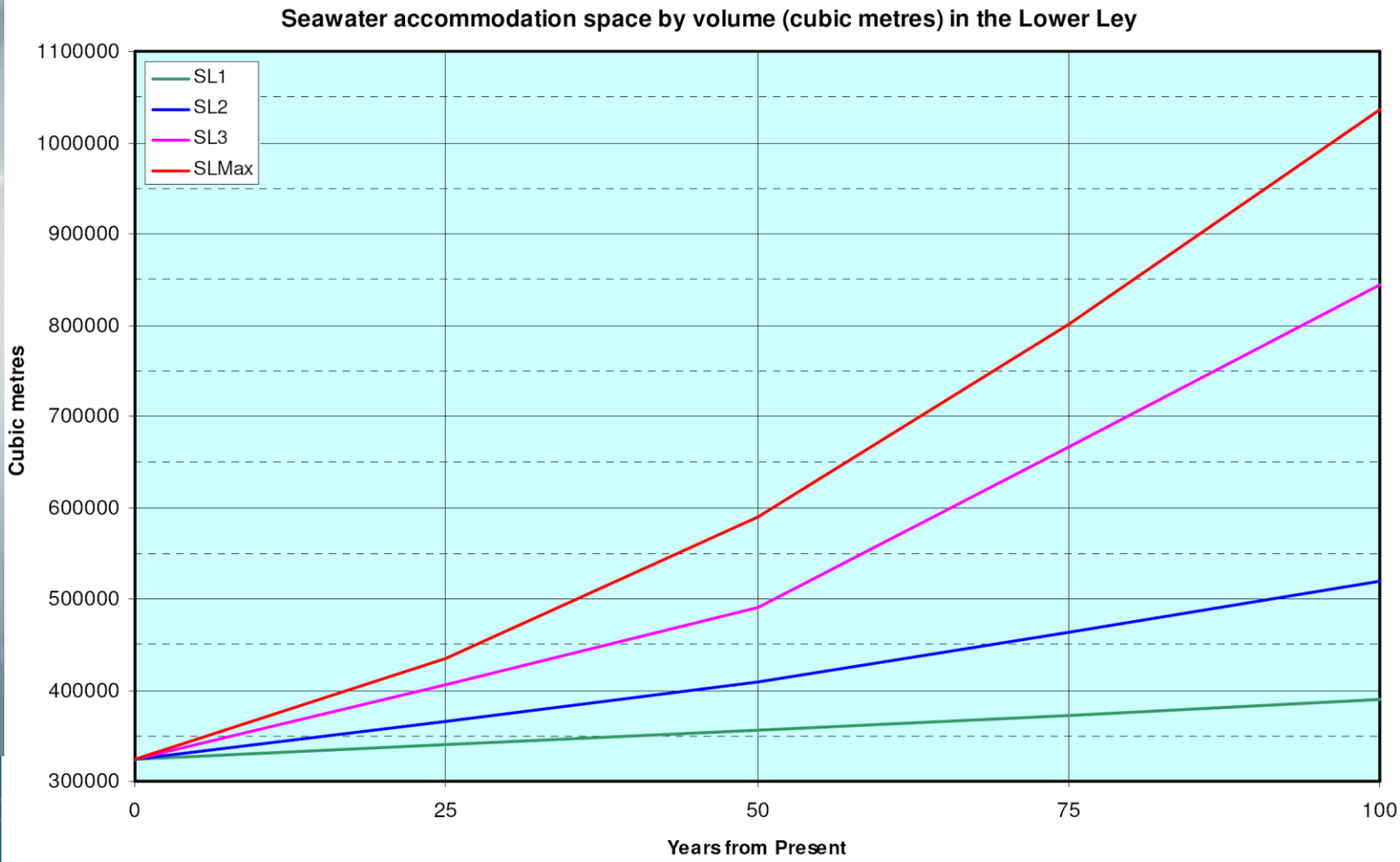

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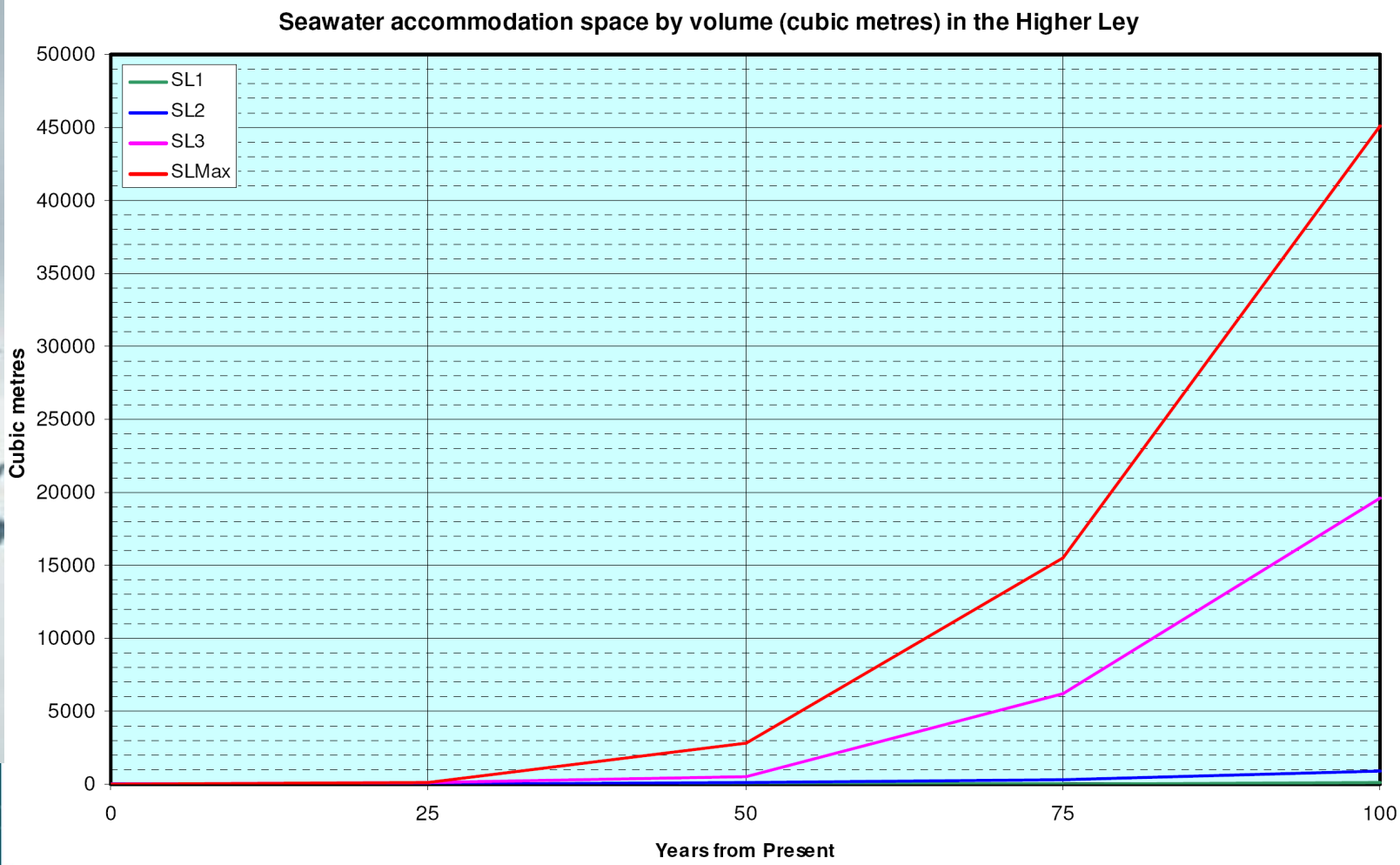
Figure showing the volume of seawater within the Higher Ley in the various sea level rise scenarios



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The findings showed a variety of responses from different sea level scenarios. In particular the following are noted:

- The Higher Ley would not be affected by inundation until the end of Scenario SL2, and at the earliest from Year 35 in the Maximum Sea Level Rise Scenario.
- Saline incursion within the Higher Ley would occur at the end of Scenario SL2, resulting in increased salinity but only on extreme tides.
- In Scenario SL3 it is only really High Spring tides that would incur within the Higher Ley, whereas all Spring and most Neap tides would incur within the Higher Ley.
- **Only if sea level rise exceeds 5mm/year or 0.50m over 100 years will the Higher Ley be affected by saline intrusion!**

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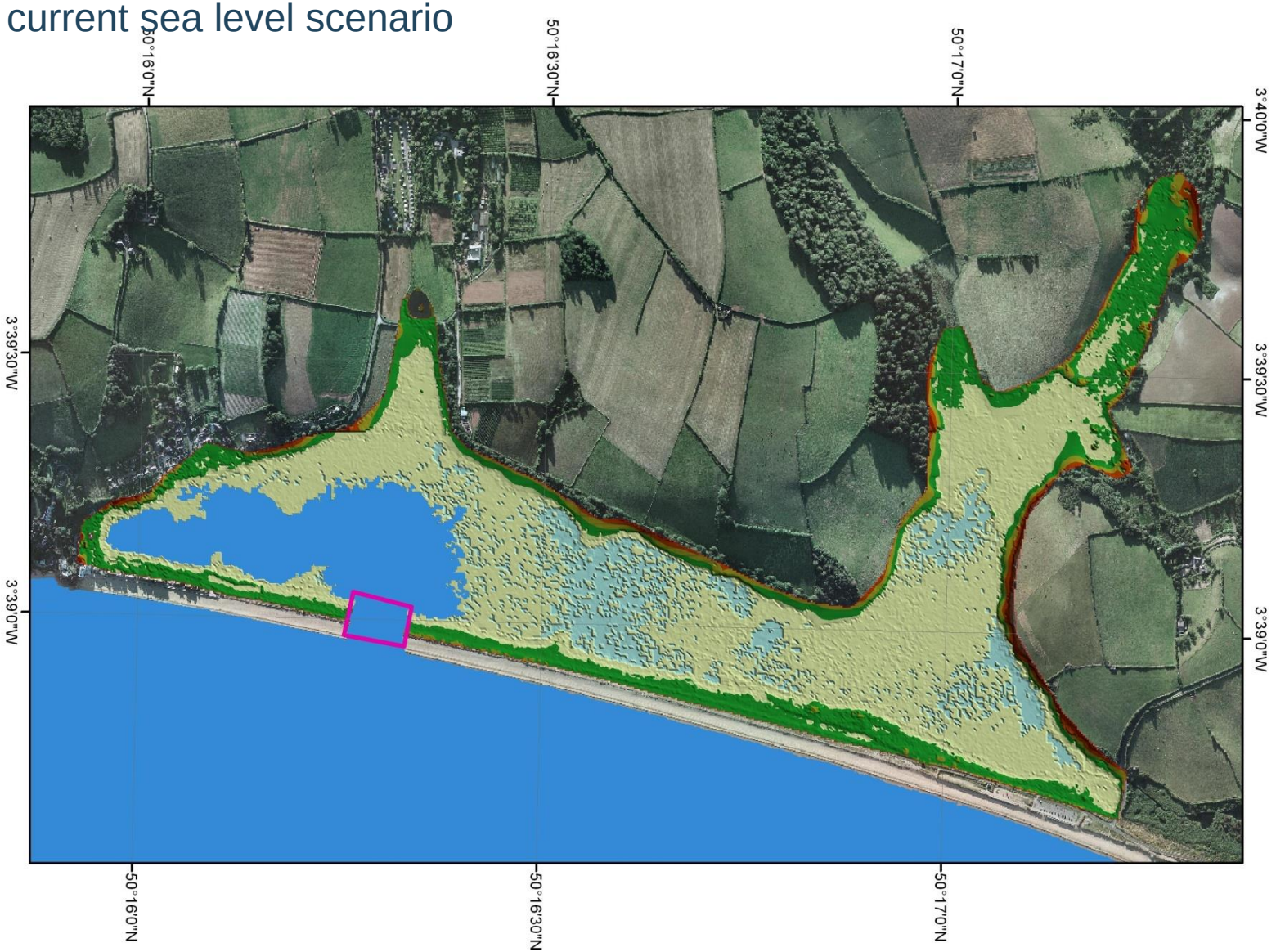
Area of Lower Ley inundated on a Mean High Water Spring Tide in the current sea level scenario



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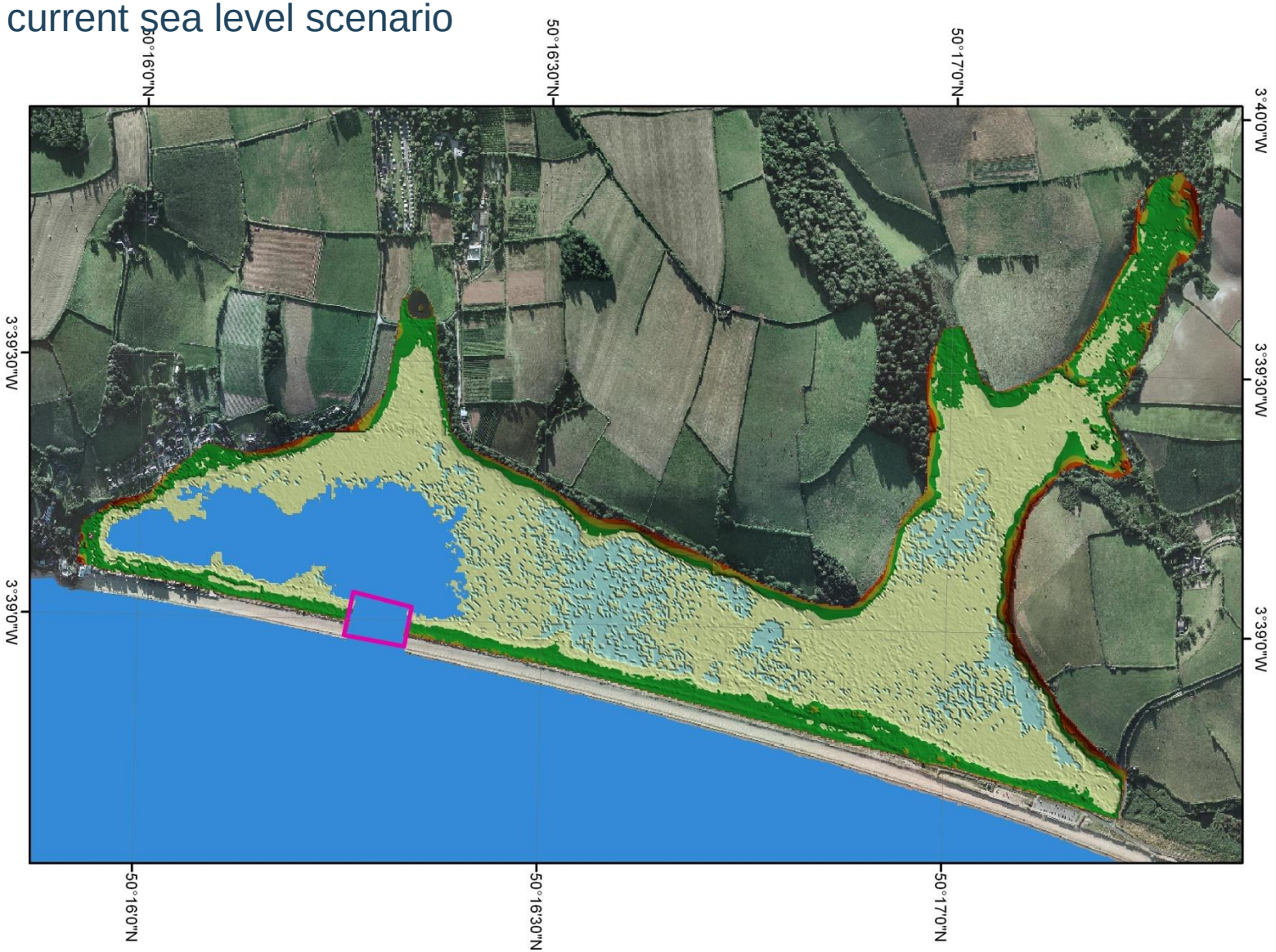
Area of Lower Ley inundated on a Mean High Water Spring Tide in the current sea level scenario



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Area of Lower Ley inundated on the highest storm tide with current sea level, HAT Year 2080 for SL2, and MHWS Year 2080 for SL3

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Area of both leys inundated on HAT Year 2105 for the Maximum Sea Level Rise Scenario

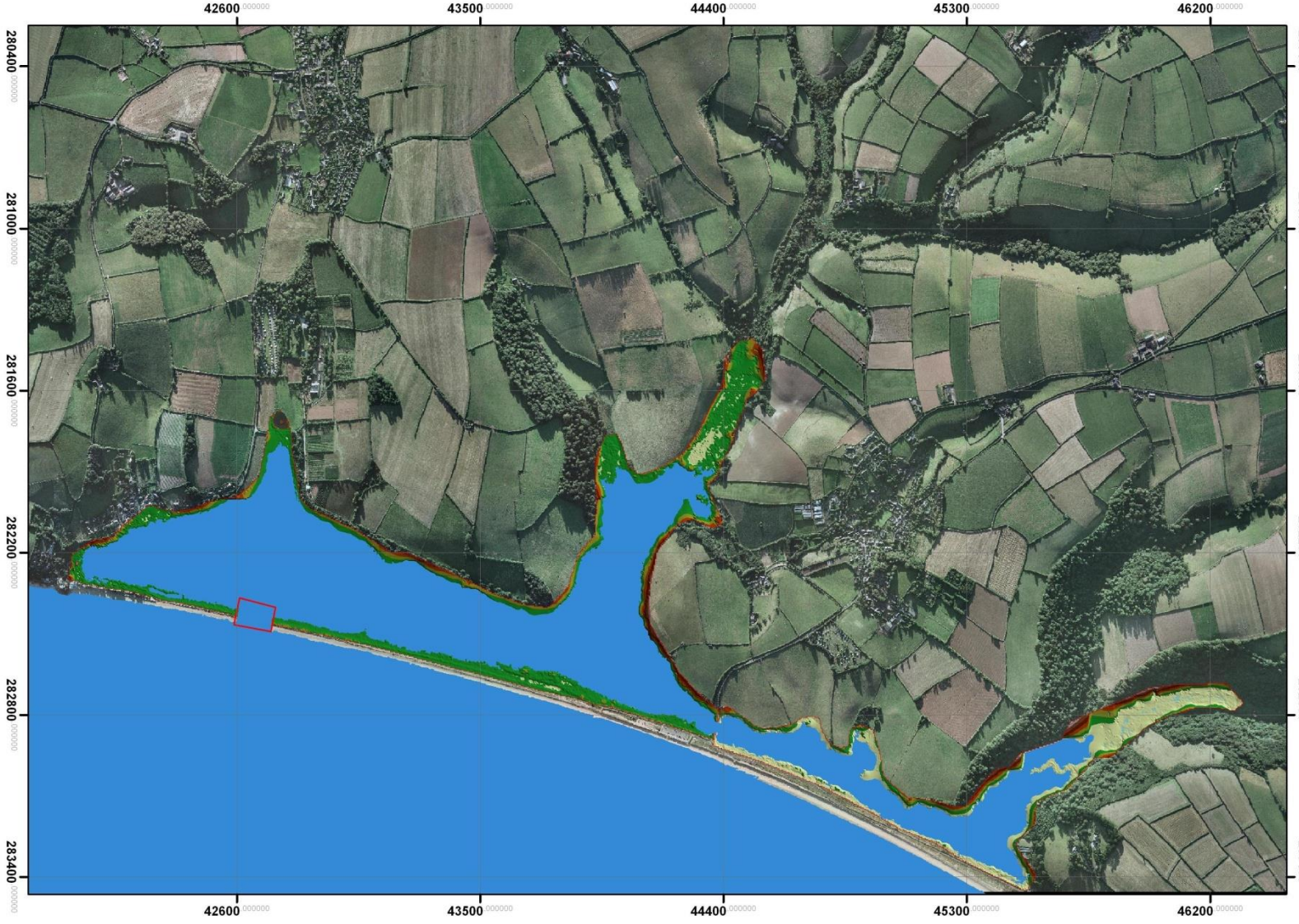

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Table showing the summary of habitat losses and gains for various Sea Level Rise Scenarios for certain key years.

Habitat type	Area of habitat (ha)					
	2005	2005 with breach	SL2 50 year	SL2 100 year	SLMax 50 year	SLMax 100 year
Broadleaved and plantation woodland	81.7	+2.3	+2.8	+7.1	+8.1	+15.5
Wet woodland	13.0	-2.3	+10.6	-4.1	-5.1	-7.5
Reedbed	45.8	+4.3	-25.7	-25.7	-25.7	-39.6
Saltmarsh	0	+18.9	+42.4	+49.3	+50.7	+56.1
Eutrophic water	59.8	-42.6	-51.0	-51.0	-51.0	-59.8
Saline/brackish lagoon	0	19.4	+19.4	+19.4	+19.4	+19.4
Intertidal flats	0	0	+1.4	+5.0	+6.7	+16.0

Table showing summary of the area of suitable habitat re-creation possibilities.

Habitat type	Area of habitat (ha)					
	2005	2005 with breach	SL2 100 year	SLMax 100 year	Maximum created	Total Cost (£)
Reedbed	45.8	+4.3	-25.7	-39.6	13.5	158,000
Eutrophic water	59.8	-42.6	-51.0	-59.8	16.7	384,000

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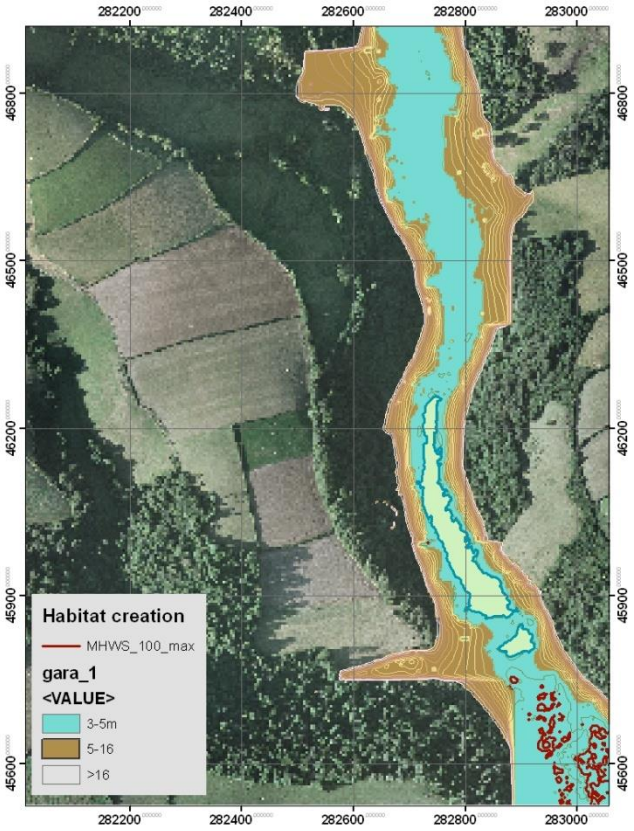
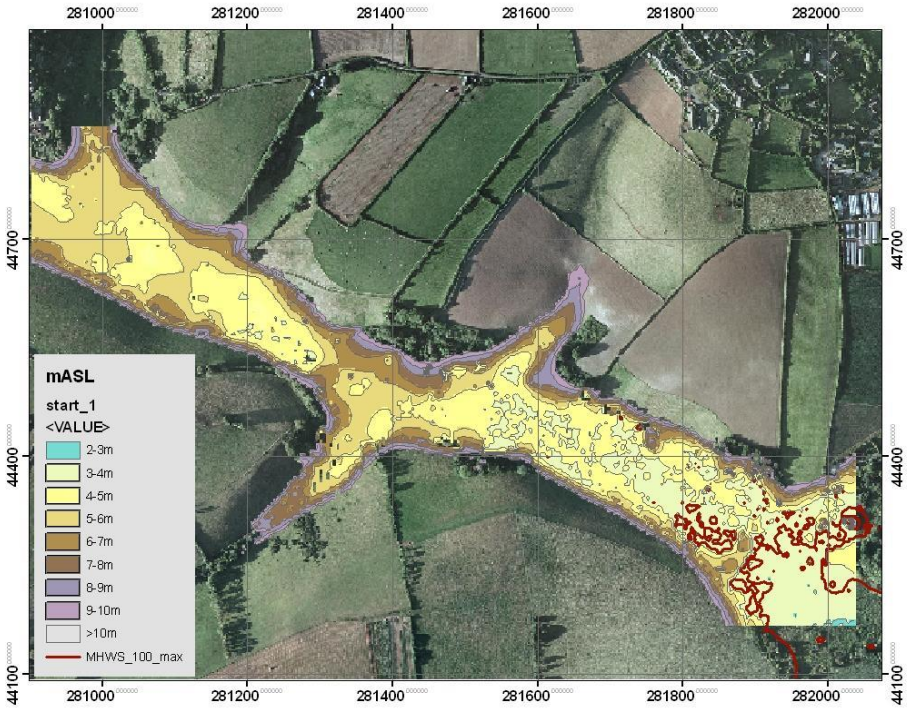
The habitat re-creation areas that were identified as suitable for re-creation of various habitat types as shown in the table on the previous slide are in the Gara Valley and the Start Valley.

Various sizes of area can be re-created, and these have been costed to inform future planning for the Ley and its habitats.





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A number of assumptions were required in order to carry out this study to the specifications of the research. These will therefore influence the accuracy of any data presented in this report. The key assumptions are:

- A breach will occur and remain stable;
- Following detailed geomorphological studies published it was anticipated that a stable breach would occur around 50 years from now;
- Sea level rise would increase parallel for each tide state (i.e. if MHWS increased by 1m, so would HAT, MHWN, MSL, MLWN, MLWS, and LAT;
- No wide-scale or large magnitude erosion would take place in the area of or in the influence of the breach; and
- No significant change in the catchment flows into Slapton Ley, or associated sedimentation rates.

In light of the assumptions required to undertake this study and the potential limitations of data and information, the following bullet points provide a short list of possible works that could be undertaken to either inform this study or provide greater confidence in the likely evolution of Slapton Ley:

- Ground-truthing of levels could be undertaken within the Higher Ley to improve the accuracy of the current bathymetric data, and to improve the volume and area calculations.
- Undertake bathymetric survey of the Higher Ley to provide detailed and accurate bathymetric data for use in volume and area calculations.
- Sample sediments in the Lower Ley and the Higher Ley to determine their shear strength, and use the data to model the hydrodynamics to ascertain the likely bathymetric changes within the Lower Ley and/or the Higher Ley following a breach.
- Undertake detailed hydrodynamic and geomorphological modelling to confirm the likelihood and time of a breach and its stability. This modelling should incorporate the shear strength data if available.
- Undertake historic aerial photographic mapping to ascertain the barrier beach width and change over the last 50 years. Current data records only measure 4 consecutive years of the barrier movement and evolution.