
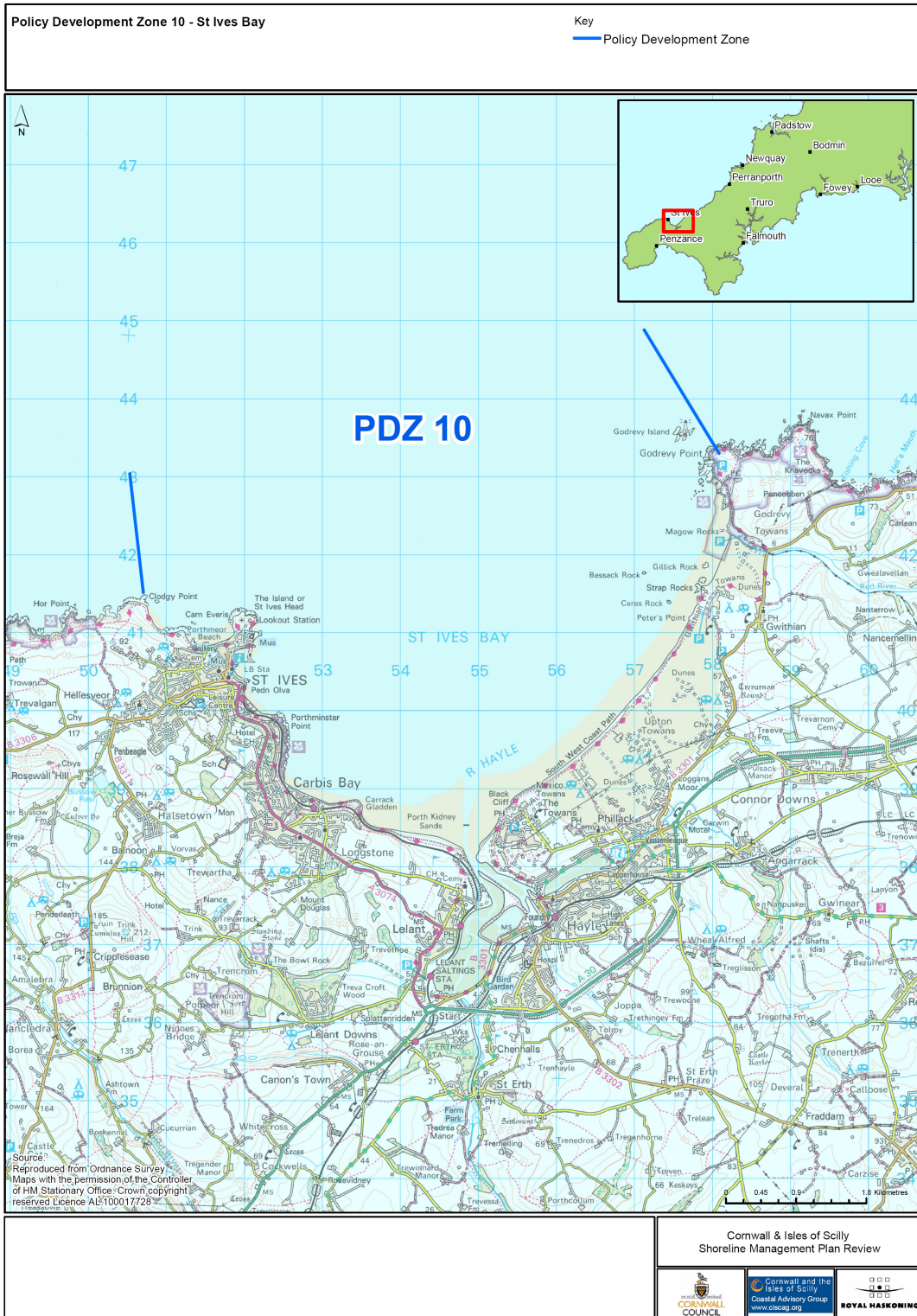



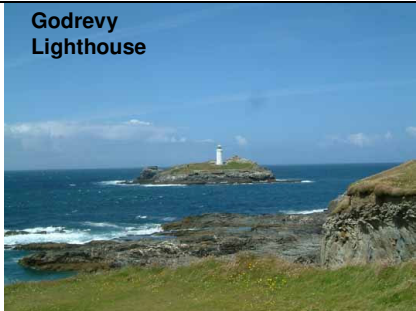


PDZ: 10	Clodgy Point to Godrevy Point	Management Area 25 Management Area 26 Management Area 27 Management Area 28
<div style="text-align: right; padding-right: 20px;"> Looking toward Hayle from Godrevy Towans </div> 		
<p>Clodgy Point to Godrevy Point</p> <p>This area encompasses St Ives Bay and is made up of both developed coastline and extensive dunes. The area contains all of the beaches, harbours and cliffs of the coastal towns of St Ives, Carbis Bay and Hayle. This includes the sandy beaches of Porthmeor, Porth Gwidden, St Ives Harbour and Porthminster. It also includes the large extensive sandy beaches of Carbis Bay, Porth Kidney, Hayle, Gwithian and Godrevy, along with the associated dune systems (Towans) of Hayle, Riviere, Mexico, Phillack, Upton, Gwithian and Godrevy. It also includes the Hayle Estuary.</p>		



General Description	
Built Environment	
<p>The fixed assets in this area are significant. The towns of St Ives, Carbis Bay and Hayle are densely populated areas. These areas contain much infrastructure including the rail link between St Ives and St Erth and the raised A30 trunk road skirting the Hayle estuary. Schools, emergency response centres, care homes, electricity sub stations and Hayle sewage treatment works are all within close proximity of the frontage. Development significantly reduces on the coastline north east of Hayle, being made up of the extensive sand beaches and dune systems that run towards Godrevy Point.</p>	 <p>Porthmeor</p>
Heritage	
<p>Historic features in the area include the harbours of Hayle and St Ives and features connected to the Cornwall and West Devon Mining Landscape WHS (The Port of Hayle). Important prehistoric and medieval settlements are associated with Godrevy and Gwithian, part preserved under the extensive dune system. Upton Towans contains the important remains of an extensive explosives works.</p>	 <p>St Ives Harbour</p>
Environment and Nature Conservation	
<p>A range of nature conservation designations exists along this frontage. These include Local Nature Reserves at Gwithian Green, Gwithian Towans, Upton Towans and along the Red River Valley. Gwithian to Mexico Towans are designated as a SSSI, as is the Hayle Estuary and Carrack Gladen. Also present is the Aire Point to Carrick Du SSSI and Godrevy Head is designated as a Geological SSSI.</p>	 <p>Godrevy, Geological SSSI</p>
Recreation and Amenity	
<p>Tourism is the major source of income particularly for St Ives, with recreation and hospitality industries thriving. A major feature of the town is the Tate St Ives Gallery, located just above Porthmeor Beach. The Hayle harbour area is under going a period of decline, but with a significant regeneration proposal under consideration. The off-shore Wave Hub (wave and tidal power generating platform) is planned in this area, with power cables landing at Hayle. The Godrevy area is owned and</p>	 <p>Godrevy Lighthouse</p>

<p>managed by the National Trust and is an extremely popular site, attracting tens of thousands of visitors every year.</p>	
<p>Key Values and Drivers</p>	
<p>The beaches, dune and estuary environment of this area are the key values for this policy unit. These features are the foundations upon which the communities in this area have developed historically as fishing and port towns for trading and export of metals. Today the amenity value of these features for tourism and recreation are essential for the viability of the communities and this is built around shoreline management intervention at St Ives, Carbis Bay and Hayle, and non-intervention at the dunes and at Godrevy Head.</p> <ul style="list-style-type: none"> • Tourism and recreation • Amenity value of beaches and dunes • Fragility of dune systems • Transport links • Significant infrastructure, commercial and residential in this areas serves the residents and tourists of the Land's End peninsula • Environment and landscape designations • Cornwall and West Devon Mining Landscape WHS features 	
<p>PDZ Management Intent</p>	
<p>The overarching management principle is therefore to manage the coast at St Ives, Carbis Bay and Hayle to maintain the amenity value of the beaches, harbours and surrounds, and to allow the natural and unconstrained evolution of the coast along the remainder of the St Ives Bay shoreline. In addition, all management should support the adaptation and resilience of the coastal communities, particularly St Ives, which is likely to display most sensitivity to climate change and sea level rise.</p>	

<p>Physical Coastal Processes (further details are provided in Appendix C)</p>
<p>This unit comprises the deeply concave St Ives Bay. The area is underlain principally by sedimentary rock (Devonian slates) although the settlement of St Ives is perched upon the north-eastern edge of the Penwith granite extrusion. It is from this granite that the resistant headlands of St Ives Head and Porthminster Point are formed.</p> <p>The great majority of this frontage displays a wide, shallow-sloping sandy intertidal area. Much of the intertidal area in the central and eastern part of the Bay are backed by extensive dune fields (the Towans). Godrevy at the north-east end of the Bay has around 500m of head cliffs which are actively eroding.</p> <p>The western end of the Bay around St Ives is comparatively sheltered in relation to the far eastern end at Godrevy. Atlantic swells from the west become increasingly refracted toward the western end of the Bay. Futurecoast (2002) concludes that Godrevy Point and St Ives Head provide key controlling functions within the Bay, however the general presence of Clodgy Head and the Penwith Peninsula provide the shelter (and therefore control) for the western end of the Bay from the dominant westerly wave climate. St Ives Head provides further shelter locally to St Ives Harbour, Porthminster Beach and Carbis</p>

Bay.

St Ives Head separates Porthmeor beach from the rest of the St Ives frontage. Porthmeor is considered as part of this Process unit as it has more characteristics in common with St Ives Bay than the coastline to the west of Clodgy Point. There are also possible sediment links and in management terms 'the Island' is a key feature as it acts to influence the retention of sediment for all of the St Ives frontage beaches.

The Hayle Estuary (formed from the River Hayle and River Angarrack) discharges into the southern-most part of the Bay. There are significant sediment interactions between the Estuary and the open coast of the Bay. The Bay itself is generally considered to be a closed sediment cell.

TIDE AND WATER LEVELS (mODN)

Extremes(mODN)									

Despite its sheltered location, the main St Ives frontage is vulnerable to large Atlantic swell conditions from the west and north-west, due to wave refraction around the Island (St Ives Head). The Porthmeor Beach frontage faces north-west and is the most exposed area.

The exposure of this frontage to the Atlantic wave climate ranges from the very sheltered north-east facing beach of Carbis Bay, to the very exposed westerly facing beaches at Godrevy (although offshore reefs give some shelter to the very northernmost part of the shoreline).

The annual 10% exceedance wave height is 2.5m – 3m, with a 1 in 50 year extreme offshore wave height of 20m. Recent wavebuoy recordings (at Perranporth) have demonstrated that significant wave heights frequently exceed 5m during the winter months and wave periods of 15 seconds and higher are not uncommon.

A small amount of wave energy from the north north-west penetrates into the lower end of the Hayle estuary. During high spring tides propagation further into the Hayle estuary is possible.

Tidal Flow

Tidal currents are generally weak, although they do increase in velocity around the headlands where they may have some local influence on sediment re-distribution. Mean tidal range is 5.2m.

PROCESSES

Control Features:

The bedrock geology is principally granite, giving way to Devonian slate cliffs towards Carbis Bay. The rocky headlands, which separate the beaches, are resistant and hold the beaches in their current positions. The 'Island' is an outcrop of rock joined to the main St Ives frontage by a narrower neck of rock that tends to entrap large amounts of sand (Futurecoast, 2002). Clodgy Point and Porthminster Point exert control on sediment movement to the

north-east and south-west of the frontage.

St Ives Bay is underlain by Devonian slates. Porthminster Point and Godrevy Point provide physical control on the plan shape of the Bay. They also generally contain the bay as an enclosed, self-contained sediment cell together with the Hayle Estuary.

There are no headland controls in this PDZ.

Existing Defences:

The eastern side of this PDZ has defences and harbour structures present along much the frontage. Much of the St Ives frontage is defended. Seawalls are in position along the rear of Porthmeor beach, Porthgwithden cove and all of St Ives Harbour. The large pier structure (Smeaton's Pier) which is orientated to the south, provides protection to the St Ives Harbour area from wave action and therefore provides both flood and erosion protection.

Defences are present along the rear of the beach at Carbis Bay. There are some defensive structures on the left hand bank in the vicinity of Lelant.

Quay walls are in existence around most of the Hayle frontage. They are generally in very poor condition and collapses have occurred in several locations. Sluicing gate structures exist at the entrances to the Carnewas and Copperhouse Pools and there are a range of flood defence structures operated by the Environment Agency that protect properties from both fluvial and tidal flooding. The Copperhouse Pool sluice works in combination with the pool to store river flows in times of high tides to prevent fluvial flooding, and with high ground levels either side of the sluice to defend properties from tidal flooding.

The Causeway and embankments on either side of the Hayle River act to protect properties in and around St Erth from flooding.

There is an artificially created bund that exists in place at the rear of the beach between Gwithian and Godrevy. This was created to provide defence to the former sand extraction works located behind the beach.

Processes:

SMP1 reports that the beaches of St Ives are composed of 80% marine shell sources. There are believed (Futurecoast, 2002) to be continuing contemporary sources of material available to the beaches. The beaches appear to behave independently of each other with little other than onshore-offshore movement of sand in response to changes in the wave climate. Annual re-profiling of the beach at Porthmeor is undertaken to move sand back down the beach profile toward MLW (Penwith DC, February 2009). This accumulation of sand is due to movement by waves and wind, due to Porthmeor's more exposed nature.

The dunes behind the beaches of St Ives Bay have been subject to significant extraction practices in the past 100 years, particularly at Gwithian. Extraction of sand at Gwithian has now ceased however dredging of the Hayle Estuary channel has recently recommenced. Much sand extraction has therefore historically occurred at Gwithian and natural exchange between beach and dunes has not operated there for considerable amount of time. This may well have contributed to localised lowering of the beach and erosion of upper foreshore in comparison with the adjacent beaches toward Hayle.

Offshore sources of sand (marine shell) feed the beach via onshore transport. Historically, sediment also accumulated on the intertidal area due to both the Red River, which used to carry significant amounts of material derived from mine workings, and

from sluicing of the Carnsew and Copperhouse Pools in the Hayle Estuary which would flush significant amounts of sediment (fluvial, mine working and marine derived) out of the estuary and on to the beach. This sluicing practice ceased some years ago and considerable silting of the estuary has resulted. These previous anthropogenic sources of sediment make the overall current picture of sediment dynamics in St Ives Bay a complex one.

Babtie (2002) conclude that littoral drift within St Ives Bay is influential on sediment distribution and that the net direction of transport is from west to east. This is illustrated by the formation of a spit extending from Porth Kidney Sands eastwards across the mouth of the estuary. Futurecoast (2002) agrees that a north-eastward direction of transport is likely, however points out that there is no accumulation of sand against the Godrevy Headland. It is likely that the dominant drift is reversed under strong north or north-easterly storm conditions.

Aeolian transport of sand is an important factor in the overall sediment budget. Increased duration of inundation of the intertidal area due to rising sea levels could increase the cohesiveness of the sand and reduce the amount of material blow onto the dune areas.

Hayle estuary displays a flood dominance that results in a net transport of material into the estuary channel and pools. In combination with fluvial derived material, this is resulting in steady accretion in all areas of the estuary. Marine derived material appears to dominate the system as currently sand encroachment is occurring on the mudflats.

Dredging of the tidal entrance channel has historically been undertaken on an annual basis, to maintain navigable depths. Further regeneration work within the Harbour will have some impact on sediment regimes within the tidal channels and pools. The re-introduction of a sluicing regime has been discussed and piloted but as yet unsuccessfully.

Of the material dredged from the estuary mouth, 20% is re-introduced to the sediment cell (currently it is re-introduced to the Hayle Towans area). 80% of the material is sold and therefore represents a net loss from the system. It is reported that in the region of 15,000m³ is being dredged annually (Babtie, 2002). Concerns have been raised linking erosion of the dunes in the Hayle area (both at Harvey's Towans and at Gwithian and Godrevy) with dredging operations and this would benefit from further investigation. It should be noted however that any net removal of sediment from the nearshore and estuarine system is discouraged by the SMP unless strong evidence demonstrates no detrimental effects to surrounding areas.

Unconstrained Scenario:

Although unrealistic, because of the residual impact of defences, this scenario considers how the coast would evolve in the absence of defences.

The complex variation in the nature of the backshore and immediate hinterland within this unit dictates that there are likely to be different responses to coastal forcing in different parts of the bay. Those frontages that are heavily constrained will display greater sensitivity to climate change than the more naturalised areas. St Ives Bay is generally very characteristic of a high energy coastal environment, dominated by waves and wind and importantly displaying a sediment rich, wide and dissipative intertidal area - as such it is equipped to cope with the pressures of rising sea levels and increasing storminess.

There has been little contemporary change in the shape and position of the shoreline. Due to the constrained nature of the shoreline, there is a potential for coastal squeeze to occur in response to rising sea levels and increased wave energy over the next 100 years. Continued supply of material from offshore may offset these impacts to a degree.

It is likely that with continued input of sediment from marine organisms and erosion of the cliffs backing the beaches at Godrevy, Gwithian and Porth Kidney, the beaches will be able to generally maintain their width.

A continued cycle of erosion of the dunes, due to storms and then their replenishment by aeolian transport should occur. The Cornwall Sand Dune and Beach Management Strategy (Halcrow, 2009) suggests that access management should be practiced for the dunes in order to reduce frontal erosion and that beach replenishment may be necessary in the vicinity of Harvey's Towans in the future.

It is likely that the observed erosion and undercutting of the gravelly bund at the rear of the beach between Gwithian and Godrevy will continue and at some point in the short to medium term breaching will occur into the low-lying area behind. Futurecoast (2002) concludes that a permanent tidal inlet is unlikely due to the topography. Continued recession of the actively eroding cliffs at Godrevy will occur, possibly at rates of up to 1-2m/yr under a scenario where increasing sea level allows increasing wave energy to reach the toe of the cliffs.

Some siltation of the estuary away from the main channel is likely to continue under present management practices. Dredging of the channel will continue to represent a net loss of sediment to the wider St Ives Bay sediment cell under current licence arrangements. Some lowering of the foreshore and subsequent erosion around Hayle / Harvey's Towans may continue to occur.

POTENTIAL BASELINE EROSION RATES

Base rates have been assessed from monitoring and historical data. The range of potential erosion is assessed in terms of variation from the base rate and sensitivity in potential sea level rise. The base rates provided below are taken as an average based on historical records. The rates are a composite value based on erosion of the toe and recession of the crest of the cliff and reflect the erosion rates following failure of defences.

(Sea Level Rise assumed rates: 0.06m to year 2025; 0.34m to year 2055; 0.96m to year 2105.)

Location	Historic recession rate (lower) (m/100 yr)	Historic recession rate (upper) (m/100 yr)	Projected 100 year erosion rate (lower) (m)	Projected 100 year erosion rate (upper) (m)	Notes
St Ives	0	10	10	19.6	Wall at back of beach, 100 year SoP
Carbis Bay	0	1.5	0	2.7	
Gwithian	10	50	9.6	48	Dunes

BASELINE MANAGEMENT SCENARIOS

Present Management

Present Management is taken as that policy defined by SMP1, modified by subsequent strategies or studies. It should be noted that both in the case of SMP1 and that of many of the strategies undertaken before 2005, the period over which the assessment was carried out tended to be 50 years.

SMP1		
MU	LOCATION	POLICY
7A-2	Clodgy Point to carrick Du	Do nothing
7A-2	Porthmeor	Hold the existing defence line
7A-2	St Ives Head	Do nothing
7A-2	St Ives	Hold the existing defence line
7A-2	Carbis Bay	Hold the existing defence line
7A-2	Hayle Estuary	Hold the existing defence line
7A-2	Hayle and Gwithian Towans	Do nothing, Hold the line at Godrevy in short term

Economic Assessment

The following table provides a brief summary of damages determined by the SMP2 analysis for the whole PDZ. Further details are provided in Appendix H. Where further, more detailed information is provided by studies, this is highlighted. The table aims to provide an initial high level assessment of potential damages occurring under the two baseline scenarios. The damages for each epoch are current values. These are discounted to give present values in the final column.

ASSESSMENT OF EROSION DAMAGES

Epoch	0 -20 year		20 – 50 years		50 – 100 years		Total		
No Active Intervention	Number of properties	Present Value x £1000	Number of properties	Present Value x £1000	Number of properties	Present Value x £1000	Number of properties	Present Value Damages (£x1000)	
<i>Location</i>									
	9	937	162	8,288	188	3,494	357	12,719	
Total for PDZ									

ASSESSMENT OF POTENTIAL FLOOD RISK

Epoch	Flood risk tidal 2025		Flood risk tidal 2055		Flood risk tidal 2105		Total	
No Active Intervention	Number of properties	Present Value x £1000	Number of properties	Present Value x £1000	Number of properties	Present Value x £1000	Number of properties	Present Value Damages (£x1000)
<i>Location</i>								
	303	2,007	449	1,677	708	792	708	4,476

Management Areas

PDZ 2 has been sub-divided into 4 principal management areas, these being:

- MA25 Clodgy Point to Porthminster Point
- MA26 Porthminster Point to Hayle Estuary
- MA27 Hayle Estuary
- MA28 Black Cliff to Godrevy Point

Within these areas a summary of policy is provided below. Management Areas statements are provided in the following sheets.

PDZ 10: Clodgy Point to Godrevy Point Management Area Statements

MA25 – Clodgy Point to Porthminster Point

Covering previous SMP1 management units:

7A-2	Clodgy Point to carrick Du
7A-2	Porthmeor
7A-2	St Ives Head
7A-2	St Ives

MA26 – Porthminster Point to Hayle Estuary

Covering previous SMP1 management units

7A-2	Carbis Bay
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MA27 – Hayle Estuary

Covering previous SMP1 management units

7A-2	Hayle Estuary
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MA28 – Black Cliff to Godrevy Point

Covering previous SMP1 management units

7A-2	Hayle and Gwithian Towans
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Within these areas a summary of policy is provided below. Management Areas statements are provided in the following sheets.