Coastal Partners

SOUTH HAYLING ISLAND BEACH MANAGEMENT PLAN: 2024 – 2029

Documents Included:	• EXECUTIVE SUMMARY • BEACH MANAGEMENT PLAN

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Document:	Executive Summary

SOUTH HAYLING ISLAND BEACH MANAGEMENT PLAN: 2024 – 2029

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Overview

The Eastoke Peninsula is located on the south-east corner of Hayling Island and is a densely populated area, the majority of which is low-lying with a history of serious flood incidents. The mixed shingle and sand beach along the Eastoke frontage, combined with a timber groyne field, work together to form the main coastal defence along this section of the open coastline.

This Beach Management Plan (BMP) has been prepared by Coastal Partners, on behalf of Havant Borough Council. The wider BMP area extends eastwards from the Ferry Boat Inn in Langstone Harbour entrance to Hayling Island Sailing Club on the Eastoke Peninsula, where material is recycled back to the area at risk at Eastoke. The BMP sets out the scheme design, monitoring and management required to maintain the beach at Eastoke to a set profile over a 5 year period between 2024 to 2029. The BMP covers areas under the ownership and maintenance responsibility of Havant Borough Council, as well as privately owned frontages where access is permitted for transportation, or where agreements are in place to allow Havant Borough Council access to beaches for material to assist with beach management.

This BMP is a recommendation of the draft Hayling Island Coastal Management Strategy (2023) and follows on from the previous 2012 – 2017 and 2017 – 2022(24) South Hayling Island BMPs. The BMP also aligns with the North Solent Shoreline Management Plan (2010), maintaining the 'Hold the Line' policy for South Hayling. The aim of the BMP is to inform, guide and assist these responsible authorities and organisations in managing the beach and to ensure that the beach management contributes to managing the risk of coastal flooding and erosion at Eastoke, alongside maintaining the beach as a key amenity asset along the frontage over the next 5 years. The BMP is intended to run for a period of 5 years, subject to funding approvals. Any further beach management works beyond this point will be subject to a further business case.

Background

Havant Borough Council and Coastal Partners have undertaken successful beach management on Hayling Island since 1992 following a significant capital recharge in 1985, with a formal beach management plan in place for the last 14 years. The BMP provides a 0.5% AEP (1:200 year) Standard of Protection (SoP) to 751 properties at Eastoke, reducing the risk of coastal flooding and erosion. Under a 'Do Nothing' scenario, we would expect the flood risk at Eastoke to revert back to pre- 1985 within the life of the BMP, depending on storm intensity. Without a beach, the old seawall would then be at risk of undermining and breaching, resulting in frequent flooding and erosion at Eastoke. The 2024-2029 BMP aims to provide the same standard of protection through a continuation of 'business as usual' – maintaining an 18m wide beach crest in front of the residential Eastoke properties to continue to reduce flood and coastal erosion risk. The BMP is implementing the strategic option as identified in the North Solent Shoreline Management Plan (2010), the Eastoke Sectoral Strategy Study (2006) and the draft Hayling Island Strategy (2023). The works will be implemented using powers under the Land Drainage Act (1991) by Havant Borough Council.

Management Units

The South Hayling frontage has been divided in to 8 discrete management units. These units are based on both ownership and coastal management policy. Although the frontage is divided in to units the coastline is seen as a single entity, whereby the individual units work together to provide a South Hayling Island wide management plan. BMP U1 is found to the east of the Island, starting at Black Point Spit, with BMP U8 at the west of the island ending at the Ferry Boat Inn. Figure 1 shows the different units along the coastline.

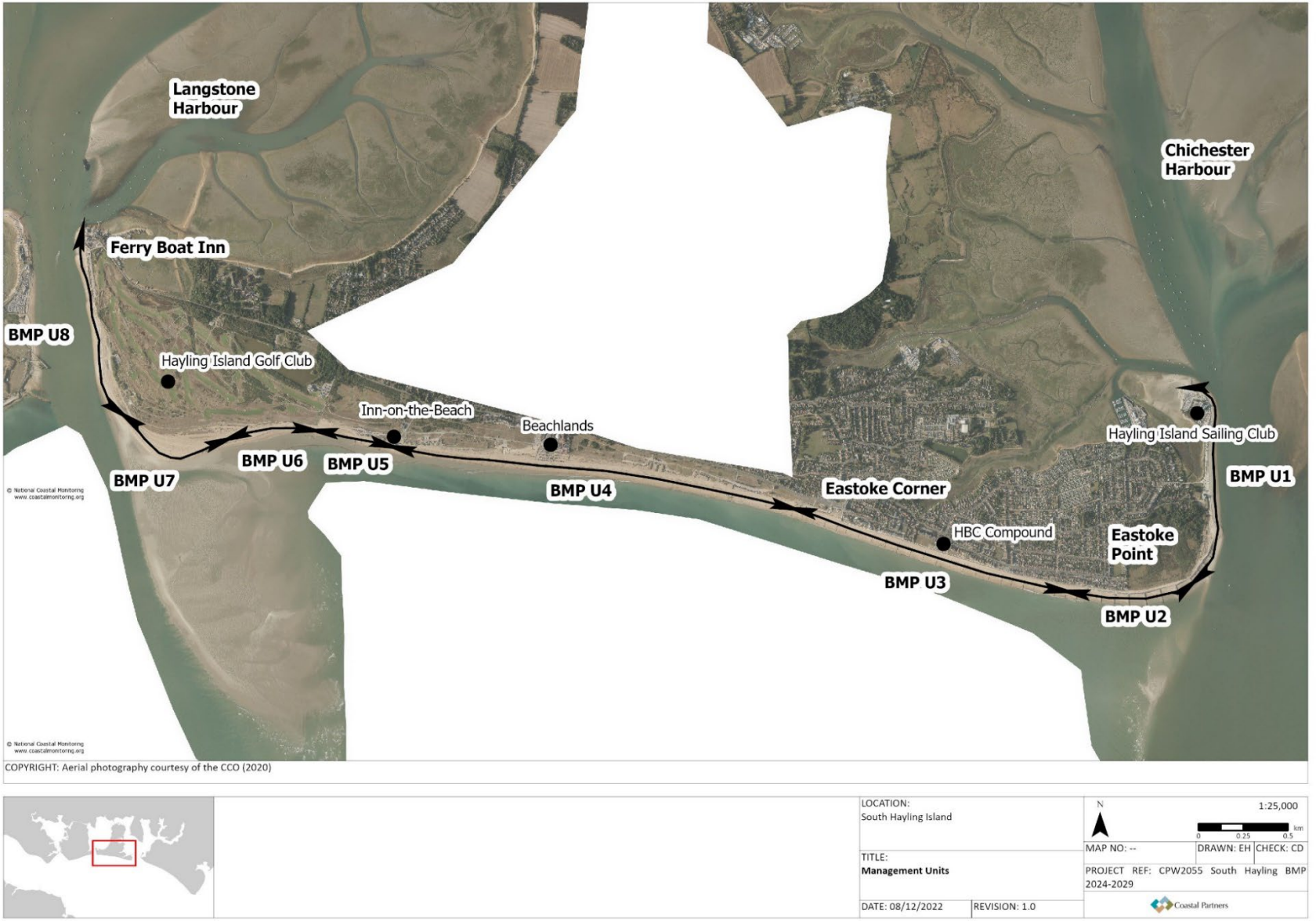

Figure 1: Location of management units along the South Hayling BMP frontage

BMP Proposals

As identified above, the BMP will continue to provide a 0.5% AEP (1:200 year) SoP under unimodal wave conditions. Emerging research is being undertaken with HR Wallingford into bimodal and swell waves at Eastoke, as evidence shows that these events damage the beach and cause increased overtopping discharges compared with unimodal waves for which the current BMP is based. This is cutting edge research that will have regional and national implications for schemes around the country where bimodal and swell waves are present. This additional complexity has been investigated by HR Wallingford and AECOM, to provide sensitivity testing around the 0.5% AEP (1:200 year) currently in place. In simple terms this found uni-modal conditions of 1:200 can be equivalent to 1:75 bi-modal events (i.e. they are more onerous). Based on the confidence in the information available and modelling limitations, this BMP will continue to use the damages and associated benefits and SoP of unimodal waves as these are well understood.

The £5.1m costs identified in the Beach Management Plan Outline Business Case are required to continue 'business as usual' over the next five years, ensuring the flood and coastal erosion risk to the Eastoke community is managed. The complexity of bi-modal seas and swell waves will then be investigated in further detail during the BMP, including the requirement for future change in the beach design profile and associated engineering works, for example extensions to groynes. These investigations are a recommendation of the draft Hayling Island Strategy, alongside an Eastoke Peninsula FCERM Scheme (currently identified on the EA Capital Investment Plan). The operational investigation recommendations, to be undertaken over the next 5 year period, will help inform any proposed change in design to account for bi-modal wave events.

The Hayling Island Strategy sets out proposals for coastal management around the whole of the Island over the next 100 years; based on various factors including economics, technical, environmental, and social impacts. The draft Strategy proposes the following for Eastoke and the wider south Hayling frontage:

- At Eastoke, the strategic intent in the very short term is to renew the existing Beach Management Plan and implement this over the next five years (2024-2029). However, it is recognised that beyond this a more strategic suite of measures will be required to protect the entire peninsula. This will involve the development of a single peninsula wide scheme under one business case (Eastoke Peninsula FCERM scheme) with a programme of works to construct new defences such as floodwalls along the northern frontage and building of a new rock revetment along parts of the southern frontage; coupled with new rock groynes. On top of this, ongoing beach management will be required to maintain a healthy and robust beach to reduce the impacts of high energy waves.
- Between Eastoke and Inn-on-the-Beach, the strategic intent is to maintain a healthy beach via ongoing beach management with new rock groynes in some locations. New defences would be required to protect the community in to the future and to maintain an adaptive control structure in the vicinity of Inn on the Beach, because it plays a key role in the beach management here – promoting sediment accumulation to maintain the beach in place to the east.
- From Inn-on-the-Beach to Ferry Boat Inn, the leading option is to create space for nature by adapting to the tide – allowing the coast to evolve naturally alongside private maintenance of defences by individual landowners.

These draft Strategy recommendations will be finalised, and approval sought during 2024. Any changes following approval which will affect the ongoing beach management will be considered as the project progresses, in line with any beach management activities.

Key Recommendations of the BMP

The key recommendations of the BMP are highlighted throughout the document in **bold, underlined text**. These have been drawn together below to provide an overview.

- Continue recycling beach material along the Hayling Island frontage to keep material in the coastal system and provide a healthy design beach at Eastoke, whilst ensuring no increase to flood risk in areas of sediment extraction.

- Prioritise the beneficial reuse of dredged material from Chichester Harbour Approach Channel and the recycling of material from Gunner Point, where possible, to keep sediment within the coastal system and provide efficiencies to the project.

- Develop an Eastoke Peninsula Flood and Coastal Erosion Risk Management (FCERM) Scheme to look at a phased approach to sustainable coastal management at Eastoke, while this BMP is undertaken, to ensure the whole of the Eastoke Peninsula is considered as a single management cell.

- Undertake ongoing monitoring of beach levels throughout the year, including before and after management campaigns, and pre- and post- storm surveys.

- Following any storm events, details of storm conditions and associated wave and water levels should be recorded. This will assist with providing an archive of conditions which will inform future revisions of the Beach Management Plan.

- Operational investigations should take place throughout the life of the BMP to increase the current knowledge on nearshore sediment transport, the influence of ebb-delta's and changing coastline morphodynamics at Gunner Point.

- Further analysis should be carried out around the impact of bi-modal and swell waves at Hayling Island and surrounding coastlines, particularly when considering overtopping of different beach profiles.

- Implement a series of operational investigations, monitoring and investigations (as set out in the Technical BMP) to support the ongoing development of the South Hayling Beach Management Plan.

Document:	**Technical Report**

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Documents Included:	• BEACH MANAGEMENT PLAN

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Document Control Sheet

Document Title	SOUTH HAYLING ISLAND BEACH MANAGEMENT PLAN: 2024 - 2029
Document Short Title	Hayling Island BMP 24-29
Version/Status	v6/Final for Review
Date	05/12/2023
Project Name	South Hayling Beach Management Plan
Project Number	CPW3212
Client	Havant Borough Council

Drafted by	Clare Dolan / Emma Harris
Checked by	Samantha Cope and Andrew Pearce
Approved by	Mark Stratton
Approval date & Signature	12/12/2023

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Glossary & Acronyms

TERM	DEFINITION
Alarm Level	This level precedes (and is less severe than) the Crisis Level. This is usually a predetermined threshold where the monitored beach parameter (e.g. beach crest level or volume) falls to a value within the range defined. 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.
Accretion	Accumulation of sediment due to the natural action of waves, currents and winds.
AEP (Annual Exceedance Probability)	The probability of an event occurring in a given year.
APO (Annual Probability of Occurrence)	Annual probability of occurrence. The chances of a flood of a certain magnitude happening in any given year, as a percentage. For example, a 1:100 year flood as a 1% APO.
ATT (Admiralty Tide Chart)	Daily times and heights of tidal high and low waters.
Backwash	The seaward return of the water following the run up (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. For destructive waves backwash is stronger than swash, and vice-versa for constructive waves.
BAP (Biodiversity Action Plan)	A strategy for conserving and enhancing wild species and wildlife habitats in the UK.
Barrier Beach	A sand or shingle bar above high tide, parallel to the coastline fronting a low-lying hinterland or lagoon.
Beach	A deposit of non-cohesive material (e.g. sand or 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 Bypassing	The transfer of material from areas of accretion, usually updrift of shoreline structures (which have interrupted longshore drift) to downdrift areas of eroding shoreline.
Beach Nourishment	A term to describe the addition of material to areas of eroding shoreline, encompassing beach bypass, recharge and recycling.
Beach Profile	Cross-section perpendicular to the shoreline, usually repeatedly surveyed (from the same start point and bearing) for regional monitoring purposes or used to describe the 1-dimensional characteristics of a beach. A profile typically extends seawards from any selected point on the landward side or top of the beach in to the nearshore.
Beach Recharge	Artificial process of replenishing a beach with material from another source outside of the local littoral system.
Beach Recycling	The movement of sediment along a beach area, typically from areas of accretion to areas of eroding shoreline within the same littoral system.
Beach Re-profiling	The shaping of the beach profile to have a desired crest height, width, or slope.
Bi-modal sea	A sea state where offshore generated swell waves (generally long period and lower wave heights) occur alongside locally generated wind waves (shorter period but higher wave height). The distribution of spectral energy is characterised by two peak frequencies.

BMP (Beach Management Plan)	This provides a basis for the management of a beach primarily for coastal defence purposes, taking in to account coastal processes and the other uses of the beach.
Breaching	Lowering (often termed failure) of the beach crest or other coast protection structure due to hydrodynamic loading (e.g. extreme sea level or waves) allowing increased overtopping or even flooding to the hinterland.
BODC (British Oceanographic Data Centre)	The British Oceanographic Data Centre (BODC) is a national facility for looking after and distributing data concerning the marine environment.
CCC (Canterbury City Council)	Coastal Operating Authority as defined under the Coast Protection Act 1949 with permissive powers to provide defence against coastal erosion.
CCO (Channel Coastal Observatory)	Based at the National Oceanographic Centre in Southampton, the CCO are responsible for the distribution of data collected through the South-East Regional Coastal Monitoring Programme.
CHIMET	Nearshore metocean, wave and water level station from Chichester Bar Beacon approximately 0.5miles out to sea from Chichester Harbour entrance.
CIRIA (Construction Industry Research & Information Association)	As a neutral, independent, and not-for-profit body that aims to link organisations with common interests and facilitate a range of collaborative activities that help improve the industry.
Coastal Protection Act (1949)	An Act to amend the law relating to the protection of the coast of Great Britain against erosion and encroachment by the sea; to provide for the restriction and removal of works detrimental to navigation; to transfer the management of Crown foreshore from the Minister of Transport to the Commissioners of Crown Lands; and for the purposes connected with the matters aforesaid [24th November 1949].
Climate Change	Long term changes in climate. The impact of climate change along the coast is usually associated with changes in sea level and wave climate.
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.
CP	Coastal Partners, a partnership of 5x local authorities working together to deliver coastal risk management.
Crest	Highest point on a beach face, breakwater, or seawall.
Crest Level / Height	The vertical level of the crest (see above), relative to a datum (usually mOD).
Crest Width	A term adopted for the nourished frontage to describe the horizontal distance from the beach crest (where the beach slope angle drops down towards the sea) to the seaward edge of the promenade.
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.
Defra (Department for Environment, Food & Rural Affairs)	Before 2001 known as the Ministry of Agriculture, Fisheries and Food – MAFF). Defra are the government department responsible for environmental protection, food production and standards, agriculture, fisheries and rural communities in the UK.
EA (Environment Agency)	A UK non-departmental government body responsible for delivering integrated environmental management including flood defence, water resources, water quality and pollution control.
Erosion	Removal of sediment due to the natural action of waves, currents and wind.

FDGiA	Flood Defence Grant in Aid. Money awarded by the Environment Agency to implement schemes and strategies to reduce flood risk to people and property.
Fetch Length	The distance that a constant direction of wind can (or has already) pass across a water body (such as an ocean) . Longer fetch creates higher energy waves. Fetch length, along with the wind speed (or wind strength), determines the size (sea state) of waves produced.
Flood Zone	Land area designated by the Environment Agency as at risk of flooding. The categorisations include 'Flood Zone 2' (between a 1 in 200 and 1 in 1,000 annual probability of sea flooding) and 'Flood Zone 3' (3a: 1 in 200 or greater annual probability of flooding from the sea; 3b: land where water has to flow or be stored in times of flood). The categorisations differ according to whether river or sea floods.
Gabion	Steel or plastic wire-mesh basket containing stones or crushed rock, held tightly together to form blocks or walls. These serve as coastal defences, usually aimed at mitigating local erosion.
Geomorphology / Morphology	The scientific study of the nature and history of the landforms on the surface of the Earth and other planets, and of the processes that create them.
GIS (Geographical information Systems)	Software which can capture, store, manipulate, and display data related to positions on the Earth's surface. GIS can show many different kinds of data on one map, hence has a range of applications in coastal analysis.
HBC (Havant Borough Council)	Coastal Operating Authority as defined under the Coast Protection Act 1949 with permissive powers to provide defence against coastal erosion.
HISC (Hayling Island Sailing Club)	Sailing club located at Sandy Point (the peninsula on the southeast of Hayling Island, on the western entrance of Chichester Harbour).
H_{m0}	Significant wave height. The average height of the highest of one third of the waves in a given sea state.
Hold the Line	One of the Shoreline management Plan (SMP) policy types, This recommends (for any given frontage) that is it preferable to hold the existing defence line, by maintaining or changing the standard of protection.
H_s	Significant wave height. Traditionally known as the 'mean wave height' (trough to crest) of the highest third of waves (in a spectrum). Statistically, it is possible to encounter waves much higher than the H_s value.
Inshore	Areas where waves are transformed by interaction with the seabed.
Import	Material 'imported' from outside the sediment cell. For this BMP import refers to material brought in my road or from an offshore dredge.
Joint Probability	The probability of two (or more) variables (e.g. wave height and sea level) occurring simultaneously.
Joint Return Period	Average period of time between occurrences of a given joint probability event.
JPA (Joint Probability Analysis)	Method to generate joint probability values, by calculating the joint probability distribution of two (or more) variables – typically based on Extreme Value Theory
Lidar (Light Detection & Ranging)	This is a remote (e.g. airborne) mapping technique which uses a laser and other instruments to measure ground elevation at high spatial resolution.
Listed Building	A building or other structure judged to be of national importance in terms of architectural or historic interest and included on an official register (' the List of Buildings of Special Architectural or Historic Interest').
Longshore Transport	Movement of material parallel to the shore, also referred to as longshore drift.

mCD (metres Chart Datum)	This is referenced to approximately the lowest astronomical tidal level at a given location. It is typically a reference datum used for navigation purposes.
mOD (metres Ordnance Datum)	. A vertical datum used in the UK, equal to the mean sea level at Newlyn in Cornwall between 1915 and 1921. It is typically a reference datum used for terrestrial purposes.
Management Unit	The BMP frontage is split into 7 Management Units (MU's) within which slightly different management approaches are required. This includes differentiating between the main extraction and deposition areas.
Met Office	UK Meteorological Office.
MLWS (Mean Low Water Springs)	The height of mean low water springs represents average low water during spring tides (i.e. when the range of the tide is greatest over a fortnightly period). It can be the average (throughout a year) of the heights of two successive low waters during a 24 hour period on spring tides. It is approximately -1.84mOD along the Hayling Island frontage.
MSL (Mean Sea Level)	This is the average sea level, usually over an annual period, taken from recorded data (e.g. a tide gauge). It is approximately 0.1 m OD at Chichester Entrance)
Nearshore	The zone that extends from the swash zone to the position marking the start of the offshore zone.
No Active Intervention	An SMP policy where there is no investment in coastal defences or operations. This assumes that existing defences are no longer maintained and will fail over time or undefended frontages will be allowed to evolve naturally.
NTSLF (National Tide & Sea Level Facility)	National Tide and Sea Level Facility. This is the UK centre of excellence for sea level monitoring, coastal flood forecasting and the analysis of sea level extremes.
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.
Percolation	The process by which water flows through the interstices of a sediment. This infiltration of water during swash into the unsaturated beach material, reduces the wave run-up level. However it can also lead to water seepage at the landward side, potentially causing instability or flooding.
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 (UNESCO). The objective of this designation it to stem the progressive encroachment onto, and loss of wetlands. This intergovernmental environmental treaty came into force in 1975.
Relict	Geomorphological feature formed of sediment deposited under past processes and climatic regimes (but no longer considered active as a sediment sink or source in the system).
Recharge	Material brought in for beach nourishment from outside the sediment cell. For the purposes of the BMP, this includes material imported by road and material dredges from licenced offshore sites.

Recycling	Material brought in for beach nourishment from within the sediment cell. For the purposed of the BMP, this includes The Ness, West Beach, Open Beach, Coastguard Revetment and Gunner Point and Chichester Harbour Entrance Channel.
Return Period (RP)	A statistical measurement denoting the average probability of occurrence of a given event (e.g. sea level or wave height) over time (usually the annual probability per year).
Revetment	A sloping surface of stone, concrete or other material used to protect an embankment, natural coast, or shoreline against erosion.
SANDS (Shoreline & Nearshore Data System)	Shoreline and Nearshore Data System – a facility through which data can be analysed to establish links between forcing and response. Data can be stored centrally and are references to a mapping system. South-East Regional Coastal Monitoring Programme data sets are stored in SANDS.
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	Permanent or temporary erosion due to waves or currents in proximity to coastal structures.
(Mean) Sea Level Change	The rise and fall of mean sea level in relation to the land level throughout geological and historic time in response to global climate and local tectonic changes.
Seawall	Structure built along the shore to prevent overtopping and / or erosion.
Sediment Transport	The movement of a mass of sedimentary material by the forces of currents, waves or wind.
SERCMP (South-East Regional Coastal Monitoring Programme)	South-east Regional Coastal Monitoring Programme. This provides a consistent regional approach to coastal process monitoring which provides information for the development of SMPs, strategies and schemes and the operational maintenance and management of existing flood protection infrastructure. Some of the information provided and surveys undertaken include topographic beach surveys, LiDAR, aerial photography and wave buoy data. Reports are produced on the analysis of some of this data.
Significant Wave Height	The average height of the highest of one third of the waves in a given sea state.
SINC (Site of Importance for Nature Conservation)	Every local authority in England has a system for identifying local sites which are of substantive nature conservation value. In Hampshire these are called SINCs. The designation helps to conserve important and distinctive habitats and species on sites that fall outside of European or national conservation designations such as Sites of Special Scientific Interest (SSSIs).
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 (Site 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
SoP (Standard of Protection)	The level of return period (or joint return period event) 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 (from the combined effects of wind stress and low pressure).
Sustainability (in coastal flood & 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.
Swash Zone / Swash	The area onshore of the surf zone where the breaking waves are projected up the foreshore / the movement of the wave up the beach face.
Swell Waves	See information on 'wind waves'.
SWL (Still Water Level)	The level of the sea surface excluding the effect of high frequency waves. Typically this is mean sea level + tide + surge (but may also include wave set-up).
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.
T_{pswell}	Swell wave period. The time it takes for two successive swell wave crests (or troughs) to pass a given point.
T_{pwind}	Wind wave period. The time it takes for two successive wind wave (wind generated gravity waves) crests (or troughs) to pass a given point.
UKCP09 (UK Climate Projections 2009)	This is the UKs leading sources of climate change information, providing projections of variables such as sea surface temperature and sea level rise. An update is due in 2018.
UKCP18 (UK Climate Projections 2018)	This is the UKs leading sources of climate change information, providing projections of variables such as sea surface temperature and sea level rise, updated in 2018.
UKHO (United Kingdom Hydrographic Office)	The UK's agency providing hydrographic and geospatial data to mariners and maritime organisations across the world. They are a trading of the Ministry of Defence (MOD), responsible for operational support to the Royal Navy and other defence customers. Located in Taunton, Somerset with a workforce of 1,000 staff.
Unimodal	A sea state which consists of wind-seas (locally generated wind waves) or swell-seas (longer period waves generated by a distant storm out in the North Atlantic). The distribution of spectral energy is characterised by one peak frequency.
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. The process by which the direction of a wave moving in

	shallow water at an angle to the contours is changed so that the wave crests tend to become more aligned with those contours.
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.
Wind Waves (or surface gravity waves)	Waves in seas, lakes etc. are generated by wind blowing over the surface. They can comprise (1) wind waves -generated by the local prevailing wind, (2) swell waves which are more regular longer period waves generated by the winds of distant weather systems. 'Sea state' describes the combination of wind waves and swell (i.e. can be used to define whether a spectrum is unimodal or bimodal). Swell contains longer period waves which can cause greater run-up and damage at the coast.

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1. INTRODUCTION

1.1. BACKGROUND

The Eastoke Peninsula is located on the south-east corner of Hayling Island in the Borough of Havant (Figure 1.1). It is a densely populated area, the majority of which is low-lying with a history of serious flood incidents. This is a five year plan, therefore the properties at risk of flooding under a present day, 0.5% AEP storm event with no defences and erosion over the next 20 years are presented in Figure 1.2 (see the South Hayling Outline Business Case for more information). To manage this flood and erosion risk to the south side of the Eastoke peninsula, the Ministry of Agriculture Fisheries and Food (MAFF) funded the Hayling Island Beach Replenishment Scheme (CPW 24) in 1985. Approximately 500,000 m^3 of material was imported to build the beach to a 0.5% AEP Standard of Protection (SoP) at Eastoke. The coastal processes along the frontage result in the longshore transport of the nourishment material away from the Eastoke frontage, therefore Havant Borough Council (HBC) implements a Beach Management Plan (BMP) to recycle this material back to Eastoke and bring in imported material when necessary. Without the Beach Management Activities (BMA) conducted as part of the BMP, very quickly the concrete seawall would be exposed, leading to a subsequent return to regular serious flooding of Eastoke, the failure of the seawall and loss of properties.

The North Solent Shoreline Management Plan (SMP) (Ref 1.1) confirmed a Hold the Line (HTL) policy for the whole of the Southern frontage of Hayling Island. In recognition of the flood and erosion risk from both the northern and southern Eastoke frontages, the Environment Agency (EA) and Havant Borough Council (HBC) worked together in partnership to produce the approved Hayling Island Eastoke Sectoral Strategy (Ref 1.2). The recommended works to the northern frontage of Eastoke were completed in 2005 raising the level of protection to 1% AEP Standard of Protection (SoP). In addition, the Eastoke Point scheme was completed in 2013, providing a 0.5% AEP SoP (see Section 3.1.3). The Strategy recommends Beach Management for the southern frontage which has involved annual recycling, regular monitoring, and periodic recharge operations.

In addition to the North Solent SMP and the Eastoke Sectoral Strategy, a new Hayling wide 'Hayling Island Strategy' is currently under production by Coastal Partners. The strategy sets out proposals for coastal management around the whole of the Island over the next 100 years; based on various factors including economics, technical, environmental, and social impacts. The draft Strategy proposes the following preferred options.

- At Eastoke, the strategic intent in the very short term is to renew the existing Beach Management Plan and implement this over the next five years (2024-2029). However, it is recognised that beyond this a more strategic suite of measures will be required to protect the entire peninsula. This will involve the development of a single peninsula wide scheme under one business case with a programme of works to construct new defences such as floodwalls along the northern frontage and building of a new rock revetment along parts of the southern frontage; coupled with new rock groynes. On top of this, ongoing beach management will be required to maintain a healthy and robust beach to reduce the impacts of high energy waves.
- Between Eastoke and Inn-on-the-Beach, the strategic intent is to maintain a healthy beach via ongoing beach management with new rock groynes in some locations. New defences would be required to protect the community in to the future and to maintain an adaptive control structure in the vicinity of Inn on the Beach, because it plays a key role in the beach management here – promoting sediment accumulation to maintain the beach in place to the east.
- From Inn-on-the-Beach to Ferry Boat Inn, the leading option is to create space for nature by adapting to the tide – allowing the coast to evolve naturally alongside private maintenance of defences by individual landowners.

These draft Strategy recommendations will be finalised, and approval sought during 2024. Any changes following approval which will affect the ongoing beach management will be considered as the project progresses, in line with any beach management activities.

A number of studies have investigated the geomorphology and sediment transport around the Hayling coastline, and the adjacent Chichester Harbour tidal inlet, covering both pre- and post-nourishment periods. The SCOPAC Sediment Transport Study (Ref 1.3) provides a review of the available research up to 2012. The main sediment transport pathways around the BMP frontage are shown in Figure 1.3. An up to date coastal process understanding is important for BMPs, particularly when recycling material within the sediment cell, therefore, this document reviews the latest coastal process data (see Section 2).

BMPs have been implemented at Eastoke since 1992, although despite regular beach management activities, beach levels had deteriorated at several locations along the Eastoke frontage in 2005, causing a reduction in the standard of protection. A significant storm in November 2005 resulted in overtopping of the vulnerable lengths of this frontage and caused flooding of a number of properties and disruption of the local transport network. This came as a stark reminder of the real and prominent risk that this area faces and the increased danger without continual management. HBC undertook an urgent beach nourishment operation along the southern shoreline of Eastoke from 2007 – 2009 using 90,000m^3 of dredged material to bring the beach back to design volume. The Council has undertaken annual beach recycling since the nourishment operation to manage the significant investment by DEFRA (Department for Environment, Food and Rural Affairs), the EA and HBC. Since then, the most significant movement of material was the emergency works in 2014 when 25,000m^3 was recycled from Gunner Point back to Eastoke. This emergency material was necessary following the persistent 2013/14 storms which resulted in beach draw down and flooding. Still, the rock revetment scheme built at Eastoke Point in 2013 helped to prevent flooding to Eastoke via Bosmere Rd.

Since the 2013/14 storms, there has been a notable increase in the frequency of long-period storm events and bimodal wave events at Eastoke (Ref 1.4 and 1.5). Most notable is the response to these changes, whereby beach management is now undertaken bi-annually rather than on an annual basis: during September to ensure the beach profile is at design prior to the winter period, and during March if required to reinstate the beach profile following the winter period. On average the same volume of material is recycled annually to reinstate the design profile, although at an increased frequency.

The current BMP funding has now come to an end and the Council wish to produce a new BMP (this document) in line with current guidance. Although the main focus of beach management works is at Eastoke, the nourished material leaving the Eastoke frontage and subsequent recovery from beach recycling, necessitates a BMP encompassing the wider south Hayling frontage (Figure 1.3). This iteration of the BMP, therefore, aims to work with our neighbours to streamline wider recycling operations and movement of material. This document will review the management of the wider frontage in line with the Strategy and the SMP and will also support the Outline Business Case to seek funding approval for the ongoing management of earlier investments in beach recharge for the next five years.

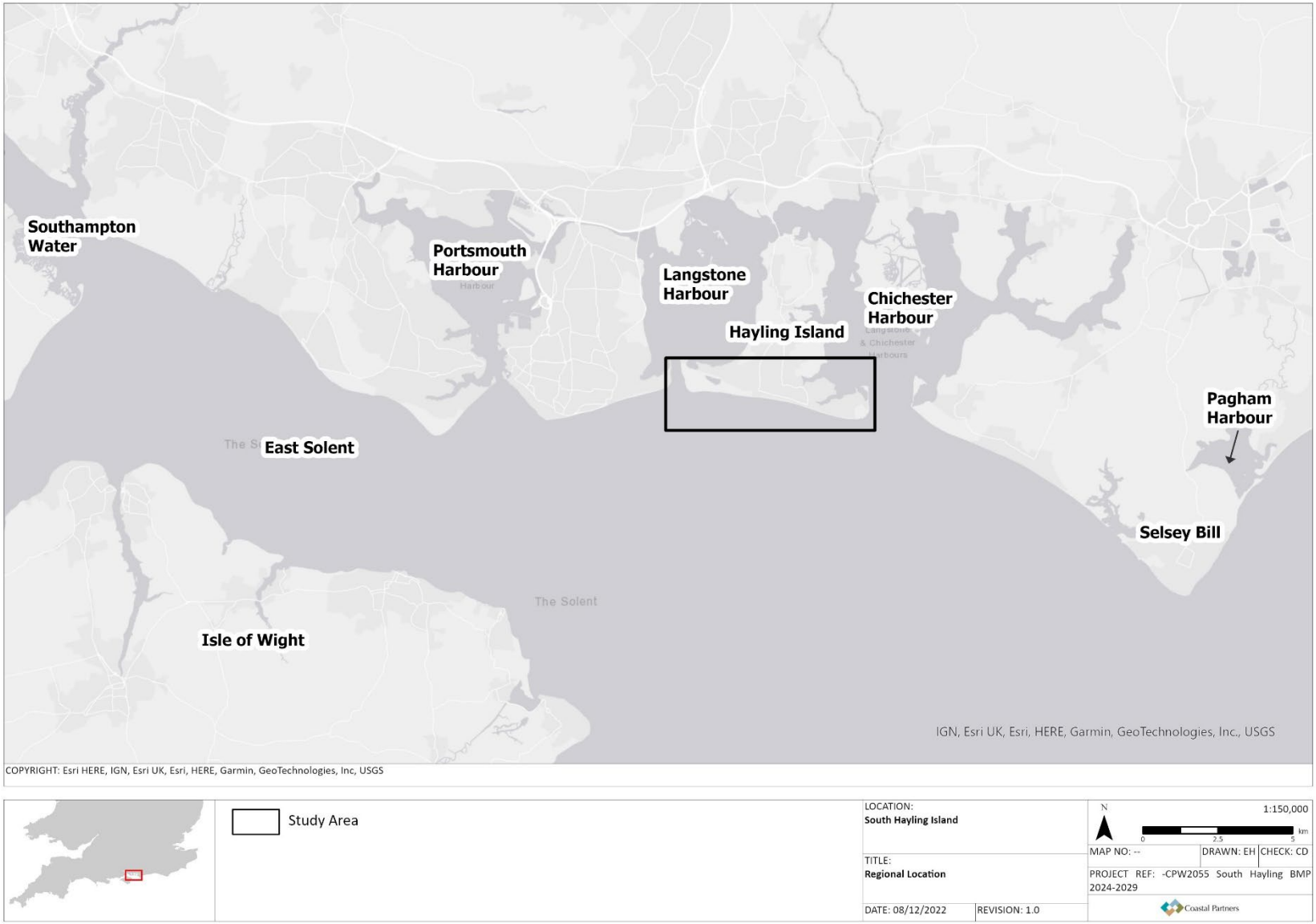

Figure 1.1: Study area in its regional context

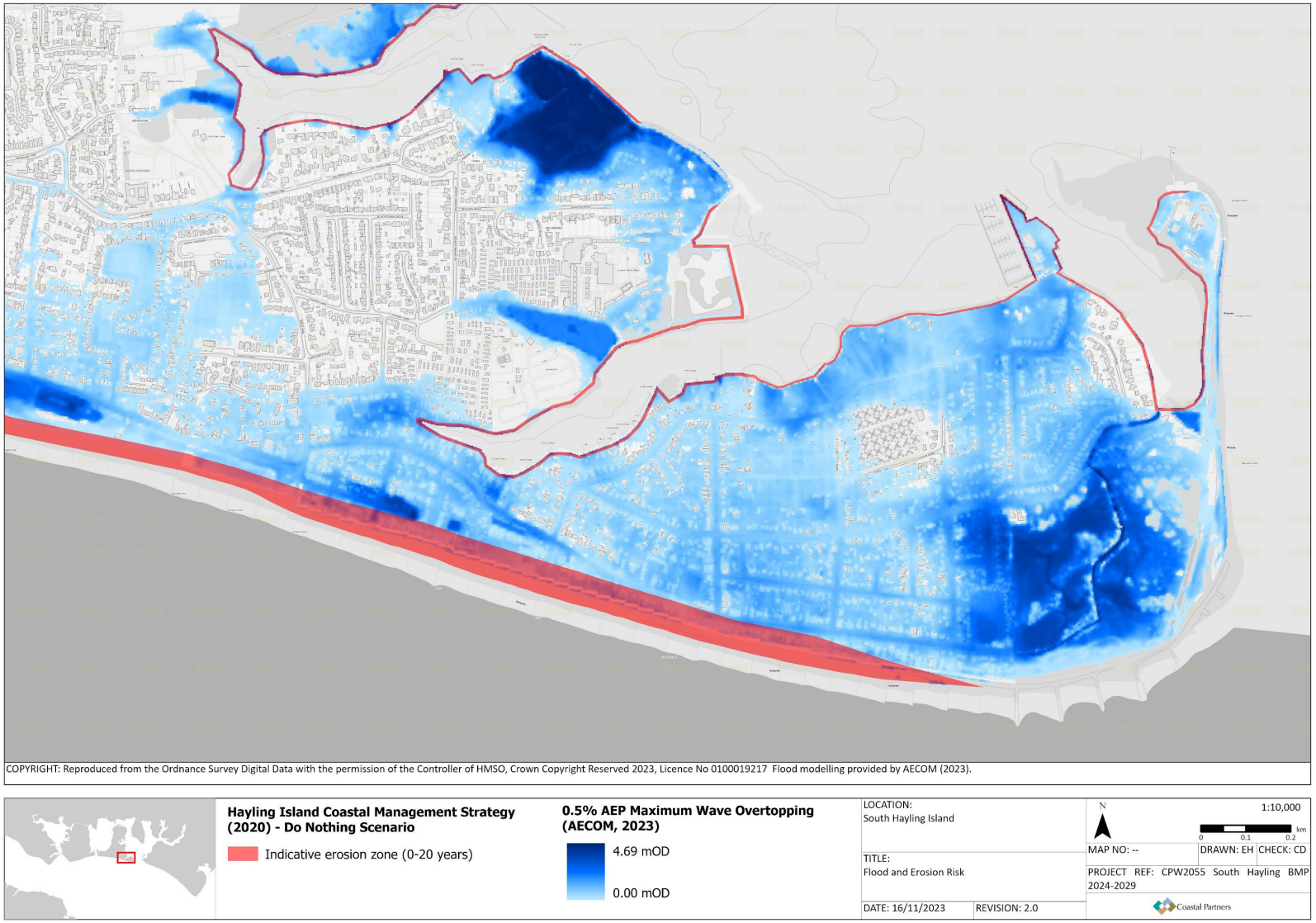

Figure 1.2: The 0.5% AEP flood risk zone and 20-year erosion zone under a "Do Nothing" scenario.

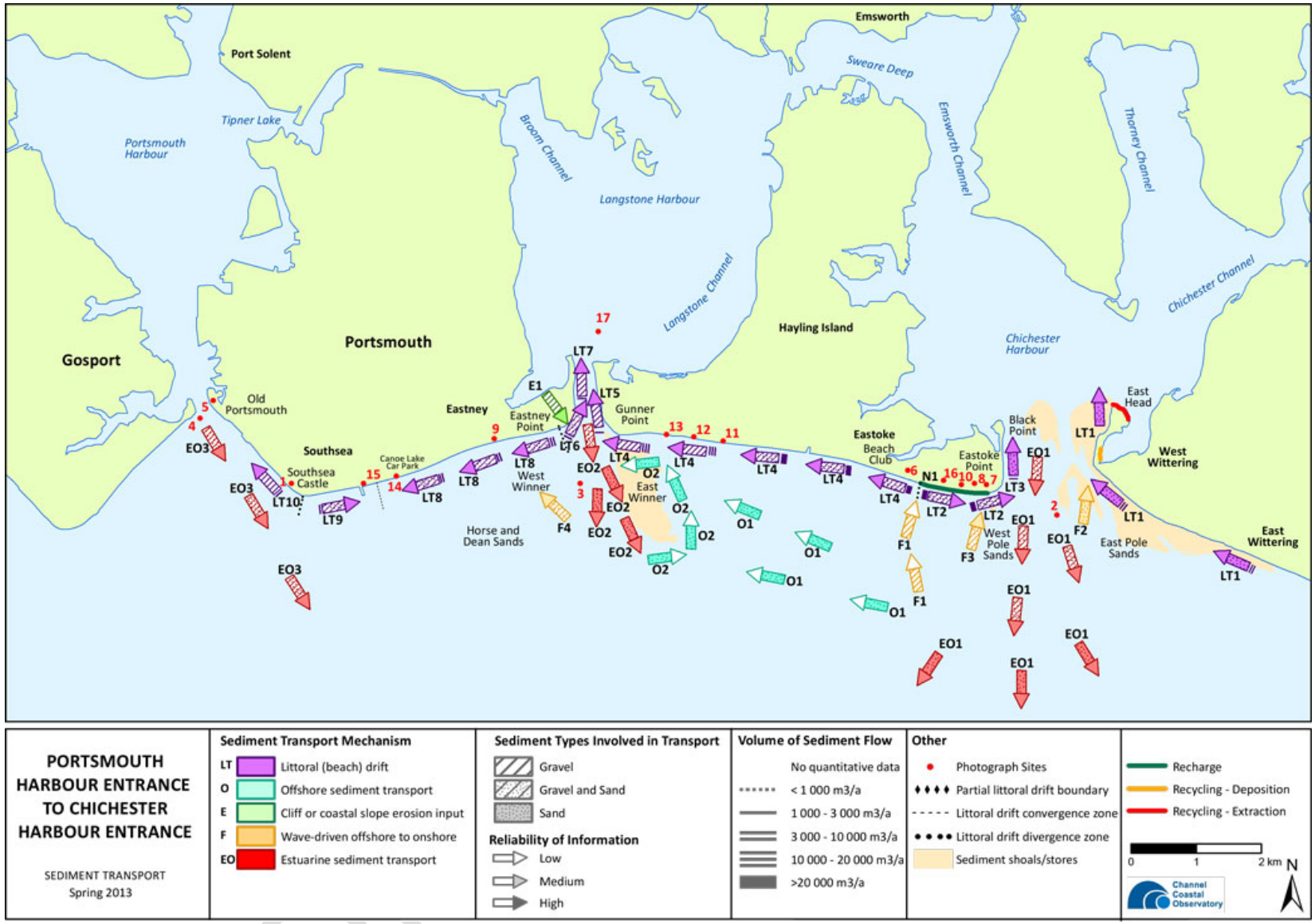

Figure 1.3: Sediment transport pathways between Portsmouth Harbour entrance and Chichester Harbour entrance (Ref 1.3).

1.2. OBJECTIVES

The key technical objectives of the scheme are as follows:

- To reduce the risk of coastal erosion by providing protection against breaching of the defences and a reduction in coastal flooding.
- To reduce the risk of flooding from extreme surges.
- To continue working with natural coastal processes.
- To limit the impact of the scheme on people and property.
- To provide a scheme which is adaptable to sea level rise and climate change.
- To maintain the amenity benefit of the beach over the whole frontage for both the local population and the holidaymakers who visit the area.
- To assist with the development of a Flood and Coastal Erosion Risk Management Scheme for Eastoke (as recommended in the draft Hayling Island Strategy), to appraise coastal management options over the next 50-100 years.

The key environmental objectives of the scheme are as follows:

- Avoid damage to human health and population and where appropriate enhance human environment (human health, population and continued flood and coastal erosion risk management).
- Protect and enhance biodiversity (biodiversity, flora, and fauna).
- Protect and enhance land quality (soils).
- Protect and enhance water quality (water).
- Protect existing infrastructure (material assets).
- Protect and enhance cultural heritage features (cultural heritage).
- Protect and enhance landscape character / visual amenity (landscape).
- Minimise disturbance to the community and natural environment through construction activities.
- Ensure no Likely Significant Effect (LSE) on the designated environment and its interest features.
- Work with natural coastal processes.

The BMP aims to identify how to deliver the above objectives in the most cost effective and environmentally acceptable manner with the minimum of disruption to the public and the environment. The BMP is written to last 5 years, commencing April 2024 and ending March 2029, setting out the strategy for maintenance, monitoring and intervention to maintain the beach and structures to the required 0.5% AEP SoP along the Eastoke southern frontage. It also includes consideration of the likely options available for carrying out Emergency Works (Section 5.2) should defences be overtopped, overwashed or even breached during a large storm event at Eastoke.

This study will align to the Shoreline Management Plan policies for this frontage that are set for a 100-year planning horizon, and which aim to 'Hold the Line' of existing defence along the length of the Eastoke frontage (Section 1.6.1). It will also closely follow the recommendations of the Draft Hayling Island Strategy (see Section 1.6.4) to ensure consistency between the proposed options and delivery of schemes on site.

The BMP also recommends further studies which may be appropriate to aid future coastal flood and erosion 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 7.

1.3. LOCATION

This BMP covers the whole southern frontage of Hayling Island, Hampshire, extending from the Ferry Boat Inn in the west, to the Hayling Island Sailing Club (HISC) in the east (Figure 1.4). Although the section of beach from Eastoke Corner Car Park to Eastoke Point is the only area which is actively managed by HBC, extraction of material and subsequent recycling operations along the wider Hayling Island coastline necessitate a BMP covering the whole sediment cell. The length of the managed frontage is 2.2km of the 8.3km Southern Frontage, which is unit BMP Unit 3 in Figure 1.4.

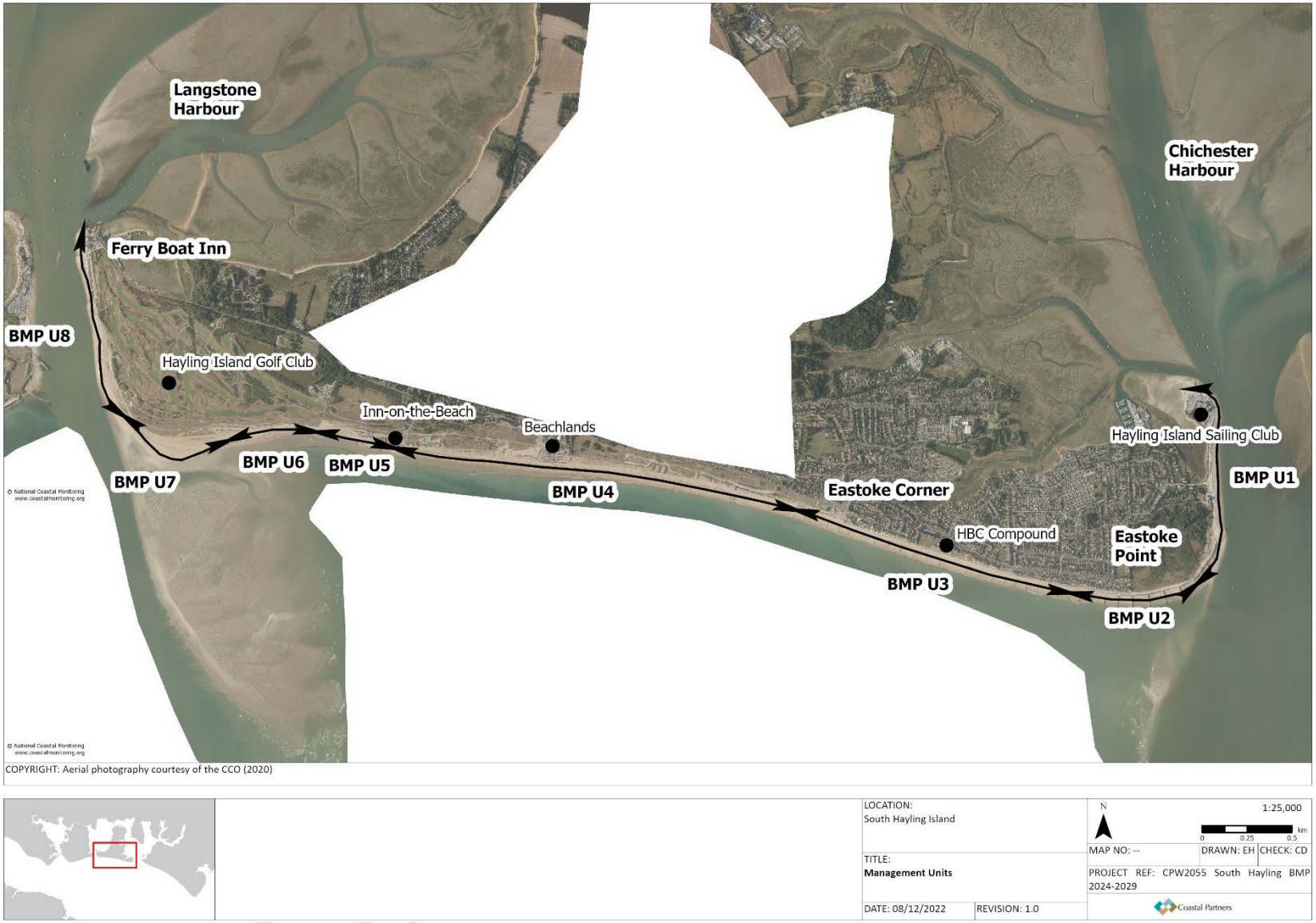

Figure 1.4: Management Units used for the BMP.

The boundaries for the BMP units (BMP Us) are influenced by a range of factors including coastal processes, existing structures, and land ownership (Figure 1.5). A summary of the key features in each BMP Management Unit in Figure 1.4 is shown in Table 1.1.

Table 1.1: Summary of the BMP unit features

BMP UNIT	EXTENT	BEACH	STRUCTURES	HINTERLAND	LAND OWNERSHIP
1	Hayling Island Sailing Club to Eastoke Point Scheme	Mixed sand and gravel barrier beach feeding into a distal sand spit at Black Point	Privately owned timber groynes, rock revetment and pontoon	Sandy Point Nature Reserve (low lying)	Main landowners include Hampshire County Council and Hayling Island Sailing Club
2	Eastoke Point Scheme (Groynes 3 - 11)	Dynamic mixed sand and gravel barrier beach	Rock revetment and rock groynes	Sandy Point Nature Reserve (low lying)	Havant Borough Council and Hampshire County Council
3	Eastoke Beach and Eastoke Corner (Groynes 11 – 35)	Nourished mixed sand and gravel barrier beach with areas of vegetated shingle	Timber groynes, buried concrete seawall, concrete splash wall to rear of promenade	Eastoke Peninsula (low lying), Eastoke Corner (low lying into relic shingle ridges)	Havant Borough Council
4	Open Beach (Groyne 35 to Inn-on-the-Beach)	Mixed sand and gravel barrier beach	Timber sloping revetment, timber groynes, timber splash wall, surface water outfall	South Hayling residential area. Central Beachlands (relic shingle ridges)	Havant Borough Council Private ownership at Beachlands
5	Inn-on-the-Beach to the eastern end of Hayling Golf Club driving range (West Beach)	Mixed sand and gravel beach	Section of sloping timber revetment	South Hayling residential area.	Main landowner Havant Borough Council
6	Hayling Golf Club driving range to start of Gunner Point accretion zone	Mixed sand and gravel beach	Buried timber groynes	Golf Club, Sinah Common	Hayling Golf Club
7	Gunner Point accretion zone	Mixed sand and gravel beach with	None	Gunner Point (shingle ridges) and Sinah	Hayling Golf Club

		areas of vegetated shingle		Common and Golf Club	
8	Northern end of Gunner Point to Ferry Boat Inn	Mixed sand, gravel and shell beach	Concrete structures, rock filled gabions, quay walls, concrete slipways	Carpark and Hayling Golf Club (relic shingle ridges)	Main landowner Hayling Golf Club

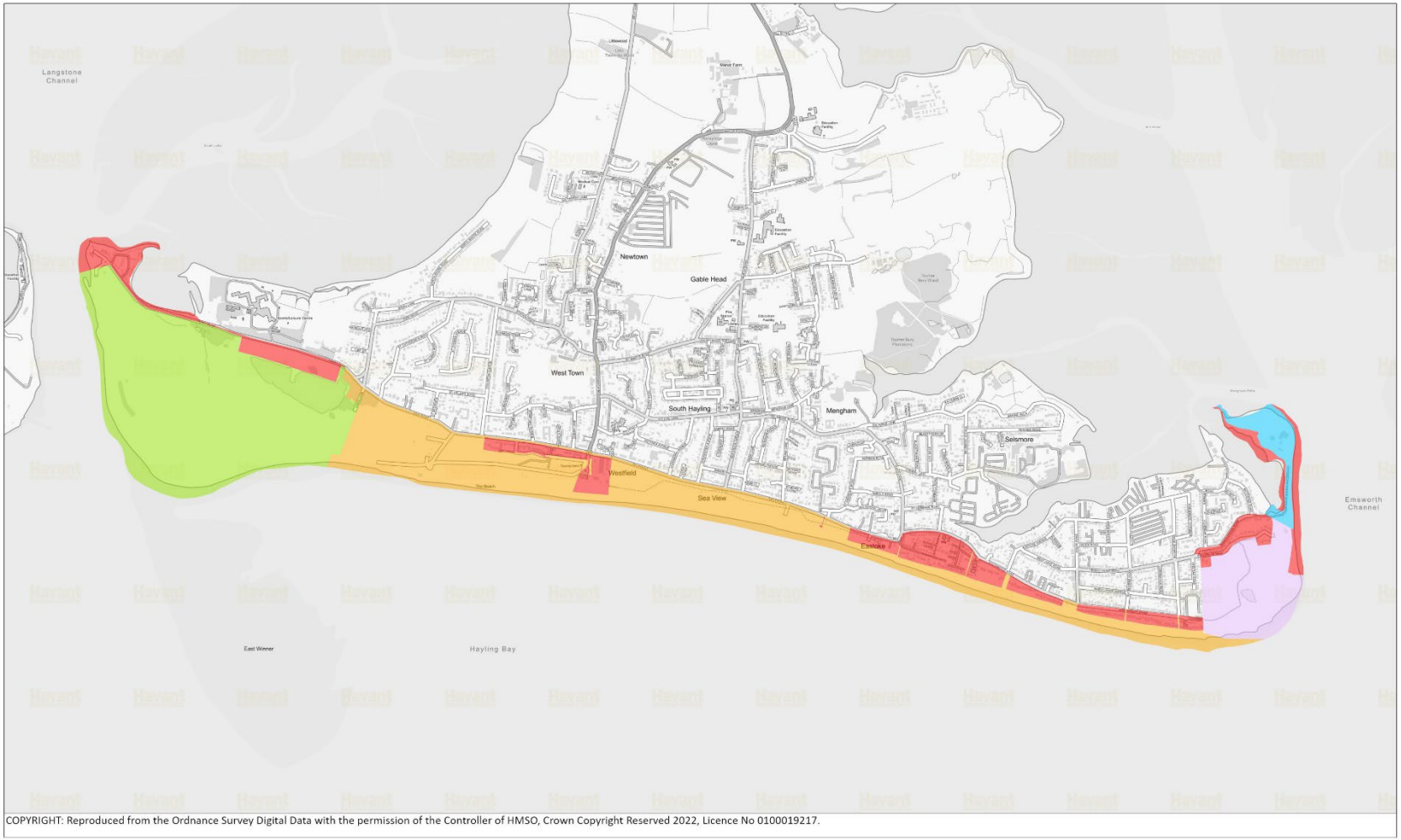

Figure 1.5: Land Ownership

1.3.1. AMENITY VALUE

The Hayling Island coast became a popular destination for visitors from London in the post-war period, with caravans and chalets a feature within the landscape. The island continues to cater for summer trippers, resulting in an increase in the summer-time population on the island. The seafront's recreational activities include jet skiing, wind and kitesurfing, golf, skateboarding, volleyball, fishing, funfair and amusements, a light railway and sailing (Ref 1.6). The blue flag beaches are popular for general amenity, especially in the summer. More passive past times include walking, cycling, sea-bathing, and eating and drinking at the pubs and café kiosks.

Havant Borough Council are currently developing a high level regeneration plan for the Hayling Island south coast, which aims to increase the amenity usage of the beach and hinterland area. It is possible that aspects of this plan will be put in place while the BMP period is underway, and therefore close communication with the HBC teams will be maintained to ensure that both plans work together without any detriment to either the flood risk at Eastoke or disruption to the wider community.

1.3.2. THE BACKGROUND NATURAL ENVIRONMENT

The BMP area is within or adjacent to the following environmentally designated areas:

- Solent Maritime Special Area of Conservation (SAC)
- Chichester and Langstone Special Protection Area (SPA)
- Solent and Dorset Coast SPA
- Chichester and Langstone Harbours Ramsar Site
- Chichester Harbour Site of Special Scientific Interest (SSSI)
- Sinah Common SSSI
- Langstone Harbour SSSI
- Sandy Point SINC, LNR (Local Nature Reserve) and Countryside Heritage Site
- Southern Eastoke Frontage Site of Importance for Nature Conservation (SINC)
- Beachlands East SINC
- Southern Eastoke Frontage SINC
- Hayling Island Beach SINC
- Lifeboats Station Heath SINC
- Lifeboats Station Saltmarsh SINC
- Land East of Sandy Point SINC

In addition, the following environmental designations are within 2km of the BMP area:

- The Kench LNR

Figure 1.6 to Figure 1.8 show the extents of the various environmental designations (European, local, and national) in relation to the BMP area. Appendix G contains further details about these designations for ease of future reference.

There are also a range of historic environment features and assets surrounding the study area, including Scheduled Monuments and Listed Buildings. None of these historic environment features are within or immediately adjacent to the BMP frontage. The Old Lifeboat House is a building of local interest located 50 metres behind the active beach.

Further detail and discussion of the environmental characteristics relating to the BMP area are provided in Section 2.8.

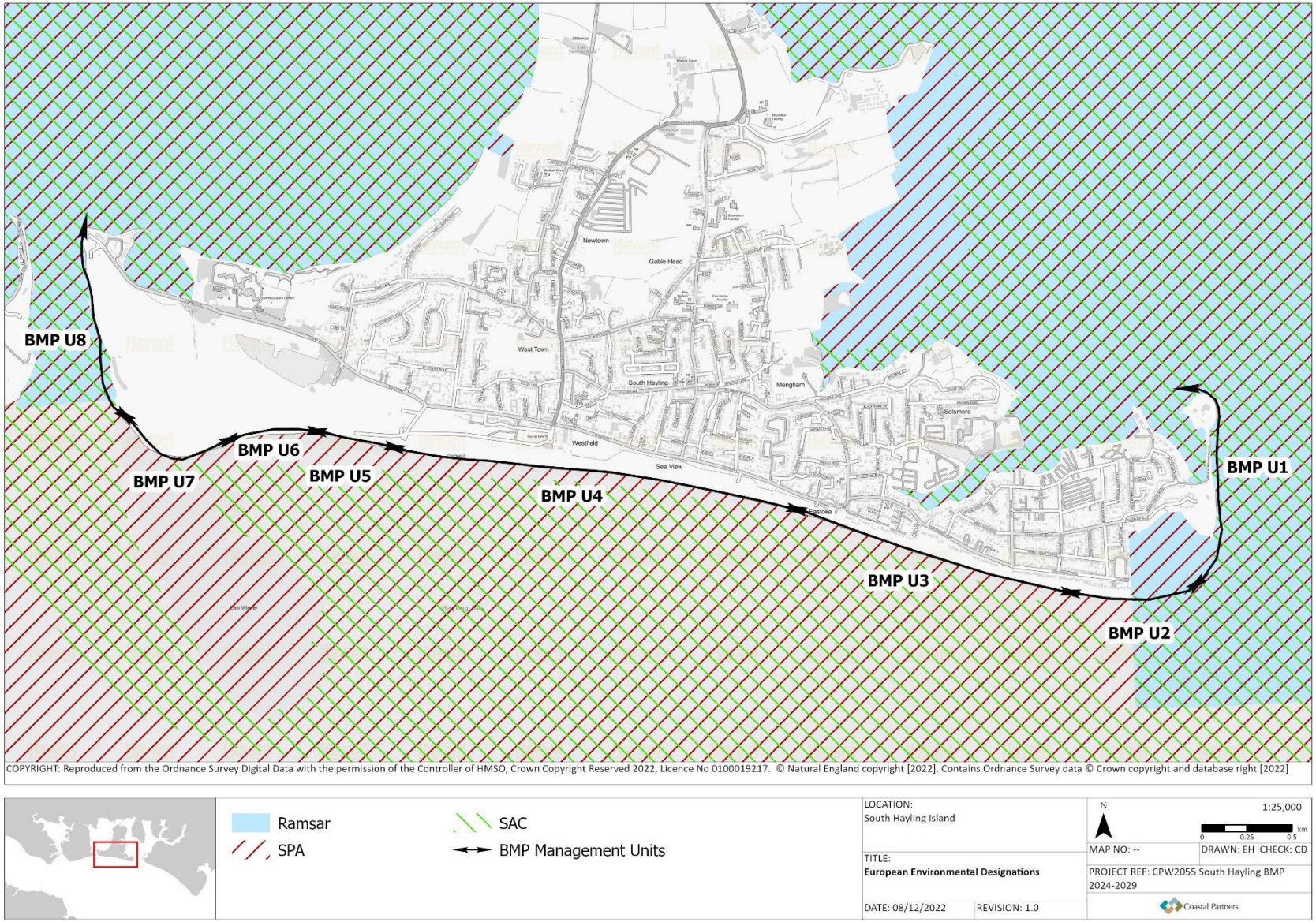

Figure 1.6: International & European environmental designations along the BMP frontage

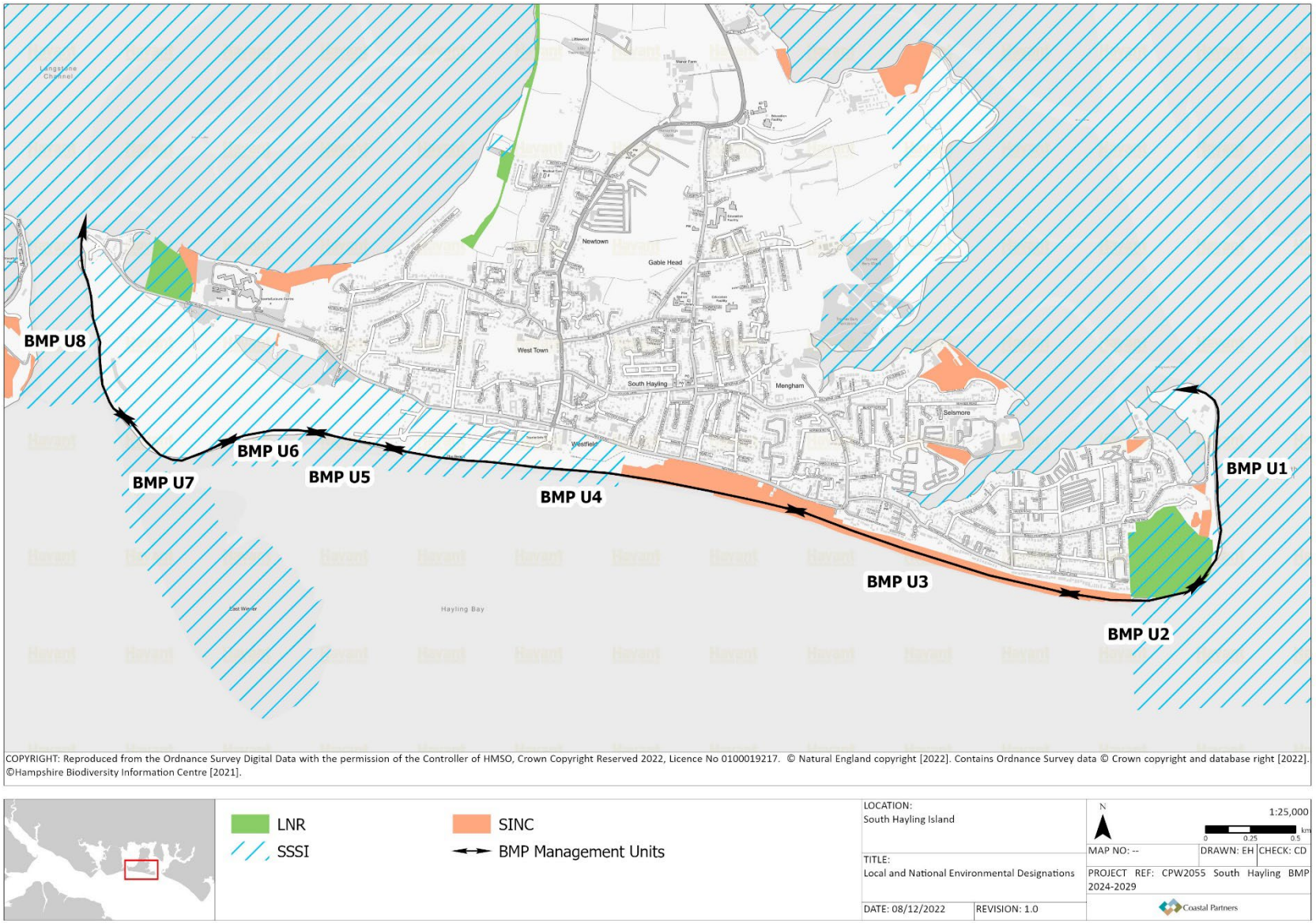

Figure 1.7: Local & National environmental designations along the BMP frontage

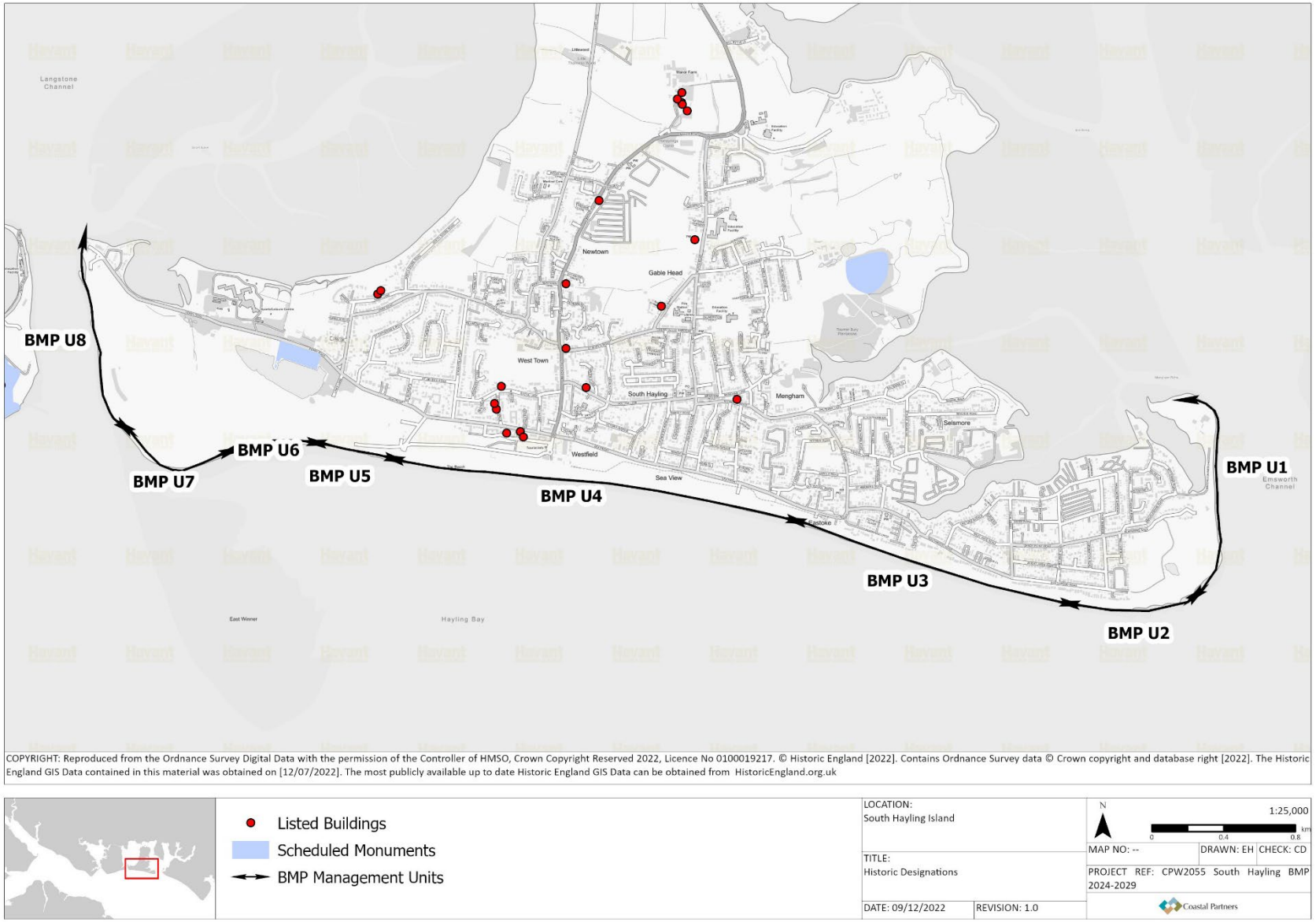

Figure 1.8: Historic environmental features in relation to the BMP study area

1.3.3. BACKGROUND WATER QUALITY: WATER FRAMEWORK DIRECTIVE

The purpose of the Water Framework Directive (WFD) is to establish a framework for protecting inland surface waters, transitional waters, coastal waters, and ground waters. It is implemented in England and Wales through the Water Environment (WFD) (England and Wales) Regulations 2003 (the Water Framework Regulations). These Regulations were revoked and replaced in April 2017 by the Water Environment (WFD) (England and Wales) Regulations 2017. The overall objective of the WFD is to achieve good status (GS) in all inland, transitional, coastal, and ground waters by 2015 to ensure that any works or discharges do not cause deterioration in the WFD water bodies. The framework for delivering this Directive is through the River Basin Management Plans (RBMPs).

The proposed Beach Management Works falls entirely within the south-east River Basin District (SE RBD) and the scheme itself falls within or is adjacent to four water bodies.

- Langstone Harbour Water Body
- Solent Water Body
- Chichester Harbour Water Body
- Isle of Wight East

Much of the South Hayling beach frontage (Central Beachlands) is classified as a Blue Flag beach under Keep Britain Tidy/Foundation for Environmental Education accreditation.

Figure 1.9: WFD water bodies adjacent to the Hayling Island open coastline

1.3.4. HISTORY OF FLOODING / EROSION INCIDENTS

The history of flooding and erosion on the Eastoke Peninsula has arisen due to the development of an urbanised area on a low-lying peninsula of land behind a retreating shingle barrier beach. As houses were constructed behind the retreating barrier beach, shore parallel defences were first constructed in the mid-1940's as a response to both erosion and wave overtopping (Figure 1.10). These were replaced with much higher seawalls in the 1970s but over time the beach levels in front of these defences continued to drop and the incidence and severity of flooding increased until the Hayling Island Beach Replenishment Scheme in 1985 (See Figure 1.11 and Table 1.2 for flood events). The areas liable to flooding due to wave overtopping prior to the 1985 scheme are shown in Figure 1.12, and the impact of extreme events illustrated in Plate 1.1 to Plate 1.9.

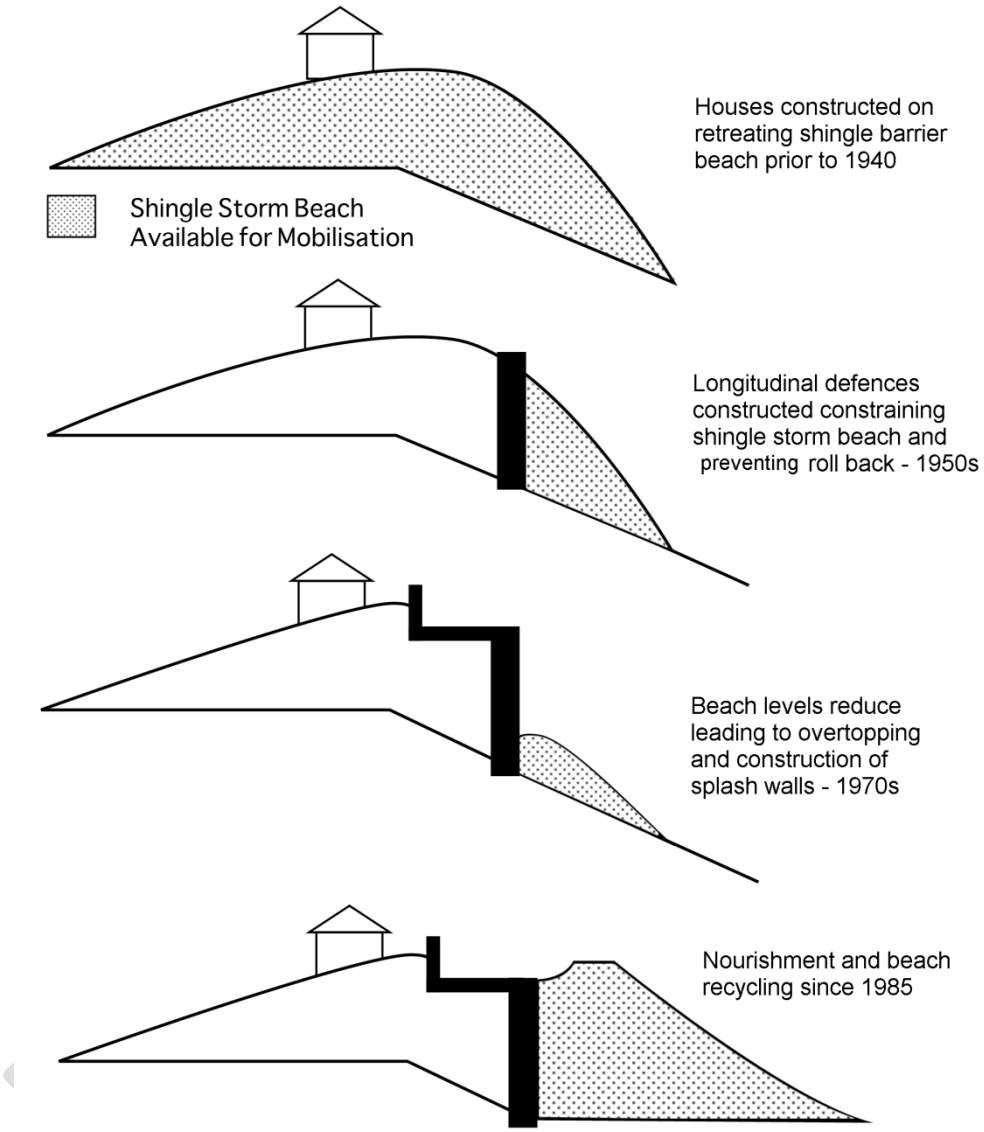

Figure 1.10: Process of beach constraint through construction of shore parallel defences at Eastoke, Hayling Island (Ref 1.7)

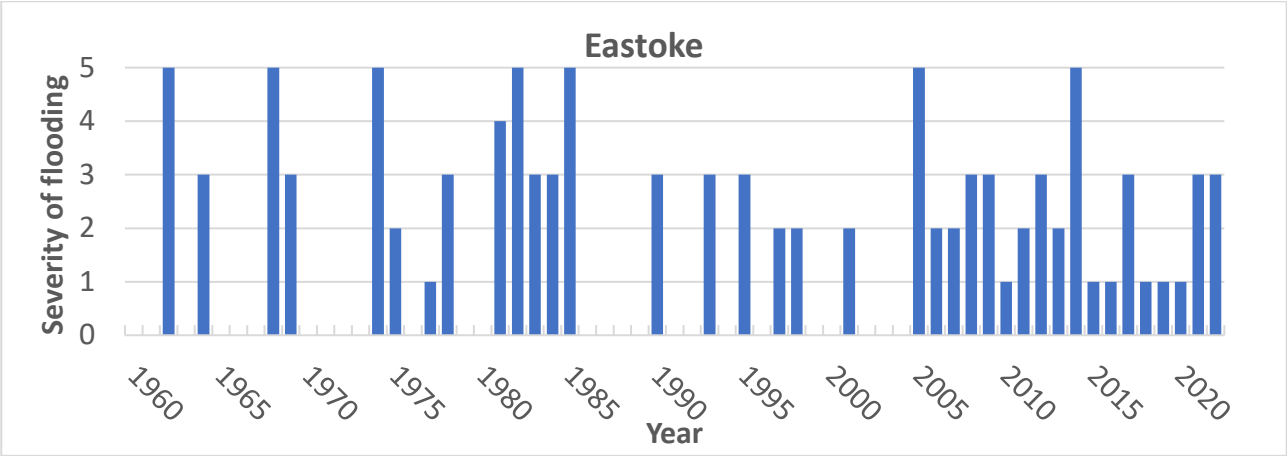

Figure 1.11: Incidence of flooding events at Eastoke from 1960 to the end of 2022, Hayling island. Severity is measured according to Table 1.2 (Ref 1.8)

Table 1.2: Severity of flooding presented in Figure 1.11 (Ref 1.8)

LEVEL OF SEVERITY	DESCRIPTION
5	Flooding over large areas. Significant pumping required by emergency services. Generally more than half a day disruption to homeowners and road users. More than 15 properties affected.
4	More than 5 properties affected by flooding.
3	More than 3 roads affected and/or at least one property affected.
2	Some road flooding - usually localised or shallow
1	Flooding in open areas/prom areas - no real structural damage or disruption.

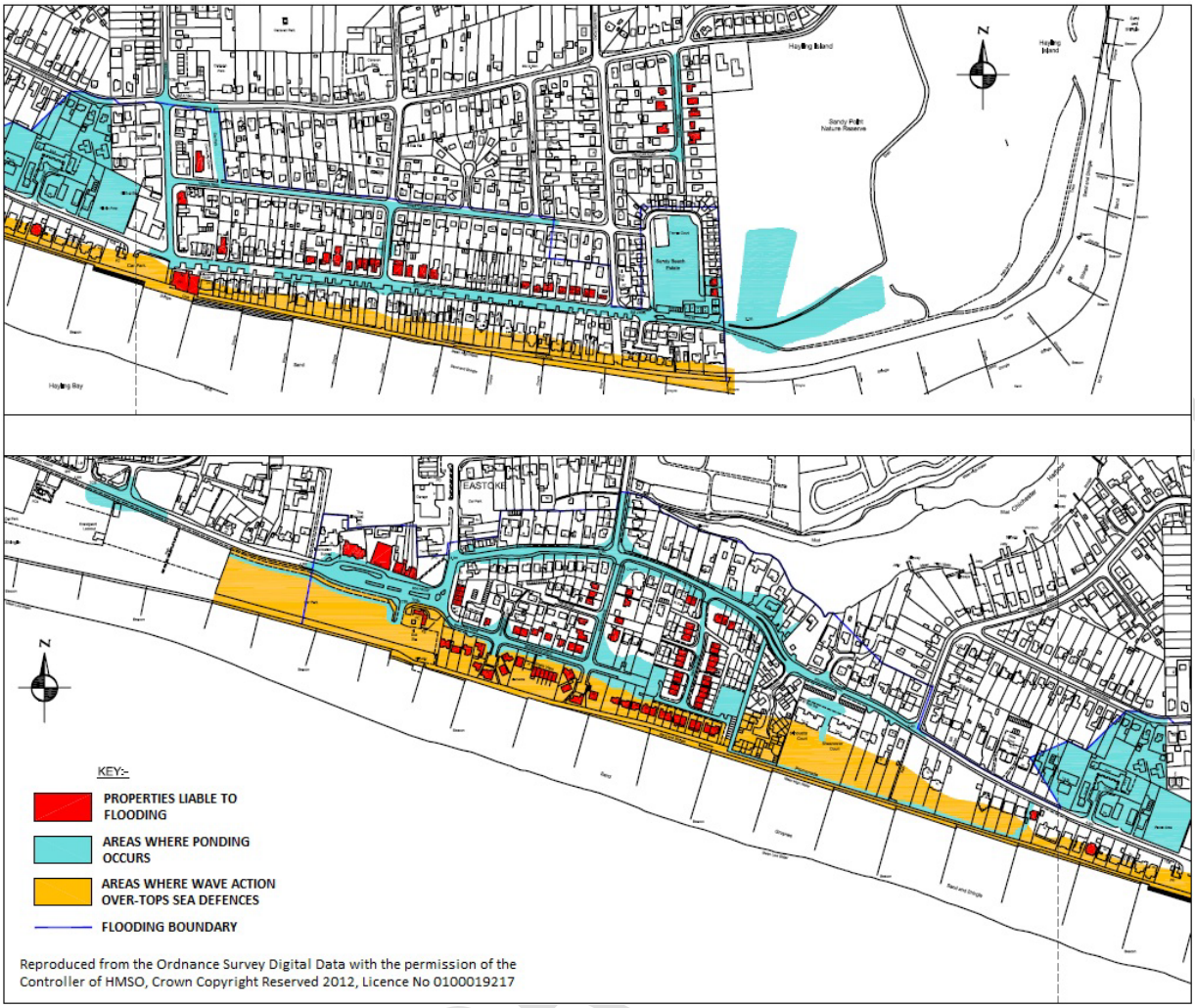

Figure 1.12: Areas liable to flood due to wave overtopping prior to the 1985 beach replenishment scheme, based on HBC drawing no. 1007/358, March 1997

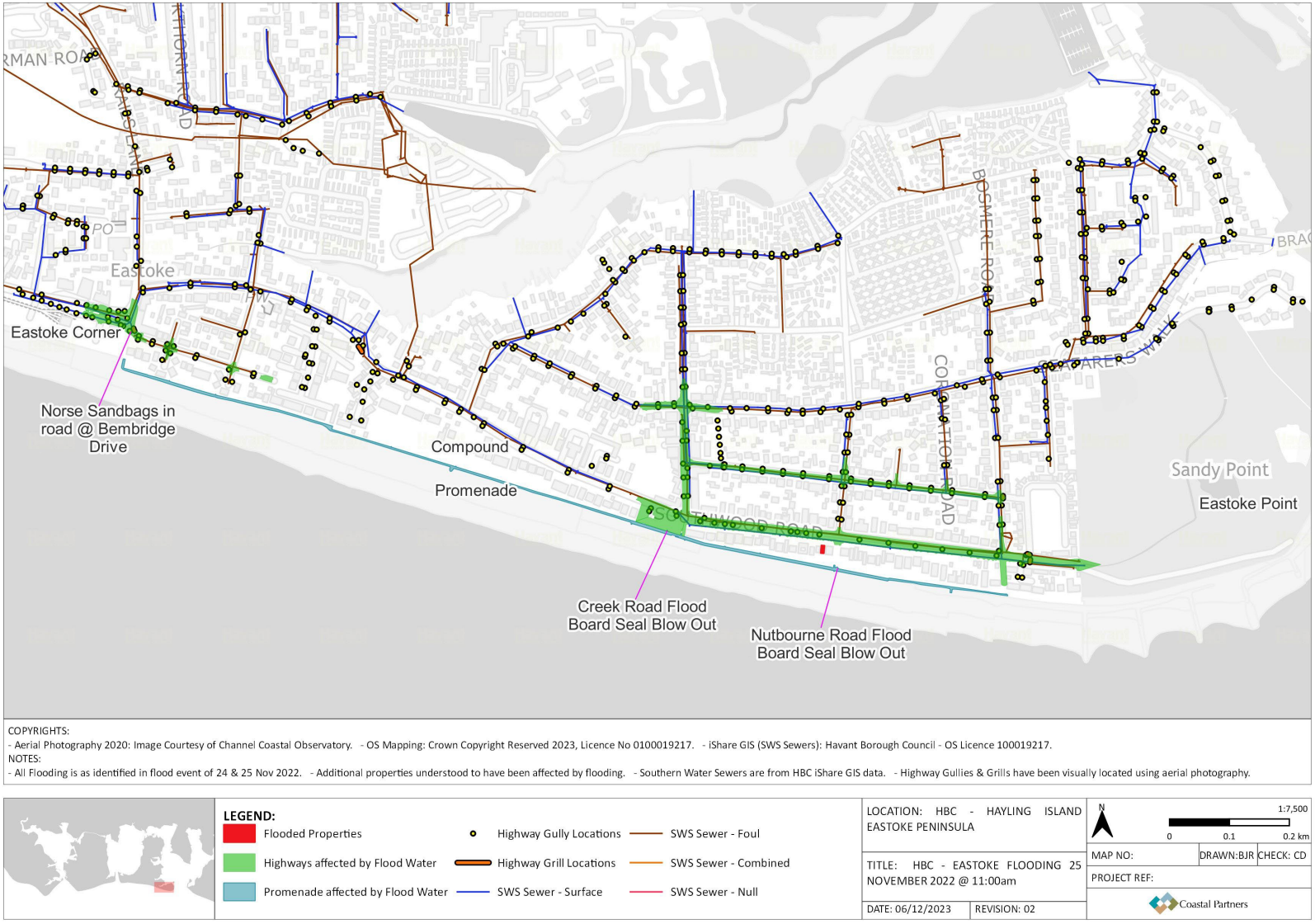

Figure 1.13: Areas flooded during November 2022 storm event at Eastoke, Hayling Island. A comparison to Figure 1.11 shows a similar flooded extent, particularly along the road network.

Plate 1.1: Storm damage to property behind promenade, December 1978

Plate 1.2: Storm damage to properties behind seawall, December 1978

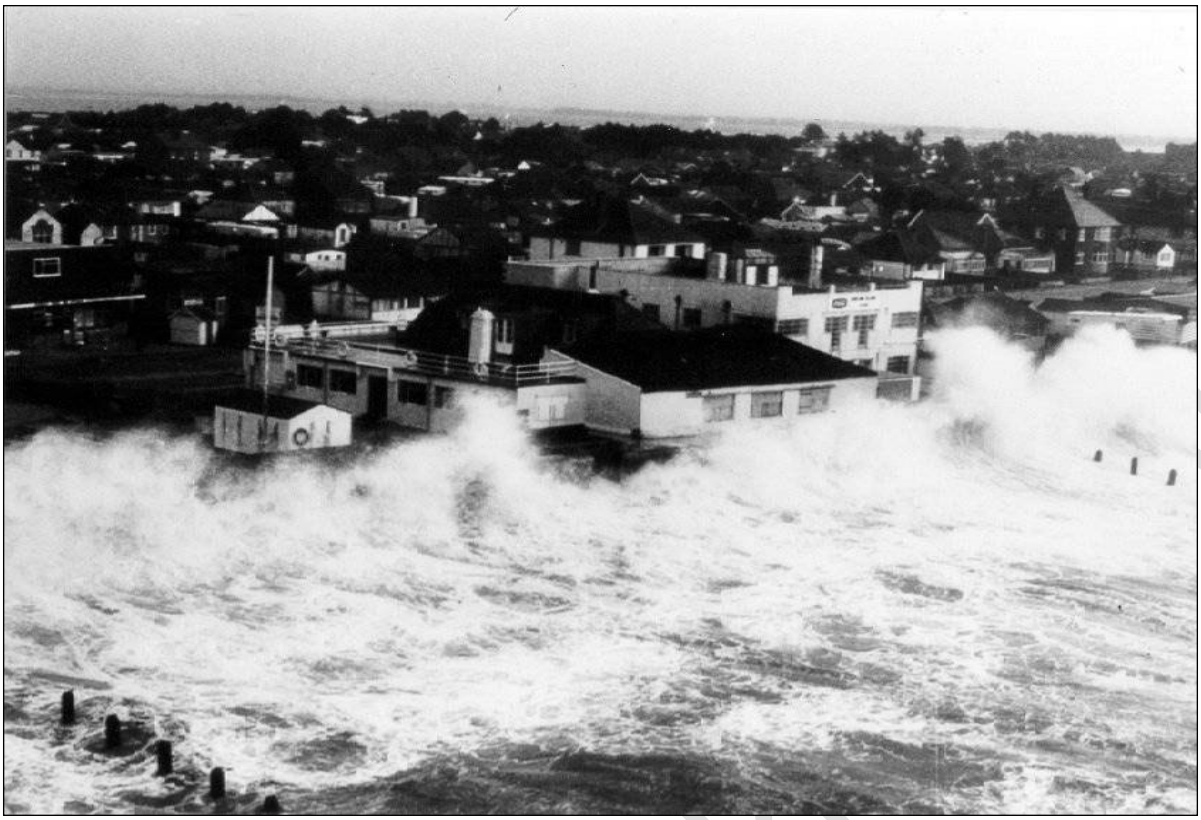

Plate 1.3: Wave overtopping adjacent to Creek Road car park, pre beach replenishment 1985.

Plate 1.4: Eastoke nourished frontage, groyne 19, 3 November 2005

Plate 1.5: Southwood Road looking west from Bosmere Road, 3 November 2005

Plate 1.6: November 2014, Southwood Road

Plate 1.7: January 2014, Southwood Road

Plate 1.8 Flooding along Southwood Road from Storm Brian (21st October 2017)

Plate 1.9 Flooding along Southwood Road during swell event in November 2022

1.3.5. RECENT FLOODING

As can be seen from Figure 1.11 there have been serious events identified at Eastoke since records began in the 1960's. Following construction of the 1985 scheme the incidence of significant flooding has greatly reduced, and incidences that has been recorded are usually associated with key erosion hotspots (Section 2.6), giving rise to localised flooding. Since the construction of the nourished beach, significant flooding occurred in November 2005 and during the winter storms of 2013/14, when the beach was overtopped along much of South Hayling. The extreme event that occurred on 3rd November 2005, including very long period swell waves in combination with extreme water levels, is discussed in detail in Sections 2 and 3. The flooding resulting from this event was not on the same scale as those prior to the 1985 replenishment scheme but did serve as a stark reminder of the very real and prominent threat to this area from overtopping, and the likely effects if beach management were to cease.

Since the beginning of the current BMP in 2017, there have been three significant flooding events. In October 2017 Storm Brian resulted in extensive flooding to residential roads as the beach crest was overtopped and lowered (Appendix C). In early February 2021 a long period swell event coinciding with a 4.9mCD tide resulted in significant wave run up, flattening the beach crest, and causing flooding along Southwood Road. Most recently in November 2022, a long period swell event occurred midway through the autumn beach management campaign. Despite most of the nourished frontage being close to the design crest width and height immediately prior to the event, significant overtopping of the beach still occurred resulting in widespread flooding to roads in Eastoke and a property along Southwood Road.

1.3.6. DEFENCE HISTORY

Since the early 1920s, the Eastoke peninsula has been increasingly developed as a residential area (Plate 1.10).

Plate 1.10: View of Eastoke Peninsula looking east (© Geomatics - Coastal Partners, 2022)

The building of beach huts and bungalows commenced in the 1930s close behind the wide shingle barrier beach. However, natural retreat and loss of sediments from this beach made it necessary to build defences to protect the properties. By 1947, a concrete seawall had been constructed in front of the old Beach Club, with a timber revetment (sloping surface) and groynes adjacent to it (Figure 1.14). By 1974, the seawall had been extended to the east and west, for a total of 2.6 kilometres. This seawall, however, did not solve the fundamental causes of beach erosion, and wave reflections from its front face lowered the levels of the shingle beach. By 1978 major repairs to the seawall were required, demonstrating the importance of the beach in dissipating wave energy.

By the early 1980s, the Eastoke frontage was regularly overtopped by wave action, causing flooding and damage of many properties. The ageing concrete seawall was also approaching the end of its serviceable life and a failure could have led to rapid shoreline retreat and subsequent loss of properties. The frequency and severity of overtopping events were increasing annually. In an effort to reduce the damage, a rear splash wall was constructed along the entire length of the seawall. These measures did not adequately prevent regular overtopping or storm damage to properties.

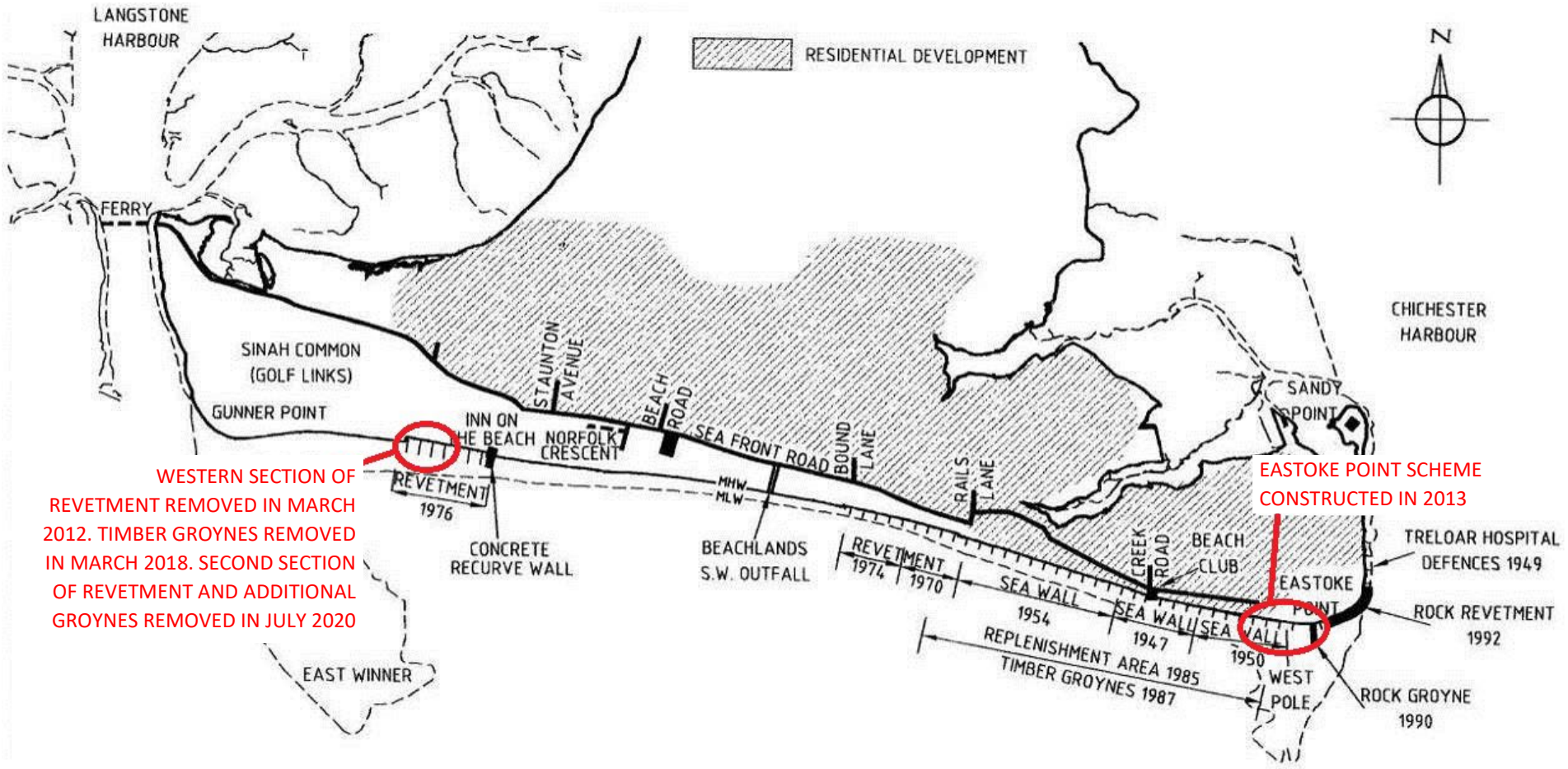

Figure 1.14: Historic construction of sea defences around South Hayling

A major Beach Replenishment Scheme, carried out in 1985 successfully alleviated further incidents of this nature by removing the energy of waves before being reflected by the concrete seawall. The scheme involved importing half a million cubic metres of shingle from the Owers Bank and placing it on the beach over a length of 2.2 kilometres. Subsequently, there has been a requirement for ongoing shingle recycling to maintain the level of protection provided by the scheme design.

Such a large amount of material being injected into the sediment transport system resulted in the rapid transport of material along the frontage. In 1987, new timber groynes were built in order to try and control the transport rate along the replenished area and in 1990 a rock groyne was constructed to further reduce loss of material around Eastoke Point.

In 1992, it became necessary for emergency repairs to be carried out at Eastoke Point. These works involved the construction of 150 metres of rock revetment and rock stub groynes. These works proved to be successful and helped to reduce the occurrence of volatile beach levels and subsequent flooding in this area.

The successful implementation of the 1992 BMP has influenced the ongoing management of the coastal defences at Eastoke. Since that time the beach has been the main defence on the open frontage, comprising recycling and periodic dredge and deposition of the material from Chichester Bar alongside occasional import of shingle from sources outside of the sediment cell if required. The associated control structures have been maintained and replaced as required, although no changes in the form of hard defences were carried out since the early 1990s, until 2013 when the Eastoke Point scheme was constructed. This involved building a rock revetment and 4 rock groynes and recharging the beach to stabilise this highly dynamic area at the entrance to Chichester Harbour. More detail on this is available in Section 3.1.3.

Away from the nourished frontage the defences west of Inn-on-the-Beach (BMP U5), constructed in 1976, are reaching the end of serviceable life and a 75m section of sloping timber breastwork was removed in March 2012 (Figure 1.14). This returned the beach to a more natural beach profile. In March 2018 the timber groynes were removed at West Beach as they had become outflanked and posed a significant health and safety risk to the public. By July 2020 a section of the sloping timber breastwork had also become a health and safety risk to the public and was removed, leaving behind a short section of sloping timber breastwork immediately adjacent to Inn-on-the-Beach along with a single timber groyne attached to the remaining structure. The timber groyne at the boundary of HBC and Private landownership adjacent to Gunner Point is a key control structure, which is regularly maintained by HBC to help stabilise the downdrift position of West Beach bay and assist with retaining material on the beach.

1.3.7.CURRENT DEFENCE CONDITION

The coastal assets along the entire South Hayling frontage are regularly inspected and maintained by Coastal Partners (Section 5.1.2), and the results are stored in the Coastal Partners coastal asset database. An overview of the defence condition, including the nourished beach, is given here for each BMP unit, based on the latest survey results stored in the database. Due to working restrictions during Covid, and other external factors, the last full inspection was undertaken in 2019. Additional inspections in localised areas have been undertaken annually between 2019 and the present day. The next planned inspections will be undertaken in 2024.

The condition of the defences is described according to the descriptions within the EA Condition Assessment Manual (Ref 1.9).

<u>BMP U1</u>

Generally beach levels are healthy and accreting, to the point that the pontoon at Hayling Island Sailing Club is no longer inter-tidal but a sand beach. This is causing difficulty at the sailing club as the pontoon is no

longer in use until permission is granted from regulatory bodies to extract excess sand. If permission is granted, any sand removed from the pontoon must remain in the SAC system and continue to feed the spit.

Various timber control structures are owned and maintained by private organisations, which are mainly in fair condition or buried beneath the beach. A rock revetment constructed around the Hayling Island Sailing Club is in good condition.

BMP U2

The rock revetment and rock groynes around Eastoke Point are in very good condition, with most of the structure buried by beach material. The original capital beach nourishment in 1985 rapidly eroded in this area and beach recycling alone was not capable of maintaining the required standard of protection, so the Eastoke Point Scheme was constructed in 2013. A rock revetment was built, and 4 timber groynes were removed and replaced with 4 rock ones and the beach was nourished. More information is available on this in Section 3.1.3. Recent inspections have identified some erosion of the beach crest above the rock revetment. The seaward edge of the crest to the rear of the rock is showing signs of cliffing and narrowing in front of the Nature Reserve. Works to stabilise this area will be undertaken, and monitoring will continue in the future.

BMP U3

The nourished beach is the primary defence along this section of the frontage. There are two key erosion hot spots where the beach crest is often drawn down below the design standard; these are Eastoke Corner and the area in front of the Creek Road car park where there is currently a sediment drift divide. These are discussed in more detail in Section 2.6. The old concrete sea wall is buried under the nourished beach and its condition is considered to be largely unchanged. The timber groynes constructed in 1987 are generally in fair condition, with ongoing maintenance and repairs carried out by HBC.

BMP U4

The timber groynes along this section of beach are generally in fair condition. The timber sloping revetment is in fair/poor condition where visible, although it is prone to damage when beach levels fall in front of the structure. Several repairs have been undertaken to this structure since 2017, with further maintenance works planned for summer 2023.

The central beachlands open coast has no hard defences other than a single timber groyne to the east of the unit which is in fair condition. The overall beach is in good condition. As an extraction area for beach management, the overall volume of this unit is monitored closely, with sediment only extracted if there has been a sufficient build-up since the previous campaign.

BMP U5

To the west of Inn-on-the-Beach at West Beach, the remaining sloping timber breastwork is in a generally fair/poor structural condition, and dependent on beach levels in front of the structure. The visible structure has been assessed as being in fair condition overall. The Council adopted policy since 2008 is to maintain the structure where reasonably practicable and if the structure fails, it should be made safe but not repaired or reconstructed to avoid a threat to public safety. A 75m section at the western end was removed in March 2012 due to a significant structural failure, triggered by falling beach levels exposing the degraded lower structure. A further section of the structure was removed in 2020, with the intermediate groynes removed in 2018. The remaining structure and the existing timber groyne will be monitored and removed as their condition deteriorates and form a significant health and safety risk.

The beach at West Beach fluctuates significantly in plan form and crest position. Since the structures have been removed, the beach has started to return to its' natural form. Significant erosion has been identified at the eastern extent of the bay, with the western beach showing signs of stabilisation. The roll-back since the removal of the groynes and revetment has been significant, with the majority of the original car park now removed by coastal processes, particularly during storm events. Analysis of the changes in plan form can be found in Appendix A.

BMP U6

There are three privately owned timber groynes in poor condition in front of the Hayling Golf Club driving range at the eastern end of this management unit. Over the past 7 years these groynes have been mainly buried by the beach levels, restricting detailed inspections. There is localised erosion associated with a dynamically changing beach planform in this location (Section 2.6). Other than these three control structures the frontage is open beach in the lee of a significant ebb-tidal shoal, the East Winner.

BMP U7

This zone is unmanaged and accreting at a rate of up to 11,200m^3 each year (2004 – 2022). Given the longshore drift direction from east to west, the main source of material accreting at Gunner Point has been from import of shingle at Eastoke since 1985. Historically, material has only been extracted from Gunner Point by HBC for emergency works in 2014. Following approval in principle by the landowners and Natural England, extraction from Gunner Point has been permitted under the BMP since 2017. The current agreement runs until 2027, at which point further discussions will be undertaken with the landowner regarding access to shingle material for the remainder of the BMP period.

BMP U8

This management unit contains a variety of redundant sea defences and man-made structures that are buried within the beach. Many of the structures, which are all privately owned and maintained, were buried as pulses of material moved up the eastern flank of the Langstone Entrance channel. There is currently some localised erosion to the north of the unit, associated with the advance of a spit like feature that is gradually moving northwards.

1.4. ISSUES

1.4.1. FLOODING/EROSION ISSUES

There is a combined risk to properties on the Eastoke Peninsula from flooding and coastal erosion. The main issue on this frontage is flooding caused by wave overtopping of the defences. Wave overtopping and coastal erosion are currently being managed through ongoing beach recycling and recharge, although there are ongoing erosion issues in specific areas (Section 2.6).

Currently the main flood defence consists of a mixed sand and gravel beach which is maintained to a design crest height and width (Section 3.2) alongside a buried seawall. Flooding occurs when the beach is not at this standard or the waves have such an intensity and/or duration that the crest height and width reduce, resulting in overtopping. This BMP will investigate the most cost-effective way of maintaining the nourished beach.

1.4.2. NATURAL ENVIRONMENT CONSTRAINTS AND OPPORTUNITIES

When undertaking beach maintenance works, there are a number of environmental aspects to be managed (refer also to Section 2.8 and Appendix G). Some key environmental elements to be appreciated and managed are:

- Protecting the integrity of the National Network Sites; Solent Maritime SAC, Chichester and Langstone Harbours SPA, Solent and Dorset Coast SPA, the component SSSI's and Marine Conservation Zones.
- Perennial vegetated shingle.
- Annual Vegetation of drift lines.
- Breeding ground nesting birds on the open beach.
- Migrating and overwintering birds (in particular over-wintering bird high tide roosts).
- Foraging Terns during breeding and post breeding seasons.
- Natural coastal processes and the need to maintain the feed of material moving towards the two peninsulas at Gunner Point and Black Point Spit, which are high tide roost sites.
- Intertidal mudflats and sandflats.
- Water Quality.
- Blue Flag beach status.
- Public Health and Safety.

Beach management works have been ongoing at Hayling Island since 1985. These works have been undertaken sensitively with respect to the natural and built environment, and through experience and analysis of monitoring data have continued to improve. The BMP is a 'soft' form of Flood and Coastal Erosion Risk Management, working with natural coastal processes. The Hayling Island open coastline has benefited from on-going beach maintenance operations. With the import of shingle, the shingle beaches have offered continued flood and erosion protection to the community and provided enhanced opportunities for the establishment of perennial vegetated shingle and annual drift line vegetation.

This revised BMP has been developed in-line with the existing management of this coastline, extending east and west to include the full Hayling Island open coastline. This will enable close working relationships with neighbouring landowners alongside coastal management at Eastoke.

Coastal Partners received Planning Permission & Marine Licence for these works in 2017. An Environmental Statement (ES), Water Framework Directive (WRD) Assessment, Habitat Regulations Assessment (HRA) and Construction and Environmental Management Plan (CEMP) were produced in close liaison with Natural England, to highlight how the BMP would be delivered without any Likely Significant Effect on the natural environment and designated sites. These have been advised by the Environmental Scoping Report, and subsequent scoping opinion. An Environmental Mitigation Plan was developed, which will be revised as required as part of the new BMP submission and shared with key stakeholders. Current duration of licences for the beach management plan are:

- Planning Permission: In Perpetuity (See Appendix E)
- Marine Licence: 10 year licence – 2017 to 2027 (See Appendix E)

A WFD assessment was undertaken to identify whether the BMP has the potential to prevent these (and wider) Water Bodies meeting their objectives, to ensure there is no deterioration to these water bodies. It identified and promoted the delivery of any objectives and mitigation measures that are required. It also considered scheme impacts on other European protected sites, including Shellfish Waters, Bathing Waters and Natura 2000 sites. This WFD assessment was guided by the preliminary WFD assessment upon which we received a scoping opinion. The proposed BMP will be fully compliant with the WFD upon adoption of appropriate mitigation.

The assessment followed the steps below.

- An overview of the WFD process and methodology for assessment.
- Information on the Beach Management works / activities.
- Background information regarding relevant water bodies and protected sites.

- Assessment of potential impacts and mitigation.
- Contributions towards achieving water body objectives.
- Conclusions, based on the evidence presented previously.

- Marine Conservation Zones

The Marine and Coastal Access Act (2009) created a new type of Marine Protected Area (MPA), called a Marine Conservation Zone (MCZ). Natural England and JNCC provided advice on how MCZ's should be selected, with the government using these recommendations as a basis for selecting MCZ's for designation in 2012. Following a second tranche of designations in January 2016 there is now a total 50 designated sites, then nearest of which are offshore the east coast of the Isle of Wight and Pagham Harbour. The South Hayling frontage is not directly adjacent to any MCZ's. MCZ's will protect nationally important marine wildlife, habitats, geology, and geomorphology. Sites will be selected to protect not just the rare and threatened, but the range of marine wildlife.

1.4.3.BEACH SAFETY AND AMENITY CONTRAINTS

As noted in Section 1.3.1, the whole of the frontage covered by the BMP is a popular destination for a range of amenity uses. The use of the beach varies depending on the season and facilities such as car parks, beach huts and water use. Zoning provides a focus for amenity use and access onto the beach. The peak tourism season is between April and September, although the seafront is used all year round.

In addition to maintaining public safety when works occur, other amenity and public safety issues exist at the site that relate to the beach and structures. These include:

- Varying beach levels could pose access and fall issues as well as create risk of undermining to the defences.
- Health and safety issues associated with the timber groynes including damaged or missing planking and jagged edges.

These issues are in part automatically resolved through the ongoing BMA as the design profile and associated control structures remove the risk of falls from the promenade. In addition, where significant cliffing of the nourished material occurs reprofiling may be undertaken to remove steep drops on the beach crest (Section 5.3.2).

1.4.4.LICENCES, APPROVALS AND CONSENTS

Planning permission in accordance with the Town and Country Planning Act 1990 and the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 for the ongoing beach recycling works around Hayling has been granted in perpetuity, starting in June 2018 (Appendix E), covering the area from The Ness to Inn-on-the-Beach. As part of the Planning Permission we have stated that we will monitor BMP works into the future to satisfy our regulators that the environment is not adversely affected by the BMP works, and this may allow refinement of activities going forward (i.e. amendment of Conditions). Beach maintenance works in the form of recycling and reprofiling are exempt from a Marine Licence under the Marine & Coastal Access Act 2009, as long as the activity is carried out within the existing boundaries of the works being maintained (Ref 1.8). The beach recycling works to remove the hazard to navigation (Chichester Bar) seaward of MHWS at Eastoke Point are exempt from requiring a Marine Licence as they are carried out on behalf of Chichester Harbour Conservancy (Appendix E).

A Chichester Harbour Conservancy 1971 Section 45 Works Licence has been approved for recycling material from Chichester Bar to Eastoke beach (Appendix E). The consent is valid until 26th January 2024 and a renewal

will be sought prior to the licence lapsing. The beach recycling operations fall outside of the area requiring a Harbour Works Licence.

A Marine Licence application was submitted to the Marine Management Organisation (MMO) to allow marine based recharge of material, thereby providing consistent licences. The licence was granted in 2017 and runs until 2027 to cover the works. The need for a Marine Licence arose from the anticipated future need for additional shingle to be imported into the system from outside the existing sediment cell. This could include import by sea or road. The only activities that require a Marine Licence, are import of material from outside the sediment cell, so the open beach recycling / dredging from Chichester Harbour entrance are exempt as they involve the recycling of materials within the same sediment cell. Under the Marine Licence a series of conditions have to be discharged prior to commencement of each campaign. Certain conditions require consultation with Natural England (NE), the CEMP for each campaign and also annual reports on vegetated shingle and ornithological surveys have been approved by NE throughout the previous campaigns.

1.5. RESPONSIBILITIES FOR MANAGEMENT

Responsibility for the management and operation of activities along the BMP frontage rests mainly with HBC. Coastal Partners provide a shared service for Havant Borough Council (HBC), Portsmouth City Council (PCC), Gosport Borough Council (GBC), Fareham Borough Council (FBC) and Chichester District Council (CDC). CP have written this iteration of the technical BMP, have current licences and consents and will submit the Outline Business Case to the Environment Agency (EA) for Flood and Coastal Erosion Risk Management Grant in Aid to fund the future 5-year phase of the BMP. Table 1.3 summarises the roles and responsibilities and identifies non-HBC responsibilities.

Table 1.3: Roles and responsibilities for management and operational activities

MANAGEMENT OPERATION		ASSIGNED RESPONSIBILITY
1	Operations to maintain beach profile	HBC
2	Cleaning/clearance of promenade, steps, revetment, for amenity	HBC
3	Cleaning/clearance of beach	HBC
4	All structural maintenance of promenade, seawall, revetment, timber groynes, slipways, and flood gates	HBC / Private Ownership
5	All structural maintenance of surface water outfalls	Southern Water
6	All maintenance of access steps, ramps, and slipways to beach from seawalls/revetments	HBC / Private Ownership
7	All maintenance of footpath and cycleways including signs for designated public footpaths and rights of way	HBC / Hampshire County Council (HCC) PRoW (Public Right of Way)
8	Litter clearance	HBC
9	Monitoring of shingle movement (and other coastal processes)	HBC / Southeast Strategic Regional Coastal Monitoring Programme (SRCMP)
10	Maintenance of seats, litter bins etc	HBC
11	Flood warning and response actions	HBC / EA
12	Emergency planning	HBC / HCC / EA

Actual ownership of the assigned responsibility for each management operation identified in Table 1.3 is in some cases held by different departments within the identified organisation. Therefore, in order to support Table 1.3 and to provide clarity on who should be contacted for each item, Appendix H provides contact details for each management operation as well as other organisations with interests in this area.

1.5.1. MONITORING

HBC has responsibility for monitoring of the South Hayling Beach covered by this plan. Further detail on the monitoring programme and objectives is contained in Section 4.

1.5.2. MAINTENANCE ACTIVITIES

HBC are also responsible for inspecting and carrying out maintenance of coastal defences on the majority of the frontage from BMP U2 to BMP U5. Structures in BMP Unit 1 and BMP Units 6-8 are inspected by HBC if required but are privately owned and maintained. **Where issues are identified in these areas the appropriate owner / maintainer is notified of the defect and any obligation to make good.**

1.5.3. OTHER ACTIONS

The majority of the beach is maintained and supervised on a day-to-day basis by Norse South-east (an HBC joint venture) from their Beachlands Office. These activities include:

- Undertaking regular daily inspections and reporting of the beach condition from the Ferry Boat Inn (BMP U8) in the west to the Nature Reserve boundary (BMP U1) in the east to check for any hazards to the public from such items as beach cliffing, groyne deterioration and voids.
- Undertaking regular daily inspections of the Beachlands Coastal area including buildings, beach huts, lifesaving equipment, signs, litter bins, dog bins and notice boards and ensuring any defects are rectified.
- Dealing with any emergency situations such as oil pollution, dangerous chemicals or canisters on the beach which may occur.

1.5.4. RESPONSIBILITY FOR FLOOD WARNING

The EA is responsible for providing flood defence warning for the South Hayling frontage through their Area Flood Warning Duty Officer (FWDO). The public are warned through the EA flood line, the EA website and by the public registering with the EA for Flood Warnings Direct.

The flood warning is passed to HBC's Emergency Response Officer and the HBC Duty Officer. The CP Coastal Incident Officer is also notified, and a coordinated response is developed following the procedures identified in the coastal flood risk response plan (Appendix I).

1.5.5. RESPONSIBILITY FOR OUTFALLS

There is only one surface water outfall along the length of beach covered by this BMP. This is opposite Sea Grove Avenue and is a ∅1050mm pipe that outfalls surface water and storm overflow into the sea. It is owned and maintained by Southern Water. There may be other minor outfalls that discharge surface water through the beach, but these are largely buried and have not been identified individually.

1.5.6. KEY STAKEHOLDERS

The following organisations are key stakeholders in the development of this BMP, and contact details are listed in Appendix H.

- **Coastal Partners**. Who are the team within HBC responsible for the development and implementation of this BMP to manage erosion and flood risk for the frontage.
- **Havant Borough Council**. Who is a major landowner of the frontage and undertake day to day management of the defences. Norse SE are responsible for the Open Beach, car parks and open areas.
- **Hampshire County Council**. Who are landowners at the eastern end of the frontage where they own the Eastoke Point nature reserve and beach frontage.
- **Hayling Golf Club**. Who are landowners at the western end of the frontage where they own the golf course and beach frontage
- **Hayling Island Sailing Club**. Who are landowners at the eastern end of the frontage where they own the spit and beach frontage extending up to Black Point.
- **Natural England**. Who have an overview on proposals to carry out works such as this BMP in an environmentally sensitive area.
- **Environment Agency**. Who have a strategic overview for all forms of flooding and coastal erosion, and therefore has a significant interest in the management of flood and erosion risk along the coastline covered by this BMP. They also administer the funding stream for any works to be carried out under this BMP.

1.6. LINKAGES WITH OTHER DOCUMENTS

1.6.1. SHORELINE MANAGEMENT PLANS

A Shoreline Management Plan (SMP) is a large-scale assessment of the risks associated with coastal processes and helps reduce these risks to people and the developed, historic, and natural environments. Coastal processes include tidal patterns, wave height, wave direction and the movement of beach and seabed materials.

The first round of SMP's were carried out in the mid 1990's and the plan covering this frontage was called the East Solent SMP and was completed in 1997. This found that the preferred option for the eastern end of the frontage was "Hold the Line" while on the frontage around Gunner Point the preferred option was "Do Nothing".

The current Shoreline Management Plan (SMP) covering the BMP area was completed in 2010 (Ref 1.1). This document adopted a single policy unit (5aHI05) covering the entire open coast for South Hayling, corresponding with the extent of this BMP. The SMP policy recommended for this section of coast is to continue to 'Hold the Line' over the next 100 years. There are additional qualifying statements about allowing the coastline in key areas to evolve with minimal interference.

1.6.2. HAYLING ISLAND: EASTOKE SECTORAL STRATEGY STUDY

This joint HBC and EA report (Ref 1.2) was completed in October 2006. It split the Eastoke frontage in to four sections, namely;

- Southern Frontage – Main section
- Southern Frontage – Eastoke Point
- Northern Frontage – Main section
- Northern Frontage – Bracklesham Road

For this BMP the options for the Southern frontage are relevant. The preferred option for the *Southern Frontage – Main section* was "Hold the Line" to a 0.5% AEP standard of defence through beach recharge and annual recycling. For the *Southern Frontage – Eastoke Point* the preferred option was "Hold the Line". Construction of the capital scheme at Eastoke Point by the CP in 2013 has helped to deliver this "Hold the Line" policy and reinforces the need for beach management on this frontage.

1.6.3. EASTOKE POINT COASTAL DEFENCE STUDY

This report (Ref 1.10) was completed in May 2009 and specifically addressed the issues in connection with maintaining the beach profile at Eastoke Point. It did however reinforce the need for continuing management of the beach in front of the wider Eastoke frontage as the beach will still provide a sea defence at this location even after construction of the capital scheme.

1.6.4. HAYLING ISLAND STRATEGY

A coastal management strategy is in draft form for Hayling Island to develop strategic coastal management options for the whole island for the next 100 years. The strategy considers how flood and erosion risk are likely to change in the future in response to climate change and will develop sustainable and robust options to manage risks associated with coastal flooding and erosion that are technically feasible, economically viable and environmentally acceptable.

Currently, a Draft Strategy (Ref 1.11) has been prepared and has split the entire coastline (open coast and harbours) up into 16 Option Development Units (ODU). The BMP frontage is located within ODU 8 to 10. For ODU8 (Eastoke peninsula), the leading option put forward by the strategy is to carry out beach management over the next five years, alongside new rock groynes and construction of new defences in the short-term, which are then maintained and raised over time to keep pace with sea level rise. However, it should be noted that significant funding from a variety of sources will be required to progress this option.

The project team are now going through a period of reviewing comments and finalising the Draft Strategy. The Strategy will be submitted for approval and adoption during 2024.

1.6.5. BEACH MANAGEMENT PLANS

The following lists the Beach Management Plans undertaken at Eastoke.

- A BMP at Hayling Island was first adopted in 1992 (Ref 1.12) and ran from 1992-1996: The objectives of this original plan included:
    - Continuous monitoring of the beach;
    - Immediate reaction to any rapid drawdown, as waves remove material in a groyne bay (beach compartment between two groynes);
    - Annual beach recycling; and
    - Use of material accreting (accumulating) at Central Beachlands as a source of material

  The study sought funding for Coastal Management Studies (to better understand the coastal processes on South Hayling) and to undertake Beach Recycling activities.

- Beach Management Strategy Plan for the southern frontage of the Eastoke Peninsula 1999 (Ref 1.13): This study was undertaken to determine appropriate and sustainable policies for the management of the coastal defences along the southern frontage of the Eastoke Peninsula. The plan

recommends maintaining a shingle beach to a 1 in 200-year standard of protection through annual Shingle Recycling operations and periodic recharge from Chichester Harbour entrance.

- Beach Nourishment 2006 Project Appraisal Report (Ref 1.14): This report sought and successfully achieved FDGiA to undertake a Beach Nourishment operation along the shore of Eastoke Beach in order to raise the defence to provide a 0.5% AEP standard of protection against coastal erosion and flooding.

- Beach Recycling 2008-2012 Project Appraisal Report (Ref 1.15): This report sought and successfully achieved FDGiA to undertake annual beach recycling operations on the southern Eastoke frontage at Hayling Island for 5 years.

- South Hayling BMP 2012-2017 Project Appraisal Report (this was a joint submission with the Eastoke Point Scheme Project Appraisal Report) (Ref 1.16): This report sought and successfully achieved FDGIA to maintain the beach to provide a 0.5% AEP standard of protection against breaching of defences and coastal flooding.

- South Hayling BMP 2017-2022(24) Outline Business Case (Ref 1.17): This report successfully achieved FDGIA to maintain the beach to a 0.5% AEP standard of protection against coastal flooding and erosion risk. This BMP was extended by two years to 2024 to allow the results of the Hayling Island Strategy to be finalised.

1.7. RELEVANT INFORMATION

The following provides a list of all sources of information that have been referenced in this section of the BMP.

Ref 1.1 **North Solent Shoreline Management Plan**, New Forest DC (2010)

Ref 1.2 **Hayling Island: Eastoke Sectoral Strategy Study**; Joint report to Havant Borough Council and Environment Agency, W.S. Atkins Ltd (2006)

Ref 1.3 **SCOPAC Sediment Transport Study,** 2012 Update of Carter, D., Bray, M. and Hooke, J. (2004) SCOPAC Sediment Transport Study. Available: https://www.scopac.org.uk/sts/phe-che.html

Ref 1.4 **SCOPAC Storm Analysis Study.** Coastal storms: detailed analysis of observed sea level and wave events in the SCOPAC region (southern England). Wadey, M.P., Haigh, I.D., Inayatillah, A. and Last, E. (2020)

Ref 1.5 **Coastal storms: analysis of observed sea level and wave events in the SCOPAC region (Southern England) following winter 2013/14.** ICE Breakwaters Conference 2023. Wadey, M.P., Haigh, I.D., Inayatillah, A. and Cope, S. (2023).

Ref 1.6 **Hayling Island Seafront Masterplan**, Havant BC (2012).

Ref 1.7 **Improving Beach Management on a Nourished Beach; Morphodynamics at Hayling Island, UK**, Unpublished MPhil Transfer Report, School of Environment and Civil Engineering, University of Southampton. Moon, C.R. (2010).

Ref 1.8 **Reconstructing coastal flood occurrence combining sea level and media sources: a case study of the Solent, UK since 1935**, Natural Hazards, 59 (3), 1773-1796, Ruocco A. C., Nicholls, R.J., Haigh, I.D. and Wadey, M.P. (2011).

Ref 1.9 **Condition Assessment Manual**, Document Reference 166_03_SD01, Environment Agency (2006).

Ref 1.10 **Eastoke Point Coastal Defence Study**, HR Wallingford (2008).

Ref 1.11 **Hayling Island Coastal Management Draft Strategy**, AECOM (2023).

Ref 1.12 **BMP 1992 – 1996**, Technical Report, Havant BC (1992)

Ref 1.13 **Beach Management Strategy Plan**, Technical Report, Havant BC (1999)

Ref 1.14 **Beach Nourishment, Eastoke, Hayling Island**, Project Appraisal Report, Havant BC (2006)

Ref 1.15 **Hayling Island Beach Recycling 2008 – 2012**, Project Appraisal Report, Havant BC (2008)

Ref 1.16 **BMP 2012 – 2017,** Technical Report, Havant BC (2012)

Ref 1.17 **BMP 2017 – 2022 (24),** Technical Report, Havant BC (2017)

2. SUPPORTING INFORMATION

This section of the Beach Management Plan (BMP) provides a summary of the coastal processes affecting the BMP frontage, extending along the 8km South Hayling coastline, between the Ferryboat Inn and Hayling Island Sailing Club (HISC). This includes an assessment of the following information:

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

The 'Sea levels', 'Wave climate' and 'Sediment characteristics and transport' sections have been updated since the South Hayling BMP (2017-2022), using South-east Regional Coastal Monitoring Programme (SRCMP) data.

2.1. SEA LEVELS

2.1.1. TYPICAL TIDAL LEVELS

Tide levels for Chichester Harbour Entrance (Ref 2.1) are provided in Table 2.1. Up to date and historical tide data, which includes both astronomic and meteorological effects, can be obtained from the National Tide and Sea Level Facility (NTSLF) network based at the British Oceanographic Data Centre (BODC) (Ref 2.2) and CHIMET (nearshore metocean, wave and water level station from Chichester Bar Beacon approximately 0.5 miles out to see from Chichester Harbour entrance) (Ref 2.3). The nearest NTSLF tide gauge is located just inside Portsmouth Harbour. The CHIMET gauge is located in the outer entrance channel to Chichester Harbour.

Table 2.1: Typical tide levels at Chichester Harbour for 2023 (Ref 2.1)

	TIDE LEVEL	
	CHART DATUM (mCD)	ORDNANCE DATUM NEWLYN (mOD)
HIGHEST ASTRONOMICAL TIDE LEVEL (HAT)	5.26	2.52
MEAN HIGH WATER SPRINGS (MHWS)	4.79	2.05
MEAN HIGH WATER NEAPS (MHWN)	3.90	1.16
MEAN SEA LEVEL (MSL)	2.97	0.24
MEAN LOW WATER NEAPS (MLWN)	1.82	-0.92
MEAN LOW WATER SPRINGS (MLWS)	0.93	-1.81
LOWEST ASTRONOMICAL TIDE (LAT)	0.21	-2.53

The typical spring tidal range at Eastoke is 4m. There is a height difference of ±0.2m on spring tides when comparing Portsmouth tides to Chichester Harbour.

2.1.2. EXTREME STILL WATER LEVELS

Extreme still water levels can cause coastal flooding or allow waves to cause flooding by reducing the freeboard (difference between top of defences and the still water level). The latter is the situation for Hayling open coast, added to which, the wave period and hence wave run-up can be relatively high. Extreme sea levels can occur due to a large astronomical tide, surge or both. The nearest high quality record of sea levels

relevant to Hayling is the tide gauge at Portsmouth, which provides a record of observed sea levels from 1991-present. Data can be downloaded from the BODC.

To determine the probability of the sea levels in this time series, extreme still water levels statistics (return periods) are available from the Environment Agency's Coastal Flood Boundary Dataset (CFBD) project (Ref 2.4). A standard surge curve is also available for use if required for further analysis (e.g. flood modelling). The extreme water levels for the nearest CFBD grid points (No. 4604, No. 46106, No. 4608 and No. 4610 (Figure 2.1) are shown in Table 2.2. Mean sea level rise means that more recent (and future) sea level extremes are likely to occur more often. Therefore, when considering return periods for sea level events, allowance can be made for mean sea level rise since these probabilities were generated (the 'base year' for the analysis was 2017). Typically, this would use a rate from the observed sea level records (approx.1.8 mm per year) to 'offset' the levels. Analysis undertaken on the Newlyn tide gauge as part of the SCOPAC Storms Analysis study (Ref 2.5 and 2.6) found a rise in mean sea level of 1.86 mm/yr between 1915 and 2019, increasing to 3.8 mm/yr between 1990 and 2019.

Over the 2013/14 winter season 14 extreme sea level events occurred in the eastern Solent (Ref 2.5). The highest sea level recorded at Portsmouth (within the 32 years of data in the BODC database) was on 6th December 2013 of 5.56 mCD (approximately a 1 in 10 year return period). This was generated by a North Sea surge (which registered as a skew surge of approximately 0.7 m at Portsmouth). This surge propagated east to west along the English Channel. Due to the lack of accompanying wind and waves, that event did not generate open coast flooding in the Solent. It is surges associated with south and south-westerly storms that pose the greatest threat to the open coast at Hayling, since the extreme sea level will be accompanied by large waves.

This was the case for the 2nd highest sea level event of 14th February 2014 of 5.54 mCD, when an almost 0.9 m skew surge accompanied by large waves caused flooding and erosion along English Channel coasts, including at Hayling Island. It is notable that on 3rd November 2005 houses flooded severely at Eastoke due to energetic swell waves overtopping the beach when the sea level was 5.17 mCD (approx. 1 in 1 year return period, with a 0.3 m skew surge). This event highlighted the important contribution of wave run-up and possibly other factors (drainage, beach levels etc.). However, larger sea levels allow waves to attack further up the beach and also represent stormy conditions that would damage the beach and defences. The 2013/14 season was remarkable for the frequency of storms over a 143 year record (over the UK and Ireland) (Ref 2.7), and along with high tides these storms generated 11 high waters in exceedance of the 1 in 1 year return period at Portsmouth (Ref 2.8). It has been noted that this exceptional period of 'temporal clustering' of storms caused high levels of damage and erosion to many beaches along the UK south coast (Ref 2.8).

Over the previous BMP period between 2017 and 2022, the highest sea level was recorded during Storm Eleanor on the 4th January 2018. Sea level during this storm event reached 5.46 mCD, which was the fourth highest recorded sea level since 1990.

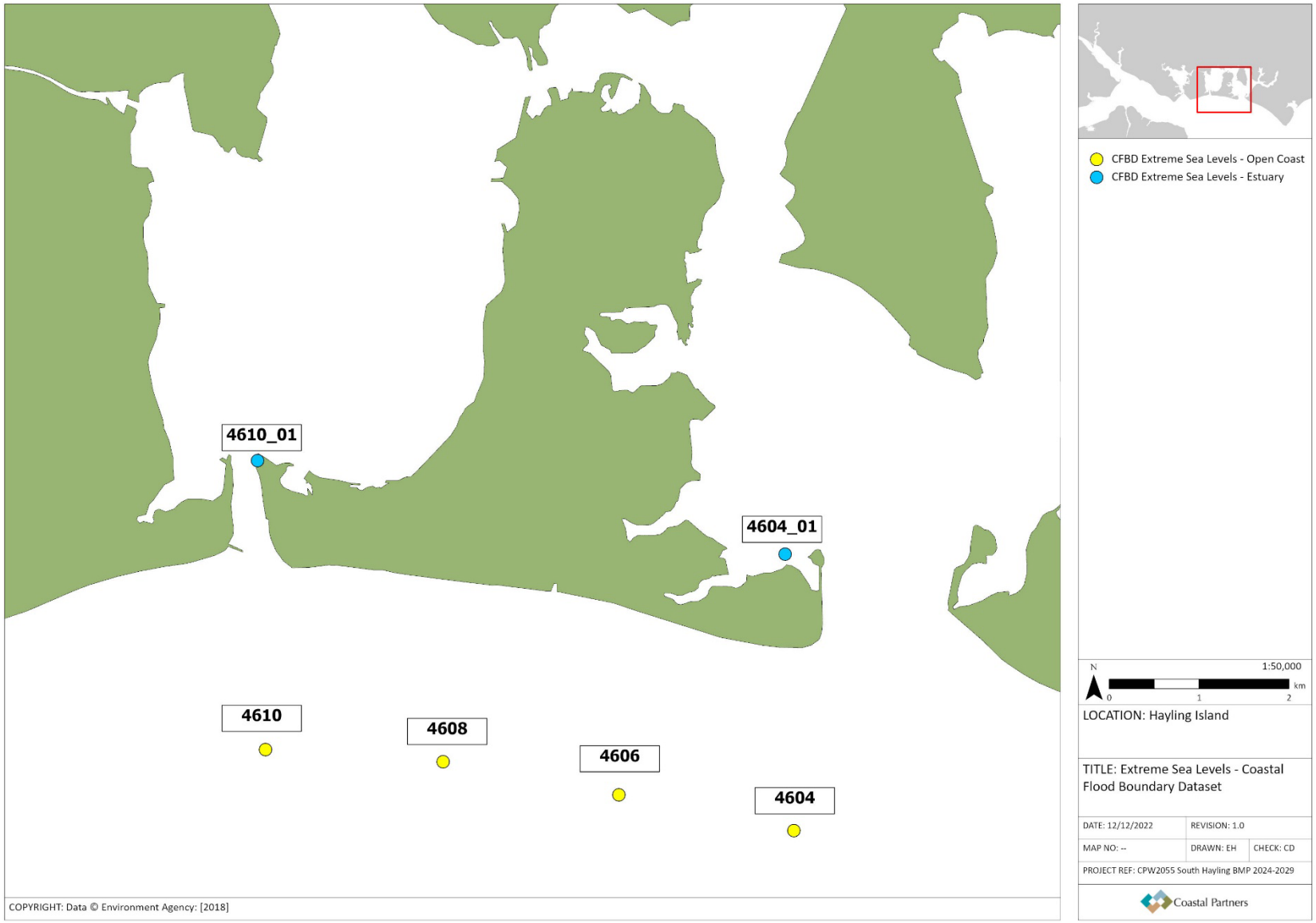

Figure 2.1: Extreme water level grid points 4616, 4610 & 4604 from the Extreme Sea Level study within the EA's coastal Flood Boundary Conditions for UK Mainland and Islands guidance (Ref 2.4)

Table 2.2: Extreme water levels from EA CFB extreme sea level (Ref 2.4)

	Chainage 4610		Chainage 4608		Chainage 4606		Chainage 4604	
RETURN PERIOD (1 IN X YEARS) [APO]	**Water Level (mOD)**	**Water Level (mCD)**	**Water Level (mOD)**	**Water Level (mCD)**	**Water Level (mOD)**	**Water Level (mCD)**	**Water Level (mOD)**	**Water Level (mCD)**
1 [100%]	2.63	5.36	2.65	5.38	2.67	5.40	2.70	5.43
2 [50%]	2.70	5.43	2.73	5.46	2.75	5.48	2.77	5.50
5 [20%]	2.80	5.53	2.82	5.55	2.84	5.57	2.86	5.59
10 [10%]	2.87	5.60	2.89	5.62	2.91	5.64	2.93	5.66
20 [5%]	2.94	5.67	2.96	5.69	2.98	5.71	3.00	5.73
25 [4%]	2.96	5.69	2.98	5.71	3.00	5.73	3.02	5.75
50 [2%]	3.03	5.76	3.05	5.78	3.07	5.80	3.09	5.82
75 [1.3%]	3.07	5.80	3.09	5.82	3.11	5.84	3.13	5.86
100 [1%]	3.10	5.83	3.12	5.85	3.14	5.87	3.16	5.89
150 [0.7%]	3.14	5.87	3.16	5.89	3.18	5.91	3.20	5.93
200 [0.5%]	3.17	5.90	3.19	5.92	3.21	5.94	3.23	5.96
500 [0.2%]	3.26	5.99	3.28	6.01	3.31	6.04	3.33	6.06
1000 [0.1%]	3.33	6.06	3.35	6.08	3.37	6.10	3.40	6.13
10000 [0.01%]	3.57	6.30	3.59	6.32	3.62	6.35	3.64	6.37

2.2. WAVE CLIMATE

2.2.1. OFFSHORE EXTREME WAVE CLIMATE

The published Best Practice Guidance from 'Coastal Flood Boundary Conditions for UK Mainland and Islands' (Ref 2.4) did not include an update of the boundary conditions for extreme (marginal) swell waves heights given in the 2011 guidance (Ref 2.9). The location of the grid point used in the 2011 guidance (Ref 2.9) is illustrated in Figure 2.2, and the outputs presented in Table 2.3 and Table 2.4.

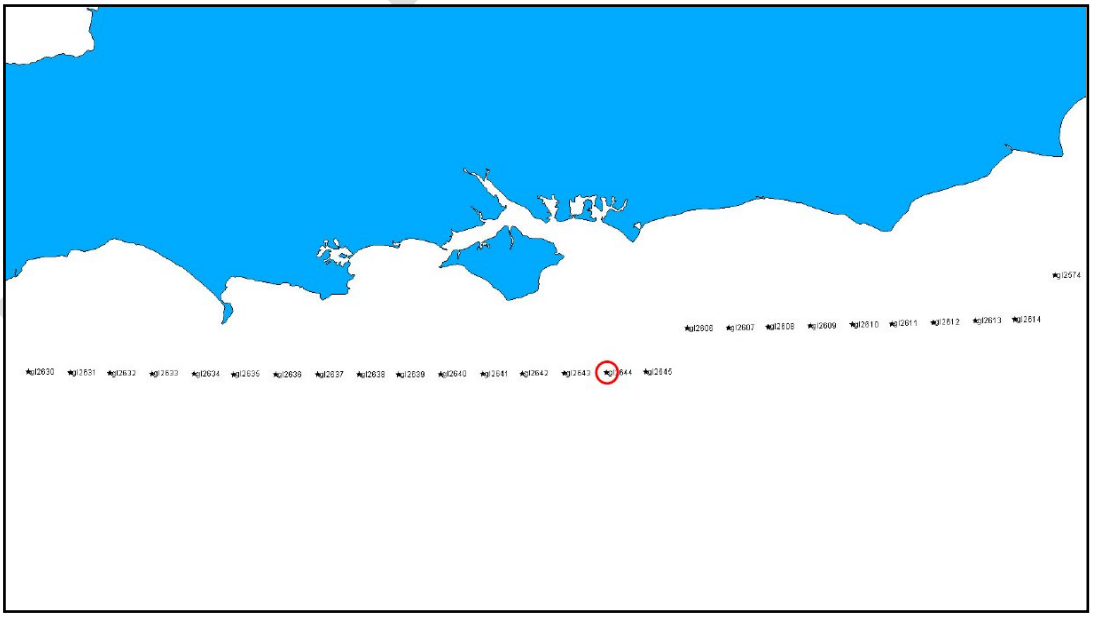

Figure 2.2: Coastal Flood Boundary Extreme Swell Grid Point Locations (Ref 2.9) – Not updated in the 2019 CFBD guidance

Table 2.3: Extreme offshore swell heights, GL2644 (Ref 2.9) – Not updated in the 2019 CFBD guidance

RETURN PERIOD	SWELL FROM SOUTH (M)	SWELL FROM SOUTH-WEST (M)
T1	2.09	2.52
T2	2.32	2.66
T5	2.57	2.82
T10	2.72	2.92
T20	2.84	3.02
T25	2.88	3.04
T50	2.98	3.13
T75	3.03	3.17
T100	3.06	3.2
T150	3.1	3.24
T200	3.13	3.27
T250	3.15	3.29
T300	3.16	3.31
T500	3.2	3.35

Table 2.4: Extreme offshore swell period, GL2644 (Ref 2.9) – Not updated in the 2019 CFBD guidance

WAVE HEIGHT (M)	T_Z (SECONDS)					
	< 8	8 – 10	10 – 12	12 – 14	14 – 16	> 16
H_s <1	0.59	0.2	0.11	0.07	0.02	N/A
H_s 1-2	0.63	0.28	0.07	0.01	N/A	N/A
H_s 2-3	0.49	0.44	0.06	0.01	N/A	N/A
H_s 3-4	N/A	N/A	N/A	N/A	N/A	N/A

Due to the importance of wave transformation at this site, the current assessment (following section) focuses upon nearshore wave conditions using observations from the nearshore Hayling wave buoy (in 10m water depth).

2.2.2.NEARSHORE WAVE CLIMATE

The processes of wave generation and transformation from offshore to inshore are particularly complex in the East Solent. Storm waves reaching the coast can be generated locally under winds from the south-west through to the east, or in the English Channel. Swell waves generated further afield will also penetrate the area, though heights will be modest (Ref 2.10).

A directional Waverider buoy has been deployed off Hayling Island since July 2003 in ~10m water depth as part of the SRCMP. Summary statistics for wave height and direction, annual maximum wave height (Table 2.5) and incidence of storms (Figure 2.3) are presented below.

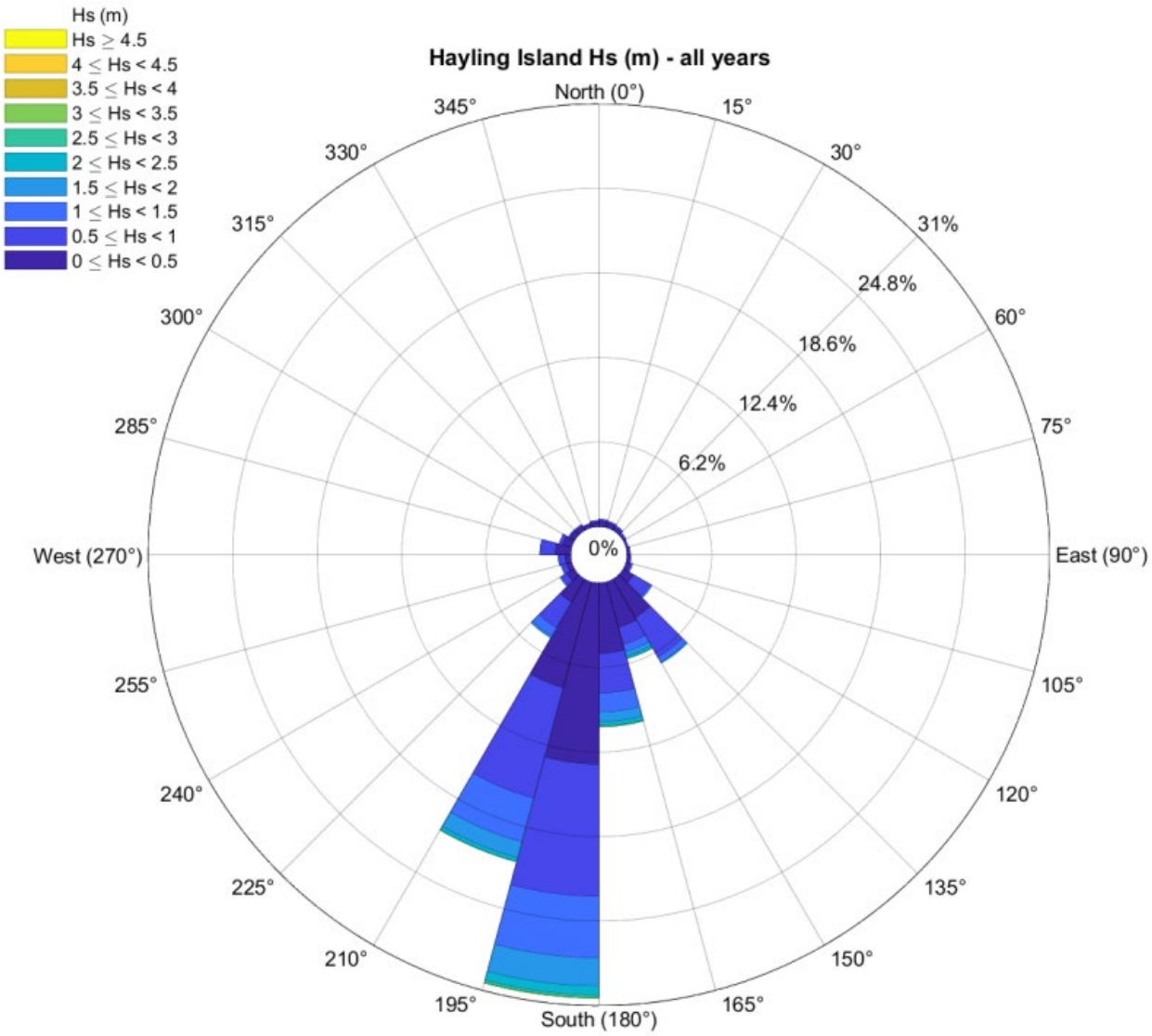

Figure 2.3: Significant wave height direction, Hayling wave buoy (2003-2022) (Ref 2.11)

The wave rose of Hs (significant wave height) and direction shows a S - SW dominated wave climate (Figure 2.3). This matches the predominant SW winds and direction of swell waves refracting around the Isle of Wight.

Table 2.5 presents the maximum wave height per year since 2003 for the Hayling Island wave buoy. The 4.4 m significant wave height recorded during the Easter 2016 storm is the highest recorded since 2003. It is equivalent to approximately a 1 in 30-year wave height. The next largest wave height recorded on the 5th February 2014 at 4.13m was downgraded from a 1 in 50 year to a 1 in 10 year event following the Easter 2016 storm (Ref 2.12). The SCOPAC Storms Analysis study (Ref 2.5) found an increasing trend in wave height at the Hayling Island wave buoy since it's deployment, however it was not statistically significant due to the relatively short length of the dataset.

Table 2.5: Annual wave statistics – Hayling Island wave buoy (Ref 2.11)

YEAR	ANNUAL MAXIMUM Hs	
	DATE	A_{MAX} (M)
2003	29-Nov-2003 10:00	2.68
2004	08-Jan-2004 10:30	3.64
2005	02-Dec-2005 17:00	3.53
2006	03-Dec-2006 08:00	3.42
2007	18-Jan-2007 13:00	3.58
2008	10-Mar-2008 08:00	3.79
2009	14-Nov-2009 13:30	3.36
2010	11-Nov-2010 08:30	3.25
2011	13-Dec-2011 01:00	3.77
2012	03-Jan-2012 08:30	3.32
2013	28-Oct-2013 06:00	3.73
2014	05-Feb-2014 14:30	4.13
2015	15-Jan-2015 03:00	3.37
2016	28-Mar-2016 03:00	4.40
2017	21-Oct-2017 13:00	3.32
2018	09-Nov-2018 22:00	3.56
2019	02-Nov-2019 14:30	3.67
2020	09-Feb-2020 11:30	3.62
2021	31-Oct-2021 09:00	3.25
2022	18-Feb-2022 13:00	3.73

Figure 2.4 shows the incidence of storms since 2003, demonstrating that the winter of 2013/2014 was the stormiest on record since the buoy was deployed in terms of wave height. Emergency works were undertaken at Eastoke following the 14th February 2014 storm, whereby 25,400 m^3 of material was recycled from Gunner Point back to Eastoke to reinstate the beach profile.

During the winter of 2015/16, the Channel Coastal Observatory (CCO) note, 'eight storms exceeded the 2.8m storm alert threshold from midwinter to early spring. The storm on 28 March 2016 was the largest recorded maximum H_s at the site and was distinctly bi-modal with waves of around 17 seconds, while the rest were relatively unexceptional' (see Figure 2.4). The clustering effect of the low magnitude, high frequency storms during the winter of 2015/16 coupled with the highest percentage of bi-modal seas recorded in December 2015 (see Section 2.2.3) and the highest recorded wave height on the 28th March 2016, resulted in substantial draw down of the beach at Hayling Island.

Fortunately, the Eastoke Point scheme was completed by November 2013. Therefore, the severity of flooding via Bosmere Road to Eastoke was less for the winter of 2013/14 and minimal for 2015/16 compared with earlier storms.

During the most recent BMP period (2017-2024), Figure 2.4 suggests a higher frequency of storm events between 2018 and 2020, with 2021 & 2022 being relatively calm in terms of wave height exceeding the storm threshold. It was noted that there were several storm events during this period which presented very long wave periods, which affected the beach at Eastoke and led to significant draw down. During these events (e.g. February 2021), the wave height did not exceed the storm threshold, however the wave period and SWL led to significant damage. Swell wave climate is discussed further in Section 2.2.4.

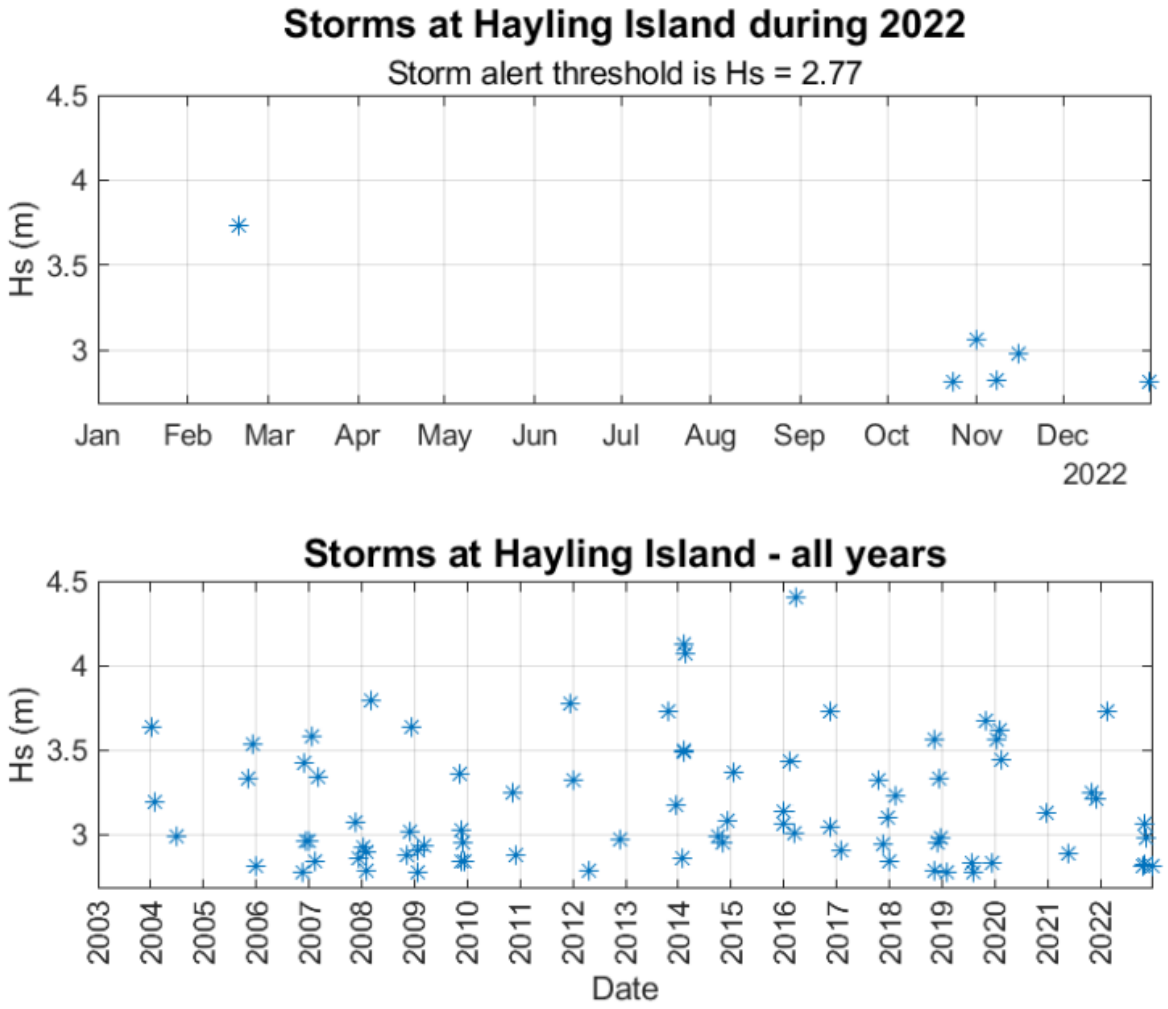

Figure 2.4: Incidence of storms since 2003 where Hs > 2.8m (the Storm Alert Threshold for Hayling Island is based on the 0.25 year return period for significant wave height which is 2.8m) (Ref 2.11)

2.2.3. BI-MODAL WAVE CLIMATE

Hayling Island has been identified as a site influenced by a bi-modal wave climate, where there is a combination of not only wind waves but swell waves also. The SCOPAC Storms Analysis study identified the winters of 2013/14 and 2015/16 to be the most bi-modal since the datasets began and look to be increasing in percentage occurrence (Ref 2.5). SCOPAC research undertaken by Professor Andy Bradbury (Ref 2.13) identifies that the traditional methods for scheme design do not tend to account for bi-modal wave conditions. Coastal flood forecasts often fail to predict these significant events which result in unexpected wave overtopping, leading to flood damage and a need for substantial maintenance. During the November 2005 event, long period swell waves, within a bi-modal wave climate, played a key role in overtopping the nourished beach, with a dominant wave period of over 18 seconds, in combination with a high spring tide and tidal surge (Ref 2.14). More recently Storm Brian on the 21st October 2017 resulted in overtopping of the beach at Eastoke and flooding to nearby roads and public car parks (Ref 2.14). The waves during Storm Brian had a large swell component (50-60%) which was comparable to the November 2005 event. In comparison, the storm event of 26th November 2022 had a lower swell component (37.5%) yet caused a similar flood extent to that of Storm Brian.

The 2022 CCO report (Ref 2.11) notes the average occurrence of bi-modal wave conditions for the month of December for the Hayling Island wave buoy is 11%. During December 2015 this rose to 38%, which is the

highest ever recorded by the SRCMP and coincided with beach draw down (Figure 2.5). Analysis undertaken for the SCOPAC Storms Analysis study (Ref 2.5) identified a linear trend in the occurrence of bi-modal seas suggesting the possibility of an increasing occurrence of bi-modal seas over time, although further work is required to confirm this.

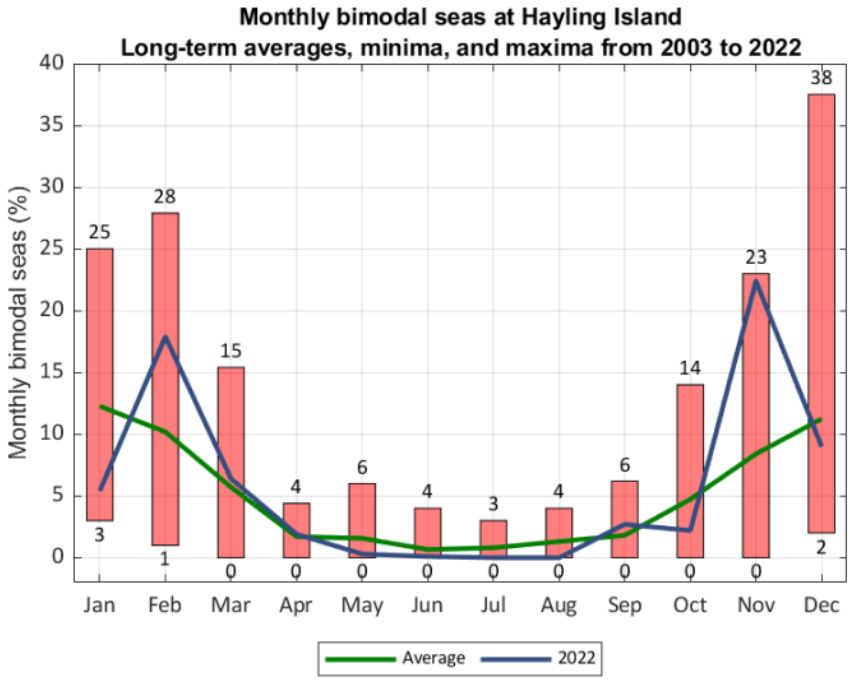

Figure 2.5: Monthly bimodal seas at Hayling Island showing long-term averages between 2003 and 2022. Graph courtesy of the CCO (Ref 2.11)

As a recommendation of the 2017-2022(2024) BMP, the Bimodal Wave Study (Ref 2.15) was undertaken to assess the Standard of Protection (SoP) offered by the design profile at Eastoke under extreme bimodal wave conditions. Further information on this joint probability extreme wave and water level work can be found in Section 2.3.

2.2.4.SWELL WAVE CLIMATE

As mentioned in Section 2.2.2, Hayling Island is also susceptible to events with particularly long wave periods, despite the measured wave heights not reaching the storm threshold level. One such event occurred on the 1st February 2021 and was driven entirely by swell waves travelling through the English Channel that were generated by a complex low-pressure system (Ref 2.16 and 2.17). During this event the Hayling wave buoy recorded 25 second+ wave periods and the highest ever energy period (T_e) since the Hayling wave buoy records began in 2003.

Significant overtopping occurred during this event and sections of the beach crest were flattened. Despite the majority of the overtopped water managing to be retained on the promenade, some flooding still occurred to gardens along Southwood Road (Ref 2.14).

A joint return probability analysis undertaken using the Hayling wave buoy for three different wave parameters (significant wave height, energy period T_e and wave power) determined that the joint return period for water level and significant wave height exceeded the 50% AEP (Ref 2.16 and 2.17). A similar pattern was shown for the joint return period of water level and wave power which also was shown to have exceeded the 50% AEP. However, the joint return period for water level and T_e was calculated to exceed the 1% AEP at

Hayling Island (Ref 2.16 and 2.17). This demonstrates that a relatively low return period of Hs and SWL is not always indicative of the power of these long period swell events. Further information on this swell event is detailed in Appendix C.

Recent analysis undertaken for the update of the SCOPAC Storms Analysis study (Ref 2.5) has identified a linear trend in the occurrence of swell waves at Hayling Island over the past 20 years. Findings from the study will be presented to the Environment Agency once the study is complete and will inform the Eastoke Peninsula FCERM scheme.

2.3. JOINT PROBABILITY EXTREME WAVE AND WATER LEVELS

Following a recommendation in the South Hayling 2017-2022 BMP, the Bimodal Wave Study (Ref 2.15) was undertaken to assess the impact of extreme bimodal wave conditions on the beach at Eastoke. The first stage of the study involved deriving of two new sets of extreme joint probability unimodal (Table 2.6) and bi-modal (Table 2.7) wave conditions through a multivariate analysis of Portsmouth tide gauge data and the Hayling Island wave buoy (Ref 2.11). The second stage input these extreme joint probability wave conditions into the parametric tool, Shingle-B, to derive the beach profile response for different return periods. SHINGLE-B was developed by HR Wallingford as part of a CCO led FDGiA (Flood Defence Grant in Aid) project for the prediction of shingle beach profiles under the influence of bimodal sea states. The third stage was an overtopping assessment which related overtopping volume to the wave run-up exceeding the beach crest level. For further information see the Bimodal Wave Study report (Ref 2.15).

For bimodal wave conditions with return periods of 0.5% AEP (Figure 2.6), 1% AEP, 1.33% AEP and 2% AEP, the beach crest was significantly pushed landwards, and it is likely that flooding events and damage at the rear-side would occur. Similar behaviour was observed for unimodal wave conditions for return periods of 0.5% AEP (Figure 2.7) and 1% AEP, however the bimodal wave conditions still produced a more critical beach response than unimodal waves triggered by the effect of the swell component on the wave-beach interaction (Ref 1.1).

Results from the initial overtopping assessment undertaken as part of the Bimodal Wave Study (Ref 2.15) are shown in Appendix K.

It is recommended that, should an Eastoke Peninsula FCERM Scheme be undertaken, the outputs from the multivariate extreme wave and water level data (Ref 2.16) be incorporated and built upon to provide a wider understanding of the impact of bimodal waves on the overall Eastoke peninsula.

Table 2.6: Extreme unimodal wave conditions derived in the Bimodal Wave Study (Ref 2.15)

Wave Condition	RP (yrs)	SWL (mOD)	H_{m0} (m)	T_p (s)
U1	200	2.4	4.7	14.0
U2	200	2.1	4.5	20.7
U3	200	2.2	4.2	25.3
U4	200	3.1	4.2	14.1
U5	200	3.1	3.8	18.0
U6	100	2.4	4.6	13.5
U7	100	2.9	4.4	11.8
U8	100	1.6	4.4	22.8
U9	100	2.1	4.1	25.7
U10	75	2.3	4.5	13.4
U11	75	2.0	4.4	19.6
U12	75	2.0	4.1	25.6
U13	75	2.9	3.6	16.3
U14	50	2.9	4.4	11.2
U15	50	1.9	4.3	20.7
U16	50	1.8	4.1	24.7
U17	50	2.4	3.6	24.5
U18	5	2.5	4.1	10.0
U19	5	1.5	3.4	23.0
U20	5	2.0	3.2	20.2
U21	5	2.9	2.6	15.7
U22	1	2.3	3.4	10.1
U23	1	1.2	3.3	18.3
U24	1	1.7	3.2	15.8
U25	1	1.4	2.5	22.3

Table 2.7: Extreme bi-modal wave conditions derived in the Bimodal Wave Study (Ref 2.15)

Wave Condition	RP (yrs)	SWL (mOD)	H_{m0} (m)	Swell %	$T_{p,swell}$ (s)	$T_{p,wind}$ (s)
B1	200	3.5	4.1	0.44	16.6	8.3
B2	200	3.3	3.9	0.64	20.5	8.2
B3	200	3.2	4.2	0.25	18.9	8.5
B4	200	3.2	4.0	0.64	22.1	8.2
B5	200	3.1	4.2	0.39	19.6	8.4
B6	200	3.1	4.0	0.19	21.7	8.3
B7	200	2.8	4.3	0.22	21.6	8.3
B8	200	2.8	4.2	0.36	20.9	8.4
B9	200	2.4	4.4	0.38	22.7	8.5
B10	200	2.3	4.5	0.61	26.3	8.4
B11	100	3.6	4.0	0.22	16.2	8.4
B12	100	2.5	4.4	0.43	21.6	8.4
B13	100	2.3	4.4	0.61	24.7	8.5
B14	100	3.2	3.8	0.64	19.9	7.0
B15	75	3.3	4.1	0.24	17.7	8.3
B16	75	2.4	4.4	0.41	21.5	8.5
B17	75	3.2	4.0	0.39	18.1	8.2
B18	75	2.4	4.3	0.61	24.2	8.4
B19	50	2.4	4.2	0.23	22.2	8.5
B20	50	3.6	3.9	0.19	16.2	8.1
B21	50	3.5	3.8	0.43	16.1	7.7
B22	50	2.4	4.3	0.60	23.5	8.3
B23	5	3.7	3.1	0.16	17.7	6.8
B24	5	3.5	3.2	0.23	16.5	7.3
B25	5	2.1	4.1	0.41	18.7	8.3
B26	5	2.2	3.7	0.63	21.1	7.8
B27	1	3.4	2.7	0.22	13.3	8.1
B28	1	2.0	3.7	0.24	16.3	8.2
B29	1	2.0	3.2	0.60	18.7	7.3
B30	1	2.0	3.6	0.38	16.1	7.9

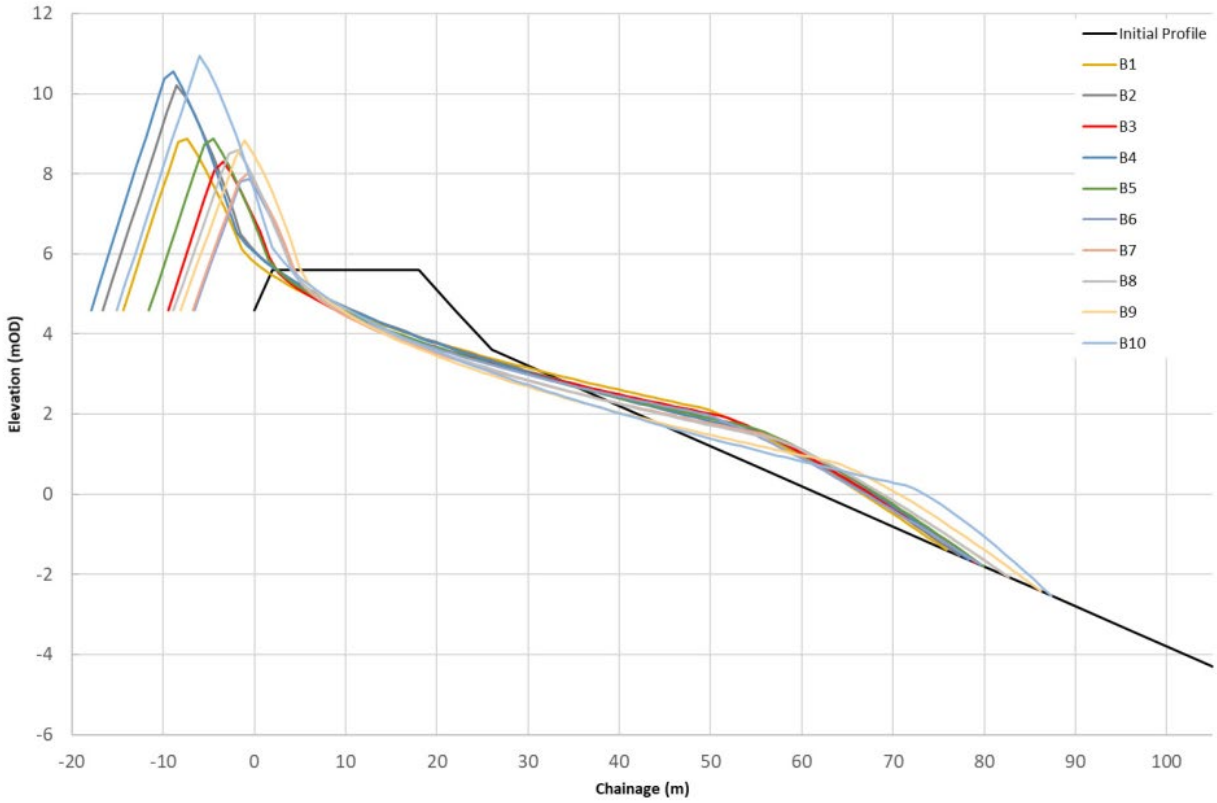

Figure 2.6: Beach profile responses under bimodal wave conditions under the 0.5% AEP (Ref 2.15)

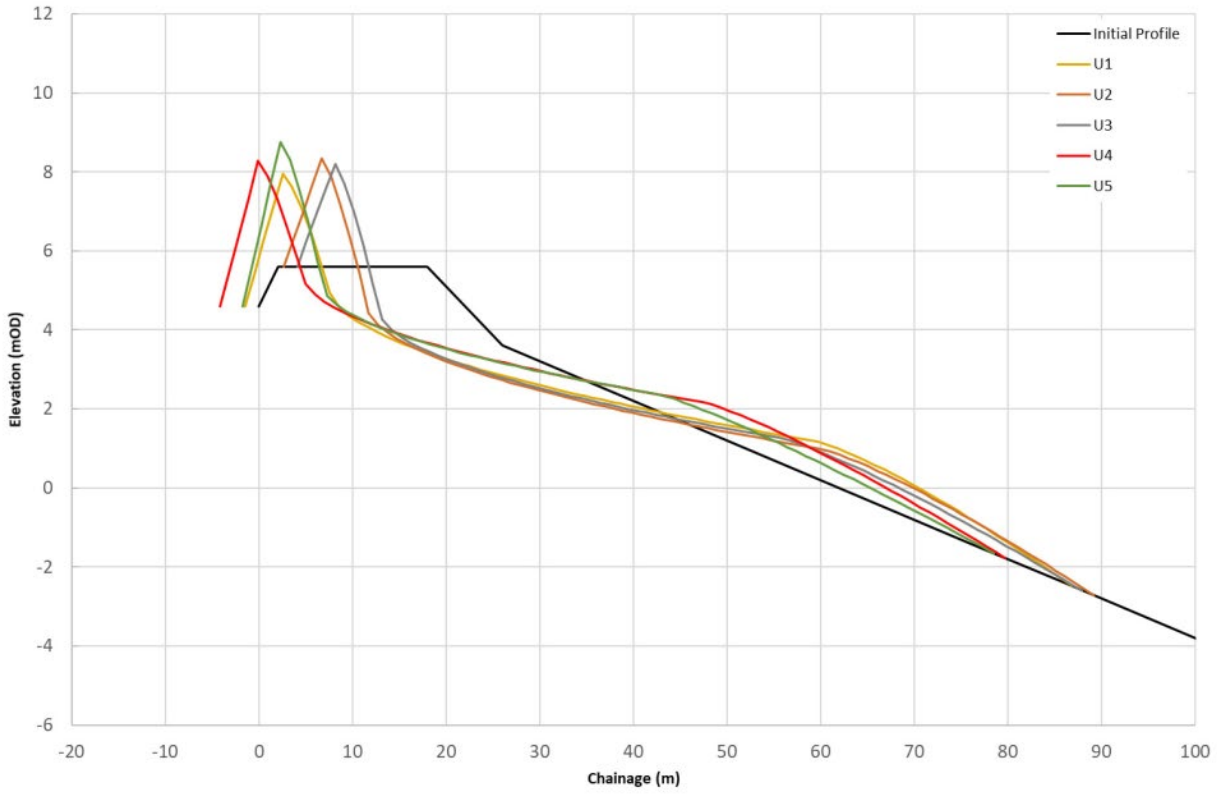

Figure 2.7: Beach profile responses under unimodal wave conditions under the 0.5% AEP (Ref 2.15)

2.4. CLIMATE CHANGE AND RISK

The latest advice for adapting to climate change was published on 26th November 2018 by the Environment Agency (EA), Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities (Ref 2.18) – from here on referred to as "EA 2018". This guidance replaces the previous advice (Ref 2.19) and includes updated sea level rise allowances for Flood and Coastal Risk Management (FCERM) based on the UK Climate Projections 2018 (UKCP18) climate change projections.

A range of scenarios are provided in the EA 2018 guidance, including low (Representative Concentration Pathway (RCP) 2.6), medium (RCP4.5) and high emissions (RCP8.5) scenarios demonstrating the range of future uncertainty.

2.4.1. SEA LEVEL RISE

The latest figures for SLR were published in the UK Climate Projections 2018 (UKCP18) dataset which presents a range of different SLR estimates based on different emission scenarios (Ref 2.20). The UKCP18 information comes under 4 Representative Concentration Pathways (RCP), which capture the assumptions in each scenario and the differences in the predicted increase in temperature. These are RCP2.6, RCP4.5, RCP6.0 and RCP8.5. The EA guidance, released in July 2020, is to use the RCP8.5 70th %ile for design purposes and use RCP8.5 90th %ile as a sensitivity test to consider more serious events and adaptability. The draft Hayling Island Strategy (Ref 2.21) has accounted for sea level rise over the next 100 years when recommending management options for the Eastoke Peninsula. However, given the exponential increase of sea level rise over time, the impacts on this 5 year BMP are negligible, with a 0.031 m increase under the RCP 8.5 70th %ile scenario or a 0.037 increase under the RCP 8.5 95th %ile. This is within the general error margins of any of the methods employed for the joint return period analysis or beach surveys. For completeness the latest figures and previous predictions are compared below (Table 2.8 and Figure 2.8).

Table 2.8: Comparison of SLR predictions (mm) – 1990-2100

	1990	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2100**
Defra Supplementary note March 2003	0	60	120	180	240	300	360	660
Climate Change Impacts October 2006	0	40	80	120	182.5	267.5	352.5	980
EA 2011 Upper End Estimate	0	40	80	120	175	245	315	945
EA 2011 H++	0	60	120	180	272.5	397.5	522.5	1902.5
EA 2011 Low emission 50%	0	30	62	97	135	176	219	474
EA 2011 Medium emission 95%	0	44	93	146	204	266	332	728
UKCP18 RCP2.6 (Ref 2.21)	n/a	n/a	n/a	70 – 130	n/a	130 - 260	n/a	290 - 700
UKCP18 RCP4.5 (Ref 2.21)	n/a	n/a	n/a	70 – 130	n/a	140 - 270	n/a	370 - 830

UKCP18 RCP8.5 (Ref 2.21)	n/a	n/a	n/a	70 – 130	n/a	160 - 290	n/a	530 - 1150

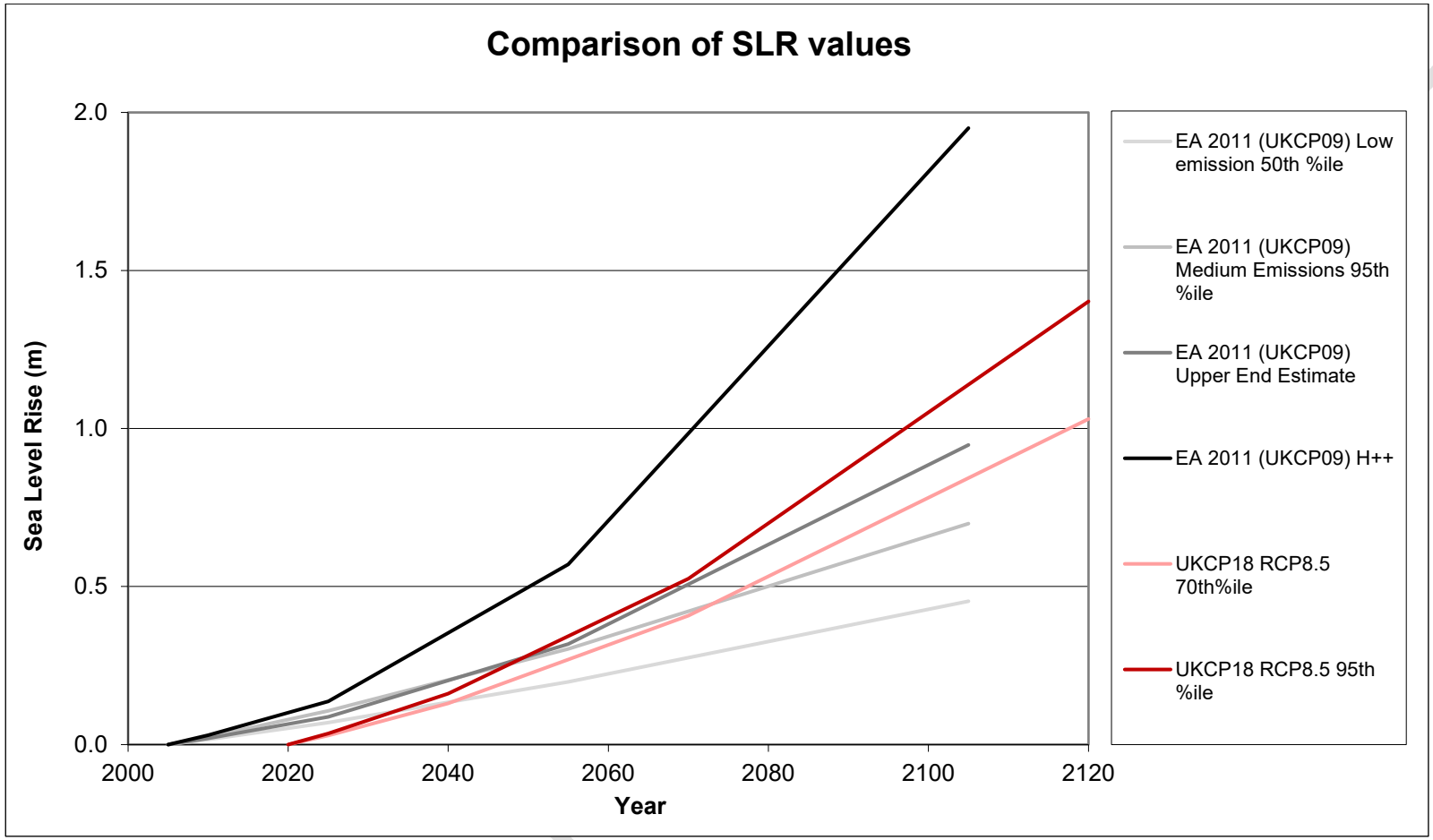

Figure 2.8: Comparison of sea level rise values from UKCP09 and UKCP18

2.4.2.FUTURE EXTREME WAVES

The EA climate change allowances guidance for FCERM projects, schemes and strategies (Ref 2.18) give percentage change allowances for extreme wave heights for two different epochs. Wave heights may change due to changes in water depths that result from Sea Level Rise (SLR) and the frequency, duration and severity of storms and winds are also expected to change (Ref 2.18). Table 2.9 shows the allowances that should be used for waves over the next 100 years due to climate change. The 2020 guidance does state that there are large uncertainties in these values. Changes in wave period and direction are small and harder to interpret and no specific allowances are recommended for wave period as more research is required in this area (Ref 2.18).

Table 2.9 Recommended national precautionary sensitivity ranges for offshore wind speed and wave height (Ref 2.18).

Applies around all the English coast	**2000 to 2055**	**2056 to 2125**
Offshore wind speed	+5%	+10%
Offshore wind speed sensitivity test	+10%	+10%
Extreme wave height	+5%	+10%
Extreme wave height sensitivity test	+10%	+10%

2.4.3.CHANGE IN SURGE

The EA climate change allowances guidance for FCERM projects, schemes and strategies (Ref 2.18) states that the present-day levels in the CFBD (2018) account for storm surge. New modelling must use the CFBD extreme sea levels (2018) to account for storm surge and then apply the sea level allowance. Where flooding impacts could be extreme, **it is recommended that designs and plans should be tested against the H++ scenario which estimates an increase of +2mm per year from the 2017 baseline (Ref 2.18).**

2.5. SEDIMENT TRANSPORT

2.5.1. SEDIMENTS

The coastline is characterised by mixed sand and gravel (shingle) beaches and a low-lying hinterland. The geology of the study area comprises a mixed sand and shingle storm beach overlying Upper Eocene deposits of the Barton, Bracklesham and Bagshot beds.

The Eastoke Peninsula has been subject to human intervention measures, including hard sea defences and beach nourishment. The entire south Hayling Island frontage has now benefitted from the material nourished at Eastoke as it has been transported across the wider BMP study area since the original Hayling Island Beach Replenishment Scheme in 1985. The beach contains wide ranging grades from sand to shingle sized material, with any finer material rapidly being winnowed out of the beach if placed as part of the ongoing nourishment operations.

The most recent set of sediment samples were collected in May 2022, on 21 different profiles around the frontage (Figure 2.9 and Appendix A). Surface samples were collected at the beach crest, MHW, MSL and MLW along each profile.

In all but the furthest eastern profile (5a00260), sediment samples taken at MLW were coarser in 2022 compared to those taken in 2017. Sediment samples taken around MSL on western profiles were coarsest in 2022 compared to previous years, whereas samples taken around MSL on more eastern profiles tended to be finer in 2022 than previous years.

Sediment samples collected from the beach crest in 2022 were generally finer than those analysed in 2005 but coarser than those collected in 2017. The exceptions were for profile 5a00295 which was significantly coarser than both 2005 and 2017 and profile 5a00286 which was slightly finer than previous years.

A comparison of sediment samples collected in 2005, 2017 and 2022 are presented in Appendix A.

Figure 2.9: Location of sediment samples, Hayling Island

Table 2.10: Summary of particle size distribution statistics for Hayling Island

		ALL SAMPLES	NOURISHED BEACH				
			ALL	CREST	MHW	MSL	MLW
FULL SAMPLE	D50 (mm)	8.8	8.8	14.1	7.9	7.6	5.5
	% GRAVEL	70.3	78.1	92.3	59.5	77.0	83.4

2.5.2.SHORELINE MOVEMENT

(a) Overview of shoreline evolution

Several authors have published work relating to the evolution of the shoreline covering the BMP frontage, notable examples include Harlow (Ref 2.22), Whitcombe (Ref 2.23), Webber (Ref 2.24), Wallace (Ref 2.25) and DEFRA (Ref 2.26) with annual reports on more recent beach changes from CCO (Ref 2.27). In summary, the present shoreline of the East Solent is a result of very active post-glacial processes of erosion and accretion, increasingly controlled by coastal defences and Beach Management Activities over the last century. Substantial erosion and roll back of the shingle banks have occurred along the eastern frontage of Hayling Island. Concurrent accretion has occurred in the central and western parts of the frontage. This is particularly so at Gunner Point where the shoreline has moved seaward by up to 400 m since 1832 (Figure 2.10), resulting in the development of multiple shingle ridges.

Figure 2.10: South-west Hayling Island MHW (1832 – 2022)

Black Point spit (BMP U1) has grown north and changed morphology markedly in the past and is currently undergoing significant accretion of sand at the tip. The proximity of the deep water channel at the entrance to Chichester Harbour, with its rapid ebb and flood flows and the intermittent onshore transport of material from the ebb delta produce a complex system that is now stabilised by the 2013 rock revetment scheme. The Eastoke frontage (BMP U3) has been subject, by contrast, to a steady rate of recession given the wave focusing and location of the drift divide, which is controlled through beach management activities.

The wide shingle beach in the central part of Hayling (BMP U4 and U5) has experienced steady accretion during most of the last century, with the western end of the Hayling frontage historically being an area of accretion and continues to be so (BMP U6, U7 and U8).

(b) Sediment transport pathways

Further detailed studies have been carried out by the Coastal Partners to improve the understanding of sediment transport from the nourished Eastoke frontage and around the wider frontage. The main sediment transport pathways around the BMP frontage are shown below Figure 1.3 in Section 2.5.2.

The Hayling open coast has a drift divide located at the centre of the nourished frontage, close to Creek Road car park, where the natural supply of material onshore (F1, Figure 1.3) is not sufficient to maintain the beach to the required levels. Beach sediment is transported both east and west off the nourished frontage at the drift divide by wave action, with approximately 1/3 of material moving eastward and 2/3 towards the west.

Beach recycling is now the main source of beach material to the wider south Hayling frontage, and the Futurecoast Study (Ref 2.28) identified Gunner Point as a potential beneficiary of the ongoing artificial recharge and recycling operations. Indeed, Harlow (Ref 2.22) assessed this area as a potential source of material for the 1985 Hayling Island Beach Replenishment Scheme. Following commencement of works under the 2017-2022 BMP, discussions with the landowner at Gunner Point led to an agreement in principle between HBC and the landowner, allowing the recycling of shingle material from Gunner Point to Eastoke on an annual basis, and/or during emergency situations if required. This agreement in principle was initially agreed until 2027, with an annual review of beach condition between the two parties. Prior to any extraction, the volume of material to be moved is agreed, and confirmation of any working restrictions with regards to the environment are confirmed. All the restrictions are detailed within the EIA and NE/MMO licences for the works, and notification of works are sent to the relevant stakeholders.

To the west of the nourished frontage net westward sediment transport is dominant. At Gunner Point there have been temporary drift reversals but a deployment of tracer pebbles in 2018 confirmed the movement of material around the point and up into the harbour entrance (Figure 2.11). Once inside the harbour entrance rates of transport fall, and beach material is either lost into the deep water channel or slowly moves north towards the Ferryboat Inn.

The 2018-2020 tracer study at Eastoke also re-confirmed the presence of the littoral drift divide near Creek Road (Ref 2.29), with tracer pebbles deployed east of the car park tending to move eastwards around Eastoke Point, bypassing the rock groyne structures built as part of the Eastoke Point Scheme in 2013 (Figure 2.12).

A new study focusing on the use of acoustic tags to track nearshore sediment movement below the water line is ongoing. This uses a different method to the RFID tagged pebbles used for the 2018 tracer study at Hayling Island. Initial pilot study deployment will take place during summer 2024, with results expected towards the end of 2024. The results will therefore not feed into this BMP update, however, will be used to inform future projects and BMP's along the South Hayling coastline with regard to nearshore sediment transport.

The Ness at Sandy Point appears to represent a point where the influence of wave action and strong tidal flows counteract each other. Sediment transport north past this point still occurs but a large proportion of beach material moving onto the Ness is either stored as an accumulation of material or lost into the adjacent deep water channel. There is currently ongoing accretion of sand occurring on Black Point Spit which is related to the wider Chichester Harbour ebb delta system, suggesting that the transport of shingle up toward the distal end of the spit slows due to the drop in wave energy in the harbour entrance. Limited quantities of gravel sized material are evident beyond the HISC pontoon as the sand fraction of the beach material is more mobile. There has been a general build-up of sand on both sides of the Chichester Harbour entrance, indicating movement from the ebb delta system to the beach stores. This is also being observed along the Southsea frontage.

(c) Difference plot changes

Analysis of topographic data has produced difference plots between 2003 and 2022 using spring/summer baseline surveys, showing annual change in beach levels (see Appendix A). A decrease in beach elevation is shown in red and an increase in beach elevation is shown in blue. The extent of the difference plots is depicted with a yellow boundary. Figure 2.13 is a difference plot using 2007 and 2021 LiDAR from the EA, incorporating the East Winner at Langstone Harbour and West Pole Sands at Chichester Harbour. The vertical accuracy for this data is ±15cm and the horizontal resolution is 1m. EA LiDAR data was used as more recent data was available.

Despite the Beach Management Activities on the frontage, the key areas of accretion and erosion can be identified from Figure 2.13. The accretion of sand at the tip of Black Point spit is evident (BMP U1), as is the import of material to the Eastoke Point scheme (BMP U2). The upper section along the Eastoke frontage (BMP U3) itself appears to be higher than 2007, while the lower section of the beach along appears to be lower. The open beach shows both accretion and erosion (BMP U4). West Beach (BMP U5) shows the rollback of beach following removal of the western part of the revetment. The substantial accretion of shingle at Gunner Point (BMP U7) is evident with pulses of accretion and erosion moving north into Langstone Harbour (BMP U8).

As part of the Hayling Island Coastal Management Strategy, an updated sediment budget was produced for South Hayling for the period between 2005 and 2019. This sediment budget went a step further than previous sediment budgets by incorporating volumetric changes across the Chichester Harbour and Langstone ebb delta systems to better understand the onshore/offshore relationship between the two. The fastest rates of sediment transport were shown westwards along the open beach, while sediment transport rates within the entrance channels were significantly lower. The East Winner ebb delta was shown to have increased in volume by approximately 13,800 m^3/yr, while West Pole Sands had shown a decrease of approximately 1,600 m^3/yr. over the same period (see Appendix A for further detail).

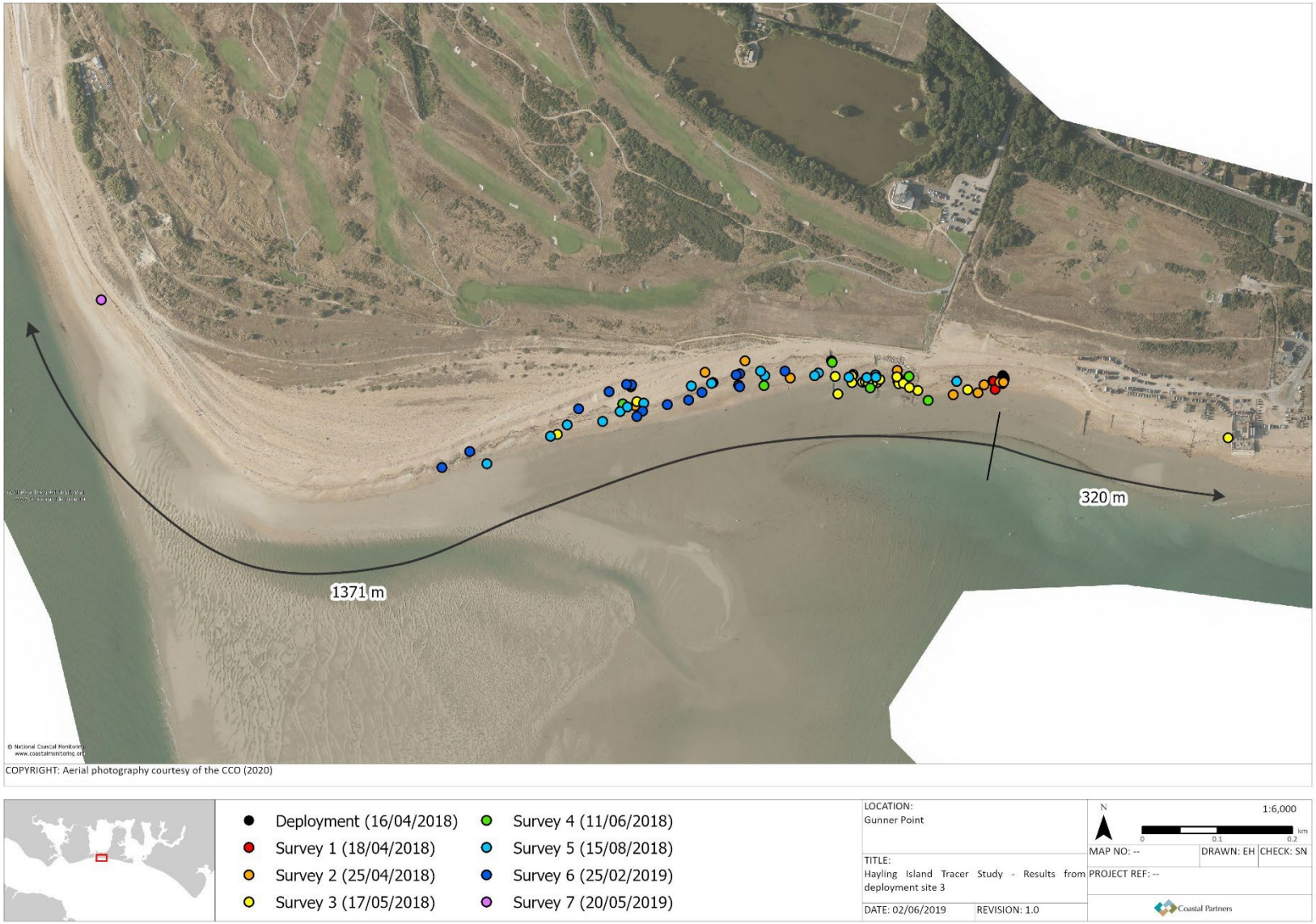

Figure 2.11: Results of the Tracer Study for Gunner Point deployment (pebbles deployed in April 2018) (Ref 2.29)

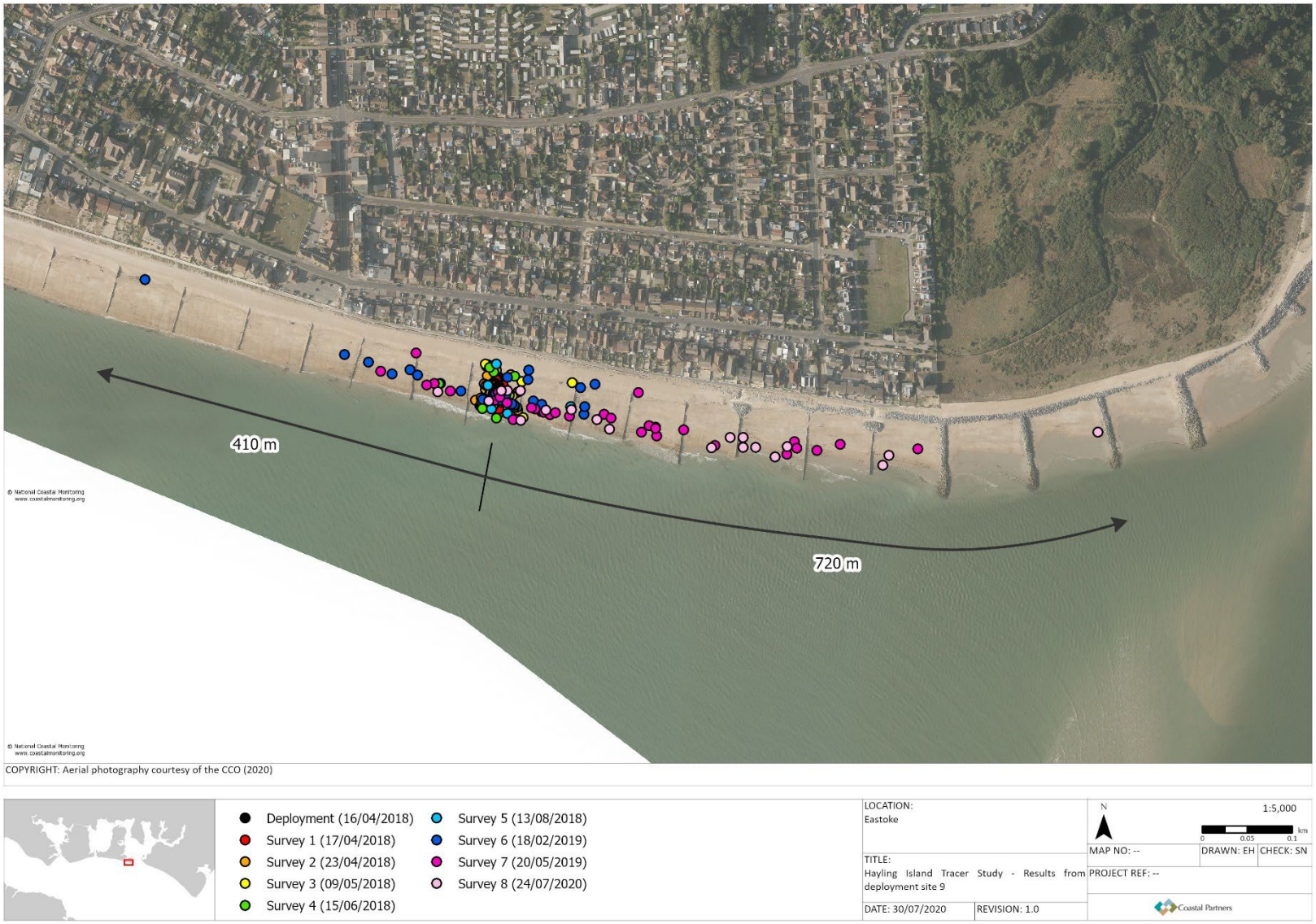

Figure 2.12: Results of the Tracer Study for Eastoke deployment (pebbles deployed in April 2018) (Ref 2.29)

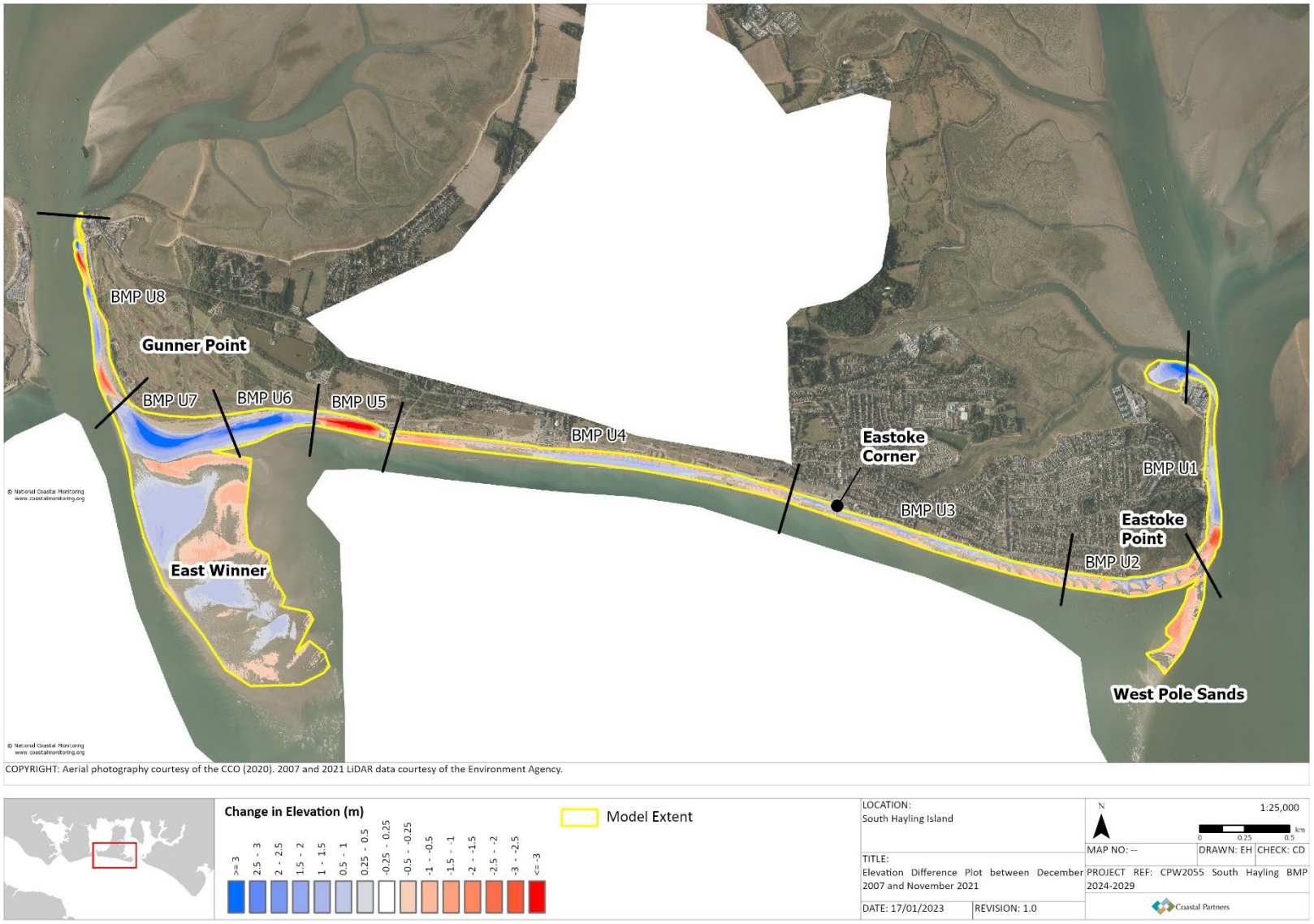

Figure 2.13: LiDAR difference plot showing beach change between 2007-2021, including changes over the East Winner and West Pole Sands ebb tidal deltas

(d) Volume analysis

The summer baseline surveys have been analysed between 2006 – 2022 to assess changes in beach volume for the common area of all surveys above MLWS. Between summer 2006 and summer 2022 there has been an overall increase in sand and gravel beach volume of 123,849 m^3 around the South Hayling frontage beaches (this does not include the East Winner or West Pole Sands – Figure 2.14). The majority of this volumetric increase has occurred at Gunner Point. However, there have been significant fluctuations in the overall beach volume over the previous BMP, with a notable decrease in this overall volume since 2016 of 129,085 m^3. Considering the 244,245 m^3 of land based and marine import, as well as Chichester Harbour dredged material supplied to the system over the same period this indicates an overall net decrease of 120,396 m^3 over the 16 year period. As with the previous BMP, there continues to be an average annual decrease of 7,524 m^3 around the South Hayling frontage beaches. Some of this material loss could be due to material feeding the growth of the Langstone Harbour ebb delta from BMP U7 or draw down of beach material below the MLWS tide level along the south Hayling frontage. The key point is that in terms of protecting the residential areas, the material is not accumulating at Eastoke where it is needed.

During the past BMP, the wider frontage (excluding the hotspots of erosion discussed in Section 2.6) appears to have a slightly eroding trend, with the majority of accretion occurring at Gunner Point (predominantly shingle) and Black Point Spit (predominantly sand) (Figure 2.14). It's important to note that the changes in beach volume across the whole of South Hayling Island are very much inter-linked with nearshore changes to the Langstone Harbour and Chichester Harbour ebb delta systems, as well as the nearshore zone.

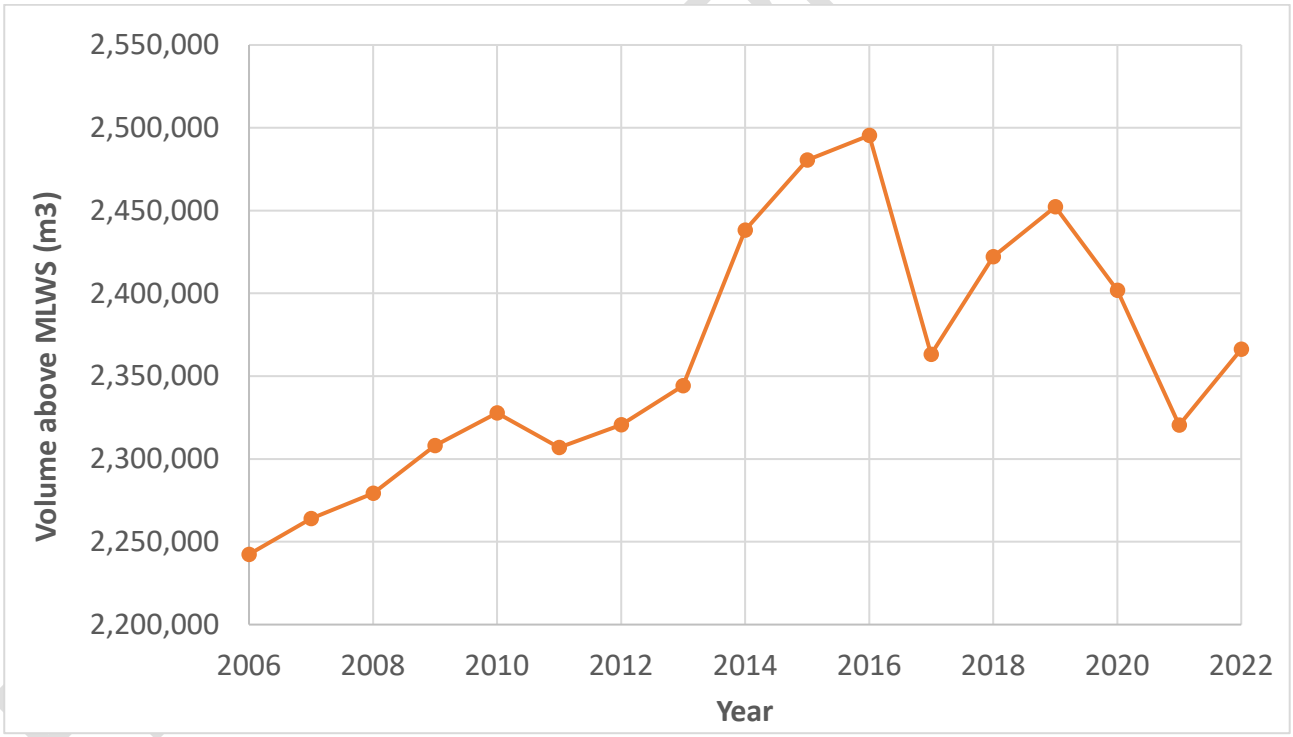

Figure 2.14: Total beach volume change along the South Hayling frontage (for a breakdown of separate BMP units refer to Figure 2.15)

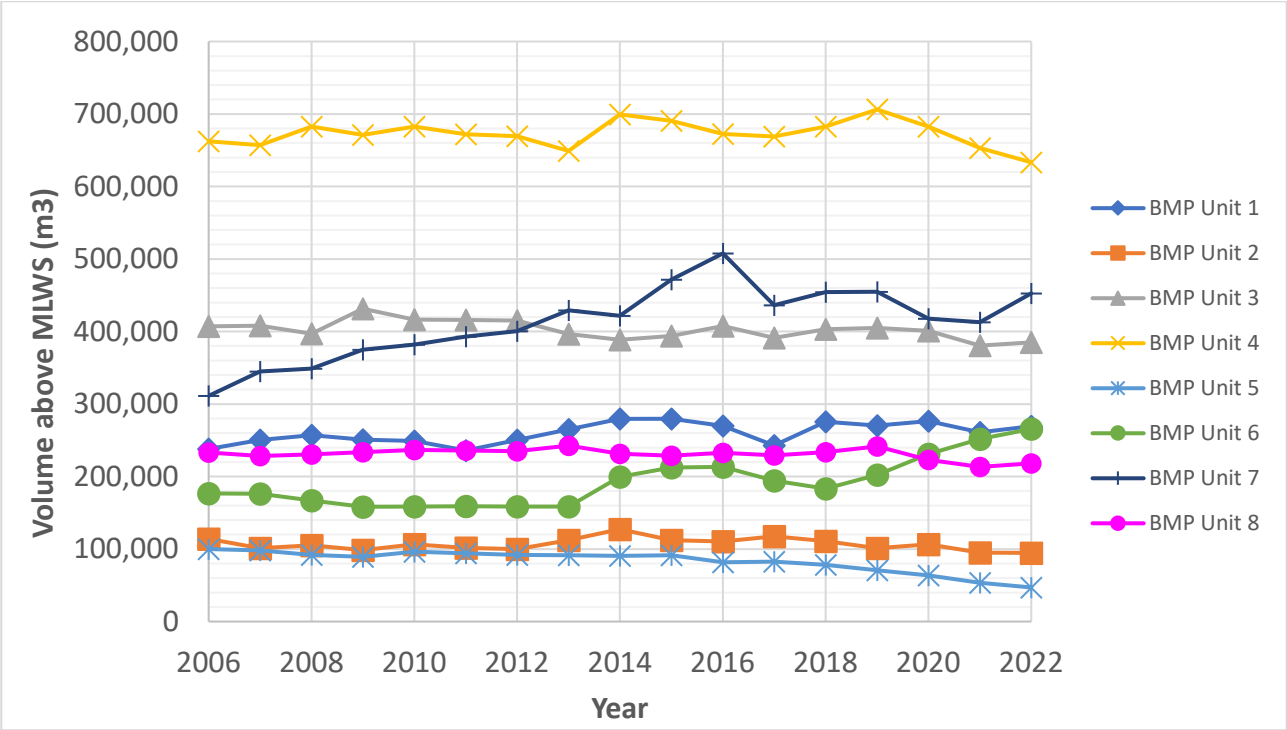

Figure 2.15: Beach volume change per BMP unit along the South Hayling frontage. Refer to Table 2.11 for BMP unit locations

Table 2.11: Names of the BMP units & corresponding locations

REFERENCE NAME	LOCATION DESCRIPTION
BMP UNIT 1	Hayling Island Sailing Club to Eastoke Point
BMP UNIT 2	Eastoke Point Scheme
BMP UNIT 3	Nourished Frontage (groynes 7-35)
BMP UNIT 4	Open Beach
BMP UNIT 5	Inn-on-the-Beach to driving range
BMP UNIT 6	Driving range to Gunner Point
BMP UNIT 7	Gunner Point
BMP UNIT 8	Gunner Point to Ferry Boat

Further analysis of volume changes between 2006 and 2022 for each BMP Unit has been carried out. Between Hayling Island Sailing Club and the Eastoke Point scheme (BMP U1), there has been a net increase of 31,492 m^3 since 2006, a large proportion of which is sand, which is linked to the wider ebb delta system. Prior to the Eastoke Point scheme in November 2013, an average of 12,983 m^3 of shingle per annum was recycled from The Ness back to Eastoke between 2006 - 2012. Since the construction of the rock revetment, access to The Ness has been limited, and therefore material has been extracted very rarely. The Ness will remain a source of shingle material in this BMP, and access will be considered to enable this source to be used over the next 5 year period.

For the nourished frontage at Eastoke (BMP U3), the volume of material has decreased by 6,119m^3 during the last 5 year BMP as result of significant storm events including Storm Brian (21st October 2017), Storm Eleanor (4th January 2018), the 2019/20 storms, 2020/21 storms, Storm Barra (7th December 2021) and Storm Eunice (18th February 2022) (Figure 2.15). This is despite emergency works in January 2018 whereby 8,400 m^3 of suitably graded material (20-63 mm) was imported from Kendall's Wharf in Portsmouth and Tarmac in

Bedhampton to Eastoke. Still, there hasn't been a major import of material to Eastoke since 2009 when 90,392 m^3 of material was brought in via an offshore dredge (Appendix D).

Since the 2009 dredge, there has been 28,824m^3 imported into the system up until April 2022. The remaining sources of material to Eastoke since 2009 have been 530,574m^3 of recycling; of which 25,000m^3 was emergency works from Gunner Point and 57,644m^3 was from three dredge campaigns in the Chichester Harbour entrance channel (Appendix D). The design profile graph (Figure 2.16) indicates 35,446m^3 of additional material is required at the time of writing, to bring the beach back up to design volume and ensure there is enough material to recycle over the next 5 year phase of the BMP. Sources of this material are discussed in Section 5.1.1. It is currently expected that the beach volume will be restored through a beach management campaign undertaken in Spring 2024, prior to the start of the 2024-2029 BMP, which will then be maintained throughout the life of the next BMP.

Between Eastoke Corner and Inn-on-the-Beach (BMP U4) and at West Beach (BMP U5), the beach volume has fluctuated depending on the amount of recycling that has taken place in recent years. Regardless of recycling, BMP U4 has decreased in beach volume by 28,832m^3 since 2006 and BMP U5 has decreased by 52,959m^3 (Figure 2.15). This substantial decrease shown in BMP U5 is a result of beach cutback following the removal of unsafe groynes and sections of damaged timber revetment in 2012, 2018 and 2020 (Figure 1.14). In 2006 and 2007 no recycling material was extracted from the Open Beach due to ongoing monitoring showing a sharp drop in the volume of the Open Beach (BMP U4). After the 2007 recycling operation the beach increased in volume again and into summer 2008. The average annual extraction from the open beach between 2006 – 2022 is 14,339m^3.

The area in front of the Golf Course Driving Range (BMP U6) has stabilised following creation of a haul route in 2014 to transport material from Gunner Point to Eastoke and increased in volume since 2018 as shown in Figure 2.15. During the 16 year period of analysis there has been a net growth of material at Gunner Point of 141,439m^3 (BMP U7), confirming the cuspate foreland is continuing to act as a long term sink but also a source of beach material on the frontage. From Gunner Point north to the Ferry Boat Inn (BMP U8) beach volumes have been stable in general, although the beach volume in this unit has shown a small decrease since 2019 and distinct pockets of erosion and accretion have formed.

In terms of recycling material, future extraction should continue to target the areas of growth on the open frontage. Extraction from Gunner Point (BMP U7) in line with existing licences and consents should continue to be sought, along with access provision made to The Ness at Eastoke Point.

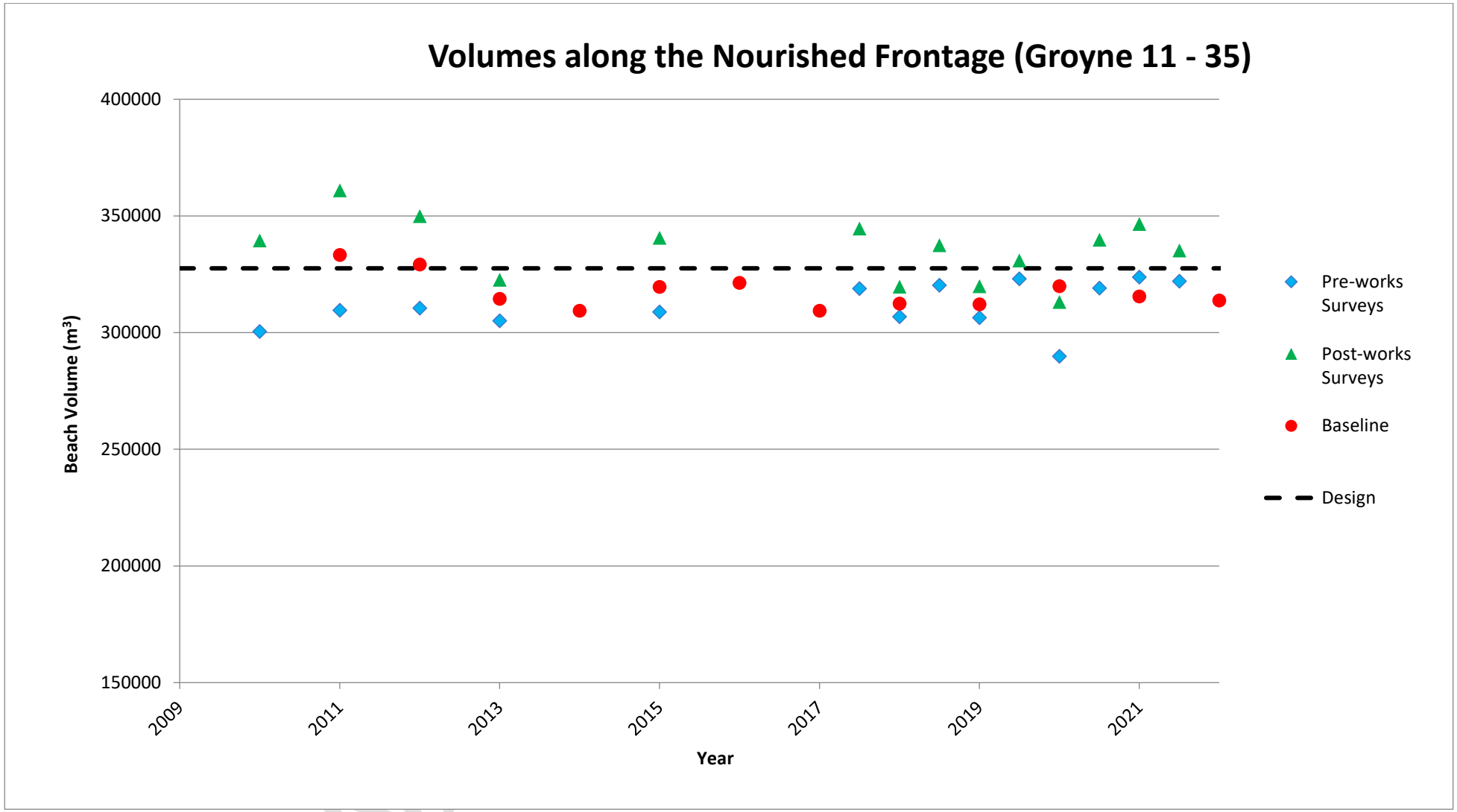

Figure 2.16: Eastoke beach design volume graph. Please note that whilst our surveyors aim to capture the full extent of the managed beach, some pre- and post-survey extents do vary depending on resource availability and weather conditions.

The annual losses from the nourished frontage, based on CSA and volumetric analysis, are contained in Appendix D. Analysis of beach volumes above -4m OD from 1985 to 2003 in the previous BMP (2012) revealed net average annual losses off the frontage of 37,984 m^3. This iteration of the BMP analysed losses between 2006 and 2022 for which topographic survey data had a more continuous coverage and reached MLWS (-1.84m OD). Net average annual losses were 50,647m^3 which corresponds well with the average annual volume of material brought into the nourished frontage at 49,243m^3. The net average annual losses range from 31,209m^3 to 85,857m^3, with the higher losses generally associated with the larger recycling and marine-based recharge operations. Over the past 7 year BMP, net average annual losses have been 48,756m^3. As the beach was not at design at the end of the previous BMP, and currently still sits below design volume (Figure 2.16), **this iteration of the BMP will be costed on the requirement of 56,000m^3 annually for the duration of the BMP period in order to bring the beach back to design volume.**

This section has discussed beach volume changes across the south Hayling frontage, as well as extraction and deposition quantities. It should be noted that previous Beach Management Activities have utilised the arisings from maintenance dredging of the Chichester entrance channel, being comprised of material similar in composition to the nourished beach. In the last 7 year phase of the BMP, there were two maintenance dredges of the Chichester Bar: one in October 2019 (28,384m^3) and one in November 2022 (12,830m^3) (Appendix D). **Arisings from maintenance dredging of the Chichester entrance channel should be a preferred source of material for the next phase of the BMP. This is an excellent beneficial re-use of material; material that has arisen from this sediment cell.**

(e) Beach profile storm response

Along the nourished frontage the general post-storm response of the beach starting at the design profile is as follows:

- Rotation of profile around approx. MSL (mean sea level)
- Upper mobile beach face lowers
- Lower mobile beach face rises
- Cliffing develops in beach crest at upper limit of run-up
- If run-up exceeds crest elevation, then material thrown over the beach crest and gathers on promenade to rear
- If overtopping is severe then crest elevation reduced through overwashing and crest drops to 'failure' profile level, which is the height of the redundant sea wall

If the beach levels are low compared to the height of the timber groynes, then long period waves have been observed to interact with the groyne, increasing run-up along the updrift side and eroding the beach crest. Initially this removes material from the beach crest leaving a cliff which blocks the wave from running up and over the crest. If conditions are severe enough then the waves overwash alongside the groynes, causing fans of beach material to be deposited on the promenade. In November 2005 the entire beach was overtopped with the areas of the nourished beach performing least well corresponding with the three original erosion hot spots; Eastoke Corner, Creek Road and Eastoke Point (although Eastoke Point is no longer a hotspot following the 2013 scheme). It should be noted that at both Eastoke Point and Eastoke Corner the beach profile was not at the design profile prior to the storm event occurring. The beach at Eastoke Corner failed in the centre of one bay and was level with the promenade with no beach crest remaining. This happened again in 2016. At Eastoke Point, the last bay on the promenade (Groyne 7 – Groyne 8) actually gained a small amount of material on the beach crest, presumably benefitting from material transported alongshore from the adjacent eroding nourished bays. At the Creek Road car park and the drift divide, the crest cut back markedly but did not fail completely. Significant volumes of beach material were deposited on the

promenade to the rear, resulting in water levels approaching the top of the rear splash wall in places as water was unable to flow to the normal discharge points and into the drainage system in Southwood Road.

Since the 3rd November 2005 storm, there have been storms which have generated larger waves and higher sea levels (although the 3rd November event was exceptional in terms of wave period). This includes the 10th March 2008, during the winter of 2013/14 (particularly early January 2014 and the 14th-15th February 2014 event), October 2017, February 2022, and November 2022. The March 2008 event affected the Solent more severely than the 2005 event, although was not as severe on Hayling (still, floodwater was present on Creek Road, Nutbourne Road, Bosmere Road, and Southwood Road). During both the October 2017 and November 2022 storm events, beach overtopping was experienced with flooding to roads on both occasions, and one property flooded internally during November 2022. The February 2021 event was considered exceptional as, although a relatively low return period for water level and significant wave height (<50% AEP), the event exceeded the 1% AEP for water level and T_e (Energy period) (Ref 2.17) The long period waves caused significant damage to the beach profile with overtopping along the full length of the Eastoke frontage, including the Eastoke Point rock revetment scheme. Further information on these storm events in Appendix C.

Events that have caused flooding generally occur when large wave conditions coincide with large enough sea levels: at Portsmouth a total sea level of approximately 5.17 mCD is the minimum still water level that has been associated with flooding at Hayling (when accompanied by large waves). The reduction in flood events despite a large number of storms and high tides since 2013, is mainly attributed to the Eastoke Point scheme which has reduced overtopping rates of the beach and flow of water onto the roads behind. There are other elements that require future assessment such as storm duration and localised factors (e.g. drainage).

As part of the 2017-2024 BMP a feasibility study was undertaken which considered options for an Eastoke Drainage Scheme. This scheme assessed the possibility of construction of a rock revetment at discrete areas along the Eastoke frontage (primarily the two known hotspots of erosion at Eastoke Corner and Creek Road), alongside drainage channels through the structure in a similar design to Eastoke Point (groynes 7 to 10). At the time of BMP production, the Eastoke Drainage feasibility study is still ongoing, with completion of the study due in 2024 and will feed into the Eastoke Peninsula FCERM Scheme options.

It is recommended that the Eastoke Feasibility Study be considered alongside recommendations from the Hayling Island Strategy as a future method of coastal protection with beach management for the Eastoke frontage.

Furthermore, aligned with the Hayling Island Strategy, it is recommended that the Eastoke Peninsula FCERM Scheme commences whilst this BMP is undertaken, to ensure the whole of Eastoke is considered as a single management cell.

(f) Predictions of future shoreline evolution

The general pattern of erosion along the Eastoke frontage (BMP U3) and accretion at Gunner Point is predicted to continue into the future. If nourishment were to cease, the main Eastoke beach would overtop heavily, accelerating beach erosion, leading to the eventual collapse of the previously buried seawalls. Assessment of beach roll back as part of the bi-modal wave study (Section 2.3) suggests that the current beach profile could completely roll back within two 0.5% AEP events if management were to cease. It is therefore possible, based on previous observations, that the beach at Eastoke could roll back within a single winter period, eroding the Eastoke Peninsula, under a 'Do Nothing' scenario. As the hinterland is low-lying, little additional material would be supplied to the wider frontage as the beach rolled back. As the nourished frontage is the supply of material to the wider frontage, cessation of nourishment activities would lead to erosion becoming prevalent around the wider frontage until a more stable plan shape was attained.

Within the overall trend there is the potential for dynamic changes in the beach plan form associated with the influence of the East Winner, and potential temporary drift reversals around Gunner Point. This could lead to further erosion or accretion at the boundary of BMP U6 and U7. Further changes in beach plan form are also anticipated in relation to the Inn-on-the-Beach and timber breastwork just to the west. If Inn-on-the-Beach were removed from the system, there would be a realignment of the frontage with erosion on the central beach updrift, and accretion downdrift.

Recent research into the evolution of the Langstone and Chichester ebb-tidal deltas has identified the possibility of West Pole Sands in Chichester Harbour decreasing in size in the future (Ref 2.30), in a similar manner to the West Winner in Langstone Harbour. Figure 2.17 shows the decline of the West Winner at the Langstone Harbour entrance between 1841 to 2008. The most recent hydrographic data is presented in Figure 2.18 for the Langstone Harbour entrance and Figure 2.19 for the Chichester Harbour entrance. If the West Pole Sands were to follow a similar pattern, the rate of sediment losses from the Eastoke nourished frontage are anticipated to increase, and the increase in wave energy would exacerbate wave overtopping.

While not anticipated within the 5-year period of this BMP, ongoing monitoring is designed to detect the early signs of a decline in the West Pole (Section 4.1 and Appendix J).

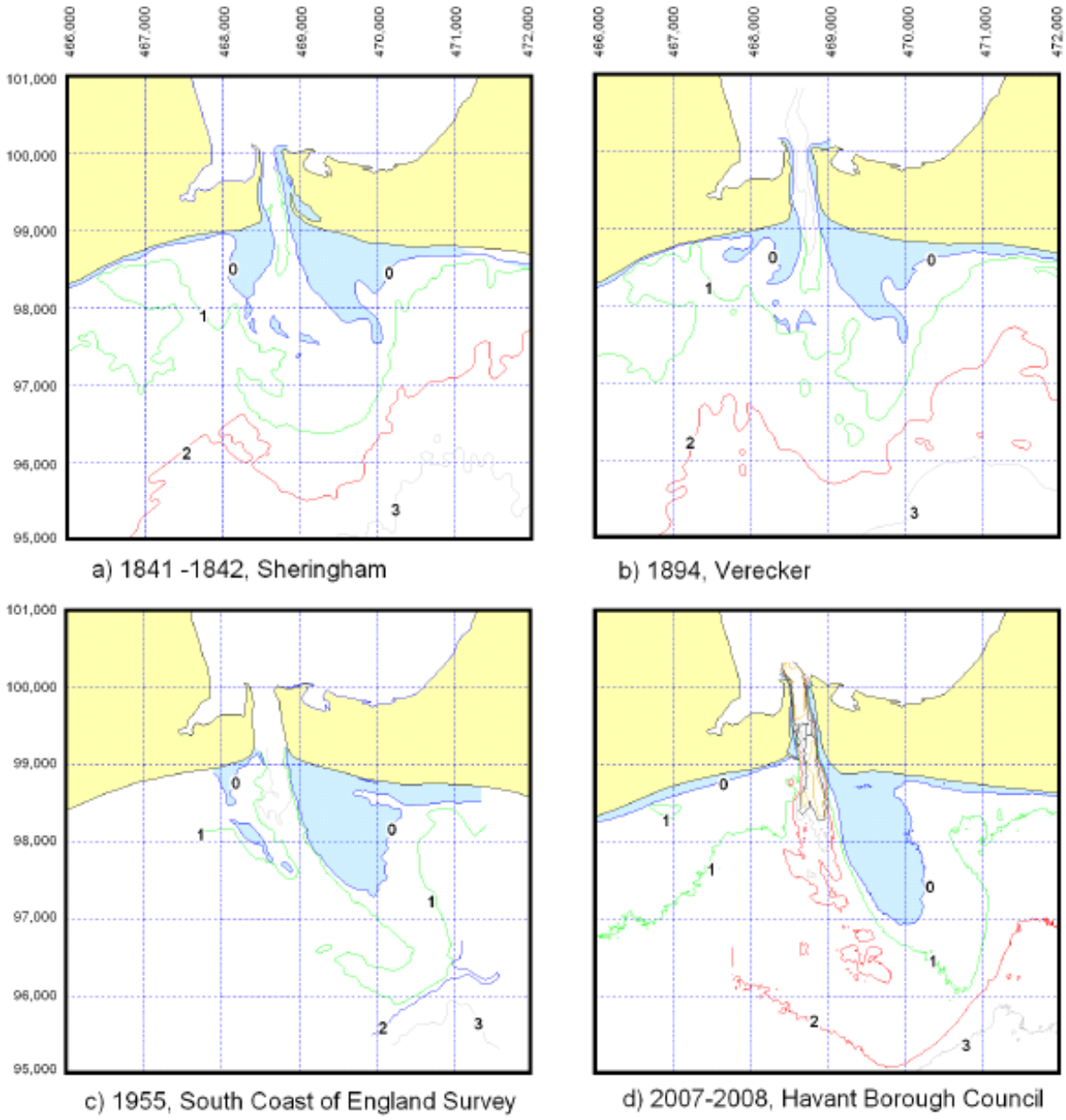

Figure 2.17: Evolution of Langstone ebb-tidal delta morphology 1841-2008 (Ref 2.30)

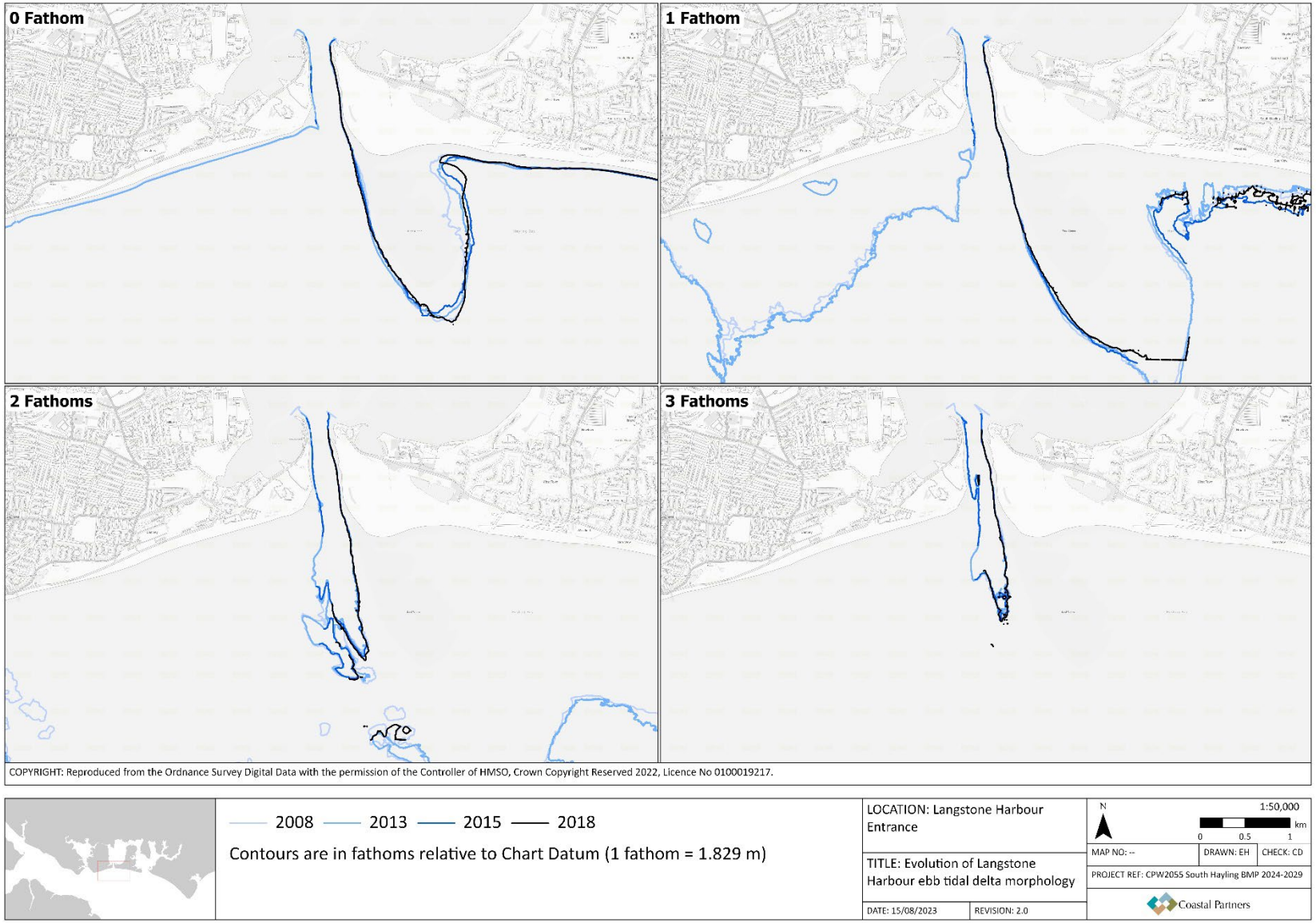

Figure 2.18: Evolution of Langstone ebb-tidal delta morphology 2008, 2013, 2015 and 2018

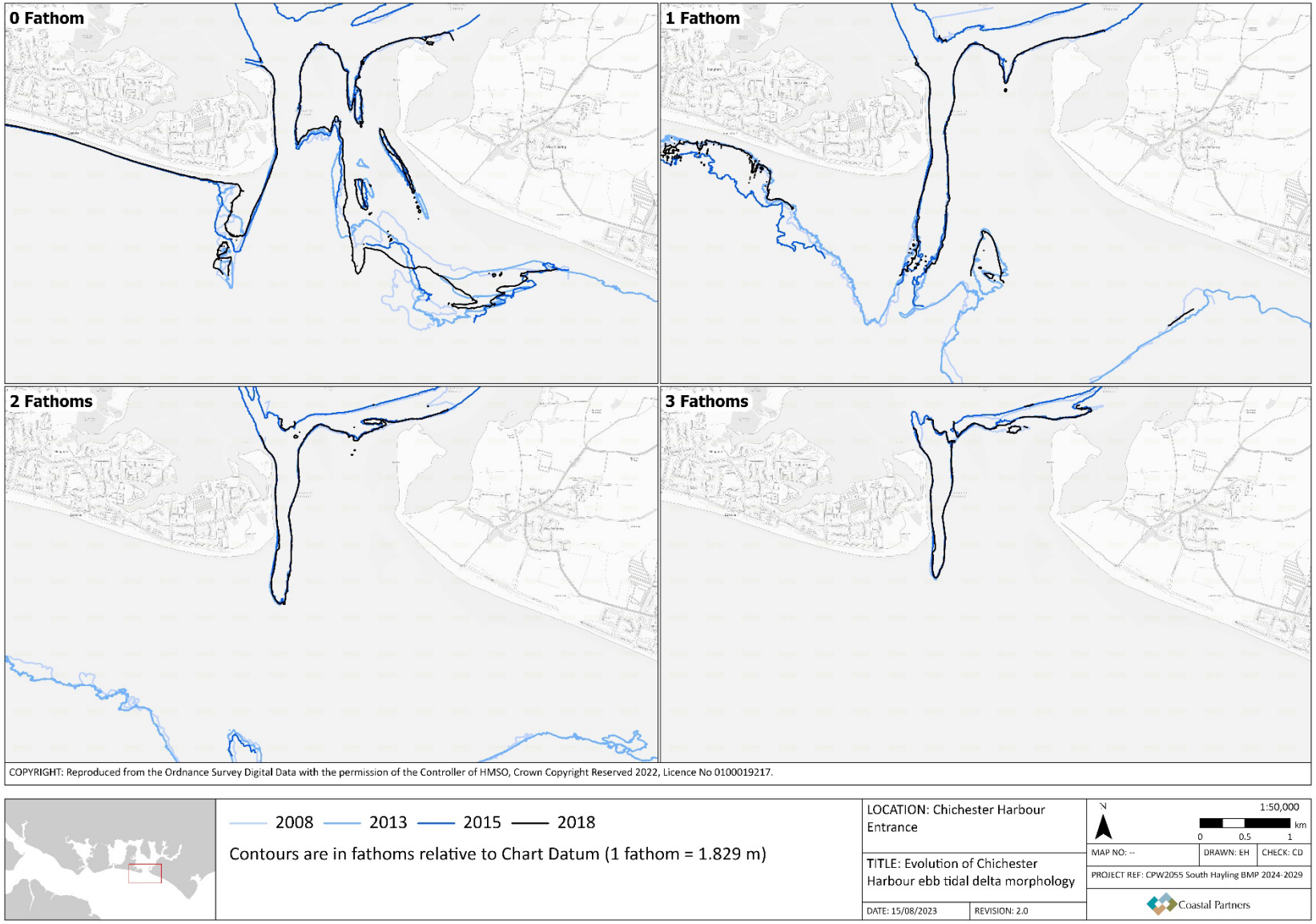

Figure 2.19: Evolution of Chichester Bar & Channel Entrance: 2008, 2013, 2015 and 2018

2.6. BEACH STABILITY

In general, the western end of the Hayling Island shoreline is largely undeveloped and has tended to accrete. This is particularly so at Gunner Point where the shoreline has moved seaward by up to 350 m since 1832, resulting in the development of multiple shingle ridges. The eastern end of the frontage has tended to erode, creating the need for intervention to manage the impact of flooding and coastal erosion. The spit at Black Point is slowly accreting sand, which has also resulted in operational difficulties at the Hayling Island Sailing Club.

Figure 2.20 shows the location of all the erosion hot spots (current issues), watch spots (potential issues) and other issues around the South Hayling frontage. These are discussed in more detail below.

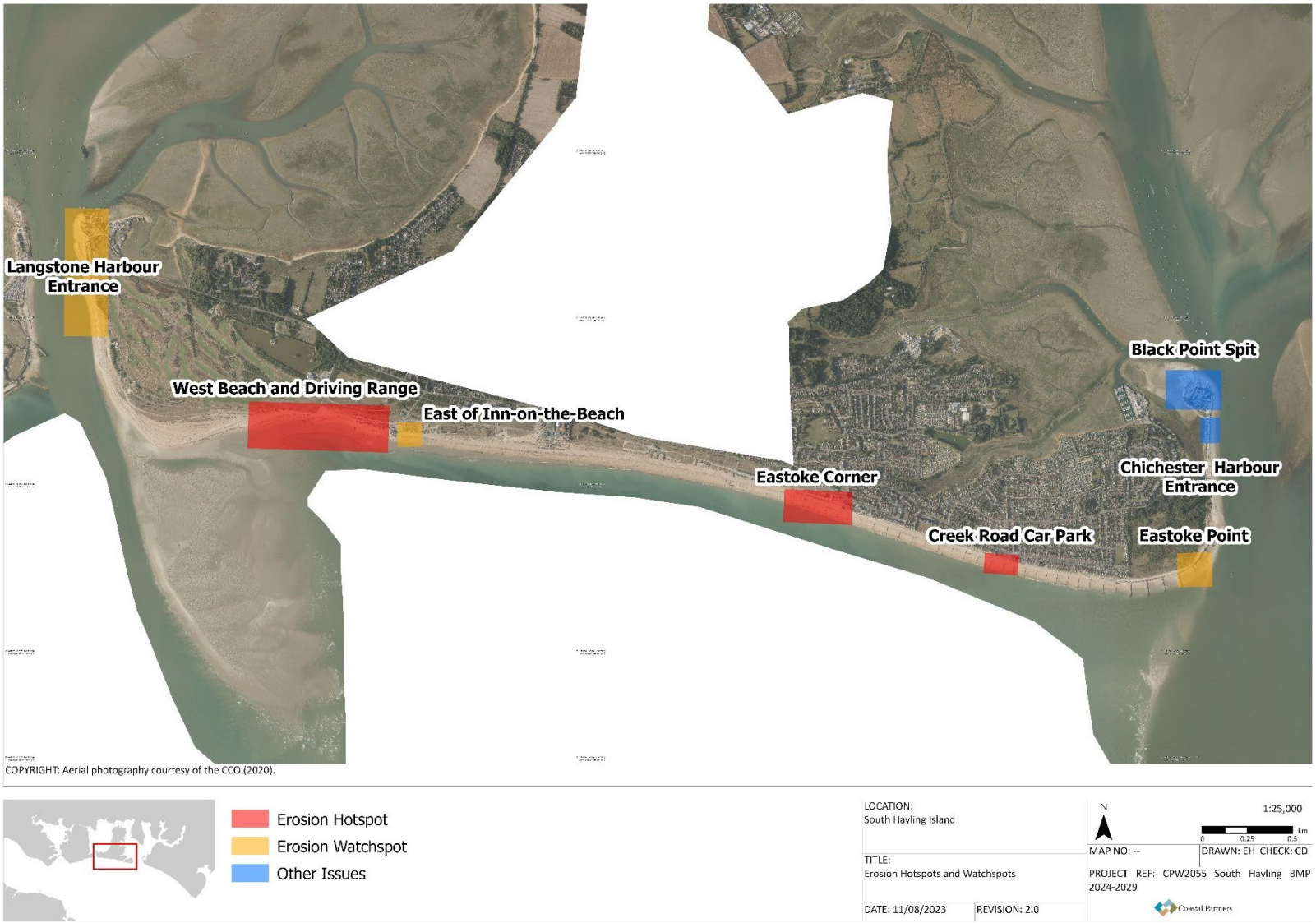

Figure 2.20: Erosion hotspots, erosion watch spots and other issues.

(a) Erosion Hot Spots

Eastoke Corner

The section of nourished frontage between groynes 26 and 35 is frequently below the required design level after relatively minor storm events. Shingle is regularly washed over onto the promenade and the beach crest is often eroded back to the promenade over the winter months. Where possible, coarser material should be used to construct the beach crest and improve stability at this site. **Further investigations into adjusting the control structures in this area should be carried out in line with the findings of the Eastoke Drainage Feasibility Study.**

Creek Road Car Park

The section of nourished frontage just east of Creek Road car park is situated over the drift divide (See Section 2.5.2 for information on 2018-2020 tracer study). It has proved difficult to maintain the design profile in this area in the past, with the beach crest regularly eroded during winter months. **Further investigations into adjusting the control structures in this area should be carried out in line with the findings of the Eastoke Drainage Feasibility Study.**

West Beach and The Driving Range

The length of beach west of Inn-on-the-Beach has undergone rapid periods of accretion and erosion historically, with the beach in front of the driving range undergoing long term erosion. The burial of the western end of the West Beach sloping timber breastwork in the 1990s was associated with a temporary littoral drift reversal in this area.

Sections of the timber breastwork at West Beach failed within the previous BMP period (2017-2022) and were removed from the beach on health and safety grounds. Following this, the beach cutback quickly to start establishing a new equilibrium profile. Since the section of revetment at West Beach was removed in 2018, no recycling has taken place from West Beach, and the profile has been left to establish naturally. Sections of the beach crest have been used as a haul route for the beach management works when accessing Gunner Point, however no material has been removed from the beach.

The construction of a suitable haul route has been undertaken when works are required in front of the Driving Range, to ensure safety of machinery movements. This shingle is sourced from Gunner Point, where extraction takes place, and ensures that the BMP works can be safely undertaken, and the Golf Club has some provision of protection due to an increased beach profile. In recent years accretion of the mid-lower beach profile in front of the driving range has been identified. **It is recommended that this accretion is monitored to understand whether it is a pulse of material moving around to Gunner Point, or whether there is a more permanent accretion of material in front of the driving range than previously identified at this location.**

(b) Erosion Watch Spots

Langstone Entrance

The beach flanking Langstone Harbour is dynamic, and pulses of material periodically move up into the harbour. This section of beach is privately owned but the car park is leased to HBC. In the past, small scale beach management works have been undertaken to protect the car park, and an earth embankment constructed in 1993 is currently being eroded adjacent to the public car park. Material has also been removed from borrow pits on Hayling Golf Club (HGC) land and used to protect the access road adjacent to the 13th

hole. Current planning permission allows for small-scale movements of material within this area to assist with erosion issues within the harbour entrance. Works would need to be undertaken on a local scale, using material from Gunner Point to restore eroded sections of beach.

East of Inn-On-The-Beach

Erosion of the beach crest immediately to the east of Inn-On-The-Beach has become an issue since 2014. During the previous BMP period a position was identified on the beach whereby no shingle could be extracted landward of the position. This has ensured that the beach crest has stabilised, with any localised issues reduced. This site remains a watch spot, to ensure that these issues are not raised again in the future.

Eastoke Point

Eastoke Point is flagged as an erosion watch spot to ensure that the beach crest on top of the rock structure doesn't become significantly narrowed by storm events, leading to potential overtopping in to the nature reserve behind. Monitoring of the beach at this location will continue regularly and any issues assessed as part of the BMP works.

(c) Other Issues

Black Point

General accretion of sand at the distal end of Black Point Spit has caused concerns to arise in this area. Prior to 2012, the operators of Sparkes Marina commissioned investigations into the cause of a bar forming in the channel north of Black Point (Ref 2.32). It appears to be the result of sand dredged from a visitors berth and deposited in the channel. Discussions were held about incorporating any further dredging with the annual beach recycling operation. The volumes being discussed were relatively low, and land-based transport to the southern frontage was discussed. A similar issue was identified around the HISC slipway, causing issues for launching and recovery of yachts. There are various environmental considerations and constraints to be considered before any works could take place, however the current planning permission covers the area to allow small scale extraction of sand back on to the southern frontage. Works could tie in with annual recycling operations if access around Eastoke Point was a possibility and would most probably require funding by private parties. **Liaison with both HISC and MDL Marinas should continue if requested and the possibility of incorporating some sand extraction into the recycling operations considered if requested.**

Chichester Harbour Entrance

The natural movement of shingle moving up towards Black Point forms a ridge of shingle across the RNLI slipway. When this prevents the RNLI from launching, the shingle is pushed down the beach using a launching tractor. In previous years this material has been cleared from the area surrounding the launching area during the recycling operation and moved back onto the Southern frontage. **If the material is of the right grade and can be used for Beach Management, then clearance of the shingle ridge in front of the RNLI station should be considered prior to each recycling operation where access around Eastoke Point is possible.**

2.7. UNCERTAINTY AROUND COASTAL PROCESSES

Despite a good level of process understanding developed for this BMP (see Section 2), there remain some uncertainties of relevance to the future management of this frontage:

- Nearshore sediment transport along the Eastoke frontage, including the transport of sediment between the beach at Eastoke Point and the navigation channel.
- The real-time impact of long-period swell waves and bi-modal events on wave run-up, overtopping and beach profile evolution.
- The impact of the East Winner ebb tidal delta on wave refraction and sediment transport at West Beach and Gunner Point.

The monitoring programme set out in Section 4 includes measures that aim to improve understanding of these uncertainties. Since the last BMP, a study on bimodal waves was commissioned by Coastal Partners in 2020 to produce a multivariate dataset of bimodal extremes for Hayling Island. The study assessed the shingle beach response to these bimodal wave conditions using the parametric model, Shingle-B. Results produced have enabled us to take important steps forward in our understanding of bimodal wave conditions at Hayling Island, however it is a complex and emerging topic. More detail on the results of this study is included in Section 2.2.3 and Appendix K. **This BMP recommends further analysis should be carried out on the impact of bi-modal waves at Hayling Island and surrounding coastlines, particularly when considering overtopping of different beach profiles, the seawall and a 'Do Nothing' scenario.**

2.8. ENVIRONMENTAL CHARACTERISTICS

The following chapter details the key environmental considerations relevant to the BMP.

2.8.1. NATURAL ENVIRONMENT

As already highlighted in Section 2.7, the BMP area is within or near to (within 2km of) a number of designated areas. These areas are shown on Figure 1.6 to Figure 1.8. Further detail on each of the designations is presented in Appendix G.

(a) International and European Designations

There are four international or European nature conservation designations within or near to the BMP area:

- Solent Maritime SAC.
- Chichester and Langstone SPA.
- Solent and Dorset Coast SPA.
- Chichester and Langstone Harbours Ramsar Site.

(b) National Designations

There are three national nature conservation designations within or near to the BMP area:

- Chichester Harbour SSSI.
- Sinah Common SSSI.
- Langstone Harbour SSSI.

Nearest Marine Conservation Zones

- Selsey Bill and the Hounds MCZ (6km east)
- Bembridge MCZ (10km south)

Non-Statutory Local Designations:

There are three local designations within the study area:

- Sandy Point Local Nature Reserve and Countryside Heritage Site
- Southern Eastoke Frontage SINC, which includes the nourished beach (BMP U4)
- Beachlands SINC, which includes area of the open beach in BMP U4.

There is one local designations near to the study area:

- The Kench Local Nature Reserve, which is adjacent to BMP U8.

During the previous BMP period, planning and environmental licences and consents were requested for a period longer than the 5 year BMP, to ensure that the project could continue smoothly if approved. Both the Planning Application and Marine Licence Application included an Environmental Statement and HRA, demonstrating how the designated and natural local environment was considered during the BMP development. These documents summarised the background environment, the proposed works, and the impacts the proposed works may have on the background environment. Where any negative impacts were identified, appropriate mitigation was discussed and agreed with Natural England, to ensure no Likely Significant Effects on the environment. The application was guided by outputs from the environmental scoping work, an Environmental Mitigation Plan and Discretionary Advice provided by Natural England. This resulted in a letter of support from Natural England, highlighting the full BMP proposal would be environmentally acceptable.

In 2018, planning permission was granted in perpetuity by Havant Borough Council. At the same time a Marine Management Organisation licence was granted for a period of 10 years, running until April 2027 (midway through this BMP period). Copies of both these documents, along with the letter of support from NE can be found in Appendix E.

Subsequently condition discharges from the MMO licence, particularly those on CEMP's and annual reporting, have provided NE and other regulators with regular opportunities to review the progress of the BMP and its potential impact on the environment. This has led to amendments in the monitoring strategy to better understand and improve the mitigation strategy.

2.8.2. LANDSCAPE

(a) Chichester Harbour Area of Outstanding Natural Beauty

The BMP sits adjacent to and partially overlaps Chichester Harbour Area of Outstanding Natural Beauty (AONB), a national designation under the National Parks and Access to the Countryside Act (1949) and as enhanced by the Countryside and Rights of Way Act (2002). Managed by Chichester Harbour Conservancy under the Chichester Harbour Management Plan 2019-2024. The acts and the management plan place a duty of regard for the protection and enhancement of natural beauty.

Virtually contiguous with this area is the Chichester Harbour Amenity Area established by the Chichester Harbour Conservancy Act (1971), which provides Chichester with jurisdiction for certain matters for the harbour and hinterland for the purposes of the management of recreational sailing.

(b) National Character Areas

The BMP study area lies within the South Coast Plain and Hampshire Lowlands National Character Area (NCA) and is comprised entirely of the generally open and often featureless landscape of the coastal plain.

Most of the length of the study area consists of a shingle barrier beach, bounded by two distal recurved spits adjacent to the harbour entrances. There are man-made sea defences at various locations along the frontage, with the largest natural sections of beach around Gunner Point (BMP U6) and central Beachlands (BMP U4). The beach frontage consists of shingle, a mixture of sand and gravel, overlaying Bracklesham Beds, with the foreshore dominated by sand where the influence of the ebb-tidal shoals is strongest. Urban development close to the beach is mainly confined to the Eastoke Peninsula, with a few individual properties located within the active beach zone along the wider study area, e.g. the Inn-on-the-Beach and the Ferryboat Inn.

2.8.3. ECOLOGY

Coastal vegetated shingle habitats and other maritime habitats are rare and specialised habitats supporting internationally important vegetation types, several types of which are listed as priority habitats in Annex I of the EU Habitats Directive (Figure 2.21 and Figure 2.22). The South Hayling Island BMP frontage includes areas of well-established perennial vegetated shingle and drift line vegetation. The BMP study area is also adjacent to areas containing intertidal mudflats and eelgrass beds, saltmarsh, saline lagoons, dune/maritime grassland, maritime heath, and coastal grazing marsh. Some of these valued features are protected within the designated sites, but significant extents have less protection and often no legal protection, and Appendix G contains more details on these.

Sand dunes are windblown sand formations associated with dune slacks, grassland and scrub. The larger areas of sand dunes are associated with shingle habitats, particularly shingle spits, with the most important sites in the county on the South coast of Hayling Island presenting a rich mosaic of sand dune and shingle habitats and associated species.

Hayling Island has a good range of foredune, mobile dune and fixed dune types (all acidic), dune slacks, sandy and fixed shingle beaches, and rich dune and shingle acid heath, including important moss and lichen communities. Transitions between sand dune, shingle and saltmarsh occur. These habitats are of particularly high biodiversity for their parched coastal grasslands, which may take many decades, even centuries to develop. They are among the botanically richest in Britain.

Coastal vegetated shingle is a Priority habitat and its two main types – Perennial Vegetation of Stoney Banks and Annual Vegetation of Drift Lines – are both Annex 1 habitats, and as such has habitat objectives:

- Maintain total extent of coastal vegetated shingle habitat throughout the UK, and the structures, sediment and coastal processes that support them. This is a 'no net loss' target to take account of the dynamic nature of shingle. This includes the maintenance of transitions to other habitats landward and seaward.
- Achieve favourable or recovering condition by appropriate management of coastal vegetated shingle systems currently in unfavourable condition since 2010. This should achieve the retention or enhancement of populations of priority species associated with vegetated shingle.

Detailed ecological considerations are included in the Environmental Statement and Habitat Regulations Assessment (HRA), being completed for the full BMP.

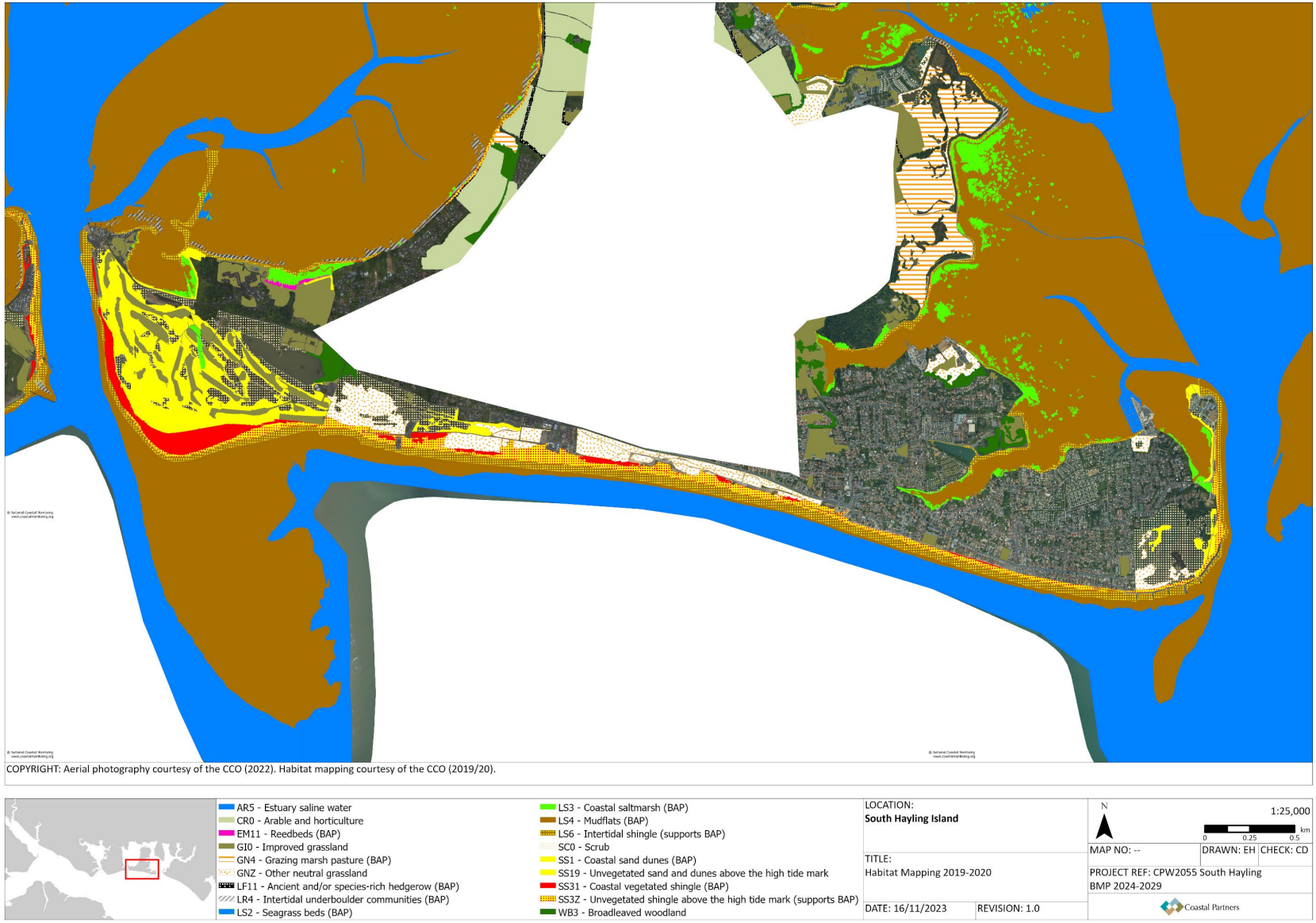

Figure 2.21: Habitats on the Hayling frontage, provided by Channel Coastal Observatory (2019/2020)

Figure 2.22: Vegetated shingle at South Hayling Island, mapped from Coastal Partners surveys (2021)

2.8.4. WATER FRAMEWORK DIRECTIVE

As discussed in Section 1.3.3, a Water Framework Directive (WFD) Assessment was completed for the 2018 planning application to demonstrate that the beach management works will not prevent the adjacent Water Bodies meeting their objectives and to ensure there is no deterioration to these water bodies. It will identify and promote the delivery of any objectives and mitigation measures that may be required. It will also consider scheme impacts on other European protected sites, including Shellfish Waters, Bathing Waters and Natura 2000 sites. The WFD Assessment will support the Planning and Marine Licence Applications.

2.8.5. CULTURAL AND ARCHAEOLOGICAL HERITAGE

The Eastern Solent coastline and adjoining harbours comprise historic landscapes which have been utilised from pre-historic periods to the present day. There are a number of cultural heritage features that lie close to the BMP area, as shown on Figure 1.7.

Successive phases of sea level rise have created the Solent and enabled archaeological deposits to be submerged and preserved. As a flooded former river valley that was drowned during the Holocene marine transgression, Chichester Harbour is known to be an area of particularly high archaeological importance.

Prehistoric Period

A prehistoric settlement has been identified at East Head and at Gutner Common on North Hayling. A thin layer of burnt material extending 23m along a low sea cliff and containing burnt flint pot boilers sealed by alluvium has been interpreted as representing prehistoric land clearance. The potential for exposing prehistoric archaeology is unknown.

Bronze Age (2000-600 BC)

In the early Bronze Age, Chichester Harbour was used for seasonal grazing as well as butchering and tanning. There is extensive evidence of Middle to Late Bronze Age settlements including farming systems and enclosures. Round houses have been found on the coastal plain at Creek Field, Hayling Island and a rare, Late Bronze Age structure comprising timbers and wattle has been found on the northern frontage of the Island. Six Middle Bronze Age palstaves were located on the east coast of Hayling in 1985. These may be associated with an urn field.

The potential for recovery of Bronze Age artefacts is unclear but this possibility must be considered.

Iron Age (600BC – AD43)

A small rise in sea levels in the Iron Age is likely to have had a significant impact on the study area. There are important links between salt workings and sites on Hayling Island including Tournerbury hill fort which guarded the western part of the entrance to Chichester Harbour. There is little potential for exposing Iron Age artefacts.

Roman Period (AD43-410)

The Roman invasion of AD43 resulted in major social and economic changes. There is evidence of an early Roman military presence in Chichester and many artefacts have been found in the area including a bronze helmet dredged from the Harbour and disparate pottery finds. The potential for the recovery of Roman artefacts is low.

Early Medieval Period (AD410-1066)

During the Early Medieval Period, there may have been trade in Chichester Harbour. Chichester was one of the five fortified sites mentioned in the Burghal Hidage, that was probably compiled in around AD919.

Chichester evolved into a major town in the 10th century and increasing trade is likely to have led to the creation of a port.

Later Medieval Period (AD1066 -1550)

During this period, the landscape would have comprised villages centred on parish churches. The harbour industries would have included fishing, salt-working, boat building and oyster farming and trade would have formed a significant proportion of the Harbour's economy. Wool appears to have been an important commodity passing through Chichester Harbour during the 13th century. By the end of the 13th century, there seems to have been a period of increased flooding within the area that has been linked to growing storminess and a slight rise in mean sea level. A considerable area of land belonging to the Priory on Hayling Island was inundated during the 14th century.

In South Hayling, three salterns are known; one medieval and two post-medieval. The medieval was the largest, known as Menghams and recorded in the Doomsday book. The salterns went out of use in the 1870s and by the 1950s there was no recognisable trace of them. Due to the inundation of Chichester Harbour, the potential for exposing artefacts from this period is low.

Post Medieval (AD1550-1800) and Modern Period (AD1800+)

The area comprises a number of post Medieval and industrial features that include mills (e.g. Hayling Island Tide Mill), harbour piles, salterns in North Hayling and oyster beds. The Sexton map of 1575 is one of the earliest maps of the area and shows Hayling Island as detached from the mainland, with channels shown as extending to Chichester. Due to the inundation of Chichester Harbour, the potential for exposing artefacts from this period is low.

2.9. RELEVANT INFORMATION

The following provides a list of sources of information that has been referenced in this section of the beach management plan.

Ref 2.1 **Tidal Levels for Hayling Island 2022**. POLTIPS 3 (v3.9.0.2/21) (Accessed 16/12/2022).

Ref 2.2 **National Tide and Sea Level Facility** at the British Oceanographic Data Centre website: https://www.bodc.ac.uk/data/hosted_data_systems/sea_level/uk_tide_gauge_network/processed/ (Accessed 23/05/2023)

Ref 2.3 **CHIMET Tide Gauge**. http://www.chimet.co.uk (Accessed 23/05/2023)

Ref 2.4 **Coastal flood boundary conditions for the UK: update 2018**. Environment Agency (2019). Project: SC060064/TR6: Technical summary report. May 2019.

Ref 2.5 **Coastal storms: detailed analysis of observed sea level and wave events in the SCOPAC region (Southern England).** (2020). SCOPAC Storms Analysis. Wady, M.P., Haigh, I.D., Inayatillah, A. and Last, E. December 2020.

Ref 2.6 **Coastal storms: analysis of observed sea level and wave events in the SCOPAC region (Southern England) following winter 2013/14.** Wady, M.P., Haigh, I.D., Inayatillah, A. and Cope, S. (2021). ICE Breakwaters Conference. April 2023.

Ref 2.7 **Stormiest winter on record for Ireland and UK.** Matthews, T., Murphy, C., Wilby, R. L. and Harrigan, S. (2014). *Nature Climate Change*, *4*(9), 738-740.

Ref 2.8 **A century of sea level data and the UK's 2013/14 storm surges: an assessment of extremes and clustering using the Newlyn tide gauge record.** Wadey, M. P., Haigh, I. D. and Brown, J. M. (2014). *Ocean Science*, *10*(6), 1031-1045.

Ref 2.9 **Coastal flood boundary conditions for UK mainland and islands**. Environment Agency (2011), Project: SC060064/TR5: Practical guidance swell waves. February 2011.

Ref 2.10 **North Solent Shoreline Management Plan**, New Forest DC (2010)

Ref 2.11 **Annual Wave Report 2022, Hayling Island**. Southeast Strategic Regional Coastal Monitoring. CCO (2022).

Ref 2.12 **Channel Coastal Observatory,** Pers Comms (2016)

Ref 2.13 **A review of regional wave climate and implications for shoreline management – extremes, swell, bimodal conditions.** Bradbury, A. (2010). https://southerncoastalgroup-scopac.org.uk/scopac-research/extreme-wave-conditions/ (Accessed 23/05/2023)

Ref 2.14 **Storms, bi-modal seas and our changing understanding of shingle beach response at Eastoke, Hayling Island, UK.** Pearce, A., Cope, S., Last, E., Harris, E., Polidoro, A. and Pullen, T. (2023). ICE Breakwaters Conference. April 2023.

Ref 2.15 **Bimodal Wave Study**. HR Wallingford (2020). Hayling Island Shingle-B Beach Modelling. Technical Note DKR6287-RT001-R02-00

Ref 2.16 **Metocean analysis of the 1st February 2021 swell event at Hayling Island.** Dhoop, T. (2021). Technical report TR111.

Ref 2.17 **Monitoring swell wave progression in the English Channel: implications for coastal monitoring**. Dhoop, T. and Thompson, C. (2021).

Ref 2.18 **Flood and coastal risk projects, schemes and strategies: climate change allowances**. Environment Agency (2020). Available: https://www.gov.uk/guidance/flood-and-coastal-risk-projects-schemes-and-strategies-climate-change-allowances#offshore-wind-speed-and-extreme-wave-height-allowance (Accessed 23/05/2023)

Ref 2.19 **Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities**. Environment Agency (2011).

Ref 2.20 **UK Climate Projections 2018.** Met Office (2018). Available: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index

Ref 2.21 **Draft Hayling Island Coastal Management Strategy.** Coastal Partners (2023).

Ref 2.22 **Sediment Processes, Selsey Bill to Portsmouth.** Harlow, D.A., 1980. Unpublished PhD thesis, Department of Civil Engineering, University of Southampton.

Ref 2.23 **Sediment Transport Processes, with Particular Reference to Hayling Island.** Whitcombe, L. J. (1995). Unpublished PhD thesis, Department of Oceanography, University of Southampton, 294pp.

Ref 2.24 **An Investigation of the Dredging in Chichester Harbour Approach Channel, and the Possible Effects on the Hayling Island Coastline**. Webber, N.B. (1979). Report to Chichester Harbour Conservancy, Havant Borough Council and Francis Concrete Limited, 56pp.

Ref 2.25 **Sea-level and Shoreline between Portsmouth and Pagham for the past 2,500 Years**. Wallace, H. (1990). Privately published by the author, 61pp.

Ref 2.26 **Flood and Coastal Defence Project Appraisal Guidance FCDPAG3 Economic Appraisal; Supplementary Note to Operating Authorities – Climate Change Impacts.** Defra (October 2006).

Ref 2.27 **Selsey Bill to Southampton Water Annual Report 2022**. Reference AR193, Southeast Strategic Regional Coastal Monitoring. CCO (2022).

Ref 2.28 **Futurecoast project by Halcrow for Defra.**

Ref 2.29 **Beach Sediment Tracer Study – Eastoke 2018-2020**. Coastal Partners

Ref 2.30 **South West Hayling Island Beach Management Study.** Moon, C.R. (2008). Inception report. HBC Technical Report CEI-2008-001.

3. SCHEME DESIGN

3.1. SCHEME DESCRIPTION

The seawall and timber revetments along the Eastoke frontage were constructed between 1947 (seawall) and 1974 (timber revetment) in stages (see Figure 1.14), with beach management works commencing in 1985 through the initial beach recharge of 500,000m^3 shingle. Although the South Hayling BMP considers the wider frontage of South Hayling Island (from Hayling Island Sailing Club to Ferry Boat Inn), the scheme design is focussed on delivering coastal flood and erosion protection to the Eastoke frontage between Eastoke Point in the east and Eastoke Corner car park to the west.

The main nourishment works are currently planned within BMP U2 and U3 (Figure 5.1). Should access to Gunner Point be required, some movement of shingle will be needed to construct and maintain a haul route in front of the driving range at BMP U7. Whilst working at Gunner Point, there is also the potential that small quantities (~100m^3) of shingle may be transported to BMP U8 and placed on the beach in front of the car park to help reduce erosion risk to this unit.

Allowing nourished beach material to travel further along the open coast frontage before recycling it back to Eastoke provides benefits to the wider frontage, rather than trapping the material on the nourished frontage and starving adjacent sections of coastline. Therefore, there is no scheme design for the wider frontage as there are few assets at flood and erosion risk; efforts will be made to minimise any impact of the ongoing beach management on these areas. Table 3.1 sets out the definitions of recycling and recharge with reference to this BMP.

Table 3.1: Definitions of recycling and recharge

	DEFINITION	LOCATIONS
RECYCLING	Material brought back to the nourished frontage from within the same sediment cell	The Ness, Coastguard Revetment, Open Beach (East & West), Gunner Point, Chichester Harbour Approach Channel
RECHARGE	Material deposited in the nourished frontage from outside the sediment cell	Material imported via road; dredged material from licensed offshore sites

3.1.1. MANAGED BEACH

The nourished beach frontage extends between groyne 7 in the east to groyne 35 in the west (Eastoke Point to Eastoke Corner); a total distance of 2.2km. The nourished frontage consists of three main sections: Eastoke Point Scheme; Eastoke Beach and Eastoke Corner Car Park as shown in Figure 3.1.

Appendix D details the quantities of material recycled and imported along the frontage between 2006 and 2023. Since 2006 approximately 563,794m^3 has been recycled, averaging ~33,000m^3 of recycling per year maintain beach levels. In addition, 146,237m^3 has been extracted from the Chichester Harbour Approach Channel, averaging 8,602m^3/year. 33,276m^3 has been imported via road to top up the beach and assist with coarsening the beach – an average of 1,957m^3/annum. The last major import of 65,196m^3 material was in 2009 from an offshore dredge.

Timber groynes along the nourished frontage act to hold more material on the upper beach (Section 5.1.2). The groynes are maintained to a consistent height by HBC and are buried at the beach crest. Maintenance of the groynes is undertaken in line with recommendations from structure inspections (Appendix J), and records are included in the BMP reporting for information (section 5.1.2).

Losses from the nourished frontage have assisted in supplying sediment to the wider Hayling Island sediment cell (Section 2.6). Historically rapid losses identified at Eastoke Point led to the construction of a rock structure: the initial rock groyne was constructed during the 1990's with additional rock work added to reduce the risk of a breach through to the Sandy Point Nature Reserve. Following further overtopping of the beach during the 1990's and 2000's, a further hotspot of erosion was identified at Eastoke Point. In 2013 a £5million scheme was constructed, further extending the rock revetment from Eastoke Point; adding rock groynes and 25,000m^3 imported shingle material (Section 3.1.3) to help reduce the risk of overtopping in to Eastoke from this location.

Analysis of data for the Eastoke BMP frontage indicates approximately 49,000m^3 material per year from recycling and recharge has historically been brought to the nourished frontage per year to maintain the current design profile between groynes 7 and 35. This iteration of the BMP is costed on the requirement of 56,000m^3/year to maintain the 0.5% AEP SoP. Experience from the 2017-2022(24) BMP suggests that 56,000m^3/year is sufficient to construct the beach to design over a standard year with the increased storminess identified over the previous BMP period. In addition, an efficiency will hopefully be gained on the project by using recycling material, rather than more costly import, with the potential funds released to be used for additional material in any one year to add further resilience to the beach, should it be required.

The current BMP will work on the assumption that some of the beach material recycled will be transported east, feeding Eastoke Point alongside The Ness and Chichester Harbour Approach Channel from where it can be recycled back to the Eastoke frontage. It is not expected that material will be required in front of the rock structure at Eastoke Point. **Beach levels here will be monitored and should there become a risk of undermining of the rock from the toe of the structure, additional material will be sought.**

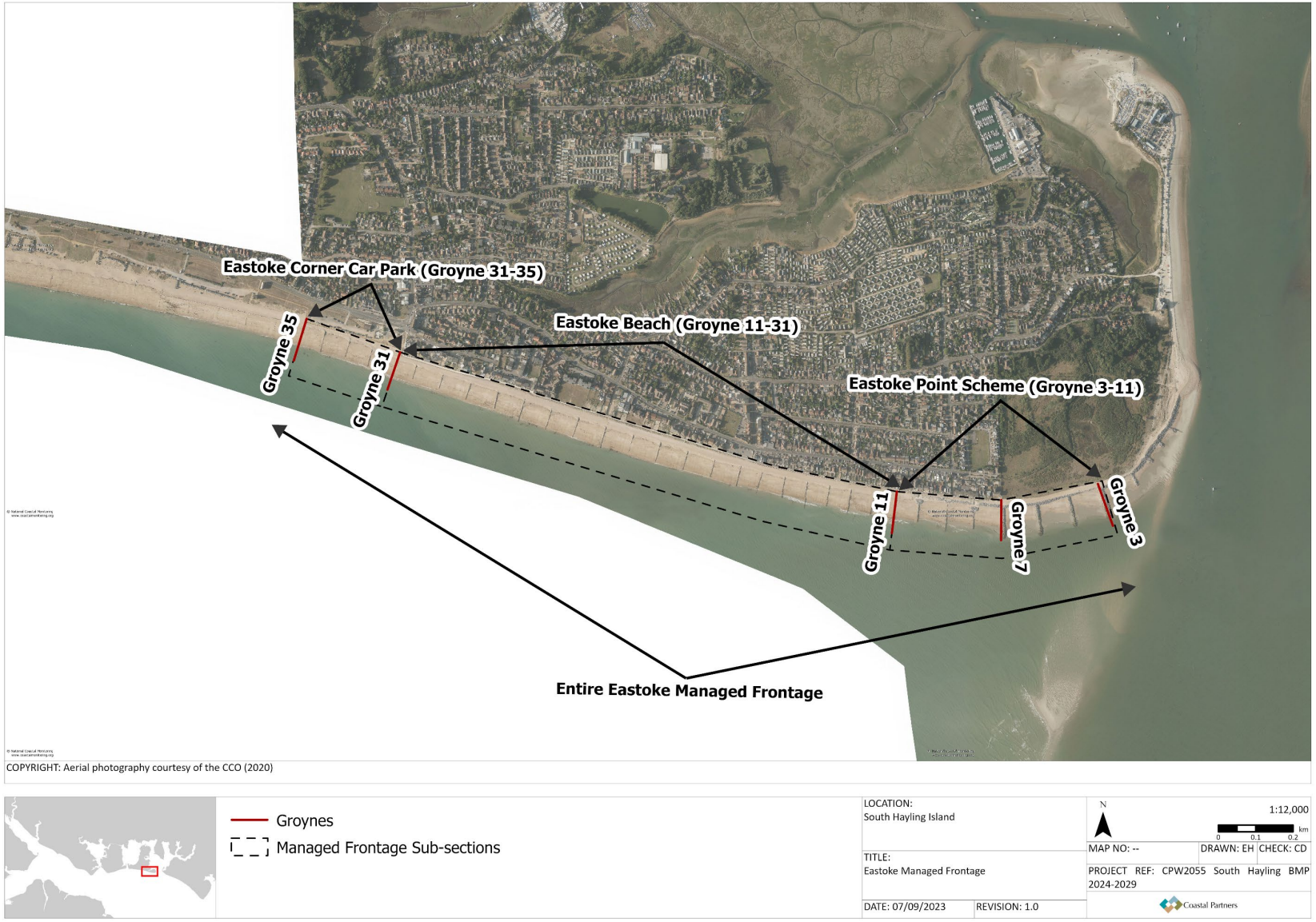

Figure 3.1: Eastoke managed frontage

3.1.2. EXISTING CONTROL STRUCTURES

The managed beach relies on 28 timber groynes and 4 rock groynes, all maintained by Havant Borough Council. The groynes are inspected annually for defects, with maintenance scheduled as required based on the outcomes of the inspections. More significant damage, requiring replacement planking, piles or top-marks would be undertaken as BMP capital works to avoid rapid beach erosion. Figure 3.2 sets out the location of the groyne structures along the frontage. At the present time the groynes are in good/fair condition along the nourished frontage with maintenance last undertaken during summer 2023.

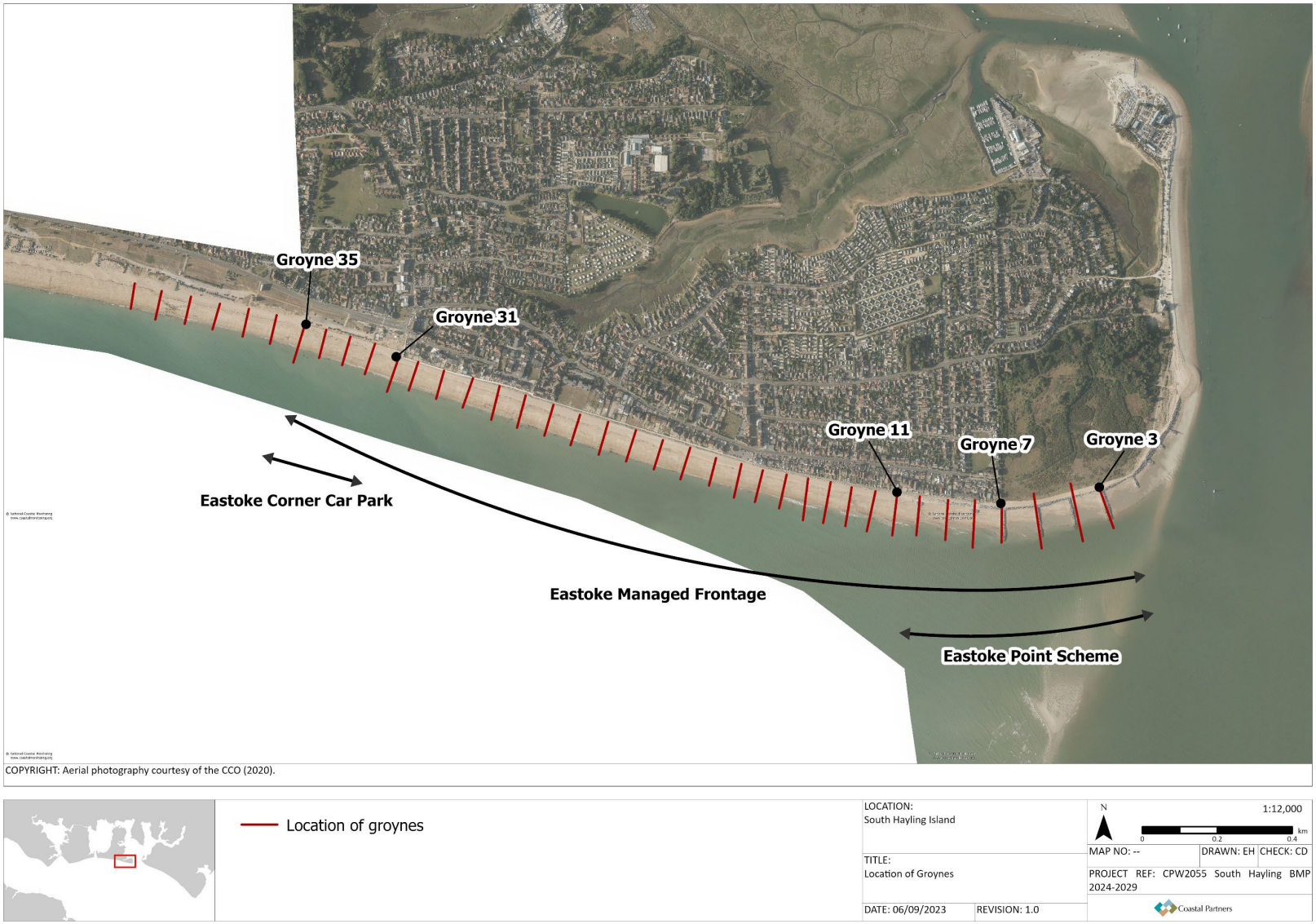

Figure 3.2: Location of groynes along the Eastoke managed frontage

3.1.3. EASTOKE POINT SCHEME

The Eastoke Point Scheme was completed in November 2013, replacing timber groynes with a reduced number of rock groynes, alongside a rock revetment to the rear of the beach (Figure 3.3). The structure was designed to a 0.5% AEP SoP in 100 years in an area with a highly dynamic coastline. This helped to stabilise the eastern section of Eastoke and reduce the loss of nourished material at this location. This section of beach relies on a sediment feed from the west to maintain the beach levels at the toe of the revetment and avoid erosion on the drift-aligned section of the frontage from The Ness to Black Point. The Eastoke Point rock structure is therefore designed to slow the transport of beach material but not act as a terminal structure for the nourished beach.

Alongside the construction of the rock structures, 25,000m^3 shingle was imported to raise the beach levels in front of the structure. The scheme was designed to retain sediment to maintain the beach levels needed for structural stability. Prior to the construction of the scheme, an average annual volume of 4,397m^3 was deposited between bays 6 and 11 (2004-2012). Since the deposition of the imported shingle material, there has been minimal deposition in these bays (Figure 3.4). Analysis of the changing beach levels within this unit of the BMP (U2) suggests that the volume of the beach has remained stable since the 2013 construction, with a fluctuation of 16,000m^3 over a 10 year period.

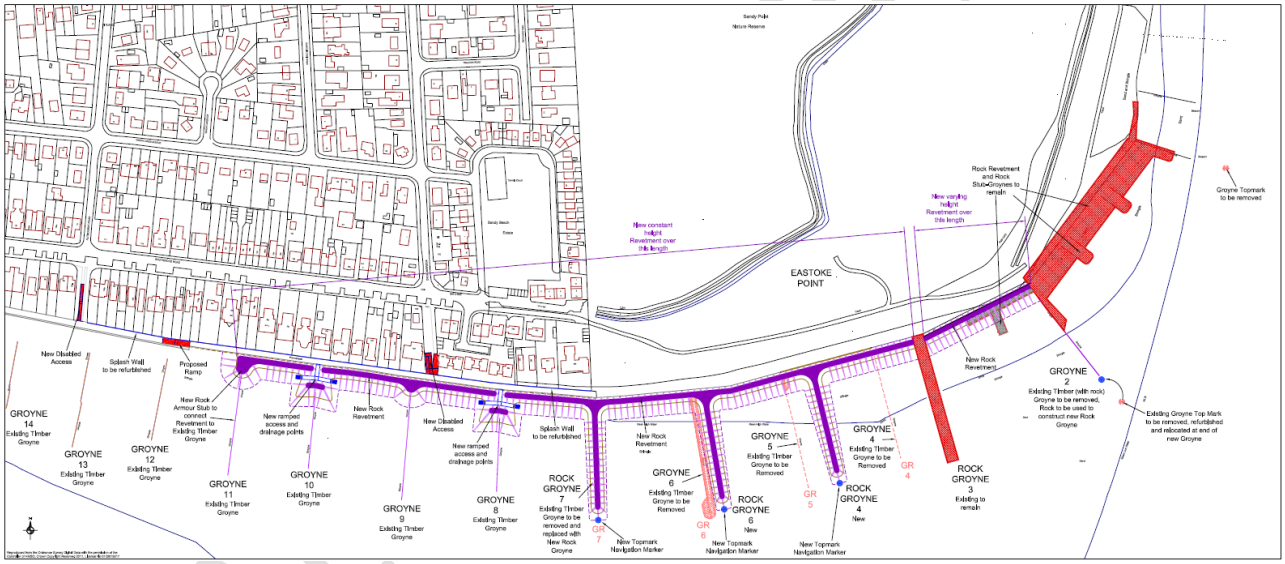

Figure 3.3: Eastoke Point Scheme design.

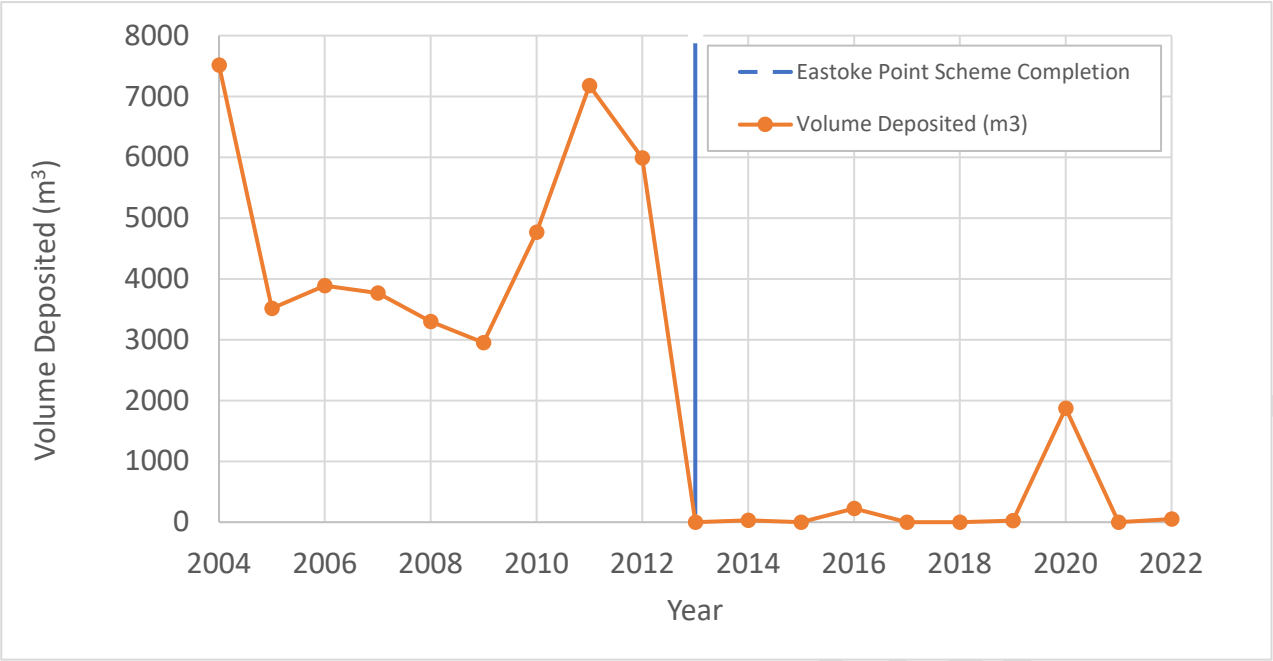

Figure 3.4: Volume of shingle deposited between groynes 6-11 (2004-2022)

3.2. STANDARD OF PROTECTION

The Eastoke Peninsula is a large urban area, densely populated with a mixture of residential and commercial property. The peninsula is at risk of flooding from both the southern and northern frontages. The figures set out below only reflect the scheme to the south of Eastoke and associated overtopping from the open coast. Under the current BMP, the assets at risk of flooding, coastal erosion and overtopping on the Eastoke Peninsula under a do-nothing scenario over the next 5 years include:

- The primary road network on to the peninsula
- 751 residential properties
- 27 commercial properties
- Sparkes marina
- Sandy Point Local Nature Reserve
- Hayling Island Sailing Club
- Extensive holiday chalets and caravan parks

The peninsula has been subject to coastal flooding on a number of occasions (1978, 1979, 1985, 2005, 2014, 2016, 2017, 2021 and 2022) and flooding from an extreme surge in 1989. The key concern along the coastal frontage is that, if unmanaged, the shingle beach would quickly erode leading to significant overtopping and eventual collapse of the existing seawall causing widespread damage to the properties, the loss of the main road on to the peninsula and frequent flooding to the many properties constructed below MLW.

The North Solent Shoreline Management Plan (SMP2) (Ref 3.6) has confirmed a Hold the Line policy for the whole of southern frontage of Hayling Island, with the exception of West Beach and Gunner Point where a policy of natural evolution should be applied. The Eastoke Sectoral Strategy Study (Ref 3.7) identifies the

Approved Option for the Southern Frontage (Main Section) as Hold the Line to a 0.5% AEP standard of defence through beach recharge and annual recycling.

More recently the draft Hayling Island Strategy (Ref 3.1) has made the following recommendation for the South Hayling frontage. It should be noted that the Strategy is in draft form, and final recommendations will not be produced until after this BMP is submitted. Should the recommendations change, they will be incorporated as required under the BMP:

> *The strategic intent in the very short term is to renew the existing Beach Management Plan and implement this over the next 5 years (2024-2029). However, it is recognised that beyond this a more strategic suite of measures will be required to protect the entire peninsula. This will involve the development of a single peninsular wide scheme under one business case with a programme of works to construct new defences such as floodwalls along the northern frontage and the building of a new rock revetment along parts of the southern frontage; coupled with new rock groynes. On top of this ongoing beach management will be required to maintain a healthy and robust beach to reduce the impacts of high energy waves.*

This Beach Management Plan will continue to provide a 0.5% AEP (1:200 year) SoP under unimodal wave conditions. As set out in Section 2.2.3, emerging research is being undertaken with HR Wallingford into bimodal and swell waves at Eastoke, as evidence shows that these events damage the beach and cause increased overtopping discharges compared with unimodal waves for which the current BMP is based. This is cutting edge research that may have regional and national implications for schemes around the country where bimodal and swell waves are present. This additional complexity has been investigated by HR Wallingford and AECOM, to provide sensitivity testing around the 0.5% AEP (1:200 year) currently in place. In simple terms this found uni-modal conditions of 1:200 can be equivalent to 1:75 bi-modal events (i.e. they are more onerous). Based on the confidence in the information available and modelling limitations, this BMP will continue to use the damages and associated benefits and SoP of unimodal waves as these are well understood.

The costs identified in the Beach Management Plan Outline Business Case are required to continue 'business as usual' over the next five years, ensuring the flood and coastal erosion risk to the Eastoke community is managed. The complexity of bi-modal seas and swell waves will then be investigated in further detail during the BMP, including the requirement for future change in the beach design profile and associated engineering works, for example extensions to groynes. These investigations are a recommendation of the draft Hayling Island Strategy, alongside an Eastoke Peninsula FCERM Scheme (currently identified on the EA Capital Investment Plan). The operational investigation recommendations, to be undertaken over the next 5 year period, will help inform any proposed change in design to account for bi-modal wave events.

3.2.1. BEACH PROFILE RESPONSE ANALYSIS

The original 1985 design of the beach nourishment was based on constructing a beach to the same elevation as the adjacent undefended sections of coastline. The crest elevation of the 1985 scheme was increased in the winter prior to construction from 5.0mOD to 5.6mOD in response to wave overtopping observed along the open beach (Ref 3.8).

In previous BMP's, the following method was undertaken to determine the appropriate crest width and elevation to deliver the required Standard of Protection for both erosion and wave overtopping:

- Derive joint probability of wave and water levels.

- Establish critical combination (maximum crest retreat).
- Test design conditions against typical beach profiles / design options.
- Test failed profile for overtopping rates using SWALLOW model.
- Establish overall overtopping discharge for each scenario tests.
- Derive minimum berm dimensions for each return period.

Following recommendations from the 2017-2022 Beach Management Plan, a study was undertaken during the previous BMP period into the impact of bi-modal waves on the Eastoke coastline. The study, undertaken by HR Wallingford using SHINGLE-B, assessed different return periods of both bi-modal and unimodal waves on the existing beach profile. Details of the bi-modal wave study can be found in Section 2.3 and Appendix K. The key output from the study was the understanding that the existing 0.5% AEP SoP was designed for unimodal waves, whereas it may not provide the same standard of protection under bi-modal wave scenarios.

The minimum design profile for a 0.5% AEP event has been updated several times since the original model runs in 1998 (Ref 3.2). In 2009 HR Wallingford amended their model results, following an update of the SHINGLE model, reducing the crest width required from an erosion perspective to 11.6m for a 0.5% AEP storm event (Figure 3.5 – Ref 3.3). This analysis does not account for bi-modal waves and was therefore not applied in either the 2012 or 2017 BMP's given the beach width can be entirely eroded over a single high water bi-modal event (example identified in the 2005 storm event).

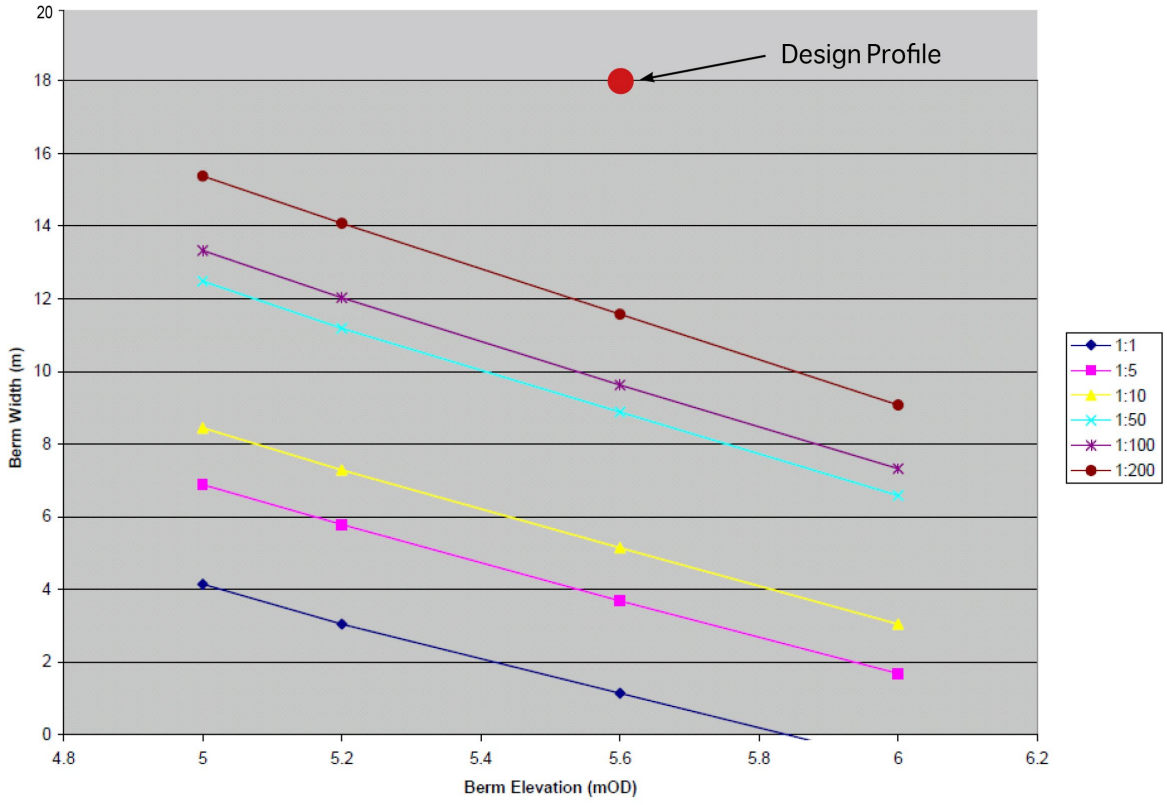

Figure 3.5: Beach design profile parameters for varying overtopping standards of protection

3.2.2. OVERTOPPING ANALYSIS

Various studies have assessed overtopping of the nourished beach (Refs 3.4, 3.5 and 3.6). The methods utilised have included SWALLOW, AMAZON, and EurOtop Neural Network. The results of previous overtopping analysis comparison the pre-nourishment profile and failed post-nourishment profile (crest reduced to level with old seawall) are shown in Figure 3.6.

Previous iterations of the BMP work used the wave and water levels from Section 2.1 and 2.2 and the EurOtop Neural Network to predict overtopping over the 0.5% AEP design profile, which indicated average overtopping rates in the order of 7l/s/m. In the past there has been significant uncertainty associated with this value due to the limited data available on overtopping on mixed sand and gravel beaches, and the impact of a bi-modal wave climate.

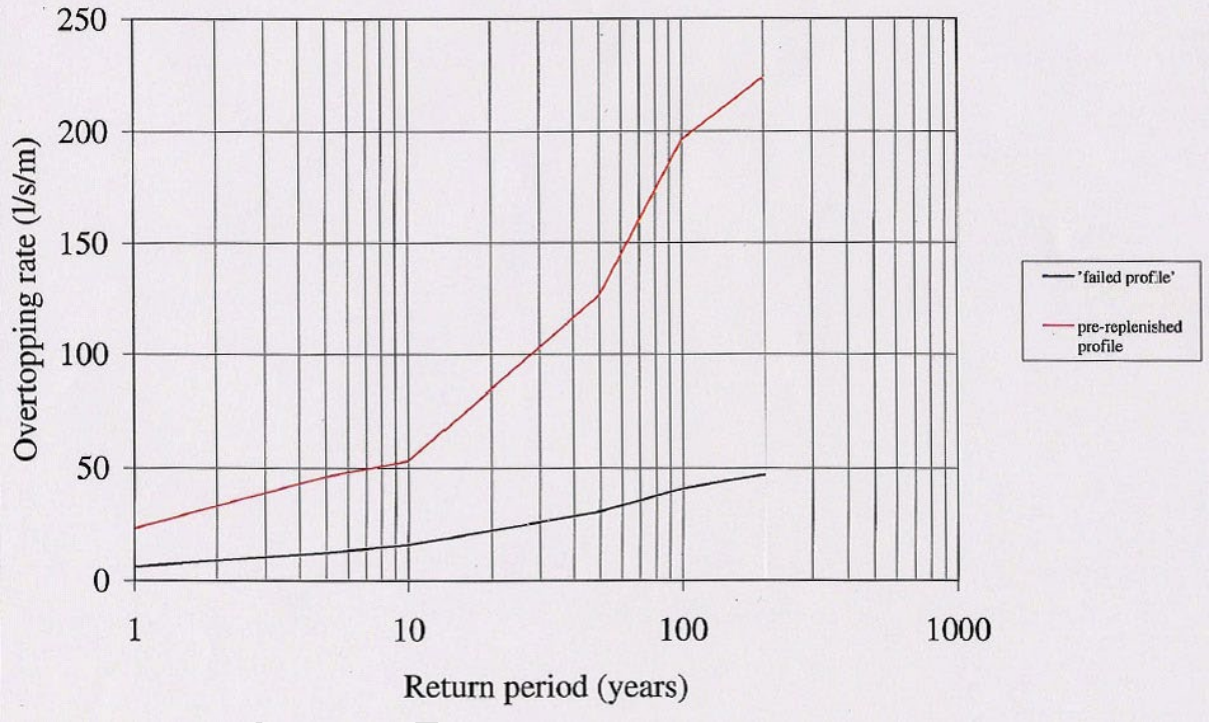

Figure 3.6: Overtopping rate of failed and pre-nourishment profile

As part of the bi-modal wave study, HR Wallingford were commissioned to calculate a proxy overtopping discharge for each model run for both bi-modal and unimodal waves. This information was then shared with AECOM who input the overtopping information in to the JBA/EA overtopping model to assess the resulting flood risk on the Eastoke peninsula.

Overtopping rates produced by HR Wallingford were significantly higher than previous assessments, however when undertaking a validation exercise using the November 2005 storm event, the overtopping rates for a similar return period was comparable. This information was therefore taken forward to assess the impact of overtopping on the flood extent at Eastoke (Appendix K).

3.2.3. DESIGN PROFILE HISTORY

Experience gained over 38 years of managing the nourished frontage indicates that long period swell waves can overtop the beach at 5.6mOD crest heights, doing so several times since the 1985 replenishment scheme was implemented. A wider berm helps to reduce the overtopping, although significant overtopping was

observed in bi-modal wave events during 2005, 2014 and 2016 on a 5.6mOD crest height and 18m crest width from the promenade to the crest. During the 2005 event, the crest at Creek Road car park was reduced in width by 11m during a single high water. A similar pattern has been identified in more recent storms.

Historically the design profile did not account for bi-modal waves, increasing the likelihood of profile failure through larger and consecutive storms. Following the bi-modal wave study the impact of these storms on the current design profile is more clearly understood, and this will be taken into consideration as part of the BMP.

The beach profile at Hayling has been tested several times over the past BMP phase, with the stormiest period identified during 2019/2020. Long term averages of bi-modal waves suggest that December has the highest proportion of bi-modal seas annually, although this can vary slightly year on year. The regional monitoring baseline topographic datasets shown in Figure 2.13 (Section 2.5.2), show that the beach volume has been fluctuating throughout the previous 7 year period. While the nourished frontage has remained relatively stable with regards to overall beach volume, the volume of the Open Beach has begun to decrease in the past 3-4 years. The total volume of the beach (Figure 2.14) shows the highest overall volume in 2018, with a drop the following year and gradual but slight increase in volume since this time.

This iteration of the Beach Management Plan will be costed assuming a requirement of 56,000m^3 material in years 1 – 5 annually, to provide the required Standard of Protection and design beach to Eastoke (see Section 2.6).

3.2.4. TESTING OF THE 2017 HAYLING DESIGN PROFILE FOR BI-MODAL WAVES

Following recommendations from the previous 2017-2022 BMP, analysis of the existing beach profile was undertaken using the new model tool developed by HR Wallingford, SHINGLE-B. This model allows bi-modal wave conditions to be tested against a shingle beach profile.

The Hayling Island Bi-Modal Wave Study was commissioned in 2020 by Coastal Partners. HR Wallingford undertook the work which involved:

- Deriving new joint probability extremes through a multivariate analysis of extreme waves using the Hayling Island wave buoy data and Portsmouth tide gauge.
- Production of present day joint probability return periods and corresponding overtopping discharges relative to the existing design profile.
- Assessment of the Standard of Protection offered by the existing design profile at Eastoke under extreme unimodal and bimodal wave conditions.

Assessment of the above scenarios suggests that under extreme unimodal conditions beach roll-back is identified however a visible crest remains in the majority of model runs. The minimum crest width which remains under unimodal conditions (modelled) is 5m. When running the model using bimodal wave scenarios, roll back of the beach is also identified in a similar trend to the unimodal conditions. It is noted that under all bimodal wave scenarios the beach profile response is more extreme than the unimodal case, with more significant roll back into the prom.

This assessment suggests that the current design is not as robust to extreme bimodal events, as unimodal events, which lead to more significant loss of beach crest and roll back of the beach into the prom. The link between this increased erosion, overtopping, flood risk and the current standard of protection is complex and difficult to model for bi-modal waves. It is an area of ongoing research. Several variations of standard of protections have been explored through the scheme economic case and the implementation of the Beach Management Plan.

Further assessment of bi-modal waves will be undertaken when assessing the design profile and trigger levels for the Eastoke Peninsula FCERM Scheme as a whole (Appendix K). **Additional modelling of bi-modal waves on different beach profiles and/or future structures at Eastoke is recommended to ensure the impact of bi-modal waves is fully understood and where possible incorporated in any future scheme design.**

3.3. DESIGN PROFILE

The design profile for Eastoke is illustrated in Figure 3.7. A beach width of 18m from the front of the beach crest to the promenade, and 5.6mOD elevation is constant along the length of the frontage between groynes 11 and 35. The rear slope varies according to the construction of the seawall and promenade behind the nourished beach. The lower beach slopes are based on an average of several years' measured beach profile data and can vary along the frontage. The 5.6mOD elevation is recommended between groynes 11 and 35 in line with the properties and infrastructure at risk to the rear of the beach (Figure 3.7). To the east of groyne 11 where the beach interacts with the Eastoke Point rock structure, the crest height lowers to an elevation of 4.6mOD where it intersects with the rock structure (Figure 3.8). Based on monitoring information collected since 2013 it is assumed that material transported east from the nourished frontage naturally feeds the Eastoke Point scheme before being transported around to The Ness and West Pole Sands where it can be recycled back into the system. Since the scheme was implemented in 2013 minimal recycling has been undertaken to this area (Section 3.1.3).

It is recommended however that the beach in front of the Eastoke Point scheme is regularly monitored both through SRCMP surveys and pre- and post- work surveys, and if necessary additional material be brought in to replenish the frontage.

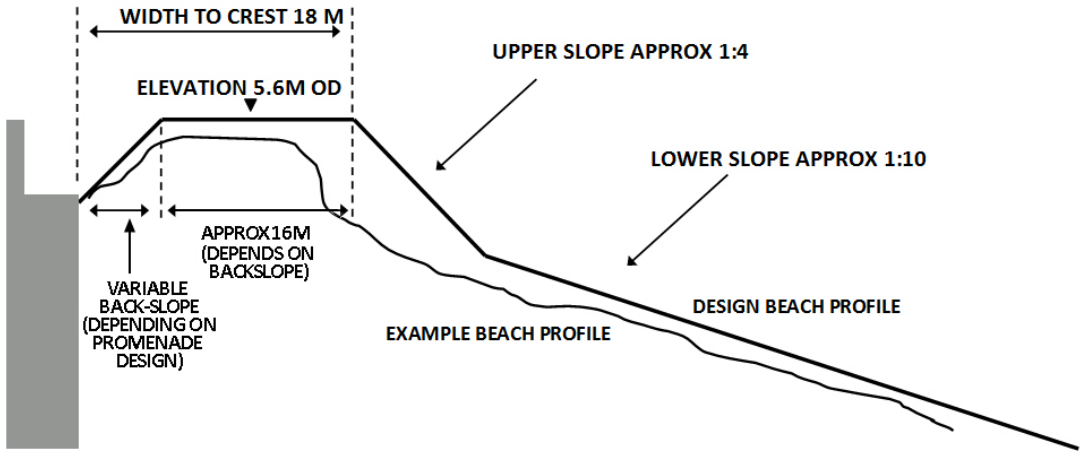

Figure 3.7: Nourished beach design profile

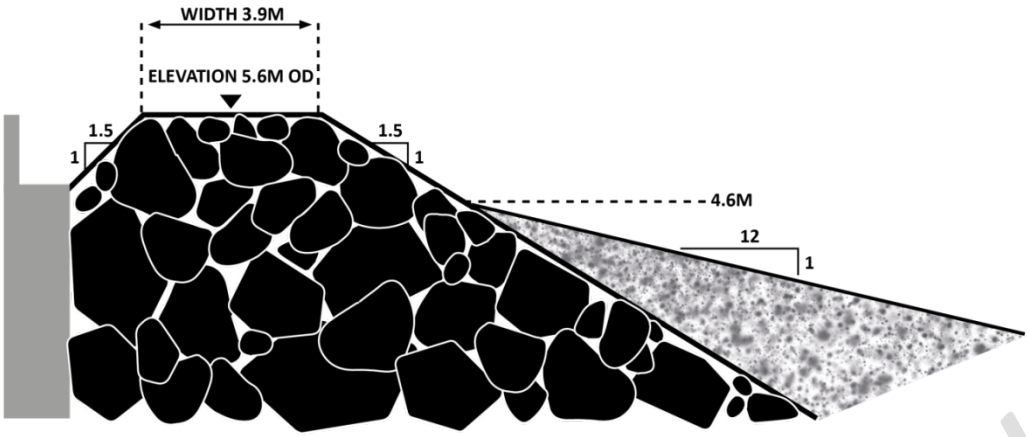

Figure 3.8: Eastoke Point Scheme design profile

A theoretical design volume for the beach between groynes 11 and 35 has been established, with a volume of 327,548m^3. This includes only the 5.6mOD design profile frontage and excludes the beach in front of the Eastoke Point scheme. The design beach surface was generated from beach monitoring surveys and design profiles along the nourished frontage. The volume of material between the design elevation and a datum of MLWS (-1.84mOD) was then calculated for each individual groyne bay along the frontage. The individual volumes will be used to inform where/if beach nourishment is required during each campaign on the Eastoke frontage. A breakdown of each individual groyne bay volume can be found in Appendix F.

3.4. TRIGGER LEVELS

Trigger levels are determined in order to maintain the beach to the preferred standard of protection, and to ensure that the scheme is not at risk of compromise. The trigger levels help to monitor the behaviour of the beach and determine when to undertake maintenance works. The trigger levels are defined as an alarm and a crisis level, and determining these levels can assist with monitoring of the beach and assess whether any works are required.

In determining the trigger levels for the South Hayling frontage, two different types of triggers were determined: volumetric and profile based. The volume thresholds are designed to ensure there is adequate material on the nourished beach to maintain the design profile. The profile based trigger levels are determined to maintain the required standard of protection – these trigger levels have been in place since the 1992 BMP and are still relevant to the current BMP. The two thresholds are applied independently of one another: the beach crest will still require topping up to maintain the beach profile, even if the overall nourished beach volume is above the required standard. It should be noted that each groyne bay has its own design volume which can help when determining whether focussed works or wider scale works are required.

Following experience gained during previous storm events, the application of trigger levels should not be absolute, and consideration should be given to sea conditions at the time of the assessment. The best opportunity for beach assessment is immediately following storm events. However, whilst beaches can experience significant draw-down and crest width reduction during storms, they usually recover to their pre-storm profile shortly afterwards in calmer conditions. It is therefore recommended that unless further severe weather is expected, several days should be allowed for the beach to recover following a storm before any remedial work is undertaken.

The trigger levels identified below are provided as a basis for assessing the requirement for works, including emergency works. Each instance should be assessed on its own merits, taking in to account other factors such as the time until the next planned works.

The trigger levels have been developed taking into consideration previous responses to severe events, changes to the frequency of planned work over the past BMP period, and the impact of bimodal waves on the Eastoke frontage – all of which have been noted as significant over the past 7 year period.

Alarm Level

- Three or more consecutive groyne bays are depleted below a 2% AEP SoP – **9m width** (Figure 3.5). **ACTION**: the area shall be monitored daily by suitable officer(s) to assess whether the area is deteriorating or naturally regenerating. If the area is regenerating, then daily monitoring shall continue until the SoP is in excess of the 2% AEP standard.
- The nourished frontage volume falls within 10,000m^3 of the design volume (section 3.3). **ACTION:** volume of the nourished frontage is to be monitored to establish if low levels are as a result of a single anomalous survey (e.g. event drawing down material below the toe of the surveys) or a longer-term erosional trend.

Crisis Level

- Three or more consecutive groyne bays are depleted below a 10% AEP SoP – **5m width** AND deemed to be deteriorating. **ACTION:** emergency works are triggered, alongside appropriate ongoing monitoring (section 4).
- The nourished beach volume continues to fall below 10,000m^3 of the design volume before the end of the BMP period. **ACTION:** emergency works triggered, alongside appropriate ongoing monitoring (Section 4).
- Individual bay(s) drop below a 20% AEP SoP – **3.5m width** (Figure 3.5). **ACTION**: emergency works triggered, alongside appropriate ongoing monitoring (Section 4).
- 50% of the frontage falls below a 1% AEP SoP – **10m width** (Figure 3.5). **ACTION:** emergency works triggered, alongside appropriate ongoing monitoring (Section 4).

These levels have been adjusted from previous BMP's to account for the presence of bimodal waves on the frontage. Section 5.1.1 sets out the sources of material, and 5.2 sets out requirements for emergency works.

3.5. RELEVANT INFORMATION

Ref 3.1 **Hayling Island Coastal Management Draft Strategy**, AECOM (2023).

Ref 3.2 **Investigation in to beach profile response and overtopping,** Letter C/H/5/0A. HR Wallingford (1998)

Ref 3.3 **Eastoke Point Coastal Defence Strategy: Investigation into minimum berm width,** Technical Note CBR3873-01b. HR Wallingford (2009)

Ref 3.4 **Pagham Harbour to River Hamble Coastal Strategy Study, Volume 1: Pagham Harbour to Portsmouth Harbour.** Report EX3121. HR Wallingford (1995)

Ref 3.5 Royal Haskoning (2012), **Eastoke Point Coast Defence Works – Wave and Overtopping Modelling, Technical Note 9X1135**

Ref 3.6 **North Solent Shoreline Management Plan**, New Forest DC (2010)

Ref 3.7 **Hayling Island: Eastoke Sectoral Strategy Study**; Joint report to Havant Borough Council and Environment Agency, W.S. Atkins Ltd (2006)

Ref 3.8 **Correspondence about HIBRS initial design,** Harlow, D.H. (2012), Pers comms.

4. MONITORING PROGRAMME AND OBJECTIVES

4.1. MONITORING PROGRAMME

The recommended monitoring programme incorporates the ongoing monitoring undertaken by Coastal Partners and the Channel Coastal Observatory (CCO) under the South-east Regional Coastal Monitoring Programme (SRCMP). **It is recommended that beach monitoring data continues to be collected to inform future revisions of the BMP**, thereby providing a greater level of quantitative field data to aid improved understanding of the coastal processes, e.g. updating the design profile graph (Figure 2.16) and predictions of beach responses to storm events. Table 4.1 provides an overview of the monitoring requirements over the next 5 years. Items highlighted in 'yellow' are actions already undertaken as part of the ongoing monitoring by Coastal Partners as part of the SRCMP.

Table 4.1: Recommended monitoring programme over the next 5-year beach management period

MONITORING REQUIREMENT	YEAR 1 (24-25)	YEAR 2 (25-26)	YEAR 3 (26-27)	YEAR 4 (27-28)	YEAR 5 (28-29)
Two annual beach profile surveys (Spring: to be extracted from the baseline survey; Autumn: designated/interim profiles)	X	X	X	X	X
Post-storm surveys (as required)					
Pre- and Post-recycling event surveys (when recycling occurs)	X	X	X	X	X
Full beach baseline topographic survey of the frontage using GPS & UAV.	X	X	X	X	X
Bathymetry survey (by SRCMP)	X		X		X
Visual walkover inspections of beach (monthly and pre-storm/post-storm as required)	X	X	X	X	X
Visual inspection regime for structures (including pre-storm and post-storm as required)	X	X	X	X	X
Detailed inspection of structures (triggered by visual inspections)	X				
Tracer pebble deployment and monitoring		X		X	
Wave data collection (Hayling buoy 5km offshore)	X	X	X	X	X
Tide level data at CHIMET/Portsmouth National Tide and Sea Level Facility (NTSLF)	X	X	X	X	X
Capture of recycling events using recycling log sheets	X	X	X	X	X
Bird and Vegetated Shingle surveys	X	X	X	X	X
LiDAR survey of the entire Hayling frontage, including harbour mouths (by SERCMP)	X		X		X
Aerial Photography (orthophotos by SERCMP)		X			
Sediment Sampling		X		X	

5. MAINTENANCE REGIME

5.1. ONGOING WORKS

This section describes the beach management works that are to be carried out over the next 5 years in order to maintain a 0.5% AEP for the managed frontage at Eastoke.

5.1.1. BEACH

Potential Sediment Sources

For the past 33 years, the design profile at Eastoke has been maintained between groynes 7 and 35 through sediment recycling (material extracted from areas of accretion at Gunner Point, West Beach, the Open Beach, Coastguard Revetment and the Ness and returned to the nourished beach – Figure 5.1); recharge from import via road; recharge from marine based import; maintenance dredging's from Chichester Bar and three emergency extractions from Gunner Point (see Appendix D).

The sources of material for recycling that are readily accessible for the 2024-2029 BMP can be split into:

a) The Ness (BMP U1)
b) the Open Beach, and Coastguard Revetment (BMP U4 and U5)
c) Gunner Point (BMP U7)

a. <u>The Ness</u>

The first area is the "Ness" just north of the Nature Reserve at Eastoke Point. Extensive monitoring, undertaken in-house by the Coastal Partners, has shown that this area historically accumulates material carried easterly from the drift divide at Creek Road. Material protruding into the channel is removed to make the navigation safe and to avoid it being eroded by the ebb dominant tide and deposited on the bar across the entrance channel. Material from this area has a higher sand content and tends to cliff if left exposed on the front face of the nourished beach. Extraction of this material now depends on the quality (coarseness) of the material and whether a haul route needs to be constructed over the Eastoke Point rock revetment for the plant to access the "Ness".

b. <u>Open Beach, and Coastguard Revetment</u>

The wide shingle storm beach in the centre of Hayling Bay is a good source of material, especially the coarse berm that often forms just above MHW. Coastal Partners undertake surveys before any beach management operation to identify areas that have accreted over the previous year if there has been sufficient build up. Beach material can be extracted from the face of the storm beach and care must be taken not to reduce the berm height or width, particularly just east of Inn-On-The-Beach (see Figure 2.20 - where an erosion watch spot is located). In addition, there is vegetated shingle on the beach crest which must not be disturbed during recycling operations.

There is one main extraction area behind sloping revetments in the study area at the Coastguard revetment. Material is periodically thrown over the structure by storm waves and thereby removed from the sediment transport system. This material is usually coarser, well sorted gravel that performs well as a front face to the nourished beach crest. This source may reduce if the section of timber revetment at the Coastguard revetment is removed on health and safety grounds. In this instance, material would initially be released into the system but no longer provide a possible recycling store.

c. Gunner Point

During the 2017-2022 BMP period, a Memorandum of Understanding was developed between Havant Borough Council and Hayling Golf Club, to permit the periodic recycling of shingle material from Gunner Point back to Eastoke. This agreement is made on a case-by-case basis and follows a pre-works survey by Coastal Partners with the information provided to the Golf Club through a short report and subsequent request for access. This material is generally of good quality coarse shingle, and therefore a beneficial source of shingle for the BMP. The MoU is in place until 2027, however there is the possibility that either party could withdraw at any point from the agreement.

To access Gunner Point, a haul route is required to be constructed along the crest of West Beach, and in front of the Golf Club driving range. This requires additional material from Gunner Point, and therefore the presence of good quality material must be confirmed before a request for access is made to the Golf Club.

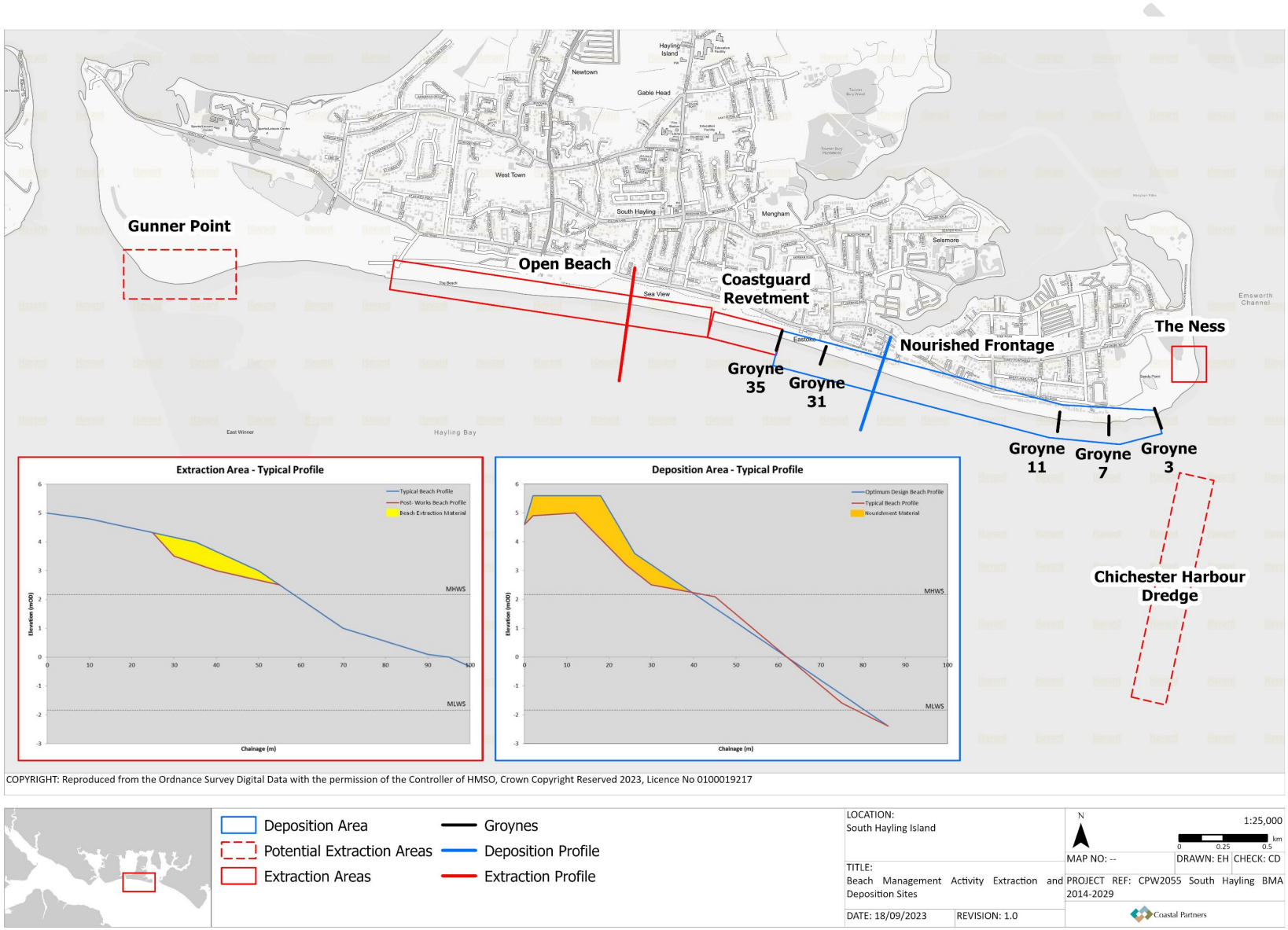

Figure 5.1: Extraction & deposition along the South Hayling frontage

Table 5.1 ranks the sources of material which can be used at Hayling Island, alongside the advantages and disadvantages of each (see Figure 5.1 for locations). The latter two options are excellent sources of material and are preferred sources to the recharge options although are conditional on the material being available and the landowner's consent.

Table 5.1: Ranked sources of material, with advantages & disadvantages of each source

RANK	SOURCES OF MATERIAL	ADVANTAGES	DISADVANTAGES	CONCLUSIONS
1	**Beach Recycling** from Open Beach	Material existing within the sediment cell on the beaches. Cheaper source of material. Possibility to remove smaller volumes on an annual basis. No impact on the transport network. Material grading the same / similar to existing material at Eastoke.	Recycling material within the littoral system so may not be beneficial to overall Hayling Island volumes as land-based or offshore source. Disruption to residents whilst works are on site. Quantities to be extracted dependant on volume on the beach in front of annual vegetation of drift line habitats.	**Leading option** when material is available on the beaches.
2	**Beach Recycling** from Gunner Point	Material grading closer to beach material than offshore source (reduced losses). Cheaper source of material. Possibility to remove smaller volumes on an annual basis. No impact on transport network.	Effectively recycling material within littoral system so may not be as beneficial to overall Hayling Island volumes as land-based or offshore source. Not a guaranteed supply of material as landowner consent required. Disruption to residents during September. Quantities to be extracted dependent on accretion in front of annual vegetation of drift line habitats. Works limited to unrestricted working during September only. Between October and March works are restricted to avoid high water and disruption to roosting birds. No works permitted	**Leading option** if material is available in September and landowner agrees to the quantity to be extracted.

			between March and August due to nesting birds.	
3	Chichester Harbour Bar	Material grading closer to beach material than offshore source (reduced losses) Cheaper source of material. Possibility to remove smaller volumes on an annual basis following a term service agreement. No impact on transport network.	Effectively recycling material within littoral system so may not be as beneficial to overall Hayling Island volumes as land-based or offshore source. Not a guaranteed quality or supply of material. Disruption to residents due to 24hr working. Susceptible to down-time due to poor weather conditions. Less control on placement of material as 'rainbowed' ashore.	**Leading option** if dredging must take place due to removal of hazard to navigation.
4=	**Recharge** from marine-based source (Offshore licenced dredge site)	Guaranteed supply of material. No impact on transport network.	Higher costs make smaller annual operations unviable. Disruption to residents due to 24hr working. Susceptible to down-time due to poor weather conditions. Less control on placement of material as 'rainbowed' ashore. Material grading less similar to beach material than Chi Entrance source (increased losses)	**Suitable as a source** to maintain overall beach volumes but not preferred source.
4=	**Recharge** from land (marine grade sorted shingle delivered by truck)	Guaranteed supply of material. Coarser grading of material improves performance. Able to profile material without need to bring additional plant. Non-weather dependant delivery. Able to procure jointly with Beach Recycling operation under Minor Works Framework. Able to import smaller volumes on an annual	Increased vehicle movements onto Hayling Island. Requires stockpiling prior to placement on the beach. More expensive than offshore marine-based material. Potential impact on transport network and local residents.	**Suitable as a source** to maintain overall beach volumes but not preferred source.

		basis, reducing losses due to overfilling of groyne bays.		

Any recharge via road should be single-size graded 20-63mm aggregate transported to site by lorry. The material is dredged at licenced offshore sites before being landed and graded ashore. The material is therefore of a similar type and appearance to the coarser fraction of material already on the beach. This material performs well on the nourished beach and has been used as part of previous operations to armour the front face of the beach crest. Unlike dredged material pumped directly ashore there is no loss of fines from the imported material as it is reworked by wave action. The absence of sand in the material prevents the occurrence of cliffing and improves drainage down through the beach crest.

Appropriate licenced offshore dredge sites will be considered should the need arise; however, this is not the 'preferred sediment source' as losses due to fines are estimated at around 20-30%. This represents the fraction of material too small to remain stable within the mobile beach and are winnowed out.

If a maintenance dredge becomes necessary to remove the Chichester Bar from the Chichester entrance channel, this material should be utilised rather than lost as part of the wider sediment budget feeding the Eastoke frontage. The sediment in the entrance channel is a good match to the current beach material, although losses due to fines are still estimated at 30-40%.

Gunner Point at the far western end of Hayling Island has been a sediment store since the beginning of the 20th century (Figure 2.10 and Figure 2.13). With a large proportion of imported material travelling west from the drift divide at Eastoke, Gunner Point has accreted substantially since the 1985 replenishment scheme and continued BMAs by (approximately 9,000m^3 on average per year since 2006. Gunner Point is therefore an excellent source of material for recycling back to Eastoke given the mix of native and imported material. This source of material along with Chichester Bar is not guaranteed in terms of timing and volume but both are considered 'over-riding' options and preferred sediment sources to recharge material. All environmental considerations will be adhered to if extraction takes place (Appendix G).

Sediment Volumes

This BMP will be costed on the requirement of 280,000m^3 of material required in total over the 5 year BMP period. This material has been assumed as available from a variety of sources as set out in Section 5.1.1. This current BMP has been costed assuming that some of the material from the Eastoke drift divide is transported east, feeding the Eastoke Point scheme and transporting around to The Ness before feeding West Pole Sands in Chichester Harbour.

When estimating volumes of material required over the next 5 year phase, the following summary was made from the previous years' datasets (2006-2022) – Appendix D.

Recycling: ~27,000m^3/year

13,650m^3 from Open Beach

4,847m^3 from Coastguard Revetment

6,554m^3 from Eastoke Point and The Ness

2,000m^3 historically from West Beach (no longer a source of material)

Recharge: ~1,987m^3/year

1,987m^3 from road import

Alternative Sources: ~14,725m^3/year

6,123m^3 from Gunner Point (MoU agreed in 2017)

8,602m^3 from Chichester Harbour maintenance dredge

Based on the information above, it is estimated that approximately 25,000m^3 in total could be recycled from the Open Beach, Coastguard Revetment and The Ness. Where possible, the remainder of the material should be sourced from alternative sources (Gunner Point and Chichester Harbour approach channel). The aim is to ensure the beach is at the 0.5% AEP SoP throughout the whole BMP period, starting in April 2024. Where it is not possible to extract material from the identified alternative sources, the recharge option will be considered – either using import by road as noted above, or through an offshore dredge of material.

Assessment of the Required Volumes

Prior to each campaign on the beach an assessment should be made of the volume of material required and the location in which it is needed. In order to understand these volumes, a digital terrain model (DTM) of the beach will be compared to the design profile of the beach. The volume of fill required to bring the beach back to design volume will be calculated and broken down in to individual groyne bays.

The volume required will then be sought from each of the potential sources in order of preference (see ranking in Table 5.1). A DTM will be compared to the previous extraction from each site to determine how much the beach volume has increased. If there is found to be insufficient material on the beach in the recycling areas, then additional imported material will be used to 'top up' the overall beach volume.

The suitability of any material will be identified through a visual inspection prior to any recycling works. Due to the dynamic nature of the beach there should be some flexibility when allocating sites for extraction. Engineering judgement should be used on site to avoid over-extraction of the beach profile, supported by post works surveys to measure the beach level change.

Programme of Works

Beach Recycling

Over the 5-year BMP period, beach recycling should take place bi-annually in March and/or September. This should use the available beach sites if material has built up since the previous works. These works should last no more than 4 weeks on site per campaign.

Chichester Harbour Maintenance Dredge

Havant Borough Council object in principle to any dredging close to the South Hayling coastline, however they will permit the use of material from the Chichester Harbour maintenance dredge, rather than lose it from the coastal system. Any dredging of the bar would typically take place on a 'passing-by' basis but should be limited in time to avoid any school holidays. Over the past 7 year BMP period these works have taken place between September and November.

Gunner Point

In 2017, a Memorandum of Understanding was agreed between Hayling Golf Club and Havant Borough Council to allow shingle extraction from Gunner Point on a case-by-case basis. The MoU was agreed to last for a 10 year period, however either party could withdraw their agreement at any time. Should any extraction take place from Gunner Point in the 2024-2029 BMP the priority month for these works would be September. Extraction between October and March (inclusive) involve the pausing for 2.5hrs each high tide to account for the presence of overwintering birds using the site as a high tide roost. No extraction can take place between March and September due to the nesting bird season, and the presence of vegetated shingle.

Recharge

Where road import or a dredging campaign is necessary, this should take place during September of any year.

Annual Reporting

Annual reporting is scheduled for July annually, to prepare the information necessary for any September campaign. This also satisfies the licence requirements from the MMO and draws together all information from the previous years' works on site alongside any environmental impacts of the work and longer term sediment volume trends. This annual reporting should continue going forwards and should be shared with key stakeholders as required.

Emergency Works

Emergency beach works may be undertaken at other times of the year in response to low beach levels and should be carried out in line with the trigger levels set out in section 3.4.

5.1.2.STRUCTURES

The BMP only considers requirements to manage the beach as part of the overall defence system. Whilst interaction with coastal structures is discussed and considered within the BMP, the requirement for ongoing routine maintenance is set out in a separate maintenance plan prepared by Coastal Partners for the structural elements of the coastline, including the groynes.

Routine maintenance is currently undertaken along the BMP frontage by Coastal Partners on behalf of Havant Borough Council. In summary, this comprises:

- Maintenance of beach control structures (timber groynes and revetment) within BMP units 2 to 5. This maintenance should continue as at present to repair defects which may affect structure performance and health and safety reasons. At the current time the beach control structures are in fair condition along the majority of the nourished frontage. Key erosion hotspots have been identified over the past 7 years as part of the Eastoke Drainage Feasibility Study, which has considered the current and potential future control structures at these locations. **Further detailed analysis should be undertaken in to any potential changes required to the control structures at these locations.**
- Structure failure the timber structures is not anticipated given their fair condition. If significant damage were to occur, this could trigger a rapid loss of beach volume and put the wider beach management plan at risk. In this scenario, replacement planking, piles, or top-marks etc would be undertaken as BMP capital works to avoid rapid and costly beach erosion.
- Clearance of shingle from the promenade within Unit 3 as required following storm events.

- Maintenance and operation of flood boards within Unit 3.
- Over the past 7 year BMP, the majority of the revetment at West Beach along with the associated groyne structures was removed due to the health and safety risk. One small section of the revetment remains, adjacent to Inn on the Beach. **Ongoing monitoring should take place prior to and following the removal of the final section of revetment, given the role of West Beach in safely accessing Gunner Point.**

This existing maintenance regime of structures should continue into the future. **Any maintenance activities should be recorded in the Structure Maintenance Log.** No other maintenance activities are proposed under this BMP.

5.1.3. PUBLIC ACCESS, AMENITY AND SAFETY

Beach management activities should avoid the peak holiday season, weekends, and public holidays where possible. Condition 4 of the recycling Planning Consent (Appendix E) prohibits all but emergency works on weekends and recognised public holidays. 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.

Experience has shown that closing the beach entirely is likely to be impractical, and **it is suggested that adequate on-site supervision and signage are employed to direct public access to safe sections of the promenade and beach during works**. Health and safety risks should be assessed through a site-specific risk assessment. It may be necessary to close the access at highest pedestrian traffic areas (e.g. Eastoke Corner car park), due to the relatively narrow crest and difficulty for dump truck drivers to identify all access points along this stretch.

Information boards should be displayed whilst the works are being carried out to explain what is being done and why. This will also serve to improve public education. Appendix H contains the Communications Plan which identifies how to communicate with the public and local businesses when undertaking the beach maintenance works. The Communications Plan also contains examples of information posters for future works. This section is not exhaustive, and any works should comply with the relevant up-to-date Havant Borough Council/Coastal Partner procedures.

5.2. EMERGENCY WORKS

If a design profile Crisis Level (Section 3.4) is identified as reached on the nourished frontage, the immediate action would be to undertake an emergency recycling campaign to top up the affected area. The potential sources of material identified in Section 5.1.1 would be assessed to determine if there is a sufficient supply of material.

If there is an inadequate volume of material identified on the beaches, then a decision should be made on a case-by-case basis for importing recharge material via road to re-establish the required Standard of Protection. The crisis works would be carried out in addition to planned bi-annual recycling campaigns. The programme of works required annually should be flexible to accommodate any emergency responses required throughout the year. Emergency works rates could be requested in the beach management Contract as day rates, therefore the cost of any works can be easily estimated prior to starting on site.

It should be noted that the application of the Crisis Level trigger should not be absolute, and consideration should be given to sea conditions at the time of the assessment. Engineering judgement should play a large role in the decision to trigger emergency works.

Beach levels in front of the Eastoke Point rock scheme should be monitored, along with the crest behind the rock structure towards the nature reserve. It has been noted that the crest behind the rock structure can narrow from wave overtopping, and therefore adjustments to the material behind the structure should also be considered to maintain the beach profile width.

5.3. IMPLEMENTATION

5.3.1. PLANT REQUIREMENTS

Beach recycling will generally be undertaken using a tracked bulldozer, hydraulic excavator (up to 50t) and dump trucks to transport the material along the beach frontage. Reprofiling of the beach crest to reduce cliffing will be undertaken by bulldozer. Dump trucks should remain on the beach at all times, with no transportation on the road (unless road legal and undertaking small-scale works within U8). Clearance of the promenade should be undertaken using a small hydraulic excavator, allowing the operator to dig close to the concrete splashwall to the rear of the promenade. Any tracked machinery driving on a metalled surface (e.g. promenade) should be fitted either with rubber tracks or use track mats to avoid scratching the surface.

This machinery is generally required during the winter months for reprofiling cliffing and promenade clearance, and during March and/or September for beach recycling operations.

Beach recharge via road will use the same machinery as a beach recycling operation. If the need arises to run a marine-based operation, the material should be 'rainbowed' ashore on to the mid- to lower- beach and allowed to disperse naturally under wave action. Where larger volumes are landed (exceeding the capacity of the groyne bays), then the excess should be transported and profiled in other groyne bays as required. Should marine-based works be undertaken, a pre-works survey of the seabed is required to identify depths adjacent to the beach and any soft-spots within the beach profile which may affect the deposition locations.

5.3.2. BEACH REPROFILING

Beach reprofiling is only undertaken to remove severe cliffing along the nourished beach frontage and is usually undertaken as standalone emergency works. It is not to be used to push up material from the lower beach to supplement the crest. Any shortfall in material will be made up by the beach recycling element of the works. Costs for beach reprofiling can be built in to the Contract as day rates. Therefore, the cost of reprofiling would be known prior to undertaking any works.

5.3.3. ACCESS

Machinery access to the beach in Unit 3 is via Eastoke Corner car park and along the beach crest to the Havant Borough Council compound on Southwood Road. The agreed delivery route for machinery is shown in Appendix L. Once at the compound machinery can access the Hayling frontage between Inn on the Beach and groyne 11 from the beach crest. From Inn on the Beach westwards (U5 – 8), some tracking along the car park surface is required to access Gunner Point, and a haul route may be required to be constructed to allow safe access along the rear of West Beach (depending on the beach profile during each campaign).

Material imported via road will be stockpiled at Eastoke Corner car park, with the closure of the western side of the car park required to ensure safe delivery of material. Access to the stockpile area would require the removal of timber parking bollards temporarily, at the entrance from the car park to the beach.

5.3.4. PERMISSIONS / CONSENTS

Planning permission has been granted in perpetuity for the beach management works on Hayling Island. Conditions of this permission should be complied with when undertaking beach management operations.

In addition to the planning permission, an MMO license has been granted which runs from 2017-2027. Conditions under this licence should be met prior to each campaign on the beach, which also incorporate conditions set by Natural England. During this BMP period the license should be re-applied for to ensure no risk to the beach management works.

A Chichester Harbour Conservancy 1971 Section 45 Works Licence has been approved for the recycling operation with various conditions attached (Appendix E). Condition XI of the Works Licence requires at least 48hrs notice of any operation be provided to the Harbour Master. This license expires in January 2024 and will be renewed prior to the next BMP commencing. The licence will then need to be renewed during the next BMP period in January 2028.

5.3.5. NOTIFYING OTHERS

In line with the Communications Plan (Appendix H), **it is recommended that explicit notification of beach works should be provided to the following stakeholders**:

- Natural England (in relation to nature conservation and coastal access interests)
- Marine Management Organisation (in relation to nature conservation in line with licences)
- Hampshire County Council (as landowner)
- Chichester Harbour Conservancy (as landowner)
- Beachlands (Funfair) (as landowner)
- Inn on the Beach (as landowner)
- Hayling Golf Club (as landowner)
- Hayling Island Sailing Club (as landowner)
- Havant Borough Council (as landowner and structure maintainer)
- Norse (SE) (as coastal inspectors)

5.3.6. ENVIRONMENTAL UPDATES AND OPPORTUNITIES

Through the monitoring and approvals process undertaken for this project, the findings, lessons learnt and discussions with regulators have led to continuous improvement to our ways of working and monitoring the project.

Bird surveys have concluded that on much of the open coast bird numbers are so low during, that survey effort is better spent assessing the impacts (if any) on birds of beach management activity, understanding the nocturnal use of the site, and better protecting the hotspots where over-wintering birds congregate.

Vegetated shingle surveys have noted a significant increase in perennial vegetation, but a sporadic occurrence of annual drift line vegetation. In discussion with Natural England (NE), more detailed analysis is underway to tease out the variation in annual vegetation and which factors – natural or man-made – may be responsible.

In recognition of local declines in breeding ringed plover, the project developed and implemented a trial enclosure on Gunner Point in 2018. The results were positive, so it was determined that a larger enclosure was required – a project led by local birders – which resulted in a significant permanent and seasonal fence being erected in 2021. In the summer of 2023 a minimum of 9 ringed plover chicks fledged. The RSPB Life on the Edge team is now leading on wardening and monitoring the success of this project.

Monitoring of birds (watching briefs of activity, nocturnal surveys, UAV, and breeding bird surveys) and vegetated shingle (annual survey of Gunner Point and five yearly surveys of the entire frontage) will continue throughout the 2024-2029 BMP.

5.3.7. RECORDING ACTIVITIES

All beach management works should be logged for inclusion in the Annual Beach Management Report (Section 6.2), and template for this report is available. In addition, all volumes of material should be recorded in a spreadsheet and provided to MMO (as required) and CCO for their records to assist with annual beach reporting. Areas of extraction and deposition should be logged throughout each operation to allow for future consideration within any sediment budget analysis.

5.4. MANAGEMENT PROGRAMME

5.4.1. MANAGEMENT AND SUPERVISION

All works carried out as part of the BMP will be managed and supervised by appropriate officers working on behalf of Coastal Partners. Coastal Partners has long standing experience of managing and supervising the ongoing beach management operations on Hayling Island.

5.4.2. TRANSPORTATION OF MATERIALS

The transportation of materials on and off Hayling Island to the BMP study area will be carried out in line with the appropriate conditions set out in the relevant HBC planning permission. For the ongoing beach recycling works this includes restrictions on the hours between which heavy plant can be delivered to the site compound, and the route to be used to access the compound (Appendix L). Where no conditions are stipulated due regard will be paid to reducing the impact that any delivery to the site will have on the residents of Hayling Island. In the case of marine-based recharge the delivery of nourishment material via 'rainbowing' will necessitate 24 hour working and local residents will be warned of any potential disruption well in advance of the operation (Appendix H).

5.5. RELEVANT INFORMATION

The following provides a list of all sources of information that have been referenced in this section of the beach management plan.

Ref 5.1 **Beach Recycling Planning Permission 09/53949/008**, Havant Borough Council as Local Planning Authority (2009).

6. REPORTING AGAINST OBJECTIVES

6.1. REPORTING PROGRAMME

The recommended reporting programme is set out in Table 6.1 and incorporates the annual reporting of various logs and data collected as part of the RCMP (Section 4.1) and maintenance regime (Section 5.1.2). The schedule set out in Table 6.1 identifies all individual logs and reports required by the BMP annually. Where the logs or reports are dependent on events to trigger them (e.g. storm/flooding log or structure maintenance log), the timings shown in the table are indicative. **There are three reports which are required annually as part of the licencing for the BMP. These are the Annual Vegetated Shingle Report, the Annual Beach Monitoring Report, and the Annual Beach Management Report. These reports will inform the ongoing Beach Management Activities, providing recommendations if change is required.**

Table 6.1: Indicative BMP reporting schedule, assuming March & September recycling and recharge operations

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Structure Maintenance Log							x					
Storm / Flooding Event Log	Report as required throughout the year											
Beach Recycling Log			x	x					x	x		
Beach Recharge Log			x	x					x	x		
Beach Visual Inspection Log	x	x	x	x	x	x	x	x	x	x	x	x
Annual Vegetated Shingle Report							x					
Annual Beach Monitoring Report							x					
Annual Beach Management Report							x					

6.2. ANNUAL BEACH MANAGEMENT REPORT

The annual beach management report will be produced in July annually and will record and summarise the beach management activities over the past year and their impact, if any, on the wider South Hayling frontage. The works will be placed in context by reporting on the wave climate and water levels, including any storm events. As during the 2017-2022 BMP, the report will include the following chapters:

1) Beach Management Activities: contains a summary of the beach management activities undertaken over the previous year, including a summary of any recycling or recharge operations as well as any maintenance to control structures.

2) Wave Climate & Water Levels: contains a summary of the wave climate and water levels over the previous year, incorporating information from CCO annual reports. Any significant storm events should be assessed in this section.

3) Performance of the Nourished Beach: the results of ongoing monitoring should be assessed and compared to the design beach parameters to analyse the performance of the beach over the previous year. This will help to determine the Standard of Protection achieved by the beach management activities. Any trends in beach performance should be identified. This analysis will use the pre- and post- works surveys alongside additional regional monitoring surveys, from which the design profile graph (Figure 2.16) will be updated.

4) Overall condition of the South Hayling frontage: this section will contain a summary of the overall beach condition, drawn mainly from the beach monitoring report (Section 6.3). It will relate any works on the beach to the overall beach condition.

5) Changes in operational practices: this section will identify any changes in practice over the past year. Any decisions should be summarised, and background evidence included in an appendix. Any changes in land ownership should also be included within this section.

6) Summary: a summary of all preceding sections of the report, including reference to the performance of the BMP over the whole period.

7) Recommendations: any recommendations resulting from ongoing monitoring should be set out in this section of the report.

8) Appendices: this should include the following items:

    a. Structure maintenance log

    b. Storm / flood event log

    c. Beach maintenance log

    d. Beach maintenance plot

    e. Beach visual inspection log

    f. Annual beach monitoring report (Section 6.3)

    g. Annual vegetated shingle / bird monitoring report (Section 6.4)

These appendices may or may not be consistent throughout the life of the BMP, depending on storm events and timings of structure inspections.

6.3. ANNUAL BEACH MONITORING REPORT

The annual beach monitoring report will be included as an appendix to the annual beach management report (Section 6.2) and will provide an analysis of the beach monitoring over the previous year. The report will be completed during June and July annually. This will also allow time for the report to be provided to the Hayling Golf Club (if required) prior to a request for access to Gunner Point for sediment extraction during any autumn campaign. If the results from the SRCP annual report is available, this should also be incorporated.

The report should include the following items:

a. Beach plan form analysis, using pre- and post- works survey data.

b. Beach profile analysis using Regional Monitoring profile data.

c. Beach volume and cross-sectional area change analysis.

d. Beach sediment tracer analysis. This should be included when any tracers are deployed, or any retrieval surveys have been undertaken in the preceding year.

e. Sediment budget analysis.

f. Wind, wave, and water level assessment.

g. Sediment sampling results. This should be included when any sediment sampling has been undertaken in the preceding year and compared to previous sampling results.

The beach volume and cross-sectional area change analysis section will include a summary of all beach changes, including Gunner Point.

6.4. ANNUAL VEGETATED SHINGLE / BIRD MONITORING REPORT

The annual vegetated shingle report and bird monitoring report will be included as an appendix to the beach monitoring report (Section 6.3) and will be compiled in conjunction. The report will detail the results of the annual vegetated shingle surveys and ongoing bird monitoring. This will help to guide ongoing works and refine any mitigation measures which were put in place where this could benefit the environment. Ideally a survey of the annual vegetated drift line habitats / vegetated shingle should be carried out in late July, and therefore this report will be included with the overall beach management report just before submission. Should any works be required at Gunner Point, the survey may be brought forward to early July to ensure enough time for discussions with Hayling Golf Club.

7. ACTION PLAN

This section provides a summary of the recommendations made throughout the rest of the BMP in the form of an action plan. The action plan is presented in Table 7.1 and identifies actions by type as being either for 'monitoring', 'maintenance', 'emergency planning', 'reporting', 'research' or 'analysis'.

It is intended that this Action Plan be used to guide future investment in this area which will ultimately enable more appropriate, effective, and efficient maintenance practices to be established and implemented along the BMP area.

Table 7.1: Action Plan

ACTION TYPE	ACTION DESCRIPTION	WHEN BY?	RELATED BMP SECTION(S)
Operational Investigations	Undertake further analysis of bi-modal waves on Hayling Island in collaboration with other studies which are ongoing / planned during the BMP period	March 2029	3.2.4
Environment	Renew the MMO licence prior to expiry on 30/09/2027	September 2027	Appendix E
Environment	Renew the Chichester Harbour Conservancy Works Licence (1971 Section 45) prior to expiry during the BMP period	January 2028	Appendix E
Maintenance / Reporting	Should any maintenance issues be identified on privately owned and maintained land, the appropriate landowner / maintainer will be notified of the defect and works undertaken.	Ongoing	5.1.2
Maintenance	Future campaigns should focus sediment extraction on the areas of growth on the open frontage, including Gunner Point if permission is granted	Ongoing	5.1.1
Operational Investigations	Sediment budget analysis including the nearshore zone, Chichester Harbour and Langstone Harbour ebb delta systems should be undertaken to understand any interaction between the systems. This is particularly required at Chichester Harbour given the maintenance dredge of the bar	Annually	2.5
Maintenance	Arisings from maintenance dredging of the Chichester Harbour Entrance Channel should be a preferred source of material for the BMP. This is a beneficial re-use of material that has arisen from this sediment cell	Ongoing	5.1
Operational Investigations	Ongoing monitoring should be designed to detect the early signs of a decline of the West Pole. New multi-beam data should confirm this.	January 2025	2.5.2
Maintenance	Liaison with HISC and MDL Marinas should continue and the possibility of incorporating some sand extraction in to the recycling operations considered if	Ongoing	2.6

	requested, and access around Eastoke Point is possible		
Maintenance	Clearance of shingle in front of the RNLI station should be considered, if access to the location is possible and the material is the right grading for beach recycling activities	Ongoing	2.6
Maintenance	Movements of small quantities of shingle around to Ferry Road car park should be considered whenever extraction from Gunner Point is undertaken, in discussion with Hayling Golf Club	Ongoing	3.1.1
Operational Investigations	If the design profile at Eastoke Corner and Creek Road cannot be maintained, further investigation should be undertaken in to the control structures here. This should tie in with any additional work undertaken in the Eastoke Drainage Study and Eastoke Peninsula FCERM Scheme.	March 2029	3.1.2
Monitoring	Monitor the beach levels at Eastoke Point, and if required bring in additional material to reinforce the structure toe	Annually	3.1.3
Operational Investigations	Undertake further assessment of bimodal waves on Hayling Island, following on from the successful project undertaken in 2020. This may include the validation of modelled data using Wirewall or in a wave flume, with additional model runs as suggested.	March 2029	3.2.4; Appendix K
Monitoring	Beach monitoring data should be continually collected to inform the revision of the BMP in 2028/29, providing a large quantity of field data to assist with coastal process understanding	Ongoing	4.1
Monitoring	Beach profiles should be collected following all major storm events, as requested by the BMP project manager to inform ongoing beach management responses	Ongoing	4.1
Monitoring	Bathymetric surveys should be undertaken as part of the SRCMP. These surveys are planned for year 1 (whole frontage) and years 3 and 5 (ebb delta's only) in line with the agreed programme	March 2029	4.1
Monitoring / Reporting	Visual inspections should continue along the southern frontage, noting the condition of the beach alongside the condition of any structures (e.g. groynes / splashwall) in line with the CP asset inspection programme. Any significant defects or structures in poor condition should be noted and inspected further	Annually	4.1; 1.5.1
Monitoring / Reporting	The regular tracking of beach sediment tracers should continue along the South Hayling frontage. A trial study of acoustic	March 2029	2.5

	tag tracers should continue to be monitored to determine their use going forwards for the BMP.		
Monitoring	A set of sediment samples should be undertaken in years 2 and 4 of the BMP	April 2028	2.5; 4.1
Environment	Vegetated shingle surveys should be carried out in July annually, prior to the September campaign to determine the presence of vegetated shingle and the location of the annual vegetated drift lines. An ecological walkover for nesting birds will also be undertaken during nesting season	Annually	6.4
Environment	Any environmental requirements stipulated as part of planning, licenses and consents should be incorporated into the BMP monitoring programme	Ongoing	Appendix G; Appendix E
Operational Investigations	The BMP should support, where possible, the development of a new numerical coastal model which covers the BMP frontage in adequate detail to improve the understanding of sediment transport under various wave conditions.	March 2025	2.5.2
Monitoring / Reporting	Details of storm conditions should be recorded (waves and water levels) alongside mapping of any flood extents where safe and possible to do so	Ongoing	6.2; Appendix C
Monitoring / Maintenance	Removal of the remaining section of revetment at West Beach should be considered if the structure deteriorates and is no longer serviceable	--	2.6
Monitoring / Maintenance	The performance of the remaining groyne at West Beach (g53) should be investigated if the remaining section of the West Beach revetment is removed. If deemed redundant the structure should be removed	--	2.6
Maintenance	When working on the beach, ensure that safe public access is permitted. Measures should include the use of banksmen where appropriate, signage to direct the public, and temporary diversions as required. This should be supported by information boards to explain the works	Ongoing	5.3
Maintenance	Ensure that adequate on-site supervision and signage is deployed to direct the public away from work areas during works on site	Ongoing	5.3
Maintenance	Request permission from Hayling Golf Club prior to any works at Gunner Point. Provide a briefing note alongside a depiction of beach volume change and a specific request for beach volume extraction	Annually	5.1.1
Maintenance / Reporting	Provide notification of beach works to landowners and key stakeholders ahead of	Ongoing	5.3.5

	any works on the beach, including any requests relating to the works		
Reporting	Produce the three reports as required by the BMP to satisfy the MMO consent: Annual beach management report, annual beach monitoring report and annual vegetated shingle report	Annually	6.1
Maintenance	Any maintenance should be included in the Structure Maintenance Log	Ongoing	6.1
Monitoring / Reporting	Continually assess the project finances, expenditures, and efficiencies. Report and resolve any issues at the earliest possible stage (e.g. contingency application / emergency works application)	Ongoing	--
Monitoring / Reporting / Research / Environment	Undertake a review of this BMP	2028	--
Operational Investigations	Investigation in to nearshore sediment transport along the Eastoke frontage, including between Eastoke Point and the Chichester Harbour Approach Channel	March 2028	2.7
Operational Investigations	Real-time impact of long period swell waves and bi-modal events on wave run-up, overtopping and beach profile evolution	Ongoing	2.7
Operational Investigations	The impact of the East Winner ebb tidal delta on wave refraction and sediment transport at West Beach and Gunner Point	March 2028	2.7

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