

**ANGUS COUNCIL****ROADS COMMITTEE****11 JUNE 1998****MONTROSE BAY SHORELINE MANAGEMENT STUDY****FINAL REPORT BY CONSULTANT****REPORT BY THE DIRECTOR OF ROADS****ABSTRACT**

This report summarises the conclusions of the consultants (Messrs Halcrow) with respect to coastal processes in Montrose Bay and recommended proposals for dealing with problems at the Golf Course frontage and the GlaxoWelcome frontage. It also proposes a way forward on this issue for the consideration of the Committee.

**1 RECOMMENDATIONS**

It is recommended that the Committee agree to:-

- (i) note that the final version of the Montrose Bay Shoreline Management Study prepared by Messrs Halcrow is available for inspection in the Members' lounge;
- (ii) note the summary of the alternative options identified in the study and advantages/disadvantages in terms of effecting engineering/environmental/economic solutions to the existing situation, noting in particular the opposition stated by Scottish Natural Heritage to any proposals involving the importation of rock armour or other intrusive artificial construction;

- (iii) remit to the Directors of Roads and Recreation Services in conjunction with the Director of Finance to investigate possible sources of funding for the proposed options, laid out in part (v) of the Details of this Report

## 2 INTRODUCTION

Halcrow were appointed by Angus Council on behalf of the Council and GlaxoWelcome (Report No. 784/97) in August 1997 to determine the underlying cause of erosion in Montrose Bay and to bring forward proposals for two particular areas of concern, namely the Golf Course frontage and the GlaxoWelcome frontage.

The first phase of the study involving the analysis of coastal processes in Montrose Bay using historical data and wave modelling techniques together with the specific protection options open to GlaxoWelcome for their site was completed in November 1997 and reported to the Committee (Report No 1224/97).

The second phase covering the Golf Course frontage has recently been completed and is the subject of this report.

## 3 DETAILS

### (i) Study Brief

Angus Council, in consultation with GlaxoWelcome, drew up the Brief for the study.

The main requirements of the Brief may be summarised as follows:-

- collection of relevant data and analysis;
- understanding of the coastal processes for the existing situation;
- consultation and inclusion of environmental issues;
- consider appropriate coastal defence options for the two areas of concern, using Ministry of Agriculture Fisheries and Food (MAFF) guidelines;

- develop preferred coastal defence options for the two areas of concern;
- outline design and benefit cost analysis;
- study conclusions and recommendations.

The Brief stipulated a 12 week programme for delivery of a draft report on the GlaxoWelcome frontage, with 18 weeks for the report on the Golf Course frontage and 20 weeks to final study report.

Copies of the full and final report produced by the Consultant for the Golf Course Frontage are available in the Members' Lounge. Extracts from the report, comprising the Introduction, Preferred Option, and Conclusions and Recommendations are attached to this report at Appendix 2.

(ii) **General**

Active erosion has been occurring between the Rivers North and South Esk since the mid-seventies after a long period of stability and even occasional accretion. Protection works started in the early fifties with the reconstruction of the pitched rock sloping seawall protecting the esplanade facilities. This was required mainly due to the breakdown of the previous crude defences at this location. Apart from this structure, man-made defences have been developed from the South Esk moving northwards since the mid-seventies.

Since 1970 erosion of the dunes in front of the GlaxoWelcome site has meant that increasing amounts of protective measures have had to be carried out by GlaxoWelcome. In June 1991 the area of the caravan site and the South Links had to be protected by a rock armour revetment following further erosion which had also led to the placing of a rock armour fillet in front of the concrete seawall (1989 and 1990) as beach levels continued to drop.

As the areas to the south of the seawall were protected severe erosion continued to the unprotected golf course frontage. Three rock armour strongpoints were constructed in 1995 opposite tees in an attempt to limit

erosion locally. Erosion decreases to the north of the golf course and there are presently no man-made defences in this area.

The coastal process assessment is described in detail in Section 5 of the Consultant's report while Section 6 identifies coastal defence options for consideration.

### (iii) Coastal Defence Options

Coastal defence options to sustain or change the existing dune line in addition to the "do nothing" scenario (required as a benchmark), were evaluated in terms of their performance, economic cost and impact on the local coastal processes, environment and ecology. The options identified have been summarised in Table 1 below.

Given the loss of income associated with the "do nothing" scenario, and the apparent availability of adjacent Council land, a variation on the "do nothing" option was developed, namely "rearrange the golf course" inland to cope with predicted erosion over the next 50 years.

<b>TABLE 1 - SUMMARY OF IDENTIFIED OPTIONS RANKED BY COST</b>		
<b>OPTION</b>	<b>TOTAL 50 YR COST</b>	<b>COMMENT</b>
Rearrange Golf Course	£743,000	Accepts erosion, best benefit/ cost ratio, disruptive to golf course activities.
Refurbish Strongpoints	£1,855,000	Not wholly effective, environmentally unattractive, sub-standard benefit /cost ratio.
Beach Recharge	£2,882,000	Not wholly effective, high revenue costs, unacceptable benefit/cost ratio.
Nearshore Breakwaters	£4,735,000	Not wholly effective environmentally unacceptable, high cost.
Rock Revetment	£7,104,000	Environmentally unacceptable, high cost
Groynes	£7,755,000	Not wholly effective, environmentally unacceptable, high cost
Do-nothing losses = £2,122k		
<b>FOR PURPOSES OF COMPARISON</b>		
Esplanade (approx)	£12,000,000	Environmentally unacceptable, very high costs

(iv) **Comparison of Options**

The advantages, disadvantages, initial capital cost and total 50 year cost at present value for each option are presented in a summary matrix. (Table 9.1 in the Report and included within Appendix 1 to this report).

The predicted erosion would affect the layout of the present 18 hole medal course probably within 5 years with a maximum erosion in the vicinity of the 2<sup>nd</sup> golf tee of 80 metres over a fifty year period. This erosion effect would diminish to the north but would threaten Traill Drive.

The “rearrange golf course” option is the best option purely on environment and economic grounds but results in a loss of income during reconstruction and requires a change to the existing course layout. The benefit/cost ratio for this option is 1.88.

The only other proposal which had a cost benefit ratio of close to one (MAFF guidelines require normally more than 1.5 before a scheme is considered viable) was the “refurbishment of existing strongpoints”. This is the only rock armour option which might be acceptable. Scottish Natural Heritage are strongly opposed to any further significant amounts of rock armour being placed on the beach.

“Beach recharge” is favoured environmentally though it is very costly taken over the fifty year period, and is not assured of being wholly effective.

All the other options have a very high cost and unacceptably low benefit/cost ratio, and those involving rock armour (ie revetment, groynes and nearshore breakwaters) are unacceptable environmentally. The construction of an esplanade with some form of precast concrete facing is prohibitively expensive, and similarly is likely to be unacceptable in environmental terms.

In undertaking their study the Consultant also investigated a number of proprietary protection systems. These were found to be unlikely to prove effective due to the "high energy" location ie. Exposed to particularly high wave energy in storm conditions

(v) **Proposals**

It is therefore proposed that the favoured option (as concluded in the Consultant's report) is that of rearranging the layout of the golf course. This has the highest benefit/cost ratio and is the preferred option on environmental grounds, although it is noted that it has a high capital cost (£750k approx) and would cause some disruption to the golfing activities while it is being undertaken.

It is noted that the Medal Course is intended for use as a qualifying course for the 1999 Open Golf Championship and therefore it is proposed that modest measures be undertaken to consolidate the existing strong points at the 2<sup>nd</sup> and 3<sup>rd</sup> tees to protect them for the 1999 summer season. The cost of such works can be contained within the 1998/99 block heading for coast protection capital works. Consideration should be given thereafter to rearranging the layout of the Medal Course as proposed. Committee may wish to remit to the Director of Recreation Services to further develop the viability and financing arrangements for such rearrangement in consultation with the Director of Finance.

Similarly it has been highlighted in the Consultant's report that if the erosion continues as anticipated then the existing revetment at Traill Drive will not be adequate to protect the area of Traill Drive, the Beach Pavilion and the new recreational area. It appears that the stability of this area would become jeopardised in a period of approximately 5 years if the erosion rate progresses as anticipated. It is therefore further proposed that the Director of Roads be instructed to investigate appropriate means and sources of funding to protect this local area from further erosion within that timescale.

#### 4 FINANCIAL IMPLICATIONS

Potentially the financial implications arising from this issue are major. However for the moment the only implications arising directly in consequence of this report are those described for the Roads Department 1998/99 capital block heading of £80,000 for Coast Protection - General.

The following potential sources for contributions to funding for possible schemes have been investigated on a preliminary basis.

- Scottish Office
- European Regional Development Fund
- Scottish Enterprise Tayside
- European Investment Bank
- Sports Lottery Funds
- Royal and Ancient Golf Club

The Sports Lottery and the Royal and Ancient Golf Club appear to be the only two potential sources of external funding. These possibilities can be pursued further should the Committee agree to Recommendation (iii).

The costs associated with the short-term consolidation of the existing strong-points protecting the tees can be contained within the £80,000 Roads Department capital block heading for Coast Protection - General in the 1998/99 Capital Budget.

#### 5 CONSULTATION

The Chief Executive, the Director of Law and Administration, the Director of Finance and the Director of Recreation Services have been consulted in the preparation of this Report.

Dr Bob McLellan  
DIRECTOR OF ROADS

NOTE

The following background papers, as defined by Section 50D of the Local Government (Scotland) Act 1973 (and not containing confidential or exempt information) were relied on to a material extent in preparing the above Report:-

Report No 784/97 - Angus Council Exec Sub-Committee of Roads Committee - 12 August 1997

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03 June 1998  
REPORTS/montrose.bay.1



**MONTROSE BAY SHORELINE MANAGEMENT STUDY  
TABLE 9.1: SUMMARY MATRIX**

Options	Initial Scheme Cost	Total Present Value	Loss	Benefit Ratio	Advantages	Disadvantages
Do Nothing	£0	£0	£2,122,318	-	No investment required	Not a satisfactory long term solution Impacts on Beach Pavilion infrastructure Loss of earnings from the Medal golf course over the next 50 years Loss of income and opportunity from the prequalification for the 1999 Open Championship Loss of jobs/income from supporting industries in the local area
Rearrange Golf Course	£742,800	£742,800	£387,603	1.88	Long term solution	Financial implications of rearrangement Loss of income and opportunity from the prequalification for the 1999 Open Championship Loss of jobs/income from supporting industries in the local area, in the short term
Beach Recharge	£312,000	£2,881,731	£287,603	0.67	Environmentally acceptable	Ongoing maintenance commitment Medal golf course will have to be rearranged
Refurbish Existing Strongpoints	£1,777,696	£1,854,740	£287,603	0.99	Reduced rate of erosion	Limited benefit compared with investment Medal golf course will have to be rearranged
Rock Revetment	£7,027,270	£7,104,314	£0	0.30	Will hold the existing line Limited impact on the existing beach and sediment transport regime	Massive structure High cost
Nearshore Breakwaters	£4,658,320	£4,735,364	£0	0.44	Long term solution Sand will be retained on the beach Improved amenity	Limited rearrangement of the Medal golf course Navigation hazard Incursion onto the beach High cost High risk option Highly visually intrusive
Groynes	£5,104,038	£7,755,325	£287,603	0.26	Long term solution Improved amenity	High cost Medal golf course will have to be arranged Access difficulties along the beach Incursion onto the beach Some visual intrusion Ongoing maintenance commitment

## 1 INTRODUCTION

### 1.1 General

Halcrow have been appointed by Angus Council to undertake a Shoreline Management Study of Montrose Bay. Gillespies are Halcrow's sub-consultant providing environmental input. The study is to focus on two particular areas of concern, namely the Glaxo Wellcome frontage and the golf course frontage. This report concentrates on the golf course frontage, within the context of Montrose Bay. A separate report covers the Glaxo Wellcome frontage, whilst both reports describe the existing situation in Montrose Bay. The study began in September 1997 and is due to be completed in January 1998.

Montrose Bay has suffered from erosion over the years, leading to the construction of various defences at several points, although the majority of the coastline is natural, comprising a sandy beach and sand dunes. The study seeks to ensure that future coastal defence works are sustainable and compatible with the Bay as a whole, whilst ensuring the protection of key areas such as the golf course.

### 1.2 Study Brief

Angus Council, in consultation with Glaxo Wellcome, Scottish Natural Heritage (SNH) and Montrose Port Authority, drew up the Brief for the study, a copy of which is enclosed in Appendix A.

The main requirements of the Brief may be summarised as follows:

- collection of relevant data and analysis;
- understanding of the coastal processes for the existing situation;
- consultation and inclusion of environmental issues;
- consider appropriate coastal defence options for the two areas of concern, using Ministry of Agriculture Fisheries and Food (MAFF) guidelines;
- develop preferred coastal defence options for the two areas of concern;
- outline design and benefit cost analysis;
- study conclusions and recommendations.

The Brief stipulated a 12 week programme for delivery of a draft report on the Glaxo Wellcome frontage, with 18 weeks for the report on the golf course frontage and 20 weeks to final study report.

### 1.3 Report Format

The format of both reports will be the same. Sections 2 to 5 will consider the existing situation, environmental issues and coastal processes, within the context of Montrose Bay. Sections 6 to 10 will detail the options and their development through to recommendations for the golf course frontage.

## 9 PREFERRED OPTION

### 9.1 Coastal Process Summary

The selection of the preferred option is dependant upon how each option would perform in response to the coastal processes. Weather patterns (particularly wind directions) vary over time. As a result the erosion observed in the last seven years (5m/year, 1989 to 1996, profile 79) has been greater than the trend over the last thirty years (2m/year, 1965 to 1997, profile 79). Note that dredging had made only a small contribution to this increase in erosion. Prior to the start of dredging there was erosion at a slightly lower rate. It is recommended that the most recent rate of erosion is used for predicting future beach movement since the pattern over the last few years is predicted to continue. Sea level rise has a relatively minor impact (ie. 5mm/year) compared to the changes in the weather patterns, although it does contribute.

The construction of coastal defences has an effect on the perception of coastal erosion. For example, since the dunes along St Cyrus continue to erode at approximately the same rate, changes over the years are difficult to see. However, where a line of defences have been constructed, or a development is under threat, the movement of the coastline is highlighted and much more apparent.

### 9.2 Selection of Preferred Option

The preferred coastal defence option for the golf course frontage in Montrose Bay has been developed taking into account the local coastal processes and impact on adjacent shoreline, environmental impact, economic considerations and effectiveness of each option. The options have been evaluated with MAFF guidelines in mind including 50 year design life. The advantages, disadvantages, initial capital cost and total present value of each option are presented in a summary matrix in Table 9.1.

For the do nothing scenario, erosion of the dunes would continue initially at several metres per year decreasing over time to a much slower rate of erosion. This erosion would render the 18 hole Medal golf course unplayable within 5 years. Over a 50 year time period, erosion is estimated to be a maximum of 80 metres near the 2<sup>nd</sup> golf tee, with a drop of 1.5m in beach level. This erosion effect would decrease and disappear to the north towards the River North Esk. At the southern end of the golf course, erosion would threaten Trail Drive and the Pavilion seawall would be at risk due to beach lowering. The estimated losses for the do nothing scenario are some £2 million, mainly through the loss of three tees, four fairways and four greens. These losses rely on information provided by Montrose Links Trust and basic assumptions which the Council and the Trust may wish to discuss further.

The rearrange golf course option is essentially an on-land response to the do nothing (to the coastline) scenario. Relocating three tees, four fairways and four greens inshore would ensure the integrity of the course over that time span. The cost of such relocation is estimated at some £717,600, for which the source of funding is unclear. Relocation would take several years and would interfere with the planned use of the course for the 1999 Open qualifiers (if the course is still complete at that stage). The option outlined is only one variation, since there are a wide range of rearrangement options, which should be developed further by the Council and Trust.

The option of beach recharge, possibly from dredging of the River South Esk, was considered. The construction of groynes at the Glaxo frontage is estimated to reduce annual dredging quantities, therefore an annual recharge of 20,000m<sup>3</sup> was selected. This would maintain the present beach levels but erosion would still occur on infrequent storm events, at a reduced rate of 25 metres over 50 years. The estimated cost over a 50 year period of £2.88 million is prohibitive for an option which would not be completely effective.

Refurbishment of the rock strongpoints would cost £1.8 million and only reduce erosion whilst a rock armour revetment would halt erosion but cost £7 million. Nearshore breakwaters were also found to be ineffective in halting erosion, at a cost of £4.7 million. Similarly, rock armour groynes would have difficulty holding beach material due to sediment drift both to the north and south of the bay, and are not cost effective at £5 million, initial capital cost. Groynes, breakwaters and revetments would also be visually intrusive apart from some local effects on the adjacent coastline, as discussed in Section 5.

On examination of the benefit cost ratios and strategy study guidelines scores, it can be seen that the rearrange golf course option is favoured, among the investment options. Taking account of indirect benefits would not sufficiently alter this ranking. Comparing do nothing to the rearrange golf course option, there are losses of some £2 million associated with do nothing whilst at a cost of £742,800 for the rearrange golf course option, these losses could be avoided. Although the assumptions made are basic, the differences between the two options are significant.

The refurbished strongpoints option has a benefit cost ratio of close to one, which is likely to rise above one if indirect benefits could be confirmed and then taken into account. It is thus the most viable intervention option but still has a lower ranking than the do nothing/ rearrange golf course option.

The rearrange golf course option (with do nothing for the coastline) is therefore the preferred option. The decision is marginal and if the do nothing option should prove unacceptable due to the importance of the golf course, then the refurbished strongpoints option could be pursued further.

## 10 CONCLUSIONS AND RECOMMENDATIONS

### 10.1 Conclusions

The study has lead to the following conclusions:

- Review of available data including beach profiles reveals that beach levels generally in Montrose bay are falling, particularly for the golf course frontage;
- Historically the coastline has been eroding, recently the rate of erosion has increased due possibly to a change in weather patterns. This higher rate of erosion is predicted to continue
- Wave data analysis and transformation inshore confirms that the bay is subject to high wave energy;
- Beach profile analysis shows high erosion rates for the golf course dunes whilst St. Cyrus dunes appear to be stable or accreting;
- Beach modelling results indicate a small net southerly drift of sand from the golf course frontage as far as the River South Esk;
- Annual dredging removes some 50,000m<sup>3</sup>/year from the sediment system and appears to be in line with the estimated losses of sediment from the upper beach;
- Site inspection found overtopping damage for the Glaxo Wellcome and caravan park defences and erosion of dunes to the north;
- Beach lowering is predicted to continue in front of the Glaxo Wellcome site and the golf course to the north;
- The do nothing option would mean erosion of up to 80m at the golf course frontage over a 50 year time period;
- Do nothing would render the Medal course unplayable within a few years;
- Options such as nearshore breakwaters or groynes would be costly, visually intrusive and ineffective;
- Beach recharge option would reduce erosion but at a high cost;
- Rock revetment option would halt erosion at a very high cost;
- Refurbished strongpoints do not halt erosion but form the most viable coastal defence option, with a benefit cost ratio near to favourable;
- Rearrangement of the golf course would avoid the losses associated with 'do nothing' at a moderate cost, and is associated with the highest benefit cost ratio.
- The Council and Links Trust through discussion could refine the rearrange golf course option further.

## 10.2 Recommendations

The following recommendations are made for coastal defence of the golf course frontage, within the context of Montrose Bay;

- Do nothing for the coastline;
- Assuming funding is available, rearrangement of the Medal course should be implemented to cope with predicted erosion, following a detailed review of the rearrangement options;
- Continued monitoring of beach profiles, to evaluate risk to Traill Drive/ Pavilion seawall with possible re-use of rock armour from strongpoints once they become less effective or the golf tees are eroded;
- Consider measures to ensure long term protection of Pavilion seawall frontage;
- Consider dumping spoil dredged from the South Esk channel nearshore within Montrose Bay.

The decision to select the do nothing option was marginal, since the refurbished strongpoints option had a benefit cost ratio of close to 1, without inclusion of indirect benefits. Should the do nothing option prove unacceptable, due to the value and importance of the golf course, or land for relocation not be available, then the refurbished strongpoints option could form a viable strategy assuming sufficient indirect benefits are available. To progress the rearrangement of the golf course option, considerable discussion between the Council and the Trust will be required to identify the optimum solution.