

Analysis of the storm event (30/01/2021-31/01/2021) along with the impact on Chesil Beach: 6aSU2

1. Introduction

This report briefly identifies the impact of the storm event on Chesil - survey unit 6aSU2. Although not a named storm, the high energy event caused overtopping and flooding of the Chesil defences on the eve of the 30th of January. The event lasted between the 30th and 31st of January, bringing wind speeds of up to 15.4 km/h, wind gusts of up to 27.7 km/h and pressures as low as 984 hPa to the SW coast of England.

Data obtained for this report includes topographic profile data for an autumn interim survey, collected on the 16th October 2020 and a post storm survey, collected on the 2nd January 2021. Analysis and comparisons within this report is only undertaken on the profiles which were captured in the post-storm survey for consistency.

The following sections will provide a brief background into the hydrodynamics occurring during this storm event period and an analysis into the changes to the beach's morphology.

2. Hydrodynamics

During the storm event, between the 30th and 31st of January 2021, the significant wave height (H_s) averaged 1.86 m (*Table 1*) and the maximum wave height (H_{Max}) averaged 2.82 m. The storm event recorded a 35% increase in H_s when compared to the January average. The average wave direction was very similar during the storm event and storm peak to the January average. The average direction was south-westerly, approaching nearly shore normal to Chesil. Despite the significant wave height not passing the storm threshold (4.18 m) even at the peak of the event which occurred on the eve of the 30th January, it did coincide with the high tide at 20:20 (3.82 m).

Table 1 – Hydrodynamic statistics recorded from Dawlish directional wave rider. H_s is wave height (m), T_p is peak wave period (s), T_z is mean wave period and Dir. is wave direction ($^{\circ}$).

	H_s (m)	T_p (s)	T_z (s)	Dir. ($^{\circ}$)
Storm Event Average (30/01-31/01)	1.86	14.4	8.2	222
January Average (2007-2019)	1.36	9.3	5.2	218
Storm Event Peak (30/01 19:00 – 31/01 03:00)	3.06	18.2	11.5	219

The period under analysis recorded a maximum wave height of 4.04 m and a maximum H_{Max} of 7.55 m. The maximum values of H_s and H_{Max} can be seen to exceed the January average by around three times.

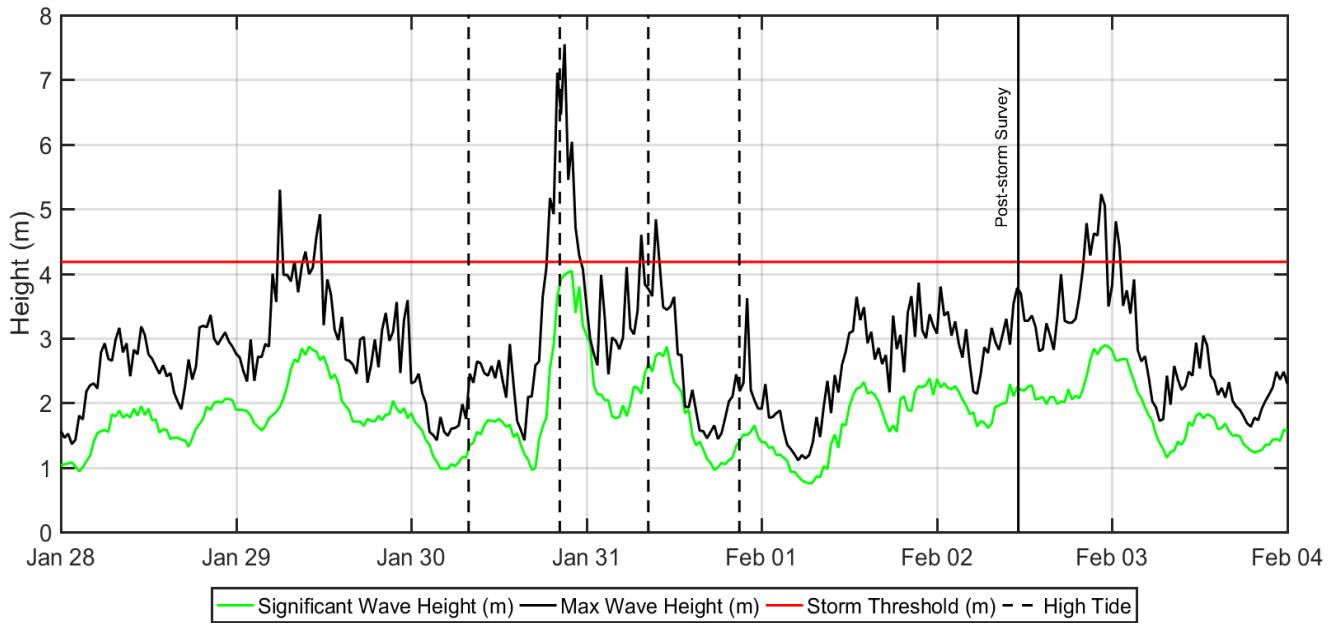
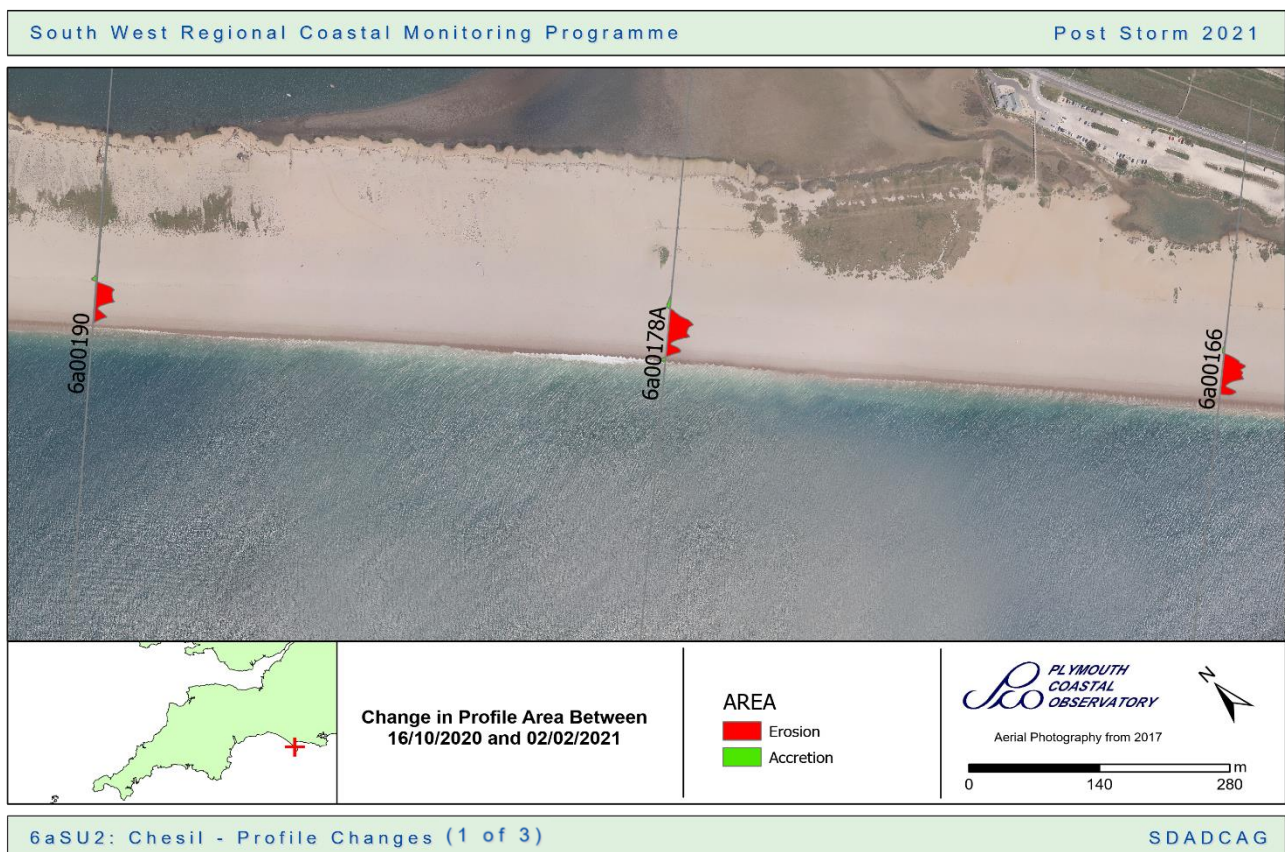


Figure 1 – Plot showing the significant wave height (H_s) and maximum wave height (H_{Max}) over a seven-day period, including the low-pressure event. High tide times during the study period are indicated with a dashed vertical black line. Data obtained from Chesil DWR.

3. Beach Morphology Change

The post-storm survey consisted of fifteen survey lines which, in this report, are directly compared against the autumn interim survey (16/10/2020); see Figure 2.



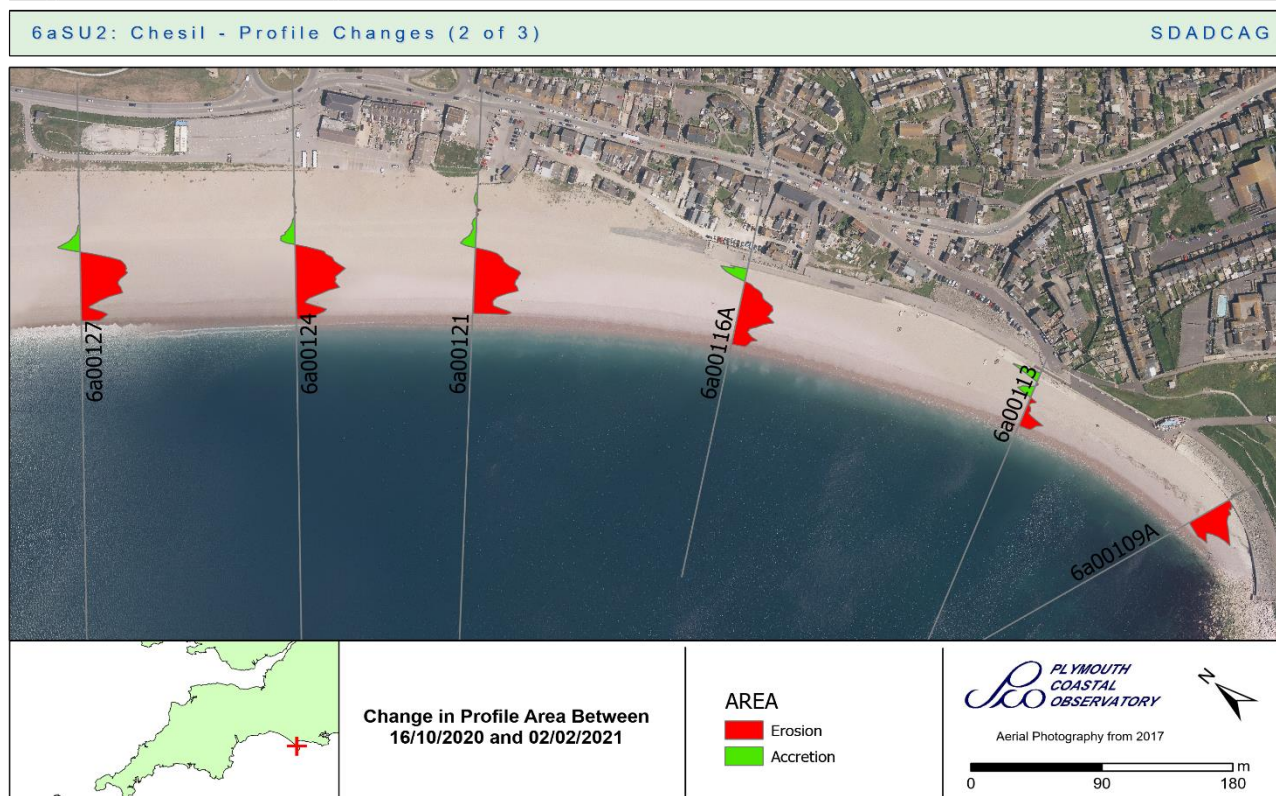
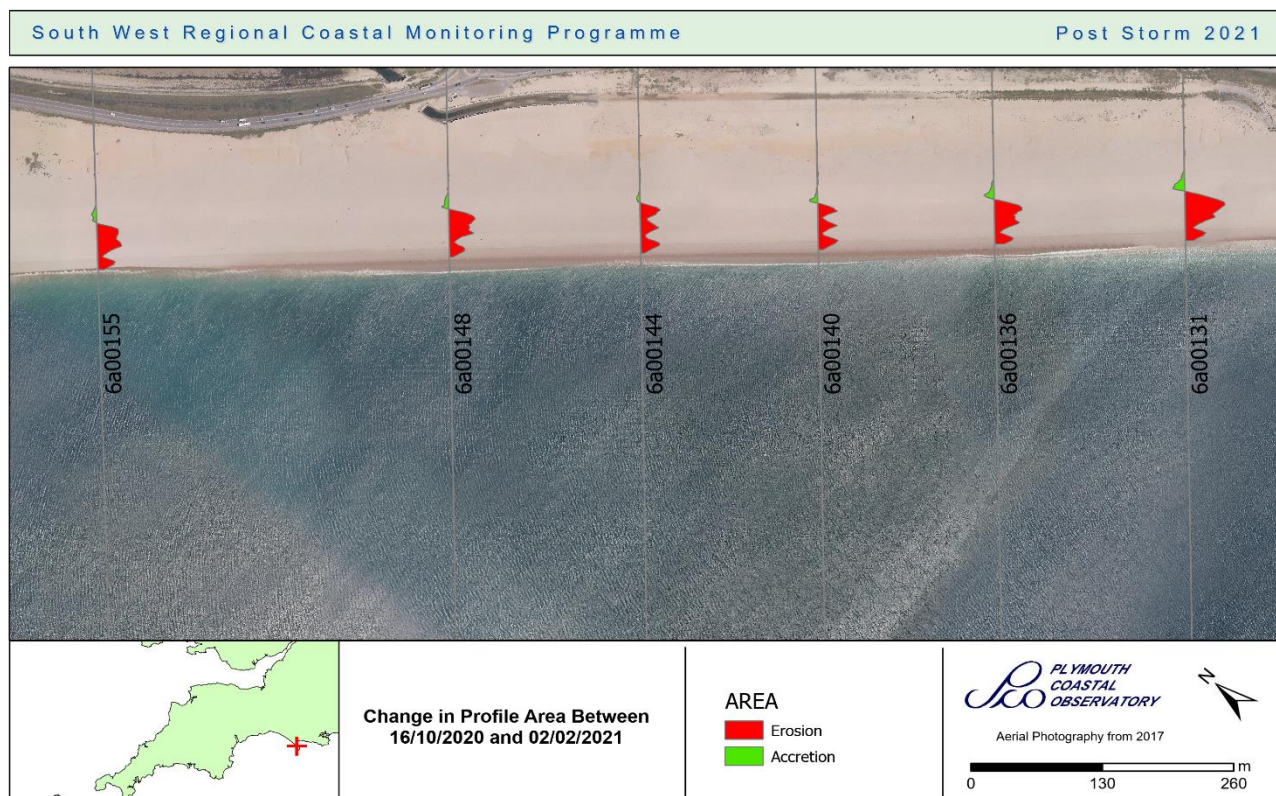


Figure 2 - Plot indicating the location of Dawlish Warren and the post storm profiles, along with an exaggerated overlay depicted where there has been erosion (red) and accretion (green) across each of the profiles since the previous interim survey (16/10/2020).

3.1 Erosion & Accretion Overview

Chesil, as a whole, lost 892.96 m² of material with the smallest net loss occurring on profile 6a00113 (-1.01 m²) and the greatest net lost on profile 6a00131 (-101.16 m²); see *Table 2*. When comparing the cross-sectional area of the fifteen survey lines all profiles exhibited minor gains in material between the interim and post-storm survey ranging from 0.71 m² to 12.75 m², however, the loss of material on each profile is significantly higher, ranging from -13.31 m² to -113.91 m² (see *Table 2*; see Appendix A).

3.2 Profile Erosion & Accretion

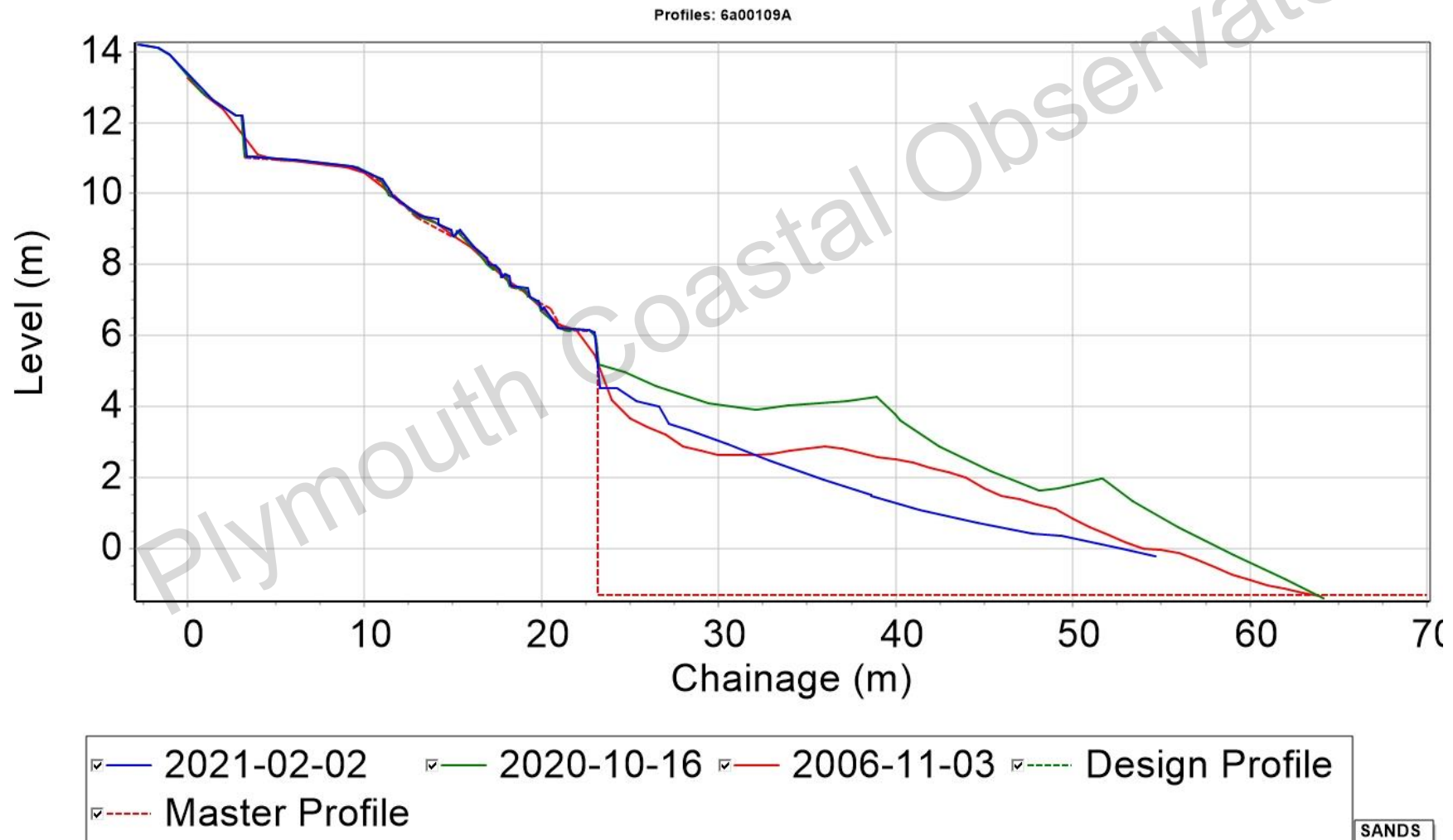
Profile 6a00109A shows a clear loss of material across the entire profile length. Profiles 6a00113 and 6a00121 show a mixture of erosion and accretion along their profiles, with accretion being dominant across the leeward side of the beach slope and erosion mainly occurring on the lower beach face (see Appendix A). In comparison, profile 6a00178A shows major erosion across the beach face with small accretion observed on the back beach and at the MLWS mark. The other eleven profiles demonstrate a strong pattern of minor accretion on the upper beach face and erosion across the remainder of the profile length (see Appendix A). The location along the profiles, where accretion outweighs erosion, generally occurs above the upper beach face suggesting potential overwash whereas erosion typically occurs below 10 m ODN for profiles west of 6a00116A (see Appendix A).

Table 2 – Overview of accretion and erosion rates at each post storm profile line, calculated from Topographic surveys between 16/10/2020 and 02/02/2021.

	Accretion (m ²)	Erosion (m ²)	Total (m ²)
6a00109A	0.71	-48.73	-48.02
6a00113	12.30	-13.31	-1.01
6a00116A	10.14	-70.34	-60.19
6a00121	12.15	-102.36	-90.22
6a00124	10.72	-110.12	-99.39
6a00127	12.73	-103.87	-19.14
6a00131	12.75	-113.91	-101.16
6a00136	10.70	-77.81	-67.11
6a00140	5.59	-55.39	-49.79
6a00144	4.16	-60.45	-56.29
6a00148	6.07	-76.45	-70.39
6a00155	5.78	-72.56	-66.77
6a00166	2.23	-65.98	-73.75
6a00178A	6.17	-79.31	-73.13
6a00190	5.41	-52.01	-16.60

Appendix A – Cross-sectional area change plots

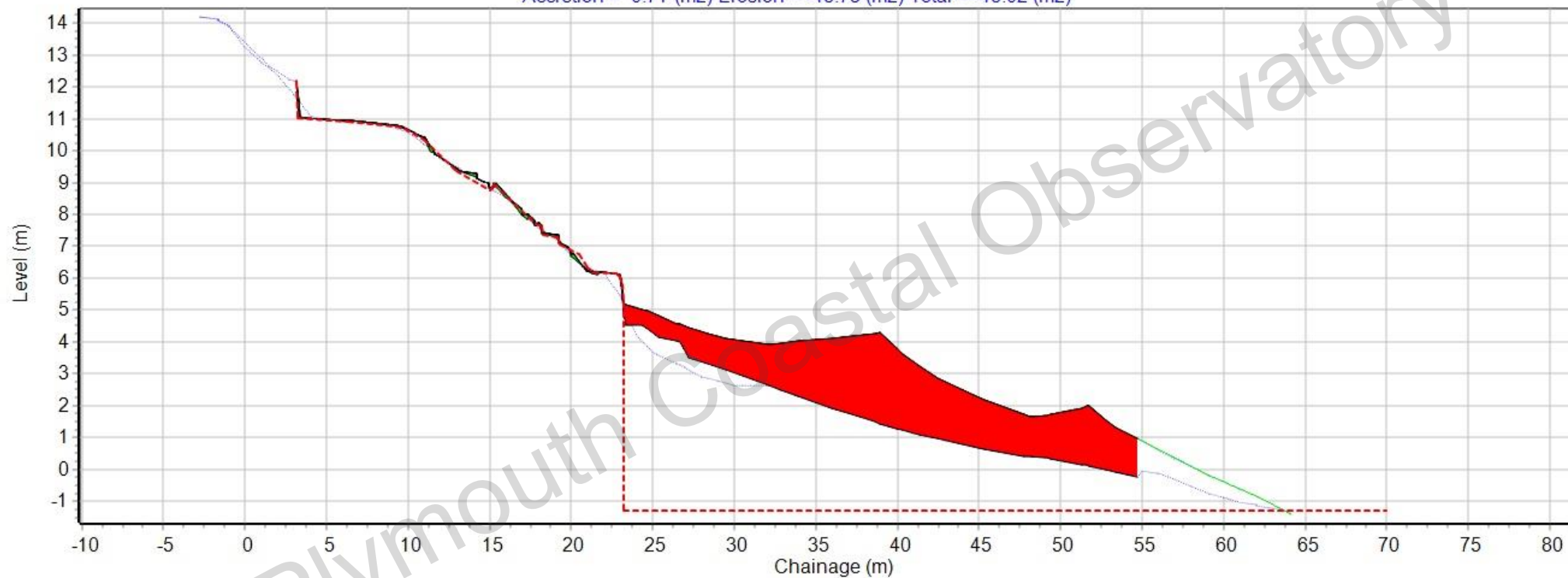
Each profile highlighted in Figure 2 is shown below, comparing the autumn interim and post-storm survey cross-sectional areas. Each plot has an accompanying profile change plot, displaying green as accretion and red as erosion for ease of visualisation.

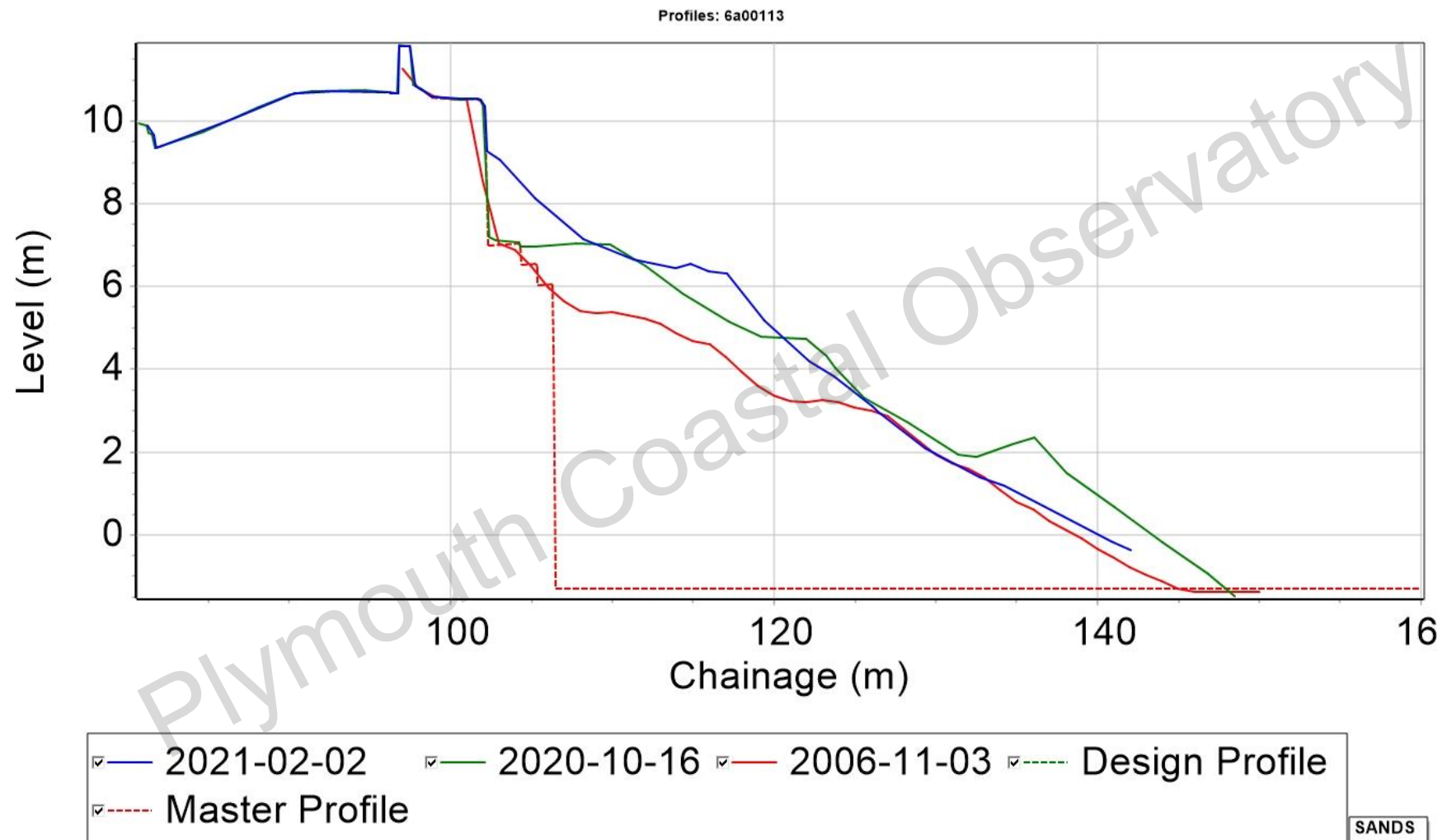


Beach Profiles: 6a00109A

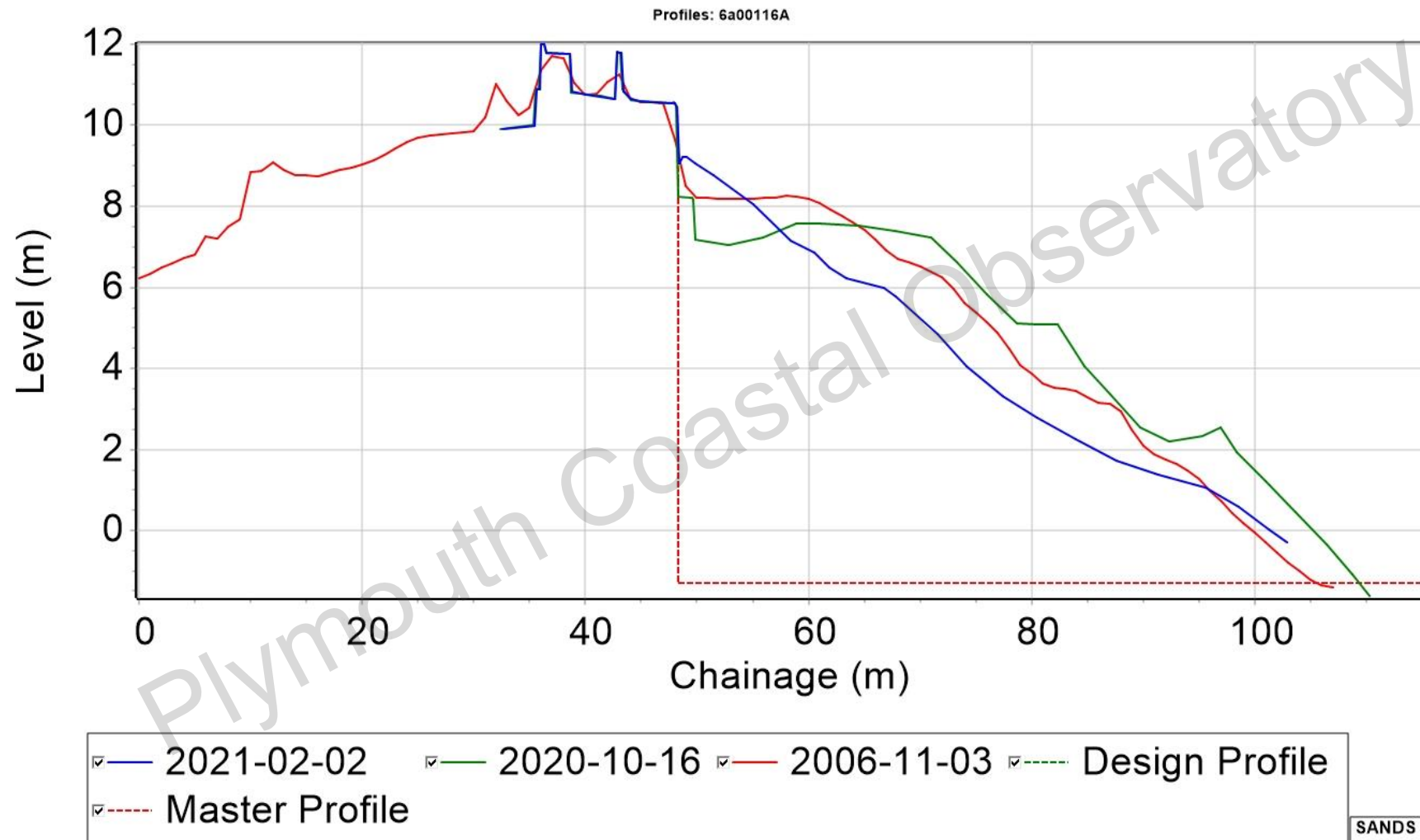
Changes between 2020-10-16 and 2021-02-02

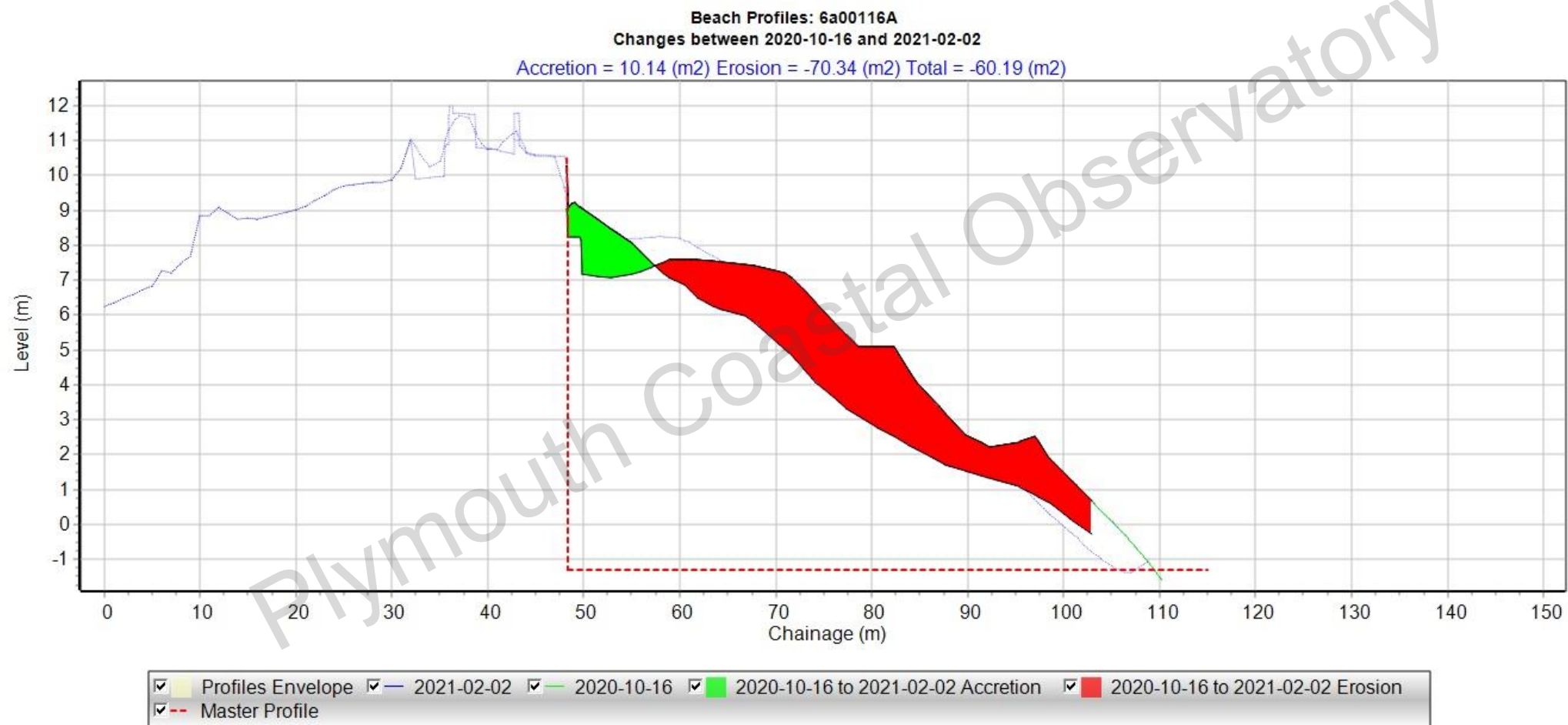
Accretion = 0.71 (m²) Erosion = -48.73 (m²) Total = -48.02 (m²)

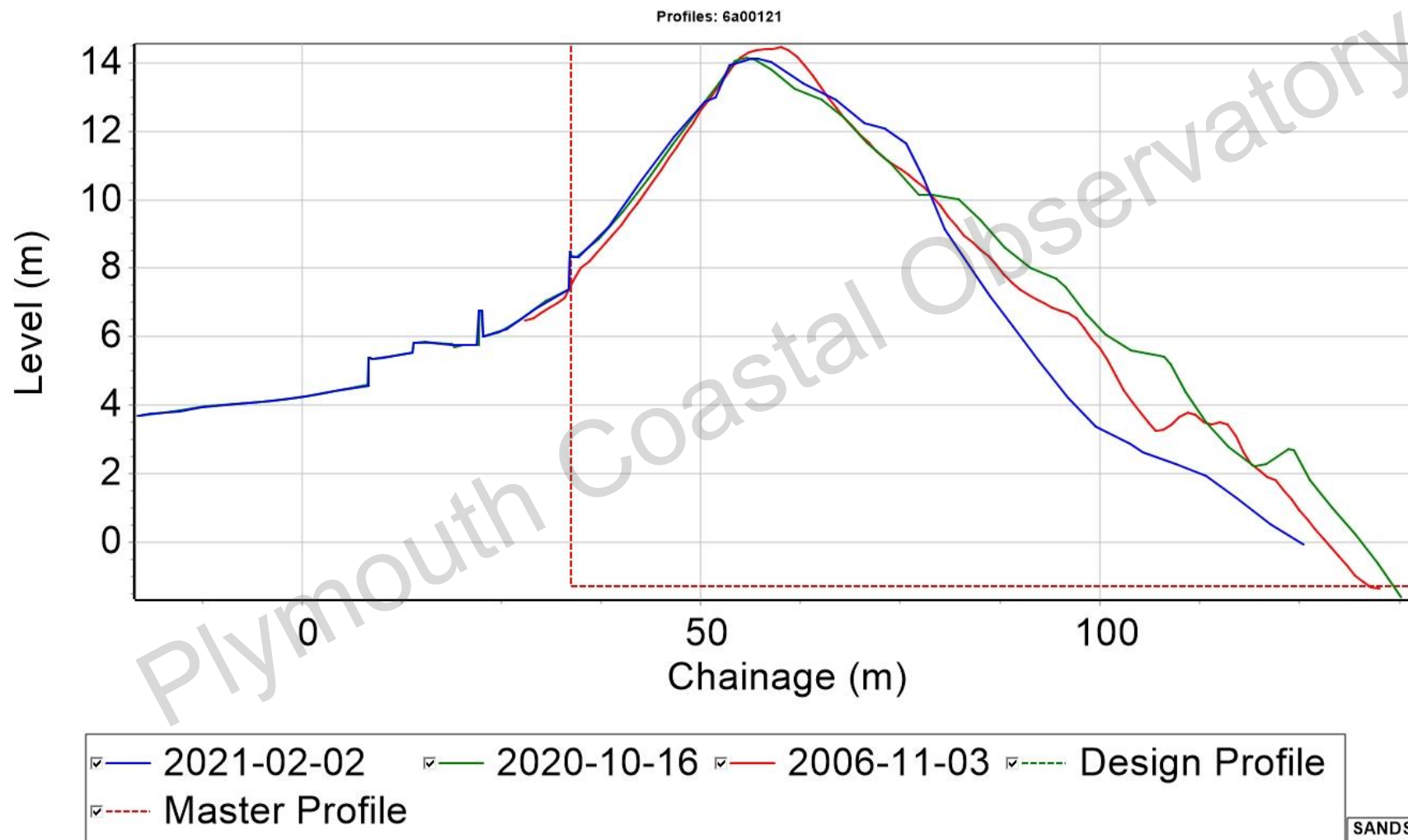


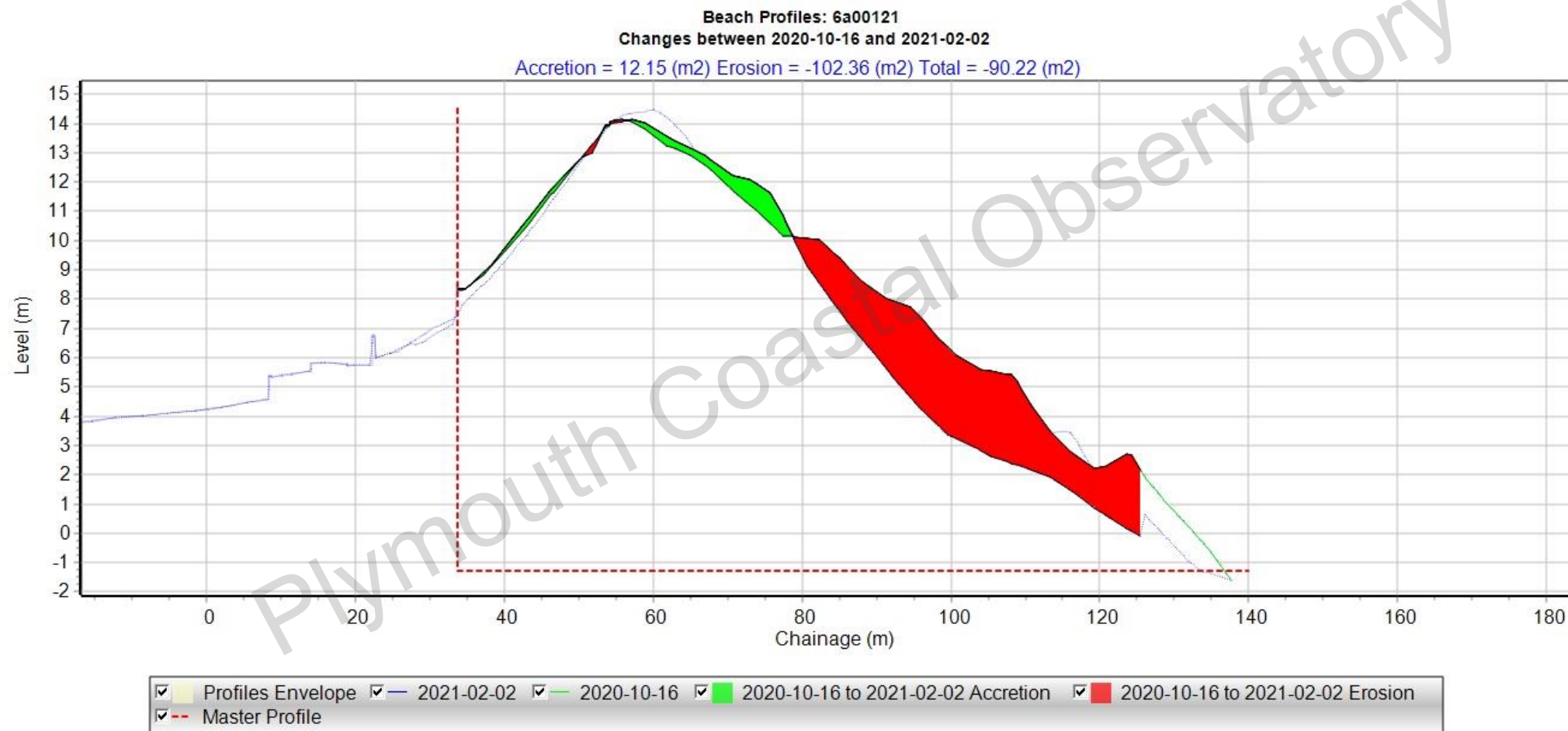


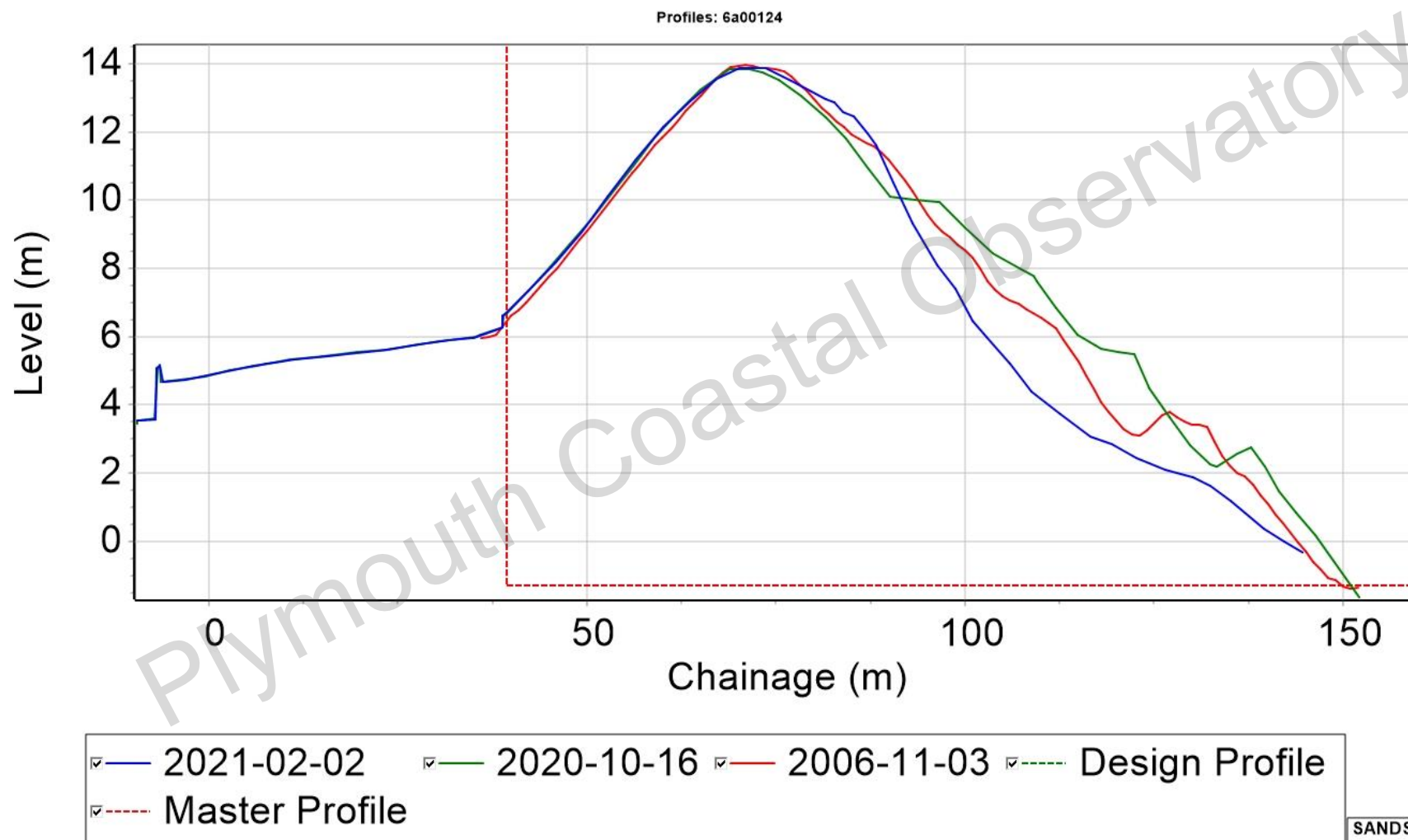


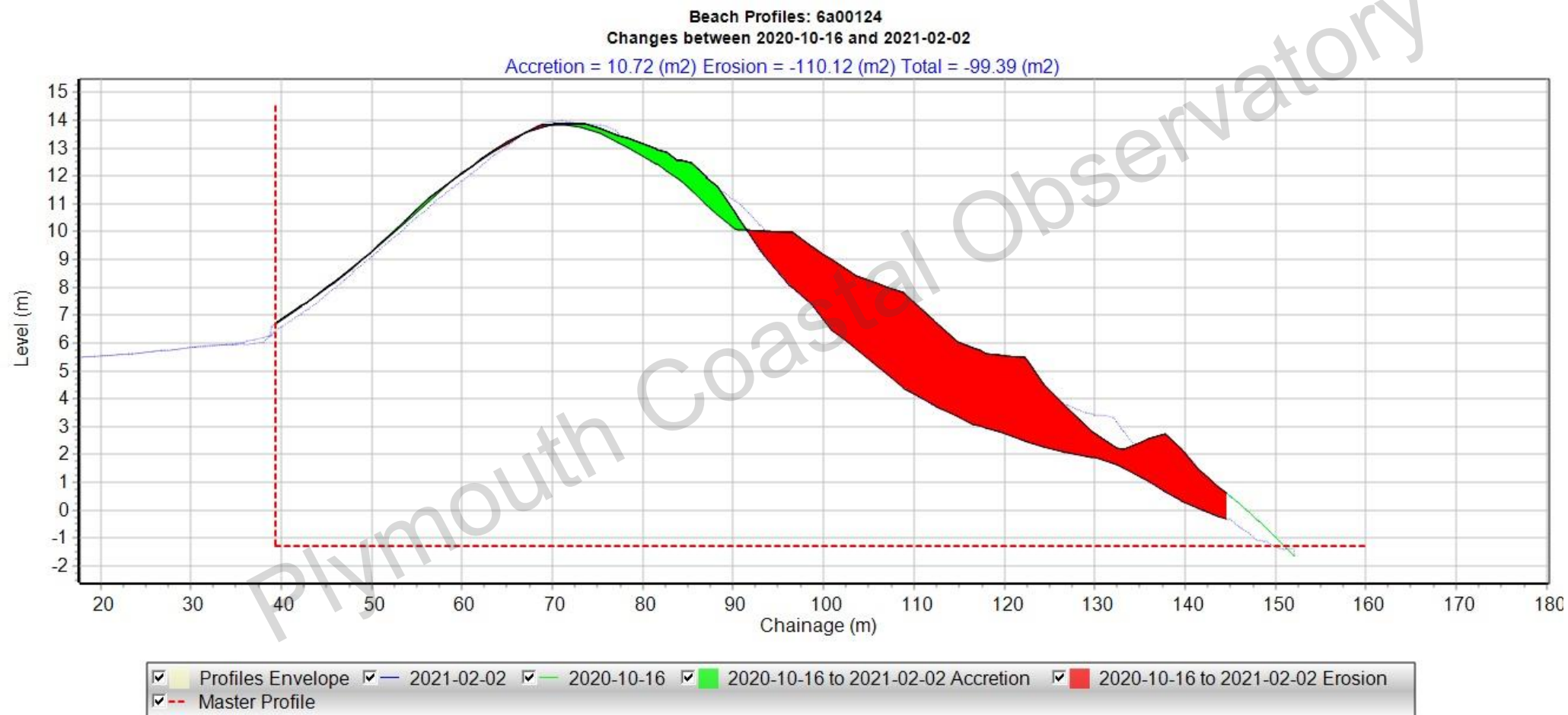


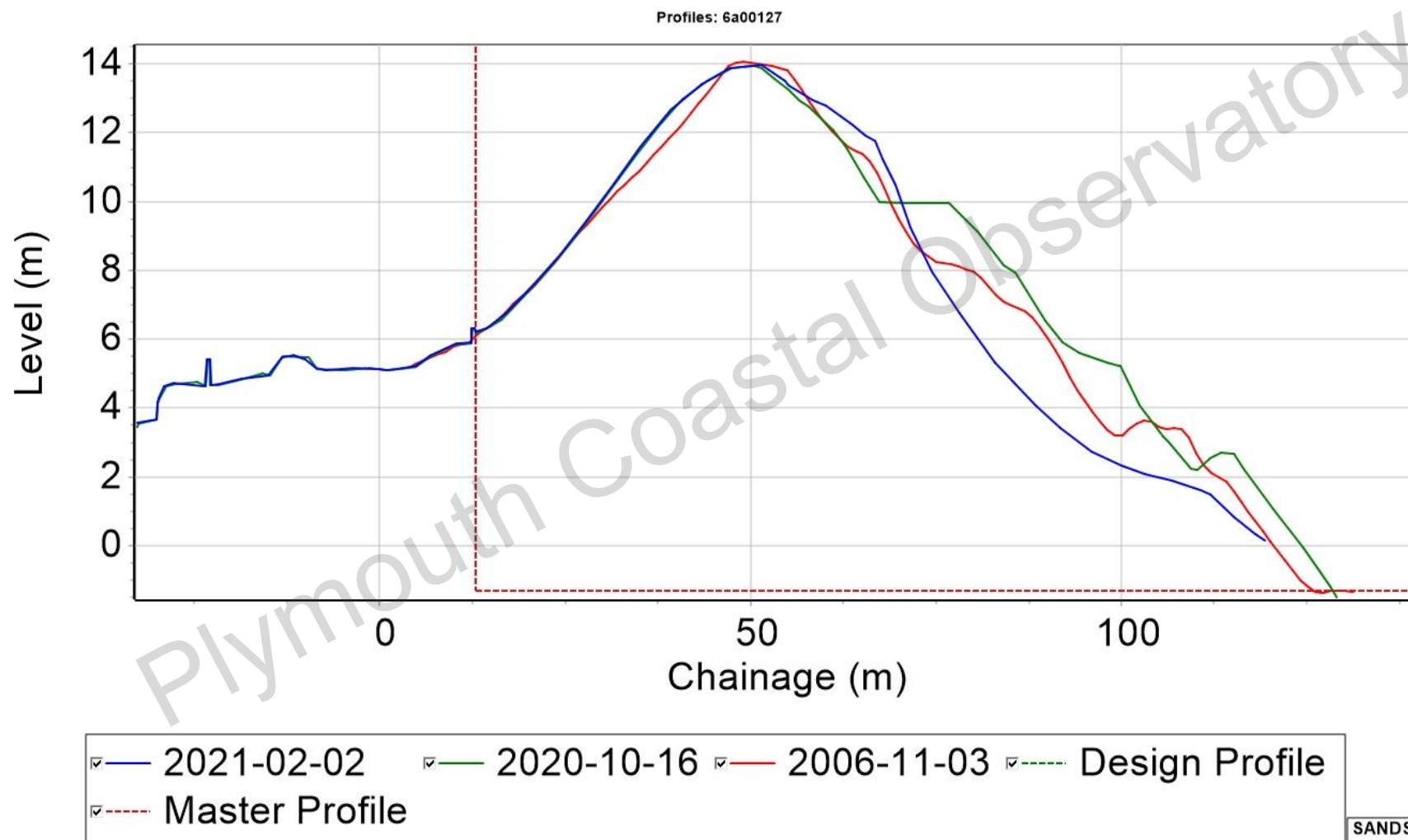


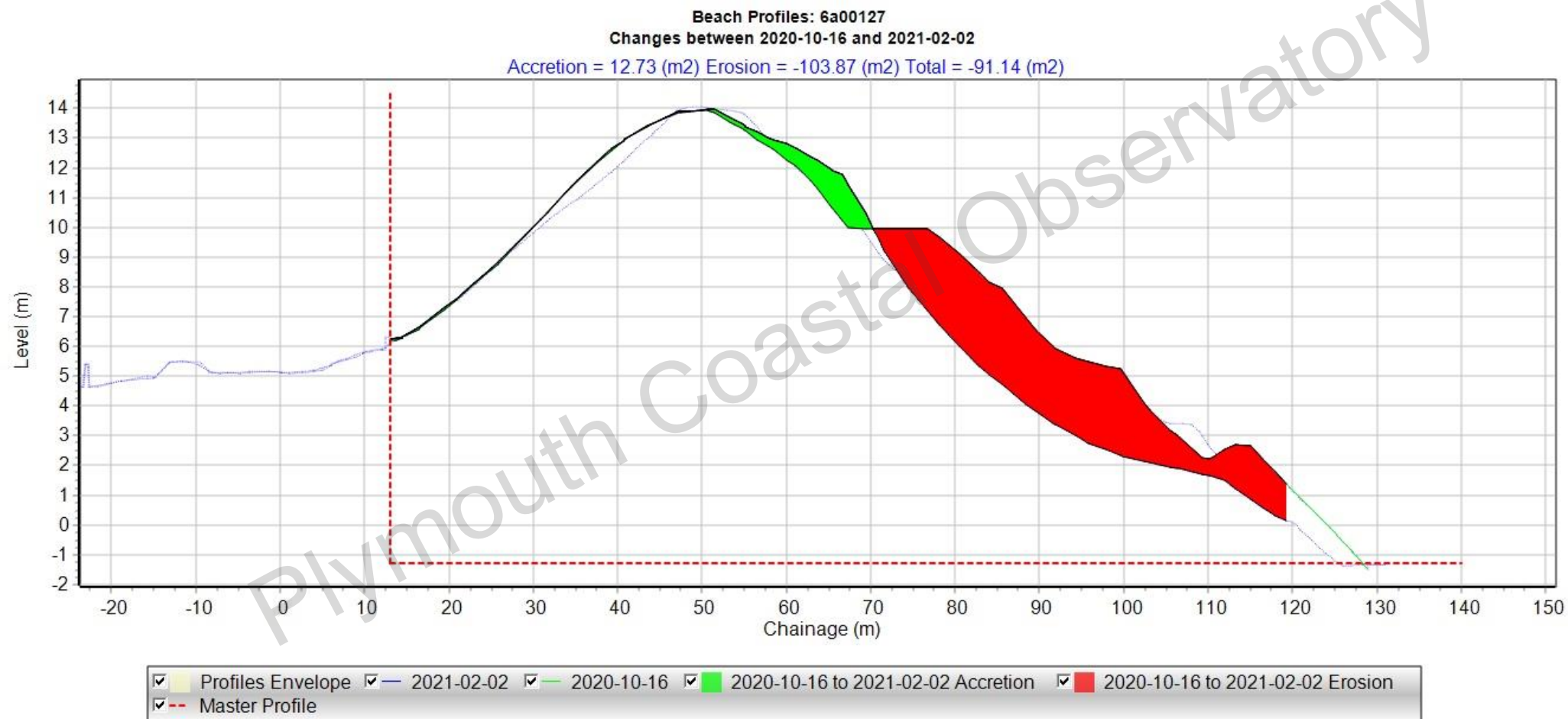


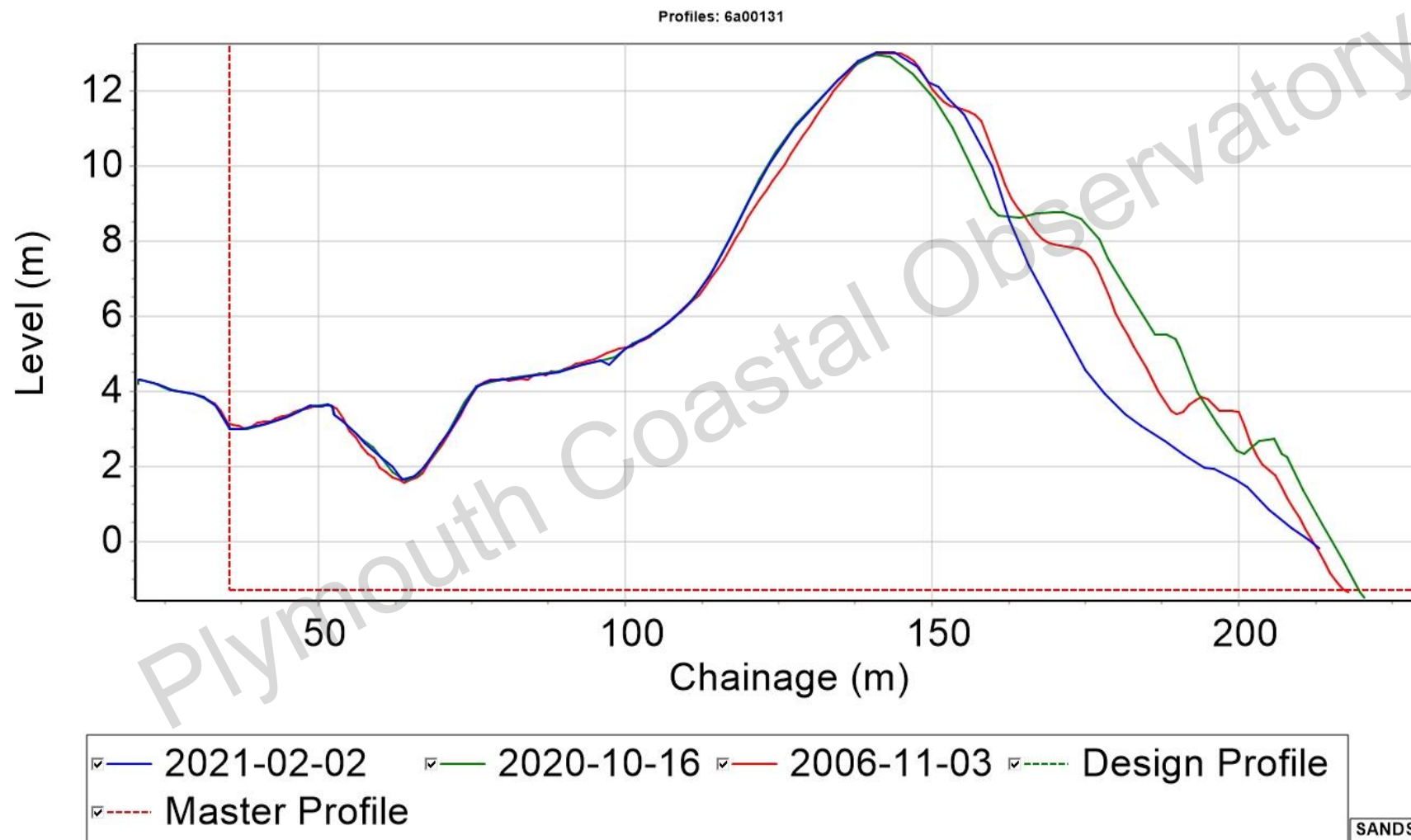


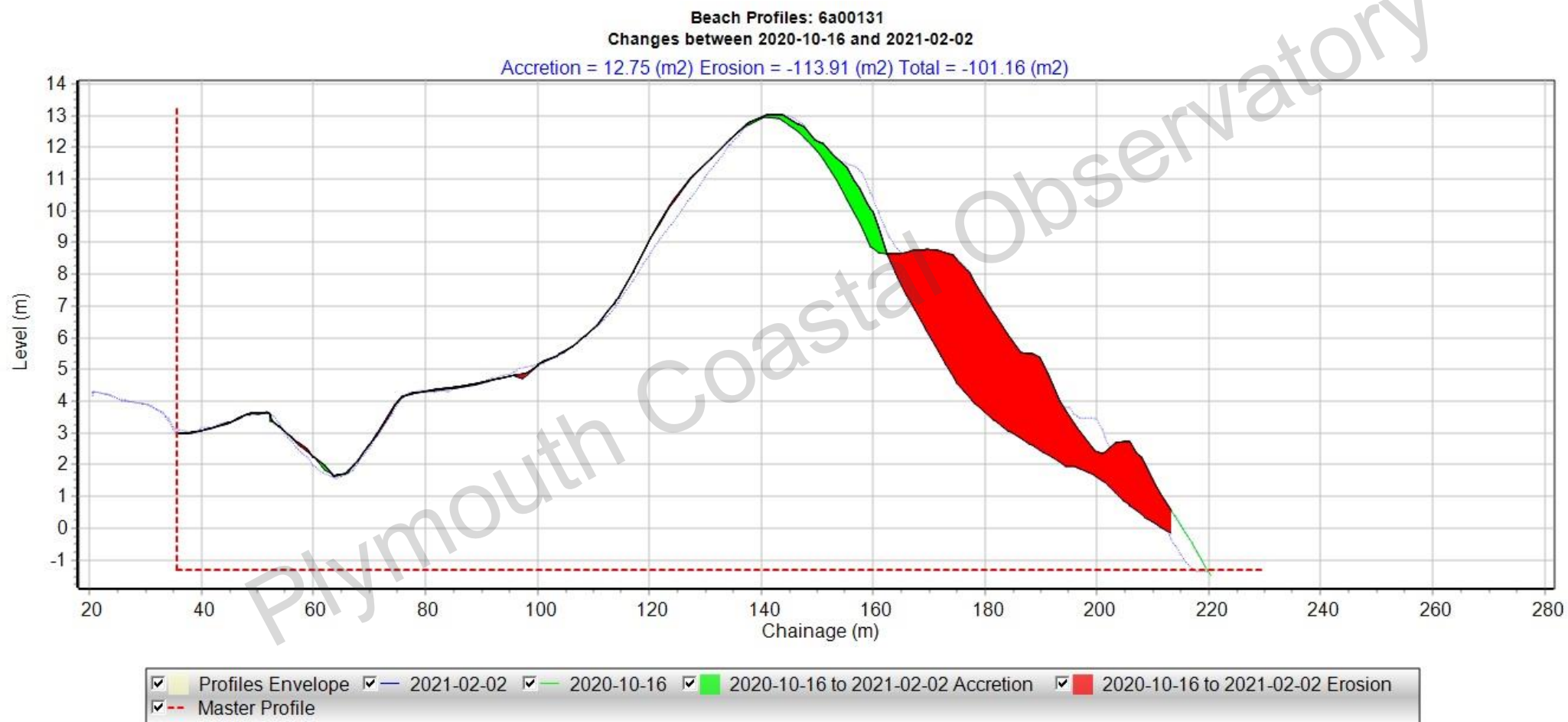


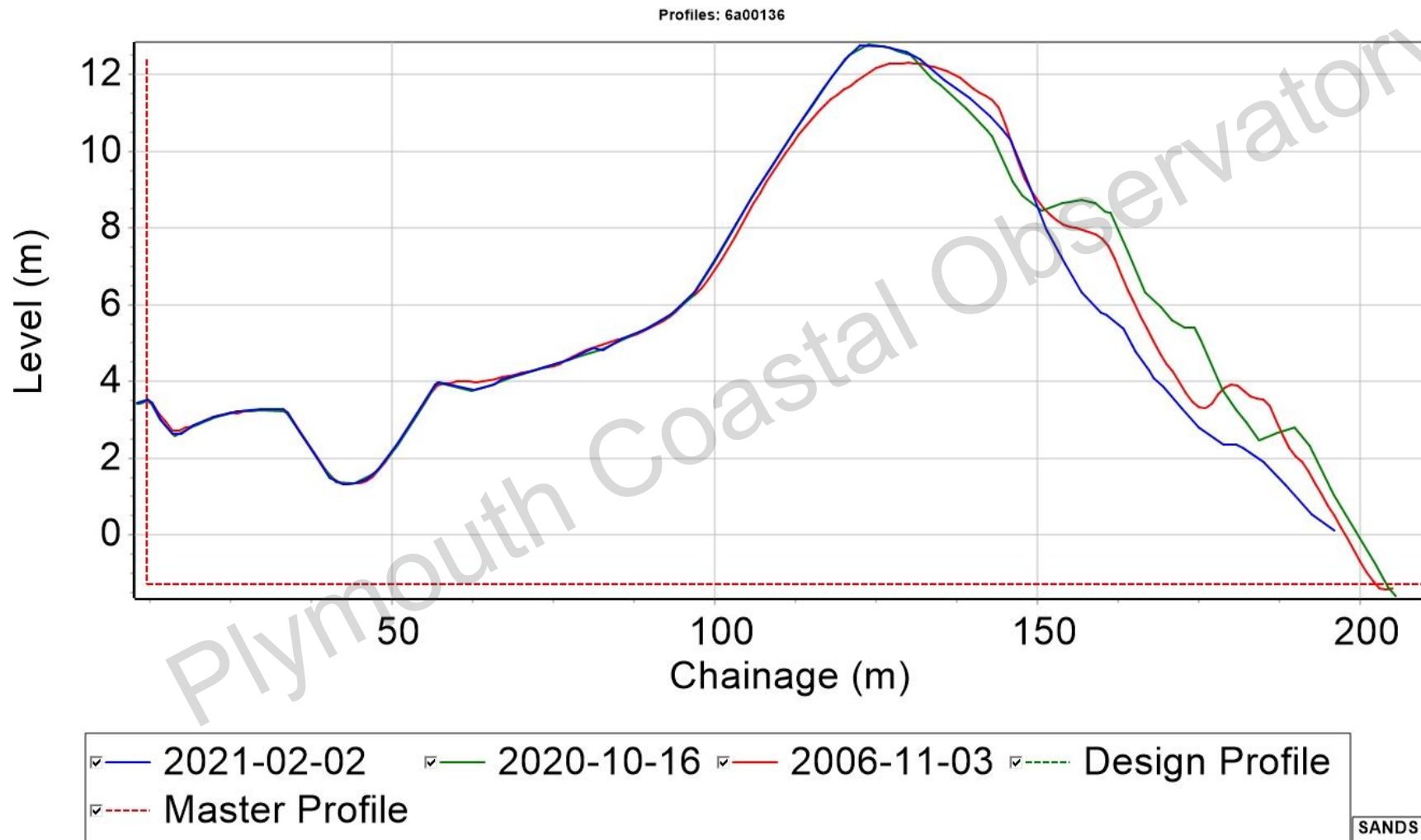


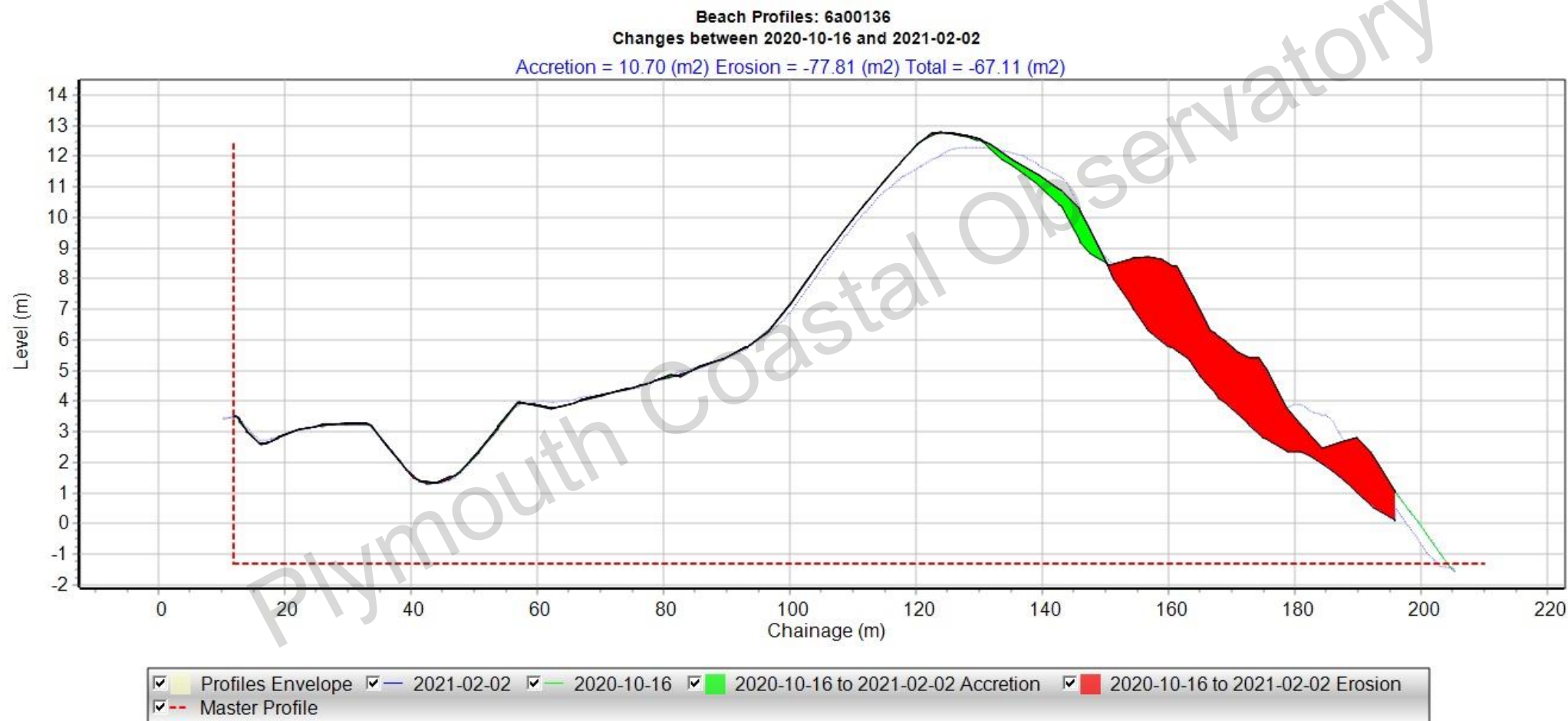


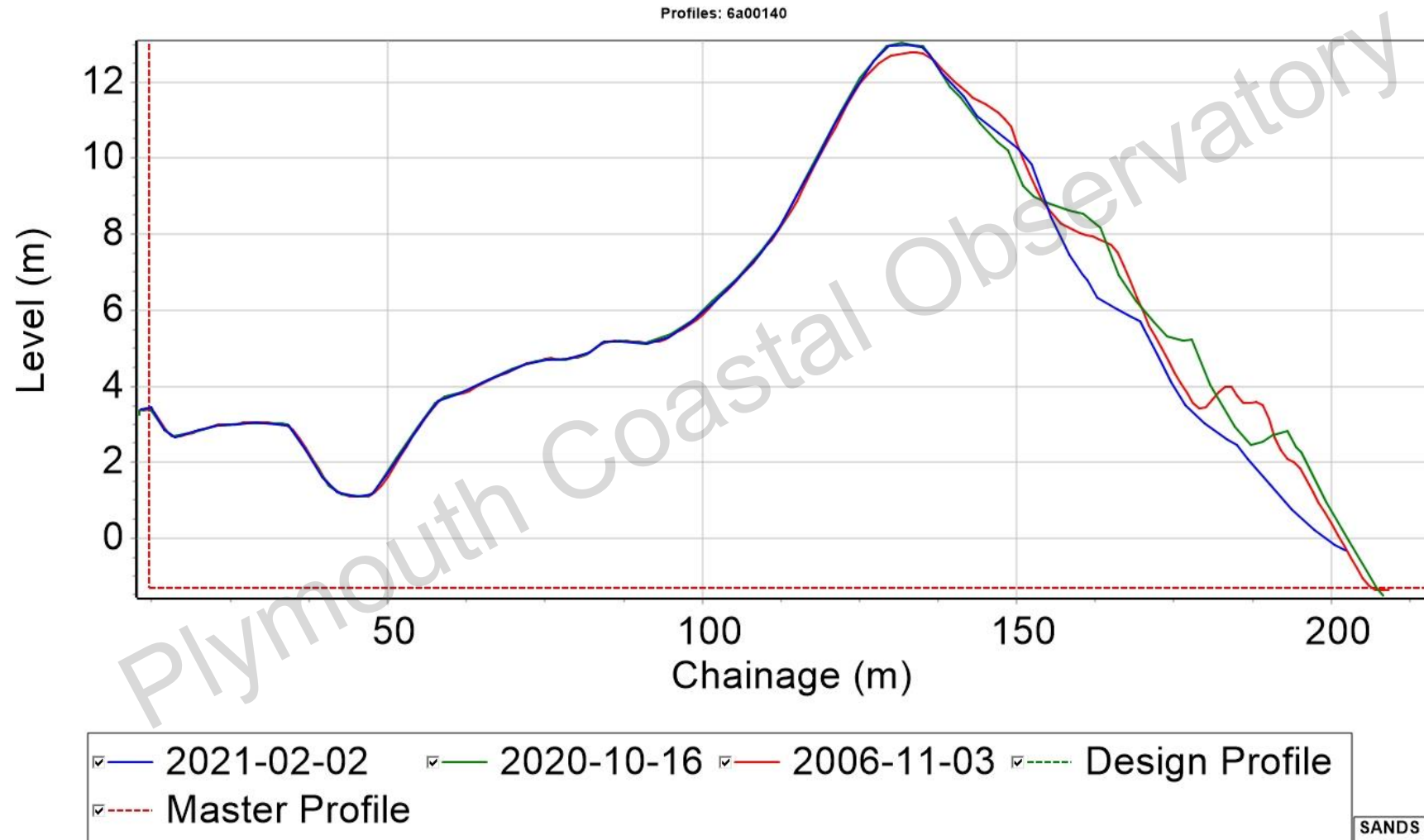








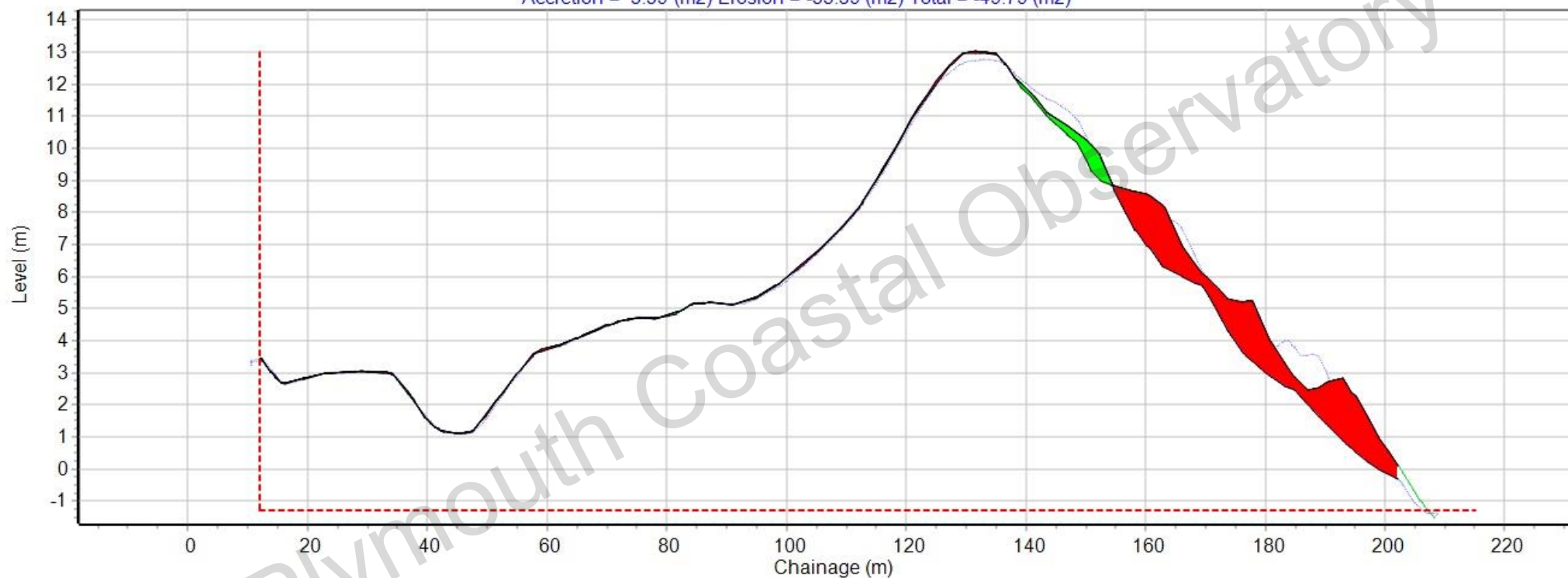




Beach Profiles: 6a00140

Changes between 2020-10-16 and 2021-02-02

Accretion = 5.59 (m²) Erosion = -55.39 (m²) Total = -49.79 (m²)



☒ Profiles Envelope
 ☒ 2021-02-02
 ☒ 2020-10-16
 ☒ 2020-10-16 to 2021-02-02 Accretion
 ☒ 2020-10-16 to 2021-02-02 Erosion
 ☒ Master Profile

