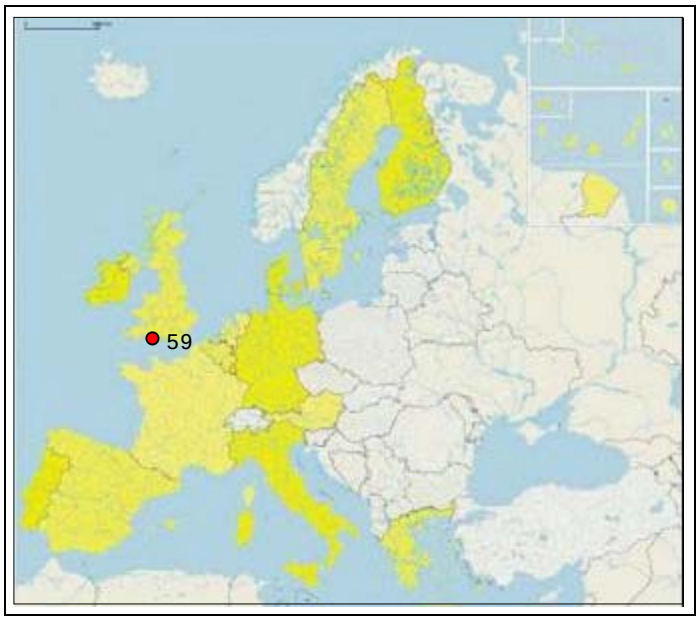
LUCCOMBE - BLACKGANG
ISLE OF WIGHT
(UNITED KINGDOM)



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1. GENERAL DESCRIPTION OF THE AREA

The Isle of Wight lies off the South Coast of England. Its 110km dynamic coastline is extremely diverse in terms of its geology and geomorphology and its coastal zone has a high nature conservation value with numerous international, European and national designations. This has resulted in a long history of managing coastal issues and finding innovative ways to reconcile conflicting activities and view points within the coastal zone. The pilot zone to be studied is the Ventnor Undercliff. The Undercliff extends for 12 km along the south coast of the Isle of Wight from Luccombe in the east to Blackgang in the west. The town of Ventnor (population 7,000) is the main residential area, together with the villages of Luccombe, Bonchurch, St Lawrence, Niton and Blackgang.

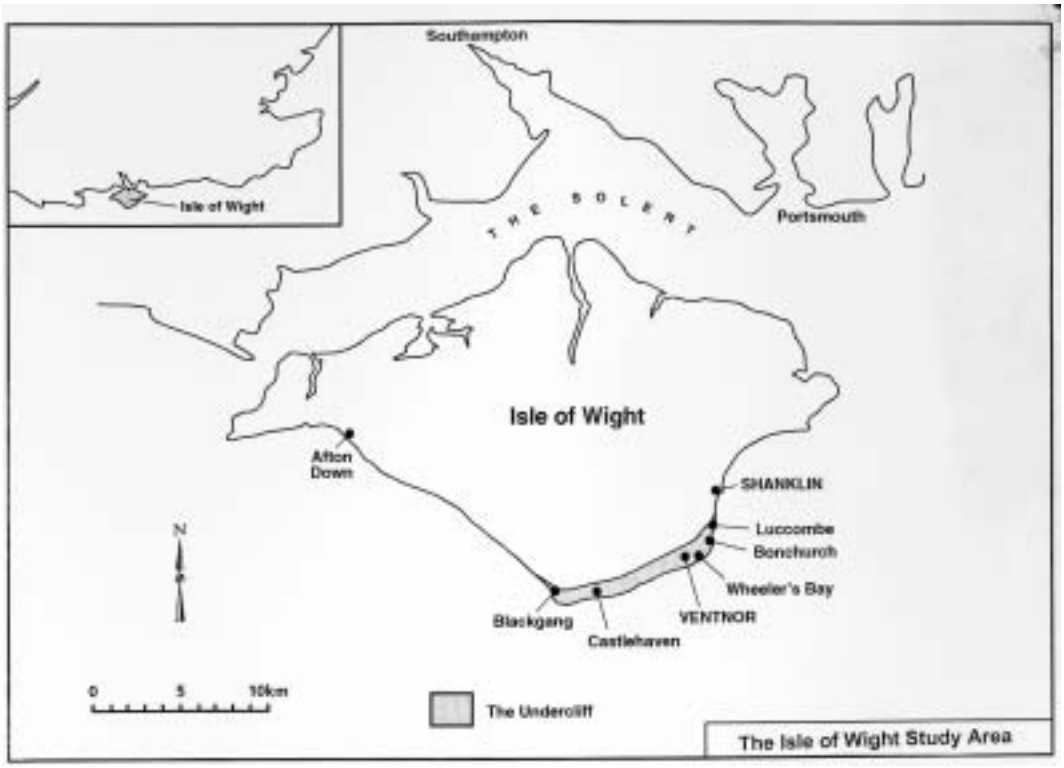

Fig. 1: Location map of the Ventor Undercliff area (Isle of Wight, UK).

1.1. Physical process level

1.1.1 Classification

- Sedimentary macrotidal (shingle beaches)

The Ventnor Undercliff is a soft rock landslide complex. The landslides themselves form a zone some 500m to 750m in width. These are fronted by sea cliffs of variable height, ranging from 10 to 80m in elevation.

Fig. 2: The Ventnor Undercliff – view East.

Fig. 3: The Ventnor Undercliff – view West.

1.1.2 Geology

The Ventnor Undercliff is formed within the Lower Cretaceous and Chalk outlier of the Island's South Downs. Its unique form results from the operation of marine erosion upon a gently south eastward dipping interbedded sequence of clays and generally weak sandstones.

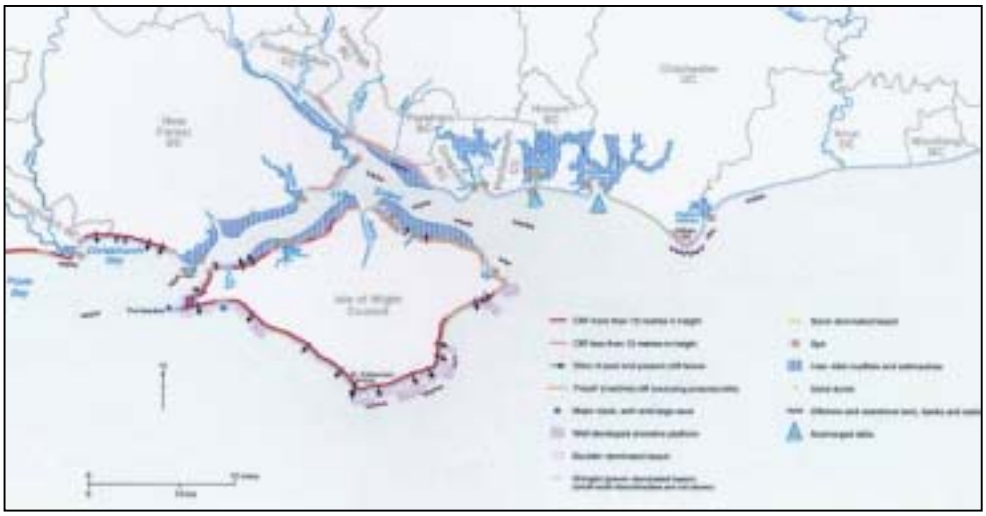

Fig. 4: Geomorphological map of the Isle of Wight.

Most of the offshore between St Catherine's and western Ventnor consists of bouldery landslide debris but in several small bays there are accumulations of fine to coarse gravels and cobbles. At Ventnor, the beach is made up of relatively coarse sand. Between Wheeler's Bay and Monks Bay there are boulders and small accumulations of shingle.

Erosion of the cliff face along the Undercliff yields a mixture of clay, sand, marl, chert and chalk.

1.1.3 Morphology of the coast

Blackgang to St. Catherine's*:* this unit as a whole has a history of landslide reactivation, related to complex feedbacks between rates of basal cliff erosion and the unloading of debris stones. Despite the intermittent delivery of large quantities of landslide debris to the foreshore, a lot of it boulder size, beach formation appears inhibited. The cliff toe therefore remains exposed to marine erosion.

St Catherine's to Ventnor: this is the classic component of the Undercliff coast, developed in the full succession of the Lower Greensand, Gault Clay, Upper Greensand, and Chalk. A strongly defined free face in the Chalk and Upper Greensand provides a backscar to the landslip complex, which is made up of a number of terrace like features. Several large detached landslide blocks have proved more resistant to marine erosion and coincide with headlands. Intervening bays are cut into softer materials**.**

Ventnor: at Ventnor various coast protection structures prevent cliff toe erosion along this frontage. The presence of seawalls along the Esplanade has inhibited beach accumulation. Although small, the beaches at Ventnor have shown relative stability in recent years.

Wheeler's Bay to Monks Bay: between Wheeler's Bay, which is fully protected by a stepped wall, groynes and tetrapod defences, and Monks Bay, the coastal cliffs are developed in landslide material, but with some exposure of the sandrock. At Monks Bay there is a detached breakwater together with beach re-nourishment, cliff re-grading and stabilisation measures.

The relief of the majority of the seabed around the island is fairly slight, with large areas effectively featureless. Offshore of the study area is an inclosed deep channel, St Catherine's Deep, which is up to 80 m below the adjacent seabed. This is considered a relic valley, maybe an ancient estuary mouth as it is too deep to have been created by recent waves and tide.

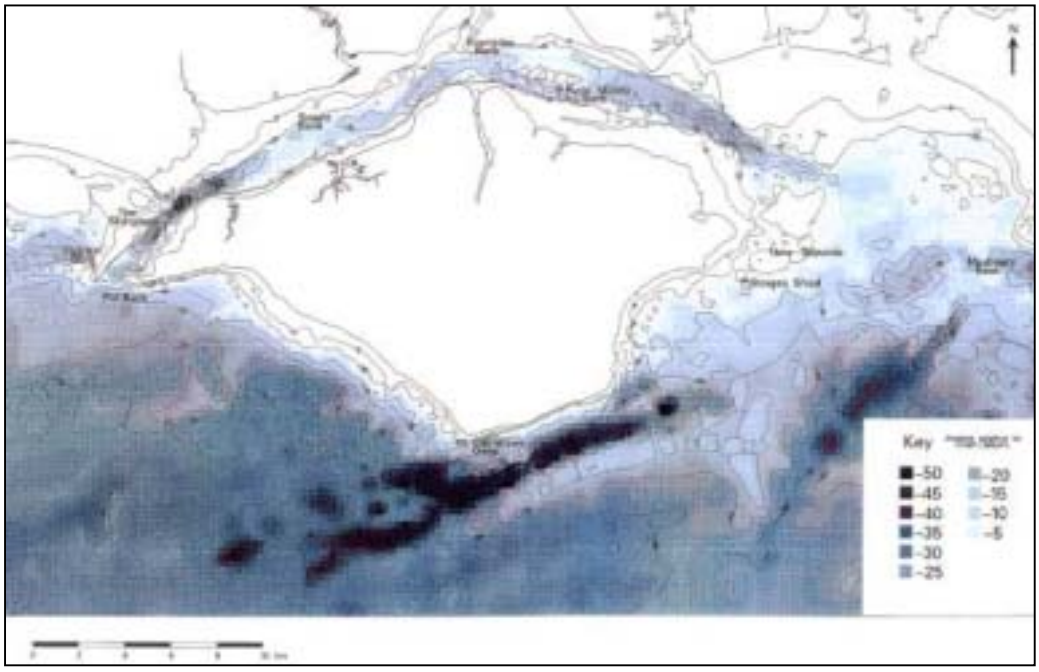

Fig. 5: Offshore bathymetry map of the Isle of Wight.

1.1.4 Physical processes

Waves of exceptional energy have the capacity to move sediments from offshore sources. In the Ventnor beach area, net sand migration in the offshore zone would appear to be west to east, induced by wave action in combination with spring ebb and flood tide currents.

Recent trends in sea level rise are most relevant. Tide gauge measurements provides estimations from 2.0mm/yr to 4.0-5.0mm/yr. A combined future rate of sea-level rise of 6mm/yr, equivalent to the DEFRA south coast allowance is applicable to the Island generally, although the Solent shores may experience more rapid rates due to local subsidence. Future sea level rise is likely therefore to be more rapid than any rates recorded for this region over the past 5,000-6,000 years and has serious implications for shoreline management.

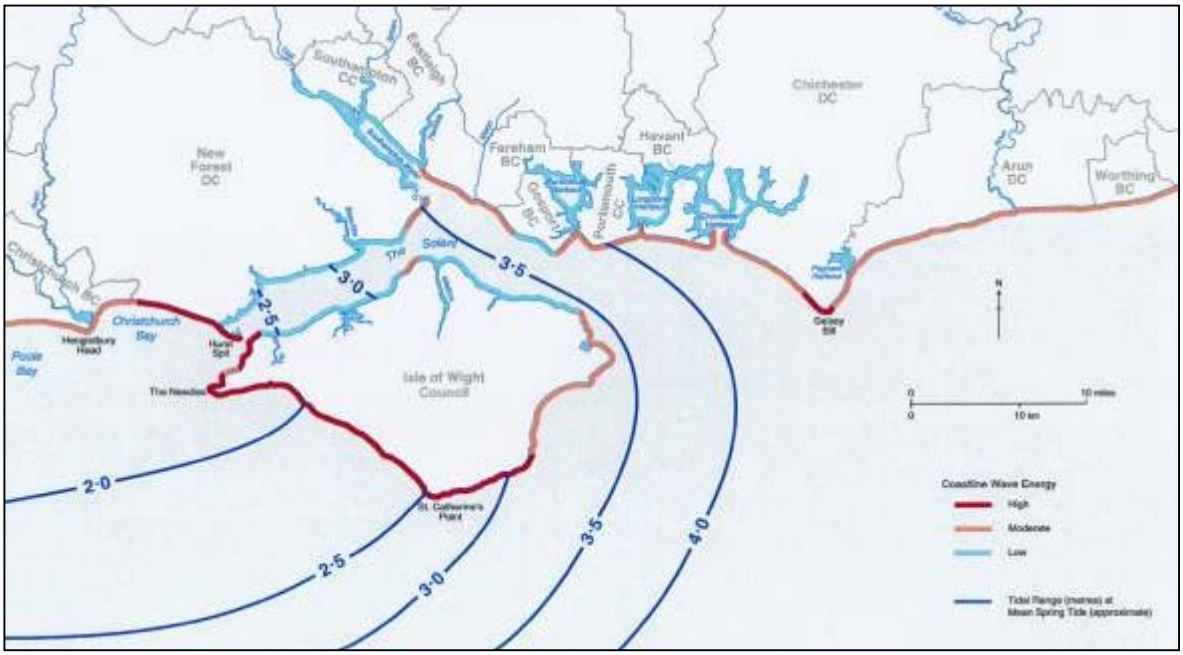

Fig. 6: Tidal currents and wave energy impact on the coast of the Isle of Wight.

1.1.5 Erosion

Sediment input in the study area was almost entirely derived from Cretaceous sands, silts and clays. There is a very limited fluvial input to the system from 4 rivers along the south coast totally less than 100m^3/yr of fine sediment. The total supply rate is in the order of 120,000m^3/yr. The erosion over a period of 75 years, considering the predicted retreat "without defences", varies between 60m and 180m.

Fine sediments are transported offshore, coarse material may remain within the confines of each bay. Generally, the pocket beaches within the coves and bays along the study frontage exhibit easterly drift. The causes of erosion are due to: south-westerly storm waves and coastal landsliding.

Most of the frontage between Ventnor and Monks Bay has been protected over the past 100 years and cliff recession is now too slow to be measured accurately. Mean pre-protection

recession of 0.43m per year recorded between 1866 and 1909 indicated the possible cliff behaviour should defences be removed.

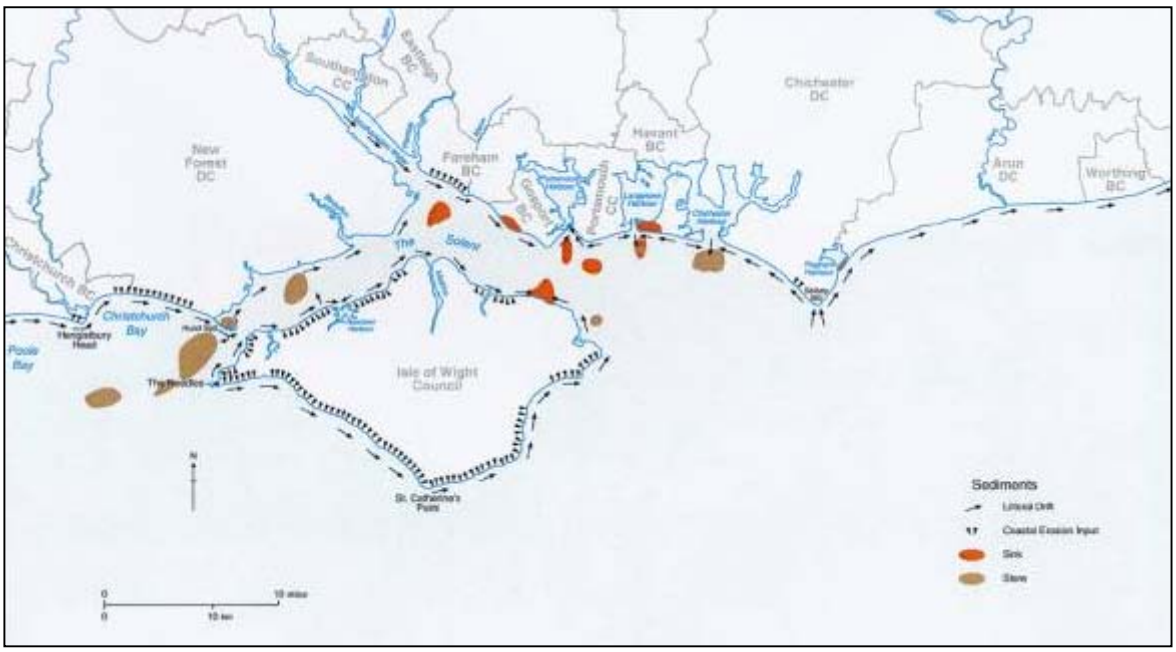

Fig. 7: Sediment transport – inputs, pathways, stores and sinks – of the Isle of Wight.

1.2. Socio-economic aspects

1.2.1 Population rate

The permanent population of Ventnor and the Undercliff is 7000 inhabitants.

1.2.2 Major functions of the coastal zone

- **Transports:** the principle road A3055, which continues round the whole of the coastline of the Isle of Wight, runs from east to west through Bonchurch, Ventnor and Niton to Blackgang and on to the West Wight. A second important road, B3327 Newport Road, leads from the town of Ventnor to Newport. A railway line extended down the east coast of the Island from Ryde to Ventnor up until 1966 but, as a result of cuts in the rail programme at that time, the route terminated at Shanklin four miles to the north of the town of Ventnor. The main roads through the Undercliff are affected by the combined effects of coastal erosion and ground instability at several locations and remedial works are currently in progress to re-open the main road between Ventnor and Niton.

- **Tourism:** Ventnor has a popular bathing beach where boating and fishing are encouraged. A number of other tourist attractions are located within and around Ventnor. The beach at Ventnor is a relatively popular traditional beach with an esplanade and beach activities centring around swimming, surfing, and beach fishing.

- **Ships and ports:** up until 1993 there was a pier at Ventnor but this has been closed for a number of years prior to then because of its poor structural conditions. The pier was demolished in 1993 following a fire. It is proposed to construct a small fair weather yacht haven at Ventnor. The harbour will fulfil both commercial and amenity purposes.

- **Fisheries and aquaculture:** there is a small commercial fishing operation that operates from Ventnor beach. This business consists of a small shop on the seafront and a fleet of two 20ft boats.

- **Urbanisation:** the town of Ventnor is the main urbanised area in this study area. Either side of this town are the settlements of Bonchurch and St. Lawrence which are semi-urbanised areas and provide a transition between the town and areas of open countryside.

- **Water management:** the EC Bathing Water Directive and Waste Water Directive set out minimum standards for the quality of bathing waters and sewage disposal into the sea. Sewage in the Ventnor area is collected into a sewage transfer station holding tank located beneath an observation platform on Ventnor seafront and then is pumped up through the town to a new treatment works and long sea outfall at Sandown.

1.2.3 Land uses

Many parts of the Undercliff have remained relatively stable and support a mix of landuses including towns and villages. The Bonchurch Landslips are designated SSSI and form part of the Solent and Isle of Wight maritime CSAC, because of the vegetated sea cliffs. The site is of value both for its flora and fauna and the geomorphological interest of its mass movement features. The whole of the coastline between St Catherine's Point and Ventnor was found to be of entomological interest, in a report commissioned by the Nature Conservancy Council in 1991.

1.2.4 Assessment of capital at risk

Capital assets in the Undercliff study area comprise land, property and infrastructure as well as the lives of the 7,000 local residents and visitors. Bearing in mind that the whole of the Undercliff study area is a major coastal landslide complex with a resident population, it is vital that coast protection measures are put in place where economically justifiable to reduce the impact of coastal erosion in terms of promoting ground instability.

At this time a major ground investigation is being undertaken in order to supplement geomorphological mapping undertaken previously and this study forms part of a quantitative risk assessment for central Ventnor which will further inform the planning process and assess whether there are any further engineering measures in addition to coast protection that can be undertaken to try and reduce the ground movement problem.

Fig. 8: Houses in serious risk of damage by cliff destruction.

2. PROBLEM DESCRIPTION

2.1. Eroding sites

Ventnor Undercliff area can be divided into 6 zones:

- From *Horse Ledge to Monks Bay* (VEN 1): in this unit cliffs are predominant and rise to 100m. This cliffs are formed in less resistant lithologies, resulting in instability. The predicted retreat is between 20m to 225m.

- From *Monks Bay to Steephill Cove* (VEN 2): in this unit the retreat is estimated between 60m and 140m. This is a risk for commercial, recreational and tourist structures.

- From *Steephill Cove to east of Binnel Bay* (VEN 3): in this unit cliffs are developed in landslide debris. In this cliffs, erosion of softer material has created bays. The expected erosion trend is between 80 m and 120m.

- From *east of Binnel Bay to Puckaster Point* (VEN 4): the erosion trend is betwwen 80m and 120m. The result of such retreat would be the loss of much undeveloped and agricultural land along the cliff top.

- From *Puckaster Point to West of Castlehaven*(VEN 5): in this unit the retreat of coast would result in the loss of substantial area of housing along the cliff top and agricultural and undeveloped land. The erosion predicted is between 100m and 180m.

- From *Castlehaven to St Catherines Point* (VEN 6): along this stretch of coast the cliffs are developed in landslide debris, with the beach predominantly formed of landslide debris including boulders. The predicted retreat for this unit is 75m. This would mean the loss of the Castlehaven camp site, cliff top agricultural land, and the lighthouse.

2.2. Impacts

An understanding of the Undercliff landslide complex has allowed the development of a landslide management strategy which has assisted the development of policies to combat coastal erosion thereby reducing ground instability.

Fig. 9: Severe damage to the A3055 as a result of coastal erosion and ground instability.

This understanding of ground conditions has enabled an assessment to be made of the relative susceptibility of assets including properties, roads and other infrastructures

3. SOLUTIONS / MEASURES

3.1. Policy options

The Shoreline Management Plan, which was ratified by the council in 1997, set out the strategic coastal defence policies for the entire length of the Isle of Wight coastline.

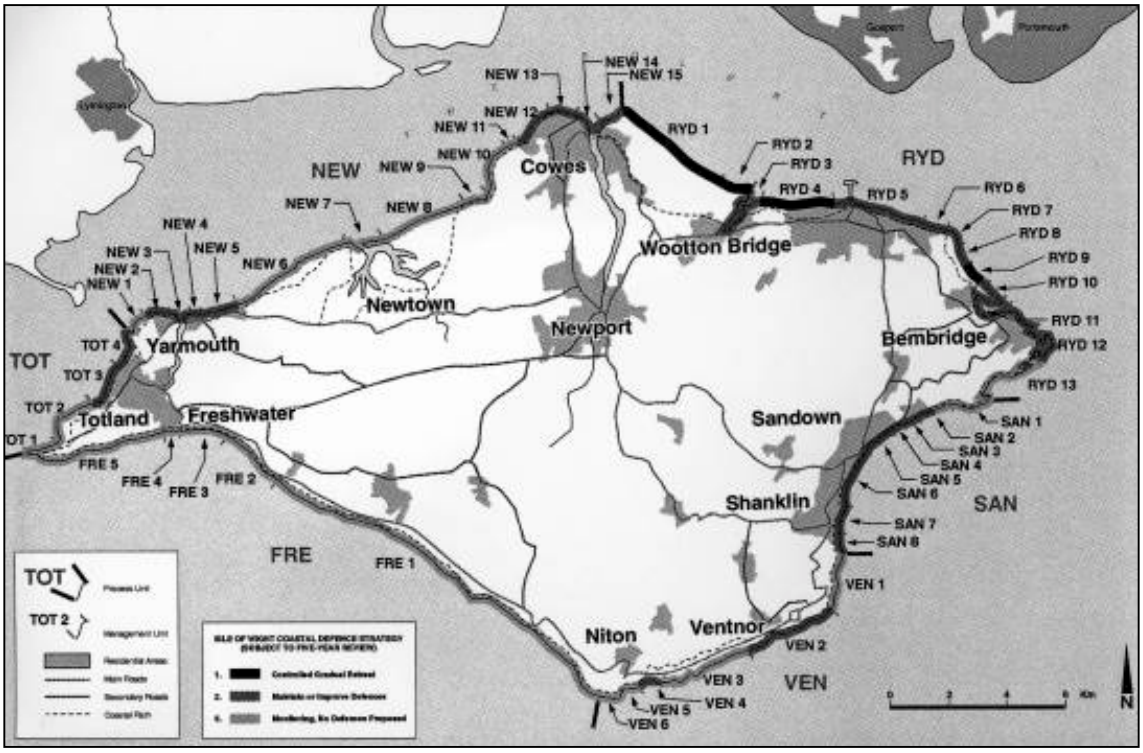

Fig. 10: The Shoreline Management Plan units.

The process unit in the Ventnor area was broken down into 6 management units and the policies decided as follows:

- VEN 1 Managed realignment
- VEN 2 Hold the line
- VEN 3 Managed realignment
- VEN 4 Managed realignment
- VEN 5 Hold the line
- VEN 6 Do nothing

3.2. Strategy

The shoreline management plan, as mentioned above, demonstrates that the chosen strategy is tailored to the coastal unit involved. When the strategy “hold the line” is considered, mostly hard measures are applied.

3.3. Technical measures

3.3.1 Historic measures

Coastal defences have existed along the developed frontages of the study area since 1850 when the Esplanade was constructed at Ventnor. These were the only defences in place in the Undercliff except for some Victorian timber groins. First defences were extended eastward from Ventnor to Bonchurch and then westwards to Steephill Cove. This programme of work has provided protection to the historically important and culturally significant town of Ventnor and the village of Bonchurch. Coastal Protection has been based on sound scientific evidence and has not been unduly influenced by politics.

3.3.2 Type / Technical details

Wheeler's Bay	Seawall	1980s
Ventnor Bay	Concrete wall and apron	1900s
	Masonry wall	1900
	Concrete apron	1987
Western cliffs	Rock revetment	1995
Steephill Cove	Concrete wall, rock revetment	1900s
	Rock groins	
Woody Bay	Protection scheme	1992

From *Bonchurch to Wheeler's Bay*: groins, rock breakwater, shore parallel offshore breakwater. Recent defences at Monks Bay with crests heights +4m and +3m, and the revetment at Horseshoe Bay with crest height +4.5m are in good condition. The seawall at Wheeler's Bay is in fair condition with a crest height of 4.1m and dates from the late 1980s.

The *Cowlease frontage of Ventnor* is protected by an 80m sloped block wall (crest height +6m) with concrete apron, toe pilling and armour, and a 100m block wall (crest height

+4,3m). Along Ventnor Bay there is a bullnose concrete wall protected by concrete tetra pods at its toe, and an early 1900s concrete wall and apron, which has more recent steel toe pilling.

Along *Ventnor Esplanade*, much of the 500m length of masonry wall built around 1900 has been reconstructed with crest height varying from +5.9m down to +4.9m. At the western end of the bay there are rock revetment in good condition with a crest height of +2.3m.

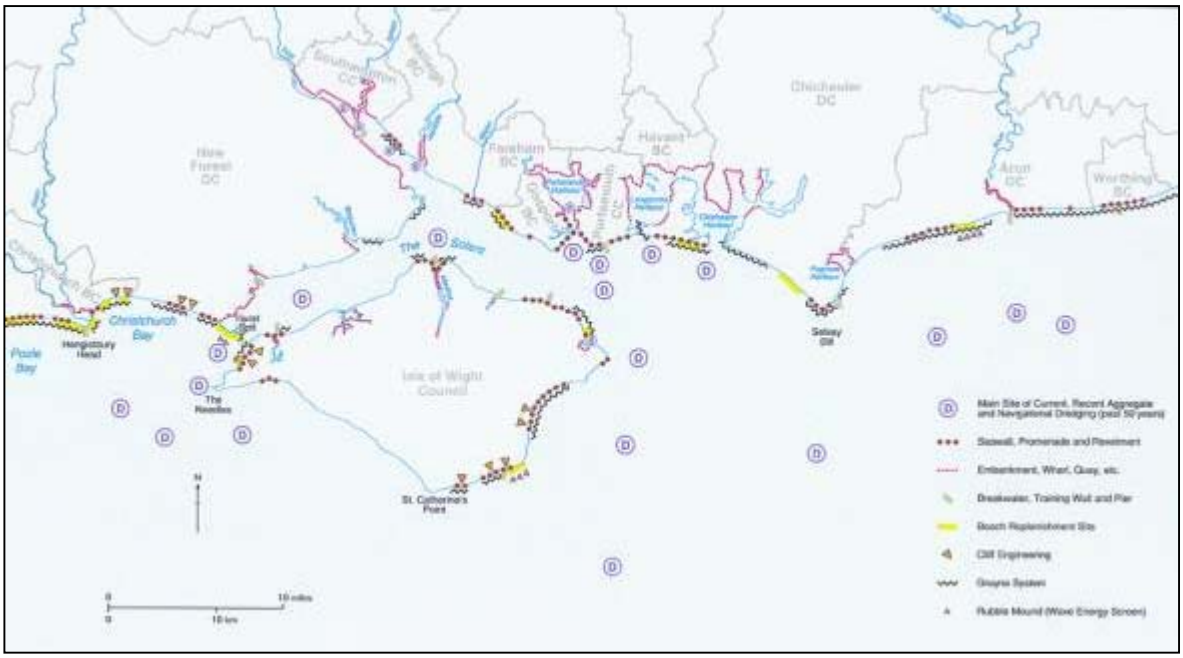

Fig. 11: Coastal Defence and Protection map of the Isle of Wight.

4. EFFECTS AND LESSONS LEARNT

4.1. Effects related to erosion

The immediately effects related to cliff recession are the loss of coastal land.

4.2. Effects related to socio-economic aspects

Residents along the Undercliff have in the past welcomed the provision of coastal defences. This is primarily because the coastal protection works have provided long-term protection for their properties and land. In such an area that is highly active in term of ground movement, properties are at risk of subsidence and have been lost in the past to the processes of landsliding and erosion. The population of Ventnor therefore recognises the profound benefits that engineering works have. There is also a financial benefit, as house prices are often higher in protected areas and insurance premiums will be lower.

4.3. Effects in neighbouring regions

Practically the entire extension of the pilot site is under erosion.

4.4. Relation with ICZM

The ultimate aim of coastal management in the UK is stated by the former Department of the Environment in its report Managing the coast as the achievement of “sustainable use”. A huge range of management plans and strategies have been developed to work towards achieving this aim. Although it is recognised that coastal management plans will not deliver sustainable use, in many areas they form an important part of the ICZM process. They can provide a focus for bringing people together and increasingly open up important opportunities for co-ordinating the range of bodies and interest groups in the coastal zone, providing mechanisms for resolving conflicts.

4.5. Conclusions

Effectiveness

All the typical defences analysed, covering defences at Horsehoe Bay, Cowslease and the Western Esplanade at Ventnor; at Wheelers Bay, and the defences at Cowslease and the Eastern Esplanade appear to achieve appropriate service levels though the risks to property are higher than perhaps is ideal.

The one exception is at Steephill cove where a case exists for the upgrading of defences to a uniform standard over the whole frontage.

The Councils work on coastal protection in recent years has identified the need for development of sustainable solutions to address the problems of coastal erosion sustainability in the study area. This has been achieved through an improved understanding of coastal evolution and natural coastal processes as set out in the SMP.

Gaps in information

Relevant information gaps at local and national level do not exist. One of the weaknesses in terms of research undertaken by Universities and other scientific institutions is often the inadequate dissemination arrangements. This has been highlighted in a report published by CIRIA entitled 'Maximizing the Use and Exchange of Coastal Data' (2000).

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