

**CARDURNOCK TO BOWNESS ON SOLWAY****Baseline Information****Start co-ordinate:** 316868, 557910      **Finish co-ordinate:** 321676, 562612**Total length:** 6.6km      **Defended length:** 0km**Saltmarsh:** 6.6km**Environmental designations:**

- SSSI
- SAC
- SPA
- Ramsar
- AONB

**Monitoring carried out:**

- 6 beach profiles

**Site overview:**

This section extends from Cardurnock to the narrowest point on the outer Solway at Bowness on Solway.

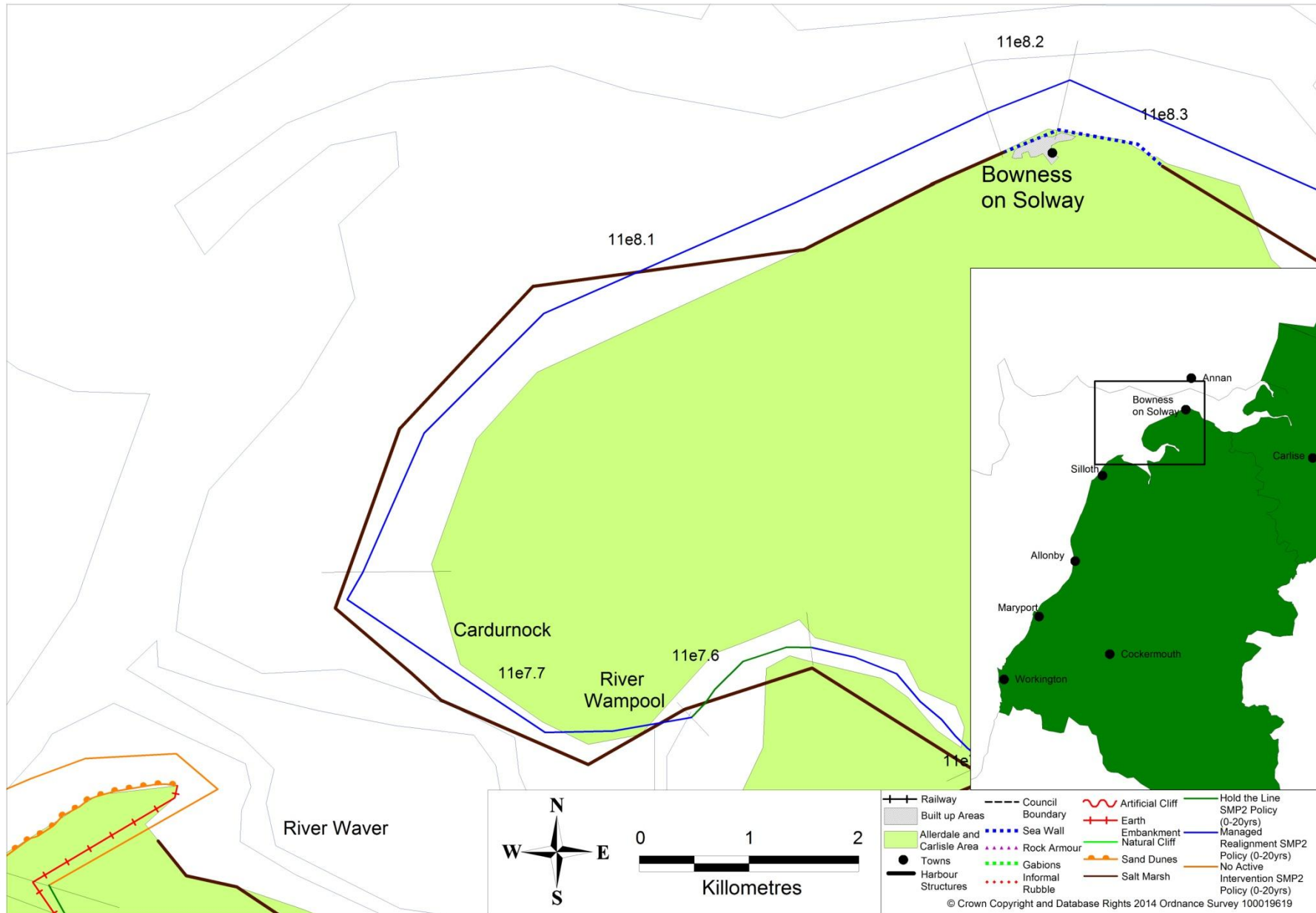
In 1868 a viaduct across the Solway Firth was constructed between Annan and Bowness. This resulted in the main Solway channel moving closer towards the southern shore. Consequently, erosion dominated the area immediately east of the viaduct and a number of coastal defence structures were built, across the Bowness frontage, whilst to the west accelerated accretion and associated saltmarsh growth occurred. The structure was removed in the 1930s, with only the lead in embankments on both shorelines remaining.

Although the Solway Viaduct embankment is not a formal coastal defence structure it has been recorded as part of coastal defence inspections.

**The Current (SMP2) Policy:**

- **Cardurnock to Bowness on Solway:** Managed Realignment in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs).

The plan overleaf summaries the above information graphically:



**Summary of behaviour**

Exposure conditions along this section are primarily influenced by the location of the main Solway channel and its associated sandbanks. As it passes the end of the Grune, the Swatchway turns northerly across the estuary before moving easterly initially along the Scottish side and into the centre of the estuary opposite Bowness. Tidal currents transport fine sediment from the inner estuary westward to Cardurnock. The sediments are deposited on Cardurnock flats which acts as a temporary store of sediments.

At Bowness exposure conditions are primarily driven by water levels with the frontage only exposed to waves generated locally within the inner Firth.

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

**Offshore Wave Climate:**

- No relevant data available.

**Wind Climate:**

- No relevant data available.

**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; and
- The following predicted extreme tide levels apply (m ODN):

Return Period (years)	Workington	Cardurnock	Bowness
10	5.49	6.64	6.84
100	5.84	7.37	7.67
1000	6.18	8.19	8.59

**Foreshore & Shoreline Changes:**

- Profiles include saltmarsh and beach in front;
- Saltmarsh generally stable/eroding but locally accreting at eastern end;
- Profile data has only been recorded twice in 2010 and in 2014; and
- Profile change: 62% – accretion, 25% – erosion, 13% – no change, including profiles at Bowness.

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 cliff changes, artificial defence conditions) across this frontage are:

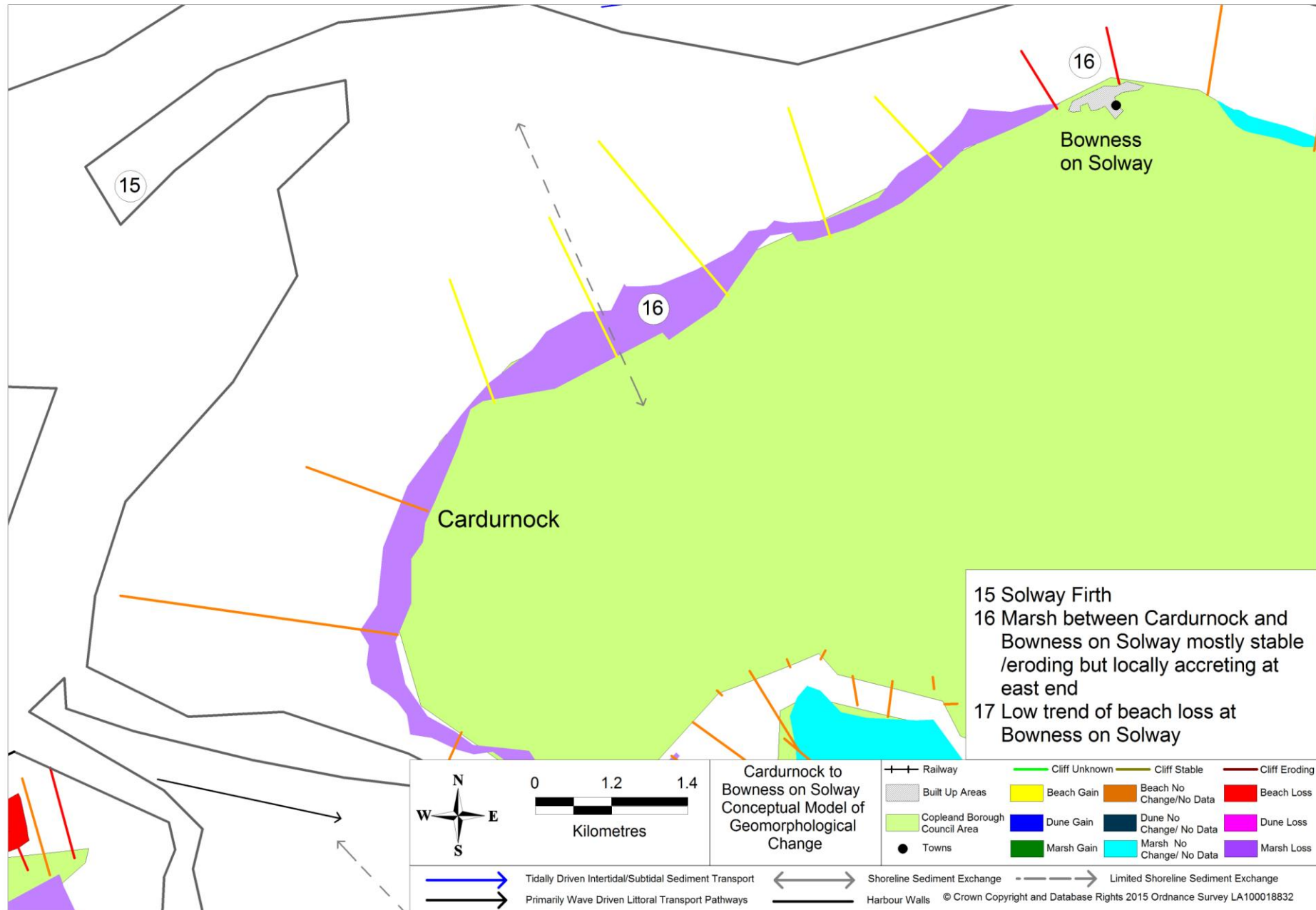
- Erosion of saltmarsh reducing natural protection and loss of habitat.

The primary consequences of this behaviour are:

- Damage to and/or loss of agricultural land and associated property and infrastructure; and
- 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>Cardurnock to Bowness on Solway Overall Risk Rating</b>					
<b>Policy Unit (11e)</b>	<b>Section of Frontage</b>	<b>Exposure</b>	<b>Probability Index</b>	<b>Consequence Index</b>	<b>Overall Risk Rating</b>
8.1	Cardurnock to Bowness-on-Solway	Medium	Low	Medium	Low



**Current Behaviour**

Analysis of the monitoring data collected in 2015 provides the following key points:

***Offshore Wave Climate:***

- No new data available for analysis.

***Wind Climate:***

- No new data available for analysis.

***Sea Levels:***

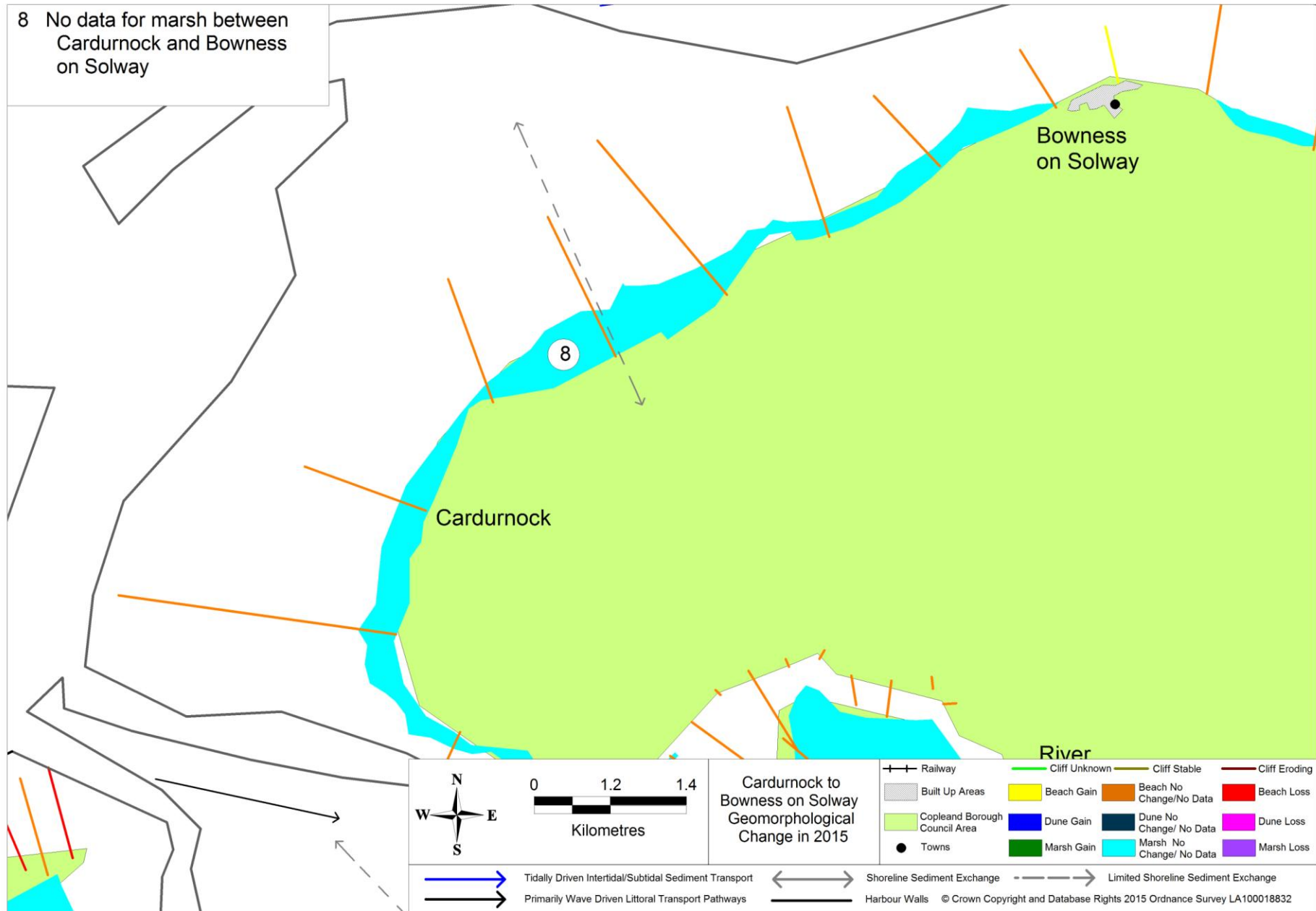
- Maximum tide level recorded on Workington tide gauge = +5.164 (m ODN) on 22<sup>nd</sup> February 2015, equivalent to a level that would be expected to be exceeded once every 1 to 2 years.

***Beach Changes:***

- Profile data recorded in 2015 only at Bowness On Solway. 50% – accretion, 0% – erosion, 50% – no change.

Note: Where profile change is shown for individual profiles on the pictorial summaries, beach gain or loss is identified, where the magnitude of change in cross sectional area is greater than 2%. Where the magnitude of change is less than or equal to 2% this is denoted as no change.

The plot overleaf summarises the results from the monitoring data analysis for this section in 2015.



**Uncertainties & Issues**

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

- Changes to beach profile;
- Quantities of sediment finding its way into this section of the Solway;
- Magnitude and frequency of bank and channel movements;
- Wave conditions occurring directly in front of shore currently unknown; and
- Changes in the overall areas of the saltmarsh.

**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; and
- Carry out remedial works to maintain integrity of defences, as required.

**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; and
- Habitat change.