group of sites that date to the 1950s and can be seen in two locations, at the airport and around the Township of Aird Uig, where the Royal Air Force still has a signal station (NB 0480 3895 and NB 0494 3809).

The effects of erosion on sites of the post-medieval and modern period are reviewed in Figures **21** and **22**

6.2.7 Sites of unknown date

Of all of the sites recorded in this study 29% are of uncertain date. This option tends to be applied either where the form and nature of a site is uncertain or with features that provide no pointers at all towards date such as cairns, field walls (surviving as fragmentary remains of obscured field systems) and some of the cellular structures and shielings. The future dating of such structures will be reliant on a new programmes of investigation of such sites providing new typologies of features that could at present date to any period from the Bronze Age through to the pre-crofting period.

The effects of erosion on sites of unknown date are reviewed in Figures **23** and **24**

7.0 CONCLUSIONS

The erosion mechanisms threatening specific lengths of the coastline are summarised by Ramsay and Brampton (1995) and the erosion summaries within this Report.

7.1 SUMMARY OF EROSION AND ITS RELATIONSHIP TO CULTURAL HERITAGE

The specific threats and erosion focuses for the archaeology can be summarised into three general classes. These apply for both the west and east coasts within the study area.

- Erosion of the sites (such as promontory enclosures) located on incised cliffs.
- Dynamic erosion/deposition system of machair impacting on the concentration of many types and ages of site within this zone.
- A small, number of areas threatened within alluvial systems.

Any future monitoring and management schemes will need to address these three conditions.

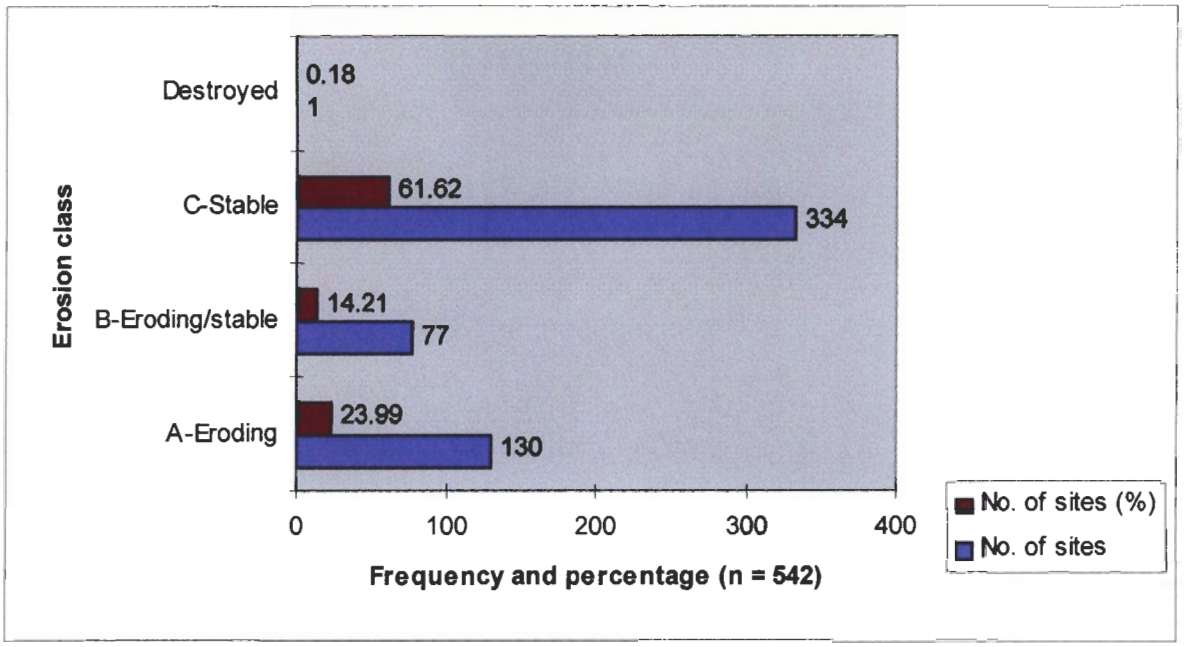

Figure 23, Site state for 'Unknown' sites by erosion class

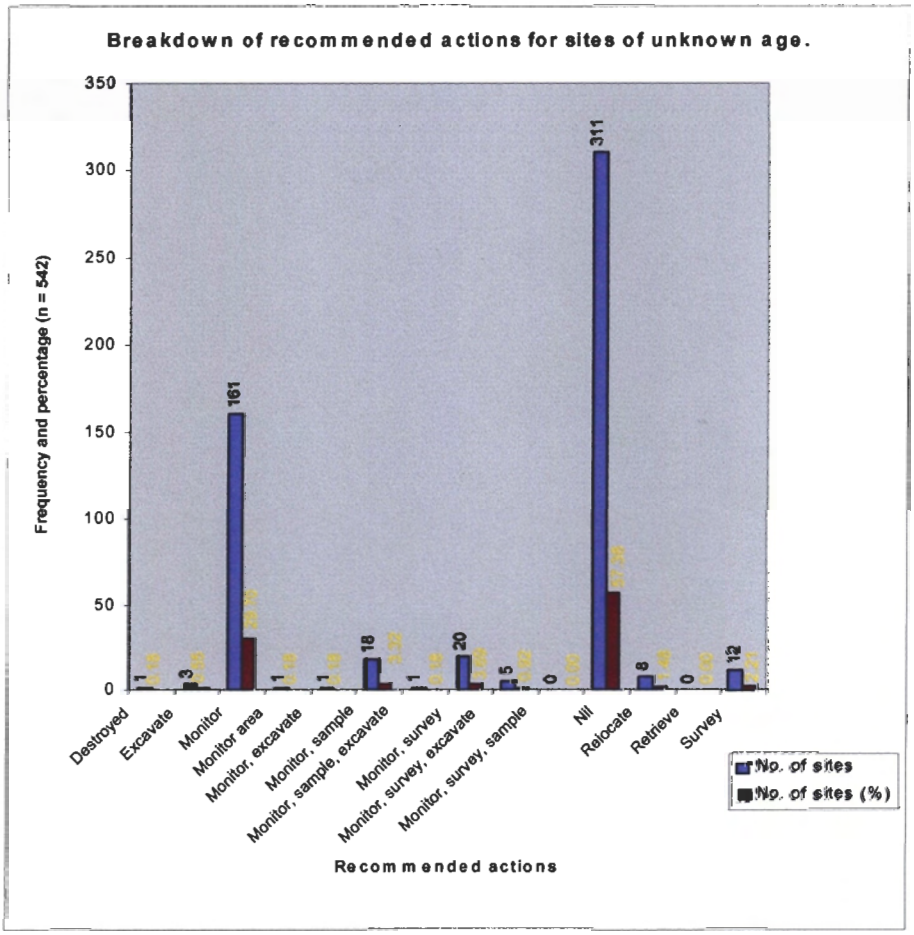

Figure 24, Recommended actions for 'Unknown' sites

7.1.1 Class One: Sites on high cliffs

Sites of this class are typified by promontory enclosures, of which over 60 individual examples have been identified. The class is threatened by the erosion of the incised cliffs upon which such enclosures are almost exclusively located. The cliffs are eroding through continuous small-scale slumping and erosion of the soil matrix coupled by low frequency, high magnitude cliff slip events which could destroy large portions of a promontory enclosure. Some of these events have reduced many examples of the promontory enclosure site type to little more than stacks of less than a few metres across.

The actual rate of erosion seems to vary depending on the underlying geology and the depth of substrate on which the site sits. For example sites located on the cliffs of Lewisian Gneiss are generally stable, the threat of erosion only increasing when sites are situated on deep soft substrates such as glacially derived sands and gravels.

Conversely, sites on the 'till cliffs' overlying Metasediments around north-west Lewis and the conglomerate cliffs of New Red Sandstone on the east coast are at a much greater risk as these areas are experiencing much higher rates of erosion of the relatively soft underlying geology.

7.1.2 Class Two: Sites within machair zones

Sand and machair zones are experiencing severe erosion which impacts on the archaeological sites within these dynamic systems. The erosion mechanisms stem from marine, aeolian, livestock and human activity. Marine erosion results in wave undercutting of the sand sections. This can vary in size from the small-scale, as seen in the eroding middens on Cnip headland (NB13NW 17 and 21), to the large continuous eroding sections of up to 5 m. at Galson (sites including NB45NW 02). Marine erosion is particularly marked at high spring tides and during high magnitude, low frequency storm events such as the storm which revealed archaeological remains at Bostadh (NB14SW 02) during the winter of 1993/4.

Aeolian erosion results in blow-outs and erosion scars which sometimes are very extensive (for example at Barvas machair). These basic erosion mechanisms and resulting features are exacerbated by animal and livestock grazing. Animals cause direct erosion through their tracks, especially up dune sides, and through extensive burrowing (*e.g.* at Mealista, Traigh na Berie, Barvas and Dal

Mor). Animal activity also impacts on the ability of the machair system to resist erosion through the removal and thinning of the vegetation which binds the unstable matrix together.

The delicate balance between the erosive faces and the erodibility of the machair is further impacted through human activity. The impact can result from direct exploitation of the zone, for example through sand extraction and cultivation at Barvas machair, or the more widespread impact from recreational activity. All these erosion mechanisms create eroded material which then is deposited, usually further inland by aeolian activity unless constrained by topography.

Both the erosion and deposition within these zones can be very local and the general regime of an erosion cell may hide the fact that an important site is being eroded or covered up. Also, as has been mentioned above, the dynamic erosion regime which exists in many of these zones can switch from erosion to deposition. Because of this machair zones with their high concentration of important prehistoric sites need a particularly rigorous monitoring and management scheme.

7.1.3 Class Three: Sites effected by alluvial action

This class is limited to the points along the coastline where rivers and streams enter the sea or within wider areas of alluvial erosion and deposition, for example at Broad Bay. Generally the erosion is not too severe as most of the water bodies are not of the size to cause extensive damage. Along certain stretches of incised coastline streams are providing a further erosive mechanism at point of weakness which may directly impact sites located there. Alluvial action is also one of the few observed mechanisms for deposition within the coastal zone. This is particularly marked at Broad Bay with a number of sites being both eroded and covered over by the sands and muds, including the probable Norse settlement (NB 4418 3523).

7.2 RECOMMENDATIONS

Actions recommended in the gazetteers of cultural heritage (section 5) are divided into 5 basic groups. These responses (listed below) are augmented by a series of other responses that cover eventualities that are not otherwise catered for with the standard responses; these additional actions are discussed in section 7.2.6.

7.2.1 Action 1: Nil

This response is proposed when no further action is required. This situation occurs when a site is not threatened by erosion because it is situated well behind the active erosion focus. This action is also recommended when other action would give little or no additional information about the site.

A representative sample of every site type that has been identified as subject to erosion should be monitored. Similarly some of the sites which at present are covered by recommendations of no further action (Nil) should be represented in a control group of sites to be monitored to prove that no erosion is occurring. This control group is not represented in the present recommendations in section 5; the authors recommend that the size and composition of such a group should be decided upon by Historic Scotland in consultation with interested parties such as bodies currently carrying out research in the region, local archaeological and historical societies and any local authority archaeological curatorial service in existence.

7.2.2 Monitor (Baseline Survey)

This action allows for the recording of continuing erosion or deposition. The use of this action has two main aims; firstly to quantify the speed and extent of erosion occurring on a site based level, this information could also be used to produce a wider picture of erosion occurring along the coastline of the study area. Secondly, monitoring can be used to establish the nature of a site, or to gather more data about a site through the recording of features and the collection of artefacts and samples that have been revealed by erosion.

In the overviews of cultural heritage (section 5) monitoring is augmented with "(Baseline survey)". This qualifying statement recognises the fact that before any programme of monitoring can commence baseline information should be gathered about the sites to be monitored. This information during future monitoring visits and should consist at a minimum of a drawing or measured sketch with a written description. Experience has shown during this and earlier studies carried out by the authors (Burgess and Church 1996) that a written description alone does not provide enough information to make sensible assessments of the state of a site compared to a previous survey visit.

7.2.3 *Detailed Survey*

This action has been recommended where a site is considered to be of local, regional or national significance and has at yet no satisfactory survey. This response will *preserve by record* information about sites that may be at threat now or in the future due to erosion.

7.2.4 *Sample*

This action has been recommended where a site is considered to be of local, regional or national significance and is (or contains elements of) a midden or deposit of artefactual remains. Such action is designed to *preserve by record* sites of this type which may be lost extremely quickly and allow quantification, dating and analysis of any such deposit to characterise in more depth aspects of the site in the framework of a wider monitoring scheme.

7.2.5 *Excavate*

This action has been recommended where a site is considered to be of local, regional or national significance and is at immediate risk of being lost for ever due to erosion activities. Such action is designed to *preserve by record* sites suffering this threat allowing quantification, dating and analysis of any such deposit.

7.2.6 *Other responses*

Several other responses have also been suggested in the gazetteers to deal with specific situations, these include the *relocation* of sites that are known to have existed (due to their presence in the NMRS) but now cannot be seen on the ground. Other responses that occur only infrequently are those such as the *retrieval* of traditional boats and other large artefacts that have been abandoned on the shore line and have intrinsic cultural heritage value to the Western Isles.

7.3 *OVER VIEW AND SUMMARY OF RECOMMENDED ACTIONS*

The actions recommended in the gazetteers of cultural heritage in section 5 are considered on a site by site basis. Any monitoring and response programme that would be instituted within the extent of this study should consider the number of recommendations to be implemented on a study wide basis. Any group of sites to undergo monitoring (Baseline survey) should be a representative sample of monument types, terrain types and location around the coastline.

In the institution of any programme of sampling, excavation and detailed monitoring very careful consideration should be given to which sites should be adopted for such activities. All of the sites recommended for such action require some sort of recording due to the lack of an existing record and the increasing presence of a destructive erosional threat; but as ever the implementation of any programme of work will be reliant on the funds that are available to carry out such work.

Any extensive monitoring programme would be an expensive affair due in part to the sheer number of sites involved. Schemes that have been suggested to combat this may include the involvement of local enthusiasts to carry out regular monitoring visits to specific sites or groups of sites. Such visits would require that specific questions be answered, and possibly that specific measurements be taken.

To enact a programme of monitoring of this scale using volunteer staff on a day to day basis would require that baseline surveys be prepared to a high level of quality, and that good instruction be given to the monitors. Details of such monitoring could be further animated using *internet* or *WWW* links to Historic Scotland, the local archaeological curator or whichever body is carrying out the monitoring on behalf of these bodies.

It is possible that such a programme should be interspersed with regular professional visits either to all sites (*i.e.* every five years) or by sampling a random group of sites on a more regular basis to provide control to the monitoring carried out locally. The extreme expense involved in any scheme of this size would suggest that funds should be sought from more than one source. While Historic Scotland has provided guidelines for the execution of such work and may wish to maintain control of such work, research and heritage based objectives attached to such programmes could possibly attract from funds as diverse as Western Isles Enterprise and the National Lottery.

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8.2 ORGANISATIONS AND INDIVIDUALS CONSULTED

Historic Scotland

Scottish Natural Heritage

RCAHMS, NMRS and APU

National Map Library

Dr Mike Cressey, Andy Dunwell and Ronan Toolis (Centre for Field Archaeology)

Dr Geraint Coles and Professor Denis Harding (Department of Archaeology, University of Edinburgh)

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APPENDICIES

9.0 FORMAT FOR RECORDING OF ARCHAEOLOGICAL SITES

9.1 RECORDING FORMAT FOR ARCHAEOLOGICAL SITES.

FIELD NAME	OPTION	DESCRIPTION AND CONVENTIONS
Parcel	Input data	Based on map sheet.
Monument number / label	Input data	Generation through position in specific map sheet (Ashmore 1996, p13)
Site name	Input data	Only given if site has a recognised and accepted name, either by local tradition, by the Ordnance Survey or by the Royal Commission.
Locale	Input data	Nearest locality on 1:25000 OS map (in Gaelic).
Situation	See Table 1B	Position of site in landscape.
Structural elements	See Table 1C	Principal type of site. Sites with multiple types are further described by *Other structural elements* or on paper.
Other structural element	Input data	Site type or further description not covered by *Structural Element* field.
Dimensions	Input data	Dimensions of entire site coverage described by **x** (maximum length), **y** (maximum breadth) and **z** (maximum height or depth) axes. When different conventions to this are used they are described in field or text.
Orientation	Input data	Gives orientation along x axis with both compass points given (e.g. n to s). Also each of the four major points are abbreviated to their first letter with composite points hyphenated (e.g. n-e equals north-east.)
Artefact elements	See Table 1D	Describes principal artefactual components seen in site.
Other artefact elements	Input data	Describes further artefactual components not covered by *Artefact elements.*
Matrix state	See Table 1E	Both *Site state* and *Matrix state* describe the erosion state of the site and matrix respectively, using the categories outlined by Ashmore (1996, p14). These two fields replace the single field 'Condition' outlined by Ashmore (1996, p14).
Site state	See Table 1E	See above.
Date visited	Input data	Allows *Matrix state* and *Site state* to be assessed within the annual erosion regime of Lewis.
Aspect	Input data	This is described by giving the first compass point followed by the last compass point, then the clockwise direction indicated by the next principal compass point the aspect runs through (e.g. n to s through e).
Period	See Table 1F	This indicates the possible age of the site, as identified by the survey team of each site. This is given by general periods as opposed to numerical chronology due to the uncertain numerical chronologies of many of the site types in this region (see Armit 1996).
Recommended action	See Table 1G	Decided initially in field by survey teams with further consideration given during post-ex.

9.2 OPTION LIST FOR SITUATION FIELD.

OPTION	DESCRIPTION AND CONVENTIONS
Beach	Includes sand and shingle beaches.
Cliff bottom	-
Cliff side	Generally means that site was observed from a distance.
Cliff top	-
Dunes	Within dune systems between beach and machair.
Eroding face	Site generally seen in section.
Foreshore slope	Specific geomorphic term describing the position just beyond a low coastal edge.
Headland	-
Hill side	-
Hill top	-
Machair	Within machair system rather than *Dunes* or *Beach*
Stack	Generally means that site was observed from a distance.
Valley floor	-
Valley side	-

9.3 OPTION LIST FOR STRUCTURAL ELEMENT FIELD

OPTIONS	DESCRIPTION AND CONVENTIONS
Blackhouse	Regionally specific type of Post-Medieval structure common throughout the area
Boat naust	-
Burial	Describes any burial type that is not covered by the more specific options of *Burial cist* or *Burial cairn.*
Burial cairn	Describes a cairn which the survey team believed contains, or contained at some point, a burial.
Burial cist	Describes a burial with stone slabbing evident to form a stone 'coffin'.
Cairn	Single cairn
Cairns	Area of cairns
Complex Atlantic Roundhouse	Iron Age drystone structure, as defined by Armit (1992).
Cave	-
Cell	Single circular or oval drystone structure of relatively small size (<4m. in diameter).
Cellular complex	Complex of cells, which may be single or multi period
Cultivation	Small area of cultivation not meriting *Field system* description.
Cultivation, cord rigging	Cultivation which in cross-section and scale is similar to that of Bronze Age cord rigging.
Cultivation, square cut	Cultivation which in cross-section and scale seems to have been dug by spade.
Dwelling	-
Dyke	Wall or boundary, with or without ditch.
Dyke, drystone	Wall or boundary of drystone construction.
Dyke, stone and turf	Wall or boundary of stone and turf construction.
Enclosure, curvilinear	The landscape of Lewis is dotted with structures whose function is hard to identify from survey alone. Hence it was decided to describe these monuments as *Enclosures* of either *curvilinear* or *rectilinear* form, with the additional label of *habitational* if it was thought that the monument could have been a domestic dwelling. The construction of the walls was also important as this may have some chronological significance in the region (Burgess forthcoming).
Enclosure,	See above.

curvilinear, drystone	
Enclosure, curvilinear, stone and earth core	See above.
Enclosure, curvilinear, turf	See above.
Enclosure, curvilinear, turf and stone	See above.
Enclosure, habitational, curvilinear	See above.
Enclosure, habitational, curvilinear, drystone	See above.
Enclosure, habitational, curvilinear, stone and earth core	See above.
Enclosure, habitational, curvilinear, turf	See above.
Enclosure, habitational, curvilinear, turf and stone	See above.
Enclosure, habitational, rectilinear	See above.
Enclosure, habitational, rectilinear, drystone	See above.
Enclosure, habitational, rectilinear, stone and earth core	See above.
Enclosure, habitational, rectilinear, turf	See above.
Enclosure, habitational, rectilinear, turf and stone	See above.
Enclosure, rectilinear	See above.
Enclosure, rectilinear, drystone	See above.
Enclosure, rectilinear, stone and earth core	See above.
Enclosure, rectilinear, turf	See above.
Enclosure, rectilinear, turf and stone	See above.

Field system	Large area of cultivation with additional associated monuments, such as field boundaries.
Harbour	-
Marine industry feature	Type of monument which is usually situated on or near a beach, specifically associated with marine industry i.e. a kelp kiln.
Mill, horizontal	Type of mill by which the stones are driven horizontally as opposed to the more common vertical position.
Mill, vertical	See above.
None	-
Other	Description occurs in *Other structural elements* field.
Promontory enclosure	New term coined for the type of monument which is situated on a promontory and involves some form of dyke sealing off the rest of the site from inland. No chronological significance is implied and the function of the site may range from being a seemingly defensive site (previously termed a 'promontory fort') to a means of keeping sheep from danger.
Simple Atlantic Roundhouse	Iron Age drystone structure, as defined by Armit (1992). However, as Armit points out (1990, p54), identifying this type of monument in the Western Isles without excavation is unwise.
Settlement	-
Settlement Mound	Usually denotes a possible settlement site.
Sheiling	Usually describes a small cell used for transhumance purposes.
Standing stone	Generally implies a Bronze Age or Neolithic date.
Stone alignment	-
Stone circle	Generally implies a Bronze Age or Neolithic date.

9.4 *OPTION LIST FOR ARTEFACT ELEMENTS FIELD.*

OPTION	DESCRIPTION AND CONVENTIONS
Bone	Unidentifiable to type.
Bone, animal	-
Bone, human	-
Ceramic / pottery	-
Glass	-
Metal	-
Midden, kitchen	Midden with multiple eco-factual and artefactual remains.
Midden, shell	Midden with shell as the predominant ecofact present.
Other	Description in *Other artefact elements.*
Quern, rotary	Provides *terminus post quem* of approximately 2nd century B.C for deposition of artefact (Caulfield 1977; Armit 1991, p192).
Quern, saddle	Unlike *rotary quern,* this artefact has no chronological significance.
Shell	-
Stone (chipped)	-
Stone (polished)	-
Stone (vessel)	-

9.5 *OPTION LIST FOR MATRIX STATE AND SITE STATE FIELDS.*

OPTION	DESCRIPTION AND CONVENTION
A - Eroding	Describes area of definite erosion.
B - Eroding / stable	Some signs of erosion.

C - Stable	No signs of erosion or deposition.
D - Stable / Depositing	Some signs of deposition.
E - Depositing	Definitely depositing.
F - Eroding / Depositing	Signs of both erosion or deposition evident within metres of each other; a phenomenon possible especially in machair systems.

9.6 OPTION LIST FOR PERIOD FIELD.

OPTION	DESCRIPTION AND CONVENTION
Bronze Age	See Armit 1996 for chronological range within the region
Crofting	Specific period within *Post Medieval* during 18th and 19th centuries.
Iron Age	See Armit 1996 for chronological range within the region
Medieval	See Armit 1996 for chronological range within the region
Mesolithic	See Armit 1996 for chronological range within the region
Modern	Specific period indicating the late 19th century up until 1945.
Neolithic	See Armit 1996 for chronological range within the region
Norse	See Armit 1996 for chronological range within the region
Pictish	Specific period used to describe the Late Iron Age in the Western Isles, characterised by cellular buildings at sites such as Berie (Harding and Armit 1990) and Bostadh (Neighbour and Burgess 1997).
Post Medieval	See Armit 1996 for chronological range within the region
Pre-Clearance	Specific period within *Post Medieval* prior to the Clearances.
Prehistoric	Generic term for sites prior to the Norse incursions in the latter quarter of the first Millennium A.D.
Unknown	-

9.6 OPTION LIST FOR RECOMMENDED ACTION FIELD.

OPTION	DESCRIPTION AND CONVENTIONS
Nil	Site does not merit any further action.
Monitor	Site is of sufficient importance or state of erosion to warrant monitoring.
Survey	Site is of sufficient importance or state of erosion to warrant survey.
Sample	Site is of sufficient importance or state of erosion to warrant sampling but not full excavation.
Excavate	Site is of sufficient importance or state of erosion to warrant full scale excavation. This applies to sites which would provide important information on periods or site types unknown or rarely excavated in the area, or to sites which would help to answer current major research questions.

10.0 FORMAT FOR RECORDING OF ENVIRONMENTAL SITES

10.1 RECORDING FORMAT FOR ENVIRONMENTAL SITES.

FIELD NAME	OPTION	DESCRIPTION AND CONVENTIONS
Site number / label	Input data	Generation through position in specific map sheet (Ashmore 1996, p13)
Parcel	Input data	Based on map sheet.
Type	See Table	Describes type of environmental site.

	2B	
Other data	Input data	Provides further information on site.
Situation	See Table 1B	Describes position in landscape.

10.2 OPTION LIST FOR TYPE FIELD.

OPTION	DESCRIPTION AND CONVENTIONS
Alluvial section	Section presently within fluvial system.
Holocene section	Section of any type but assumed to be within Holocene (past 10000 years).
Other	Description given in *Other data* field.
Palaesol	Section contains old ground surface (s).
Pre Holocene section	Section of any type but appears to be pre Holocene due to existence of glacially derived deposits.

11.0 RECORDING FORMAT FOR EROSION / GEOMORPHIC CELLS

11.1 RECORDING FORMAT FOR EROSION / GEOMORPHIC CELLS.

FIELD NAME	OPTION	DESCRIPTION AND CONVENTIONS
Cell number / label	Input data	Generation through position in specific map sheet (Ashmore 1996, p13)
NGR (centre of cell)	Input data	-
Erosion class	See Table 1E	Dominant erosion class within cell.
Locale	Input data	Nearest locality on 1:25000 OS map (in Gaelic).
Foreshore	See Table 3B	Dominant foreshore type within cell.
Hinterland	See Table 3C	Dominant hinterland type within cell.
Geology	Input data	Indicates solid and drift geology (cross-referenced to BGS maps during post-ex).
Modifier	See table 3D	Dominant modifier within cell.

11.2 OPTION LIST FOR FORESHORE FIELD.

OPTION	DESCRIPTION AND CONVENTIONS
Mainly alluvial sand / mud	Much of sediment derived from fluvial deposition of sand and mud.
Mainly rock platform	Much of foreshore covered by exposed solid geology.
Mainly sand	Much of sediment consists of sand, derived from processes other than fluvial.
Marsh	Marsh dominant.

11.3 OPTION LIST FOR HINTERLAND FIELD.

OPTION	DESCRIPTION AND CONVENTIONS
Alluvium	Much of sediment derived from fluvial deposition of sand and mud.
Drift, boulder clay	Diamicton observed.

Drift, boulder clay over visible rock	Diamicton overlying solid geology.
Glacial sand and gravel	Glacially derived sands and gravels observed, representing a different deposition regime to that of diamicton.
Raised beach and marine deposits	Describes raised beaches of early to mid Holocene or pre Holocene age.
Wind blown sand	Generally describes back of beaches or machair systems.

11.4 OPTION LIST FOR MODIFIER FIELD.

OPTION	DESCRIPTION AND CONVENTIONS
Cliff over 5 m.	-
Human disturbance	Describes area of accidental or deliberate modification by humans.
Low edge < 5 m.	-
Man made barrier	Specifically built by humans.
Shingle / storm bank	-