

**RAVENGLASS ESTUARIES****Baseline Information**

<b>Start co-ordinate:</b>	307568, 489746	<b>Finish co-ordinate:</b>	304550, 498800
<b>Total length:</b>	23.3km	<b>Defended length:</b>	1.8km
<b>Sea Wall:</b>	1.8km	<b>Clay Cliff:</b>	1.0km
<b>Mudflats:</b>	5.0km	<b>Sand Dunes:</b>	15.5km

**Environmental designations:**

- SSSI
- SAC
- LNR

**Monitoring carried out:**

- 16 beach profiles
- Topographic survey (Stubb Place only)
- Coastal defence inspection
  - Stubb Place, Bootle
  - Ravenglass

**Site overview:**

This section runs from Tarn Point to the south, across Eskmeals and north across the entrance to the Ravenglass Estuaries, to Barn Scar, including the shoreline within the estuary mouth, where the rivers Esk, Mite and Irt meet. The length identified includes the shoreline within each of the rivers upstream to the railway viaducts.

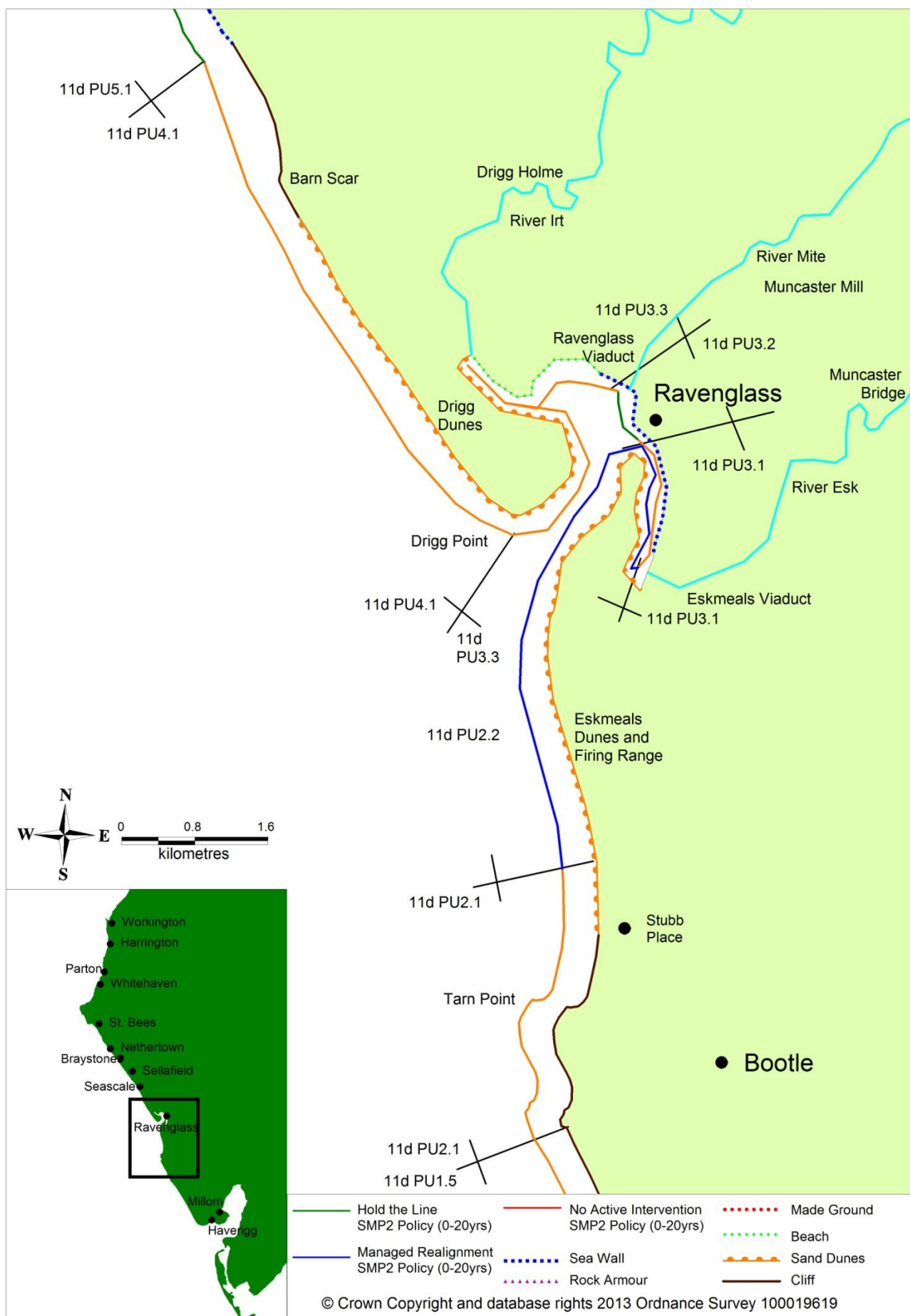
The section comprises almost entirely natural features which are dominated by the two dune systems on either side of the entrance to the Estuary. There are two sections of artificial coastal defences at Stubb Place, Bootle, where the highway is located adjacent to the shoreline and between the Mite and Esk viaducts, primarily associated with protection to the Cumbrian coast railway line and the village of Ravenglass.

On the south side of the estuary the hinterland comprises the Ministry of Defence firing range at Eskmeals, with access within the dunes and across the foreshore restricted. On the north side the Drigg Dunes are natural haven for wildlife and recreation.

**The Current (SMP2) Policy:**

- **Selker to Stubb Place:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Stubb Place & Eskmeals Dunes:** Managed Realignment in the short term (0-20yrs) allowing short term measures to allow continued use of road, medium term (20-50yrs) and long term (50-100yrs);
- **Eskmeals Dunes to Ravenglass including River Esk to Muncaster Bridge:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs), except where works are required to maintain railway operation;
- **Ravenglass:** Hold the Line in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Ravenglass to Drigg Point including River Mite to Muncaster Mill & River Irt to Drigg Holme:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs), except where works are required to maintain railway operation; and
- **Drigg Point to Seascale:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs).

The plan below summaries the above information graphically:



**Summary of behaviour**

This section of shoreline forms an embayment in the general north west to south east alignment of the Cumbrian coastline. Wave, tide and sediment behaviour here is locally different and more complex than across the adjacent sections. To the south of the estuary mouth the shoreline is aligned generally in a northerly to north north-westerly direction. This leads to predominant waves impacting the shoreline slightly obliquely inducing a net northerly movement of sediment towards the estuary mouth. This sediment movement has caused the growth in the dune system and development of a spit at the northern end which has pushed into the estuary.

To the south of this section dunes have developed similarly although the growth of the dune feature has produced a shoreline that is currently north west/south east aligned.

The growth of these dune features over many centuries has gradually restricted the width of the entrance thereby reducing the exposure of the shorelines within the estuary.

The following key points arise from analysis of the contemporary monitoring data:

**Offshore Wave Climate:**

Historic wave data from the Met Office identifies:

- Approximately 70-75% of waves < 1 metres high; <1% of waves > 3 metre high.

**Wind Climate:**

Historic wind data from the Met Office identifies:

- 40% of wind greater than 9 metres per second (Force 5 and above) & 55% of wind coming from offshore directions (NW to SE)

**Sea Levels:**

- Maximum tide level recorded at Workington in the last 20 years = +5.76 (m ODN) in February 1997, which equates to approximately a 1 in 50 return period.
- The following predicted extreme tide levels apply (m ODN):

Return Period (years)	Workington	Drigg
10	5.49	5.59
100	5.84	5.95
1000	6.18	6.30

**Foreshore & Shoreline Changes:**

Eskmeals:

- Sediment transfer from beach to dunes and vice versa (qualitative assessment)
- Overall Dune growth (qualitative assessment)
- Average volume decrease at Stubb Place of 2,000m<sup>3</sup> per year equivalent to a decrease in beach height of 25mm across the area monitored, based on 2004-2014 data. Alternative reversed shorter term trend of +400m<sup>3</sup> per annum for 2009-2014 equivalent to an increase in beach height of 4mm across the area monitored.
- Profile change: 11% – accretion, 11% – erosion, 78% – no change

Ravenglass Estuaries

- Little change taking place
- Profile change: 14% – accretion, 0% – erosion, 86% – no change

Drigg Dunes

- Sediment transfer from beach to dunes and vice versa (qualitative assessment)
- Overall Dunes stable (qualitative assessment)
- Profile change: 40% – accretion, 0% – erosion, 60% – no change

This behaviour is illustrated graphically on the plan overleaf.



**Risk Assessment**

The primary risks arising from the behaviour of coastal forcing processes (wind, waves and tides) and the reaction of the shoreline (beach and dune changes, artificial defence conditions) across this frontage are:

- Overtopping of artificial defences causing flooding of the hinterland,
- Breaching of artificial coastal defences, causing erosion of the shoreline
- Erosion of dunes increasing exposure of sheltered frontages

The primary consequences of this behaviour are:

- Damage to and/or loss of property and infrastructure
- Damage to environmental habitats.

The table below shows the overall risk rating(s) that apply within this section of frontage. Overall risk is defined from the probability of conditions/behaviour occurring and the consequences the conditions/behaviour would have.

<b>Duddon Estuary to Tarn Point Overall Risk Rating</b>				
<b>SMP Policy Unit (11d)</b>	<b>Section of Frontage</b>	<b>Probability Index</b>	<b>Consequence Index</b>	<b>Overall Risk Rating</b>
2.1	Selker to Stubb Place	Low	Medium	Low
2.2	Stubb Place & Eskmeals Dunes	Low	Medium/High	Medium
3.1	Eskmeals Dunes to Ravenglass including River Esk to Muncaster Bridge SMP boundary	Low	Medium/High	Low
3.2	Ravenglass	Low	High	Medium
3.3	Ravenglass to Drigg Point including River Mite to Muncaster Mill and River Irt to Drigg Holme	Low	Medium	Low
4.1	Drigg Point to Seascale	Medium	Medium/High	Medium

**Current Behaviour**

Analysis of the monitoring data collected in 2014 provides the following key points:

***Offshore Wave Climate:***

- No new data available for analysis

***Wind Climate:***

- No new data available for analysis

***Sea Levels:***

Maximum tide level recorded on Workington tide gauge = +5.696 (m ODN) on 3<sup>rd</sup> January 2014, equivalent to a level that would be expected to be exceeded at least once per year.

***Beach Changes:***

Eskmeals Dunes:

- Overall decrease in beach cross sectional areas
- Profile change: 11% – accretion, 33% – erosion, 56% – no change

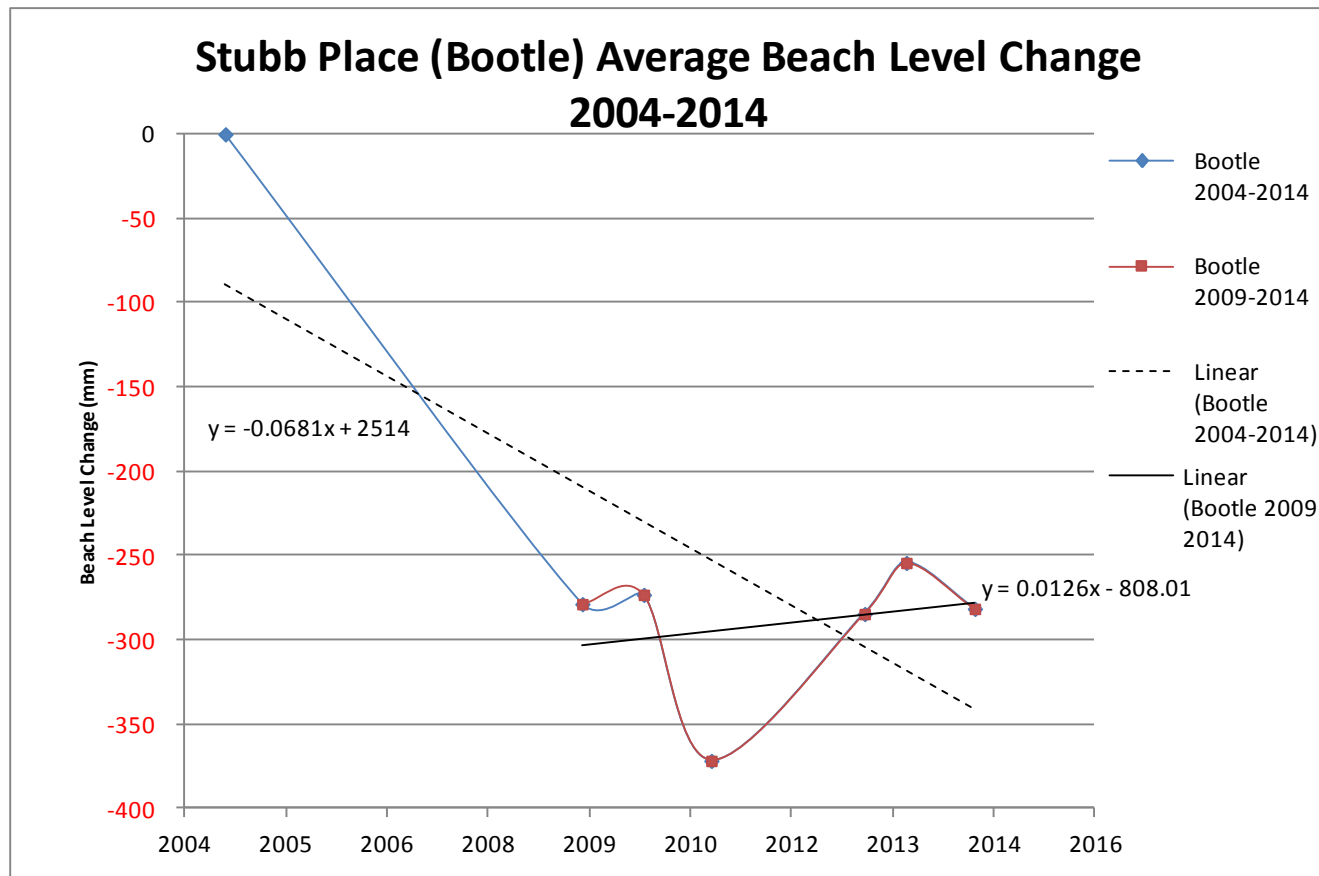
Ravenglass Estuaries

- Little change to beach or condition of artificial defences
- No overall change in beach cross sectional areas
- Profile change: 14% – accretion, 14% – erosion, 72% – no change

**Drigg Dunes**

- Stable upper beach at southern end, more movement further north
- Evidence of ridge and runnel movement lower down the beach
- Profile change: 20% – accretion, 0% – erosion, 80% – no change

The plot below shows the change in the average height of the beach across the Stubb Place frontage from 2004 to 2014.

**Uncertainties & Issues**

The following uncertainties have arisen from the data monitoring programme and analysis of the data collected:

- Quantities of sediment arriving on the beach from offshore.
- Behaviour around mouth of Ravenglass estuaries
- Changes to dune features
- Changes to marsh areas within estuaries
- Wave conditions occurring directly in front of shoreline currently unknown.

**Future Management Actions**

The following monitoring and management actions are recommended:

- Continue current monitoring regime
- Improve additional remote sensing e.g. LiDAR,
- On-going monitoring of condition of artificial defence structures
- Carry out remedial works to maintain integrity of defences, as required.
- Management of dune frontages, as necessary – fencing, access control, etc.

**Linkage(s) to Decision Making**

The monitoring provides information to support:

- Implementation of SMP2 policies, particularly; identification of timing for future capital works or capital maintenance works for artificial defences;
- Decision making process in relation to development planning control.

The plot below summarises the results from the monitoring data analysis for this section in 2014.

