Swanage Beach Management Plan

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Swanage Beach Management Plan Update 2020

Dorset Council

25 August 2020

Dorset Council

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Document history

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Swanage Beach Management Plan Update 2020

Dorset Council

This document has been issued and amended as follows:

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Appendix K EA Best Practice Guide for Public Engagement when undertaking beach maintenance works

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Executive Summary

This Beach Management Plan (BMP) covers the central part of the Swanage Bay coast, extending from The Mowlem to the south, northwards to Shep's Hollow. The area covered by this BMP is the responsibility of Dorset Council (DC)[1]; the coastal operating authority. In addition, the Channel Coastal Observatory (CCO) undertakes coastal monitoring of the area as part of the South East Regional Coastal Monitoring Programme.

The aim of this BMP, which has been developed in accordance with best practice contained in the CIRIA Beach Management Manual (second edition), is to inform, guide and assist these responsible authorities and organisations in managing the beach, and to ensure that beach management continues to manage the risk of coastal erosion and flooding, whilst recognising and managing the environmental and amenity implications.

This BMP area is primarily at risk of coastal erosion and land-sliding and has been subject to major coastal protection works in the past including, most recently, the 2005/6 Swanage Beach Recharge Scheme and slope stabilisation measures by various private landowners in the cliffs above the Local Authority assets at the northern end of the BMP area, such as the works constructed by the owner of the Pines Hotel. At the southern end of the BMP area, there is also a risk of coastal flooding by wave overtopping during storm events. These defences along the BMP frontage protect up to £20m of assets (excluding amenity value). The beach itself also provides a vital amenity resource that is of significant benefit to the local economy, the value of which is estimated to be of the order of £400,000 to £500,000 per year.

It is the management of the beaches, timber groynes and seawalls along the BMP frontage that this BMP defines in order to reduce the risk of further coastal erosion and flooding. Doing so also supports slope stabilisation efforts by private landowners in the northern part of the BMP frontage. The management regime defined in this BMP is also presented in the context of the wider environmental setting and important amenity value of the beach environment to the local economy. This is in line with both the longer term SMP policy and FCERM Strategy approach for Swanage Bay over the next 100 years.

The key objective of this BMP is to manage the risk of coastal erosion and flooding by ensuring that an adequate beach is maintained in combination with the hard defence/control structures, such that the 1:300 year (0.33% Annual Exceedance Probability (AEP)) Standard of Protection (SoP) of the 2005/6 Swanage Beach Recharge Scheme is retained for the full

[1] Dorset Council was formed on 1st April 2019 and became the coast protection authority. Prior to this date, this role was undertaken by Purbeck District Council.

50-year scheme design life (i.e. to at least 2055). To ensure that the most appropriate approach continues to be taken to achieving this objective, a review of beach management options has been undertaken; the preferred approach determined from this review is described in detail in Appendix B, but the key elements can be summarised as follows:

- Along the 2005/6 scheme section of the BMP frontage (Banjo Pier to Shep's Hollow), continue with inspection driven maintenance of the seawalls and timber groynes, supported by periodic beach recharge using sediment derived from dredging of Poole Harbour to maintain the 2005/6 beach design levels. The next beach recharge campaign is required to occur between 2023 and 2025. Future beach recharge campaigns should:
    - Be driven by ongoing monitoring and consider being undertaken more frequently than every 20 years to minimise risk of low beach levels impacting existing beach structures;
    - Expand the area that receives beach recharge to also include the southern part of the BMP area (The Mowlem to the Banjo Pier) – this area was not recharged as part of the 2005/6 scheme; and
    - Working within the framework of the Durlston Head to Hurst Spit Sediment Resource Management Programme, led by the Dorset Coastal Engineering Partnership, be supported by **regular meetings with Poole Harbour Commissioners (PHC)** to discuss alignment of future dredge operations with future beach recharge needs in order to maximise opportunities for carbon and cost reduction via potential re-use of dredge arisings.
- Between beach recharge events, occasional beach recycling could occur. However, beach recycling throughout the entire length of the BMP area is not technically viable due to tidal constraints and limited beach width, so such activity would be constrained to rebalancing material within individual groyne bays and/or adjacent groyne bays to redistribute the sediment accreted at the crest of the slope. Locally redistributing sediment within individual groyne bays that are experiencing reduced crest width in this way would enable a flatter profile to be created towards the design 1 in 20 slope. This flatter slope would help reduce draw down from offshore transport and have other recognised benefits including increased protection to the groynes and seawall and reduced overtopping.
- Plan to undertake a capital programme to replace the timber groynes in 2040/41, though the exact timing of this will be guided by regular inspection of the existing timber groynes.

The strategy for monitoring and intervention defined in this BMP is aligned to this preferred option, and includes actions to progress delivery of the next beach recharge campaign through development of an Outline Business Case (OBC) in the coming years to allow beach recharge to occur between 2023 and 2025. In developing the OBC, there are a number of technical, environmental and economic details to be resolved including:

- Confirm the source of future beach recharge, with a preference to securing future dredge material from Poole Harbour.

- Seek to optimise the frequency of future beach recharge from the assumed every 7 years used in the options appraisal, taking into account both the quantities of sediment needed over different time-scales, and the volume of sediment of required sediment grading available from different sources to meet this need.
- Further assess how to best reduce the risk of seawall undermining in areas where the seawall toe is about 0mOD, through use of either rip-rap buried beneath the beach or seawall underpinning works.
- Further assess the need for an additional control structure(s) to support retention of beach levels along the section from The Mowlem to the Banjo Pier.
- Undertake ecological surveying of the seabed in Swanage Bay to confirm the presence and distribution of key habitat and species that are protected by various marine SAC, SPA, WFD and MCZ designations covering the bay to support the application for a Marine Licence required to undertake the next beach recharge campaign. The exact scope of such survey work should be discussed and agreed with Natural England and the MMO at the start of the work to develop the OBC for the next beach recharge campaign.
- Seek clarity from the Environment Agency on the most appropriate valuation of amenity benefits to support the next scheme OBC economic case, given that the FCERM Strategy Strategic Appraisal Report (StAR) was granted approval following technical assurance. In particular, confirmation that the Environment Agency are in agreement with the high valuation of beach amenity recreation benefit should be discussed. This will then allow discussions to commence with funding contributors, such as Dorset Council, Swanage Town Council and the Wessex RFCC, in order to secure the Partnership Funding contribution required; currently estimated to be several million pounds.

Between beach recharge campaigns, ongoing maintenance works will continue to occur either as planned maintenance or in response to alarm or crisis trigger levels being reached. Such works will be guided by:

- Regular (bi-annual) surveys of beach profiles along the BMP frontage to allow ongoing monitoring of beach volumes and beach levels against trigger levels defined in Section 3.3 of this BMP.
- Regular (at least once per year) inspection of the condition of the seawalls and timber groynes to allow timely maintenance works to be undertaken in order to maximise the life of these structures and so delaying when major capital works are required to replace them.

These activities defined in the BMP will continue to manage the risk of coastal erosion and flooding to at least 2055 (the 2005/6 scheme design life). Beyond this timeframe, it may not be sustainable to continue to protect the seawall along the BMP frontage through beach recharge and timber groynes, and alternative defence approaches may be needed. The longer-term measures needed to continue to protect Swanage along the BMP frontage will need to be determined based on the evidence provided by the ongoing monitoring defined in this BMP and kept under review as part of regular review and update of the BMP and overarching FCERM Strategy.

This section provides a summary of the recommendations made throughout the rest of this BMP in the form of an Action Plan. The Action Plan is presented in Section 6 of the BMP and identifies actions grouped by type as being either for ‘Management, ‘Monitoring’, ‘Maintenance’, or ‘Future Studies / Research’. It is intended that this Action Plan be used to guide future management of this area.

1 Introduction

1.1 Background

This Beach Management Plan (BMP) covers the central part of the Swanage Bay coast, extending from The Mowlem to the south, northwards to Shep's Hollow (see Figure 1-1). This BMP provides a review and update of the existing BMP first produced by Halcrow in March 2005 as part of the 2005/6 Swanage Beach Recharge Scheme (Halcrow, 2005a).

This BMP area is primarily at risk of coastal erosion and land-sliding and has been subject to major coastal protection works in the past including, most recently, the 2005/6 Swanage Beach Recharge Scheme and slope stabilisation measures by various private landowners in the cliffs above the Local Authority assets at the northern end of the BMP area, such as the works constructed by the owner of the Pines Hotel (see Sections 1.3.3 and 3.1.4). At the southern end of the BMP area, there is also a risk of coastal flooding by wave overtopping during storm events. These defences along the BMP frontage protect up to £20m of assets, excluding amenity benefits (see Appendix A). The beach itself also provides a vital amenity resource that is of significant benefit to the local economy, the value of which is estimated to be of the order of £400,000 to £500,000 per year (see Appendix A).

It is the management of the beaches, timber groynes and seawalls along the BMP frontage that this BMP defines in order to reduce the risk of further coastal erosion and flooding. Doing so also supports slope stabilisation efforts by private landowners in the northern part of the BMP frontage (see also Section 3.1.4). The management regime defined in this BMP is also presented in the context of the wider environmental setting and important amenity value of the beach environment to the local economy.

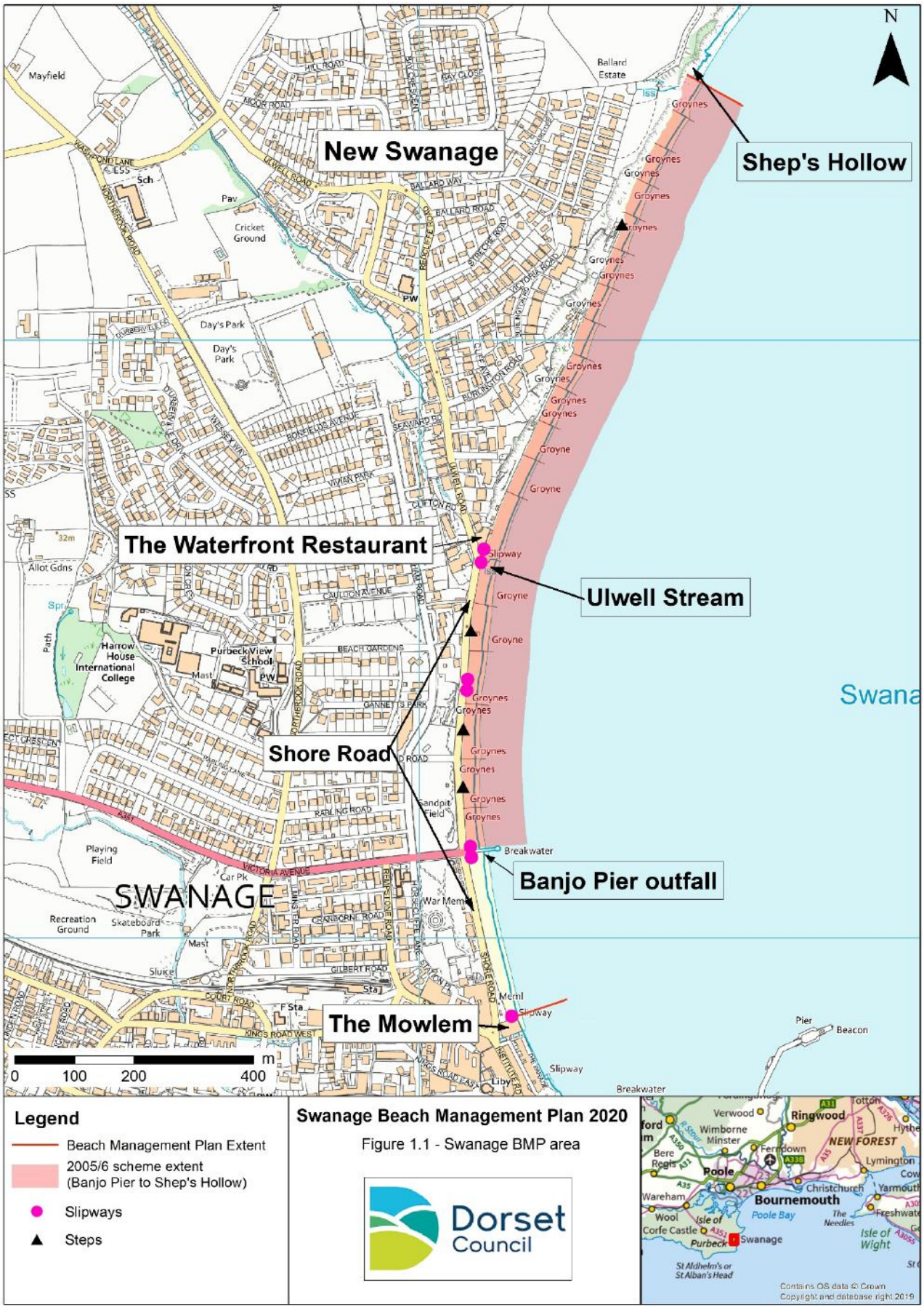


Figure 1-1 Swanage beach management plan area.

1.2 Objectives

The area covered by this BMP is the responsibility of Dorset Council (DC)[2]; the coastal operating authority. In addition, the Channel Coastal Observatory (CCO) undertakes coastal monitoring of the area as part of the South East Regional Coastal Monitoring Programme (SERCMP).

The aim of this BMP, which has been developed in accordance with best practice contained in the CIRIA Beach Management Manual (second edition), is to inform, guide and assist these responsible authorities and organisations in managing the beach, and to ensure that beach management continues to manage the risk of coastal erosion and flooding, whilst recognising and managing the environmental and amenity implications.

The key objective of this BMP is to manage the risk of coastal erosion and flooding by ensuring that an adequate beach is maintained in combination with the hard defence/control structures, such that the 1:300 year (0.33% Annual Exceedance Probability (AEP) Standard of Protection (SoP) of the 2005/6 Swanage Beach Recharge Scheme is retained (see also Section 3.2). To ensure that the most appropriate approach continues to be taken to achieving this objective, a review of beach management options has been undertaken; the preferred approach determined from this review is described in Section 1.2.1.

The BMP sets out the strategy for monitoring and intervention to maintain the beach, timber groynes and seawalls to ensure it continues to provide adequate SoP to Swanage for the next 5 years (the BMP review period), in line with the longer term SMP policy (see Section 1.7.1) and FCERM Strategy approach (see Section 1.7.2) for Swanage Bay over the next 100 years.

The BMP also recommends what further studies may be appropriate to aid future coastal erosion and flood risk management in this area. Recommendations are contained throughout the BMP, and are identified with **bold underlined text**. These are also summarised in an Action Plan presented in Section 6.

1.2.1 Summary of beach management options review

As part of the 2020 update of the BMP, a review of options available for the continued beach management at Swanage was completed to ensure that the 2005 Swanage Beach Recharge Scheme continues to be maintained in line with the preferred strategic approach defined in the 2011 Shoreline Management Plan (SMP) (Poole & Christchurch Bays Coastal Group and Royal Haskoning, 2011) and subsequent 2014 Flood and Coastal Erosion Risk Management (FCERM) Strategy (Environment Agency, 2014), taking into account both more recent

[2] Dorset Council was formed on 1st April 2019 and became the coast protection authority. Prior to this date, this role was undertaken by Purbeck District Council.

guidance, monitoring data and investigations / studies. The full options review is provided in Appendix B.

The following provides a summary of the preferred option for future management of coastal flood and erosion risks along the BMP area, the key elements of which are:

- Along the 2005/6 scheme section of the BMP frontage (Banjo Pier to Shep's Hollow), continue with inspection driven maintenance of the seawalls and timber groynes, supported by periodic beach recharge using sediment derived from dredging of Poole Harbour to maintain the 2005/6 beach design levels. The next beach recharge campaign is required to occur between 2023 and 2025 (refer also to Section 1.4.1). Future beach recharge campaigns should:
    - Be driven by ongoing monitoring and consider being undertaken more frequently than every 20 years to minimise risk of low beach levels impacting existing beach structures;
    - Expand the area that receives beach recharge to also include the southern part of the BMP area (The Mowlem to the Banjo Pier) – this area was not recharged as part of the 2005/6 scheme; and
    - Working within the framework of the Durlston Head to Hurst Spit Sediment Resource Management Programme, led by the Dorset Coastal Engineering Partnership, be supported by **regular meetings with Poole Harbour Commissioners (PHC)** to discuss alignment of future dredge operations with future beach recharge needs in order to maximise opportunities for carbon and cost reduction via potential re-use of dredge arisings.
- Between beach recharge events, occasional beach recycling could occur. However, beach recycling throughout the entire length of the BMP area is not technically viable due to tidal constraints and limited beach width, so such activity would be constrained to rebalancing material within individual groyne bays and/or adjacent groyne bays to redistribute the sediment accreted at the crest of the slope. Locally redistributing sediment within individual groyne bays that are experiencing reduced crest width in this way would enable a flatter profile to be created towards the design 1 in 20 slope. This flatter slope would help reduce draw down from offshore transport and have other recognised benefits including increased protection to the groynes and seawall and reduced overtopping (refer also to Section 5.1.1 and Section 5.2.1).
- Plan to undertake a capital programme to replace the timber groynes in 2040/41, though the exact timing of this will be guided by regular inspection of the existing timber groynes (refer to Sections 3.1.2 and 4.2).

Section 1.4.1.1 sets out further details of considerations to be developed in taking forward plans for the next beach recharge campaign between 2023 and 2025.

The strategy for monitoring and intervention defined in this BMP is aligned to this preferred option, and includes actions to both progress delivery of the next beach recharge campaign, and address recommendations identified in the options appraisal provided in Appendix B.

1.3 Location

1.3.1 Environmental setting

There are a number of statutory environmental designations directly within, or within close proximity (approx. 2km) of, Swanage Bay that need to be considered when planning and implementing FCERM activities, including:

- Isle of Portland to Studland Cliffs Special Area of Conservation (SAC)
- Studland to Portland Marine SAC
- St Albans Head to Durlston Head SAC
- Solent and Dorset Coast Special Protection Area (SPA)
- Purbeck Coast Marine Conservation Zone (MCZ)
- Studland Bay MCZ
- Purbeck Ridge (East) Site of Special Scientific Interest (SSSI)
- Dorset and East Devon UNESCO World Heritage Site (the 'Jurassic Coast').

Figure 1-2 shows the extents of the various environmental designations in relation to the BMP area.

There are also a range of historic and cultural environment features and assets within and around the BMP area, including many Listed Buildings and structures around the Swanage town area. Figure 1-3 shows the location of these historic and cultural environment features in relation to the BMP area.

Further detail and discussion of the environmental characteristics relating to the BMP area is provided in Section 2.7 and Appendix C.

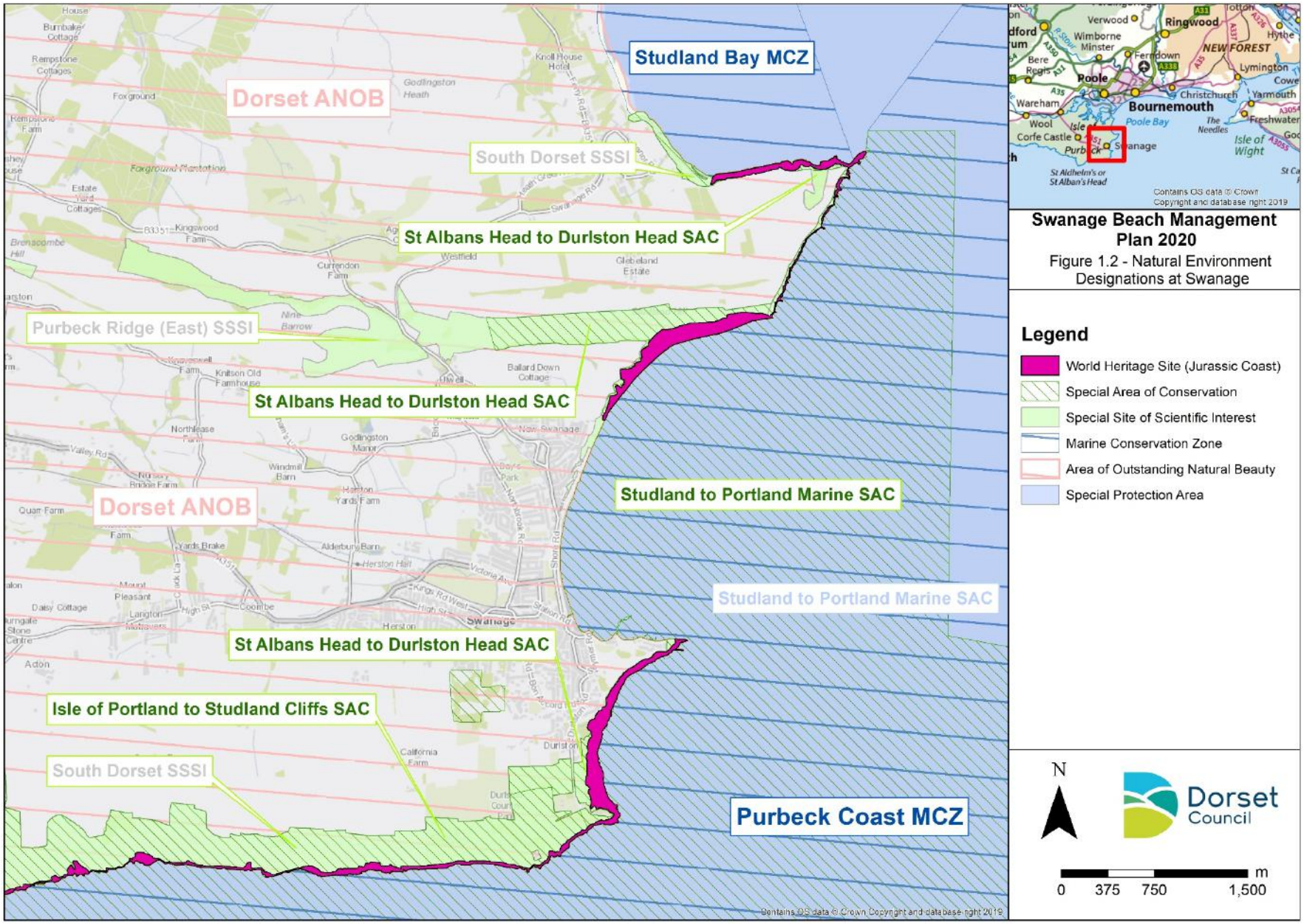


Figure 1-2 Natural environmental designations at Swanage.

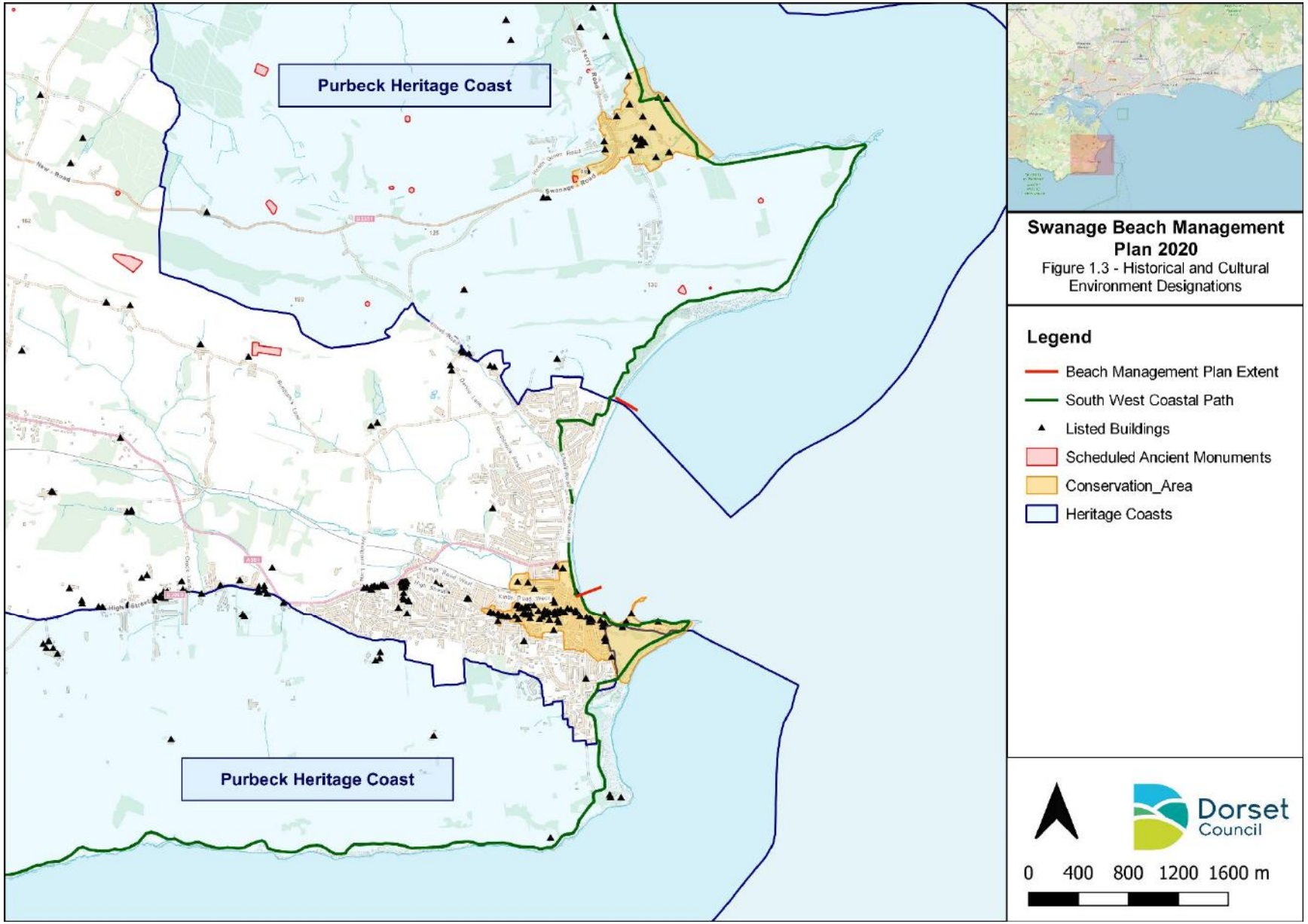


Figure 1-3 Historic and cultural environment features at Swanage.

1.3.2 History of coastal flooding and erosion

The following provides a summary of the history of coastal flooding and erosion at Swanage. Further information is provided in Appendix D.

1.3.2.1 Coastal erosion

The risk of coastal erosion extends along the majority of the BMP frontage, particularly from the Banjo Pier northwards (see Section 1.4.1). Protection against the risk of coastal erosion has been the driver for the construction of coastal defences along the shoreline of Swanage Bay in this area since the very early 20th century (see Section 1.3.3), and as such erosion of the shoreline by marine action at the base of the cliffs and higher ground along the shoreline has been prevented for many decades. Coastal erosion issues are primarily constrained to reduction in beach levels where backed by the seawalls due to scour and beach draw-down, which is exacerbated historically when timber groynes have been allowed to deteriorate and become ineffective (Halcrow, 2004). The most recent coast protection works occurred in 2005/6 when the Swanage Beach Recharge Scheme was constructed (see Section 3.1). The aim of the scheme is to protect Swanage from coastal erosion, which if left unaddressed could lead to damage to local properties and roads over the next 50 years amounting to over £20 million (Purbeck District Council, 2005).

Despite all these works to prevent coastal erosion due to marine action, the cliff section of coast along the New Swanage part of the BMP frontage (i.e. north of the Ulwell Stream outfall) is still subject to landslides and ground instability issues caused by groundwater conditions. Private landowners have installed a variety of slope stabilisation measures along parts of this section (see Sections 1.3.3 and 3.1.4), but localised slips do still occur, and can cover the promenade atop the seawall that protects the base of the cliff as well as threaten loss of cliff top assets including properties and gardens (Dorset Coast Forum, 2014).

Beyond the northern end of the seawall at New Swanage, there are a number of timber groynes that aim to retain beach levels against the base of the cliff in order to reduce wave action leading to coastal erosion. Despite this, landslips do still occur in this area, and have on occasion, covered and caused damage to the landward end of some of the timber groynes in this area.

1.3.2.2 Coastal flooding

The area of Swanage Bay covered by this BMP has limited history of coastal flood events; coastal flooding at Swanage is more of an issue to the south of the BMP area (i.e. the Swanage town frontage) (see Section 1.4.1). Indeed, the Swanage Beach Recharge Scheme Coastal Report (Halcrow, 2005b) states that along the scheme (BMP) frontage (from the Banjo Pier northwards) "*wave overtopping under extreme storm events could result in flooding of the Shore Road. Most of the seawater would return to the sea either directly over the seawall or through the road gullies. It is possible that some of the water could flow southwards down the road into the town centre and cause flooding of properties. Given that there is no historical record of this occurrence, the probability of occurrence is very low, but will increase with sea level rise. The most appropriate response to this problem is to make provision for the placement of a temporary barrier of sandbags or similar across Shore Road to the south of the Outfall Jetty, should the need arise.*"

Whilst there is minimal direct coastal flooding from the BMP frontage, storm events do cause wave overtopping along the Shore Road section of the BMP frontage; particularly the southernmost section between the Mowlem and the Banjo Pier, especially when beach levels are low and the sea is able to attack the face of the seawall. Storm events can result in beach material and marine debris being thrown up onto the promenade along Shore Road, and cause damage to the seawall and promenade, as occurred in February 2014 (see Figure 1-4).

Figure 1-4 Significant damage occurred to the seawall along Swanage promenade between the Mowlem and the Banjo Pier as a result of a storm on 14th February 2014. This displaced approximately 25m of top stones (from JBA, 2020a). Note also an exposed, historic rock groyne-type structure adjacent to the slipway (marked with an arrow). Insert is a photo of waves breaking on the seawall during the same storm event (from Goater, 2014).

1.3.3 Defence history

Coastal defences to protect Swanage against coastal flooding and erosion have been installed along the BMP frontage over the past two centuries. Key periods of construction to note are:

1) In response to concerns over the loss of sand from the beach by the action of the sea in the late 19th century, construction of a seawall between the Mowlem and the Ulwell Stream outfall commenced in 1904 along Shore Road. The seawall was widened seawards as part of widening Shore Road in the early 1920s. Also, during this time ad hoc sections of seawall were constructed in an erratic alignment along the toe of the cliff north of the Ulwell Stream outfall along the New Swanage frontage (Section 3.1.3 provides further details).

2) It is likely that the highly reflective vertical seawall constructed in the early part of the 20th century would have resulted in an increased loss of beach at the toe of the structure. Therefore, in an effort to maintain beach levels, a groyne field was constructed between 1929 and 1931 (see Figure 1-5).

3) During the 1960s, Purbeck District Council took operational responsibility for the coastal protection scheme along the New Swanage section, and funded the repair and rebuilding of the ad hoc private seawall, extending the wall up to The Pines Hotel and supporting this with the construction of timber groynes in 1962 to aid retention of beach levels in this area to Shep's Hollow.
4) 1993 saw construction of the Outfall Jetty at the southern end of the bay (also known as the "Banjo Pier") as part of the Swanage Flood Alleviation Scheme; now maintained by the Environment Agency.
5) In 2005/6, the Swanage Beach Recharge Scheme was constructed. This involved:
    - The removal of the 19no. old timber groynes northwards of the Banjo Pier, plus the two older timber groynes between the Mowlem and the Banjo Pier that are outside the official extent of this 2005/6 scheme.
    - Construction of 18no. new timber-groynes northwards of the Banjo Pier.
    - Import and placement of around 130,000m^3 of beach recharge sediment.
    - Installation of a flushing system to the Outfall Jetty.
    - Repairs to sections of the seawall and access steps.

    Sections 3.1.1 and 3.1.2 provide further details of this scheme.
6) During the 20th century, private landowners have constructed an ad-hoc arrangement of slope stabilisation measures along the New Swanage section of coast (north of Shore Road) to address ongoing coastal slope instability issues. The most recent intervention is the slope stabilisation scheme constructed by the owners of the Pines Hotel in between 2015 and 2017, following emergency slope stabilisation works in 2013 (Section 3.1.4 provides further details).

Section 3.1 and Appendix D provide further details on the history of the coastal defences at Swanage along the BMP frontage.

Figure 1-5 Photo showing the older timber groynes along the Shore Road part of the BMP frontage, prior to construction of additional timber groynes northwards along the New Swanage frontage. Date thought to be around 1949. Photo from Channel Coastal Observatory. Owned by Dorset County Museum. Copyright Dorset Natural History and Archaeological Society.

1.3.4 Current defence condition

An assessment of the condition of the timber groynes and seawalls along the BMP frontage was undertaken in 2019.

The timber groynes were typically noted to be in a **very good** condition. Minor algae growth/ green staining was noted sporadically throughout, with isolated areas of seaweed growth on the timber and minor gaps (non-significant) between timber planks. Minor surface corrosion was observed to all groyne steel fixings; however, no significant failures were noted. It should be noted that the seaward ends of the groynes were not inspected in November 2019 due to tidal constraints. **Future inspections should be planned to occur at spring low-tides in order to inspect these sections of the timber groynes (see also Section 4.2)**.

The seawall is observed to have changes in construction form throughout the length of the Swanage Beach. Despite the different seawall forms, the sea wall was typically noted in a **good** condition. Isolated mortar loss was noted sporadically throughout.

Further details are provided in Section 3.2 and Appendix I.

1.3.5 Amenity value

The Dorset coast is a popular tourist destination and as such the local economy is heavily dependent on this source of revenue. Swanage itself was a booming holiday resort in 1880's when the railway line was first opened. Today Swanage is a small residential tourist town, with a range of shopping and leisure facilities. The town promenade is lined with tourist

facilities and attractions such as cafes, shops and arcades. Swanage pier, which dates from 1895 has been restored in recent years and includes many facilities such as visitor centres, shop, toilets, boat trips and angling.

Walking, horse riding and seaweed collecting are popular activities, and Swanage is very popular with Geology students. The Purbeck cycleway also provides a network of cycle routes through the County, one of which follows the main road from South Haven Point to Studland.

1.3.5.1 Water-based recreation

Swimming occurs throughout most of the bay, largely associated with the main beach. In some places zonation of the beach exists to prevent conflict with other use groups. The bay is also a popular site for diving, especially for beginners. Visiting divers and more experienced local divers also frequent the waters here.

Other water-based activities include angling by boat, and from shore, jet skiing, water skiing, and sailing. Swanage Sailing Club is situated on the seafront, at the south side of the bay before the pier. Hire facilities are available at Swanage for a variety of water-based equipment such as sea canoes, dinghies, wind surfers and jet skis. The town also has a sea rowing club, and the Club boats are used every day in the bay in the summer (https://www.gigrower.co.uk/swanage-sea/; date accessed: 3rd March 2020).

1.3.5.2 Access to the beach and coastal areas

To the south of Handfast Point, access is restricted by Ballard Cliff, which extends to the north of Swanage. There is a footpath at Shep's Hollow, near Whitecliff farm and parking/pedestrian access continues at Swanage where the promenade facilitates easy access to the sea front. There is also slipway access by the Ulwell stream, however this is not for public use. There is a narrow slipway at the Parade/The Mowlem, together with a main slipway off the High Street. At Swanage Pier Car Park there is also access to the shingle beach, via the sailing club. To the south of Swanage, access is restricted by the cliffs that extend to Durlston Head. Further information on accommodation, tourism and local economy, and special events can be found in the Final Environmental Statement for the 2005/6 Swanage Beach Recharge Scheme (Halcrow, 2005c).

1.3.5.3 Blue Flag Beach

The Blue Flag is an eco-label awarded to more than 4500 beaches, marinas and boats in 47 countries. The Blue Flag is awarded annually and is only valid for one year. Swanage Central Beach has Blue Flag status for 2020 and has held it since 2001.

Further information on the Blue Flag Criteria can be found here: http://www.theseasideawards.org/blueflagawardcriteria/2128; date accessed: 3rd March 2020).

1.3.5.4 Seaside Award

The Seaside Award is presented to the best beaches in England and Swanage Central Beach has had this award since 2011 also. Seaside Award criteria can be found here: http://www.theseasideawards.org/seasideawardcriteria/2130; date accessed: 3rd March 2020).

1.3.6 Land ownership

Land ownership along the BMP frontage, particularly north of the Ulwell Stream, is complicated.

Dorset Coast Forum (2014) states that *"the Crown Estate owns the seabed and foreshore up to the Mean Low Water mark. Swanage Town Council owns the beach between Mean Low and Mean High Water marks. The beach above the Mean High Water mark is privately owned by a number of different owners. Cliff top properties will continue to own their original land boundary and this does not move back with erosion. Technically this would mean if some land from an owner's original cliff top boundary has been lost due to coastal erosion (e.g. now forms part of the cliff face or beach below), it is still owned by the cliff top property owner.*

Due to the complexity of landownership, The Land Registry records should be consulted at the time any beach management activities are being planned / implemented to ensure the most recent information is being referred to in terms of who the current landowners are.

The Land Registry holds ownership details of those pieces of land that have been registered. However, because there was no legal obligation to register land before 1984/5 the records are unlikely to be complete. Further information is available from the Land Registry via their website www.landregistry.gov.uk/home or by contacting the local office at Melcombe Court, 1 Cumberland Drive, Weymouth, Dorset DT4 9TT.

1.3.7 Highways, services and utilities

Shore Road runs parallel to the BMP frontage between the Mowlem and Ulwell Stream, before it turns inland and rises to run landward of cliff top properties between the Ulwell Stream and Shep's Hollow.

Various utilities and services run beneath Shore Road in this southern part of the BMP frontage, most notably sewer network infrastructure (the protection of which formed a key part of the economic case for the 2005/6 beach recharge scheme; see Appendix A). Wessex Water operates the Ulwell public surface water sewer outfall, which is shared with a storm sewage outfall associated with the Shore Road attenuation tank and pumping station. The main sewage treatment plant and associated outfalls are, however, outside of the BMP area and are adjacent to the pier in the southern part of Swanage Bay. Swanage is served by a combined surface water and foul water sewerage system that discharges through an outfall 170m east of Peveril Point. This discharge is designed to protect bathing water quality.

1.4 Issues

1.4.1 Flood and coastal erosion risk management

As described in Section 1.3.2, the defences along the BMP frontage primarily protect against the risk of coastal erosion and land-sliding. There is little or no risk of coastal flooding along most of the BMP frontage, except for some risk from wave overtopping during certain storm events at the southern end of the BMP area (see Figure 1-6).

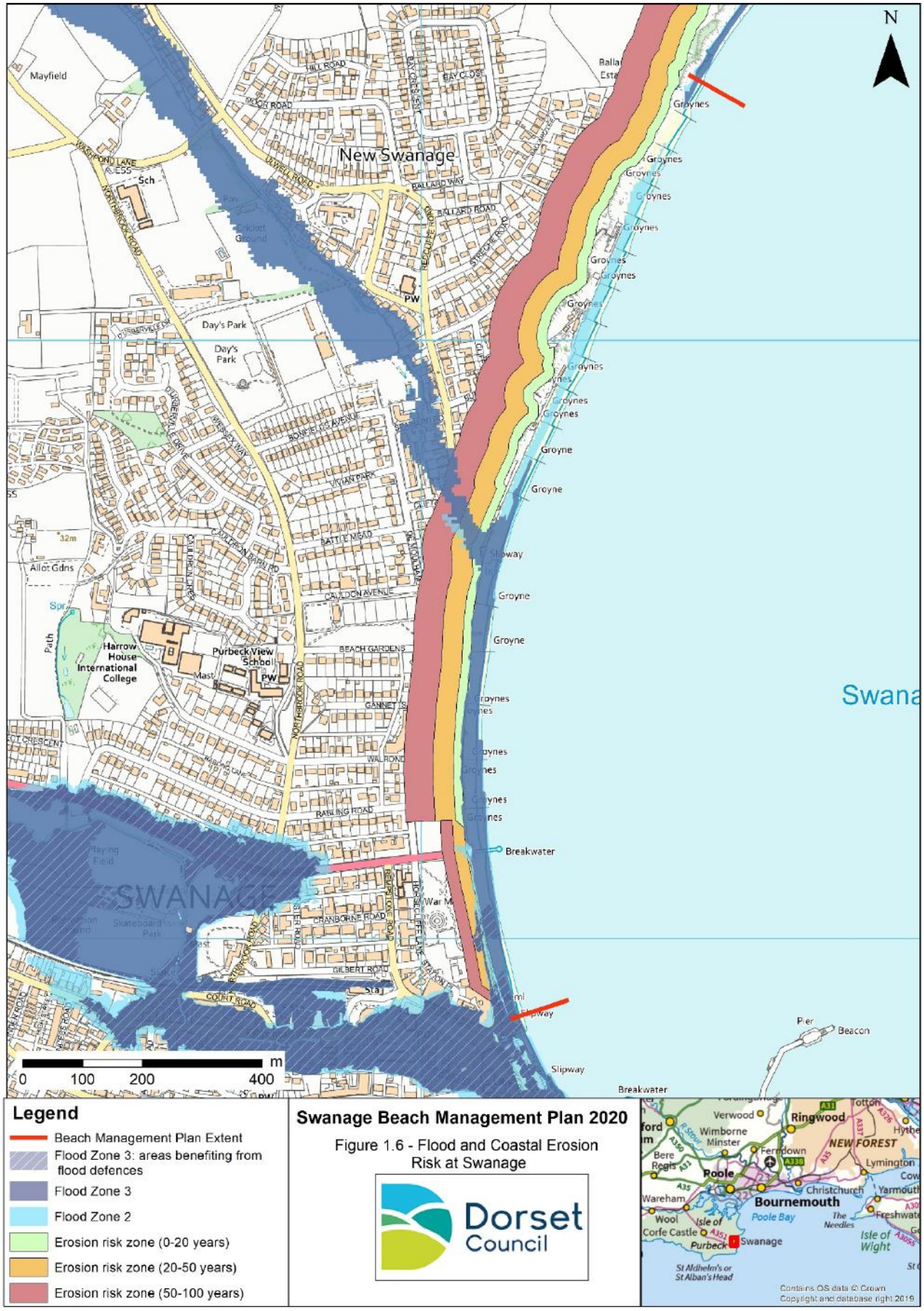


Figure 1-6 Flood and coastal erosion risk at Swanage.

The 2005/6 scheme constructed 18 new timber groynes and placed recharged beach material along the frontage to improve the level of protection against coastal erosion risk. The business case for the 2005/6 scheme was based on preventing coastal erosion to 84 residential properties and 15 commercial properties, as well as cost of closing and diverting roads / utilities, and avoiding loss of amenity value of the Swanage seafront. Appendix A provides further details.

Ultimately the seawall will continue to provide defence against coastal erosion and landslide risk. However, the concern is how long it will be sustainable to continue to protect the seawall along the BMP frontage through beach recycling and further beach replenishment, or if an alternative defence option may be needed in place of a beach (e.g. rock armour). The aim of this BMP is to identify how the beach can be managed in the immediate future to continue to protect the seawall that runs along the majority of the frontage, and it is to this end that the preferred option for achieving this described in Section 1.2.1 has been determined. Any decision to provide an alternative defence in place of a beach will be taken through future study and informed by monitoring data collected as part of the monitoring regime set out in Section 4 of this BMP, and should re-consider (as a minimum) the long-list of options provided in Appendix B.

Maintaining a suitably healthy beach level is required at Swanage in order to ensure the risk to these assets upon which the 2005/6 scheme was based continues to be managed appropriately. In this regard, the beach serves the following functions:

1. **Structural failure risk**: The beach provides a protective base to the toe of sea wall structures, hence preventing failure caused by undermining including the process known as ‘draw down’ during storms. A lack of beach support can lead to sliding or overturning of the gravity-based walls or rotation of piled structures – progressing to subsequent collapse. This creates both (i) a hazard to the public; and (ii) an FCERM related risk with a reduction in effective crest height that could lead to eventual breach of the sea wall and subsequent erosion of the hinterland.
2. **Cliff stability**: The presence of a sizeable beach reduces erosion of the material from the foot of a coastal cliff – which will otherwise progress to steepening of the cliff and eventually landslide collapse of the cliff top and a consequent reduction in the cliff slope. This is due to attenuating wave energy prior to reaching the cliff base and also providing toe weight that can hold the base of the cliff in place.
3. **Flood risk**: In front of the sea wall, the beach will attenuate wave energy and hence overtopping onto the land behind provided that beach levels are sufficiently high enough. If beach levels lower, waves can directly break against the seawall which results in higher amounts of water overtopping the seawall.
4. **Amenity**: In recent years the beach has been regarded as an amenity asset with its “gently shelving, golden sandy beach”, which has achieved the blue flag award for 19 consecutive years (Swanage.gov, 2019), making it an asset to maintain and protect in terms of safety (i.e. drop from sea wall to the beach, or stability of structures) and also in basic terms of width and height so people can occupy it.

The design specification of the beach for this BMP is driven primarily upon managing the risk from the first point above (structural protection and draw down), and the economic case for the 2005/6 scheme is based largely on preventing sea wall failure by undermining rather than overtopping, whilst also acknowledging the amenity value of the beach.

The BMP scheme was implemented in 2005/6 across a 1.3km long area. This included placement of between 90,000m^3 to 130,000m^3 of beach sediment along the shoreline source from the Swash Channel located at the Poole Harbour approaches (see Section 3.1.1). There is some uncertainty about the exact volume placed in 2005/6 as both 90,000m^3 and 130,000m^3 are stated in the various scheme reports available. This could indicate some uncertainty in the original volume assessment methodology, and/or placement of a large portion of fine material which washed out rapidly before post-placement surveys were completed (see also Section 1.4.4).

The 2005 version of this BMP (Halcrow, 2005a) anticipated that there would be a need for further beach recharge of about 40,000m^3 every 20 years – so in late 2025. Beach volumes analysis undertaken as part of the 2020 BMP update has calculated that given the trend in beach volume loss since 2005/6, that beach volume that is required to provide the minimum design 1 in 300 year standard of protection at Swanage is likely to be lost between the years 2023 to 2025. Therefore, **beach recharge is needed between 2023 and 2025**; so in line with the predictions made in 2005. Delay for replenishment beyond 2025 should be avoided because once the minimum design levels are reached, there will be an increased risk of a single storm event causing beach lowering of up to about 1m, causing the action and/or emergency trigger levels to be reached. Sections 2.6.3, 2.6.4 and 3.3 provide further details.

In addition to the beach recharge, 18 timber groynes between the Outfall Jetty and Pines Hotel were also constructed as part the 2005/6 scheme (replacing the previous groyne field). These groynes are in very good condition and will not need to be replaced as frequently as the 35 years predicted in the 2005 scheme design assumptions (Halcrow, 2006). Sections 3.1.2 and 3.2 provide further details.

1.4.1.1 Future beach recharge requirements

As noted above, the next beach recharge is needed between 2023 and 2025 and should be placed along the entire BMP frontage (see Section 1.2.1). **In order to deliver this next beach recharge, an Outline Business Case (OBC) will need to be developed and approved in the coming years**. The options appraisal completed as part of developing this BMP (refer to Section 1.2.1 / Appendix B) has identified the need to consider a number of technical aspects in further detail, as follows:

- Confirm the source of future beach recharge, with a preference to securing future dredge material from Poole Harbour (refer also to Section 1.2.1).
- Seek to optimise the frequency of future beach recharge (from the assumed every 7 years used in the options appraisal), taking into account both the quantities of sediment needed over different time-scales, and the volume of sediment of required sediment grading available from different sources to meet this need.
- Further assess how to best reduce the risk of seawall undermining in areas where the seawall toe is about 0mOD (see Section 3.1.3), through use of either rip-rap buried beneath the beach or seawall underpinning works.
- Further assess the need for an additional control structure(s) to support retention of beach levels along the section from The Mowlem to the Banjo Pier.

In addition to considering these technical matters, development of the OBC will also need to address funding and environmental issues set out in Sections 1.4.1.2 and 1.4.2 respectively.

1.4.1.2 Funding for future FCERM activities

Funding for flood and coastal erosion risk management can be achieved via a number of sources, some examples are provided below:

- Environment Agency via FCERM-GiA – whereby funding must be used to provide measures that protect against flood and erosion damages and realise the 'benefits'. Any business case submitted to the Environment Agency must demonstrate 'confidently' that the problem of flooding/erosion would be 'solved' and not need further protecting for the duration of the 'benefits' claimed.
- Environment Agency funding streams (as identified in Operational instruction 492_09, Environment Agency, 2017), including:
    - Capital budgets – allocated to the construction, provision, purchase and replacement of assets owned and managed by the Environment Agency. This is expenditure that leads to the creation of tangible and intangible assets which are included on the Environment Agency asset register. Capital assets must have a value greater than the £5k.
    - Capital Works Expensed in a Year (CWEiY) – this is budget allocated to works on assets that are not included on the Environment Agency asset register and includes works to replace an existing asset or structure / significantly improve the useful life of the existing asset or structure beyond its original design. CWEIY is treated by Defra as part of the Grant in Aid capital allocation.
    - Revenue Budgets – allocated as operating expenditure. This includes the maintenance of existing structures that are not below target or useable condition; or capital works valued to be less than £5k.
- Directly via the assets' owner / responsible authority, such as Dorset Council via local levy.
- Third party funding, such as utilities companies, local landowners and residents.

When managing the coastline within the BMP area, there is a need to have a realistic view of what is possible with the funding that can be achieved. Previous studies have demonstrated that there is an economic case for continued investment in FCERM activities at Swanage, including along the BMP area. The most recent assessment was for the FCERM Strategy (see Section 1.7.2 / Appendix A). This FCERM Strategy economic case has been further reviewed as part of the review of beach management options undertaken in producing the 2020 BMP update (see Section 1.2.1 / Appendix B); the key findings of which – in relation to the preferred option of continued beach recharge – are summarised in the following:

- Based on a high-level review of the costs, assuming material can be sourced from Poole Harbour Commissioner, the Present Value cost (PVc) over a 100 year appraisal period is calculated to be £6.8m. This is inclusive of 40% optimism bias.
- The economic Present Value benefits (PVb) as derived by the FCERM Strategy over 100 years are calculated to be £55.3m. This includes both erosion losses to property and infrastructure, as well as a significant amount derived from amenity benefits.
- With the inclusion of this significant amenity benefit, the scheme has a healthy benefit:cost ratio (BCR). If the amenity benefit was to be reconsidered and potentially

reduced the BCR would correspondingly fall. However, it is likely that the BCR would remain greater than unity and therefore in economic terms would remain a candidate for investment. The financial case would require a much greater Partnership Funding (PF) contribution as a result.

- The impact of varying the amount of amenity benefit assumed on the amount of PF contribution required has been calculated and is as follows:
    - If using the full £55m PVb, and £6.8m PVc, this leads to a 53% Raw PF score. This equates to a PF contribution requirement of approximately £3.2m.
    - If the overall PVb is reduced to around £14m, coupled with the £6.8m PVc, this leads to a 17% Raw PF score. This equates to a PF contribution requirement of approximately £5.7m.

  From this, it can be seen that the selection of an appropriate value of amenity benefits is an important consideration in developing the OBC for the next beach recharge campaign between 2023 and 2025. As such, **at the commencement of the OBC development, clarity should be sought from the Environment Agency on the most appropriate valuation of amenity benefits to support the next scheme**, given that the FCERM Strategy Strategic Appraisal Report (StAR) was granted approval following technical assurance. In particular, confirmation that the Environment Agency are in agreement with the high valuation of beach amenity recreation benefit should be discussed. This will then allow discussions to commence with funding contributors to commence, such as Dorset Council, Swanage Town Council and the Wessex RFCC.

1.4.2 Environmental considerations

A range of environmental mitigation measures were identified as part of the 2005/6 Swanage Beach Recharge Scheme. These are provided in Appendix E and largely remain valid, so should be referred to when planning and implementing future beach management activities at Swanage along the BMP frontage.

Within these, a key environmental consideration will be the impact of beach management activities on internationally and nationally designated sites, and the need to avoid disturbance to notable and protected habitats and species. A Habitats Regulations Assessment will be required to assess the impacts of beach management activities on the integrity of the international conservation sites, particularly when undertaking future beach recharge campaigns.

The options appraisal (see Section 1.2.1 / Appendix B) identifies that **ecological surveying of the seabed in Swanage Bay should be undertaken to confirm the presence and distribution of key habitat and species that are protected by various marine SAC, SPA, WFD and MCZ designations covering the bay**. At the very least a single survey to provide a current baseline should be completed against which any potential impacts of future FCERM activities along the Swanage Bay shoreline – such as turbidity and/or sedimentation following beach recharge – may be measured (refer also to Appendix B); however repeat surveys over a year to capture any potential seasonal variation would be preferable. Subsequent surveys during and following beach recharge may also be required depending on any conditions placed on granting of a Marine Licence. **The exact scope of such survey work should be discussed and agreed with Natural England and the MMO at the start of the work to develop the OBC for the next beach recharge campaign**, to allow for any

data capture in the coming years to support the Marine Licence application (see also Section 1.6).

1.4.3 Public safety and amenity considerations

The following public safety and amenity considerations for when beach management activities are undertaken at Swanage have been identified:

- Access and disturbance to recreational users as the beach is used extensively for amenity purposes - all works will need to be programmed to minimise the impact on amenity users by avoiding the peak holiday season, where possible. Also, there is a need to ensure safe public access of any possible recycling/re-profiling/recharge works.
- Access and noise/visual disturbance to residents/local businesses.

In addition, during periods when beach levels are lowered along the frontage, the presence of the timber groynes makes access along the shoreline via the beach challenging and can pose a public safety risk where the public may become trapped in a groyne bay. Historically this has required some of the groyne planks at the landward ends of the groyne to be removed temporarily until beach levels recover. Section 5.1.3 provides further detail on the management response to be taken in future.

Furthermore, the November 2019 inspection (WSP, 2019b; see Appendix I) also identified a number of public health and safety issues along parts of the BMP frontage. With reference also to Figure 3-12 below, these issues are summarised as follows:

- **Seawall – Beach Zone 03:** Localised failure to the coping stone of the sea wall in front of steps onto the beach and localised spalling to the blocks on the steps present a trip hazard to members of the public.
- **Seawall – Beach Zone 06:** The support shim for the balcony outside the restaurant has slipped. This may pose a hazard and should be raised with the balcony owner.
- **Seawall – Beach Zone 09:** There is a localised failure to a secondary wall for a length of 8m. This involves a large horizontal crack running almost the entire length of the secondary wall in front of the hotel; the top half of the wall has started to slide forward and is also rotating. There is possibility of it collapsing onto the footpath (onto the seawall) which is used by pedestrians throughout the year and so presents a hazard to members of the public.
- **Seawall – Beach Zone 13:** Cliff slumping/ movement in this zone has caused a partial blockage across the walkway above the sea wall. Signage at this end of the beach are present to state that beach use is at users own risk. However, in any case it was evident during the 6th November 2019 inspection that members of the public would squeeze past the earth material blocking the path directly adjacent to the edge of the wall in preference of stepping down onto the beach (both of which would be hard/ unsafe, especially for the less mobile).

These issues should be addressed as part of routine maintenance works (see also Section 5.1.2).

1.4.4 Uncertainties about coastal processes

The detailed review of coastal processes provided in Appendix F and summarised in Section 2, generally provides a good understanding of the beach at Swanage that is subject of this BMP in the wider context of Swanage Bay. However, there remain some uncertainties as follows:

- As noted in Section 1.4.1, there is some uncertainty in the capture of the full 2005/6 replenished volume (stated as being between 90,000m^3 to 130,000m^3) in the monitoring data, indicating some uncertainty in the original volume assessment or placement of a large portion of fine material which washed out rapidly before post-placement surveys were completed (see also Section 2.6.2). **Detailed survey immediately prior to, during and after the placement of sediment along the BMP frontage as part of future beach recharge campaigns should be undertaken** in an effort to provide greater confidence in the 'as-placed' volumes stated in the future (see Section 4.1.3).

- To improve understanding of sediment transport pathways and rates in nearshore and offshore zones of Swanage Bay and the surrounding area, and so reduce present uncertainties, the SCOPAC Sediment Transport Study (New Forest District Council, 2017) recommends **undertaking a primary survey of seabed bedforms, preferably repeated throughout at least one year, to gain some inference of sediment transfer paths and directions. This should be supported by, as a minimum, a grab sample survey of Swanage Bay** which would provide at least a provisional answer to the deposited location of the fine texture sediment. It would also be worthwhile to investigate if any sediment grades are able to bypass Durlston Head, thereby confirming whether, or not, it is a fixed and absolute boundary dividing the south and east Purbeck transport sub-cells.

- In the southernmost section of the BMP frontage, between the Mowlem and Banjo Pier, recent modelling for the Environment Agency (JBA, 2020a; see Section 3.2.3), indicates that it is not possible to achieve a recharged beach profile in this area that would reduce the rate of wave overtopping to a safe level for unaware pedestrians. There is also uncertainty about how stable a beach towards the Mowlem end of this section is, as the monitoring data shows a trend for accumulation in this embayment towards the Banjo Pier. As such, although beach recharge supported by either occasional beach recycling or introduction of measures to protect the seawall toe within this section, is the preferred approach to take for the immediate future, **further review should be undertaken when this BMP is next reviewed in 5-years' time to determine if there is a need for additional control structures to help retain beach sediment towards the Mowlem; or accepting that this cannot be achieved and instead using rock-armour in this section to provide protection to the seawall and acts as a transition to beach area towards the Banjo Pier**.

- The analysis of beach volume changes does not take into account of the gradual loss due to removal of wind-blown sand that encroaches onto the promenade/seawall and road behind the beach (most typically under more easterly wind patterns – see Figure 1.7) and is then removed from the system as waste as it cannot be replaced on the beach having reached the highway. There are no records of the amount of sand removed from the system as waste to indicate volumes and frequency of removal.



Table 1-7 Photos of wind-blown sand on the highway along Shore Road in March 2020 (photos courtesy of Dave Picksley, Environment Agency).

The monitoring programme set out in Section 4 includes measures that aim to improve understanding of these uncertainties.

1.5 Responsibilities for management

Responsibility for the management and operation of activities along the BMP frontage varies depending upon the activity. Table 1-1 summarise the roles and responsibilities.

Table 1-1 Assigned responsibilities for Swanage beach management operations.

Management Operation		Assigned Responsibility
1a	Operations to maintain beach profile for FCERM function	Dorset Council
1b	Operations to maintain beach profile for amenity	Swanage Town Council
2a	Cleaning/clearance of beach, steps, access ramps, etc. for amenity	Swanage Town Council
2b	Cleaning/clearance of promenade for amenity	Dorset Council / Dorset Waste Partnership

Management Operation		Assigned Responsibility
3	All maintenance of Outfall Jetty (Banjo Pier) and Ulwell Stream Outfall	Environment Agency
4	Structural maintenance of timber groynes	Dorset Council
5	All structural maintenance of promenade, seawall, beach access structures, and highway/surface water drainage assets	Dorset Council
6	Maintenance of slope stabilisation measures along New Swanage section of the BMP frontage	Private Landowners *(refer to Sections 1.3.6 and 3.1.4)*
7	Monitoring of beach movement (and other coastal processes)	Channel Coastal Observatory
8a	Maintenance of seats/shelters	Swanage Town Council
8b	Maintenance of litter bins	Dorset Council / Dorset Waste Partnership
9	Flood warning and response actions	Environment Agency / Swanage Town Council / Dorset Council
10	Emergency Planning	Dorset Council
11	Monitoring and management of amenity / environmental aspects of the beach area and promenade	Dorset Council / Swanage Town Council / Environment Agency / Wessex Water
12	Cleaning/clearance of beach in response to pollution incidents.	Dorset Council
13	Maintenance of footpath and cycleways including signs for designated public footpaths and rights of way.	Dorset Council

Actual ownership of the assigned responsibility for each management operation identified in Table 1-1 is in some cases held by different departments within the identified organisation. Therefore, in order to support Table 1-1 and to provide clarity on who should be contacted for each item, Appendix G provides more specific contact details for those responsible for each management operation. Appendix G also contains contact details for some of the other key stakeholders who do not have a direct management role at Swanage but who are likely to be key contacts for future beach management activities.

1.6 Licences, approvals and consents

There are no current activities licensed for Flood and Coastal Erosion Risk Management (FCERM) purposes along the BMP frontage. However, going forward, in order to undertake any future capital scheme along the frontage (as described in Section 5.2.2), a range of licences, approvals and consents will be required, including:

- Marine Licence under the Marine and Coastal Access Act 2011, including Water Framework Directive Assessment
- Habitats Regulations Assessment Screening exercise

- SSSI Assent from Natural England
- Planning Application under the Town and Country Planning Act 1990, including Environmental Impact Assessment Screening.
- Environmental Permit from the Environment Agency
- Protected Species Licences.

The following sections summarise the required consents and the processes to obtaining them.

Discussions should be held with the relevant consenting organisations in a timely manner to ensure that all requirements of licence/consent application are confirmed and addressed in order to minimise the risk of delays to implement the works. These discussions should also assess the applicability of progressing a licence application through the streamlined process defined in the Coastal Concordat for England first published in November 2013 and revised in December 2019 (Defra, 2019).

1.6.1 Marine Licence

No Marine Licence is currently held for beach management activities along the frontage, as the current activities of occasional beach recycling and re-profiling are exempt from requiring such a licence, as the Marine Management Organisation (MMO) guidance is that beach recycling and re-profiling activities within the same sediment cell are exempt from the need for a Marine Licence. However, there is still a need to notify the MMO of a licence exempt activity notified via the MMO website (see https://www.gov.uk/guidance/make-a-marine-licence-application). Should the MMO not agree with the exemption they will notify the applicant (usually within a week). It is recommended that initial consultation is undertaken with the MMO as soon as possible to notify them of any proposed beach recycling and re-profiling works along the BMP frontage to determine whether or not a Marine Licence is required, when the need arises. The notification should include details of the period over which it will take place, the location of movement along the beach and cross the beach, whether movement will be above/below MHWS, and likely volumes.

When beach recharge is required, and/or if future construction works are proposed to occur below the MHWS mark (e.g. to replace timber groynes), then this will require an application for a marine licence from the MMO. At present, no Marine Licence is held to facilitate any potential future beach management capital works.

The MMO must be engaged when planning any future capital works along the frontage. The time-scale involved to obtain a Marine Licence is typically 14 weeks, so it is recommended that a Marine Licence from the MMO is obtained in good time to enable beach management works to be implemented when it becomes required, rather than having a 14 week delay at a time when such a delay may increase risk of failure of the seawall, etc. It should be noted, that any Marine Licence application may need to be supported by a suite of supporting environmental evidence and assessments including, but not limited to, intertidal and marine ecological studies, HRA Screening, EIA, WFD Assessments, all of which would need to be completed prior to submitting a Marine Licence Application (see also Section 1.4.2). Hence, it would be prudent to commence discussions with MMO (and other regulatory bodies) relating to any planned works at least 12-18 months prior to any planned start on site date.

Any Marine Licence should be kept up to date so there is no lapse. It may be pertinent to seek a Marine Licence in the immediate future that would facilitate undertaking emergency works prior to the planned works that are to be developed in further detail.

As part of the process of obtaining a Marine Licence or Licences for undertaking beach recharge or other capital works, consideration of the Marine Work Regulations 2017 (as amended) is required. Through an Environmental Impact Assessment (EIA) screening exercise in consultation with the Marine Management Organisation, the need to produce an EIA will be determined.

A Water Framework Directive Assessment may also be required to support the Marine Licence application. The scope of any such assessment would require consultation with the Environment Agency.

Further studies or assessments may need to be completed in order to allow a Marine Licence to be granted by the MMO. Examples of such studies include ecological assessments, noise assessments, coastal impact assessments, water and sediment quality assessments and other studies. The full list of the MMO's requirements would need to be scoped with MMO and their advisors through consultation at the start of the development of the OBC (see Section 1.4.1.1).

1.6.2 Habitats Regulations Assessment Screening

Under the Conservation of Habitats and Species Regulations 2017, (as amended) (the 'Habitats Regulations') 'Competent Authorities' must assess Plans and Projects for their potential to cause Likely Significant Effects (LSE) on European designated sites. Where a Plan or Project may lead to LSE, they must be subject to a Habitats Regulations Assessment (HRA) to determine whether adverse effects to any European Sites may result. Any Plan or Project that would lead to adverse effects on the integrity of European Site(s) cannot be permitted without meeting strict additional tests.

The requirements of the Habitats Regulations are usually met by undertaking an initial two-stage approach; Stage 1 Screening of potential LSEs on the qualifying features and conservation objectives of European sites. Subsequently, depending on the results of the Screening assessment, a Stage 2 Appropriate Assessment on the adverse effects on the integrity of identified European sites resulting from the Proposed Scheme. All Stage 1 assessments are undertaken in the absence of proposed mitigation measures intended or incidentally reducing or avoiding negative impacts of a project on European sites.

Consideration of areas designated under the Conservation of Habitats and Species Regulation 2010 directly within or within close proximity to the study area is required for any proposed works to coastal defence assets or recycling works area. In this case, the key features of concern will be the Isle of Portland to Studland Cliffs SAC, the Studland to Portland SAC, the Purbeck Coast MCZ, and the Solent and Dorset Coast SPA (see Section 2.7). This will be undertaken initially through a Habitat Regulation Assessment (Stage 1) Screening exercise, in which the potential for likely significant effects to the designated features of the SAC will be established in consultation with the Competent Authority and Statutory Nature Conservation bodies. The Competent Authority for this would be the MMO. Statutory Nature Conservation bodies would include Natural England.

Environmental surveys are likely to be required to inform the HRA process (see also Section 1.4.2). Given the features of the relevant designated sites, it is likely that such surveys would include breeding bird studies, benthic and epibenthic ecological studies and coastal vegetation studies. The requirement for survey work to inform any HRA may impact upon the works programme if not given early and adequate consideration, not least from the perspective of the season restrictions associated with any survey work. The full scope of any fieldwork would need to be confirmed through consultation with Natural England and MMO.

Should this screening exercise identify any likely significant effects (in the absence of mitigation measures), then the next stage of HRA assessment (an “Appropriate Assessment”) will be required.

1.6.3 SSSI Assent

The northern end of Swanage Bay, including the northern part of the area where the beach is actively managed, is within the designated extent of the Purbeck Ridge (East) SSSI. As a public body, Dorset Council have an obligation under Section 28H(1) of the Wildlife and Countryside Act 1981 (as amended and inserted by section 75 and Schedule 9 of the Countryside and Rights of Way Act 2000) to notify Natural England of any operations taking place within an SSSI. A SSSI Assent for works to take place within the existing SSSI will be required; this includes both capital works and maintenance works (e.g. beach recycling), although the latter is unlikely to occur in the area of the SSSI.

The SSSI Assent has a 28 day approval process and permission will need to be in place ahead of the works starting. Any assent application may need to be informed by the outputs of ecological surveys focussing on habitats and vegetation and invertebrates. The full scope of any fieldwork would need to be confirmed through consultation with Natural England.

1.6.4 Planning Application

Current beach management activities do not require any planning consent. As such there is no current planning consent in place that needs to be referred to.

Future construction works / any capital scheme along the BMP frontage involving works to the seawalls, timber groynes and beach recharge, will require some form of planning consent from Dorset Council. It is recommended that the local planning officer be consulted at the time when the works / a capital scheme is being developed to determine the most appropriate route for planning consent. This is also the case for any slope stabilisation works along the New Swanage frontage that the private landowners may wish to undertake.

Above the MHWS mark, the planning authority would act as the Competent Authority and planning permission would be sought. An application under these circumstances would also require consideration under the Town and County Planning (Environmental Impact Assessment) regulations 2011. In this regard, Dorset Council would likely act as the Competent Authority. To this end, an EIA Screening should be undertaken for any proposed works as a minimum, with Scoping and a full EIA undertaken where appropriate; this screening should be undertaken alongside that for the Marine Licence EIA Screening (refer also to Section 1.6.1).

The Local Planning Authority may also input into discussions relating to any HRA works for terrestrial sites and should, therefore, be consulted in relation to these matters (refer to Section 1.6.2).

1.6.5 Environmental Permit from the Environment Agency

The preferred option may necessitate the undertaking of works within area of designated Flood Zone (refer to Figure 1-6). As a result, an Environmental Permit may be required from the Environment Agency. Flood risk modelling works may need to be undertaken in order to underpin the application for this permit. Environmental Permit applications are subject to a two-month determination period. In the event that a Marine Licence is required for the project, an Environmental Permit may not be necessary. The works proposed as part of the final option should be reviewed against the list of exclusions and exemptions that can apply to the Environmental Permitting process in order to ascertain whether such exclusions and exemptions are valid.

1.6.6 Protected Species Licences

Desk and field-based studies may need to be undertaken in order to identify whether protected species are found in the proposed project area (refer also to Section 1.4.2). In the event that such species occur, and that they have the potential to be impacted by the scheme, consultation should be undertaken with Natural England in order to secure any protected species licences necessary for the scheme.

1.7 Linkages to other appropriate documents

1.7.1 Shoreline Management Plan policy

The current Shoreline Management Plan (SMP) covering the Swanage frontage was adopted in 2011 (Royal Haskoning, 2011). Table 1-2 summarises the SMP policies that apply to Swanage Bay, though only policy units SWA.N.1 and SWA.N.2 cover the BMP area from The Mowlem to Shep's Hollow (see also Figure 1-1 above).

Table 1-2 SMP policies adopted 2011 (from Royal Haskoning, 2011).

Policy Unit	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
SWA.M.1 Handfast Point to Ballard Estate	No Active Intervention.	No Active Intervention.	No Active Intervention.
SWA.N.1 New Swanage	Hold the Line. Maintain all existing defences.	Hold the Line. Maintain all existing defences but develop a scheme for transitional management of this northern frontage.	Managed Realignment. Implement transitional approach to provide suitable transition to NAI in policy unit SWA.M.1.
SWA.N.2 Promenade	Hold the Line. Maintain all existing defences.	Hold the Line. Maintain all existing defences.	Hold the Line. Maintain all existing defences.
SWA.N.3 Town Centre	Hold the Line. Maintain all existing defences.	Hold the Line. Maintain all existing defences.	Hold the Line. Potential need to raise defences.

Policy Unit	Short Term (to 2025)	Medium Term (to 2055)	Long Term (to 2105)
SWA.N.4 Town Centre to Peveril Point	Hold the Line. Maintain all existing defences.	Hold the Line. Maintain all existing defences.	Hold the Line. Maintain all existing defences. Consider possible benefits in reinforcing the local headlands between the town and Peveril Point.

The SMP policy for the developed area of Swanage town intends to maintain and improve defences to reduce the risk of coastal flooding to the town centre area and coastal erosion risk along the promenade and New Swanage sections. This will protect residential and commercial properties, as well as highway and other infrastructure that serves a wider area of the town. Within this context, it is the intent of the SMP policy to also manage the transition at the northern end from New Swanage (north of Tranville Ledges) towards Ballard Down in the longer-term, where the policy is for no active intervention to allow continued erosion of the undefended cliffs. **A coastal adaptation plan should therefore be developed with the local community in the near future to manage future development in this area of Swanage Bay in the context of this policy transition**. This should be taken forwards as part of or following definition of Coastal Change Management Areas as part of the Local Plan (see Section 1.7.3) and could form part of the work of developing a cliff management strategy for this area (see Section 3.1.4).

1.7.2 Poole Bay, Poole Harbour & Wareham FCERM Strategy (2014)

The Poole Bay, Poole Harbour and Wareham FCERM Strategy (Environment Agency, 2014a) re-enforced the SMP policy for Swanage Bay defined in 2011 (see Section 1.7.1), concluding the preferred option for the area is to sustain defences along Swanage seafront over the next 100 years, with Do Nothing for the cliff section at North Swanage and The Pinnacles, and a short transition Managed Realignment section between. This sustain policy assumes:

- There will be no improvements to the Standard of Protection (SoP) above that provided by the 2005/6 coast protection scheme, which the 2005 Swanage Beach Management Plan (BMP) states was to provide a 1:300 year SoP over a 50 year scheme life comprised of timber groynes, beach recharge and seawall maintenance (refer also to Section 3.1 below).
- For the short-term (first 20 years to about 2033), there will be beach recycling and maintenance of the groynes and seawall.
- In medium-term (about 2033 to 2063), the short-term measures will continue and be supported by recharge in 2033 and top up recharge every 7 years thereafter (*NB: the 2005 BMP assumed recharge every 20 years only – see also Section 3.1.1 below)*.
- In the long-term (about 2063 to 2113), the medium-term measures will continue, but top up recharge frequency will increase to every 5 years with a 50% increase in recharge volume anticipated each time. In addition, the northern-most 630m of seawall along the Swanage frontage is expected to be replaced after about 75 years (i.e. about 2088).

The implementation of this option, and how it may change depending on the actual rate of climate change/sea level rise experienced in the future, is summarised in Figure 1-8. Should climate change/sea level rise occur at a faster rate (i.e. upper end scenarios) then this would result in the need to raise the seawall in order to achieve the sustain approach.

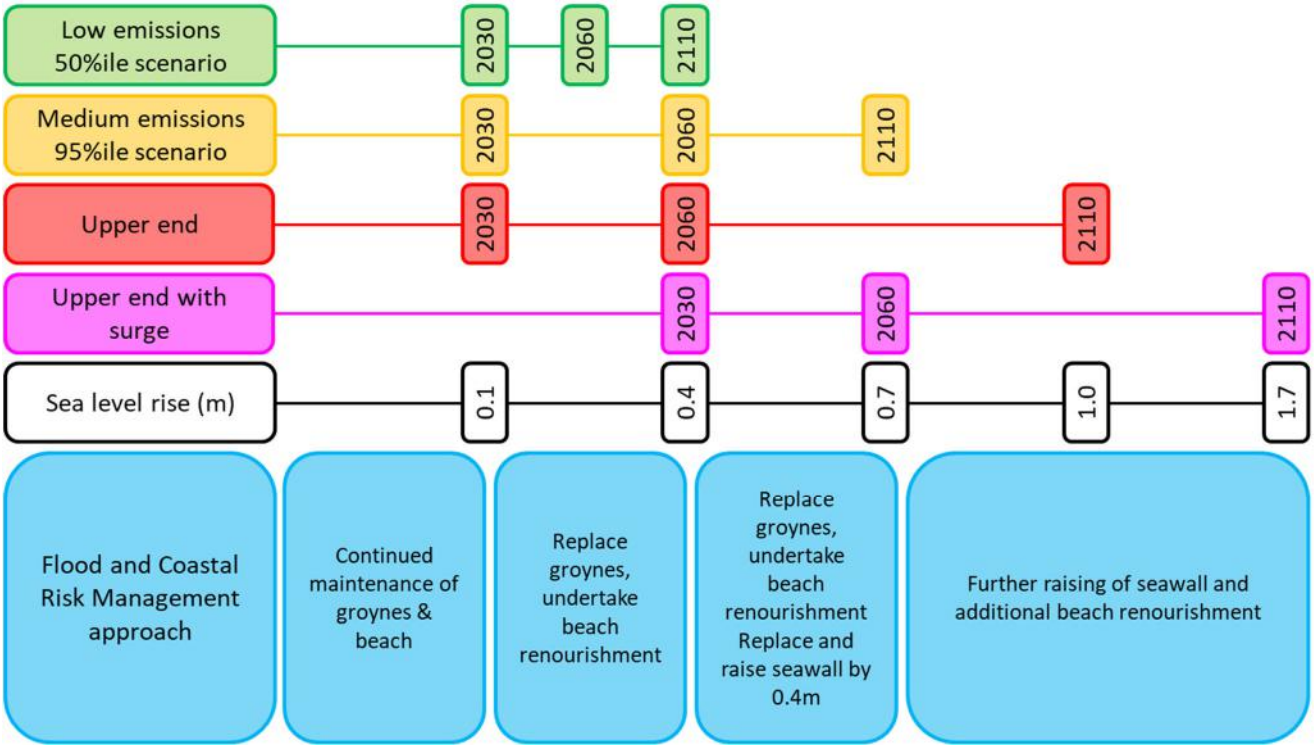


Figure 1-8 Climate change adaptive management for Swanage; NB: Medium emissions 95%ile scenario is core appraisal scenario (from Environment Agency, 2014a).

As indicated above, in implementing this preferred option, the strategy anticipates need for beach recharge to occur at some point in the future. However, the timing of the next beach recharge at Swanage is dependent on trigger levels from the on-going monitoring of beach profiles and losses, but estimated that this will not be required for at least 10 years. This could be re-considered (i.e. brought forward) if:

a) need arises based on newer data or assessments; or

b) opportunity arises before then to consider making beneficial use of dredging arisings from the Poole Harbour navigation channels, with significant cost savings relative to standard beach recharge rates.

The economic case for this sustain approach for Swanage, including both the erosion risk along the BMP area and the flood risk area to the south along the Swanage town centre frontage, gave a benefit:cost Ratio of 7.8; clearly demonstrating that there is an economic case to continue to invest in coastal flood and erosion risk management at Swanage, so long as the required levels of partnership funding contributions can be achieved (see Section 1.4.1.2). Further details on the economic case set out in the 2014 FCERM Strategy are summarised in Appendix A. This has been further developed in the options review undertaken as part of preparing the 2020 BMP update (refer to Section 1.2.1 and Appendix B).

1.7.3 Dorset Council Planning Policy

The following section summarises local planning policies that are relevant for coastal flood and erosion risk management activities defined in this BMP.

1.7.3.1 Adopted Purbeck Local Plan Part 1 (2012)

This Plan sets out the strategy for the delivery of development and supporting infrastructure in Purbeck for the period 2006-2027, in balance with the exceptional landscape and environmental setting. It is the culmination of seven years' preparation and engagement with the local community.

Relevant policies for this BMP aligned to the vision contained in the Local Plan are:

- Policy SE: South East Purbeck
- Policy BIO: Biodiversity & Geodiversity
- Policy CE: Coastal Erosion
- Policy LHH: Landscape, Historic Environment and Heritage.

1.7.3.2 Purbeck Local Plan Submission (2019)

The Purbeck Local Plan 2018-2034 Pre-Submission Draft is currently being reviewed. The Purbeck Local Plan identifies opportunities for achieving sustainable growth across the District and investment in infrastructure and community facilities. Together with the Swanage Local Plan, Minerals and Waste Local Plans jointly produced for Dorset and any adopted neighbourhood plans; these collectively form the development plan for the District.

Relevant policies for this BMP aligned to the vision contained in the draft Local Plan are:

- Policy E2: Historic environment
- Policy E4: Assessing flood risk
- Policy E6: Coastal change management areas (CCMAs)
- Policy E10: Biodiversity and geodiversity.

This Purbeck Local Plan is due to be adopted during 2020. Once adopted, it will inform the ongoing work to produce a new Dorset Local Plan. The programme for this aims to have the Dorset Local Plan adopted by mid-2023. Further details are available online at https://www.dorsetcouncil.gov.uk/planning-buildings-land/planning-policy/dorset-local-plan.aspx (date accessed: 3rd January 2020).

1.7.3.3 Swanage Local Plan (2017)

The Swanage Local Plan meets the relevant strategic requirements set out in Purbeck Local Plan 1 (PLP1) (see Section 1.7.3.1). Any development in Swanage, further to that identified in PLP1 and not provided through the Swanage Local Plan, will be considered as part of the review of PLP1 (see Section 1.7.3.2).

Relevant policies for this BMP aligned to the vision contained in the Local Plan are:

- Policy SS Swanage.

1.7.4 South West River Basin Management Plan (2015)

The South West River Basin Management Plan (Environment Agency, 2015) was prepared under the Water Framework Directive (WFD) as an update to the original programme produced in 2009 as part of a series of six-year planning cycles. It contains actions to improve the ecological status of water bodies in river basin catchments, including coastal waters from mean low water up to one nautical mile from shore. The BMP area lies within two WFD Water Bodies (one coastal, one river) and all BMP activities need to comply with the requirements of this plan in respect of these water bodies (see also Section 2.7.3.1).

This plan is due to be updated by December 2021 and this updated version should be referred to after this date. Further details are available online at https://www.gov.uk/government/collections/river-basin-management-plans-2015 (date accessed: 3rd March 2020).

1.7.5 Dorset Local Flood Risk Management Strategy (2014)

The Local Flood Risk Management Strategy (Dorset County Council, 2014) sets out the vision for managing local flood risk across the County, and how the Lead Local Flood Authority we will seek to work with communities and partner organisations. The vision is "*working together to manage local flood risk in Dorset so communities are resilient and prepared for flooding*". This vision will be met through the following objectives:

- Understand flood risk across Dorset
- Manage the likelihood and impacts of flooding
- Help Dorset's communities to manage their own flood risk
- Ensure flood risk is considered in local land development proposals
- Improve flood prediction, warning, response and flood recovery.

1.7.6 Frome and Piddle and Catchment Flood Management Plan (2012)

The Frome and Piddle Catchment Flood Management Plan was published by the Environment Agency in 2012 and assesses the inland flood risk for this area. This document highlights the need to ‘Review the maintenance regime’ and ‘flood risk management in and around Swanage to ensure it is appropriately targeted and revised as appropriate in order to prevent a future increase in flood risk in Swanage’, also acknowledging that flood risk due to river and tidally influenced flooding and surface water flooding is expected to increase in Swanage.

1.7.7 SAC Site Improvement Plans

Site Improvement Plans (SIPs) have been developed by Natural England for each Natura 2000 site in England as part of the Improvement Programme for England's Natura 2000 sites (IPENS). “Natura 2000 sites” is the combined term for sites designated as Special Areas of Conservation (SAC) and Special Protected Areas (SPA).

In the case of the Swanage BMP extent, there are two key SIPs covering features associated with:

- Isle of Portland to Studland Cliffs SAC (Natural England, 2014); and

- Studland to Portland SAC Site Improvement Plan (Natural England, 2015).

These SIPs provide a high level overview of the issues (both current and predicted) affecting the condition of the Natura 2000 features on the sites and outlines the priority measures required to improve the condition of the features. It does not cover issues where remedial actions are already in place or ongoing management activities which are required for maintenance.

Further details of these SIPs, and others in the South West region, can be found at: http://publications.naturalengland.org.uk/category/5755515191689216 (date accessed: 3rd March 2020).

1.7.8 Jurassic Coast: Dorset and East Devon Coast Word Heritage Site Management Plan 2014 – 2019

The current UNESCO Dorset and East Devon Coast World Heritage Site Management Plan (Jurassic Coast, 2014) defines a number of aims and objectives for the long-term sustainable management of the site. The aim is 'to protect the Site's Outstanding Universal Value (OUV) and setting'.

In line with this aim, the management plan sets out a range of policies covering all aspects of coastal management. The following policies are of particular relevance to the future management of the BMP area:

- Policy 1.1: Protect the OUV of the Site through prevention of developments that might impede natural processes, or obscure the exposed geology, as set out in the GCR / SSSI details, now and in the future.
- Policy 1.2: Where developments affecting the Site or setting do take place, avoid or at least mitigate negative impact on the natural processes of erosion and exposed geology.
- Policy 1.3: Oppose developments in the Site's setting that may warrant a future need for coastal defences, particularly in light of potential sea level rise and extreme weather events.
- Policy 1.4: Protect the landscape character, natural beauty and cultural heritage of the Site and setting from inappropriate development.
- Policy 1.5: Ensure that the 'South Devon and Dorset', and 'Two Bays' Shoreline Management Plans continue to take full account of the OUV of the Site and the specific geological and geomorphological features in the GCR sites when defining actions for coastal defences.
- Policy 2.14: Promote research that informs conservation and sustainable management of the Site and furthers the advancement of science that underpins its OUV.

This plan is in the process of being updated and will be published during 2020 as the Jurassic Coast Partnership Plan 2020-2025 (Jurassic Coast Trust, 2019).

1.7.9 Dorset Coast Strategy 2011 – 2021

The Dorset Coast Strategy (Dorset Coast Forum, 2011) is a high level non-statutory document that provides a framework for how members of the Dorset Coast Forum, of which

Dorset Council and the Environment Agency are members, can improve the planning and management of the Dorset Coast and inshore waters.

The goals of the strategy include establishing integrated coastal policy, identifying strategic opportunities for resource development, engaging and developing participation of a wide range of partners, and identifying solutions for sustainable coastal development, management and access.

These goals should be considered in all management decisions in this BMP area.

1.7.10 Dorset Area of Outstanding Natural Beauty (AONB) Management Plan 2019 – 2024

The Dorset AONB Management Plan (Dorset AONB Partnership, 2019) contains a policy framework based on three key areas of interaction with the AONB landscape, namely:

1. The working landscape, covering farming, forestry, fishing and conservation land management within the AONB.
2. Exploring, understanding and engaging, covering access, tourism, recreation and educational use of the AONB.
3. Planning and landscape quality, covering forward planning, development management and infrastructure.

Policies and objectives under these areas will need to be considered when planning and implementing future beach management activities at Swanage.

1.7.11 South Inshore and South Offshore Marine Plan (2018)

The South Inshore and South Offshore Marine Plan was published by the Marine Management Organisation (MMO) on 18th July 2018. Full copies are available online at https://www.gov.uk/government/publications/the-south-marine-plans-documents (date accessed: 3rd March 2020).

The BMP area is located within the South Inshore Marine Plan area. The Marine Plan is a statutory planning document used to guide licence and consent decisions within the marine environment up to the Mean High Water mark including beach management activities. The South Marine Plan will help ensure that the right activities happen in the right place and in the right way within the marine environment. It provides a framework that will shape and inform decisions over how the areas' waters are developed, protected and improved over the next 20 years. Particular policies to note in this regard are:

- Policy S-CO-1: Proposals will minimise their use of space and consider opportunities for co-existence with other activities.
- Policy S-INF-1: Appropriate land-based infrastructure which facilitates marine activity (and vice versa) should be supported.
- Policy S-AGG-4: Where proposals require marine aggregates as part of their construction, preference should be given to using marine aggregates sourced from the south marine plan areas. If this is not appropriate, proposals should state why.
- Policy S-TR-1: Proposals supporting, promoting or facilitating tourism and recreation activities, particularly where this creates additional utilisation of related facilities beyond typical usage patterns, should be supported.

- Policy S-TR-2: 2 Proposals that enhance or promote tourism and recreation activities will be supported. Proposals for development must demonstrate that they will, in order of preference: a) avoid, b) minimise, c) mitigate significant adverse impacts on tourism and recreation activities.
- Policy S-CC-2: Proposals should demonstrate for the lifetime of the proposal that: 1) they are resilient to the effects of climate change 2) they will not have a significant adverse impact upon climate change adaptation measures elsewhere. In respect of 2) proposals should demonstrate that they will, in order of preference: a) avoid, b) minimise, c) mitigate the significant adverse impacts upon these climate change adaptation measures.
- Policy S-CC-3: Proposals in the south marine plan area and adjacent marine plan areas that are likely to have a significant adverse impact on coastal change should not be supported.
- Policy S-ML-1: Public authorities should ensure adequate provision for and removal of beach and marine litter on amenity beaches.
- Policy S-DEF-1: Proposals in or affecting Ministry of Defence Areas should only be authorised with agreement from the Ministry of Defence.

The South Inshore and South Offshore Marine Plans are expected to be reviewed every six-years.

1.7.12 Dorset Coastal Pollution Clearance Plan (2010)

The Dorset Coastal Pollution Clearance Plan (Dorset County Council Emergency Planning Service, 2010) defines the details of the shoreline clean-up operational procedures to be followed in the event of a coastal/marine pollution incident from Oil, Inert, Hazardous and Noxious Substances (HNS). This includes any substance that is liable to create hazards to human health, harm to living resources and marine life, to damage amenities or to interfere with other legitimate uses of the coastline.

This plan is a joint emergency planning procedure developed by a range of partners, and details the procedures to be followed when a pollution incident occurs, including:

- Initial cascade procedures,
- Pollution officers, contacts and notification procedures,
- Action plans,
- Roles and responsibilities,
- Available resources,
- Method of clean-up, and
- Technical information.

1.7.13 Dorset Local Resilience Forum (LRF) Rockfall and Landslide Response Plan (2019)

The Dorset LRF Rockfall and Landslide Response Plan (May, 2019a) provides an update to the 2013 Dorset Coastal Rock Fall and Landslide Protocol (Dorset County Council

Emergency Planning Service, 2013). It aims to establish the Multi-Agency response to reduce the risk of accidents associated with landslides or rock falls along the Dorset coast.

It seeks to achieve this aim by:

- Defining the roles and actions of agencies involved in the prevention and management of rock fall/landslide incidents.
- Defining the roles and actions of agencies involved in the monitoring of existing rock falls/landslides and precautionary measures that can be taken to avoid potential incidents.
- Facilitating a co-ordinated and effective multi-agency response to such incidents.
- Defining the roles and responsibilities of agencies involved in the short, medium and long-term recovery phase and ensure that follow-up actions and an ‘exit strategy’ is carried out.

2 Supporting Information

This section of the BMP provides a summary of the physical setting of the BMP area along the defended central frontage of Swanage Bay. The aim of this summary is to provide an overview of the coastal processes affecting this frontage and the impacts of human intervention upon them, as well as details of the environmental features of the site that must be considered when undertaking beach management in this area. This includes the following information:

- Wave climate (typical waves, extreme waves).
- Water level climate (tidal information, extreme water levels).
- Joint probability extreme wave and water levels.
- Climate change.
- Sediment transport (sediments, shoreline movement, beach stability).
- Environmental characteristics.

2.1 Wave climate

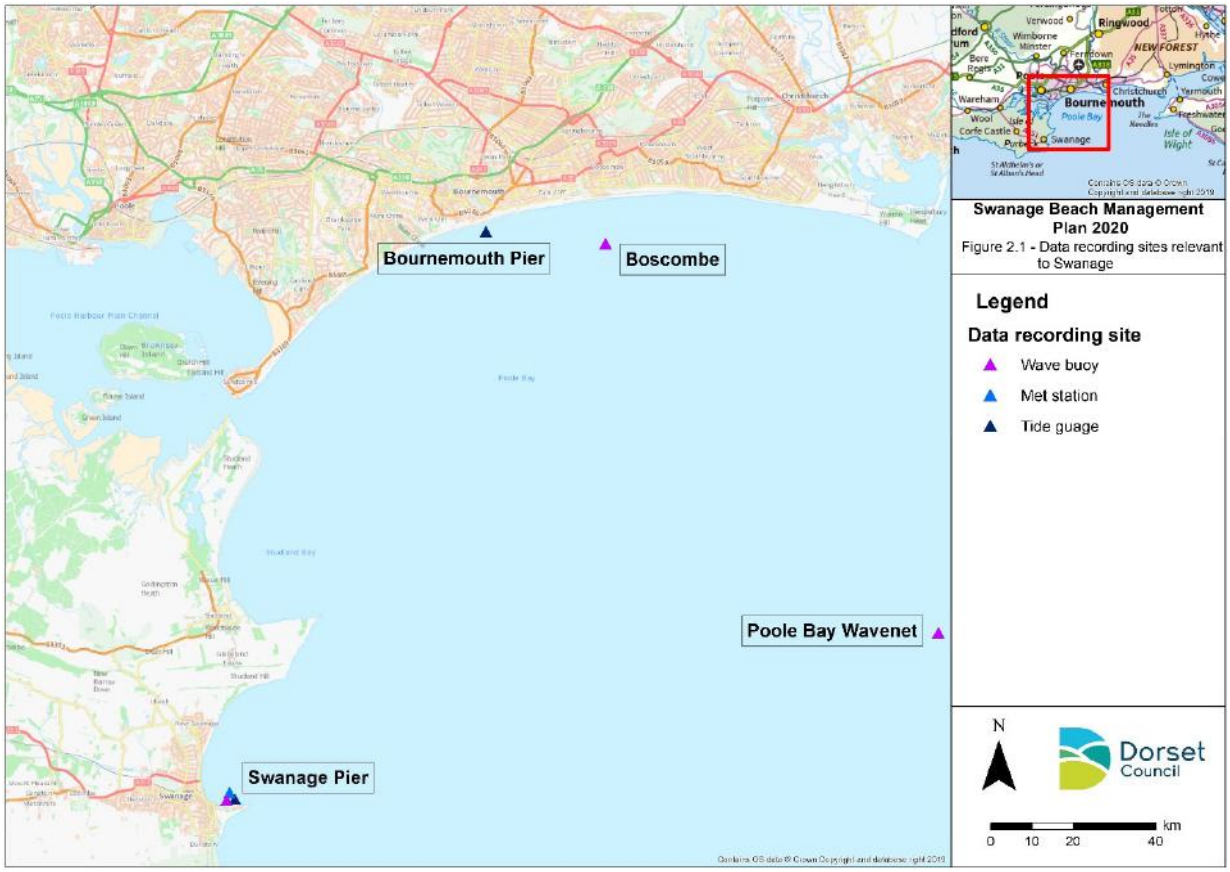
2.1.1 Typical waves

Wave data in Swanage Bay has been recorded by a non-directional Wave Radar device on Swanage Pier owned by the Channel Coastal Observatory (CCO) since January 2008 to present; data can be accessed online at: http://www.coastalmonitoring.org/data_management/real_time_data/charts/?chart=93 (date accessed: 3rd March 2020).

This Swanage Pier location is shown in Figure 2-1 along with, for reference, the locations of the offshore Poole Bay WaveNet buoy and Boscombe buoy. Due to data gaps and lack of direction in the Swanage Pier data, the Poole Bay WaveNet buoy is also used to support analysis of beach profile data, such as that described in Section 2.6.3 below.

Poole WaveNet buoy is operated by Cefas and data is available online at https://www.cefas.co.uk/data-and-publications/wavenet/ (date accessed: 3rd March 2020).

Boscombe buoy is also operated by CCO and data is available online at http://www.coastalmonitoring.org/data_management/real_time_data/charts/?chart=66 (date accessed: 3rd March 2020).



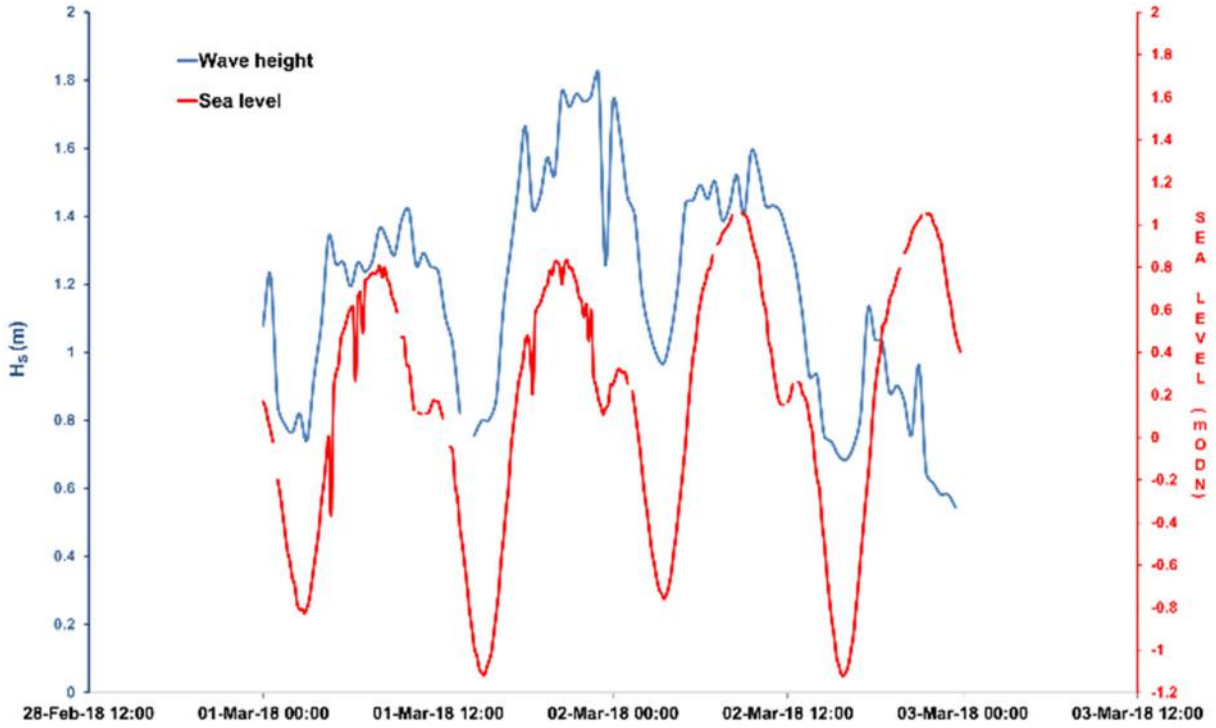
Figures 2-1 The triangles show recorders of wave data – Boscombe (CCO 2003-present) is in 10m depth, Poole Bay WaveNet (Cefas, 2003-present) is an offshore site and Swanage Pier (CCO 2008-present).

The Poole WaveNet buoy data emphasises how the dominant wave direction to Swanage Bay is from approximately 200˚ south-west (Miller, 2019), whilst within the bay itself the predominant wave angle is 150˚ as waves have diffracted around Durlston Head to approach normal to the shoreline.

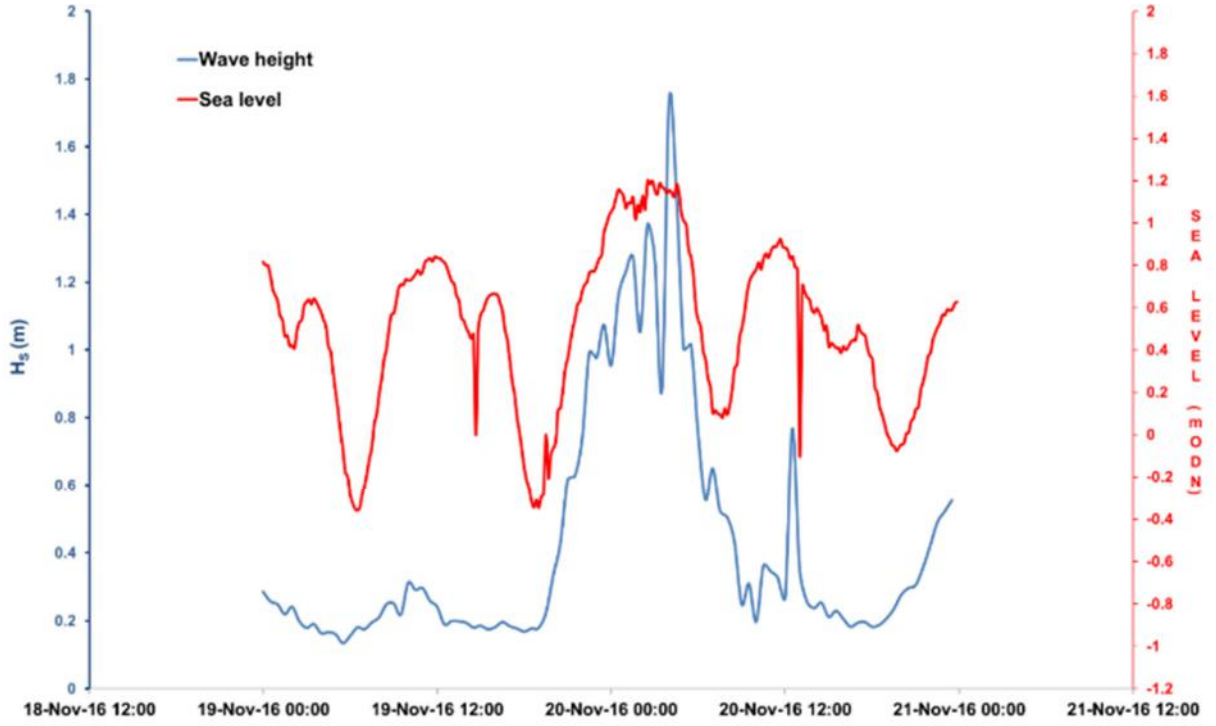
From the Swanage Pier data, it is observed that wave heights are generally greatest in December and arise from east-south-easterly events. The largest significant wave height (H_S or $H_{1/3}$) was on 1st March 2018 of 1.8m (Figure 2-2a), and the next highest was during Storm Angus on 20th November 2016 (Figure 2-2b).

The highest run up level would have likely been during Storm Angus on 20th November 2016 when high tide plus surge and waves flooded Swanage High Street. The annual return period H_S at this site is around 1.5m – occurring during east-south-east winds. Wave propagation into Swanage Bay is constrained by tide – only during the higher water depths afforded at high tide can wave maxima occur. In Figure 2-2a, the wave and sea level data for Storm Angus (November 2016) was a rare occasion where peak wave activity and sea level timings coincided (along with onshore winds).

Appendix F provides additional details.



Figures 2-2a Wave times series (blue line and axis) and sea level data (red line and axis) at Swanage Pier for Storm Emma in March 2018.



Figures 2-2b Wave times series (blue line and axis) and sea level data (red line and axis) at Swanage Pier for Storm Angus in November 2016.

2.1.2 Extreme waves

Extreme waves can occur during storm events, with waves generated locally to the site having relatively short wave periods. However, extreme events can also be generated far

from the site by storms in the Atlantic, when long-period swell waves may be created, which can potentially lead to significant overwashing / overtopping events.

Extreme wave heights were calculated for the BMP area as part of the design of the 2005/6 Swanage Beach Recharge Scheme. These are presented in Table 2-1. For comparison, the CCO uses a storm alert threshold to define a “storm” based on a 0.25 year return period event, which CCO has calculated from the recorded Swanage Pier data (see Section 2.1.1) data as being a wave with Hs = 1.2m.

Table 2-1 Extreme waves calculated at Swanage from Halcrow, 2005a.

Return Period (Years)	Significant wave height, Hs (m) *10m nearshore contour (Halcrow, 2005a)*
1	3.0
2	
5	3.7
10	3.9
20	4.2
25	
50	4.6
75	
100	4.8
150	
200	5.2
250	
300	
500	5.5
1000	5.8
10000	

The modelling work undertaken as part of this 2020 BMP update (JBA, 2020b) used the Environment Agency’s State of the Nation (SoN) dataset to derive extreme wave values to use in joint probability analysis (see Section 2.3). In doing so, JBA (2020b) compared these SoN values to those stated in Table 2-1 and found the SoN values to be lower than those used for the original 2005 scheme design. The reasons for these differences is uncertain as a detailed review of the 2005 values has not been undertaken.

2.2 Water levels

2.2.1 Tidal information

The tidal regime can be defined as the behaviour of water levels, which are in turn driven by the action of tides and other influences, such as shoreline morphology, river flows, winds, atmospheric pressure and storm events.

Swanage Bay has a micro-scale tidal range with net tidal circulation being anticlockwise. Values of tide levels are available from several sources, including the Environment Agency

(2018), CCO and United Kingdom Hydrographic Office (UKHO) (cited in Halcrow, 2005b). These values all differ slightly, and as such Table 2-2 provides an average of the various tidal values. The values have been converted to a common datum (Ordnance Datum, OD) for ease of reference to other water level values stated in this BMP. For reference, the conversion factor from mCD to mODN = -1.4m.

Table 2-1 Tide levels for Swanage averaged from Environment Agency (2018), CCO and United Kingdom Hydrographic Office (UKHO) admiralty tide tables, with the exception of MHWS & HAT which are from Environment Agency, 2018.

Tidal level	Still water level (mODN)	Still water level (mCD)
HAT	1.12	2.52
MHWS	0.69	2.09
MHWN	0.27	1.67
MLWN	-0.17	1.23
MLWS	-0.88	0.52

Observed sea level data from January 2008 to present is recorded at a gauge located on Swanage Pier owned by the CCO, alongside wave data (see Section 2.1.1 and Figure 2-1). This data can be accessed online at: http://www.coastalmonitoring.org/data_management/real_time_data/charts/?chart=93 (date accessed: 3rd March 2020).

Additional water level data is available from the Bournemouth tide gauge (see Figure 2-1) operated as part of the National Tide and Sea Level Facility; data is available online at https://www.ntslf.org/tgi/portinfo?port=Bournemouth (date accessed: 3rd March 2020).

Appendix F provides additional details.

2.2.2 Extreme water levels

The most recent estimate of extreme tide levels for this area is provided by the Environment Agency's 'Coastal Flood Boundary Conditions for the UK' (Environment Agency, 2018). The data relevant to the frontage at Swanage is shown in Table 2-3; this 2018 data was also used to inform the joint probability analysis undertaken as part of this 2020 update of the BMP (see Section 2.3).

For comparison, this table also shows the extreme water levels calculated to inform the design of the Swanage Beach Recharge Scheme constructed in 2005/6. This comparison shows that the 2018 extreme water levels are slightly higher (by up to a few centimetres) than the 2005 levels.

Table 2-2 Extreme tide levels for a range of return periods at Swanage.

Tidal level Return Period (Years)	Still water level (mODN)	
	Environment Agency (2018)	*Halcrow (2005a)*
1	1.45	1.41
2	1.52	
5	1.61	1.58
10	1.68	1.65
20	1.75	
25	1.77	1.75
50	1.84	1.82
75	1.87	
100	1.90	1.90
150	1.94	
200	1.96	1.97
250	1.99	
300	2.00	
500	2.05	
1000	2.12	
10000	2.34	

2.3 Joint probability extreme waves and water levels

Joint probability wave and water levels for Swanage were produced as part of developing the 2005/6 Swanage Beach Recharge Scheme (Halcrow, 2005b).

New joint probability wave and water levels have been calculated as part of the 2020 BMP update by JBA (2020b) and are shown in Figure 2-3. From these, six wave and water level combinations were extracted for each return period to use as boundary conditions for beach response modelling (see Section 2.6.3.1); these values are provided in Table 2-4 for present day (2020) and year 2070, allowing for sea level rise (2070 values are 2020 values raised by 0.495m for water levels, and 10% for wave heights, in accordance with the UKCP09 climate change guidance – see Section 2.4).

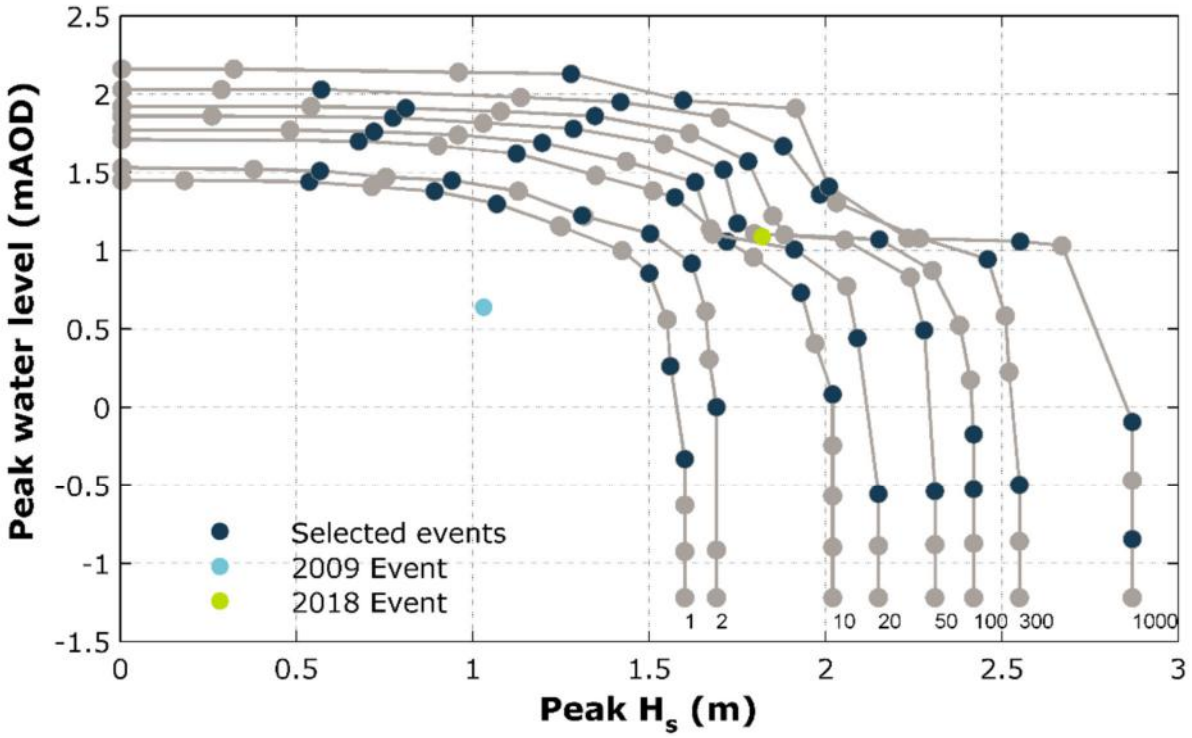


Figure 2-3 Joint probability extreme wave heights and water level curves for Swanage (JBA, 2020b). NB: "selected events" are those listed in Table 2-4.

Table 2-3 Joint probability extreme wave heights and water levels used for new modelling at Swanage – see Section 2.6.3.1 (JBA, 2020b).

RP (years)	*Event #*	2020 WL (mOD)	2020 Hs (m)	2070 WL (mOD)	2070 Hs (m)
1	*1*	1.47	0.54	1.97	0.59
	2	1.41	0.89	1.91	0.98
	3	1.33	1.07	1.83	1.17
	4	0.89	1.50	1.38	1.65
	5	0.69	1.56	1.19	1.72
	6	0.69	1.60	1.19	1.76
2	*1*	1.54	0.57	2.04	0.62
	2	1.48	0.94	1.98	1.03
	3	1.26	1.31	1.75	1.44
	4	1.14	1.50	1.64	1.65
	5	0.95	1.62	1.45	1.78
	6	0.69	1.69	1.19	1.86
10	*1*	1.73	0.68	2.23	0.74
	2	1.65	1.12	2.15	1.24
	3	1.37	1.57	1.87	1.73
	4	1.09	1.72	1.59	1.89
	5	0.77	1.93	1.26	2.12
	6	0.69	2.02	1.19	2.22

RP (years)	*Event #*	2020 WL (mOD)	2020 Hs (m)	2070 WL (mOD)	2070 Hs (m)
20	*1*	1.79	0.72	2.29	0.79
	2	1.72	1.20	2.22	1.32
	3	1.47	1.63	1.96	1.79
	4	1.04	1.91	1.54	2.10
	5	0.69	2.09	1.19	2.30
	6	0.69	2.15	1.19	2.36
50	*1*	1.88	0.77	2.38	0.85
	2	1.81	1.29	2.31	1.41
	3	1.55	1.71	2.04	1.88
	4	1.21	1.75	1.70	1.93
	5	0.69	2.28	1.19	2.51
	6	0.69	2.31	1.19	2.54
100	*1*	1.94	0.81	2.44	0.89
	2	1.89	1.35	2.39	1.48
	3	1.60	1.78	2.10	1.96
	4	1.10	2.15	1.60	2.37
	5	0.69	2.42	1.19	2.66
	6	0.69	2.42	1.19	2.66
300	*1*	2.06	0.57	2.56	0.63
	2	1.98	1.42	2.48	1.56
	3	1.70	1.88	2.20	2.07
	4	1.39	1.98	1.89	2.18
	5	0.98	2.46	1.47	2.71
	6	0.69	2.55	1.19	2.81
1000	*1*	2.16	1.28	2.66	1.41
	2	1.99	1.60	2.49	1.76
	3	1.44	2.01	1.94	2.21
	4	1.09	2.55	1.59	2.81
	5	0.69	2.87	1.19	3.16
	6	0.69	2.87	1.19	3.16

2.4 Climate change and risk

Information on the impacts of climate change to assume for flood and coastal risk projects, schemes and strategies is available online at https://www.gov.uk//guidance/flood-and-coastal-risk-projects-schemes-and-strategies-climate-change-allowances. This guidance is was updated in July 2020 and is based upon UKCP18 climate change projections. It replaced the previous guidance “Advice for Flood and Coastal Erosion Risk Management Authorities” (Environment Agency, 2016) which was based upon UKCP09 climate change projections.

This current guidance requires coastal flood and erosion risk projects such as this BMP, to consider the following range of sea level rise projections:

- UKCP18 Representative Concentration Pathway (RCP) 8.5*, 70th percentile (higher central) as the design allowance
- UKCP18 RCP8.5*, 95th percentile (upper end) allowance to test the sensitivity of options to more severe climate change and planning any additional mitigation
- H++ scenario from UKCP09 to test options under more extreme climate change and exceedance events. These are generic values of sea level rise provided in the climate change guidance taken from Environment Agency, 2016; they are 6mm (up to 2025), 12.5mm (2026 to 2050), 24mm (2051 to 2080), and 33mm (2081 to 2115)
- UKCP18 RCP8.5 projections to year 2300.

  **RCP8.5 data is downloaded for specific sites from the UKCP18 website – https://ukclimateprojections-ui.metoffice.gov.uk/ui/home.*

Table 2-5 presents the rates of relative sea level rise and surge estimates over several time periods from present day following the current guidance described above.

A graph showing the predicted change in relative sea level to the year 2100 for the UKCP18 RCP8.5 scenario is presented in Figure 2-4.

Table 2-4 Relative sea level rise estimates for Swanage for the UKCP18 RCP8.5 scenario. See text above for an explanation of the terms used in this table.

Time period	Various estimates of relative sea level rise (m)		
	RCP8.5, 70%ile (higher central) – Design Allowance	RCP8.5, 95%ile (upper end)	H++ (from UKCP09)
2020 to 2025	0.03	0.04	0.03
2020 to 2075	0.47	0.60	0.94
2020 to 2125	1.10	1.48	2.55
2020 to 2300	2.80	4.12	N/A

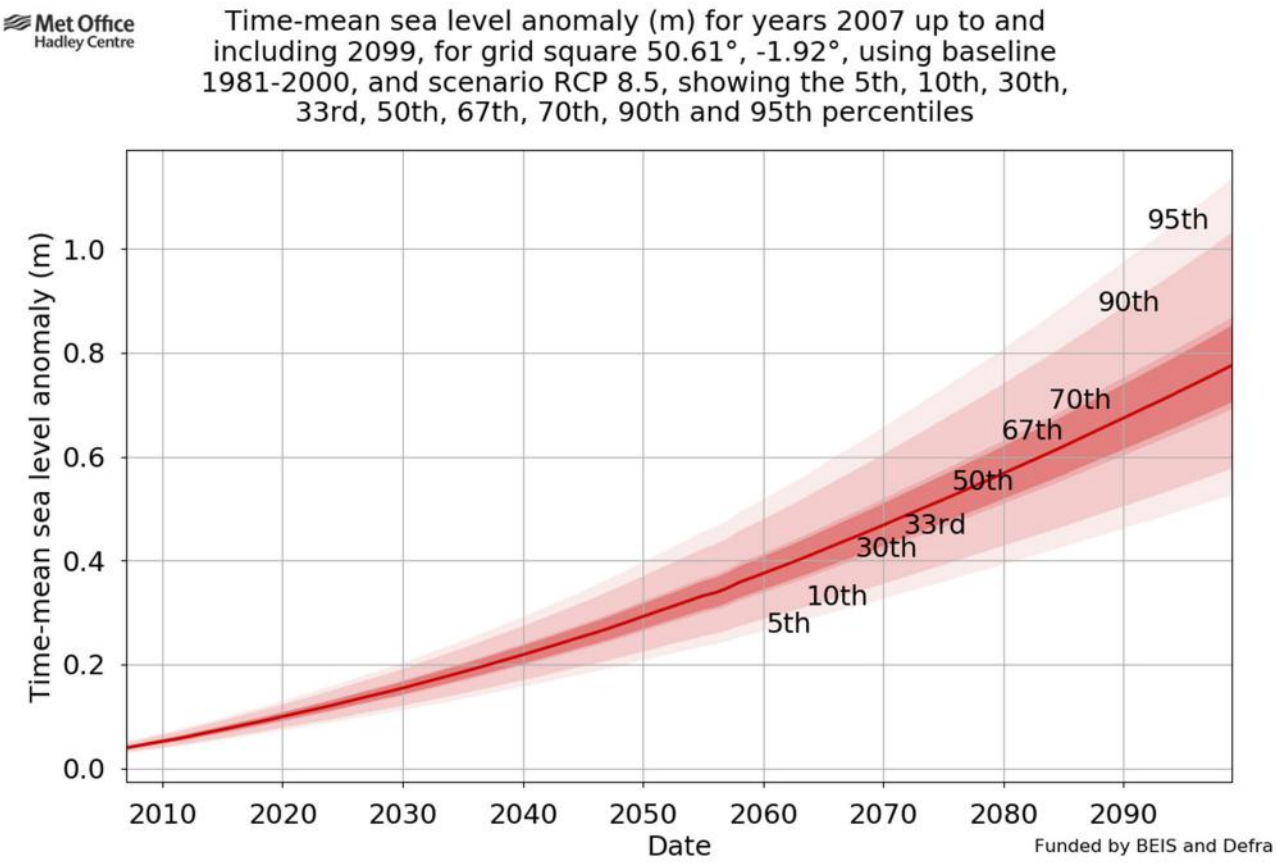


Figure 2-4 Projected change to relative sea level 2007 to 2099 for the UKCP18 RCP8.5 scenario for Swanage Bay area (source: UKCP18 website – https://ukclimateprojections-ui.metoffice.gov.uk/ui/home).

2.5 Sediment transport

2.5.1 Sediments

The BMP scheme was implemented in 2005/6 across a 1.3km long area (see Section 3.1). As part of this scheme, between 90,000m^3 and 130,000m^3 of beach recharge material was placed on the frontage. The material was sourced from the Swash Channel located at the Poole Harbour approaches.

Halcrow (2005a) states that the Swash Channel source provided sand with a D_{50} value of about 0.2mm, and with very little shingle content, and that this is similar to the pre-recharge beach, albeit to the low end of the grading envelope identified in 1998-2002 (see Section 3.1.1 also). This recharge material is what is found along the BMP frontage in 2020.

There is limited sediment input from the river and cliffs across the south and mid areas of the bay due to the coastal defences protecting the town.

To the north end of the bay between Shep's Hollow and Ballard Down (i.e. beyond the managed beach area) the sediment grading is coarser with typically 50% or more of shingle. Cliff erosion here provides small amounts of beach material (New Forest District Council, 2017).

2.5.2 Sediment transport mechanisms

Figure 2-5 provides an overview of sediment transport processes around Swanage Bay.

In Swanage Bay, the net longshore drift of the sand is generally from south to north. The transport rates are in the order of 3,000m³ -10,000m³ per year (the sediment depleted rocky southern shore between Peveril Point and Swanage Pier has lower drift, east to west). Since 2006 (shortly after the most recent replenishment) there has been significant nearshore movement of sediment within the bay. The offshore movement of material has resulted in the formation of a bar at the northern end of the bay, followed by onshore movement of material onto the beach north of the area recharged as part of the 2005/6 scheme. These movements are essentially nearshore movement and not considered as offshore transport or wave-driven onshore transport (New Forest District Council, 2017). However, the up-to-date nature of changes is quantified by the survey data discussed in Section 2.6.2, with further detail provided in Appendix F and the SCOPAC Sediment Transport Study (New Forest District Council, 2017).

The tidal range on springs is around 1.6m, reducing to around 0.4m on neaps. A feature (notoriously pronounced at Poole Harbour) is that Swanage shows a ‘double’ high tide, which results in a long period of standing water. The low tide duration is short compared to the high tide duration, and the tidal rise (flood) is more prolonged than the drop (ebb). This has significant implications for coastal flood and erosion events as the water level can stay raised for relatively long durations. The main tidal streams are generally parallel to the coastline offshore and during the flood tide flow the currents are in an easterly direction. During the ebbing tide the flow is westwards offshore (Halcrow, 1999; cited in Carter *et al*, 2004), whilst net tidal circulation is anticlockwise (Carter *et al*, 2004).

The dominant wave direction for the coast is from the south to south-west, which corresponds with the direction of longest fetch and longer period swell waves originating in the Atlantic Ocean. However, Swanage Bay faces east and south-east with the southern end of the bay shielded from south-westerly swells by the headland at Peveril Point, so shorter period wind waves from the east and south-east are more significant and energetic in terms of flood risk and geomorphological development along most the frontage (compared to refracted Atlantic swell waves), although significant storms from the south-west can generate higher sea levels and enable larger waves to propagate into the bay with significant local impact.

As noted in Section 2.5.1, there is limited sediment input from the river and cliffs across the south and mid areas of the bay due to the coastal defences protecting the town. Hence the main sediment input comes from circulation within the bay and periodic beach recharge as occurred in 2005/6 (see also Section 3.1.1).

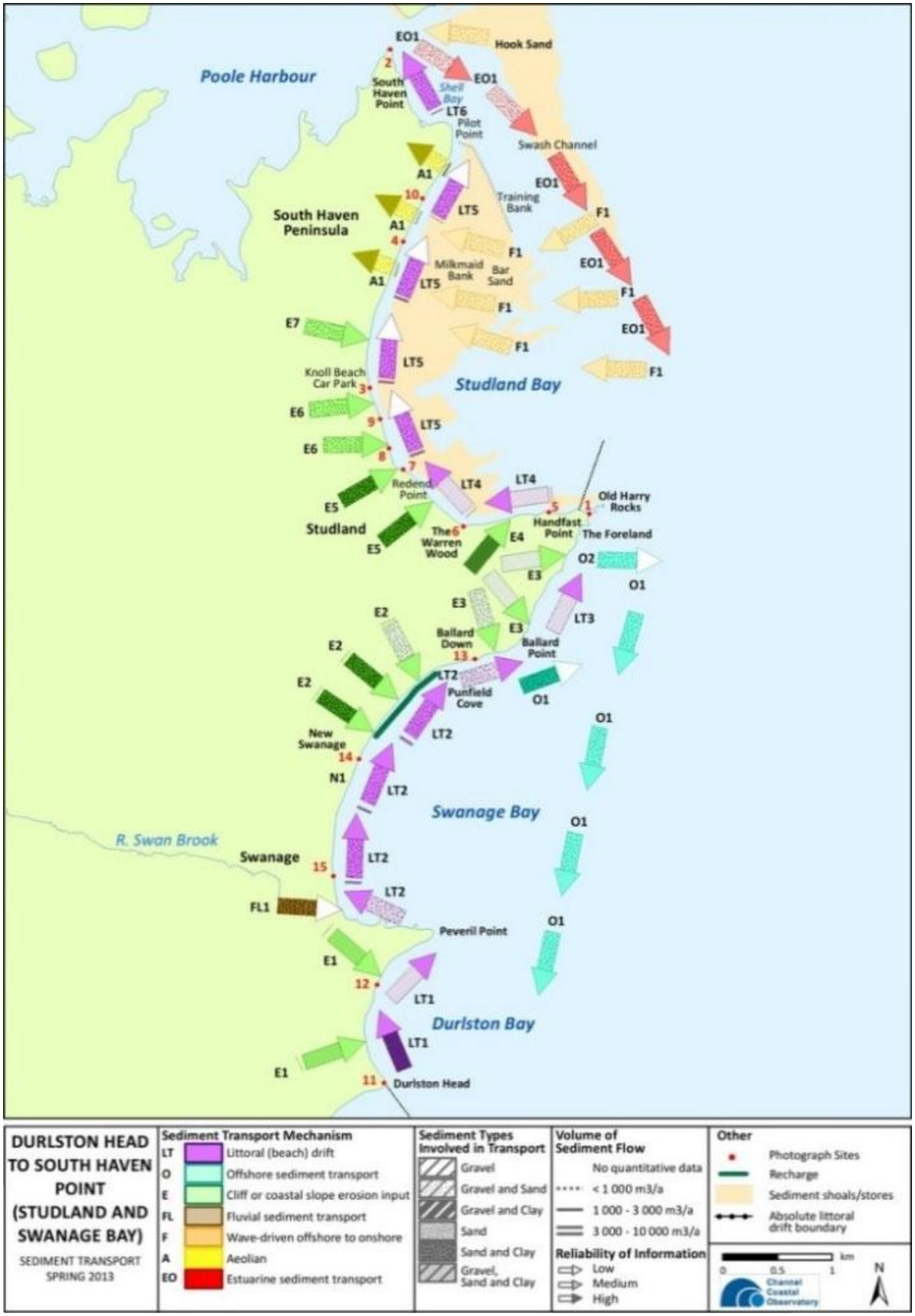


Figure 2-5 Overview of sediment transport pathways in Swanage Bay (New Forest District Council, 2017).

2.6 Shoreline movement

2.6.1 Overview of the evolution of this shoreline

Swanage Bay is an open coastal bay, with geology comprising the Wealden beds of sands and clays and shoreline primarily of chalk. The intertidal beach consists of a sand and shingle beach, with much of the surface material now generally shingle covered by a layer of recharged sand. The bay has formed into a well-defined log spiral shape as the Wealden beds have eroded more rapidly than the resistant headlands of Ballard Point and Peveril Point which are the bay's main control features. The bay has a distinctively eastward facing orientation.

Analysis of the equilibrium bay shape of Swanage Bay was undertaken by Halcrow (2000). This identified that the shoreline along the BMP frontage, particularly the section north of the Ulwell Stream, is held seawards of where the natural equilibrium profile wishes to be by the coastal defences in this area, indicating ongoing erosion pressure on the shoreline as nature tries to erode the bay back to the stable bay shape.

The land behind the sea walls is higher towards the west and north and falls gently to the south. The cliffs lying from Ulwell Stream to Shep's Hollow are typically up to 30m in height. Heading offshore, the ~10mCD depth contour lies approximately 0.5km from the shore.

Further information is available in the SCOPAC Sediment Transport Study (New Forest District Council, 2017).

2.6.2 Beach profile analysis

Since the start of SERCMP in 2003, Swanage's beach has been surveyed frequently, and there have been various surveys and sampling previously with topographic profile data available back to 1998. Post 2003 topographic data includes twice per year 1D profile surveys, 4-yearly baseline surveys (high resolution, 5m point spacing, or more recently laser scanning) along with intermittent post storm, LiDAR surveys and bathymetry surveys. Two multi-beam bathymetry surveys (Autumn 2019 and Spring 2020) of the bay were commissioned as part of this BMP update.

This section summarises the analysis of the changes observed in the beach monitoring data since the beach was recharged in 2005/6. Further details are provided in Appendix F.

2.6.2.1 Beach change over time

Analysis of beach change over time has been undertaken as part of the 2020 BMP update in a number of ways.

The first method involves comparison of topographic profile surveys converted to volumes (higher temporal resolution, lower spatial resolution); and topographic and bathymetric difference plots producing using high resolution regional monitoring data and multi-beam bathymetry surveys.

In Figure 2-6, the topographic elevation difference plots 2003 until 2019 show beach level changes, pre and post replenishment. Key points from these difference plots are that:

- Post replenishment (between 2006 to 2019) there has been a drop-in beach level as would be expected after large scale placement of imported beach material of over 0.5m across most of the BMP area, and in some cases over 1m drop in level.

- There are a couple of areas that appear relatively more susceptible to erosion (red dashed boxes in Figure 2-6) and associated with the larger elevation changes – notably the groyne bay just south of “The Waterfront” where Ulwell Road meets Shore Road, which contains the Ulwell Outfall.
- Comparison of 2003 to 2019 (a couple of years before replenishment until February 2019) indicates that the net change is still gain in elevation across the upper foreshore.

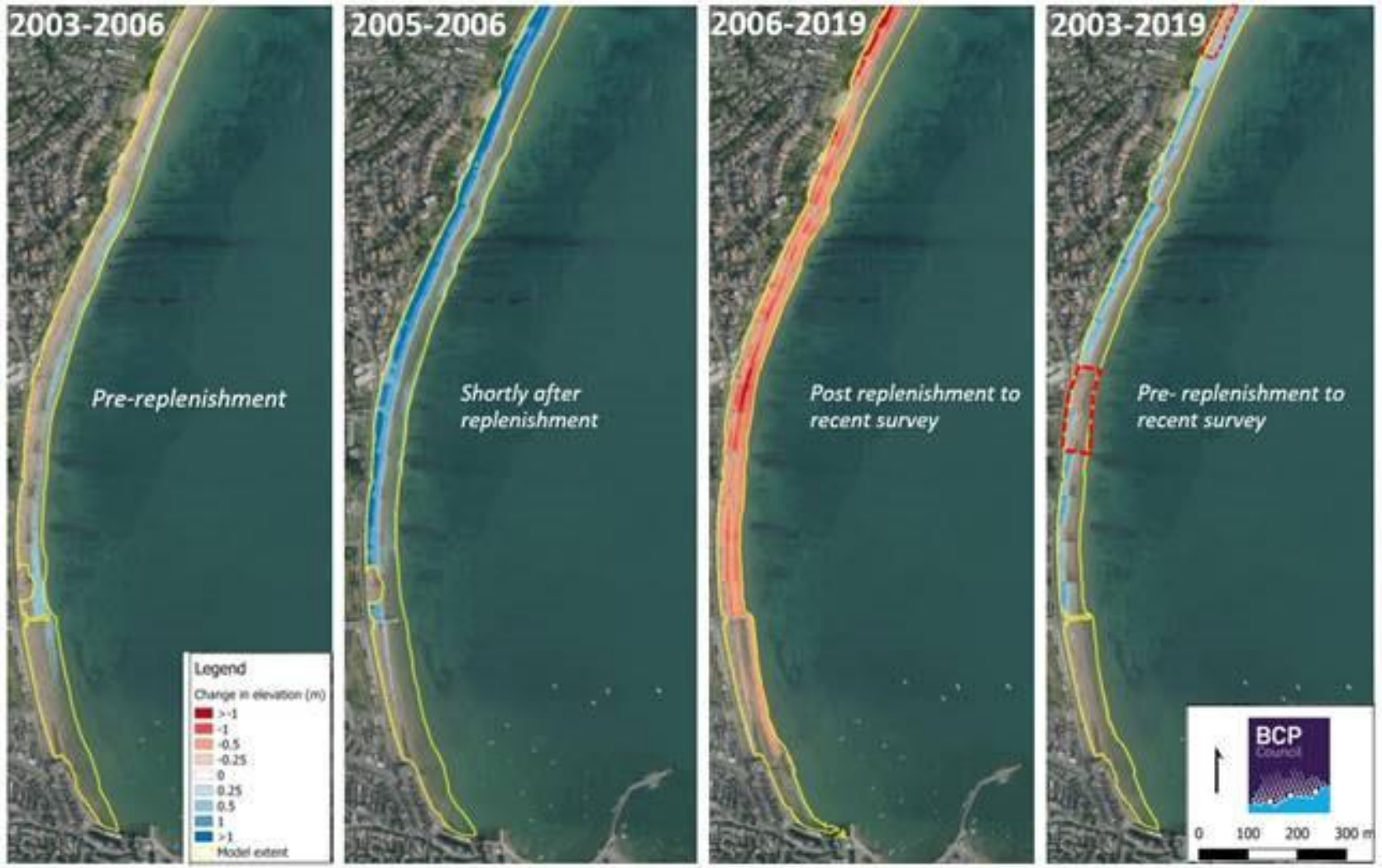


Figure 2-6 Topographic elevation difference plots 2003 until 2019 – showing pre replenishment, shortly after replenishment, change since the replenishment and change pre replenishment to recent (with the red-dashed lines highlighting erosion hotspots).

The second method of analysis summarised in Figure 2-7 is interpretation of the more frequently obtained beach profile surveys covering over 21 years from 1998 to 2019, by converting these surveys into volumes across the whole bay. Appendix F provides further detail on the method of calculation. This method of profile to volume analysis, created volumes across Swanage Bay and also in subdivided sections either side of the BMP frontage, i.e.:

- the south between the Mowlem and Outfall Jetty, and
- the undefended section to the north between the last groyne at Shep's Hollow and Ballard Cliff.

The black upper line in Figure 2-7 is the volume change time series across the bay, and the distinct rise in beach volume as a result of the 2005/6 replenishment and steady decline volume trend since then.

The red line of the BMP area shows how the upper beach volume between the Outfall Jetty and Shep's Hollow almost doubles pre- to post- replenishment. This profile and the continuous topographic (baseline surveyed) data shown in Figure 2-6 and Figure 2-7 only captures a volume change of up to +55,000m^3 between the surveys before and after of the replenishment. This is substantially less than the stated approx. 90,000m^3 dredge and nourishment (see Section 3.1.1).

This volume discrepancy is also highlighted in the analysis presented in Section 2.6.2.2 and could be due to the time lag between the completion of works and the post works survey, as well as the survey extent (i.e. only upper foreshore) and error ranges in (survey and dredge) measurements. Also, rapid initial losses are possible post works as the beach adjusts, particularly as finer material is winnowed away. This discrepancy is perhaps explained further by understanding bay-wide volume changes. By October 2007, the bay wide volume change compared to pre-replenishment is +86,300m^3, closer to the replenishment amount. It seems possible that initially some of the replenished material may have washed offshore and 20 months later driven back onshore in the northern and southern beach areas outside of the BMP zone.

A key outcome of the analysis in Figure 2-7 is that distinct storms known to affect other beaches in the region (e.g. 14th February 2014) are not associated with rapid bay-wide beach losses at Swanage (although at some locations as later explained there can be lowering of distinct profiles). Rather a steady downward trend, whereby the bay has lost over two thirds of the replenished material, with all of the three subsections of the bay (represented by the red, blue and green lines) still at a higher level than they were prior to the replenishment.

Based on the averaged loss rate volume calculated from this analysis, the bay is likely to return to pre-recharge volume around spring to summer 2025; although this statement should always be caveated by (a) the uncertainties in beach volumes, (b) distinct periods of loss or inertia that may arise due to storm activity, changing this forecast estimate, and (c) this does not capture spatially where losses may be more intense over localised areas.

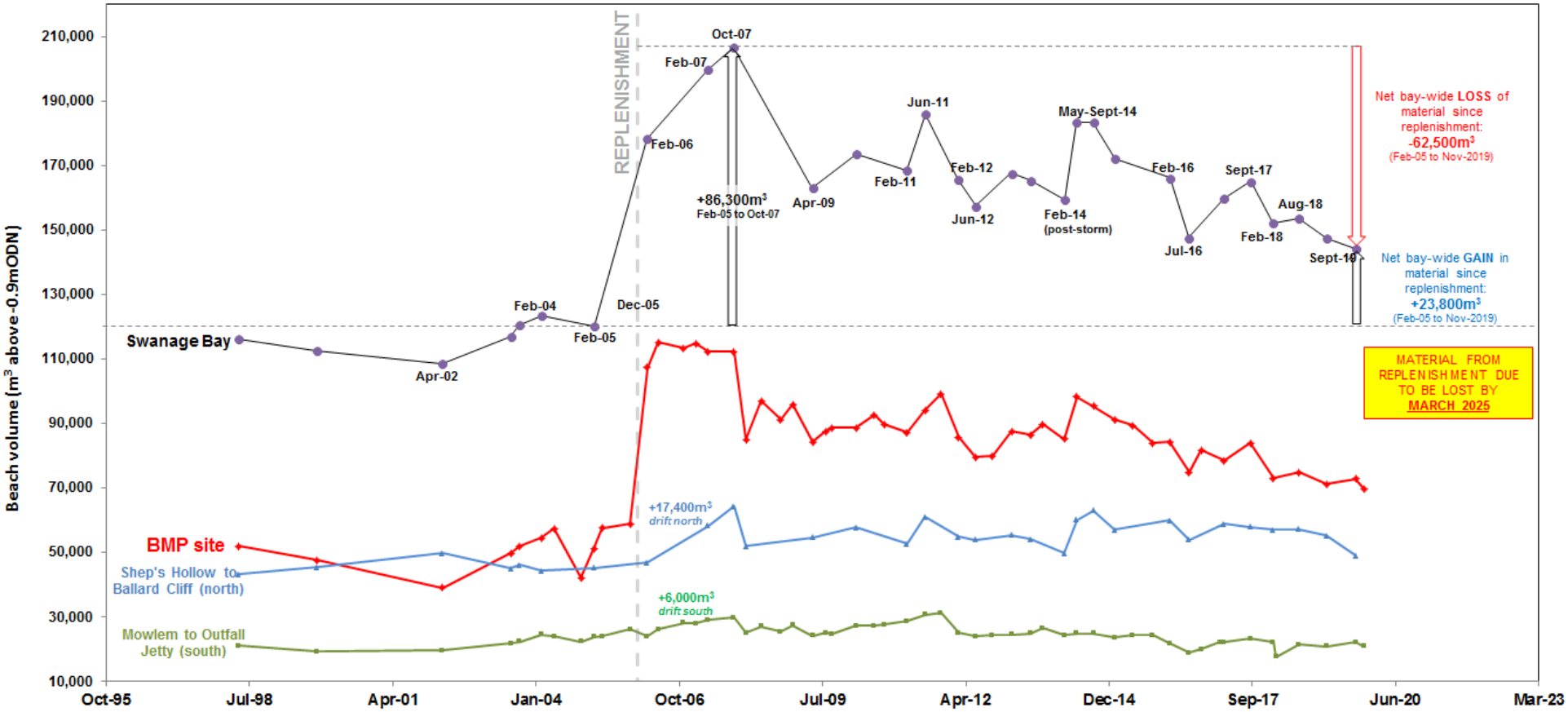


Figure 2-7 Volume change over time at Swanage Bay as interpreted by 1D profile data taken from 11/05/1998 to 08/11/2019.

2.6.2.2 Performance in relation to Design and Monitoring Levels

Further analysis of the beach profile monitoring data has been undertaken in relation to the minimum design and trigger levels defined as part of the 2005/6 scheme (see Section 3). This further analysis focussed on assessing where the beach lies at the present time in comparison to these levels. Full details of this analysis are provided in Appendix F.

The key findings from this analysis are summarised in Figure 2-8, which focusses on the volume analysis along the 1.3km of frontage between the Banjo Pier and Shep's Hollow that was recharged in 2005/6. The surveyed volumes from monitoring data are compared to minimum design volume (see Section 3.1.1), and also the Alarm and Crisis Levels (see Section 3.3). This indicates that the beach is currently above the minimum design volume; the significance of which being that most of the frontage is likely above the 1:300 standard of protection targeted in the 2005/6 scheme design. If localised hotspots of erosion emerge in the near future there is, in theory, enough beach sediment to recycle to maintain this level across the BMP area. However, the average beach volume loss rate from the BMP area since replenishment is estimated at **-2,800m^3 per year.** If this trend is extrapolated, the minimum design volume is lost during 2023. A higher rate whereby an additional loss per year of -1,000m^3 is assumed (for worse condition and uncertainty in the existing data) could bring this about sooner, by Winter 2022.

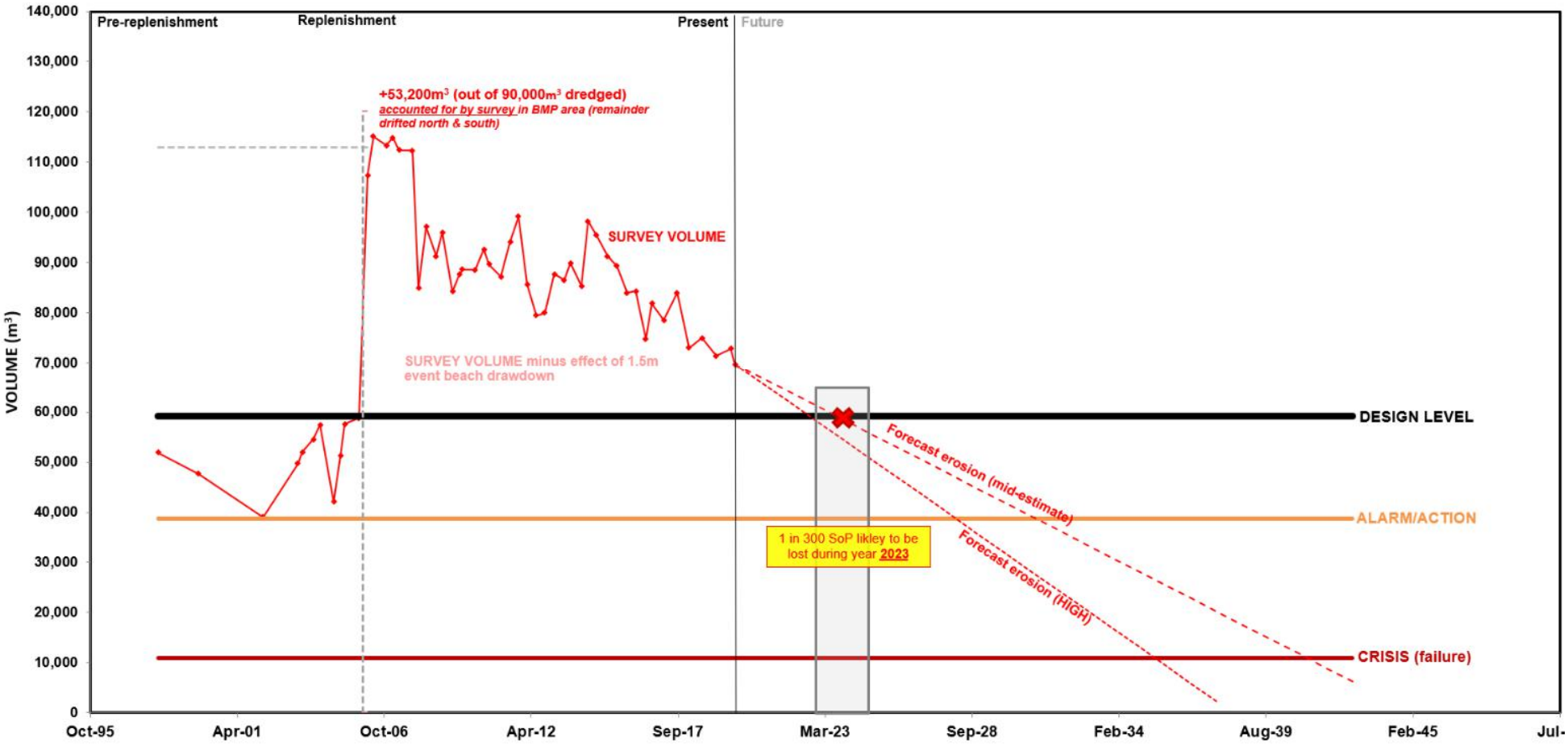


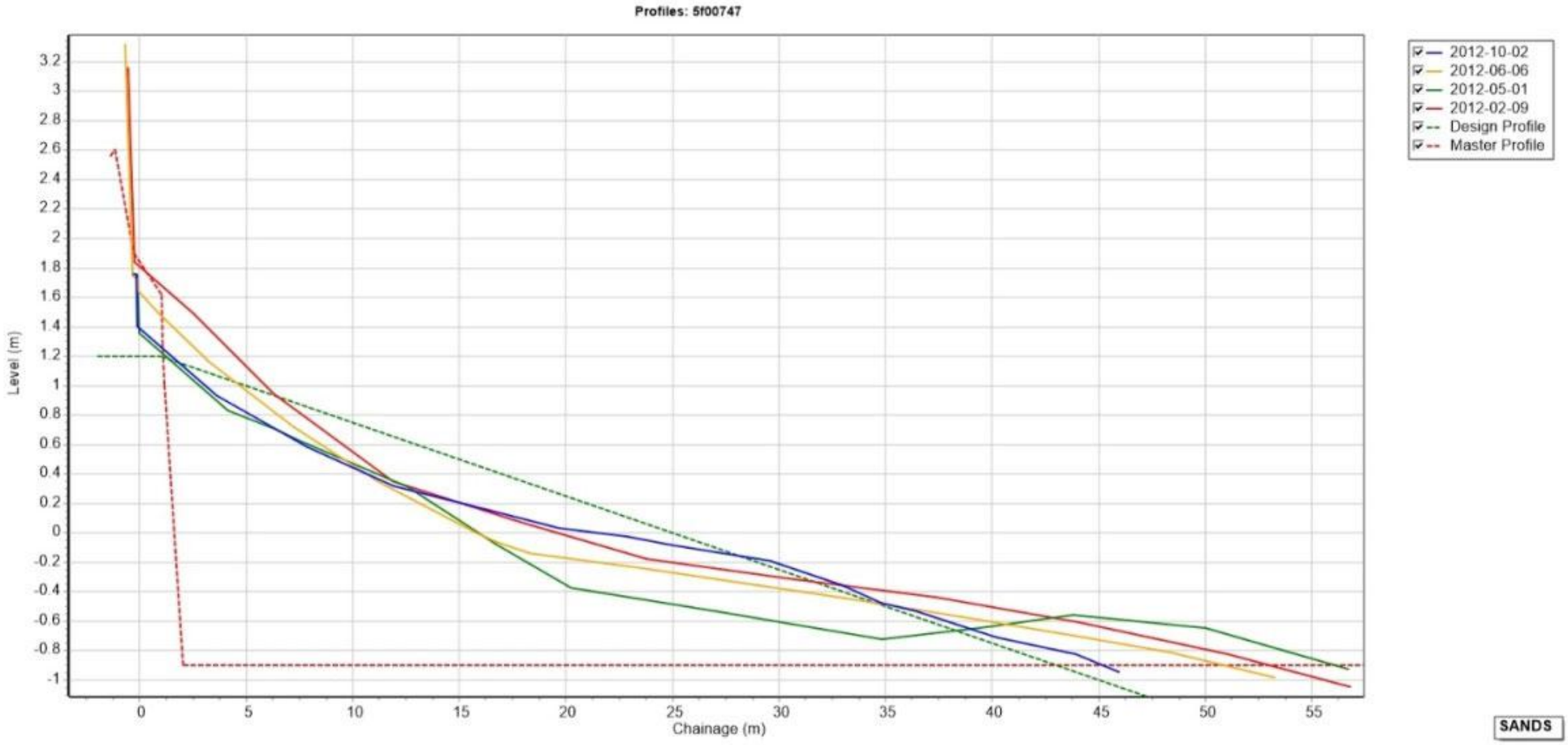
Figure 2-8 Volume plotted over time, compared to design, Alarm and Crisis Levels in the Swanage BMP area.

2.6.3 Beach profile storm response

The beach volume time series plots of Figure 2-7 and Figure 2-8 highlight that specific storms have caused highly obvious volume responses. These tend to be different storms to those that have been known to have affected south/south-west facing locations locally, such as in Poole and Christchurch Bays.

The following provides a summary of storm events attributed to beach loss in the Swanage BMP area, with additional details provided in Appendix F:

- **16th to 19th April 2008:** wave heights exceeded the storm threshold at Swanage Pier for approximately 36 hours and were above 0.5 m for 60 hours. The sustained NE/E wind exceeding 30 knots at times created a sustained period of wave set up with maximum wave heights in excess of 2m. Wind data at Swanage shows an easterly direction at over 30 knots – although the data is cut short. However, another south coast CCO data point at Lymington gauge shows four days of NE/E wind at 15 to 30 knots, and the Boscombe buoy recorded wave conditions of 0.75 – 1.5 m H_S approaching at 135° for the four days. A post storm survey less than a week later shows a drop in the level (of entire profiles) for 5 profiles of approximately 0.3m to 0.4m.
- **2nd November 2010:** sustained 20 knot wind from 135° for 48 hours with wave of over 1m Hs. Although not as large a storm as other events that have impacted Swanage, sustained SE wind created prolonged wave action in Swanage Bay which resulted in all profiles drawing down on beach material, with beach lowering against the promenade and flattening of lower foreshore to a shallower gradient.
- **29th to 30th April 2012:** This event was preceded by two smaller storms on 23rd and 25th-26th. The significant wave height did not exceed storm threshold, but maximum wave heights did exceed this threshold for almost 36 hours, with unexceptional wave period (10s) and wind waves. The wind was NE-SE 20-30kn gusting 40kn with a surge during neap tides. The post-storm profile at the northern end of the BMP site lowered to around crisis level at the sea wall and for the majority of the profile, with a sand bar forming at the toe (Figure 2-9). The other four post storm profiles saw draw down of material from upper profile.



Figures 2-9 Notable profile change at Shep's Hollow end of the BMP site observed on 1st May 2012 (green line) following east-north-easterly event.

- **Mid-to-late March 2013:** around this time there were two wave events recorded at Swanage (11th March during spring tides and 22nd during neaps) that were in exceedance of the significant wave height storm threshold and with long period swell (even though predominantly a NE/E storms). Interestingly, there was not long period swell recorded at the Boscombe wave buoy and no official post-storm survey was completed. On the 11th March wind speeds were 30 knots for 24 hr from the NE/E direction with a minor event on Boscombe wave buoy. This caused damage to Swanage Pier. On the 22nd March winds were above 15 to 20 knots for four days, again from NE/E. Snow. Comparing surveys from 13th February to 24th June all profiles from The Mowlem northwards show signs of erosion on the lower foreshore and accretion on the upper beach. The beach toe retreated up to 25m on certain profiles and the beach below MHW was steepened. The beach crest increased and become wider for most profiles.
- **14th February 2014 ("Valentine's Day Storm"):** A notable event on the south coast with low pressure (<980mb) and wave heights of 1.75m at Swanage, with less notable wave period during the storm (<10s). The beach across the north and mid sectors of the BMP area underwent distinct loss of material at the top of beach, with particularly notable draw down around the more vulnerable Pines Hotel section where there was a large draw down of material (approximately 1m). The toe of the beach was flattened out in some of these areas to extend 20-45m further offshore. Profiles around the Outfall Jetty were not badly affected. The foreshore further south near the Mowlem was impacted quite severely, with profiles showing flattening of the upper beach profile with sediment loss against the sea wall and upper berm; the toe of the sea wall was exposed in places.
- **3rd February 2017:** this was a short storm, where the significant wave height did not exceed the storm threshold at Swanage or Boscombe CCO wave buoys. However, it was quite long period wave conditions at over 16s and wind speed increased throughout day to peak at 36 knots to 50 knots and veering from 225° (W-SW) to 135° (SE) for 6 hours. This generated bimodal sea conditions (both long period swell and strong wind wave components) for the six hours which coincided with the usual prolonged (double standing high) water which included a surge of 0.25 to 0.4m (which brought the water level up to the equivalent of spring tide). The impacts were notable for draw down at the sea wall just south of the BMP area, although the remaining profiles were impacted positively with profiles overall becoming shallower in gradient and rising in height against the sea wall. However, as a whole this 2016/17 winter did not have notable impacts on beach volumes at Swanage with net accretion across the BMP area.
- **1st March 2018 ("Storm Emma" during the "Beast from the East"):** this was a "northeaster" with a constant wind speed in excess of 30 knots with gusts of over 40 knots from an easterly to north-easterly direction. The storm tracked from Portugal with its centre passing over the Isles of Scilly. Tides were not extreme although three high tides occurred over the period of the storm. The 1-year spacing between pre and post storm surveys does not allow specific attribution of volume losses although the beach in the southern end of the bay lost over 10,000m^3 between February and March 2018. From a volumetric perspective, much (but not all) of the material was recovered by August 2018, but the worst hit areas around the central Outfall Jetty area and south underwent large beach height losses at the sea wall. In most cases, beach height at the sea wall did not fully recover and profiles remain steeper (i.e. shorter).

2.6.3.1 New beach response modelling

To provide additional support to understanding extreme storm conditions and beach response, JBA (2020b) undertook a beach profile modelling study as part of the 2020 BMP update. This modelling assessed how the beach is likely to respond under a range of extreme events in the present day and in 50 years' time allowing for sea level rise (i.e. to beyond the end of the 2005 scheme design life); see also Section 2.3.

A key element of this modelling study was to appraise if the minimum design profile required to achieve the 1:300 year standard of protection of the 2005/6 scheme remains sufficient to achieve the original 50-year design life of the scheme, in light of more recent (current) guidance on extreme waves and water levels and sea level rise projections.

This work is summarised thoroughly in Appendix F. However, the key findings of this modelling are that it:

- Highlights the potential for around 1m of beach draw down as a result of extreme storm events in the present time.
- Suggests a longer, shallower beach profile such as the 2005/6 design profile is more effective in dissipating wave energy and reducing upper beach erosion and toe scour; the current steeper profile is less effective so future beach recharge needs to achieve the shallower gradient as per the design profile.
- Indicates that while there is potential for the 2070 scenario (allowing for sea level rise) to have less erosion across the entire profile (albeit because it is a "drowned system" which is not desirable for various reasons) there is risk that a scour hole may develop at the toe of the sea wall from interaction with the structure. *It is important to note that the JBA (2020b) provides a note of caution about this finding, as such a phenomenon cannot be appropriately represented using a 1D XBEACH model used for this analysis.*

2.6.4 Predictions of future shoreline change

In the immediate future, there will continue to be net loss of beach material along the BMP frontage. The volume loss across the BMP frontage compared to the design profile volume presented in Section 2.6.3, suggests from a broad perspective that the minimum beach volume required to provide the 1 in 300 year standard of protection at Swanage is likely to be lost during the year 2023, whilst the full amount of beach sediment placed on the shoreline as part of the 2005/6 beach recharge scheme is predicted to be lost in 2025.

Analysis of storm event impacts on the beach profiles and volumes, supported by new numerical modelling shows that there is potential for around 1m of beach draw down against the seawall in a single event. Such lowering poses a risk of the seawall being undermined and failing which would lead to the onset of coastal erosion; if left un-addressed under a no active intervention scenario, coastal erosion would occur rapidly at a rate of 0.5 to 1.0m/year (Halcrow, 2004) and lead to the loss of residential and commercial property, roads, utilities and services, and amenity use of the area.– all reasons that formed the basis of the business case for the 2005/6 Swanage Beach Recharge Scheme (see also Section 1.4.1 and Appendix A). The risk of this occurring in a single storm event is significantly increased once the minimum beach volume is reached / exceeded; and as such a further beach recharge is required by 2025 (see Section 5.2.2).

As the policy is to continue to provide coastal protection measures along the BMP frontage (see Sections 1.7.1 and 1.7.2), the no active intervention scenario will be avoided. However, continuing with the present management approach will present its own challenges in the face of sea level rise which will allow larger waves to reach the shoreline. The sustainability of providing coastal defence using beach recharge, timber groynes and seawalls at their current levels and configuration in the longer-term is uncertain and changes to the defences may need to be considered in the second half of the 21st century as the current scheme reaches the end of its 50-year design life (see also Section 3.1).

2.7 Environmental characteristics

This section provides an overview of the environmental setting and identifies key environmental features within the vicinity of study area (refer to Figure 1-1 above). The section is structured around a number of environmental topics as highlighted in the first column of Table 2-6. These follow the recommended structure contained in the Beach Management Manual (CIRIA, 2010).

The second column in Table 2-6 makes reference to the environmental aspects documented in Annex 4 of the European Union Directive 2011/92/EU '*on the assessment of the effect of certain public and private project on the environment*' (the EIA Directive). This is provided by way of cross-reference to the EIA requirements such that the information in this BMP is able to be developed further should the need arise at a future date, e.g. if future works are needed that are determined to present a significant scale or impact as to need a statutory Environmental Statement (ES) to accompany consent applications. Additional information about various environmental designations is also provided in Appendix C.

Table 2-6 A summary of environmental topic and cross-reference to EIA Directive topics.

Environmental topics (with reference to CIRIA, 2010)	Reference Annex 4 of the EIA Directive
Geology and Geomorphology	Soil
Sediment quality	Soil
Water quality	Water
Ecology	Flora and Fauna
Fisheries	Material Assets
Navigation	Material Assets
Landscape setting	Landscape
Archaeology and Cultural Heritage	Material Assets
Air quality	Air
Noise	Population
Amenity value (see Section 1.3.5)	Population

2.7.1 Geology & Geomorphology

There are a number of statutory environmental designations with geological and/or geomorphological features of interest directly within, or within close proximity (approx. 2km) of Swanage Bay that need to be considered when planning and implementing FCERM activities; see also Figure 1-2 above.

The following sections describe the geological/geomorphological features of these designations; further details on the ecological features that are supported by the geology/geomorphology are provided in Section 2.7.4.

2.7.1.1 Purbeck Ridge (East) Site of Special Scientific Interest (SSSI)

This SSSI extends westwards (inland) for 15km from the cliffs at Ballard Down on the north side of Swanage Bay. The SSSI was extended in parts to include the cliffs between Ulwell Stream Outfall and Shep's Hollow. The SSSI is designated for both geological/geomorphological and biological interests.

Of relevance at Swanage Bay, the geological/geomorphological interests include:

1) The low sea-cliffs from Swanage Bay to Ballard Point that expose Upper Wealden sands, grit marls and clays which are overlain by Lower Greensand sediments.
2) Ballard Down, a key site for coastal geomorphology as the cliffs contain exposures of chalk and unconsolidated sands and gravels, each of which responds in a different manner to the erosion on a coast facing storms from a southerly direction.

The northern end of Swanage Bay has a complex geology and this affects cliff processes and therefore mass movements. Up to 8m of cliff recession has occurred since the early 1920's. Since the mid 1980's it is understood there has been a lowering of beach levels in the northern part of Swanage Bay, where the natural beach protecting the cliff has dropped by 2m (Halcrow, 2005c).

Section 2.7.4.1 provides further information on the ecological features designated under this SSSI that are supported by the above geological features.

2.7.1.2 Studland Cliffs SSSI

The Studland Cliffs SSSI lies to the north of the BMP area and is designated because of its importance for palaeontological and geomorphological studies.

2.7.1.3 South Dorset Coast SSSI

The western end of the South Dorset Coast SSSI lies to the south of the BMP area. This SSSI is of special interest due to its calcareous and neutral grassland, supralittoral rock and broadleaved, mixed and yew woodland.

2.7.1.4 Geological Conservation Review Sites

There are three Geological Conservation Review Sites (GCR) within or in close proximity to the BMP area. These are listed below with their associated reference numbers and GCR block reference provided:

- Ballard Down (1843) – Coastal geomorphology of England.
- Swanage (2629) – Wealden.
- Punfield Cove (636) – Aptian-Albian.

2.7.1.5 Dorset and East Devon Coast UNESCO World Heritage Site

The SSSI designations described above also underpin the UNESCO World Heritage Site designation for the Dorset and East Devon Coast (the "Jurassic Coast") which covers the same extent. It has achieved this status due to fulfilling two criteria established by UNESCO:

- An outstanding example representing major stages of Earth's history, including the record of life, significant ongoing geological processes in the development of landforms, or significant geomorphic or physiographic features; and
- Contains superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.

The primary reasons for designation that support achievement of the above criteria include (but are not limited to):

- The site comprises a near continuous sequence of rock exposures covering 185 million years of geological history from the Triassic, Jurassic and Cretaceous periods, and provides exceptional geomorphological features and fossil sites.
- The contribution the area has made to earth sciences and understanding of geology.
- The remarkable varied coastal scenery and geomorphology with unique features.
- A combination of important habitats and conservation features.

2.7.1.6 Isle of Portland to Studland Cliffs SAC

Covering the northern part of the shoreline and hinterland, this terrestrial SAC is designated for its internationally important geological interest with rich range of wildlife habitats.

The geological interest is the exposed soft chalk bedrock around Ballard Cliffs in the east and Ringstead Bay in the west; the limestone ledges at Worbarrow Bay; and shale reefs extend from Kimmeridge.

Further details on the ecological qualifying features of the SAC are provided in Section 2.7.4.1.2.

2.7.1.7 Studland to Portland Marine SAC

Covering the entirety of the seabed of Swanage Bay up to MHW, this marine SAC was designated on 27th September 2017. The primary reason for selection of this site is:

- Reefs.

These reefs are in various forms and exhibit a large amount of geological variety and biological diversity. The site is split into two portions:

- the Studland Bay to Ringstead Bay Reef, and
- the Portland Reefs.

Detailed seabed mapping shows that infra-littoral and circa-littoral reef features are present in the SAC (see Figure 2-10).

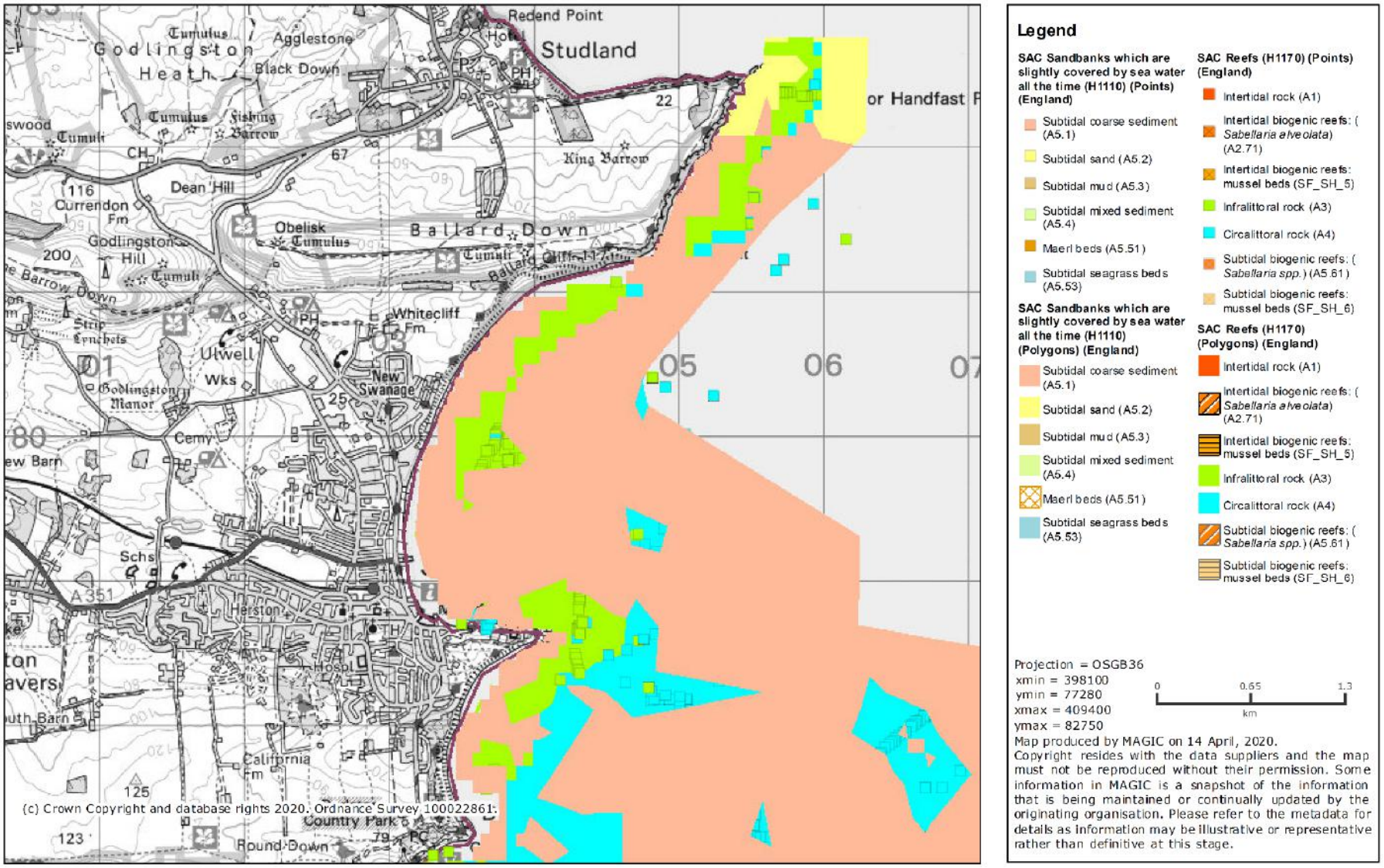


Figure 2-10 Screenshot taken from https://magic.defra.gov.uk/MagicMap.aspx on 14th April 2020 showing the extent of Marine SAC features and sub-features in Swanage Bay.

Further details on the ecological qualifying features of the SAC supported by the above geological features are provided in Section 2.7.4.1.3.

2.7.1.8 Purbeck Coast MCZ

This area was designated as an MCZ in May 2019. It stretches from Ringstead Bay to Swanage and extends offshore, covering the seabed down to depths of 52 metres. The site overlaps with the eastern section of the Studland to Portland Special Area of Conservation (SAC). This MCZ contains features and sea caves which are an important nursery ground for sea bass, and flat fish, and also a home for rare sponges, edible crabs and velvet swimming crabs. This sediment can also support species such as sand eels, which are an important food source for seabirds including puffins, razorbills and guillemots. The protected features are underpinned by the following geological and geomorphological features in this area:

- High energy intertidal rock.
- Intertidal coarse sediment.
- Moderate energy intertidal rock.
- Subtidal mixed sediments.

Further details on the ecological qualifying features of the MCZ supported by the above geological features are provided in Section 2.7.4.1.5.

Figures 2-11(a) and 2-11(b) shows features of designation of the MCZ.

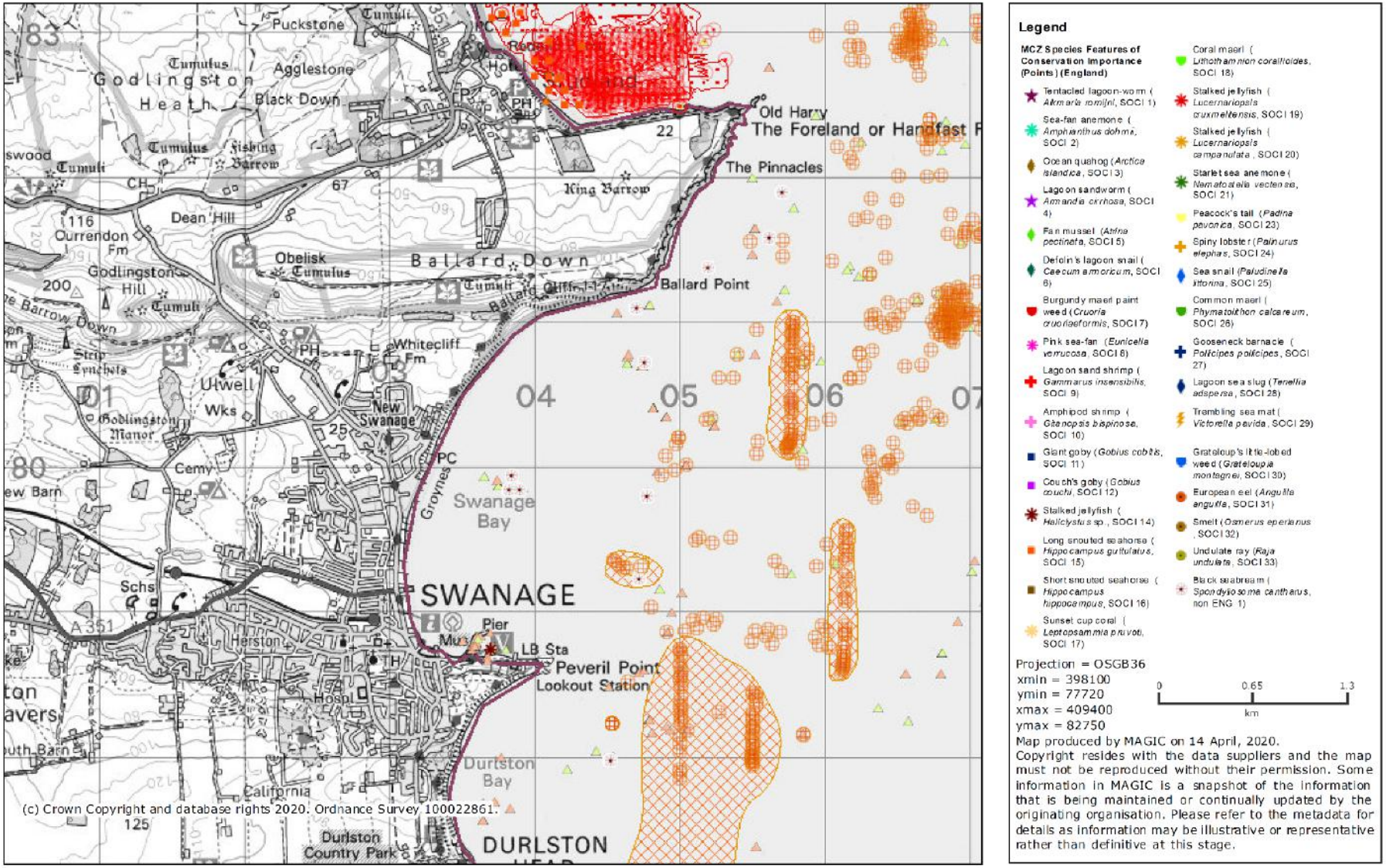


Figure 2-11(a) Screenshot taken from https://magic.defra.gov.uk/MagicMap.aspx on 14th April 2020 showing the extent of MCZ features and sub-features in Swanage Bay.

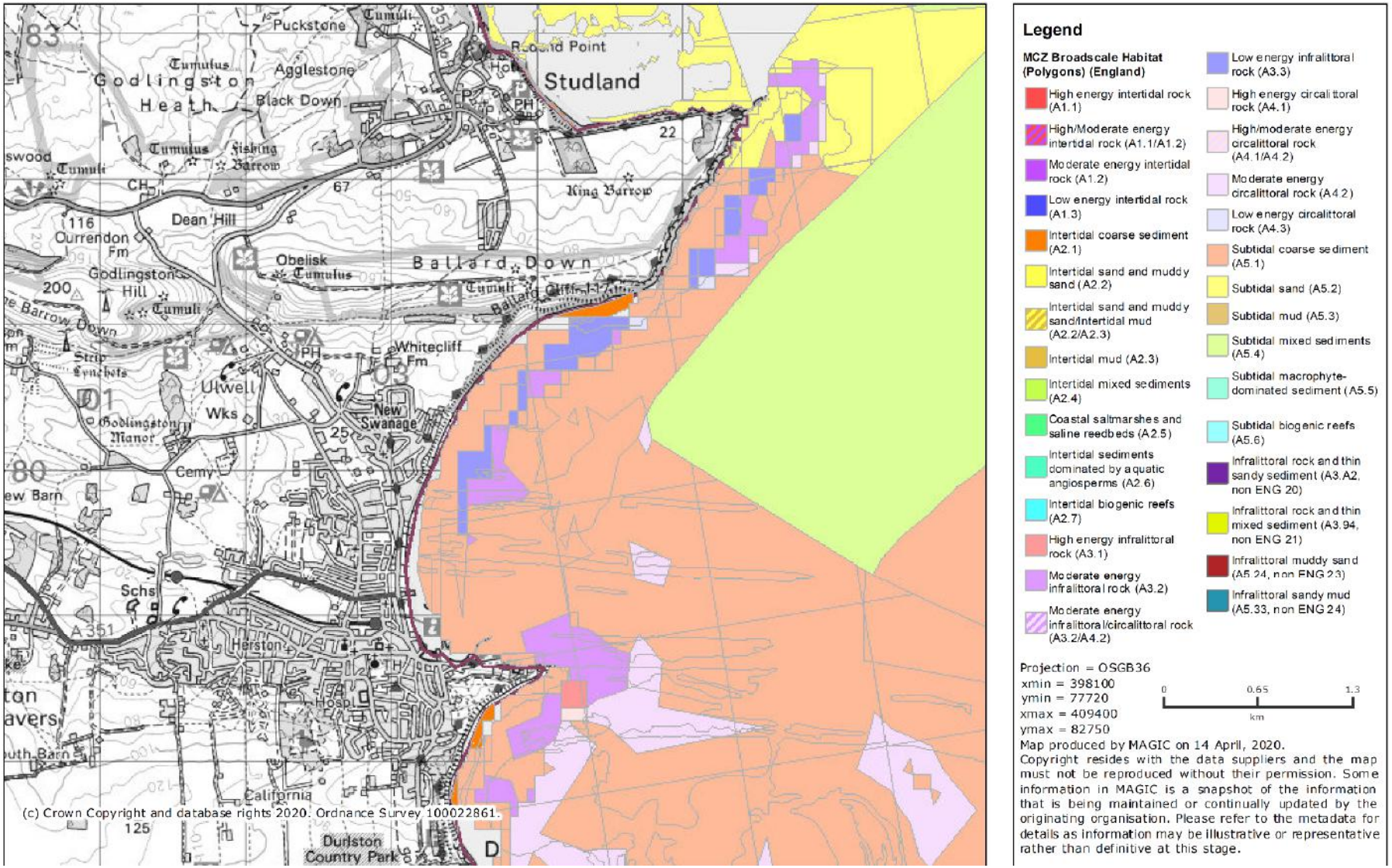


Figure 2-11(b) Screenshot taken from https://magic.defra.gov.uk/MagicMap.aspx on 14th April 2020 showing the extent of MCZ features and sub-features in Swanage Bay.

2.7.1.9 Studland Bay MCZ

Studland Bay MCZ is just to the north of the site area. This site is of particular importance as it is protected from south westerly winds, and the shallow sandy seabed provides the ideal habitat for dense seagrass meadows to form. The protected features are underpinned by the following geological and geomorphological features in this area:

- Intertidal coarse sediment.
- Subtidal sand.

Further details on the ecological qualifying features of the MCZ supported by the above geological features are provided in Section 2.7.4.1.6.

2.7.2 Sediment Quality

CIRIA (2010) identifies that sediment quality data for beach locations is not readily available unless dredge material has been sourced from a location for capital or maintenance dredging.

This is the case for this BMP, where the only sediment data available is that stated in Sections 2.5.1 and 3.1.1, derived at the time of undertaking the beach recharge in 2005/6. No more recent sediment sampling has been undertaken at Swanage.

2.7.3 Water Quality

There are important water quality designations within the BMP area.

2.7.3.1 Water Framework Directive (WFD)

The BMP area is located within the South West River Basin which is managed by the South West River Basin Management Plan (Environment Agency, 2015); see also Section 1.7.4.

The Environment Agency's Catchment Data Explorer was used to assess water bodies present within the BMP area, and includes their ID numbers, designation and classification details (see Table 2-7 below).

Table 2-7 Water bodies present within the BMP area.

Water body code	Name of water body in RBMP	Hydro-morphological designation	Current Status / Potential (Cycle 2) 2016 data	Objective status / potential	Linked Protected Areas
Rivers					
GB108044009920	Swan (Swanage)	River (not designated artificial or heavily modified	Poor	Poor by 2015 (due to unfavourable balance of costs and benefits, retain background condition)	Habitats & Species Directive
Coastal					
GB620705550000	Dorset / Hampshire	Coastal Water (not designated artificial or heavily modified)	Moderate	Good by 2021	Bathing Water Directive, Conservation of Wild Birds Directive, Habitats & Species Directive, Shellfish Directive

2.7.3.1.1 Dorset/Hampshire coastal water body

With regard to the Dorset/Hampshire coastal water body listed in Table 2-7, this water body contains the following features considered to be “higher sensitivity habitats” based on Natural England’s marine evidence database:

- Chalk reef
- Maerl
- Sub-tidal kelp beds
- Subtidal seagrass.

In relation to the BMP area, chalk reef is present mostly in the outer half of Swanage Bay with a small extent nearer to the shore that runs parallel to the shore offshore of New Swanage. Maerl beds are present in a small area on the outer edge of Swanage Bay. Subtidal seagrass is present in Swanage Bay in a small area just offshore of the end of Swanage Pier, with more present out into the wider Poole Bay area according to detailed seabed mapping of features of designation related to this WFD water body, which are shown in Figures 2-11(a) and 2-11(b) above.

This Dorset/Hampshire coastal water body also contains the following features considered to be “lower sensitivity habitats” based on Natural England’s marine evidence database:

- Cobbles, gravel and shingle (intertidal and sub-tidal sediment)
- Inter-tidal soft sediment
- Rocky shore
- Sub-tidal rocky reef

- Sub-tidal soft sediments.

In relation to the BMP area, of the features listed above, cobbles, gravel and shingle are present in most of Swanage Bay, and sub-tidal rocky reef is present in small areas within central and northern parts of Swanage Bay, according to detailed seabed mapping of features of designation related to this WFD water body, which are shown in Figures 2-11(a) and 2-11(b) above.

2.7.3.1.2 Swan (Swanage) river water body

The River Swan passes through the town of Swanage and drains into Swanage Bay near the southern end of the beach. Its condition is rated as Poor with no plan to be able to improve this status identified (see Table 2-7).

Despite the poor water quality rating, Brown Trout are present in the Swan and there is believed to be an associated migratory component (Halcrow, 2005c).

2.7.3.2 Designated Bathing Waters

Along the BMP frontage, the "Swanage Central" location became a designated bathing water in 1988. Water quality monitoring occurs between 1st May and 30th September each year in accordance with the EU Bathing Water Directive 1976 (updated 2006). In 2019, the bathing water was classified as "excellent". Further details are available online at http://environment.data.gov.uk/bwq/profiles/profile.html?site=ukk2204-19800 (date accessed: 3rd March 2020).

The bathing water profile also notes that Swanage is served by a combined surface water and foul water sewerage system that discharges through an outfall 170m east of Peveril Point. This discharge is designed to protect bathing water quality.

2.7.3.3 Designated Shellfish Waters

There are no designated shellfish areas in vicinity of the BMP area.

2.7.4 Ecology

2.7.4.1 Statutory Designated Sites

The following describes the various nature conservation designations and their qualifying ecological interest features are all within or lie in close proximity (within 2km) of the BMP area (see also Figure 1-2 above); details of the geological/geomorphological features of these designations that support these ecological features are provided in Section 2.7.1.

2.7.4.1.1 Purbeck Ridge (East) SSSI

This SSSI extends westwards (inland) for 15km from the cliffs at Ballard Down on the north side of Swanage Bay. The SSSI was extended in parts to include the cliffs between Ulwell Stream Outfall and Shep's Hollow. The SSSI is designated for both geological/geomorphological (see Section 2.7.1.1) and biological interests.

The biological features of the SSSI in Swanage Bay in particular, include a variety of coastal habitats situated on the steep cliff slopes and ledges along Ballard Down which support a range of species. Rare plants found here, include:

- carrot broomrape (*Orobanche maritima*),
- wild cabbage (*Brassica oleracea*), and
- early gentian (*Gentianella anglica*).

The slope provides a range of conditions which suit many invertebrates, including a large number of butterfly species. The site is of national importance for Adonis blue (*Lysandra bellargus*) and supports scare species such as Lulworth Skipper (*Thymelicus acteon*).

2.7.4.1.2 Isle of Portland to Studland Cliffs SAC

Covering the northern part of the shoreline and hinterland, this terrestrial SAC is designated for its internationally important geological interest with rich range of wildlife habitats. There is exposed soft chalk bedrock around Ballard Cliffs (Swanage Bay) in the east and Ringstead Bay in the west, limestone ledges at Worbarrow Bay and shale reefs extend from Kimmeridge. In particular, the qualifying features for which the SAC is designated are:

- **Annual vegetation of drift lines** – Semi-natural dry grasslands and scrubland facies on calcareous substrates occurring both inland and coastal on both chalk and Jurassic limestone. These sites are important for orchids. The site contains extensive species-rich examples of CG4 *Brachypodium pinnatum* grassland in the southern part of its UK range. Smaller areas of CG2 *Festuca ovina – Avenula pratensis* grassland occur on shallow soils on steeper slopes. Transitions from calcareous grassland to both chalk heath and acid grassland are also present. The site has well-developed terricolous and saxicolous lichen and bryophyte communities associated with open turf, chalk rock and pebbles, and flinty soils.
- **Vegetated sea cliffs of the Atlantic and Baltic coasts** – a single unit of cliffed coastline around 40km in length, stretching from Isle of Portland to Studland Cliffs. The cliffs are formed of hard limestones, with chalk at the eastern end and slumped sections of soft cliff of sand and clays spread throughout. These cliffs support species rich calcareous grassland with species that are rare in the UK such as:
    - wild cabbage (*Brassica oleracea*),
    - early spider orchid (*Ophrys sphegodes*), and
    - Nottingham catchfly (*Silene nutans*).

The Portland peninsula extends 8km south of the mainland, and clearly shows the contrast between exposed western and southern coasts. Sheer rock faces and sparse maritime vegetation is evident on the southern and western coast, contrasting with the sheltered eastern side, where sloping cliffs support scrub communities and wood spurge *Euphorbia amygdaloides* grows in grassland.

As with the Purbeck Ridge (East) SSSI designation (see Section 2.7.1.1), the species that is a primary reason for designation of the SAC is early Gentian, *Gentianella anglica.*

Within this SAC, data was collected to inform The Seabird 2000 dataset – a full census of all breeding seabirds in Britain and Ireland. This enabled baseline figures for those species that were until then, poorly recorded. Further information can be found here: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UK0030382&HasCA=1&NumMarineSeasonality=0&SiteNameDisplay=Studland%20to%20Portland%20SAC (date accessed: 3rd March 2020).

2.7.4.1.3 Studland to Portland Marine SAC

Covering the entirety of the seabed of Swanage Bay up to MHW, this marine SAC was designated on 27th September 2017. The primary reason for selection of this site is reef habitats (see also Section 2.7.1.7). These reefs are in various forms and exhibit a large amount of biological diversity. The site is split into two portions:

- the Studland Bay to Ringstead Bay Reef, and

- the Portland Reefs.

Features of interest in these two areas is provided in the following:

- **Studland Bay to Ringstead Bay Reef**

  Features of particular interest within the Studland Bay to Ringstead Bay area, which encompasses Swanage Bay, include a series of limestone ledges (up to 15m across) protruding from shelly gravel at Worbarrow Bay, which support a rich sponge and sea fan community, and dense brittle star beds (*Ophiothrix fragilis*)) on shale reefs extending from Kimmeridge.

  The chalk bedrock occurring between Ballard Cliffs and Handfast Point is encrusted with red algae (*Calliblepharis ciliata* dominant), *Saccorhiza polyschides* and *Dictyota dichotoma.* Overhangs provide shelter for a variety of fauna including the sponges *Dysidea fragilis*, *Esperiopsis fucorum*, *Dercitus bucklandii* and *Hemimycale columella*, the fanworm *Bispira volutacornis*, deadmans fingers (*Alcyonium digitatum*), crabs and squat lobsters (*Galathea sp.*).

  Within the outer limits of Swanage Bay lies a feature known as Evans Rock, which is a gently sloping mound rising to 9m with a flattish top, covered with small, slab-like boulders and cobbles, and separated by small areas of shelly sand. This feature supports a diverse cover of sponges (*Esperiopsis fucorum*, *Hemimycale columella*, *Dysidea fragilis*, *Tethya aurantium*), hydroids (*Nemertesia* sp, *Plumularia setacea, Aglaophenia* sp.), bryozoans and tunicates (*Aplidium* sp*., Lissoclinum perforatum*). The fanworm, *Bispira volutacornis* is abundant here, as is the cowrie, *Trivia artica.* The boring phase of the sponge, *Cliona celata*, has been recorded here along with a patch of the horseshoe worm, *Phoronis* sp. Three species of crevice dwelling sea-cucumber have also been recorded. Mussel beds *Mytlius edulis* also occur off Swanage.

  A unique reef feature, known as St Albans ledge, extends out over 10km offshore and is subject to strong tidal action, with an area of large limestone blocks known as the “seabed caves”. A wide variety of species typical of both cold and warm-water environments, such as *Alcyonium glomeratum* and *Holothuria forskali*, are also evident within this SAC. Stony reef occurs in both reef portions, with pink sea fans and ross coral present. The ross coral *Pentapora foliacea* also commonly occurs on circa-littoral rock throughout the site along with hydroids and sponges.

  The SAC Selection Assessment states that there are some records of damage / degradation to the areas of reef sub-features associated with the Ross worm (*Sabellaria spinulosa*) features off Swanage. However, despite these structural concerns with some of the sub-features an overall assessment of the structure of Annex I habitat within this area for all features suggests that it is in excellent condition.

  Seagrass (*Zostera marina*) also occurs within Swanage Bay, but as this is not found within the sandbank habitat features, seagrass is not considered to be representative Annex I habitat. Seagrass beds are:

  - Priority Habitat under UK Post-2010 Biodiversity Framework.
  - OSPAR List of Threatened and/or Declining Species and Habitats.

- **Portland Reefs**

  The Portland Reefs are characterised by flat bedrock, limestone ledges (Portland stone), and stony reef with large boulders and cobbles. The reefs are divided into three sub-features: infrallitoral rock, circalittoral rock, and subtidal stony reef. On the western side of Portland Bill, rugged limestone boulders provide deep gullies and overhangs.

Mussel beds (*Mytilus edulis*) are found to occur in very high densities on bedrock associated with strong currents to the southeast of Portland Bill. These are largely focussed in bands that extend west-east within the central part of Swanage Bay offshore of the managed beach section. Pink sea fan (*Eunicella verrucosa),* has been recorded within the SAC, but these are more highly concentrated near Warbarrow Bay. This provides an important habitat for two associated notable species; the sea slug *Tritonia nilsodhneri* and nationally rare sea fan anemone *Amphianthus dohrnii*. High energy infralitorial rock can be found south of Portland Bill, with an area dominated by kelp. Two species of cup corals have been recorded on large boulders off Portland Bill: *Caryophyllia inornata, and Caryophillia smithii*.

Also to note within this SAC, there is a Wild Bird General Restriction Zone, this means that trapping is not permitted under certain General Licenses for wild birds (see www.magic.gov.uk for more information).

2.7.4.1.4 St Albans Head to Durlston Head SAC

St Albans Head to Durlston Head SAC is more than 2km from the BMP area. It is highly unlikely that the works will affect this designated area, but it is important to note the primary reasons for selection of this site as follows:

- **Vegetated sea cliffs of the Atlantic and Baltic coasts** (see Section 2.7.4.1.2 above for details)
- **Semi-natural dry grasslands and scrubland** facies on calcareous substrates occurs both inland and coastal on both chalk and Jurassic limestone. These sites are important for orchids. The site contains extensive species-rich examples of CG4 *Brachypodium pinnatum* grassland in the southern part of its UK range. Smaller areas of CG2 *Festuca ovina – Avenula pratensis* grassland occur on shallow soils on steeper slopes. Transitions from calcareous grassland to both chalk heath and acid grassland are also present. The site has well-developed terricolous and saxicolous lichen and bryophyte communities associated with open turf, chalk rock and pebbles, and flinty soils.

  The qualifying species for designation of the SAC is Greater horseshoe bat *Rhinolophus ferrumequinum,* and species that are a primary reason is early Gentian, *Gentianella anglica.*

2.7.4.1.5 Purbeck Coast MCZ

This area was designated as an MCZ in May 2019 and stretches from Ringstead Bay to Swanage. It also covers an area of seabed that ranges from 36-52 metres deep. The site overlaps with the eastern section of the Studland to Portland SAC (see Section 2.7.4.1.2).

This MCZ contains features and sea caves which are an important nursery ground for sea bass, and flat fish, and also a home for rare sponges, edible crabs and velvet swimming crabs. This sediment can also support species such as sand eels, which are an important food source for seabirds including puffins, razorbills and guillemots. The protected features and general management approach of this MCZ are described below and summarised in Table 2-8.

Table 2-8 Features of the Purbeck Coast MCZ.

Protected features	General management approach
High energy intertidal rock	Maintain in favourable condition
Intertidal coarse sediment	
Moderate energy intertidal rock	
Peacock's tail (*Padina pavonica*)	
Stalked jellyfish (*Haliclystus* species) Subtidal coarse sediment	
Subtidal mixed sediments	
Black seabream (*Spondyliosoma cantharus*) (nesting)	Recover to a favourable condition
Maerl beds	

With regard the features listed in Table 2-8, the following provides additional details about each:

- **High energy intertidal rock** areas are characterised by exposure to strong waves that wash away any sand and mud, leaving only bedrock boulders. Typically, limpets, mussels and barnacles are found here, with opportunistic seaweeds that grow in cracks and crevices.
- **Intertidal coarse sediment** areas are characterised by coarse shores, consisting of small rocks, pebbles, and gravel, occasionally mixed with coarse sand. A more volatile habitat to live in, but in the spaces between the shingle and gravel, shrimp-like creatures can live.
- **Moderate energy intertidal rock** habitats are not exposed to the full force of the waves and tides, but the energy provided by those tides prevents much sand or mud accumulating. Animals can find shelter from the waves in rock pools, landward side of boulders and in cracks and crevices. Barnacles, blue mussels, limpets, whelks and periwinkles are all common on shores such as this. Red seaweeds are found on the lower shore.
- **Subtidal mixed sediments** are characterised by mixed seabeds, are varied, and can therefore provide home to a wide range of animals, both on and in the sediment. Worms, bivalves, starfish, urchins, anemones, sea fires and sea mats make their home here.

  Purbeck District Council (now Dorset Council) carried out a marine benthic ecological assessment for the previous recharge scheme in 2005 and compared this with an earlier benthic study conducted in 1996. Large boulders were recorded at Evans Rock and coarse sands noted south of Ballard Point. Heterogenous seabed comprising of bedrock, boulders and cobbles interspersed with patches of sand, gravel, silty gravel and sand covered clay was identified near Tanville Ledge.
- **Peacocks tail** has been recorded along the south coast of England including the Isle of Wight, Pembroke and south coast of Ireland. *Padina pavonica* reaches the northern limit of its range in the British Isles. This species was included within the UK BAP Priority Species which has now been succeeded by the UK Post-2010 Biodiversity Framework (see Section 2.7.4.2.1). Although now superseded, it is important to recognise that the UK BAP Priority Species list is still used as a reference point to draw up statutory list of priority species in the UK.

- *Haliclystus* is a type of **stalked jellyfish**, recorded around many parts of the UK coast. This species was included within the UK BAP Priority Species. *Haliclystus* was originally listed due to a decrease in population visually recorded since the 1970's.

- **Black seabream** are found off the coast of south-west Britain and east Ireland in the English Channel and the Irish Sea respectively. They spawn in April to July, nesting in specific habitats characterised by smooth bedrock with a veneer of sediment in shallow water. Their nests are typically around 1-2m in length, and 10cm deep. Males remain at the nest site guarding the nests until the eggs hatch, and they return to the same site to nest each year. High numbers of nesting black seabream are found within the boundary of the site. Their nesting behaviour means they are a more vulnerable species than other fin fish around British waters, especially to fishing activity or dredging activities which could smother the nests.

  Feedback from a local diver has shown that the previous Swanage sediment recharge in 2005 resulted in more sediment settling on the sea floor than had been predicted. In particular around 30-40cm was observed on Tanville Ledge the following spring. Bream managed to nest successfully the following spring, but it is unknown whether these were in the numbers that previously managed to nest, and whether these nests were as successful as prior to the recharge scheme.

  A pilot study was conducted in 2017 to determine the effect of pile driving noise on black bream nests in the Tanville Ledge area (University of Exeter, 2017). This study was not published, but the results showed no observable effect on male defensive posturing, although males decreased their time fanning their nests, which in turn could have a negative impact on reproductive success. There were many variables to the project, but it is important to note that any works could have a negative impact on black bream especially during nesting season.

- **Maerl beds** allow water to flow through the bed, and oxygenated water to penetrate at depths, which means species can colonise the seabed at deeper depths than in other sediments. All maerl forming species are slow growing, (they rarely produce reproductive spores), and therefore very sensitive to any change to their habitat. Maerl beds support diverse communities of burrowing infauna, especially bivalves, and interstitial invertebrates including polychaetes and echinoderms. The current evidence on recovery of maerl beds states that if maerl is removed, fragmented or killed, it has almost no ability to recover. Resilience of maerl beds is therefore assessed as 'very low'. If the maerl is killed, but dead maerl remains, then the resident community could recover within 2-10 years, however if the maerl is fragmented, species richness will probably decrease. For some species, (*Mya truncata, Dosinia exoleta*), it can take 20-50 years for recovery (https://www.marlin.ac.uk/habitats/detail/255/maerl_beds; date accessed: 3rd March 2020). Also associated with the maerl beds in Swanage, records of *Ampelisca* mats have been recorded over a number of years, (https://nbnatlas.org/).

- It is also important to note that although not a feature of the MCZ, **undulate rays** (*Raja undulata*) are present in Swanage. They are listed as Endangered by the IUCN Red List, and a Priority Species. The rays in Swanage have been recorded by local divers, and reported through the Undulate Ray Project. 151 individuals have been photo identified in this area. The Undulate Ray Project has no record of any rays making significant movements around the coast, suggesting that these undulate rays show a high level of site fidelity.

- **Marine mammals** such as grey seals (*Halichoerus grypus*), and bottlenose dolphins (*Tursiops truncatus*) frequent the area. The bottlenose dolphin is semi-resident. Sightings are recorded through the Durlston Marine Project (https://www.durlston.co.uk/wildlife-and-marine-marine-latest-sightings.aspx; date

accessed: 3rd March 2020). Purbeck District Council (2005) details other marine mammals that frequent the area such as Harbour porpoise (*Phocena phocena*), Common dolphin (*Delphinus delphis*), Pilot whale (*Globicephala melaene*) and Killer whales (*Orcinus orca*).

2.7.4.1.6 Studland Bay MCZ

Studland Bay MCZ is just to the north of the site area. This site is of particular importance as it is protected from south westerly winds, and the shallow sandy seabed provides the ideal habitat for dense seagrass meadows to form. These seagrasses provide cover for a variety of fish and invertebrates, but also for seahorses. Two species are known to breed here, and Studland Bay is the only place in the UK where long-snouted seahorses breed.

Protected features are summarised in Table 2-9.

Table 2-9 Features of the Studland Bay MCZ.

Protected features	General management approach
Intertidal coarse sediment	Maintain in favourable condition
Long-snouted seahorse (*Hippocampus guttulatus*)	
Subtidal sand	
Seagrass beds	Recover to a favourable condition

Further information can be found here: https://www.gov.uk/government/publications/marine-conservation-zones-studland-bay (date accessed: 3rd March 2020).

2.7.4.1.7 Solent and Dorset Coast SPA

In January 2020, Swanage Bay was designated as part of a SPA that extends from west of Worbarrow Bay to east of Selsey Bill, for the following breeding seabirds that are found in this extent:

- Common tern,
- Sandwich tern, and
- Little tern.

The area is designated as much of the sea around these birds' breeding colonies is the ideal habitat for plunge diving for food. The terns use this area for foraging during April – September. The designation of this SPA will mean that the birds will have protection in the sub-tidal areas, not currently encompassed within existing SPA's, with its landward boundary at MLW, abutting any existing SPA where terns are already a feature. More information about this SPA can be found at https://www.gov.uk/government/consultations/solent-and-dorset-coast-potential-special-protection-area-comment-on-proposals (date accessed: 3rd March 2020).

More information on breeding seabirds can be found in the Swanage Beach Recharge Scheme Final Environmental Statement (Halcrow, 2005c).

2.7.4.2 Non-Statutory Designated Sites

2.7.4.2.1 Biodiversity Action Plan (BAP) Habitats

The Dorset Biodiversity Strategy (Dorset Biodiversity Partnership, 2003) and Action for Biodiversity in the South West (South West Regional Biodiversity Partnership, 2004) are the relevant biodiversity plans for the study area. There is currently no local Biodiversity

Action Plan (BAP). The Dorset Biodiversity Strategy highlights the following habitats found within Swanage as priority marine habitats.

- *Sabellaria spinulosa* comprise dense subtidal aggregations of this small, tube-building polychaete worm that can act to stabilise cobble, pebble and gravel habitats, providing a consolidated habitat for epibenthic species. They are solid, albeit fragile, structures at least several centimetres thick, raised above the surrounding seabed, and persisting for many years. As such they provide a biogenic habitat that allows many species to become established. Significant *Sabellaria spinulosa* reefs have been recorded 4km east of Swanage pier. These reefs found off Swanage are up to 30cm high and 60cm wide (as on photograph on MARLIN's website: https://www.marlin.ac.uk/habitats/detail/377/sabellaria_spinulosa_on_stable_circalittoral_mixed_sediment (date accessed: 3rd March 2020).
- Seagrass *(Zostera marina)* is one of the few flowering plants (angiosperm) adapted to living fully submerged in marine conditions. Seagrass beds develop in fairly sheltered intertidal and shallow subtidal areas on sand and muds. Extensive beds may form which stabilise the substratum and provide attachment for associated species. Three species of Zostera occur in the UK, with *Zostera marina* predominating in the sublittoral zone. The shelter provided by seagrass beds makes them more important nursery areas for fish, and they also provide a food source for wildfowl. Seagrass beds are also commonly referred to as Zostera or eelgrass beds. Seagrass beds are found at the southern end of Swanage Bay in the vicinity of Swanage Pier (see Section 2.7.3.1.1).
- *Maerl* beds. Maerl is a collective term for certain coralline red algae that grow unattached on a clean, tidally swept seabed, and may accumulate to form maerl beds. Maerl is slow growing, but over long periods its dead calcareous skeleton can accumulate into deep deposits (an important habitat in its own right), overlain by a thin layer of pink, living maerl. Maerl beds have considerable conservation value because they support a rich associated fauna. The coralline algae Phymatolithon calcareum, and Lithothamnion coralloides form an important maerl bed off Handfast Point. This is the most easterly known location in the English Channel. They are a fragile habitat, easily damaged by human activity

The Dorset Biodiversity Strategy states that the conservation objectives for the above priority marine habitats are:

- Maintain the extent and quality of marine priority habitats.
- Assess feasibility of restoration of damaged habitats.
- Improve understanding by promoting research and survey.
- Promote awareness amongst public, especially divers.

These objectives should be considered when planning and implementing beach management works along the BMP frontage.

In addition to the above, it should be noted that the man-made structure of Swanage Pier supports rich assemblages of encrusting marine life including the Tompot blenny, noted of being of particular nature conservation importance. Handfast Point with its rocky intertidal communities supports hydroids and sponges. Peveril Point is also the eastern most extent of the brown seaweed *Himanthalia elongata* (thong weed) in the English Channel.

The Durlston Marine Research Area is also situated from Durlston Head to Studland within which marine monitoring takes place and is one of the best places in the country to see dolphins.

2.7.4.2.2 Peveril Point to Durlston Head European Important Plant Area for marine algae

The Important Plant Area (IPA) concept, a mechanism for identifying the most important plant areas in the world, has been applied to the UK marine algae (seaweeds) and freshwater algae (excluding stoneworts) in order to determine which sites to propose as the first list of UK algal sites with IPA designation (European IPAs). Peveril Point to Durlston Head was considered a 'diversity hotspot' with many nationally rare species and having a long history of algal study. Swanage is the type locality for *Acrochaetium trifilum* (Buffham) Batters. Further information can be found here: https://www.plantlife.org.uk/application/files/4814/8233/1532/IPA_Algae_Report_.pdf (date accessed: 3rd March 2020).

2.7.5 Fisheries

The fishing industry in Purbeck is relatively small, with no more than 10 commercial fishing vessels based in Swanage. Poole Harbour provides sheltered landing and marketing facilities for boats from Swanage when the weather is inclement. The Southern Inshore Fisheries & Conservation Authority (IFCA) limits the maximum size of a commercial fishing vessel to 12m within its district's boundaries, so the fleet is made up of 'day boats' that are not required to have Vessel Monitoring Systems (VMS).

Working from Swanage there are approximately four full time crab and lobster potting boats and an additional four or more part time boats that net for finfish or pot for crabs and lobsters. The sea going capabilities of the smaller boats are limited. These vessels are generally confined to Swanage Bay and the nearby area, whilst the larger vessels are able to fish the grounds off of St. Albans Head and further afield.

2.7.6 Navigation

There is a small fishing community which could be affected by recharge operations, but these effects will be mitigated through consultation with stakeholders. Swanage Pier is also used regularly by smaller vessels, including dive boats and pleasure boats for launching and temporary mooring.

A Local Notification to mariners which highlights the work operations when they occur may be needed, which would identify any navigation hazards.

2.7.7 Landscape Setting

The BMP area is directly within the Swanage Conservation Area (see Section 2.7.8.1.3), whilst within 2 to 5km of the BMP area is the following landscape designated areas:

1. Dorset Area of Outstanding Natural Beauty (AONB)
2. Purbeck Heritage Coast.

The extent of these landscape designations in respect of the BMP area are shown in Figures 1-2 and 1-3 above.

Future coastal flood and erosion risk management activities will have to consider the landscape impacts on these designations.

In addition, the Dorset and East Devon Coast UNESCO World Heritage Site (WHS) is within 2km of the study area. The WHS Management Plan 2014 to 2019 refers to the 'immediate setting of the WHS' and 'important views and other areas of attributes that make the site what it is'. The WHS Management Plan refers to the need to protect this setting and highlights that the 'Outstanding Universal Value as a cultural phenomenon that means our experience of the Site and its setting is part of this equation, and it is not just

protection for the intrinsic value of the geology'. As such, future coastal flood and erosion risk management activities will also need to consider impacts on setting of the WHS (see also Section 1.7.8 and 2.7.1.5).

2.7.7.1 Contaminated Land

Potentially contaminated land sites in the Swanage area include a former gas sewage works at Swanage (1860), which is located inland close to Prospect Farm and King George's Field, and a former sewage works (1927), by the coast, at the northern end of the town. There is also one existing landfill site within the study area on Panorama Road, Swanage, which is licensed by the Environment Agency (Halcrow, 2005c).

None of these sites are at risk of coastal erosion or flooding along the BMP frontage.

2.7.7.2 Agriculture Land Use

The majority of the agricultural land around Swanage is a permanent pasture, principally grazed by horses, cattle and sheep. High grade (Grade 1-3a) agricultural land being of Grade 3 or 4 is scarce in the Purbeck area (Halcrow, 2005c).

No agriculture land is protected by the Swanage BMP scheme between the Mowlem and Shep's Hollow.

2.7.8 Archaeology and Cultural Heritage

2.7.8.1 Designated Sites

2.7.8.1.1 Scheduled Monuments

On the north side of Swanage Bay there are a number of barrows that are designated. These are located atop the undefended, naturally eroding Ballard Down. One site is a lock-up in Swanage town itself. Figure 1-3 above shows the location of these features.

In addition, Corfe Castle (also a listed building) is an important landscape and tourist feature, and lies on the main access route to Swanage (A351).

2.7.8.1.2 Listed Buildings

There are many listed buildings within Swanage town (see Figure 1-3 above). This includes the area of quay/seawall that extends eastwards from The Square, between The Mowlem and the stone jetty. The exact citation for the designated feature describes this section as being *"The stone quay and stone sea retaining wall between the stone quay and ramp adjoining."*

2.7.8.1.3 Conservation Area

Swanage is a conservation area, and is listed on the Historic England 'At risk register' (https://historicengland.org.uk/advice/heritage-at-risk/search-register/list-entry/3272 (date accessed: 24th February 2020).

As per the Draft Purbeck Local Plan (see Section 1.7.3.2) development should respond to local character and history, whilst preserving neighbouring amenity.

2.7.8.1.4 National Trails

The South West Coast Path extends around Swanage Bay, running along much of the seafront at Swanage.

In addition to this, the new English Coast Path national trail is due to be opened around Swanage Bay in 2020. This will largely follow the same route as the South West Coast Path in this area. Further information can be found here:

https://www.gov.uk/government/collections/england-coast-path-improving-public-access-to-the-coast (date accessed: 24th February 2020).

Both trails are shown in Figure 1-3 above.

2.7.8.2 Non-designated Sites

There are numerous non-designated sites/monuments recorded in the Dorset Historic Environment Record (HER), both on land and in the nearshore area of Swanage Bay. These are sites of archaeological interest but do not hold a formal designation. Further information can be accessed via the online Heritage Gateway database at https://www.heritagegateway.org.uk/gateway/advanced_search.aspx (date accessed: 24th February 2020).

There are no reported Protected Wrecks in the vicinity of the study area. However, non-designated wrecks of two historic sailing vessels have been recorded near to the centre of Swanage Bay, approximately 300m offshore. One wreck lies just off Ballard Point, and a number of wrecks lie off Peveril Point. None of the above are Scheduled Wrecks (Halcrow, 2005c).

2.7.8.3 Unexploded Ordnance

Swanage beach was mined during World War II for defensive purposes and there is a low risk that unexploded ordnance remain at the site (Halcrow, 2005c).

2.7.9 Air Quality

The environmental statement prepared to support the 2005 Swanage Beach Recharge Scheme stated that air quality in Purbeck has been regularly assessed against the National Air Quality Standards and there have been no occasions when these reviews have identified that the objectives contained within the standards are being exceeded (Halcrow, 2005c)

The potential impacts of the future coastal flood and erosion risk management activities upon air quality relating to vehicle emissions are expected to be short term during the construction phase(s). These could include increased emissions due to traffic delays or traffic on diversion routes and construction vehicle movements. In addition to vehicle emissions, there is potential for dust emissions generated during construction activity. Potential impacts on air quality will need to be addressed through construction and method statements associated with any future works.

2.7.10 Noise

With regards to potential noise pollution from the proposed works, the impact this will have on marine mammals, including bottlenose dolphins, will have to be reviewed, as it is illegal to harm a dolphin under Countryside and Rights of Way Act (2000), and Wild Mammals (Protection) Act (1996).

No baseline data on existing background noise level has been sourced for this BMP. This may be required prior to any management activities depending on their scale and scope to produce elevated levels of noise.

3 Scheme Design

3.1 Scheme description

The present-day coastal defences along the study frontage are comprised of the following elements:

- Beach;
- Timber groynes;
- Seawall and promenade; and
- Slope stabilisation measures.

The following Sections 3.1.1 to 3.1.4 provides a brief description of each of these elements along the BMP frontage, including the most recent elements that were constructed in 2005/6 as part of the Swanage Beach Recharge Scheme.

3.1.1 Beach

The 2005/6 Swanage Beach Recharge Scheme involved placement of between 90,000m^3 to 130,000m^3 of sediment along the central part of Swanage Bay, supported by the construction of new timber groynes (see Section 3.1.2). This beach recharge campaign was undertaken by Van Oord and involved 76 loads of sediment delivered to site between 22nd November and 9th December 2005.

The sediment placed was derived from dredging of Poole Harbour Swash Channel for navigation purposes, so provided a beneficial use of the dredged material. The current BMP (Halcrow, 2005a) indicates that the sediment grading of this material from the Swash Channel is sand with a D_{50} value of about 0.2mm, and with very little shingle content. This provided a sediment grading that was similar to the pre-recharge beach based on sediment sampling undertaken along Swanage Bay in 1998, and the recharge material placed is represented by the lower limit of the grading envelope shown on Figure 3-1, that was identified by a sediment grab sampling investigation of the Swash Channel in May 2002 (Halcrow, 2005a).

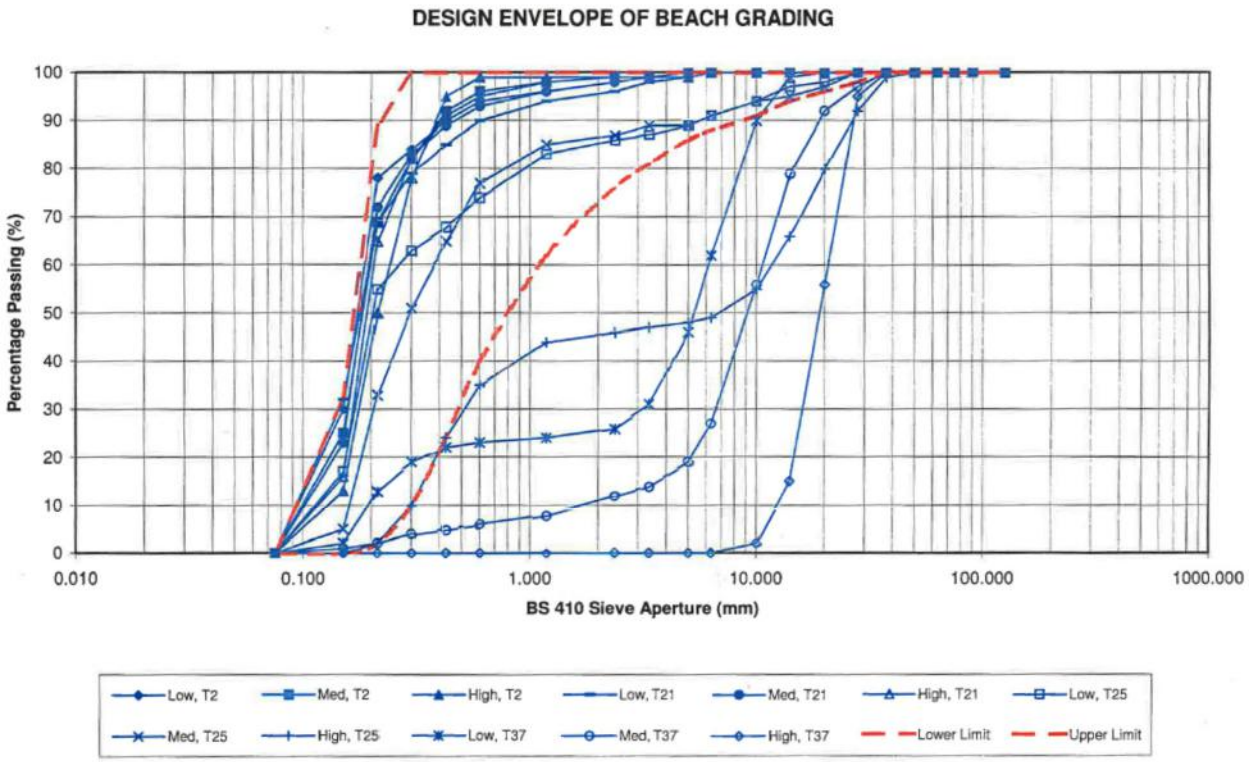


Figure 3-1 Sediment grading design envelope (red lines) in context of sediment samples taken along the Swanage Bay shoreline in 1998 that show the pre-recharged beach sediment grading (blue lines; Note, locations T2 and T21 are along the section that was eventually recharged in 2005) (from Halcrow, 2005a).

Sediment was pumped ashore via a 750m long pipeline with 700mm diameter laid across Swanage Bay from a vessel moored offshore in Swanage Bay, and then using bulldozers to provide the design beach profile (see Figure 3-2). The pipeline used was assembled in Newhaven Harbour in Sussex and towed to Swanage. In the interests of health and safety it was necessary to close short sections of the beach when the sand was pumped ashore and being moved by heavy plant. The promenade remained open at all times (https://poolebay.net/past-projects/beach-replenishment-2005-2007-phase-one/; date accessed: 3rd March 2020).

Figure 3-2 Photos of beach recharge underway in 2005/6 (from Goater, 2014).

To pump the sediment ashore, it was mixed with water. Initially the pumped sand appeared to be darker than that forming the current beach, but very soon lightened to a normal colour with exposure to oxygen and daylight. In the first few weeks small ledges or cliffs were cut into the front of the beach by wave action as it sorted the new material, but

these soon disappeared as the sand was moved by wind and waves into a natural beach profile; see Figure 3-3 (https://poolebay.net/past-projects/beach-replenishment-2005-2007-phase-one/; date accessed: 3rd March 2020).

Figure 3-3 Small cliffs cut into the front of the newly recharged beach in 2006 (from Royal Geographical Society, 2007).

The 2005 Swanage BMP (Halcrow, 2005a) was prepared as part of the scheme and guides future maintenance to ensure the constructed design standard of 1:300 years is provided over the 50-year scheme life. The design standard is achieved by providing a beach profile with a 1:20 slope to a minimum beach crest level against the backing seawall of +1.2mODN (see Figure 3-4). During construction in 2005, the as-built drawings in the Health & Safety file (Halcrow, 2006) show the installed beach crest level against the seawall as being approximately 0.53m above this minimum level at +1.73mOD; this was to allow for loss of sediment due to longshore transport over the life of the scheme. For context, prior to the beach recharge in 2005, the beach level against the seawall was typically about +0.5mOD (see Figure 3-5).

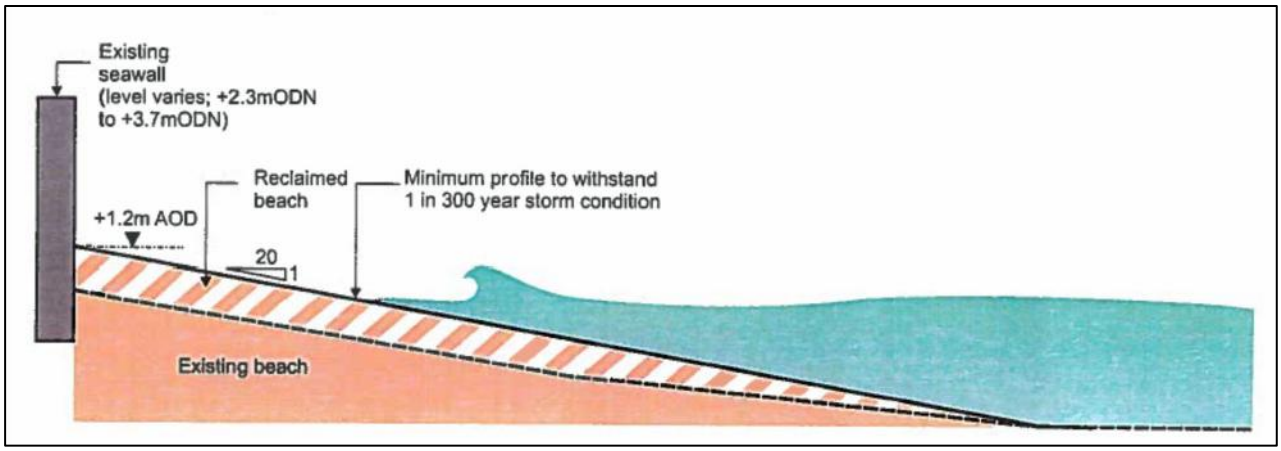


Figure 3-4 Schematic representation of minimum design beach profile required to provide 1:300 year standard of protection (from Halcrow, 2005a).

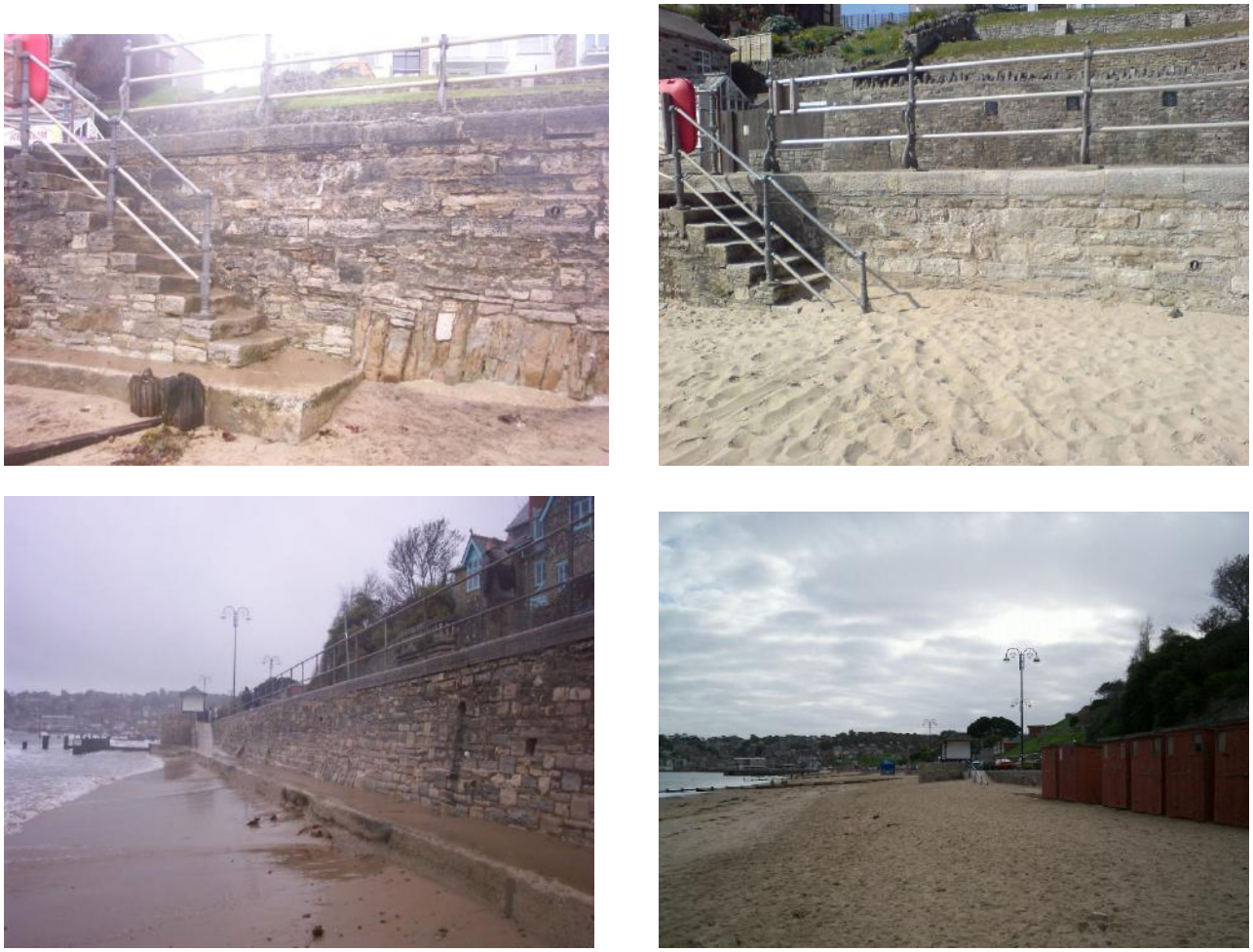


Figure 3-5 Photos showing two sections of the BMP frontage before and after beach recharge in 2005/6 (from Royal Geographical Society, 2007).

As part of the scheme design, it was assumed that the level of the beach will need to be increased to account for sea level rise in order to sustain the design standard of protection, and this will require additional beach recharges over the 50-year scheme design life. The BMP (Halcrow, 2005a) estimates a further beach recharge of around 40,000m^3 would be needed after 20 years – so in about year 2026 – to support this objective. A further recharge in about year 2046 may also be required, but possibly a large volume to account for increased sea levels.

Section 2.6.2 presents a review of all monitoring data collated since the 2005 beach recharge has been undertaken as part of the 2020 Swanage BMP update. This shows that

the trend along the recharged beach area is one of gradual loss of beach volume; when this trend is extrapolated, it is predicted that the minimum beach volume required to provide the 2005 scheme design standard of protection will be reached between 2023 and 2025, meaning further beach recharge will be needed in this time-frame, so broadly in line with the original scheme design assumption (see also Sections 1.4.1 and 2.6.4).

3.1.2 Timber groynes

The 2005/6 Swanage Beach Recharge Scheme also involved the construction of 18 new, 40m long timber groynes to replace the 19 constructed in the 1920s and 1960s. The old groynes were removed from along the length of the frontage extending north from the Mowlem Theatre, whilst the new groynes were constructed along the section north of the Banjo Pier only to Shep's Hollow. As-built drawings for the timber groynes as provided in Appendix H. The location and numbering of the timber groynes constructed in 2005/6 is shown in Figure 3-12 below.

The contractor, Dean & Dyball, used land-based plant including piling rigs and dump trucks to remove the old groynes, which also included removal of the old sheet-pile groyne ends for safety reasons (Halcrow, 2005a). It should be noted that on the "as built" drawings (General Arrangement Sheet 1 of 2) provided in Appendix H, that approximately 7m of the landward end of old timber groyne number 1 was left remaining in the beach between the Banjo Pier and the Mowlem; all other parts of the old groynes were removed (Halcrow, 2006).

The new groynes were constructed in early 2006 (following beach recharge) using hardwood Greenheart timber and land-based plant. Each groyne is approximately 40m long and tied into the seawall or cliff line as appropriate. Timber piles of dimensions 300mm x 300mm x 7800mm were then driven into the underlying clay bed layer at 2m intervals. 75mm x 225mm x 6000mm (typical length) planks were then installed so they butted together to form a tight seal with no gaps, with the bottom planks dug into the clay bed layer to form a seal. A waling beam was then added to the top of the piles. Towards the landward end of each groyne, there is a gap in the waling beam present in order to provide a 4m wide gap for access along the beach for beach users as well as maintenance plant (see Figure 3-6). All details are shown for each groyne in the As Built drawings provided in Appendix H.

Figure 3-6 Photos showing 4m gap in the waling beam towards the landward end of each timber groyne, so allow access along the beach.

Ongoing maintenance works to the timber groynes is guided by the regular inspection of the structures (see also Section 4.2).

Timber groynes typically only have a relatively short design life (compared to rock groynes) and need to be replaced periodically to ensure they continue to be effective in delivering the shoreline/beach control function they are designed to do. Anticipating this need, the scheme design in 2005 includes the expectation that the timber groynes along the Swanage frontage will need to be replaced once during the 50-year design life of the scheme, after about 35 years (Halcrow, 2006). Section 3.2 provides assessment of the current condition and residual life of these structures based on new inspection completed as part of preparing this report.

3.1.3 Seawall and promenade

In response to concerns over the loss of sand from the beach by the action of the sea in the late 19th century, construction of a seawall between the Mowlem and the Ulwell Stream outfall commenced in 1904. This wall was pushed seawards as part of widening Shore Road in the early 1920s, and is the wall currently seen along this section of the BMP frontage. It is likely that the highly reflective vertical seawall would have resulted in an increased loss of beach at the toe of the structure, and is therefore why a timber groyne field was constructed between 1929 and 1931 along this section, in an effort to maintain beach levels (Halcrow, 2000); see also Section 3.1.2.

This seawall has a varying toe level between the Outfall Jetty and the Ulwell Stream outfall. In the main, toe levels range from between +0.3mOD and -0.2mOD, except in localised sections where some underpinning has been carried out, deepening the toe level to between -0.6mOD and -1.95mOD (Halcrow, 2005b). Figure 3-7 illustrates where the toe levels vary along this section of the frontage. Figure 3-8 shows the seawall construction when beach levels were low prior to the 2005 beach recharge.

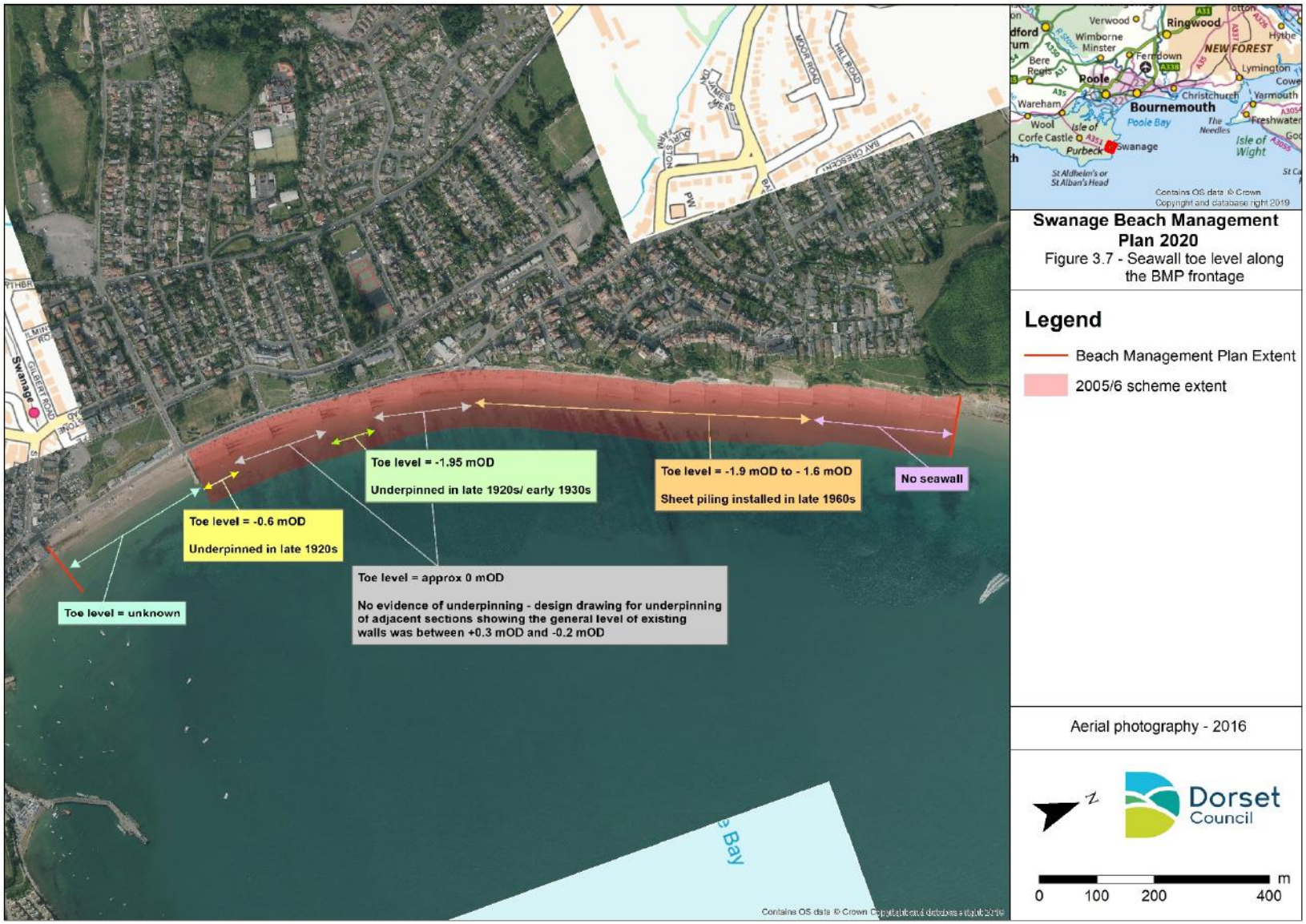


Figure 3-7 Map showing notes on the variance in seawall toe levels from the Banjo Pier northwards, based on analysis presented in Halcrow, 2005b.

Figure 3-8 1920s seawall along part of Shore Road exposed by low beach levels prior to beach recharge in 2005, shows toe details (from Goater, 2014).

There is no information identified on the seawall toe level for the length of wall between the Mowlem and the Outfall Jetty. Figure 1-4 above appears to show some concrete stepped toe protection to the seawall in places – possibly previous underpinning works. **Further investigation using trial pits is required in this area to confirm seawall toe levels and current toe protection works**. This will in turn aid refinement of trigger levels in this area (refer also to Section 3.3) and inform potential targeted structural enhancements (e.g. rip-rap or underpinning; refer to Section 1.4.1).

This length of seawall is also intersected by two water courses that discharge to the sea via manmade structures, namely:

- The Swanbrook River discharges into the southern end of Swanage Bay via the Outfall Jetty (also known as “The Banjo Pier”) that was constructed in 1993 as part of the Swanage Flood Alleviation Scheme and is maintained by the Environment Agency. The Outfall Jetty is about 5m wide with a 4m radius round end and has two outfall exits on each side of the round end with an invert level of -0.7mOD. The Outfall Jetty is observed to trap beach material on its southern side, with beach levels being higher to the south of the structure compared to the north side; as such the outfall jetty is in effect acting as a groyne with a significant impact on longshore transport along the Swanage Bay shoreline.

  Sand siltation inside the outfall is an occasional problem, and so as part of the 2005/6 Swanage Beach Recharge Scheme a jetty pumped flushing system was installed. This is comprised of a stainless steel submersible pump with motor size of approximately 1.1kw, mounted on the base of the culvert within the jetty at an invert level of -0.7mOD, close to the exit grills (Annex E of the Engineers Report (Halcrow, 2004) provides additional information).

- The Ulwell Stream Outfall, operated by the Environment Agency, is located at the northern end of Shore Road where the road heads inland and discharges across the beach.

In addition to the above main outfalls, along this section of wall between the two outfalls, there is also a 0.3m diameter surface water outfall pipe adjacent to Groyne number 5 (NB: this is identified as Groyne number 8 on the “as built” general arrangement 1 of 2 drawing provided in Appendix H) and several highway gully outflow pipes that discharge through the seawall directly onto the beach. These are owned and maintained by Dorset County Council (NB: now Dorset Council) (Halcrow, 2000 & 2006).

To the north of the Ulwell Stream outfall, along the New Swanage section of the BMP frontage, a series of small seawalls protecting beach huts were constructed in an erratic alignment along the toe of the cliffs in this area around the 1920s (believed to be by private landowners). In 1962, Purbeck District Council (now Dorset Council) took operational responsibility for the coastal protection measures in this area and paid for these sections of seawall to be either refurbished or rebuilt, and extended up to The Pines Hotel, with a new concrete and sheet pile toe detail added as part of these works to provide a toe depth of between -1.6mOD and -1.9mOD (Halcrow, 2005b; Dorset Coast Forum, 2014); see Figure 3-9. Timber groynes were also constructed in front of the seawall between the Ulwell Stream and Shep’s Hollow in 1962 (Halcrow, 2000; see also Section 3.1.2). Parts of this length of seawall, and some access steps, were repaired as part of the 2005/6 Swanage Beach Recharge Scheme. The as built “General Arrangement” drawings provided in Appendix H indicate where such works were undertaken.

Figure 3-9 Parts of the seawall along the New Swanage frontage refurbished/rebuilt in 1962, with steel sheet pile exposed when beach levels were lower, prior to beach recharge in 2005 (left = from Goater, 2014; right = from Royal Geographical Society, 2007).

3.1.4 Slope stabilisation measures

During the 20th century, private landowners have constructed an ad-hoc arrangement of slope stabilisation measures along the New Swanage section of coast (north of Shore Road) to address ongoing coastal slope instability issues (see Figure 3-10).

Figure 3-10 An example of historic ad hoc slope stabilisation measures introduced along the New Swanage frontage by a private landowner (photo taken on 24th October 2019).

The most recent intervention is the slope stabilisation scheme constructed by the owners of the Pines Hotel between 2015 and 2017, following emergency slope stabilisation works in 2013. These works comprised of the following:

- Phase 1 – Emergency works in 2013 (following coastal slip in 2012) saw soil nailing and slope drainage installed in the upper slope.
- Phase 2 – Planned works constructed between 2015 and 2017 installed soil nails, slope drainage and a reinforced retaining wall with bore pile retaining end walls in the lower slope (see Figure 3-11). The construction of the retaining wall involved removal of the lower part of the slope, thus creating development space for the landowner to construct a terrace of beach huts to be used to provide an income stream and offset some of the costs incurred in constructing this scheme. The design of this scheme also relies on protection at the cliff toe provided by the exiting groyne field and beach management scheme constructed in 2005/6 (see Sections 3.1.1 and 3.1.2).

Figure 3-11 The Pines Hotel slope stabilisation scheme constructed by the private landowner between 2015 and 2017. The 1960s seawall and 2005 timber groynes at the base of the cliff are also shown.

In 2013, Purbeck District Council funded a study (Halcrow, 2013) to assess the cliff fall and landslide / land instability risks along this length of coast and make recommendations on stabilisation measures required along the length of the frontage in the near-term and longer-term. The findings of this report were recommended to be developed into a full cliff management strategy for Swanage, working with all the private landowners to provide a joined-up approach to cliff stabilisation works in this area. To date, such a cliff management strategy has yet to be developed and near-term works continue to be planned / delivered in an ad hoc way funded by private landowners individually or working together in small numbers. **Efforts should be made in the near term to work with all landowners and key stakeholders to develop a single cliff management strategy to ensure coherent approach is taken in the future; this could also incorporate longer-term adaptation planning in line with SMP policy (see Section 1.7.1).** The ongoing maintenance of the seawall, beach and timber groynes at the base of the cliff will support that work.

3.2 Defence Condition & Performance

3.2.1 Defence condition assessment

Inspection of the various coastal defence elements along the BMP frontage was undertaken in 2019 by WSP, with the features south of the Banjo Pier being inspected in February 2019, and the features (including timber groynes) north of the Banjo Pier being inspected in November 2019 (NB: the Banjo Pier itself was not included in these inspections, as this is an Environment Agency asset). Appendix I provides the full inspection reports.

Table 3-1 summarises the condition of the various coastal defence elements from these inspection reports. Figure 3-12 shows the extents / locations of “feature IDs” listed in this table.

Table 3-1 Summary of current coastal defence elements and assessed condition along the Swanage BMP frontage (from WSP (2019a) and WSP (2019b) – see Appendix I).

Defence element^	Inspected	Condition*	Key notes
Slipway – Structure 5	19 Feb 2019	2 - Good	The slipway was recorded as being 16.6m long and 4.6m wide. Minor undermining was observed at the toe of the structure and cracks / spalling in the concrete was observed along the length of the structure.
Seawall – Section G	19 Feb 2019	1 – Very Good	This section of the masonry wall was noted to be in a very good condition with no major defects noted. Drainage holes through the wall appear blocked with stones/debris and the raised sand level of the beach. These drainage holes appear to drain surface runoff from the road. The drainage strategy should therefore be reviewed to understand the impact of these blockages on the highway structure. Minor horizontal cracks along sections of the capping beam were noted though these do not appear large enough to affect the performance of the wall.
Seawall – Beach Zone 01	6 Nov 2019	2 – Good	Seawall generally in good condition. A surface water outfall is located along this section of wall.
Timber Groyne 01	6 Nov 2019	2 - Good	Typically, good condition with some localised damage.
Seawall – Beach Zone 02	6 Nov 2019	2 – Good	Seawall generally in good condition. Surface water outfalls located along this section of wall have stones within outfall.
Timber Groyne 02	6 Nov 2019	1 – Very Good	Typically, very good condition with some localised damage.
Seawall – Beach Zone 03	6 Nov 2019	2 – Good	Seawall generally in good condition with some insignificant local damage. There are a number of surface water outfalls located along this section of wall.
Timber Groyne 03	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 04	6 Nov 2019	2 – Good	Seawall generally in good condition. Surface water outfall located along this section of wall is partially buried by beach.
Timber Groyne 04	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 05	6 Nov 2019	2 – Good	Seawall generally in good condition.
Timber Groyne 05	6 Nov 2019	1 – Very Good	Typically, very good condition with some insignificant localised damage.
Seawall – Beach Zone 06 (south of slipway)	6 Nov 2019	2 – Good	Seawall generally in good condition. There are three mains surface water outfalls located along this section of wall, none show visible signs of deterioration.

Defence element^	Inspected	Condition*	Key notes
Seawall – Beach Zone 06 (north of slipway)	6 Nov 2019	2 – Good	Seawall generally in good condition with some local damage, including missing sealant between joins in concrete wall, minor sporadic joint loss to masonry blocks, and minor vegetation growth to masonry wall.
Timber Groyne 06	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 07	6 Nov 2019	2 – Good	Seawall generally in good condition with some local damage, including minor joint loss to masonry blocks throughout.
Timber Groyne 07	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 08	6 Nov 2019	2 – Good	Seawall generally in good condition with some local damage, including minor joint loss to masonry blocks throughout and seepage through concrete wall hairline fractures.
Timber Groyne 08	6 Nov 2019	1 – Very Good	Typically, very good condition with some insignificant localised damage.
Seawall – Beach Zone 09	6 Nov 2019	2 – Good	Seawall generally in good condition with some local damage, including minor spalling to concrete wall and moderate spalling to concrete slipway. Note, the secondary wall at the toe of the cliff is grated as “5 – Very Poor” with localised failure for 8m length of this wall (refer also to Section 4.3.1.1 / Appendix B).
Timber Groyne 09	6 Nov 2019	1 – Very Good	Typically, very good condition with some insignificant localised damage.
Seawall – Beach Zone 10	6 Nov 2019	2 – Good	Seawall generally in good condition.
Timber Groyne 10	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 11	6 Nov 2019	2 – Good	Seawall generally in good condition with some local damage, including minor fracturing to concrete capping with water seepage, and at the western end of this section of wall, minor settlement to concrete with minor hairline fracturing.
Timber Groyne 11	6 Nov 2019	1 – Very Good	Typically, very good condition with some insignificant localised damage.
Seawall – Beach Zone 12	6 Nov 2019	2 – Good	Seawall generally in good condition with some local damage, including minor masonry block spalling and joint loss, and minor seepage through horizontal and vertical fractures within concrete wall. Note, cliff slumping has caused undermining to an existing masonry wall located behind the seawall.
Timber Groyne 12	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 13	6 Nov 2019	2 – Good	Seawall generally in good condition with some local damage, including sporadic masonry block joint loss throughout and minor joint loss caused by seepage from surface water discharge over footpath.

Defence element^	Inspected	Condition*	Key notes
Timber Groyne 13	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 14	6 Nov 2019	2 – Good	Seawall generally in good condition with some local damage, including sporadic masonry block joint loss throughout and minor joint loss caused by seepage from surface water discharge over footpath.
Timber Groyne 14	6 Nov 2019	2 – Good	Typically, good condition with some localised deficiencies. However, the landward-most end of the groyne is graded as "5 – Very Poor", as the top timber pile has failed due to displacement cased by cliff movement. Failure does not appear to have impacted the function of the overall groyne.
Seawall – Beach Zone 15	6 Nov 2019	N/A	Cliff only, no seawall.
Timber Groyne 15	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 16	6 Nov 2019	N/A	Cliff only, no seawall.
Timber Groyne 16	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 17	6 Nov 2019	N/A	Cliff only, no seawall.
Timber Groyne 17	6 Nov 2019	1 – Very Good	Typically, very good condition with no notable deficiencies.
Seawall – Beach Zone 18	6 Nov 2019	N/A	Cliff only, no seawall.
Timber Groyne 18	6 Nov 2019	1 – Very Good	Typically, very good condition with some insignificant localised damage.
Seawall – Beach Zone 19	6 Nov 2019	N/A	Cliff only, no seawall.

^see Figure 3-12 for defence element locations.

**Condition is defined in accordance with the Condition Assessment Manual (Environment Agency, 2012b).*

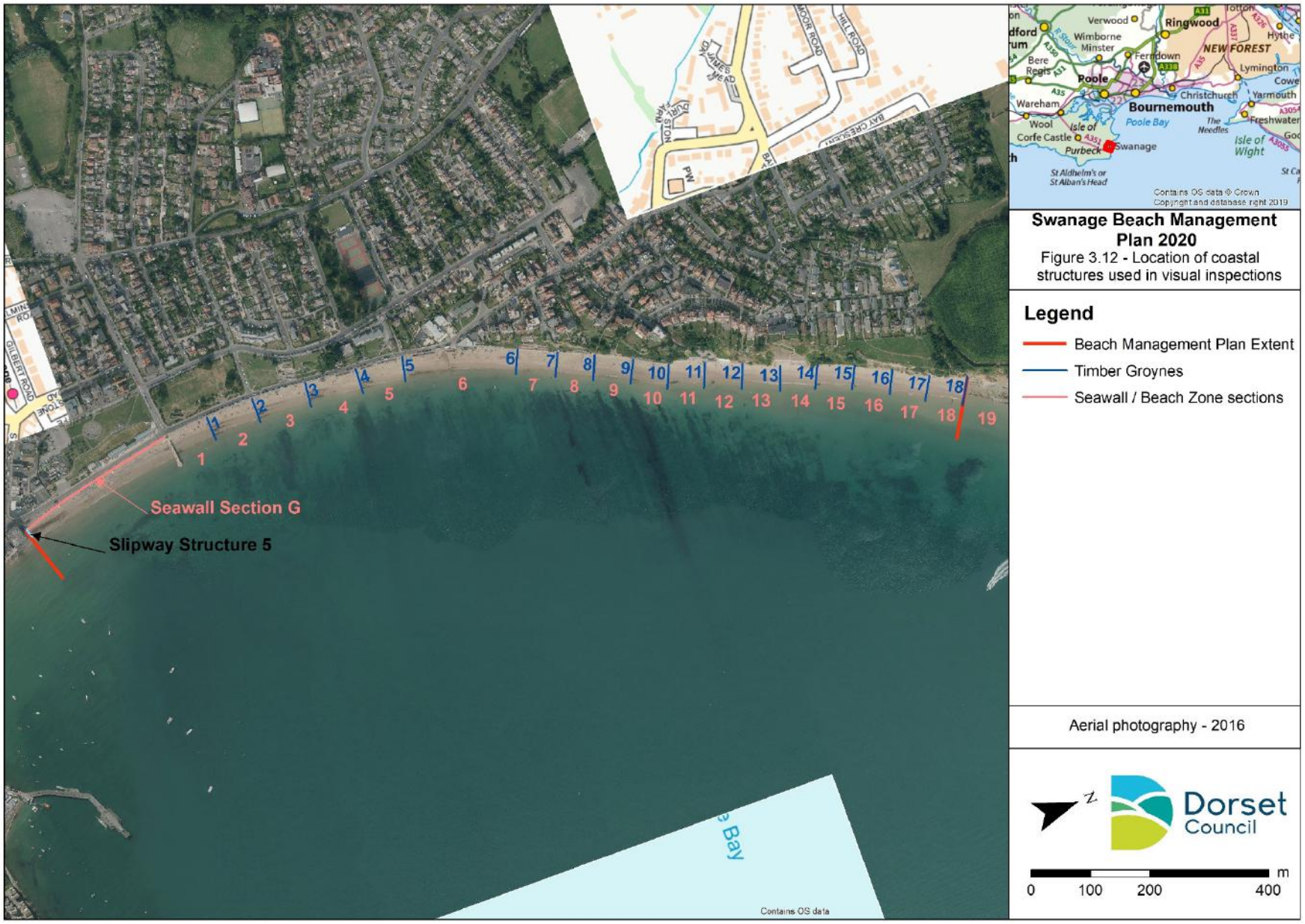


Figure 3-12 Location of timber groynes and seawall / beach zone sections inspected by WSP in 2019 (see also Table 3-1 and Appendix I).

3.2.2 Residual life estimate

Using the condition grading information in Table 3-1 and assessment by WSP (2019b; see also Appendix I), the residual life of the seawall/promenade and timber groynes along the BMP frontage has been assessed using the guidance on determining asset deterioration and the use of condition grade deterioration curves (Environment Agency, 2009).

The following presents the residual life assessment findings:

- **Timber groynes:**

  The timber groynes are generally all at condition grade 1. Under a scenario assuming a medium rate of deterioration, the residual life of the timber groynes is estimated to be:

  - Best estimate from Grade 1 to Grade 5 is 35 years*
  - Fastest estimate from Grade 1 to Grade 5 is 20 years
  - Slowest estimate from Grade 1 to Grade 5 is 50 years.

- **Seawalls:**

  The seawalls are generally all at condition grade 2. Under a scenario assuming a medium rate of deterioration, the residual life of the seawalls is estimated to be:

  - Best estimate from Grade 2 to Grade 5 is 55 years
  - Fastest estimate from Grade 2 to Grade 5 is 40 years
  - Slowest estimate from Grade 2 to Grade 5 is 70 years.

**It should be noted that the best estimate of residual life for the timber groynes of 35 years is the same as the expected timber groyne replacement period of 35 years stated in the 2005 scheme design (refer to Section 3.1.2).*

3.2.2.1 Limitation / assumptions

The assessment of residual life is based on the assumption that maintenance works will occur to achieve a medium rate of asset deterioration. If maintenance is not undertaken to any part of the assets, the rate of deterioration will be greater and so residual life shorter.

In addition, the WSP (2019b) inspection highlighted the **need to identify the cause of water seepage through sections of the seawalls in Beach Zone 08 and 11 (see Figure 3-12) with a view to formalising drainage** to limit risk of washout of fines from within the seawall.

3.2.3 Performance against wave overtopping risk

As described in Section 1.3.2.2, there is minimal history of coastal flooding occurring via wave overtopping along the BMP frontage, and although the 2005/6 Swanage Beach Recharge Scheme was not constructed as a sea defence scheme to manage the risk of coastal flooding from wave overtopping, the beach, timber groyne and seawall system along the BMP frontage does also provide some protection against this risk which can be managed appropriately by *"the placement of a temporary barrier of sandbags or similar across Shore Road to the south of the Outfall Jetty"* (Halcrow, 2005b).

The most recent assessment of the wave overtopping risks along the BMP frontage, using latest guidance on extreme wave and water levels and sea level rise projections, is provided in the Swanage Flood Modelling Report (JBA, 2020a). This assessed the wave overtopping risk along the following two profiles along the BMP frontage using the EurOtop Neural Network method:

- Profile WO_01 located between the Banjo Pier and Ulwell Stream.
- Profile WO_02 located between the Mowlem and the Banjo Pier.
- The calculated overtopping discharge rates calculated for these two locations show the following:
- The general pattern is that wave overtopping rates at profile WO_01 are generally less than at profile WO_02 profile. Therefore, the wave overtopping risks are much greater to the south of Banjo Pier than to the north of the Banjo Pier. This is in line with experience (see also Section 1.3.2.2).
- The risk from wave overtopping to public safety risks is the main issue arising from wave overtopping. Aware pedestrians could be at risk about 2 times per year by wave overtopping.
- Testing was undertaken to determine the beach profile required in order to achieve the 1 in 200-year standard of protection in relation to the public safety risks. This testing showed that it was not possible to achieve a 200-year standard of protection using realistic recharged beach profiles to reduce public safety risk. However, this does show significant reduction of wave overtopping rate with a realistic beach recharge profile that reduces the risk of structural failure of the seawall.
- The risk of wave overtopping posing a risk to the overall structural stability of the seawall is only likely to arise in the future during an event with a return period between 1:200 and 1:1000 years, and allowing for the impacts of sea level rise. That said, as illustrated in Figure 1-4 above, storm damage to the seawall can still occur; Figure 1-4 above is in the area covered by profile WO_02 in the overtopping analysis by JBA (2020a).
- There is a significant increase in wave overtopping rates in the scenarios that assumed beach levels are lowered, compared to the scenario that assumes the 2005 recharged beach profile is maintained in the future. This demonstrates the value of maintaining beach levels into the future via beach recharge also reduces the risks from wave overtopping as well as undermining, which was the primary concern of the 2005 Swanage Beach Recharge Scheme (see Section 3.2.4).

3.2.4 Performance against seawall undermining risk

The 2005/6 Swanage Beach Recharge Scheme was designed to provide a 1:300 year standard of protection against the risk of beach lowering leading to the undermining and failure of the seawall. In developing the business case for this scheme, the low beach levels along the frontage prior to the scheme, led to it being assessed that without the scheme, then the probability of seawall collapse was assumed at 10% in year 0 of the appraisal period, increasing to 80% in year 1 and 100% in year 7 (i.e. seawall failed in year 7 of 50 year appraisal period), leading to the resumption of coastal erosion at an assumed average annual rate of 0.5m/year (Halcrow, 2004).

The design beach profile (see Section 3.1.1) was established by assessing the potential for the beach to be drawn-down (lowered) during storm events and, with reference to the seawall toe levels (see Section 3.1.3), is designed to ensure sufficient beach material will remain in front of the seawall and so minimised the risk of undermining of the seawall in a storm event with a return period of 1:300 years.

The design profile was based upon extreme wave and water levels and sea level rise guidance at the time. For this BMP update, a reappraisal has been undertaken using the current guidance for these parameters. This reappraisal, described in Section 2.6.3.1, involved beach profile response modelling and concluded that the minimum design profile defined in 2005 (see Section 3.1.1) remains valid to 2070, allowing for current guidance on sea level rise.

3.3 Trigger levels

The Swanage Beach Management Plan (BMP) (Halcrow, 2005a) was prepared as part of the 2005/6 Swanage Beach Recharge Scheme. The purpose of the BMP is to guide future maintenance of the scheme to ensure the constructed design standard of 1:300 years is provided over the 50-year scheme life. The design standard is achieved by providing a beach profile with a 1:20 slope to a minimum beach crest level against the backing seawall of +1.2mODN. To achieve this objective, the BMP defines trigger levels for when intervention would be required, as follows:

- **Action Level:** When the beach crest level is less than +0.8mODN (corresponding to the beach profile that will withstand the 1:100 year storm) along a total length of 100m over the 1.2km frontage.
- **Crisis Level:** When the beach crest level is less than 0mODN along a total length of 100m over the 1.2km frontage, the defences would no longer meet the objectives of the scheme with regard coastal protection.

Review of all monitoring data collated since the 2005 beach recharge shows that these trigger levels have not been reached in the years since. This monitoring evidence, combined with evidence from new wave overtopping modelling (JBA, 2020a; see Section 3.2.3) and beach profile response modelling (JBA, 2020b; see Section 3.2.4), demonstrates that the trigger levels defined in 2005 remain valid as the beach has performed as predicted in the scheme design.

4 Monitoring Regime

The following describes the monitoring regime that is required to inform future management decisions at Swanage along the BMP area.

4.1 Beach monitoring

4.1.1 Routine beach profile survey

Topographic beach profile surveys are carried out by the CCO every spring and autumn for the SERCMP. Profiles are taken at pre-defined locations within the management unit (see Figure 4-1). CCO also undertake post-storm surveys that are initiated by Dorset Council (see Section 2.6.3). Data is available through the SERCMP website (www.coastalmonitoring.org).

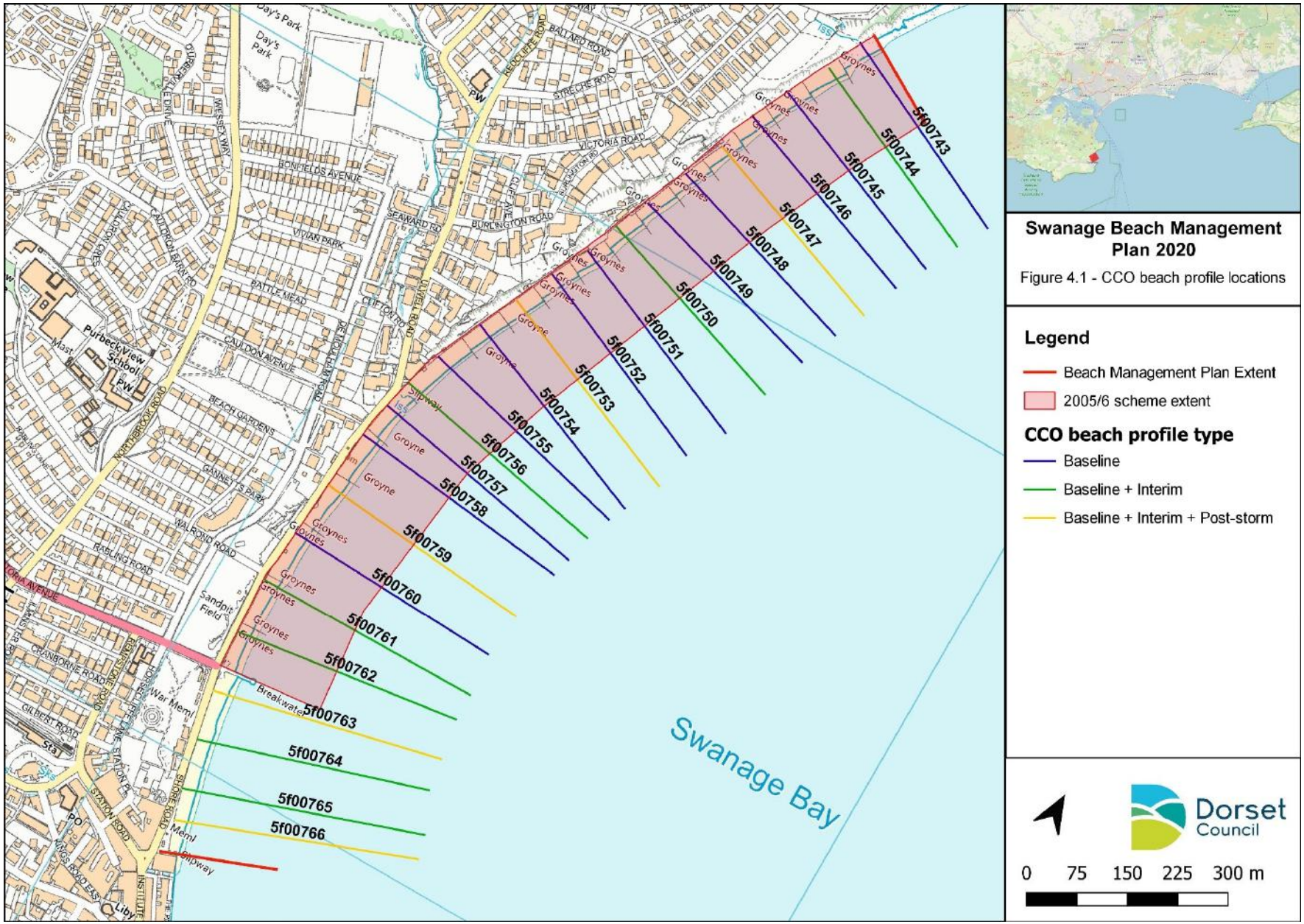


Figure 4-1 SERCMP beach profile survey locations along the Swanage BMP frontage.

Table 4-1 provides a summary of the beach profile location, including origin co-ordinates, and highlights those profiles that are used for post-storm surveys and those profiles that CCO survey but do not report on in their annual monitoring reports.

Table 4-1 SERCMP beach profile survey locations along the BMP frontage (those used for post-storm surveys are highlighted in yellow; those surveyed by CCO but not routinely reported in the annual monitoring reports are shaded grey).

Profile ID	Origin Easting	Origin Northing	Date of first survey	Used for post-storm survey?
5f00743	403438.56	80423.40	05/04/2002	No
5f00744	403417.43	80367.54	05/04/2002	No
5f00745	403383.35	80305.36	05/04/2002	No
5f00746	403353.94	80249.31	05/04/2002	No
5f00747	403338.36	80187.12	05/04/2002	Yes
5f00748	403311.58	80125.35	05/04/2002	No
5f00749	403284.35	80059.38	05/04/2002	No
5f00750	403260.23	80006.09	05/04/2002	No
5f00751	403242.43	79953.12	05/04/2002	No
5f00752	403213.37	79897.02	05/04/2002	No
5f00753	403186.23	79837.13	05/04/2002	Yes
5f00754	403158.69	79777.99	05/04/2002	No
5f00755	403128.29	79706.07	05/04/2002	No
5f00756	403109.96	79650.16	05/04/2002	No
5f00757	403098.25	79605.69	05/04/2002	No
5f00758	403088.61	79550.47	05/04/2002	No
5f00759	403082.45	79459.48	05/04/2002	Yes
5f00760	403074.29	79373.72	05/04/2002	No
5f00761	403071.02	79289.96	05/04/2002	No
5f00762	403074.36	79203.21	05/04/2002	No
5f00763	403086.38	79108.55	05/04/2002	Yes
5f00764	403102.07	79034.14	05/04/2002	No
5f00765	403119.09	78959.97	05/04/2002	No
5f00766	403132.57	78913.46	05/04/2002	Yes

Monitoring of beach profiles every spring and autumn by CCO is to continue as part of the SERCMP.

In addition to the work of SERCMP, **additional (more frequent) survey of the SERCMP interim profiles surveyed each spring and autumn is to be undertaken by the Dorset Coastal Engineering Partnership to provide additional data on beach dynamics**.

In order to determine when there is a need to begin the process of implementing future beach recharge, **a regular review of the beach profile survey data to monitor beach volume in relation to minimum beach volume requirements is required** (refer also to Section 5.2.2). This should build upon the analysis presented in Section 2.6.2 above and with reference to the trigger levels stated in Section 3.3.

In addition to the regular annual beach profile surveys, continued capture of post-storm surveys is to occur. **Post-storm surveys are to be triggered if required following visual inspections shortly after storm events** (see Section 4.1.6).

Once a greater amount of post-storm survey data is gathered, pre-storm profiles could be monitored if (a) sufficient understanding of the conditions of most concern can be developed through continued capture and review of post-storm surveys in the coming years (refer also to Section 4.4.2), and (b) opportunity arises and/or funding is available. This is not a key requirement of the monitoring regime but would provide useful additional understanding of the beach behaviour in storm events to inform future management decisions.

4.1.2 Master profile survey

The work done to develop the 2005/6 Swanage Beach Recharge Scheme included identifying the levels of the underlying clay bedrock located beneath the beach along the Swanage BMP area. As such, there is no requirement to undertake further investigation of this to provide a more definitive master profile for beach volume calculations.

The existing data should be transposed into SANDS to use in future beach volume calculations (see also Section 2.6.2).

4.1.3 Beach recycling / recharge logs and survey

During future beach recycling and beach recharge works along the BMP frontage, **beach recycling / recharge logs are to be completed** by the operational staff (see also Sections 5.1.1, 5.2.1 and 5.2.2) and provided to SERCMP. This information will allow future analysis of beach volume changes to more accurately account for the effects of beach recycling and recharge work, and will enable the underlying natural beach movements to be identified.

A template of the beach recycling log to be used is provided in Appendix J of this BMP.

In order to validate the beach recycling / recharge logs, **it is recommended that two separate beach surveys, 'in' (pre-recycling) and 'out' (post-recycling), are undertaken when such activities occur (refer also to Section 1.4.4)**. This will allow a relationship to be established between the information recorded on the beach recycling / recharge logs and the changes in beach profile/volume. Such information will provide confidence in the accuracy of future beach recycling / recharge logs when no pre- and post-works surveys are conducted. These surveys should be conducted to the same specifications used in the SERCMP.

In addition to the above, **a record should also be kept of when and approximately how much sand is removed from the highway / promenade as waste** to better understand how often this occurs and its impact on overall beach volumes observed in measured data (see also Section 1.4.4).

4.1.4 Bathymetric survey

Bathymetric surveys are to continue in line with the schedule determined as part of the SERCMP. As of April 2020, the next bathymetric survey for Swanage Bay is not currently programmed.

In addition to the SERCMP schedule, **additional bi-annual nearshore bathymetry surveys of Swanage Bay are to be undertaken each spring and autumn** to allow monitoring of the nearshore area and so aid understanding of where sediment moves to once it goes below MLWS level (the maximum extent of the beach profile surveys). This information will also support ecological impact assessment for the next beach recharge campaign (see Section 1.4.2).

These annual bathymetry surveys should be combined with seabed sediment sampling (see also Section 4.1.5), which will further improve understanding of sediment transport pathways and rates in nearshore and offshore zones of Swanage Bay and the surrounding area, and so reduce present uncertainties. This will also contribute to addressing a recommendation in the SCOPAC Sediment Transport Study to undertake *"a primary survey of seabed bedforms, preferably repeated throughout at least one year, to gain some inference of sediment transfer paths and directions. This should be supported by, as a minimum, a grab sample survey of Swanage Bay which would provide at least a provisional answer to the deposited location of the fine texture sediment. It would also be worthwhile to investigate if any sediment grades are able to bypass Durlston Head, thereby confirming whether, or not, it is a fixed and absolute boundary dividing the south and east Purbeck transport sub-cells"* (New Forest District Council, 2017).

4.1.5 Sediment sampling

As part of planning the next beach recharge campaign (see Sections 1.2.1 and 1.4.1), **sediment sampling of the proposed sediment source area should be undertaken to confirm that the recharge material is in line with the beach sediment grading envelope for the design beach** (see Section 3.1.1).

In addition, sediment sampling at points within Swanage Bay may be required to support ecological impact assessment (EcIA) for the next beach recharge campaign. This is to be confirmed in discussion Natural England and the MMO (see Section 1.4.2). A sediment sampling campaign could also improve understanding of sediment transport processes in combination with additional bathymetry surveys (see Section 4.1.4).

4.1.6 Walkover survey

Visual walkover inspections should be undertaken to monitor beach crest level against the seawall, with reference to the trigger levels defined in Section 3.3. One walkover survey should be undertaken every month during the winter (October to March) and one survey every two months during the summer (April to September). Throughout the year, additional walkover surveys will need to be carried out prior to and immediately after storm events, as required.

To aid visual inspections, and because the drop measurement from the seawall crest to the beach varies along the BMP frontage, **visual markers indicating the trigger levels could be placed on the seawall**.

In addition, **post-storm event visual inspections should be used to record when events have occurred that require the promenade behind the beach to be cleared of beach sediment/debris**. This information should be collated so that it may be used to develop flood warning procedures in the future (see also Section 4.5.1).

4.1.7 Aerial photography and LiDAR

Aerial photography and LiDAR surveys are to continue to be flown every 5 years and 3 years respectively as part of the SERCMP. This data is available through the CCO website (www.coastalmonitoring.org).

Continuation of these aerial photography and LiDAR surveys, combined with regular monitoring of beach profiles (see Section 4.1.1) will inform future derivation of long-term trends of beach volume and recession rates.

4.2 Structure monitoring

4.2.1 Visual inspection

Visual inspection of the seawalls and timber groynes along the BMP frontage occur annually (as minimum) and after storm events. These inspections have historically been undertaken by the Local Authority and/or the Environment Agency. The most recent inspection was completed as part of updating the Swanage BMP (see Section 3.2), and these are the assets that will continue to be inspected in the future.

This is in line with the recommendations stated in the health & safety file (Halcrow, 2006), which states that *"as a minimum the groynes should be visually inspected on an annual basis and after storm events. Minor damage should be repaired immediately and any large scale damage or defects referred back to the designer or a competent structural engineer, if deemed necessary."*

The current BMP (Halcrow, 2005a) also recommends that photographs be taken along the frontage from the same locations as part of each inspection to provide a consistent record. This recommendation does not appear to have been enacted.

Going forwards, this **annual visual inspection of all of the structures along the BMP frontage will continue to occur during the spring of each year** to allow any maintenance works required to be identified and completed prior to the busy summer period, thus avoiding impacting on the amenity use of the beach. As noted in Section 1.3.4, these inspections should be planned to occur at spring low-tides in order to inspect the most seaward sections of the timber groynes. These inspections should be undertaken by Dorset Council as the relevant asset operator. In doing so, the WSP inspection report (WSP, 2019b; see also Appendix I) recommends that the following elements are considered in future inspections:

- **Timber groynes:**
  - Missing or damaged planks and fixings;
  - Missing or damaged walings and fixings;

  - Groyne no longer able to arrest drift of beach material; and,
  - Movement, rotation, bulging or undermining of planks and piles.
- **Pile failure (Groyne 14):**
  - Failure is in a relatively protected location at the back of the foreshore and therefore is unlikely to have any significant impact on the overall function of the groyne in its existing state, however, monitor during future inspections.
- **Timber plank gaps:**
  - All Groynes – monitor gaps between planks to identify if gaps increase in size and allow further passage of beach material.
- **Seawalls:**
  - Movement of surrounding strata leading to loss of stability;
  - Undermining, failure or damage to toe protection (e.g. beach);
  - Washout of fill/retained material; Exposure/corrosion of reinforcement;
  - Honeycombing, flaking or spalling of concrete;
  - Abrasion damage;
  - Sealant or joint fill material loss; and,
  - Cracks or fissuring.
- **Concrete fractures:**
  - Monitor concrete cracks – apply tell-tales/ mortar tabs to enable monitoring if on-going movement is occurring.
- **Surface water outfalls:**
  - Monitor all outfalls to ensure no undermining occurs to outfall foundations, sea wall or adjacent groynes.
  - Consider the loss of beach material at large outfalls.

Visual inspections to monitor structures after storm events should also occur, since damage to the structures is most likely to occur during storms. Such inspections may also identify the possible need to remove some planks from the landward end of some timber groynes for safe public access (see Section 5.1.3).

Each inspection (routine or post-storm) should be recorded in a consistent way in a defence inspection log. Monitoring of the coastal structures should be, where possible, undertaken in combination with a visual walkover inspection of the beach as, particularly following storm events.

For consistency of approach and recording, and in anticipation of a consistent Dorset-wide coastal asset data system being developed, the undertaking of these inspections should follow the methodology defined in the Environment Agency's *Condition Assessment Manual* (Environment Agency, 2012b). This would also have the advantage of ensuring captured data is in a format typically required when requested for national scale studies; it would also

align to the recommendation in Section 4.2.2 to align to the three-tiered approach to asset inspection. In order to enable this change in methodology, Dorset Council will need to ensure these visual inspections are undertaken by experienced engineers.

4.2.2 Detailed inspection

No regular detailed inspections of the seawalls and timber groynes, or other hard structures along the frontage, currently occurs.

The future need for detailed inspections will be guided by visual inspection findings (see Section 4.2.1), and progress firstly to non-intrusive investigations and then (if necessary) intrusive investigations. This is in line with the Environment Agency's Asset Inspection Guidance (Environment Agency, 2014b), which defines a 3-tiered approach to targeting asset inspections as follows:

- Tier 1 inspection is the default level, routine visual inspection (see Section 4.2.1). Tier 1 inspections identify areas of concern that would prompt Tier 2 and 3 inspections and investigations to seek more detailed information than is routinely collected as Tier 1 inspections.
- Tier 2 inspections are non-intrusive investigations carried out by an appropriate expert (e.g. ground penetrating radar surveys etc.).
- Tier 3 inspections are intrusive investigations into the make-up of the asset (e.g. investigation of ground condition and/or structural assessment).

4.3 Environmental monitoring

The area covered by this BMP is within the vicinity of a number of environmental designations. Consideration of these features will form a key element for future beach recharge campaigns and ongoing environmental monitoring before, during and after beach recharge campaigns is likely to be required. The exact nature of environmental monitoring need prior to the next beach recharge campaign between 2023 and 2025 should be discussed and agreed with Natural England and the MMO at the commencement of the OBC (see also Section 1.4.2 and Section 1.6).

This monitoring will support the Marine Licence application. As part of granting a Marine Licence for beach recharge, additional environmental monitoring may be stipulated as part of the Marine Licence conditions. Any such conditions should be documented in this section as part of future updates of this BMP.

4.4 Physical conditions

4.4.1 Sea conditions

The nearest locations where wave climate is monitored are the devices operated by CCO at Swanage Pier wave radar (non-directional waves) and Boscombe wave buoy (directional waves); see also Section 2.1.1.

The Swanage Pier device also provides tide level recording; see Section 2.2.2.

In addition, the Swanage Pier device also captures weather condition data.

The ongoing recording of this site specific wave and water level data, in combination with additional monitoring of other parameters as discussed in the other parts of this section of the BMP, will aid improvements in the understanding of the relationship between these forcing parameters and the beach response. This will help to both improve understanding of the processes in this area as well as provide information that can provide a basis for developing improved flood warnings in the future.

4.4.2 Storm events

The movement of material along the beaches at Swanage is significantly increased during storms as a result of increased wave action (see Section 2.6.3). In order to continue to improve understanding the effect of storm events upon the beach response, **details of the storm conditions (waves, winds and water levels) will need to be recorded** in support of the post-storm profile surveys (refer to Section 4.1.1).

Data from the CCO device on Swanage Pier (refer to Section 4.4.1) should be used for obtaining these details at the time of the storm event. Additional information on the offshore wave climate should also be recorded from other data sources such as the Boscombe wave buoy (see Section 4.4.1) and other near real time data from the National Data Buoy Centre (http://www.ndbc.noaa.gov/) and the CEFAS WaveNet (https://www.cefas.co.uk/cefas-data-hub/wavenet/) websites. These websites provide data for a number of locations between the Atlantic and the English Channel that are relevant to Swanage Bay, and recording of this information will allow further assessment of any linkages between offshore and nearshore wave climate to be made in the future.

This data should be recorded as part of the storm event record.

This storm record should contain details of all storm events including the prevailing conditions (as discussed in this section), pre/post-storm surveys, and effects/impacts of the event.

4.5 Warning and emergency procedures

4.5.1 Flood warning and response procedures

NB: the following is based upon information provided by the Environment Agency in June 2020, and is taken from a combination of the Environment Agency report "Swanage Flood Warning and Forecasting" (JBA, 2019) and the Dorset Local Resilience Forum "Protocol for deployment of temporary flood barriers in Swanage" (2019b).

This section gives an overview of the flood warning procedures applicable to the Swanage BMP area. Full details of the up-to-date flood warning procedures are to be found in the Environment Agency's *Wessex South Flood Warning Procedures Manual*. The current procedures are kept electronically on the Environment Agency's "Blandford" server, or in hard copy form in the incident room of the Environment Agency's Blandford office. They can also be accessed through the Environment Agency's incident management toolbox.

Three levels of warning are issued:

- A **Flood Alert** indicates that flooding is possible. The Flood Alert Area (FAA) along the coastal frontage at Swanage, including the BMP area, is shown in Figure 4-2. The criteria that would trigger a flood alert is based upon properties at risk of coastal flooding when the either or both of the following thresholds are forecast to be exceeded:

- The predicted total tide level (including surge) is greater than +2.33mOD.
- The predicted wave overtopping rate that corresponds to the “Aware pedestrian” EurOtop overtopping threshold of 0.0001m^3/s.

This alert gives an indication to professional partners and members of the public that there is the possibility of flooding along the coast. The key risk areas would be seawalls, promenades and town center area in the FAA. Flooding of property is not expected at this time. On the issue of the flood alert current actions would be for the Environment Agency’s Flood Incident Duty Officer (FIDO) to request that the Environment Agency’s Operations Delivery team initiate a tide watch and record any observations of flooding.

- A **Flood Warning** indicates that flooding is expected. At Swanage this is triggered when the predicted wave overtopping rate is 0.002457m^3/s, which equates to the maximum wave overtopping rate for the 50% AEP (1 in 2 year) event that causes the first property to flood in the underpinning flood mapping.

  Flood Warnings goes to professional partners and members of the public who are at risk. The community is registered on an “opt out” system. There are several Flood Warning Areas (FWAs) for the study frontage, as follows (see also Figure 4-3):

  - FWA01: Swanage fluvial flood risk only (227 properties).
  - FWA02: Swanage coastal flood risk only (39 properties).
  - FWA03: Swanage fluvial and coastal flood risk (517 properties).

  The Swanage BMP extent encompasses areas in both FWA02 and FWA03, within which there is a total of 556 properties at risk from coastal flooding. When the flood warning is issued the Environment Agency’s Flood Warning Duty Officer (FWDO) would discuss conditions with professional partners. Depending on conditions, the FIDO would request that the Environment Agency’s Operations Delivery team initiate a tide watch and record any observations of flooding of other significant issues.

  The issuing of a Flood Warning for FWA02 or FWA03 will also trigger the use of the *Protocol for deployment of temporary flood barriers in Swanage* (Dorset Local Resilience Forum, 2019b), a multi-agency plan for the deployment of temporary barriers at key points to protect Swanage town centre from coastal flooding (though outside the extent of the BMP). As part of this protocol, there is an addendum focused on the Promenade at Swanage, which is within the BMP area. In this area a decision is to be taken (over a FASTCON with professional partners) as to whether or not to close the road and Promenade for a period of time during the event and after (to allow for debris clearance).

- The **Severe Flood Warning** indicates that there is a risk to life. Automated flood warnings are issued when defined thresholds are reached, as per above for Flood Warnings. A severe flood warning threshold forecast would trigger a FASTCON with professional partners to discuss the situation and determine actions to respond to the situation as it develops, informed by additional information from on- site observations. At Swanage, a severe flood warning is issued if the predicted total tide level (including surge) is greater than +2.63mOD; the minimum defence crest height that protects any property in the FWA (JBA, 2019).

BOX A: Seasonal variation to Flood Warning Procedures

It is important to note that the above criteria are varied if seasonal concrete wave barriers are in place at Swanage (see Figure 4-4). These were first deployed at Swanage in October 2019 and removed in April 2020, and greatly reduce the risk of flooding at locations of otherwise high flood risk, including at the Mowlem slipway at the southern boundary of the BMP area. Future deployment of these concrete wave barriers is expected to occur annually between October and April, and at these times the Environment Agency will issue flood alerts and flood warnings in accordance with requirements set-out in a Special Action Memo contained in the *Wessex South Flood Warning Procedures Manual.*

The issuing of flood warnings by the Environment Agency is currently based upon the following information:

1. Forecast data from the National Flood Forecasting System (NFFS) including forecast wave height, wave period, wave direction, wind speed, wind direction and total tide height.
2. On-site observations by Environment Agency's Operations Delivery team.

Currently, flood warnings are based on the 'pre-conditions' for a large flood event being reached. Decisions are made based on a set of condition tables that take into consideration forecast astronomical tide, wave height, wave period, wave direction, wind direction and total water level. Data gathered from future storms will be used to improve the accuracy of the warnings and refine further the flood warning criteria.

The monitoring regime set out in **Section 4** of this BMP will also provide improved information for understanding the whole beach system. In doing so, it is anticipated that this will also allow the relationship between certain wave conditions and water levels being reached and the associated consequences to be better defined to improve 'accuracy' of flood warnings.

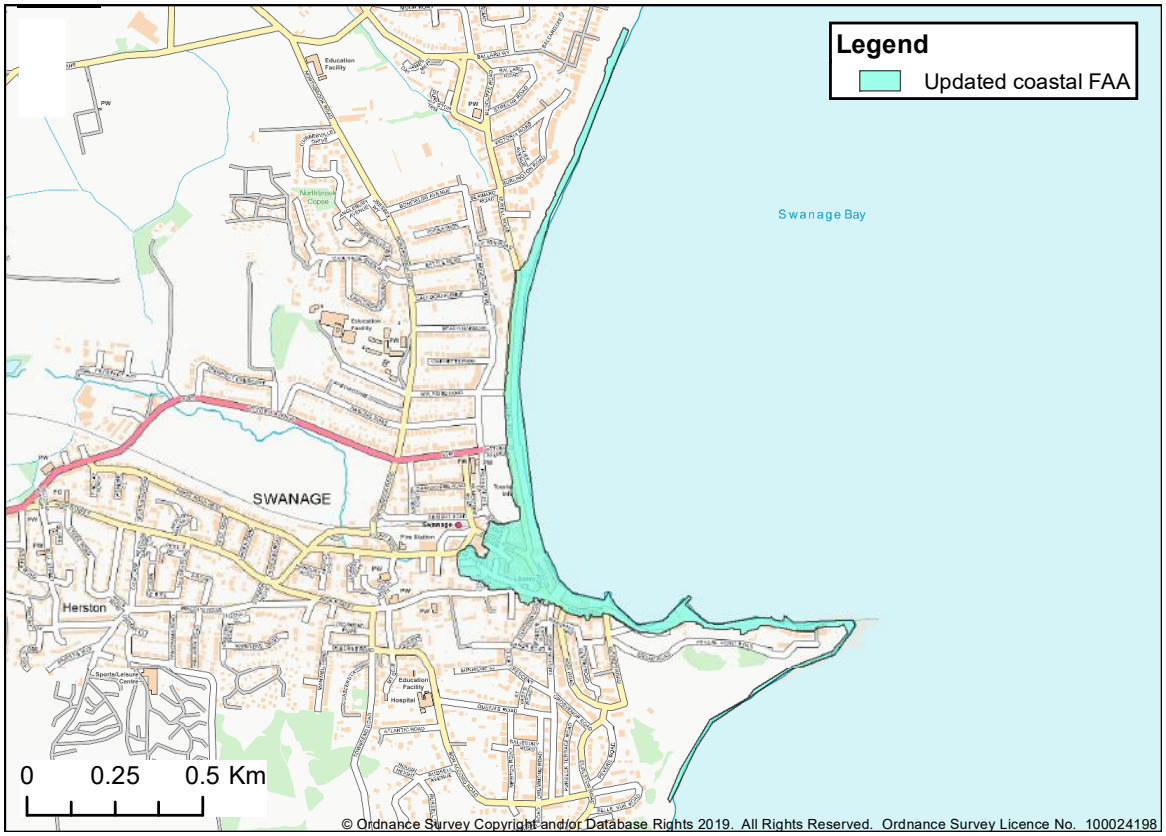


Figure 4-2 Flood Alert Area (FAA) along for Swanage, including along the BMP area (from JBA, 2019).

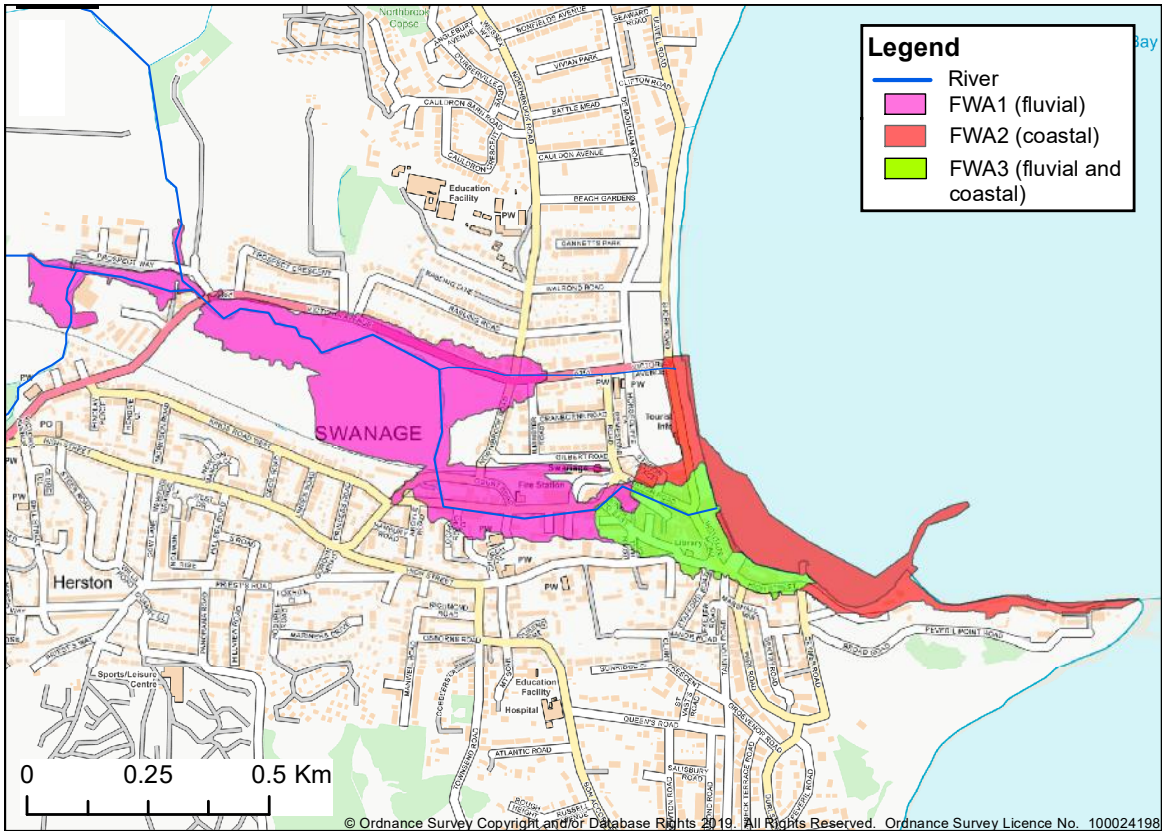


Figure 4-3 Flood Warning Areas (FWAs) along for Swanage, including along the BMP area (from JBA, 2019).

Figure 4-4 Seasonal concrete wave barriers installed at the top of the slipway adjacent to The Mowlem at the southern end of the BMP frontage in February 2020.

4.5.2 Landslide and cliff fall response procedures

Should a large landslide event occur at Swanage, then the Dorset Local Resilience Forum Rockfall and Landslide Response Plan (May, 2019a) is to be followed. Refer also to Section 1.7.13.

4.5.3 Pollution incidents

Pollution incidents can occur at varying scales. Minor pollution such as litter and small debris are typically dealt with by Swanage Town Council or Dorset Waste Partnership (see Section 1.5).

Larger pollution incidents are dealt with by Dorset Council, guided by Section 4 of the *Dorset Coastal Pollution Clearance Plan* (Dorset County Council Emergency Planning Service, 2010); refer also to Section 1.7.12.

4.6 Data

Having collected the beach monitoring data, it is important that all of the information is stored and analysed to allow decisions to be made with respect to ongoing maintenance and future management of the beach at Swanage.

Following each scheduled twice-yearly beach profile survey, the information collected is uploaded for storage and analysis to a database system that operated by the South East Regional Coastal Monitoring Programme at CCO. Additional survey data that is to be collected as per the requirements set out in this BMP, should be collected, stored and analysed in accordance with CCO quality standards and be compatible with CCO's database system (if CCO are not used to undertake the additional survey work).

Additional beach monitoring data, obtained from sources such as the post-storm visual walkover inspections (with associated storm event data – see Section 4.4.2) or beach recycling logs (see Section 4.1.3), should also be stored in the same database. The database should include any photographs taken during each survey.

This information should be used in compiling future annual beach monitoring reports produced by CCO.

In addition, **a review of all survey data should be carried out at least annually (and ideally after every survey) with particular focus on beach volume changes and how they relate to the minimum beach volumes defined by the trigger levels in Section 3.3** (i.e. build on the analysis presented in Section 2.6.2.1). These reviews could form part of the CCO annual report, or they could be completed separate to the CCO reporting. Either way, each review should be recorded in a standard format to enable later audit of decisions made in relation to future beach management, and in particular to justify assessments as to when future beach recharge is required.

5 Maintenance Regime

The following describes the maintenance regime that is necessary to ensure that the beach at Swanage continues to provide the required beach levels in support of the wider flood and coastal erosion risk management of the area. This maintenance regime has been developed in line with the preferred management regime (see Section 1.2.1).

5.1 Ongoing works

5.1.1 Beach

There is no regular, planned beach recycling/re-profiling that occurs along the BMP frontage to support coastal flood and erosion risk management. Such works are only undertaken as required, guided by monitoring and with reference to the beach management plan produced in 2005 (Halcrow, 2005a). No such works have been required since the beach was recharged in 2005, as trigger levels (see Section 3.3) have not been approached. Future beach recycling for FCERM purposes will continue to be undertaken only in response to Alarm Levels being exceeded (see Section 5.2.1).

The only works of this type that do occur along the BMP frontage are undertaken by Swanage Town Council and only very rarely to maintain the beach profile for amenity purposes. This typically involves some levelling of a section of the beach between the Mowlem and the Banjo Pier when the beach becomes more shingly and pooling occurs in proximity to deckchair/sunbed concession. If this occurs **in the future, details of the operation should be captured by Swanage Town Council in a recycling log (see Section 4.1.3) and provided to Dorset Council.**

5.1.2 Structures

Ad hoc maintenance works to the various structural elements along the study frontage (i.e. seawalls, slipways, access steps and timber groynes) are carried out by the Local Authority and private asset owners as required, guided by regular monitoring and visual inspection. See also Section 4.2.

The November 2019 asset inspection by WSP (see also Section 3.2) identified the following maintenance recommendations for the coastal defence structures along the BMP frontage, as summarised in Table 5-1 (refer also to Appendix I). **These maintenance works should be progressed as soon as possible, subject to funding being available to do so, alongside addressing the public health and safety issues identified in Section 1.4.3**.

Table 5-1 Summary of recommended maintenance works from WSP, 2019b.

Priority	Location	Description	Repair implementation required within
1 - High	Seawall – Beach Zone 03 (steps)	Replace failed blocks on steps	0 – 6 months (by June 2020)
1 - High	Seawall – Beach Zone 06	Rebuild joist support to balcony (notify private owner)	0 – 6 months (by June 2020)

Priority	Location	Description	Repair implementation required within
1 - High	Seawall – Beach Zone 07	Cliff safety – consider closing clifftop footpath or notifying landowner	0 – 6 months (by June 2020)
1 - High	Seawall – Beach Zone 09	Rebuild secondary wall (notify private owner). In interim close footpath?	0 – 6 months (by June 2020)
1 - High	Seawall – Beach Zone 13	Formalise drainage over sea wall	0 – 6 months (by June 2020)
1 - High	Seawall – Beach Zones 13 and 14	Remove material blocking footpath (build temporary walkway around cliff slippage?)	0 – 6 months (by June 2020)
1 - High	Throughout	Replace degraded safety signage/ implement where no signage present with safety risks (e.g. unprotected edge, risk of falling from height/ danger of unstable cliff etc.)	0 – 6 months (by June 2020)
2 - Med.	Timber Groyne 01	Replace top timber plank and fixings	1 – 2 years (by end 2021)
2 - Med.	Timber Groynes, 08, 09 and 18	Remove splintering	1 – 2 years (by end 2021)
2 - Med.	Timber Groyne 09	Tighten fixing to top waling	1 – 2 years (by end 2021)
2 - Med.	Throughout	Clean all outfalls	1 – 2 years (by end 2021)
2 - Med.	Seawall – Beach Zone 04	Level beach material to keep away from currently buried outfalls	1 – 2 years (by end 2021)
2 - Med.	Seawall – Beach Zones 06, 07, 08, 13 and 14	Repointing of blockwork	1 – 2 years (by end 2021)
2 - Med.	Seawall – Beach Zone 06	Remove vegetation in blockwork	1 – 2 years (by end 2021)
2 - Med.	Seawall – Beach Zone 06	Replace failed sealant between concrete sections	1 – 2 years (by end 2021)
2 - Med.	Seawall – Beach Zones 08, 09, 10, 11 and 12	Render over failure in concrete walls (spalling/ fractures)	1 – 2 years (by end 2021)
3 - Low	Timber Groyne 01	Replace top timber plank	2 – 3 years (by end 2022)

5.1.3 Timber groynes – plank removal

When beach levels between timber groynes are persistently low with large drops on the down-drift side, it poses an issue with regard safe public access along parts of the coastline, especially the northern end of the BMP frontage when the promenade may also be blocked by cliff fall material (see also Section 1.4.3). In such scenarios, it may be pertinent to temporarily remove timber planks at the most landward end of timber groynes to improve the safe public access situation.

A decision to remove timber planks will be made following engagement with the coastguard and Swanage Town Council, and need to be informed by the following:

1. Visual inspections of the area by a Dorset Council coastal engineer to assess extent of the low beach levels and whether plank removal could cause wider problems with beach stability in front of the seawall (see also Section 4.2.1);
2. Consideration of whether the issue of low beach levels is likely to be temporary or persistent; and
3. Consideration of whether the issue is localised to part of the frontage and if there is sediment in adjacent groynes bays that could be recycled to the low beach level area to rectify the issue.

If it is decided that timber planks are to be removed from any of the timber groynes, then this will be done using hand-tools. A tractor and trailer will be used to transport the removed planks to a Swanage Town Council depot on a business park of Victoria Avenue.

Reinstatement of timber planks to the timber groynes would only occur if:

1. Beach levels were substantially increased along the affected parts of the frontage, which will be informed by ongoing monitoring of beach levels and visual inspections; and/or
2. Cliff stabilisation measures were introduced to stop the promenade along the backing seawall from being blocked.

If timber planks have been removed, they will definitely need to be reinstated prior to any future beach recharge campaigns in order to retain the increased beach levels that will be provided, as per the 2005/6 scheme design requirements.

5.2 Alarm trigger level works

If an **Alarm Level** (refer to Section 3.3) is identified as being reached on a profile, the immediate task would be to carry out a visual inspection of the profile concerned to validate the survey data and check that it is representative of the general beach area over a 100m length (i.e. not a localised ‘low’’ point). A period of more frequent (at least weekly) inspections should then be undertaken to monitor the situation and determine if it a short-term issue or a persistent problem (i.e. beach levels do not recover naturally after two to three weeks).

If the low beach levels persist, then the actions listed below should be enacted in response to the **Alarm Level** being reached.

5.2.1 Beach Recycling

A first consideration for persistent breach of the Alarm Level should be to undertake localised beach recycling and re-profiling within individual groyne bays or between adjacent groyne bays (see also Section 1.2.1).

The ability to undertake beach recycling will depend on there being sufficient sediment within a groyne bay or adjacent groyne bays. It is not technically viable to recycle beach sediment along the entire Swanage Bay frontage due to tidal constraints and limited beach width. As such, a beach profile survey will need to be undertaken to confirm if the required volume of sediment exists to be recycled to achieve the desired profile levels.

The normal storm response of a beach involves the flattening of the slope as material is removed from the crest and distributed both further seaward along the profile, and alongshore. The process of beach recycling and re-profiling is likely to be a short-term measure. For the material to be available for re-profiling it must realistically be above the level of Mean Low Water Neaps (MLWN) to enable recovery with land-based plant. Quantities available for beach recycling could also be limited, as material can only be removed from one part of the frontage provided that this does not compromise the defence standard of protection in the 'source' area. As such, if this situation is reached, measures should be taken to begin the planning and implementation of a beach recharge campaign (refer to Section 5.2.2).

5.2.2 Beach recharge

At the time when ongoing monitoring indicates that Alarm Levels are being consistently exceeded or beach volume will be below minimum levels within two to three years, then measures should be taken to begin the planning and implementation of a beach recharge campaign in order to increase the volume of sediment along the BMP frontage such that the design beach levels can be restored.

In order to undertake a beach recharge campaign, a business case will need to be prepared each time to secure the necessary funding (refer also to Section 1.4.1). Various licences and consents will also need to be obtained (see Section 1.6). This process can take a year or more to achieve all necessary approvals and deliver a recharge campaign on site.

As stated in Section 2.6.2, review of all monitoring data collated since the 2005 beach recharge shows that the trend along the recharged beach area is one of gradual loss of beach volume, and that when this trend is extrapolated, it is predicted that the minimum beach volume required to provide the 2005 scheme design standard of protection will be reached between 2023 and 2025, meaning further beach recharge will be needed in this time-frame. As such, measures are defined in this BMP to take forward the development of the outline business case (OBC) from 2021 to allow the next required beach recharge campaign to be delivered (see Section 1.2.1 and Section 1.4).

5.3 Crisis trigger level works

If a **Crisis Level** (refer to Section 3.3) is identified as being reached on a profile, the immediate task would be to carry out a visual inspection of the profile concerned to validate the survey data and check that it is representative of the general beach area over a 100m length (i.e. not a localised 'low'' point). If the Crisis Level is shown to be a general problem to be addressed, then timely action will be required to safeguard the integrity of the sea wall.

Ultimately the response to the Crisis Level being reached will be for beach recharge to be carried out. If not already in process (due to Alarm Levels having been reached), then planning and implementation of a beach recharge campaign should begin as per the process defined in Section 5.2.2.

However, it is likely that the occurrence of a Crisis Level will be as a result of a storm event that erodes a large amount of beach material over a short period of time. Whilst the preferred solution of beach recharge is being planned and implemented, a short term measure will be to place rip-rap rock armour along the toe of the seawall to reduce the risk of it being undermined (see also Section 1.4.1.1). In order to be in a position to implement a rock armour solution in a rapid time-frame should the situation ever arise, **it is recommended**

that analysis should be undertaken to determine (a) the appropriate size of rock to place in a crisis situation, such that it is large enough to withstand the forces it will experience, and (b) the source of rock that will be used, noting that any possible source must be near to the site and readily available whenever it may be required; this should also consider the viability of creating a local stockpile near to the site as a way of ensuring this ready availability.

5.4 Implementation

5.4.1 Beach recycling and re-profiling operations

Whenever beach recycling and re-profiling activities are required in the future (i.e. if/when trigger levels are reached), then beach recycling logs are to be kept that record the locations of where sediment is extracted and deposited, and approximately how much sediment is moved (e.g. number of dumper loads). This information will help to inform analysis of beach volume changes in the future. See Section 4.1.3 for further details.

5.4.2 Beach recharge operations

When beach recharge occurs along the BMP frontage, it is likely that material will be delivered via the sea, involving the use of a pipeline across the seabed (as was used to recharge Swanage Beach in 2005/6 (see Section 3.1.1)). However, the precise method for implementing beach recharge will be determined by the contractor and designer in discussion with Dorset Council at the time such works are to be carried out, giving consideration to the availability of sediment of appropriate grading and required volume from different sources (refer also to Section 1.2.1 and Section 1.4.1).

Whenever beach recharge occurs, then beach recharge logs are to be kept that record the locations of where sediment is placed. This is to be supported by pre- and post-recharge surveys which will help to inform analysis of beach volume changes in the future. See Section 4.1.3 for further details.

5.4.3 Structure maintenance and repair operations

The maintenance and repair of the timber groynes, seawalls, promenade and other structures are undertaken on an ad hoc basis, guided by regular visual inspections. The approach to implementing maintenance and repairs is guided by the issue(s) to be addressed at the time, and as such, there are no routine planned activities that occur to these features.

For any future maintenance works, the nature of the works will guide what plant is needed.

5.4.4 Plant requirements for beach recycling

Since the beach was recharged in 2005, there has not been a need to undertake any recycling along the BMP frontage. Should there be a need to undertake beach recycling in the future, consideration of the most appropriate equipment to use will need to be made at the time depending on the nature and location of works. Based on experience at other beach management sites, this is likely to require use of the following plant:

- 22-ton excavator;

- 22-ton bulldozer; and
- Dump truck(s).

For any future capital works, the nature of the works will guide what plant is needed.

5.4.5 Access for works

For beach recycling and re-profiling activities, access to the beach area is potentially available via a number of slipways extending onto the beach from Shore Road, at:

- Adjacent to the Mowlem at the southernmost end of the site.
- Either side of the landward end of the Banjo Pier to access north and south of this structure.
- Adjacent to the Waterfront Restaurant at the junction of Shore Road and Ulwell Road.

There is no access to the beach north of the Waterfront Restaurant via the seawall / slipways.

Depending on the plant used, it may not be viable to use the above stated access points. In such circumstances, beach material will need to be pulled up against the seawall to allow access directly onto the beach from the promenade along Shore Road into the relevant groyne bay(s).

Access along the beach is facilitated by the 4m gaps at the landward end of each groyne (refer to Section 3.1.2), though significant drops can exist on down-drift sides of the groynes, so some localised use of beach material to create safe access across these crossing-points may be required.

For any future capital works, the above access points will be adopted. However, there is no area close to the frontage that could serve as a compound to provide direct access to the beach. Access to the frontage from any compound for capital works located elsewhere will use the local road network; as such this will need to be carefully planned to minimise impacting other users and manage risks of multiple hazards.

5.4.6 Public access, amenity and safety

Beach management activities should avoid the peak holiday season, weekends and public holidays where possible. This will minimise the impact of works on beach users and will reduce the minor risk to public safety that such work would pose.

In order to ensure the safety of the public whilst works are being carried out, restrictions on public access to the areas of the beach being worked on should be implemented, with alternative routes provided if possible, as was done when constructing the 2005/6 Swanage Beach Recharge Scheme (see Section 3.1.1).

More recent previous experience elsewhere has shown that closing the beach entirely can be impractical, and if this is the case in the future at Swanage, **it is suggested that a banks-man is present with each machine, and that personnel along with signage are employed to direct public access to safe sections of the promenade and beach during works**.

Information boards should be displayed for one week prior to, and for the duration of, the works being carried out to explain what is being done and why. This will also serve to improve public education. Appendix K contains a best practice guide on how to communicate with the public and local businesses when undertaking beach maintenance works.

5.4.7 Notifying and engaging with others

When undertaking beach recycling and re-profiling works, the local community and local business are notified of works a few days ahead of them commencing. This includes utilising news items in the local media.

When any future capital works occur along the frontage, a much greater effort will be undertaken to communicate plans to a wider group of stakeholders. Therefore, in addition to communicating effectively with the public (see also Section 5.4.6), it is recommended that explicit notification of any future capital works (including contact details should there be any queries) should be provided to the following organisations/groups depending upon the location where capital works are occurring:

a) Natural England (in relation to nature conservation and coastal access interests).

b) UNESCO Dorset & East Devon “Jurassic Coast” World Heritage Site (in relation to nature conservation interests).

c) South West Coast Path (in relation to coastal access interests).

d) Dorset Historic Environment Officer (in relation to historic environment interests).

e) Environment Agency (in relation to FCERM and funding).

f) The Marine Management Organisation (only if beach recharge or major scheme and works occurring below MHW level).

g) The Crown Estate (only if a major scheme).

h) Swanage Town Council (including the “Beach Management Advisory Committee”).

i) Swanage Coastal Change Forum.

j) Southern IFCA.

k) Local businesses and those people who have a day to day interest in what is happening along the frontage where works are to occur, i.e. any businesses/user groups that may be affected.

l) Local residents and beach hut owners directly affected by any road or access closures along the frontage when works occur.

6 Action Plan

This section provides a summary of the recommendations made throughout the rest of this BMP in the form of an Action Plan. The Action Plan is presented below and identifies actions grouped by type as being either for ‘Management, ‘Monitoring’, ‘Maintenance’, or ‘Future Studies / Research’.

It is intended that this Action Plan be used to guide future management of this area.

Table 6-1 Swanage BMP Action Plan

Action No.	Action Description	By Who?	Date Action First Defined	When by?	Related BMP Section(s)	Current Status
MANAGEMENT ACTIONS						
MAN_01	Review and update this BMP every 5 years. Next BMP Review due in 2025. When doing so, further review should be undertaken to determine if there is a need for additional control structures to help retain beach sediment towards the Mowlem; or accepting that this cannot be achieved and instead using rock-armour in this section to provide protection to the seawall and acts as a transition to beach area towards the Banjo Pier (**see action no. FSR_02**). This could also be explored as part of the OBC (**see action no. MAN_03**).	Dorset Coastal Engineering Partnership	August 2020	August 2025	1.2 and 1.4.4	Not Started
MAN_02	Hold regular meetings with Poole Harbour Commissioners (PHC) to discuss alignment of future dredge operations with future beach recharge needs, to maximise opportunities for potential re-use of dredge arisings, as part of ongoing work through the Durlston Head to Hurst Spit Sediment Resource Management Programme.	Dorset Coastal Engineering Partnership	August 2020	Ongoing (~every 6 months)	1.2.1	Ongoing
MAN_03	In order to deliver the next beach recharge between 2023 and 2025, an Outline Business Case (OBC) will need to be developed and approved between 2021 and 2023. In doing so, the various technical, environmental and economic issues described in this BMP will need to be addressed, including: • at the commencement of the OBC development, clarity should be sought from the Environment Agency on the most appropriate valuation of amenity benefits to support the next scheme. • ecological surveying of the seabed in Swanage Bay should be undertaken to confirm the presence and distribution of key habitat and species that are protected by various marine SAC, SPA, WFD and MCZ designations covering the bay. The exact scope of such survey work should be discussed and agreed with Natural England and the MMO at the start of the work to develop the OBC for the next beach recharge campaign, to allow for any data capture in the coming years to support the Marine Licence application. This may include undertaking a primary survey of seabed bedforms, preferably repeated throughout at least one year, to gain some inference of sediment transfer paths and directions. This should be supported by, as a minimum, a grab sample survey of Swanage Bay.	Dorset Coastal Engineering Partnership	August 2020	Start OBC ~April 2021	1.4	Not Started
MAN_04	Efforts should be made in the near term to work with all landowners and key stakeholders to develop a single cliff management strategy to ensure coherent approach is taken in the future along the New Swanage section of the BMP frontage. This could also incorporate longer-term adaptation planning in line with SMP policy (**see action no. FSR_01**).	Swanage Landslides Group / Swanage Coastal Change Forum	August 2020	August 2025	3.1.4	Not Started
MONITORING ACTIONS						
MON_01	Continue current beach monitoring to provide longer-term data to allow more accurate assessment of beach change patterns.	CCO	August 2020	Ongoing (~every 6 months)	4.1.1	Ongoing
MON_02	Undertake detailed survey immediately prior to, during and after the placement of sediment along the BMP frontage as part of future beach recharge campaigns in an effort to provide greater confidence in the 'as-placed' volumes stated in the future. **See also action no. MON_07**.	Dorset Coastal Engineering Partnership	August 2020	When next beach recharge occurs	1.4.4	Not Started
MON_03	In addition to the work of the SERCMP (**see action no. MON_01**), additional (more frequent) surveys of the SERCMP interim profiles surveyed each spring and autumn is to be undertaken by the Dorset Coastal Engineering Partnership to provide additional data on beach dynamics.	Dorset Coastal Engineering Partnership	August 2020	Ongoing (~every 2 to 3 months)	4.1.1	Not Started

Action No.	Action Description	By Who?	Date Action First Defined	When by?	Related BMP Section(s)	Current Status
MON_04	In order to determine when there is a need to begin the process of implementing future beach recharge, a regular review of the beach profile survey data to monitor beach volume in relation to minimum beach volume requirements is required.	Dorset Coastal Engineering Partnership	August 2020	Ongoing (after each beach survey)	4.1.1	Ongoing
MON_05	Post-storm surveys are to be triggered if required following visual inspections shortly after storm events.	Dorset Coastal Engineering Partnership	August 2020	Ongoing (as required)	4.1.1 and 4.1.6	Ongoing
MON_06	The work done to develop the 2005/6 Swanage Beach Recharge Scheme included identifying the levels of the underlying clay bedrock located beneath the beach along the Swanage BMP area. As such, there is no requirement to undertake further investigation of this to provide a more definitive master profile for beach volume calculations. Rather, the existing data should be transposed into SANDS to use in future beach volume calculations.	Dorset Coastal Engineering Partnership	August 2020	August 2021	4.1.2	Not Started
MON_07	During future beach recycling and beach recharge works along the BMP frontage, beach recycling / recharge logs are to be completed by the operational staff. This includes any occasional beach recycling undertaken by Swanage Town Council between the Mowlem and the Banjo Pier for amenity purposes. **This action links to action no. MON_02 and MON_07**.	Dorset Coastal Engineering Partnership / Swanage Town Council	August 2020	Ongoing	4.1.3 and 5.1.1	Not Started
MON_08	In order to validate the beach recycling / recharge logs, it is recommended that two separate beach surveys, 'in' (pre-recycling) and 'out' (post-recycling), are undertaken when such activities occur (refer also to Section 1.4.4). **See also action no. MON_02 and MON_07**.	Dorset Coastal Engineering Partnership	August 2020	When next beach recycling event occurs	4.1.3	Not Started
MON_09	A record should also be kept of when and approximately how much sand is removed from the highway / promenade as waste to better understand how often this occurs and its impact on overall beach volumes observed in measured data. **This action links to action no. MON_07.**	Dorset Coastal Engineering Partnership / Swanage Town Council	August 2020	When next sand clearance event occurs	4.1.3	Not Started
MON_10	In addition to the SERCMP schedule, additional bi-annual nearshore bathymetry surveys of Swanage Bay are to be undertaken each spring and autumn to allow monitoring of the nearshore area and so aid understanding of where sediment moves to once it goes below MLWS level (the maximum extent of the beach profile surveys).	Dorset Coastal Engineering Partnership	August 2020	Ongoing (~every 6 months)	4.1.4	Not Started
MON_11	As part of planning the next beach recharge campaign (see Sections 1.2.1 and 1.4.1), sediment sampling of the proposed sediment source area should be undertaken to confirm that the recharge material is in line with the beach sediment grading envelope for the design beach. This activity could be undertaken as part of the OBC work (**see action no. MAN_03**).	Dorset Coastal Engineering Partnership	August 2020	Start OBC ~April 2021	4.1.5	Not Started
MON_12	Visual walkover inspections should be undertaken by the Dorset Council engineers to monitor beach crest level against the seawall, with reference to the trigger levels defined in Section 3.3. One walkover survey should be undertaken every month during the winter (October to March) and one survey every two months during the summer (April to September). Throughout the year, additional walkover surveys will need to be carried out prior to and immediately after storm events, as required. To aid visual inspections, and because the drop measurement from the seawall crest to the beach varies along the BMP frontage, visual markers indicating the trigger levels could be placed on the seawall.	Dorset Coastal Engineering Partnership	August 2020	Ongoing	4.1.6	Ongoing
MON_13	Post-storm event visual inspections should be used to record when events have occurred that require the promenade behind the beach to be cleared of beach sediment/debris. This information should be collated by the DC engineer so that it may be used to develop flood warning procedures in the future.	Dorset Coastal Engineering Partnership	August 2020	Ongoing (as required)	4.1.6	Ongoing

Action No.	Action Description	By Who?	Date Action First Defined	When by?	Related BMP Section(s)	Current Status
MON_14	In order to continue to improve understanding the effect of storm events upon the beach response, details of the storm conditions (waves, winds and water levels) will need to be recorded in support of the post-storm profile surveys.	Dorset Coastal Engineering Partnership	August 2020	Ongoing	4.4.2	Ongoing
MON_15	A review of all survey data should be carried out at least annually (and ideally after every survey) with particular focus on beach volume changes and how they relate to the minimum beach volumes defined by the trigger levels in Section 3.3.	Dorset Coastal Engineering Partnership	August 2020	Annually (as minimum)	4.6	Not Started
MAINTENANCE ACTIONS						
MAI_01	Annual visual inspection of all of the structures along the BMP frontage is to occur during the spring of each year to allow any maintenance works required to be identified and completed prior to the busy summer period, thus avoiding impacting on the amenity use of the beach. In doing so, future inspections of the timber groynes should be planned to occur at spring low-tides in order to inspect these sections of the timber groynes.	Dorset Coastal Engineering Partnership	August 2020	Annually, each spring	4.2.1 and 1.3.4	Ongoing
MAI_02	Undertake the maintenance works to the various coastal defence structures along the BMP frontage recommended in the November 2019 asset inspection by WSP (see Section 3.2) as soon as possible, subject to funding being available to do so, alongside addressing the public health and safety issues identified in Section 1.4.3	Dorset Coastal Engineering Partnership	August 2020	As soon as possible, subject to funding being available to do so.	5.1.2 and 1.4.3	Not Started
MAI_03	Further investigation using trial pits is required in the area between The Mowlem and the Outfall Jetty to confirm seawall toe levels and current toe protection works. These investigations should be undertaken as part of developing the OBC, and consideration be given as part of the OBC (**see action no. MAN_03)** as to whether or not to include measures to address undermining risk considered in Appendix B as part of the next beach recharge campaign (or as a separate project at a different time).	Dorset Coastal Engineering Partnership	August 2020	Do as part of OBC to commence ~April 2021	3.1.3	Not Started
MAI_04	Undertake investigations to identify the cause of water seepage through sections of the seawalls in Beach Zone 08 and 11 (see Figure 3-12) with a view to formalising drainage to limit risk of washout of fines from within the seawall. These investigations should be undertaken as part of developing the OBC, and consideration be given as part of the OBC as to whether or not to include measures to address undermining risk considered in Appendix B as part of the next beach recharge campaign (or as a separate project at a different time) (**see action no. MAN_03**).	Dorset Coastal Engineering Partnership	August 2020	Do as part of OBC to commence ~April 2021	3.2.2.1	Not Started
MAI_05	When works are occurring on the beach, ensure that a banks-man is present with each machine, and that personnel along with signage are employed to direct public access to safe sections of the promenade and beach during works. Information boards should also be displayed for one week prior to, and for the duration of, the works being carried out to explain what is being done and why.	Dorset Coastal Engineering Partnership	August 2020	Whenever works are occurring on the beach	5.4.6	Ongoing
FUTURE STUDIES / RESEARCH						
FSR_01	It is the intent of the SMP policy to also manage the transition at the northern end from New Swanage (north of Tranville Ledges) towards Ballard Down in the longer-term, where the policy is for no active intervention to allow continued erosion of the undefended cliffs. A coastal adaptation plan should therefore be developed with the local community in the near future to manage future development in this area of Swanage Bay in the context of this policy transition. This should be taken forwards as part of or following definition of Coastal Change Management Areas as part of the Local Plan (see Section 1.7.3) and could form part of the work of developing a cliff management strategy for this area (see Section 3.1.4).	Dorset Coastal Engineering Partnership / Swanage Coastal Change Forum	August 2020	As soon as possible, subject to funding being available to do so.	1.7.1	Not Started

Action No.	Action Description	By Who?	Date Action First Defined	When by?	Related BMP Section(s)	Current Status
FSR_02	It is likely that the occurrence of a Crisis Level will be as a result of a storm event that erodes a large amount of beach material over a short period of time. Whilst the preferred solution of beach recharge is being planned and implemented, a short term measure will be to place rip-rap rock armour along the toe of the seawall to reduce the risk of it being undermined (see also Section 1.4.1.1). In order to be in a position to implement a rock armour solution in a rapid time-frame should the situation ever arise, it is recommended that analysis should be undertaken to determine (a) the appropriate size of rock to place in a crisis situation, such that it is large enough to withstand the forces it will experience, and (b) the source of rock that will be used, noting that any possible source must be near to the site and readily available whenever it may be required; this should also consider the viability of creating a local stockpile near to the site as a way of ensuring this ready availability. This needs to be completed to inform the next BMP update at the latest (**see action no. MAN_01**), but could be undertaken as part of the OBC work (**see action no. MAN_03**).	Dorset Coastal Engineering Partnership	August 2020	As soon as possible, subject to funding being available to do so.	5.3	Not Started

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Glossary

Term	Definition
Accretion	Accumulation of sediment due to the natural action of waves, currents and wind.
AEP	Annual Exceedance Probability. The probability of a defined level being exceeded in any given year.
Alarm Level	The level before Crisis Level. This is usually a predetermined value where the monitored beach parameter falls to within range of the Crisis Level, but has not resulted in systematic failure of the function being monitored, e.g. recession of a beach crest eroding to within 10m of an asset, where it has been predetermined that an extreme storm event could result in recession of 5m. The Alarm Level in this example is therefore a 5m buffer. Increased monitoring would be required when an Alarm Level is compromised and intervention undertaken if deemed necessary. Managing Alarm Levels can be planned in advance.
Amenity	The tangible or intangible elements of a location that contribute to a perceived positive character of the area for the enjoyment of those that use it.
AONB	Area of Outstanding Natural Beauty. Designated by the Countryside Commission. The purpose of the AONB designation is to identify areas of national importance and to promote the conservation and enhancement of natural beauty. This includes protecting its flora, fauna, geological and landscape features. This is a statutory designation.
ATT	Admiralty Tide Table.
Backwash	The seaward return of the water following the up-rush (swash) of the waves. For any given tide stage the point of farthest return seaward of the backwash is known as the ‘limit of backwash’.
BAP	Biodiversity Action Plan. A strategy for conserving and enhancing wild species and wildlife habitats in the UK.
Beach	A deposit of non-cohesive material (e.g. sand, gravel) situated on the interface between dry land and the sea (or other large expanse of water) and actively ‘worked’ by present day hydrodynamic processes (i.e. waves, tides and currents) and sometimes by winds.
Beach Profile	Cross-section perpendicular to the shoreline. The profile can extend seawards from any selected point on the landward side or top of the beach into the nearshore.
Beach recharge (nourishment)	Artificial process of replenishing a beach with material from another source.
Beach recycling/re-profiling	The movement of sediment along a beach area, typically from areas of accretion to areas of erosion, and shaping the beach profile to have a desired crest height, width and slope.
BMP	Beach Management Plan. It provides a basis for the management of a beach for coastal defence purposes, taking into account coastal processes and the other uses of the beach.
Breaching	Failure of the beach head allowing flooding by tidal action.

Term	Definition
CCO	Channel Coastal Observatory. Based at the National Oceanography Centre, (University of Southampton), responsible for the South-East Strategic Regional Coastal Monitoring Programme.
CIRIA	Construction Industry Research and Information Association.
Climate Change	Long term changes in climate. The term is generally used for changes resulting from human intervention in atmospheric processes through, for example, the release of greenhouse gases to the atmosphere from burning fossil fuels, the results of which may lead to increased rainfall and sea level rise.
Coastal squeeze	The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by a fixation of the high water mark.
Crest	Highest point on a beach face, breakwater or seawall.
Crest level/height	The vertical level of the beach relative to mOD.
Crest width	The horizontal distance of the beach measured from the seaward edge of the promenade to the point where the beach slope angle drops down towards the sea.
Crisis Level	The level at which the function being monitored, such as the stability of the beach and/or any backing structures (seawall/promenade), could be compromised and emergency remedial action becomes necessary, e.g. as in the case described under Alarm Level above, the beach crest recedes to within 4m of an asset that requires protection, where it has been predetermined that an extreme event could result in 5m of recession.
DC	Dorset Council. Coastal Operating Authority as defined under the Coast Protection Act 1949 with permissive powers to provide defence against coastal erosion. Dorset Council was formed on 1st April 2019 following a Local Government Review. Prior to this, the Coastal Operating Authority for the Lyme Regis BMP area was West Dorset District Council.
Defra	Department for Environment, Food and Rural Affairs (formerly known as MAFF)
Environment Agency	Environment Agency. UK non-departmental government body responsible for delivering integrated environmental management including flood defence, water resources, water quality and pollution control.
Erosion	Wearing away of the land, usually by the action of natural forces.
FDGiA	Flood Defence Grant in Aid. The mechanism by which most of the funding for flood and coastal defence works in England is provided by the Government. The grants are used to cover our operating costs and to fund capital projects.
Flood and Coastal Risk Management	Flood and coastal risk management addresses the scientific and engineering issues of rainfall, runoff, rivers and flood inundation, and coastal erosion, as well as the human and socio-economic issues of planning, development and management.
Flood Zone	A geographical area officially designated subject to potential flood damage. The Environment Agency uses Flood Zone 2 and Flood Zone 3.
Geomorphology/ morphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.

Term	Definition
GIS	Geographical Information System
Groyne	Narrow, roughly shore-normal structure built to reduce longshore currents, and/or to trap and retain beach material. Most groynes are of timber or rock, and extend from a seawall, or the backshore, well onto the foreshore and rarely even further offshore.
Groyne bay	The compartment between two groynes.
Hard defence	General term applied to impermeable coastal defence structures of concrete, timber, steel, masonry etc, which reflect a high proportion of incident wave energy.
Heritage Coast	Heritage Coasts represent stretches of our most beautiful, undeveloped coastline, which are managed to conserve their natural beauty and, where appropriate, to improve accessibility for visitors. Definition is formalised by agreement between the relevant maritime local authorities and Natural England.
Hold the Line	An SMP policy to maintain or change the level of protection provided by defences in their present location.
Jetty	See 'Groyne'
Joint probability	The probability of two (or more) things occurring together.
Joint Probability Analysis (JPA)	Function specifying the joint distribution of two (or more) variables.
Joint return period	Average period of time between occurrences of a given joint probability event.
LiDAR	Light Detection and Ranging. This is an airborne mapping technique which uses a laser to measure the distance between the aircraft and the ground.
Listed Building	A building or other structure officially designated as being of special architectural, historical or cultural significance.
Locally generated (wind) waves	Locally generated short period and irregular waves created by the flow of air over water.
Longshore transport	Movement of material parallel to the shore, also referred to as longshore drift.
MCZ	Marine Conservation Zone. Designated under the Marine and Coastal Access Act 2009.
MMO	Marine Management Organisation. An executive non-departmental public body established and given powers under the Marine and Coastal Access Act 2009. Responsible for managing activities in the marine environment including marine licensing and marine planning.
mCD	metres Chart Datum. Approximately the lowest astronomical tidal level, excluding the influence of the weather.
mOD	metres Ordnance Datum. A universal zero point used in the UK, equal to the mean sea level at Newlyn in Cornwall.
Mean sea level	Average height of the sea surface over a 19-year period.

Term	Definition
Mean High Water (MHW)	The average of all high waters observed over a sufficiently long period.
Mean High Water Springs (MHWS)	The average height of the high waters of spring tides.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Mean Low Water Springs (MLWS)	The average height of the low waters of spring tides.
Met Office	UK Meteorological Office.
Monitoring	Systematic recording over time
Natural England	A non-departmental public body of the UK government responsible for ensuring that England's natural environment, including its land, flora and fauna, freshwater and marine environments, geology and soils, are protected and improved. It also has a responsibility to help people enjoy, understand and access the natural environment.
Nearshore	The zone that extends from the swash zone to the position marking the start of the offshore zone, typically to water depths of about 20m.
No Active Intervention	An SMP policy that assumes that existing defences are no longer maintained and will fail over time or undefended frontages will be allowed to evolve naturally.
Offshore	The zone beyond the nearshore zone where sediment motion induced by waves alone effectively ceases and where the influence of the seabed on wave action has become small in comparison with the effect of wind.
Overtopping	Water carried over the top of a coastal defence due to wave run-up exceeding the crest height.
Overwashing	The effect of waves overtopping a coastal defence, often carrying sediment landwards which is then lost to the beach system.
Policy Unit	A Policy Unit relates to the policy area defined by the Shoreline Management Plan (SMP).
Ramsar	Designated under the, “Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat.” 1971. The objective of this designation it to stem the progressive encroachment onto, and loss of wetlands.
Relict	Features or sediment formed or deposited by processes no longer active in the area.
Return Period	A statistical measurement denoting the average probability of occurrence of a given event over time.
RNLI	Royal National Lifeboat Institute
Rock Armour	Wide-graded quarry stone normally bulk-placed as a protective layer to prevent erosion of the seabed and or other slopes by current and/or wave action.

Term	Definition
SAC	Special Area of Conservation: this designation aims to protect habitats or species of European importance and can include Marine Areas. SACs are designated under the EC Habitats Directive (92/43/EEC) and will form part of the Natura 2000 site network. All SACs sites are also protected as Site of Special Scientific Interest, except those in the marine environment below the Mean Low Water (MLW).
Scheduled Monument	Scheduled Monument: formerly referred to as Scheduled Ancient Monuments. Scheduled Monuments are nationally important archaeological sites which have been awarded scheduled status in order to protect and preserve the site for the educational and cultural benefit of future generations. The main legislation concerning archaeology in the UK is the Ancient Monuments and Archaeological Areas Act 1979. This Act, building on legislation dating back to 1882, provides for nationally important archaeological sites to be statutorily protected as Scheduled Monuments.
Scour	Removal of underwater material by waves or currents, especially at the toe of a shore protection structure.
Sea level change	The rise and fall of sea levels throughout time in response to global climate and local tectonic changes.
Seawall	Massive structure built along the shore to prevent erosion and damage by wave action.
Sediment	Particulate matter derived from rock, minerals or bioclastic debris.
Sediment transport	The movement of a mass of sedimentary material by the forces of currents and waves.
SERCMP	South East Regional Coastal Monitoring Programme. See “CCO”.
Significant wave height, H_s	The average height of the highest of one third of the waves in a given sea state.
SMP	Shoreline Management Plan. It provides a large-scale assessment of the risks associated with coastal processes and presents a policy framework to manage these risks to people and the developed, historic and natural environment in a sustainable manner.
SPA	Special Protection Area. These are internationally important sites, being set up to establish a network of protected areas for birds
SSSI	Sites of Special Scientific Interest. These sites, notified by Natural England, represent some of the best examples of Britain’s natural features including flora, fauna, and geology. This is a statutory designation
Standard of Protection (SoP)	The level of return period event which the defence is expected to withstand without experiencing significant failure.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Sustainability (in coastal flood and erosion risk management)	The degree to which coastal flood and erosion risk management options avoid tying future generations into inflexible or expensive options for flood defence. This usually includes consideration of other defences and likely developments as well as processes within catchments. It will take account of long term demand for non-renewable materials.

Term	Definition
Swash	The area onshore of the surf zone where the breaking waves are projected up the foreshore.
Swell waves	Remotely wind-generated waves (i.e. Waves that are generated away from the site). Swell characteristically exhibits a more regular and longer period and has longer crests than locally generated waves.
SWL	Still water level. The level that the sea surface would assume in the absence of wind and waves.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Toe level	The level of the lowest part of a structure, generally forming the transition to the underlying ground.
UKCP09	UK Climate Projections 2009. Research giving predictions of how future climate change may affect the UK.
UKHO	United Kingdom Hydrographic Office.
UNESCO	United Nations Educational, Scientific and Cultural Organisation.
Wave climate	Average condition of the waves at a given place over a period of years, as shown by height, period, direction etc.
Wave direction	Direction from which a wave approaches.
Wave height	The vertical distance between the crest and the trough.
Wave hindcast	In wave prediction, the retrospective forecasting of waves using measured wind information.
Wave period	The time it takes for two successive crests (or troughs) to pass a given point.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.
Wave reflection	The part of an incident wave that is returned (reflected) seaward when a wave impinges on a beach, seawall or other reflecting surface.
WFD	Water Framework Directive. A European Directive that aims to establish a framework for the protection of inland surface waters (rivers and lakes), transitional waters (estuaries), coastal waters and groundwater.
World Heritage Site	A place of ‘outstanding universal value’ selected by UNESCO.

Appendix A

Economic Case Information

Appendix A Economic Case Information

This appendix is provided electronically alongside this BMP.

Appendix B

Beach Management Options Appraisal (2020)

Appendix B Beach Management Options Appraisal (2020)

This appendix is provided electronically alongside this BMP.

Appendix C

Environmental Designation Information

Appendix C Environmental Designation Information

This appendix provides a summary list of natural environment and heritage features that are both within and adjacent to the Swanage Beach Management Plan area.

Isle of Portland to Studland Cliffs SAC

Refer to designation information provided by the Joint Nature Conservation Committee, available online at https://sac.jncc.gov.uk/site/UK0019861 (date accessed: 9th March 2020).

Studland to Portland SAC

Refer to designation information provided by the Joint Nature Conservation Committee, available online at https://sac.jncc.gov.uk/site/UK0030382 (date accessed: 9th March 2020).

Solent and Dorset Coast SPA

Refer to designation information published online in 2020 following consultation on designating this SPA at https://www.gov.uk/government/consultations/solent-and-dorset-coast-potential-special-protection-area-comment-on-proposals (date accessed: 9th March 2020).

Purbeck Coast MCZ

Refer to designation information available online at https://www.gov.uk/government/publications/marine-conservation-zones-purbeck-coast (date accessed: 9th March 2020).

Studland Bay MCZ

Refer to designation information available online at https://www.gov.uk/government/publications/marine-conservation-zones-studland-bay (date accessed: 9th March 2020).

Purbeck Ridge (East) SSSI

Refer to designation information provided by Natural England, available online at https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1002368&SiteName=Purbeck%20Ridge%20(East)&countyCode=&responsiblePerson=&SeaArea=&IFCAArea= (date accessed: 9th March 2020).

Studland Cliffs SSSI

Refer to designation information provided by Natural England, available online at https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1000898&SiteName=studland&countyCode=&responsiblePerson=&SeaArea=&IFCAArea= (date accessed: 9th March 2020).

South Dorset Coast SSSI

Refer to designation information provided by Natural England, available online at https://designatedsites.naturalengland.org.uk/SiteDetail.aspx?SiteCode=S1002501&SiteName=edge&countyCode=&responsiblePerson=&SeaArea=&IFCAArea= (date accessed: 9th March 2020).

Geological Conservation Review (GCR) Sites

Information about GCR Sites, including access to the GCR Site Database, is provided by the Joint Nature Conservation Committee, available online at available online at https://jncc.gov.uk/our-work/geological-conservation/ (date accessed: 9th March 2020).

Dorset and East Devon UNESCO World Heritage Site (the 'Jurassic coast')

The Dorset and East Devon Coast World Heritage Site is England's first natural World Heritage Site - it is known as The Jurassic Coast. It covers 95 miles of truly stunning coastline from East Devon to Dorset, with rocks recording 185 million years of the Earth's history. World Heritage status was achieved because of the site's unique insight into the Earth Sciences as it clearly depicts a geological 'walk through time' spanning the Triassic, Jurassic and Cretaceous periods.

Further information about the World Heritage site is to be found at https://jurassiccoast.org/ (date accessed: 9th March 2020). Of particular relevance is the Jurassic Coast Partnership Plan that is to be found on these pages and which guides management of the site.

Dorset Area of Outstanding Natural Beauty (AONB)

Details about the Dorset AONB can be found at https://www.dorsetaonb.org.uk/ (date accessed: 9th March 2020). Of particular relevance is the AONB Management Plan that is to be found on these pages and which guides management of the site.

Purbeck Heritage Coast

Some information about the Purbeck Heritage Coast can be found online at https://www.britainexpress.com/countryside/coast/purbeck.htm (date accessed: 9th March 2020).

Historic and Cultural Environment data

Up to date information on the various historic and cultural environment data around the Swanage BMP area, including scheduled monuments, listed buildings and national trails, is available online at https://magic.defra.gov.uk/MagicMap.aspx (date accessed: 9th March 2020).

Biodiversity data

Dorset Biodiversity Strategy

Information on the Dorset Biodiversity Strategy can be found online at the Dorset Local Nature Partnership website, https://dorsetlnp.org.uk/wp-content/uploads/2019/01/Dorset-Biodiversity-Strategy-2003.pdf (date accessed: 9th March 2020).

Action for Biodiversity in the South West

Information on actions to improve biodiversity in the South West of England can be found online at the Biodiversity South West website, http://www.biodiversitysouthwest.org.uk/docs/Natural%20Advantage.pdf (date accessed: 9th March 2020).

Marine Life Information Network (MarLIN)

Information on the biology of species and the ecology of habitats found around the coasts and seas of the British Isles is available online at https://www.marlin.ac.uk/ (date accessed: 9th March 2020).

Water Quality (WFD) data

Information about water quality in relation to WFD sites is available online via the Environment Agency's *Catchment Data Explorer* tool, https://environment.data.gov.uk/catchment-planning/ (date accessed: 9th March 2020).

Bathing Water Quality data

Information about bathing water quality is available online via the Environment Agency's *Bathing Water Profiles*, https://environment.data.gov.uk/bwq/profiles/ (date accessed: 9th March 2020).

Appendix D

History of Coastal Flooding, Erosion and Defences at Swanage

Appendix D History of Coastal Flooding, Erosion and Defences at Swanage

This appendix is provided electronically alongside this BMP.

Appendix E

2005 Beach Recharge Scheme Environmental Mitigation Measures

Appendix E 2005 Beach Recharge Scheme Environmental Mitigation Measures

NB: The information in this appendix is taken directly from the 2005 Swanage BMP and Environmental Statement.

Ecology and Nature Conservation

M.1 The locations of potential site compounds are to be located outside of the areas of nature conservation interest.

M.2 No new access routes to site other than the existing slipway are to be created and the boundary of works is to be confined to the beach, access routes and contractors' compounds, with no encroachment into the adjacent SSSI.

M.3 An action plan will be agreed and adopted to cover accidental spillage to the foreshore and local marine waters. Personnel will be informed of the plan, the environmental risks of fuel and oil spillage on the foreshore and contingency in the event of an accidental spillage.

M.4 Refuelling, storage of synthetic compounds and maintenance of all mechanical plant will be undertaken within a designated enclosed area away from the foreshore.

M.5 Plant machinery will be fitted with oil/fuel traps or drip trays to minimise spillage to the foreshore.

Landscape and Visual Impact

M.1 The sand will be selected to be of similar colour and general appearance to that existing on beach.

M.2 Proposed beach recharge will mitigate the potential negative landscape impact of the new structures.

M.3 All works to be undertaken outside of the main tourist months of May to August and the presence of vehicles and construction plant will be limited to maintain the visual amenity currently afforded.

Tourism and Recreation

M.1 Groyne construction and beach recharge will be undertaken between mid-September and mid-April inclusive.

M.2 Local businesses will be kept informed about the nature, timing and duration of the works, including compound locations and traffic controls.

M.3 Adequate safety measures, such as fencing, will be erected around the working areas and construction compound(s), to ensure that the general public and recreational users are not put at risk from the works.

M.4 Construction of timber walkways over the landward end of each groyne to aid access along the beach.

M.5 Signs will be put up on the groynes to warn about the potential hazard.

M.6 The groynes will be regularly inspected for litter and seaweed and the beach will be cleaned if either of them are causing a problem.

Fisheries

M.1 Prior to commencement of the works, a consultation meeting will be held with the local fishermen to establish lines of communication between the contractor, fisheries liaison officer and the fishermen.

M.2 Access points for delivering sand by pipeline to the shore will be agreed in advance to minimise disruption to static fishing gear.

M.3 The contractor will maintain liaison with local fishermen through appointment of a fisheries liaison officer.

M.4 All activities that restrict access to the sea or fishing grounds are to be notified in advance, and where possible account is to be taken of fishermen's requirements.

M.5 Warning markers to be placed at the end of the timber groynes.

Transport and Traffic

M.1 Once the scheme has been developed further, particularly in respect of timetable, vehicle numbers and vehicle types, agreement on control of vehicle routes and timing will be reached with the County Council Highways Department.

M.2 Periods during which barge or boat movements are programmed to take place are to be notified to the public by site notices, and directly to local fishermen by the fisheries liaison officer.

Archaeology and Cultural Heritage

M.1 Any articles of interest discovered during the works will be recorded appropriately by a qualified archaeologist.

M.2 The location of wrecks and other known underwater sites will be avoided when determining the route of the sunken pipe for importing the beach recharge material.

Water and Aquatic Environment

M.1 To protect water quality during construction, the contractor will implement best practice methods and work in accordance with UK legislation, and Environment Agency/CIRIA Pollution Prevention Guidelines, including:

- The Water Resources Act 1991.
- The Environmental Protection Act 1994.
- The Environment Act 1995.
- PPG1 (General Guide to tl1e Prevention of Water Pollution).
- PPGS (Works In, Near or Liable to Affect Watercourses).
- PPG6 (Working at Construction and Demolition Sites).
- CIRIA C532 (Control of water pollution from construction sites guidance for consultants and contractors).

M.2 No vehicles, plant or materials other than timber and sand are to be stored on the beach where there is any danger of flooding and consequent pollution by fuels, cement, concrete, debris etc.

M.3 All storage areas for fuel, oil, chemicals and other potentially contaminating liquids are to be appropriately sited away from possible flooding and bunded in accordance with standard Environment Agency requirements.

Under Section 85 of the Water Resources Act 1991, it is an offence to knowingly or accidentally permit the discharge of any polluting material into controlled waters. The contractor will ultimately be responsible for carrying out the works in such a way so as to prevent offences under this legislation.

Land Use and Population

M.1 Appropriate timing of groyne works (no Sunday/public holiday working) to minimise disruption to local residents, traffic and businesses (sand recharge has to occur 24 hours a day, 7 days a week); and

M.2 Reinstatement/returfing of all private and public areas following completion of the works. Areas will be reinstated to the same or better standard as found prior to the works and a condition survey will be undertaken before and after to ensure this.

Adopting good practice and ensuring contractual constraints on the contractor's activities (which will need to be agreed with the Local Authorities in advance of the works) will mitigate impacts on the local community. The following measures will be implemented:

M.3 Planning haul routes and works programme to minimise impacts on local residents and tourist industry (e.g. working outside of the summer months);

M.4 The use of plant and machinery for the groyne works will be limited to between the hours of 0800 and 1800 Mondays to Fridays and between 0800 and 1300 on Saturdays. Work on Sundays or bank holidays will be avoided, except in emergencies;

M.5 Keeping local residents and property owners fully informed about the nature and timing of the works;

M.6 Adequate safety measures, such as fencing erected around the working areas and construction compound, to ensure that the general public is not put at risk from the works;

M.7 Wheel washing facilities at the site compound, and cleaning the road at the compound and access locations will reduce dust emissions and the amount of mud on local roads; and

M.8 Working areas and compound(s) will be fully reinstated after completion of the works (including removal of all temporary fencing and making good any damage to hard surfaces).

Air Quality and Noise

M.1 Consideration has been given to a working method at night that enables the reversing alarms on bulldozers to be turned off, which would significantly reduce noise impacts. It is believed that this may be possible, if either:

- the site operation can be arranged to guarantee that no pedestrians (site workers or members of the public) are present when bulldozers are operating; or
- infrared detector are used in place of reversing alarms to detect any pedestrians in the vicinity and automatically immobilise the bulldozers.

The practicability of either of these arrangements are to be discussed and agreed between the contractor and the Council's Environmental Health Department and the Health and Safety Executive.

M.2 Calculations suggest that the noise of recharge material in the discharge pipe may be significant at the point where the pipe reaches the shore and turns through 90 degrees. This can be mitigated by recharging this part of the beach first and then burying the corner of the pipeline in the beach. This is expected to be effective in limiting noise impact from this source.

M.3 Local residents and property owners will be kept fully informed about the nature and timing of the works. The most effective way to do this is by notices on the seafront and letters, both in advance of the works starting and during construction, giving the dates, locations and programme of the works and as much additional information as possible. A comprehensive community information programme will result in residents finding it easier to adapt to the noise impacts during the weeks when works will be near their properties.

M.4 Dust suppression activities will be carried out to reduce the amount of mud on local roads e.g. wheel washing facilities at the site compound, covering lorries where appropriate, and cleaning/ spraying the road with water, as necessary.

Appendix F

Coastal Processes Understanding

Appendix F Coastal Processes Understanding

This appendix is provided electronically alongside this BMP.

Appendix G

Contact Details

Appendix G Contact Details

Responsibility for the management and operation of activities along the BMP frontage varies depending upon the activity. Table G-1 summarise the roles, responsibilities and contact details.

Table G-1 Contact details for assigned responsibilities for Swanage beach management operations.

Management Operation		Assigned Responsibility	Contact within organisation
1a	Operations to maintain beach profile for FCERM function	Dorset Council	Assets and Property, Dorset Council, South Walks House, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
1b	Operations to maintain beach profile for amenity	Swanage Town Council	Swanage Town Council, High Street, Swanage, Dorset, BH19 2HZ. Tel. (Switchboard) 01929 423636
2a	Cleaning/clearance of beach, steps, access ramps, etc. for amenity	Swanage Town Council	Swanage Town Council, High Street, Swanage, Dorset, BH19 2HZ. Tel. (Switchboard) 01929 423636
2b	Cleaning/clearance of promenade for amenity	Dorset Council / Dorset Waste Partnership	Leisure and Tourism, Dorset Council, South Walks House, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010 Dorset Waste Partnership (DWP), Dorset Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
3	All maintenance of Outfall Jetty (Banjo Pier) and Ulwell Stream Outfall	Environment Agency	Environment Agency Asset Performance Team Leader. Environment Agency South Wessex Area Office, Rivers House, Sunrise Business Park, Higher Shaftesbury Road, Blandford, Dorset, DT11 8ST. Tel. (EA Switchboard) 08708 506506

Management Operation		Assigned Responsibility	Contact within organisation
4	Structural maintenance of timber groynes	Dorset Council	Assets and Property, Dorset Council, South Walks House, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
5	All structural maintenance of promenade, seawall, beach access structures, and highway/surface water drainage assets	Dorset Council	Assets and Property, Dorset Council, South Walks House, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010
6	Maintenance of slope stabilisation measures along New Swanage section of the BMP frontage	Private Landowners *(refer to Sections 1.3.6 and 3.1.4)*	
7	Monitoring of beach movement (and other coastal processes)	Channel Coastal Observatory	Channel Coastal Observatory National Oceanography Centre, University of Southampton, Waterfront Campus, European Way, Southampton, SO14 3ZH. Tel. 023 8059 8467
8a	Maintenance of seats/shelters	Swanage Town Council	Swanage Town Council, High Street, Swanage, Dorset, BH19 2HZ. Tel. (Switchboard) 01929 423636
8b	Maintenance of litter bins	Dorset Council / Dorset Waste Partnership	Assets and Property, Dorset Council, South Walks House, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010 Dorset Waste Partnership (DWP), Dorset Council, Stratton House, 58-60 High West Street, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010

Management Operation		Assigned Responsibility	Contact within organisation
9	Flood warning and response actions	Environment Agency / Swanage Town Council / Dorset Council	Flood Incident Management Team Leader, Environment Agency South Wessex Area Office, Rivers House, Sunrise Business Park, Higher Shaftesbury Road, Blandford, Dorset, DT11 8ST. Tel. (EA Switchboard) 08708 506 506 Swanage Town Council, High Street, Swanage, Dorset, BH19 2HZ. Tel. (Switchboard) 01929 423636 Dorset Council Emergency Planning Service, Dorset Council, County Hall, Dorchester, Dorset, DT1 1XJ. Tel. (Switchboard) 01305 251010
10	Emergency Planning	Dorset Council	Dorset Council Emergency Planning Service, Dorset Council, County Hall, Dorchester, Dorset, DT1 1XJ. Tel. (Switchboard) 01305 251010
11	Monitoring and management of amenity / environmental aspects of the beach area and promenade	Dorset Council / Swanage Town Council / Environment Agency* / Wessex Water* **contact via Dorset Council or Swanage Town Council*	Assets and Property, Dorset Council, South Walks House, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010 Swanage Town Council, High Street, Swanage, Dorset, BH19 2HZ. Tel. (Switchboard) 01929 423636
12	Cleaning/clearance of beach in response to pollution incidents.	Dorset Council	Dorset Council Emergency Planning Service, Dorset Council, County Hall, Dorchester, Dorset, DT1 1XJ. Tel. (Switchboard) 01305 251010

Management Operation		Assigned Responsibility	Contact within organisation
13	Maintenance of footpath and cycleways including signs for designated public footpaths and rights of way.	Dorset Council	Leisure and Tourism, Dorset Council, South Walks House, Dorchester, Dorset, DT1 1UZ. Tel. (Switchboard) 01305 251010 Rights of Way Team, Dorset County Council, County Hall, Dorchester, Dorset, DT1 1XJ. Tel. (Switchboard) 01305 221000
	Historic Environment	Dorset Council	Dorset Historic Environment Officer, Environmental Services, County Hall, Dorchester, Dorset, DT1 1XJ. Tel. (Switchboard) 01305 221000
	Natural Environment	Natural England	Natural England, Level 9, Renslade House, Bonhay Road, Exeter, EX4 3AW. Tel. 0300 060 1110
	World Heritage Site	Jurassic Coast Trust	Jurassic Coast Trust HQ, Mountfield, Bridport, Dorset, DT6 3JP. Tel. 01308 807000

Appendix H

2005 Beach Recharge Scheme As-Built Drawings

Appendix H 2005 Beach Recharge Scheme As-Built Drawings

This appendix is provided electronically alongside this BMP.

Appendix I

2019 Condition Assessment Reports

Appendix I 2019 Condition Assessment Reports

This appendix is provided electronically alongside this BMP.

Appendix J

Beach Recycling / Recharge Log Template

Appendix J Beach Recycling / Recharge Log Template

This appendix is provided electronically alongside this BMP.

Appendix K

EA Best Practice Guide for Public Engagement when undertaking beach maintenance works

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