

SECTION 8

RECOMMENDATIONS FOR FUTURE WORKS

8 RECOMMENDATIONS FOR FUTURE WORKS

8.1 Shoreline Monitoring

Although it is obvious enough as a statement, the monitoring of the shoreline in order to see how it develops in response to changes in the local environment or to man's interference, is something that has seldom happened on a systematic basis. Historically, there was seen to be little need for monitoring. However, over the last 100 years or so, especially since the construction of the extensive coastal engineering works of the Victorians, much development has taken place close to the water's edge in what has subsequently become known as "coastal squeeze". The self-same structures that the Victorians created, making the coastline attractive to developers, also created changes in the shoreline that were sometimes detrimental to other shores downdrift of them. Changes occurred to coastlines either caused by works upstream or naturally generated which, crucially, affected the new developments and therefore were a reason for concern.

The contemporary evidence of local people living in and having intimate knowledge of an area over many years is extremely helpful in monitoring shoreline development. However, in terms of obtaining quantitative information about shoreline changes, folk memory is unreliable as there is often conflict between witnesses. Tied up however, with contemporary newspaper accounts and old maps, such data becomes invaluable but it is usually patchy in its coverage.

The accuracy of mapping by the Admiralty has increased vastly since the first officially published surveys of the Isles of Scilly were made over 200 years ago - a comparison of the most recent Admiralty survey of the Isles of Scilly with the original Graeme Spence survey has the Bishop Rock almost 200 m out of place although the general error throughout the archipelago was of the order of 20 m compared with modern position-fixing.

In coastal engineering, however, one is probably more reliant on Ordnance Survey mapping of the High and Low Water Marks. Historically, the OS measurements of the Low Water Mark would have been made during the brief intervals between tides and they would therefore be subject to those constraints: lack of time and paucity of readings from which to interpolate contours amongst them. Doubtless the High Water Mark would have been more accurately surveyed. The modern day tide marks are surveyed by means of aerial photography timed to coincide with the predicted Mean High and Low Waters and calibrated against local tide gauge measurements which means that a more accurate contour can be obtained. However, small-scale changes can be difficult to measure with accuracy because

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of the scale of the survey and the accuracy of or confidence in earlier surveys with which later surveys will be compared. All of this underlines the necessity of a programme of shoreline monitoring.

Owing to the high cost that shoreline monitoring can potentially incur, it is something that has to be carefully targeted in order to achieve the maximum benefit. This is particularly true of the Isles of Scilly which has very tight budgetary constraints. Recommendations for shoreline monitoring have therefore been drawn up based on the minimum essential information required and are as follow below. The results of the surveys can be input to the Geographical Information System (GIS) that the Council has recently purchased for ease of comparison with existing OS data and future surveys.

8.1.1 St Agnes

New works have recently been constructed in the area of Big Pool at Porth Killier, Porth Coose and Periglis. It will be necessary to assess the impact that the new works have had in the area and a survey should be carried out at the end of the maintenance period (one year after construction is complete) and annually thereafter for the first five years. Further monitoring should then be undertaken at five-yearly intervals. It will not be necessary to carry out complete topographic surveys but merely to measure the critical cross-sections. These are identified in Figure 8.1.

There already exists a body of detailed local topographical information. A detailed topographic survey of the Big Pool area was made by the Council in November 1992 which forms a very useful starting point for comparison of changes. It should be noted, however, that in early 1996, prior to the new works being commenced, there had been some quite large changes to the upper beach particularly at the junction between Porth Coose and Periglis. Initial site possession surveys were made in April 1996 prior to the new coast protection works being started and a post-construction survey was carried out on completion.

8.7.2 Bryher

New works were completed at Great Porth and Popplestones Bay in May 1995. Pre-construction surveys at Great Porth, Great Popplestones and Little Popplestones were made in November 1994 with post-construction surveys of the beach and works completed in May 1995. An earlier comprehensive topographic survey of Bryher from Stony Porth in the south to Popplestone Brow in the north was made by the Council of the Isles of Scilly in November 1992.

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The works completed in the north of the island were surveyed at the end of the maintenance period (May 1996). This survey should be followed up by a survey approximately five years following construction. It is suggested that a complete topographic survey is unnecessary but that selected cross-sections (see Figure 8.2) should suffice. Further to surveying of the works, monitoring of the retreat of the beach crest should be monitored at Rushy Bay/Stony Porth. This may be undertaken simply and cheaply by establishing permanent coordinated beacons and survey lines and having the shoreline crest measured at intervals by a reliable and objective member of the local community. This duty may perhaps be undertaken by the Isles of Scilly Environmental Trust during their frequent inspections of the islands.

8.1.3 *Tresco*

During an inspection visit to Tresco in January 1996, pegs were established at several locations along South Beach and Pentle Bay. Measurements taken from these pegs have already established the rates of erosion experienced during winter gales. Measurements should continue to be taken from these pegs as appropriate and should be tied in with measurements at Bar Point on St Mary's to determine what interrelationship exists. They have not been coordinated or levelled and it would be helpful if this were done during survey of the south of the island.

In assessing the coastal problems of Tresco, it has been difficult to establish from OS maps (of various scales) precisely what level of risk is posed to the south of the island owing to the paucity of level data. Since the heliport area is important in terms of tourism and fresh water supply, it is important to determine accurately the level of risk that continued erosion at South Beach and Pentle Bay poses, particularly if the high levels of erosion experienced during the winter 1995/1996 continue. It is therefore recommended that, as a matter of some urgency, a topographic survey with contours at intervals of not more than 0.5 m be taken. The sand dunes at the east and south of the island are known to be eroding and some systematic measurements should be taken of these. Measurements can then be correlated against the prevailing weather conditions in order to seek some explanations for the erosion which is occurring.

Appletree Point in the vicinity of the existing seawall needs to be surveyed in order to ascertain the extent of erosion in front of the wall and to determine precisely the hinterland area threatened by any potential breach in the defences. This information is essential for the design of potential replacement defences and the economic benefit/cost assessment. Since

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potential defences include an offshore breakwater, the survey should extend seawards to Chart Datum as a minimum.

Fixed cross-sections should be maintained around Abbey Farm northwards to the Cliff as quantitative information on coastal retreat is scarce in this location. Such sections should be taken at the same time of year (say summertime) at regular intervals of 2-3 years.

On the east coast of the island, there is an erosion problem immediately adjacent to the *Island* Hotel dining room which needs to be addressed in the very near future. In order to design the proposed new defences it is necessary to have a comprehensive survey of the topography. The survey was undertaken on the Council's behalf in April 1997.

Sites requiring monitoring are shown in Figure 8.3 together with the potential Coast Defence Works sites.

8.1.4 St Martin's

The assessment of the island of St Martin's has revealed very few problems. Such erosion problems as there are threaten very little property owing to most development being located on high ground sufficiently remote from the sea. At this time, it is considered that no coastline monitoring is required.

8.1.5 St Mary's

New works have been constructed at Porth Cressa (completed in phases in April 1995 and January 1996), Old Town and Porth Minick (both completed in May 1997) and the effect of these new structures on the beaches where they are situated should be monitored. Baseline measurements are available from the contractors' pre-start and post-construction surveys.

It was noted during the course of the winter 1995/96 that there was a transfer of sand from the east end of the Porth Cressa beach to the west. However, this phenomenon was noticed throughout the south coast of Cornwall during the winter owing to the preponderance of south-easterly gales. Surveys at selected cross-sections (see Figure 8.4) should be made at one year (end of the maintenance period) and five years after construction. It is recommended that the first of these surveys should be undertaken as soon as possible after beach recovery from winter gales.

Bar Point remains an area of some concern. It should continue to be monitored by means of comprehensive topographic surveys at intervals of,

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say, five years and at fixed cross-sections at the same times as surveys of adjacent shorelines on Tresco. It is important, in order to determine the relationships between the sediment fluxes at both locations, that the measurements on the two islands are coordinated. Bar Point has been the subject of surveys by the voluntary sector and this could be coordinated by the Council's officers to give a cost-effective database which could be incorporated into their GIS system.

8.1.6 Inter-Island Areas

Crow Sound and St Mary's Sound are believed to be sink sites for sand-sized sediment. In order to prove this hypothesis the sites need to be monitored and measured to provide the raw data. Measurement of sand movement may be by indirect means; principally by inference from current meter data.

A simple way of gaining good data is by means of a fly-by from which Low Water and High Water marks could be obtained and plotted using Computer Aided Drafting (CAD) and incorporated into the GIS system. If flights were organised every five years trends should be more easily picked out and a volumetric analysis by ground modelling could be carried out. This method would be cost effective and would provide data throughout the island chain including those islands, such as Annet, where there is no external influence other than nature. It is possible that flights proposed for the Scillies could be coordinated with similar work within the South West Coastal Group to minimise overheads, increase efficiency and thus obtain the minimum cost to the tax- and rate-payer.

8.2 Implementation and Periodic Review

The objective of the report is to present to the Council the information necessary to prepare a strategy plan covering the Management Units (MU) within their area of responsibility. Sections 1 to 7 set out this information. Section 6 looks at the options for each of the identified MUs systematically using the approach promoted in the guideline document.

Once the process of consultation is complete and the report finalized, it is anticipated that the Council will review the options and either adopt them, seek further information or put forward alternatives. It is important that out of the review should come a plan which should, fundamentally, indicate the proposed programme for any future works in the knowledge that the effects of the works will have been considered in relation to the remainder of the coastline and the environment.

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The Plan is intended, in the words of the MAFF guidelines, to be "a working document". It should be updated when significant events occur, such as the completion of a scheme, and periodically reviewed in the light of, for example, further reports of damage, environmental discoveries or perhaps funding changes.

It is suggested that the review should take place annually - most sensibly to coincide with the preparation of budgets for the following financial year.

8.3 Recommendations for Further Work

In Section 6 future work for each Management Unit is proposed, with timescales as appropriate. Listed below are the locations at which coastal protection schemes are considered to be a priority on the basis that significant assets are at risk.

When considering these and other future works it is recommended that consideration be given to combining small schemes in particular in order to mitigate the high cost of mobilization to the Isles of Scilly.

8.3.1 *St Agnes*

No needs have been identified other than monitoring as defined in Section 8.1.1 and shown in Figure 8.1.

8.3.2 *Bryher*

No needs have been identified other than monitoring as defined in Section 8.1.2 and shown in Figure 8.2.

8.3.3 *Tresco*

The *Island Hotel* is on the Council's list of immediate concerns owing to the imminence of its attack by the elements. Design work is planned to take place in winter 1997/98 with construction taking place over the following winter.

The southern end of the island is threatened from three sides (east, south and west as detailed in Section 6) although it appears that there is sufficient volume of dune etc. in the south for attack from that direction not to be such a serious concern. However, the present levels of erosion at South Beach are very high. Apart from the odd spot height, there is insufficient data on Ordnance Survey maps below the critical 5 mAOD contour on which to base rational decision-making. Topographical surveys should be conducted around the south of the island as identified in Section 8.1.4 and

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shown in Figure 8.3. This is a precursor to undertaking any of the potential works identified in Section 6 and will be needed to establish the actual (compared to perceived) risk and then to determine their feasibility.

8.3.4 St Martin's

No needs have been identified.

8.3.5 St Mary's

There is a need for post-construction monitoring of the beaches at Porth Cressa, Porth Minick and Old Town Bay as identified in Section 8.1.5 and shown in Figure 8.4.

Section 6 examines each management unit individually and indicates the need for and feasibility of potential future coast defence works at Town Beach, Porth Loo, Porth Hellick and Old Town Bay.

The accelerating dilapidation of the seawall at Town Beach in Hugh Town has been caused, at least in part, by the reduction in beach levels which have been noted by council officers amongst others. In advance of any intended works, it would be advisable, as at Porth Loo, to survey the beach at selected chainages to establish the long term trends. This work still requires to be done and should be logged onto the GIS once complete.

It is proposed by the Council of the Isles of Scilly that a scheme may be constructed at Porth Loo in the near future. It is difficult from the maps and charts to precisely define the rate of erosion and hence the degree of threat presented to the low-lying properties in the hinterland. Stakes were established in Porth Loo on the advice of the consultants for the purposes of monitoring erosion of the ram cliff there. The stakes were coordinated by the Council's land surveyor and initial measurements were taken in April 1997 and logged onto the GIS system.

If schemes at Town Beach and Porth Loo are adopted and feasible, it is desirable, in terms of making them as cost-effective and economically viable as possible, that they be constructed at the same time. This is because mobilisation costs of equipment and materials to the islands and overhead costs of operating on the islands constitute some 50% of the cost of a contract compared to contractor's establishment costs of 10-15% on equivalent mainland contracts. It is especially important in respect of the relatively low anticipated values of the projects.

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Porth Hellick has been a cause for concern although it is apparently stable despite some minor erosion at the flanks. Given the importance of its low-lying hinterland in fresh water supply, it is advisable to monitor this bay in order to verify or, indeed, to deny its stability.

8.3.6 Inter-Island Areas

Changes in Crow Bar are important to the Bar Point area on St Mary's and the Pentle Bay and South Beach areas on Tresco. The Admiralty Chart BA34 of 1972 was updated in 1984 to include new survey data (1981-82) of Crow Bar. The updated survey showed an extensive ridge of drying ground at Crow Bar although the extent of the bar seemed to be more or less unchanged compared to earlier versions of this chart (e.g. that of 1906).

The most recent version of the chart notes the presence of sand waves at the bar (easily visible on sidescan traces and therefore more likely to be noted on modern-day than on pre-war charts) indicating the mobility of sediment at this location. It is therefore possible that the extent and/or shape of Crow Bar has changed to initiate the increased rates of erosion noted at Pentle Bay and South Beach.

It would be helpful to have more information on Crow Bar to try to establish causes of the erosion on Tresco. A survey of the area could be coordinated with the in-survey of the next project to be carried out on the islands in order to keep costs to a minimum. The survey is therefore most realistically undertaken as a bathymetric survey. An aerial survey would be able to show the shape of the exposed bar at Lowest Astronomic Tide (which occurs roughly every 17 years) or as near as practicable to it which occurs once or twice a year. However, an aerial survey would show no detail either side of the drying Crow Bar or, most importantly, if the bar had collapsed in height such that it was below drying height, it would show nothing of importance to wave penetration or wave focusing.

8.4 Issues affecting the Shoreline Management Plan

8.4.1 General Development Control

The Isles of Scilly already has much control over development on the islands particularly owing to its Heritage Coast and other designations and strong local concerns with respect to maintaining the wild beauty of the islands. These have been reflected in the Local Plan which severely restricts the scope for any new developments.

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However, a new consideration which could be incorporated into the Local Plan would be to further restrict new development not within areas already protected by existing or planned coast protection structures. Proposed new buildings would in this event not be permitted to be constructed below the **5 m** contour or within an area likely to be affected by coastal erosion within a reasonable timeframe which should be judged in terms of the proposed buildings' likely lifetimes (but unlikely to be less than 60 years which is the general lifetime for most coast protection structures). It is noticeable that where this sort of policy has been (perhaps unconsciously) practised as on St Martin's, the coast protection issues are few as the coast can respond to nature without interfering with man's interests.

Certain basic information is contained within this document but the onus should be placed on the developer to expand on this data to show that new developments would not be affected by coastal erosion and would not therefore be likely to need coast defences providing for them (as measured by MAFF criteria).

There is a lack of clarity in the building control legislation as to whether or not planning permission should be required for coast protection structures (whether publicly or privately owned). The Council has applied the policy that planning permission should be applied for such that these important structures can be properly considered by the public for their impacts in the sensitive locations in which they will be situated. It is recommended that this policy be continued for both public and private coast protection proposals.

8.4.2 Mineral extraction

There is much map and anecdotal evidence that activities related to extraction of minerals from the beach has been harmful to coastline development throughout the Scillies. Map evidence of the plan forms of HWM on OS charts over the **100** years to **1980** demonstrate that the sand spits at Bar on Bryher and Bar Point on St Mary's have markedly changed in form over the past century. This may be due to short-term variability in the occurrence of storm wind directions. However, at Bar Point on St Mary's there is also evidence of a longer-term persistent eastward migration of the spit⁽¹⁾. Both sites are, or have been, local extraction points for building aggregates.

(1)

Isles of Scilly Shoreline Management Plan: A Review of Physical Processes, R.S. Nunny, Sea Sediments Ltd, Chard, Somerset, October 1995

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Anecdotal evidence of the erosion of Bar Point related to the report authors and corroborated by physical evidence indicates erosion over the last **25** years amounting to approximately 15-20 m or about 0.6-0.8 m/yr. It has been determined that coastal erosion at this location is not entirely attributable to mineral extraction but that that activity has probably accelerated the decline in Bar Point. Present controls on development within the islands has meant a decline in volumes extracted from the Bar Point beach over the last decade.

Further anecdotal evidence has been related regarding the beach at **Pelistry Bay**. There was apparently a land connection between the mainland at **Pelistry Bay** and Toll's Island -sufficient on which to hold picnics and cricket matches. Sand extraction had taken place at the upper beach of sufficient depth to make lorries invisible from the beach and a figure of 15 ft (**4.5 m**) depth was quoted. During a southerly gale the land connection was obliterated - a contributory factor possibly being the loss of volume at the crest leading to a weakening and inability to resist the storm **drawdown** of the beach profile. An apparently stable tombola is in place between the land and Tolls Island but the previous permanence of the connection has never been restored.

More recent evidence of coastal erosion at least partially attributable to mineral extraction has come from Tresco. The South Beach has been the source of building sand for the large scale development over the last decade in which concrete roads and buildings were constructed. It seems that the artificial reduction in beach volume has permitted it to be further reduced by subsequent natural processes revealing the underlying peat layers (which provide much information to archaeologists for sea-level rise predictions amongst others) which quickly break-up and erode. No figures of the amounts of sand removed from the beach for building have been recorded and so a comparison between artificial and natural erosion rates is not possible. Apart from the fact that building activities have reduced dramatically over the last few years, it is understood that the beach is no longer able to provide sand of sufficient quality and quantity for building and has therefore been abandoned as a source.

Owing to the fine grading of sand available from dunes throughout the islands, they are naturally regarded as a source of building sand. This was noted at Little Popplestones where a narrow part of the dune was further reduced (on the landward side) by excavation for building material. The hole thus created was subsequently filled with excavated material derived from construction of rock revetments elsewhere on the island.

Beaches and dunes form essential parts of natural defences and it is inadvisable to deplete their volumes - particularly so where they are thin or narrow. It has been demonstrated (although hard quantitative evidence is lacking) time and again throughout Scilly that beach extraction is detrimental to the coastline. Although it will be unpopular owing to the cost, it is considered that building sand and aggregates be imported for all, other than trivial, projects. The adoption of this policy would transfer an environmental problem from Scilly to the mainland. However there are quarries on the mainland, particularly in the Falmouth-Penzance area; which are less sensitive environmentally than the Isles of Scilly. In one respect, for example where building sand is obtained as a by-product of China Clay extraction, the importation of building sand would assist the mainland environment.