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Coastal Assessment Survey
Inner Moray Firth

Inverness to Dingwall

September 1998

VOLUME 1

Map sets 1-18

a report for
HISTORIC SCOTLAND

by the
CENTRE *for* FIELD ARCHAEOLOGY

CENTRE *for* FIELD ARCHAEOLOGY

University of Edinburgh

November 1998

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MORAY, BEAULY AND CROMARTY FIRTH COASTAL ASSESSMENT 1998

Report No. 446

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1 INTRODUCTION

Background

In August 1998 Historic Scotland invited tenders to conduct a coastal survey project to cover the coastal edge from Inverness to Tarbat Ness (National Grid Reference NH 650465 and NH 950 878 respectively). Following submission of its Project Design, the Centre for Field Archaeology was awarded the contract.

This project is part of a larger Historic Scotland review of archaeology and the coastal zone and is the thirteenth such survey to be completed. Surveys have already examined the Solway coast (Cressey and Toolis 1996), the north coast of the Forth estuary (Robertson 1996); the south coast of the Forth estuary (James 1996); a stretch of coast from Ullapool to Lochinver (Long 1996) and the coastline within the Firth of Forth and Tay Estuary Robertson *et.al.* (1997). Surveys have also been undertaken in Lewis (Burgess & Gilmour 1997), Orkney (Moore & Wilson 1997) and Shetland (Moore & Wilson 1997). In addition there have been excavations, site recording and focal studies such as the Solway Phase 2 study that examined the biostratigraphy of coastal sediments (Cressey *et. al.*1998)

This programme of work has come out of the recognition of the importance of the coastal zone to Scottish archaeology and the need for information that will allow Historic Scotland to determine the nature of specific threats to archaeology and formulate solutions for specific sites (Ashmore 1994). Of particular relevance here was the recognition of the need to obtain standardised information and colour-coded mapped data for coastal areas. As a consequence, all the coastal surveys follow similar methodologies, based on Historic Scotland's *Archaeology Procedure Paper 4, Coastal Zone Survey* (1996), although there has been some evolution of the format.

In addition to the archaeological dimension, this survey has been conducted against a wider regional interest in the management of the Moray Firth. The Moray Firth Partnership (hereafter MFP) has generated a large corpus of information designed to promote management objectives for the area centred on a cultural and historical perspective. The MFP document *Living and Working* considers, amongst other topics, the landscape and cultural heritage, geology and geomorphology, marine and coastal environments, ecology, social and economic resources, recreation and tourism, harbours and shipping as well as coastal protection, planning and management. Archaeology, and the preservation of archaeological sites, clearly cross-cuts a number of these subjects. The present report contributes towards understanding the current status of the coastal archaeology and built heritage, which can be placed alongside the wider issues central to coastal zone management for the Moray Firth.

During this project, desk based work and report production were conducted by Andy Dunwell, Alex Hale and Dr Mike Cressey. Alex Hale supervised the fieldwork, with assistance from Alastair Rees, Bruce Glendinning, Ian Sudderby and George Mudy. Geomorphologic and erosion mapping was conducted by Mike Cressey. Dr Malcolm Murray assisted with aspects of the coastal geomorphology and computer-based map production. Dr Bill Finlayson managed the project for CFA and Patrick Ashmore for Historic Scotland.

Project Aims

The objectives for the Moray Firth Survey were set out in the Historic Scotland Project Outline as:

To gain factual information on, and an inventory of part of the coastal heritage to provide a basis for more work including:

- *detailed survey of important areas prior to protection, excavation or abandonment;*

- *Monitoring of sites and stretches of coastline by local organisations and people.*

In addition to agreeing to follow the Historic Scotland *Procedure Paper* to fulfil these objectives, CFA has undertaken to carryout certain additional elements of work to further the long-term objectives of the project.

Report Format

In this report we use the term *shoreline* to refer to the distinct boundary between land and sea that changes with the tides. A *coastal unit* defines the areas between individually numbered cut-off points that demarcate individual sections of coastline which may be classified according to its *eroding, stable* or *accreting* status. The *unit* is distinct from littoral "cells" or segments of coastline that normally include an entire cycle of sediment delivery to the coast by either rivers or coastal erosion.

This report contains the results of the rapid coastal assessment. These are presented sequentially for each coastal unit and follow a standard format. Elements include an introductory section, a section containing the coastal geology/morphology, coastal erosion and archaeological gazetteer and maps. Pertinent issues are highlighted through three case studies, which are followed by a section incorporating results and observations. This is followed by a list of references, contacts made whilst the project was in progress and persons to who's help we acknowledge. Appendix 1 includes histograms of the statistics in support of the results.

The Study Area

The study area as defined for this project comprises a wide variety of coastal land - forms, including the steep precipitous cliffs characterised by the North and South Sutors. Estuarine environments are predominant within the Beulay and Cromarty Firths where intertidal mud flats, macro-tidal river channels and saltmarsh are extensive. Relict shoreline features reflecting relative sea-level changes are also present within the study area. The coastline is dynamic and its configuration is changing albeit at different rates.

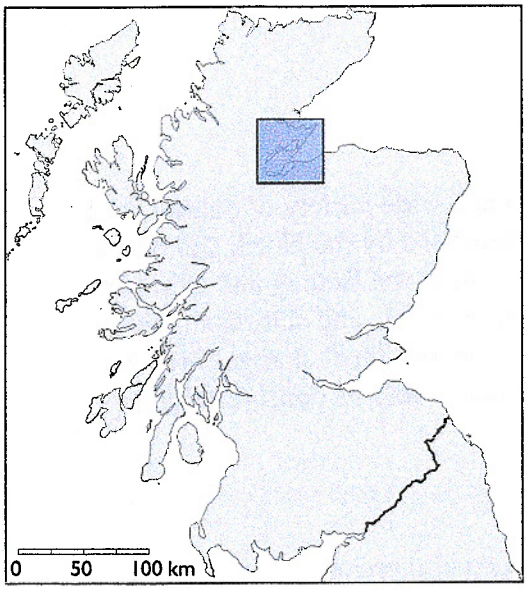
Geological Background

The geological structure of the Moray Firth has been comprehensively mapped and described by British Geological Survey in *The Northern Highlands of Scotland* 1989 publication. The distribution of basement and drift lithologies are shown in Figure 1. The dominant basement lithology consists of metamorphosed Moine sediment that is unconformably overlain by Old Red Sandstone of Devonian Age. The Old Red Sandstone is locally exposed along much of the coastal sections and is overlain by younger rocks of Permo-Triasic and Jurasic Age. These rock types are derived from mainly non-marine sources such as aeolian dune sand and freshwater/brackish marine alluvial sediment. Within the Moray Firth region, the Old Red Sandstone is sub-divided into Middle and Upper Old Red Sandstone. The latter series is predominant along the Black Isle shoreline and further south towards Inverness.

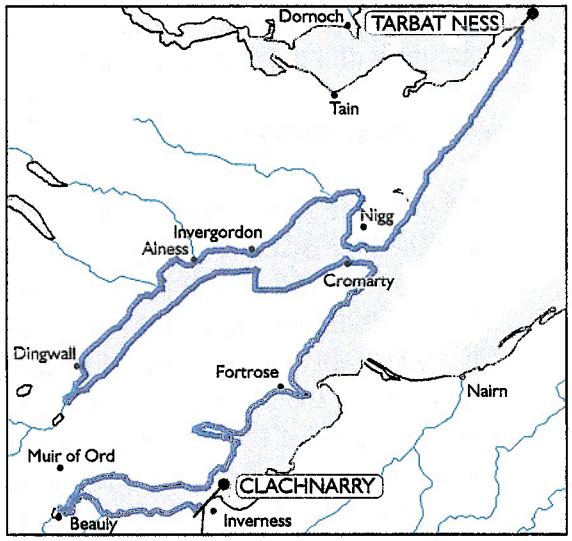
Quaternary/Holocene geomorphology and relative sea-level changes

The climatic oscillations occurring within the Quaternary era (<1.6 million years BP) have given rise to a series of erosion and depositional events that have shaped the character of the present coastline. The Moray Firth experienced four major periods of glaciation during the Pleistocene epoch. The glacial maximum occurred ca 18000 years BP, during which time the ice sheet limit extended across the survey area beyond the present coastline and out into the dry bed of the North Sea (Jardine 1979). Deglaciation from ca. 13500 years BP onwards was marked by rapidly rising temperatures and rapid ice wastage, probably associated with high melt-rates, while unvegetated till-mantled slopes became exposed (Maizels and Aitken 1991). The wastage of the late Devensian Ice-Sheet (c.13000 BP) was instrumental in releasing large volumes of out-wash that was carried along much of the Inner Moray Firth at this period. The wastage of the Loch Lomond Advance (c.11.500-10500 years BP) is also attributed to the extensive re-distribution of glacial sands and gravel that mantle the basement facies already described.

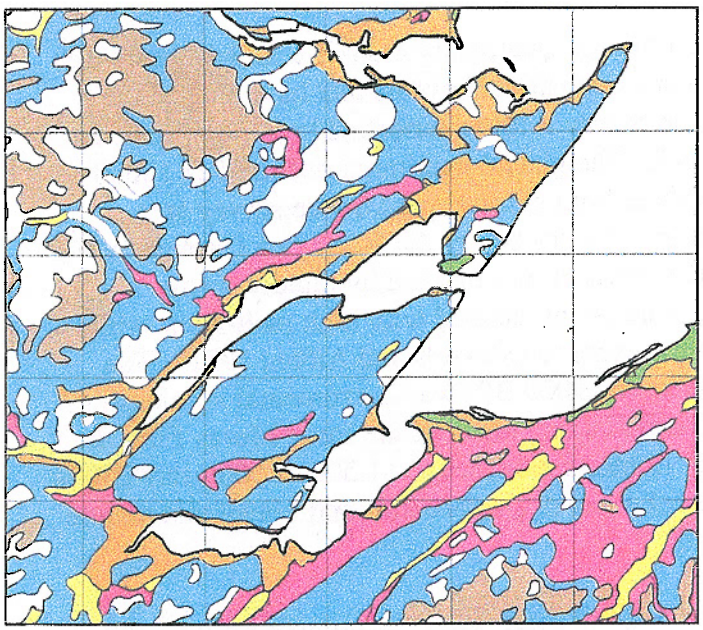
During the Pleistocene, sea level rose and fell episodically as climate warmed and cooled and continental glaciers advanced and retreated. After the ice was removed, the continents rebounded. The rate of rebound was not a simple linear trend but rather a function of the isostatic/eustatic budget. Within our study area, the rebound has been on the order of several metres, and abandoned beaches and wave cut terraces lie several metres above current sea level.



LOCATION OF THE MORAY FIRTH SURVEY



LIMITS OF THE MORAY FIRTH SURVEY
Clachnarry to Tarbat Ness



DRIFT GEOLOGY
1: 625 000

Key:

- Blown sand
- Peat
- Alluvium (incl. River Terrace Deposits)
- Raised Beach and Marine Deposits
- Glacial Sand and Gravel
- Boulder Clay and Morainic Drift

Based on the 1977 *Quaternary Map of the United Kingdom* (First Edition), North Sheet.

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FIGURE 1: LOCATION AND GEOLOGY MAPS

Based on the results of detailed stratigraphic investigations at the head of the Beauly Firth, Sissons (1981) proposed that extensive marine erosion occurred in the area during the Loch Lomond Stadial (Younger Dryas). He argued that the erosion produced distinctive abandoned clifflines that border much of the inner Moray Firth. Sissons (1981) suggested that the shoreline associated with this event stands at about 2 m above OD and it is equivalent to the Main Lateglacial Shoreline of the Forth Valley (Sissons 1969, 1974, 1976). Biostratigraphic analyses of the sediments deposited at the head of the Beauly Firth by Haggart (1986, 1987 and 1988) and Firth and Haggart (1989) have led to a greater understanding of sea-level movements and shoreline displacement. Haggart (1986) postulated that at 9600 BP, the estuarine flats (the so-called Barnyard Beds) lying at an altitude of 6m above OD, at the head of the Beauly Firth, were abandoned as relative sea-level fell. The limit of the regression is not known, but a rise in relative sea-level is recorded to 9m above OD at Bêauly, and radiocarbon dated to between 7100 and 5775 years BP. This marine transgression is correlated with the Main Postglacial Shoreline of eastern Scotland (Sissons, 1989). The late Holocene has been characterised by falling relative sea-levels (Firth 1990). Minor transgressive events or stillstands are responsible for up to five late-Holocene shorelines (Firth and Haggart 1989).

The Tidal Environment of the Moray Firth

According to the MFP *Geomorphology and Coastal Defence Topic Paper* (p.17) there is a general lack of detailed scientific information on the movement of beach sediment or on the history of onshore wave height and direction. This is compounded by the fact that there are similar gaps in information on offshore wave height/period and direction. The MFP sees this as a serious obstacle in assessing the local effects of any global climate change. This report does however note (p.27) that at present the major tidal currents bypass the mouth of the Moray Firth and pass down the North Sea where the surge in water level can build up to 3m above the predicted level. This has allowed the Moray Firth coast to escape the worst effects of recent storm surges. The Shoreline Management Plan (SMP) 1996 Wallingford publication provides more information based on metrology and hydrographic information obtained from Admiralty records, the Met Office and offshore oil industry. The wave climate is suggested to be dominated by locally generated wind waves and episodic storm activity (see Lamb 1991). Short-fetch lengths are seen as a contributing factor in suppressing wave height (*ibid* p.7). Wind direction is critical in controling the tidal regimes at any given location. The Spring tidal range is quoted (*ibid* p.8) as increasing south-westward within the region; from 2.8/3.1m at Wick/Fraserburgh through 3.5m at Lossiemouth, Burghead and Cromarty, and through 3.6/3.7m at Nairn/Invergordon and 4.1m at Inverness. Overtopping events (breaches in sea defences) and the damage to coastal defence is usually associated with times of both large waves and high water levels. Within the survey area, the largest waves occur during storms from the north-westerly or north-easterly quadrants. There appears to be no known information on wave conditions within the Inverness Firth. Wave energy generated offshore of the Moray Firth will have limited effect on the coastline within the Beauly Firth due to the shelter provided by the forelands of Fort George and Channory.

Sites of Special Scientific Interest

Within the study area there are six sites designated as Sites of Special Scientific Interest and are important for specific habitats of plants and wildlfowl. The Rosemarkie to Shandwick coastline is important for its geology. All sites are associated with maritime and peri-marine environments. Table 1 below lists the sites by name and the reason for their designation.

No	Site Name	Conservation status and habitat	Principal Conservation Interest
1	Beauly Firth	SSSI, intertidal sand and mudflats; saltmarsh	Nationally important site for overwintering wadersand wildfowl; internationally important populations of seaduck.
2	Munlochy Bay	SSSI; intertidal sand and mudflats; saltmarsh	Important area for overwintering wildfowl
3	Conon Islands	SSSI; saltmarsh; fen woodland	Woodland; brackish fen vegetation; woodland and heathland birds; overwintering waders and wildfowl
4	Cromarty Firth	SSSI; intertidal sand and mudflats; saltmarsh; sand and shingle; Nigg & Udale Bays	Internationally and nationally important site for waders and wildfowl.
5	Rosemarkie to Shandwick Coastline	SSSI; slumped cliffs; rocky platform	Coastal cliff vegetation; seabirds; Cromarty and Rosemarkie inliers provide insight into the basement of the East Scotland Caledonides.
6	Tarbat Ness	SSSI; rocky platforms and low cliffs.	Maritime heath and salt spray communities

Table 1 Sites of Special Scientific Interest within the study area. The sites are shown in Figure 2 (Source: Moray Firth Review).

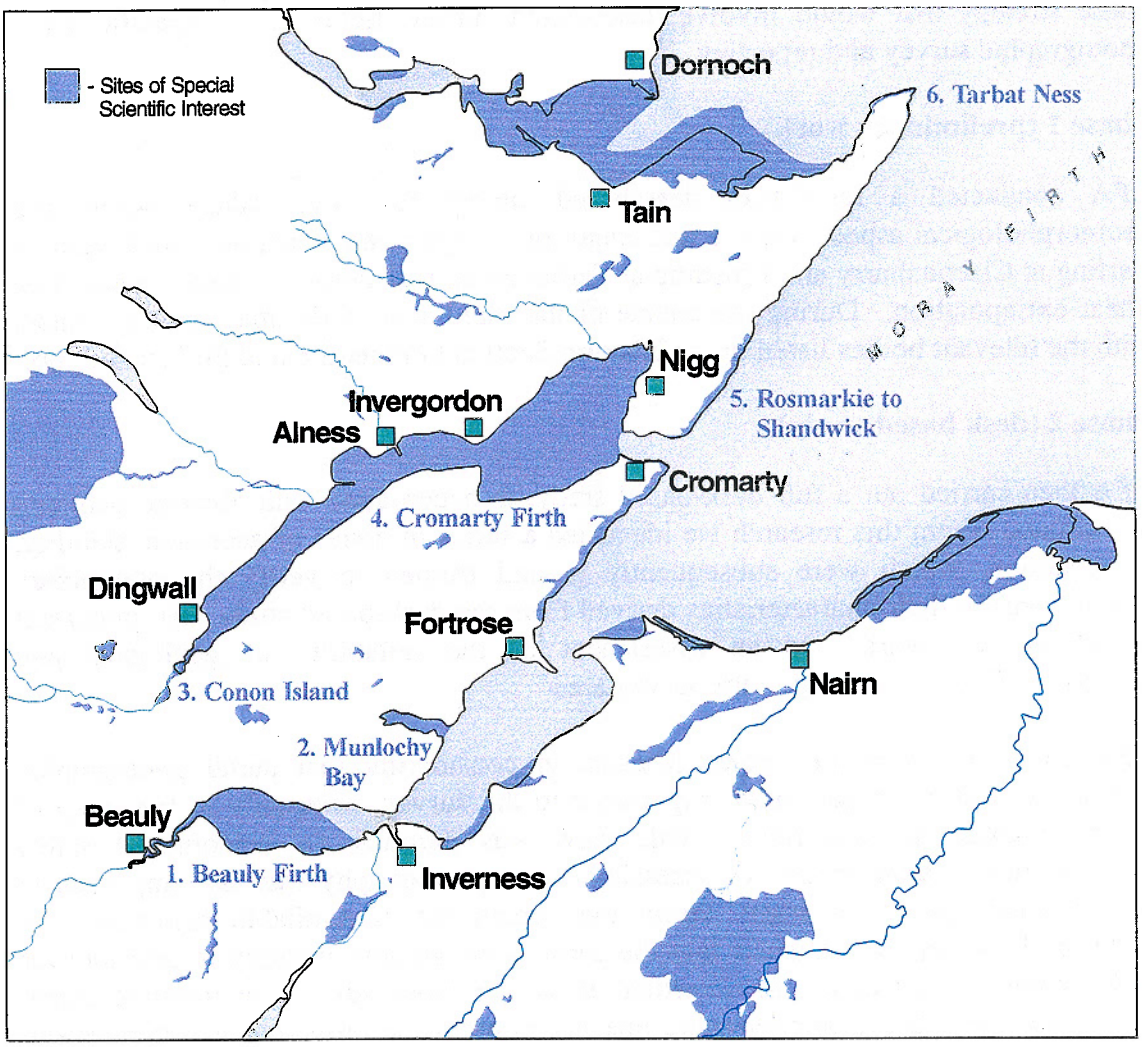

Figure 2. Distribution of Sites of Special Scientific Interest in the survey area.

2 METHODOLOGY

Methodology

The Project Outline requests information regarding the extent of our proposed survey within the total 200km coastal strip. To this end our Project Design proposed a four-phase strategy that would involve; desk-based survey, field survey, specific aerial photographic survey and reporting.

Phase 1 (preliminary work)

CFA conducted a rapid-scan desk-based survey for both archaeological and geomorphological aspects for the full length of the specified coastline from Inverness starting at Clachnaharry and finishing at Tarbat Ness, a distance of 166.8 km based on linear extrapolation. During the course of the rapid scan, CFA made initial contact with the relevant bodies listed in the Historic Scotland Procedure and Project Outline.

Phase 2 (desk based study)

CFA then carried out a full desk-based study, in accordance with Historic Scotland procedures. From this research we identified a series of zones of accretion, stability, or recession, which were subsequently ground truthed to verify the preliminary conclusions on their characteristics derived from the desk-based study. An important aspect of this work was an assessment of the reliability of geological and geomorphological mapping in the survey area.

CFA concurred with the Project Outline in considering that aerial photographic imagery would be of particular importance to the survey, especially in the study of intertidal mud and silt flats. This view was partially an outcome of safety considerations. Examination of accessible aerial photography was also important to ensure good spatial coverage within the constraints of available resources. In addition, however, we consider that the aerial photographic imagery is probably the best source of information for intertidal areas. Previous surveys of intertidal zones have shown that aerial photographic imagery is often the only source which reveals the patterns of large scale features.

There are several series of photographs relevant to the study, including runs from the immediately post war period, and surveys undertaken in the 1960s and' 70s taken for land use capability studies. More recent aerial surveys have been commissioned by SNH and these were scrutinised for additional information. These provide a series of images that can be used for comparative purposes over a considerable period, and when combined with ground inspection, provide evidence for almost 50 years of change. Although the Historic Scotland procedure notes that the examination of several series of photographs and map sources can be expensive, we consider that, especially given the importance we attach to aerial photographic analysis for the intertidal zone, the time employed on aerial photographic analysis and other documentary sources repaid the investment. In addition, it can be difficult in the field to determine whether a given stretch of foreshore is accreting, stable, or eroding, and the accumulated aerial photographic evidence makes this possible.

There have been a number of geomorphological studies made along the Inner Moray Coast, including work by Haggart (1987) and Peacock, Graham & Gregory (1980). Recent work conducted by Dr Andrew Haggart of London Guildhall University assessed the previous models of coastal change over the last ten thousand years and using multi-approach methods has proposed a remodelled sea-level change curve for the area (Haggart 1989). More recently collaboration between geomorphologists and archaeologists has led to the combination of using intertidal archaeological remains as specific sea-level indicators in the Beauly Firth (Haggart, Hale & Firth forthcoming). In many respects the paleoenvironmental data required for the purposes of the project has already been collected, and one of the chief aspects of the work required here is that of collation. Unfortunately, as much of this work has not been conducted with a specific archaeological/heritage interest and has occurred over the last 30 years, there are problems of compatibility of information and standards of research. However, recent commercial development, especially by the Cromarty Firth Partnership, has led to the production of a number of useful geological and geomorphological studies. The focus of most of the palaeoenvironmental research has been on Holocene deposits and the encouraging results indicate the potential for future palaeo-archaeological, multi-discipline research projects to develop in the North-East Firths region.

Phase 3 (fieldwork)

The archaeological survey undertaken required (as specified in the Historic Scotland procedure) to be systematic and to be conducted in all relevant land parcels (with the exception of unsafe intertidal areas). The northern shoreline of the Cromarty Firth has become heavily industrialised since the North Sea oil companies began to use the Firth as a deep water storage and repair base for off-shore oil rigs and the adjacent shorelines as supply depots and fabrication yards. This was considered likely to have had an impact on both the presence of archaeological remains and their visibility. No survey work was undertaken within the extensive petrochemical installations at Invergordon and further south at the Nigg Offshore Fabrication yards (see Map Sheet 25 below). However the desk-based assessment did take into account all the sites and monuments previously destroyed as a result of their construction. It was clear on the ground that industrial development had in fact been so intense to make inspection worthless in the immediate hinterland behind the artificial coasts created to protect them. Where access was available on the seaward side of the works, then the foreshore was examined according to normal procedures.

Based on the information obtained at the desk-based stage (both archaeological and geomorphological), we ensured that the field survey covered a representative sample of the various combinations of environmental settings and on the cultural side, periods/site types. There were no restrictions to access in regard sensitive wildlife areas including sites designated as SSSIs.

The desk study was completed before fieldwork commenced, allowing the field teams to be supplied with data assembled from a range of sources for checking. In essence, the fieldwork comprised standard archaeological fieldwalking survey, combined with the recording of the erosional status of sites, the assessment of vulnerable parts of the landscape, and ground truthing of geomorphological data. We used GPS to assist in the determination of the location of sites for mapping as required in the Historic

Scotland Procedure, where local mapped features did not provide an accurate fix. The survey was not done in a single sweep but was carried out at selected points along the coast in order to take into account the vagaries of local tidal variation. Separate field visits along key locations by the geomorphology team (Drs Cressey, Murray and Alex Hale) ensured that the observations made during the initial survey were as accurate as possible. Additional information was added to CFA's Rapid Coastal Assessment Sheets as required.

The initial survey was undertaken during September 1998, during which the full advantage of the equinoctal tides were taken and no time was lost to inclement weather. The only restriction imposed on the field team was access to beaches at the base of precipitous cliffs. These were encountered at the North and South Sutors, parts of which were not surveyed on the grounds of health and safety.

Phase 4 (report compilation)

We allowed a considerable time element for reporting, as we appreciated that a considerable volume of data is likely to be produced during the survey. The present Report has been constructed using digitised map-based data based on desk-based results and field data. The survey map sheets are shown from south to north forming a logical progression around this sinuous part of the Scottish coastline.

MAP 1: CLACHNAHARRY TO PHOPACHY

Hinterland Geology and Coastal Geomorphology: This section of coastline forms part of the southern shore of the Beauly Firth. The basement geology consists of sedimentary Middle Old Red Sandstone of the Moine Series. Boulder clay dominates the main lithology away from the coast. Clachnaharry sits on a low-level delta that flanks the river Ness. A degraded Holocene raised shoreline runs west parallel with the present shore. This feature is discontinuous and hard to recognise owing to presence of a road and railway line but it becomes more prominent in the region of Bunchrew. From here and towards the head of the Beauly Firth, Holocene marine deposits become the dominant coastal lithology. The foreshore is linear until Bunchrew Mains where a foreland at c.5-10m OD juts out into the firth. West of Bunchrew the shoreline is dominated by saltmarshes, mud and shingle that overlook extensive intertidal mudflats.

Erosion Class: The Beulay Firth is sheltered from larger swell and storm waves from the east in the Moray Firth by the promontories at Chanonry and Fort George. As a result of this, the predominant character of this the coastline between Clachnarry and Bunchrew Mains is classified as eroding or stable with accretion predominant in parts. Erosion is mainly confined to scour zones at the base of sea walls and at Bunchrew caravan site where concrete rubble and old tree stumps have been placed in an attempt to stabilise erosion at the HWM. Degraded saltmarsh also points to local erosion induced by wave attack. This is less noticeable to the north of Englishton where a sheltered bay is accreting and saltmarsh is well developed. Offshore where bladder-wrack seaweed covers rocks and shingle conditions are considered to be stable.

Built Heritage & Archaeology: The first archaeological remains recorded in this coastal survey consist of the major 19th century engineering works of the Caledonian Canal, designed and built by Telford in 1810 (Butt 1967). The excellent state of preservation of not only the canal, sea locks and basin are complimented by the associated workman's cottages, workshops and hand crane. This example of Industrial heritage is contrasted by the Mesolithic ? shell midden situated on the raised sea beach behind the canal. Further built heritage include Buchrew House and designed landscape gardens, built 1615. To the west of Buchrew house, the remains of an 18th/19th century landing place and associated storehouse were located, although they were both in a very poor state. To conclude, this area shows a varied group of sites in age, location and fabric.

Map 1: Hinterland Geology and Coastal Geomorphology

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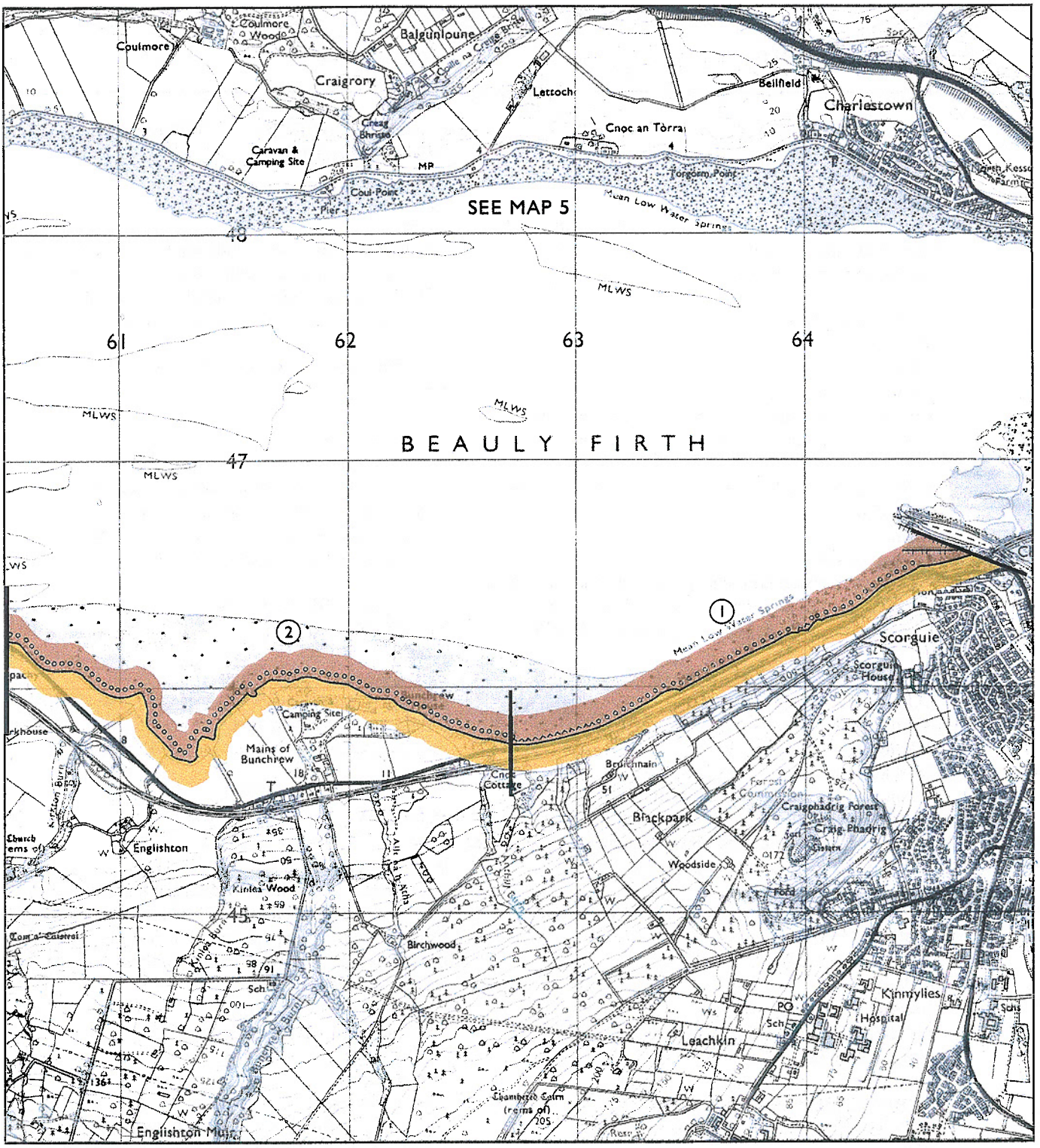
1. CLACHNARHARRY: CALEDONIAN CANAL PIER to CNOCH COTTAGE.
NH 635 460
2.2km
Mainly mud and sand
Low edge (<10m)
Raised beach and marine deposits
This unit has a low cliff backed by marine sands and gravel overlain by boulder clay. The foreshore is mainly mud with shingle. Breakwaters protect the canal entrance.

2. North of CNOCH COTTAGE to east of PHOPACHY FARM
NH 617 460
3km
Mainly mud and shingle
Low edge (<10m)
Raised beach and marine deposits
Curvilinear low cliff-edge backed by marine derived sands and gravel consolidated by boulder clay. Estuarine tidal flats of mud and shingle.



MAP 1: CLACHNARRY TO PHOPACHY

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 61-65/44-49

Basemap: O.S. *Pathfinder* Series
Sheet 177
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 08 September 1998

Hinterland:

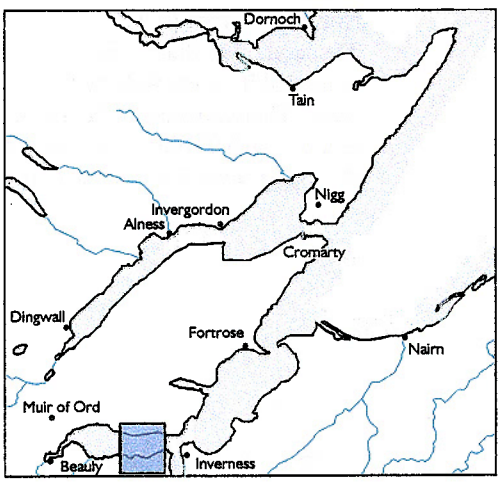
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



Map 1: EROSION

1. CLACHNARRY to SCOURUIE
NH 644 464
0.8km
Eroding or stable
Concrete sea defences are being eroded by scour at their base. Mudflats contain patches of boulders and shingle that has evidence for accretion.

2. WEST SCOURUIE
NH 640 463
0.5m
Eroding or stable
This unit of coastline is defended by concrete rubble that is eroding at the base. Mudflats are accreting

3. WEST OF SCOURUIE to north of BRUICHCHAIN
NH 635 462
7.2km
Eroding or stable
A concrete sea wall defends this unit of coastline that is being effected by scour at the base. Mudflats are accreting with shingle banked against the MHWM.

4. North of BRUICHCHAIN to North of CNOC COTTAGE
NH 630 458
0.7km
Eroding or stable
A concrete sea wall defends this unit. Erosion is occurring at the MHWM. Dumped rubble also shows signs of erosion. The intertidal zone appears to be stable with the accretion of mud and shingle

5. North of CNOC COTTAGE to BUNCHREW HOUSE
NH 625 458
0.2km
Eroding or Stable
Sea defences being effected by erosion. Foreshore scoured seaweed and rocks.

6. BUNCHREW HOUSE
NH 623 459
0.3km
Definitely Eroding
The land immediately in front of Bunchrew House is defended by a sea wall that shows signs of scouring at its base. There appears to be a noticeable lack of shingle against the MHWM which suggest that sediment supply is reduced here for reasons that are not clear

7. East of BUNCHREW HOUSE to BUNCHREW CARAVAN HOUSE
NH 620 460
0.3km
Stable
This unit is stable with a wide range of different particle sizes on a low angled beach. Vegetation at the MHWMS lends additional stability to the backshore. Accreting mud and shingle form the wide intertidal area.

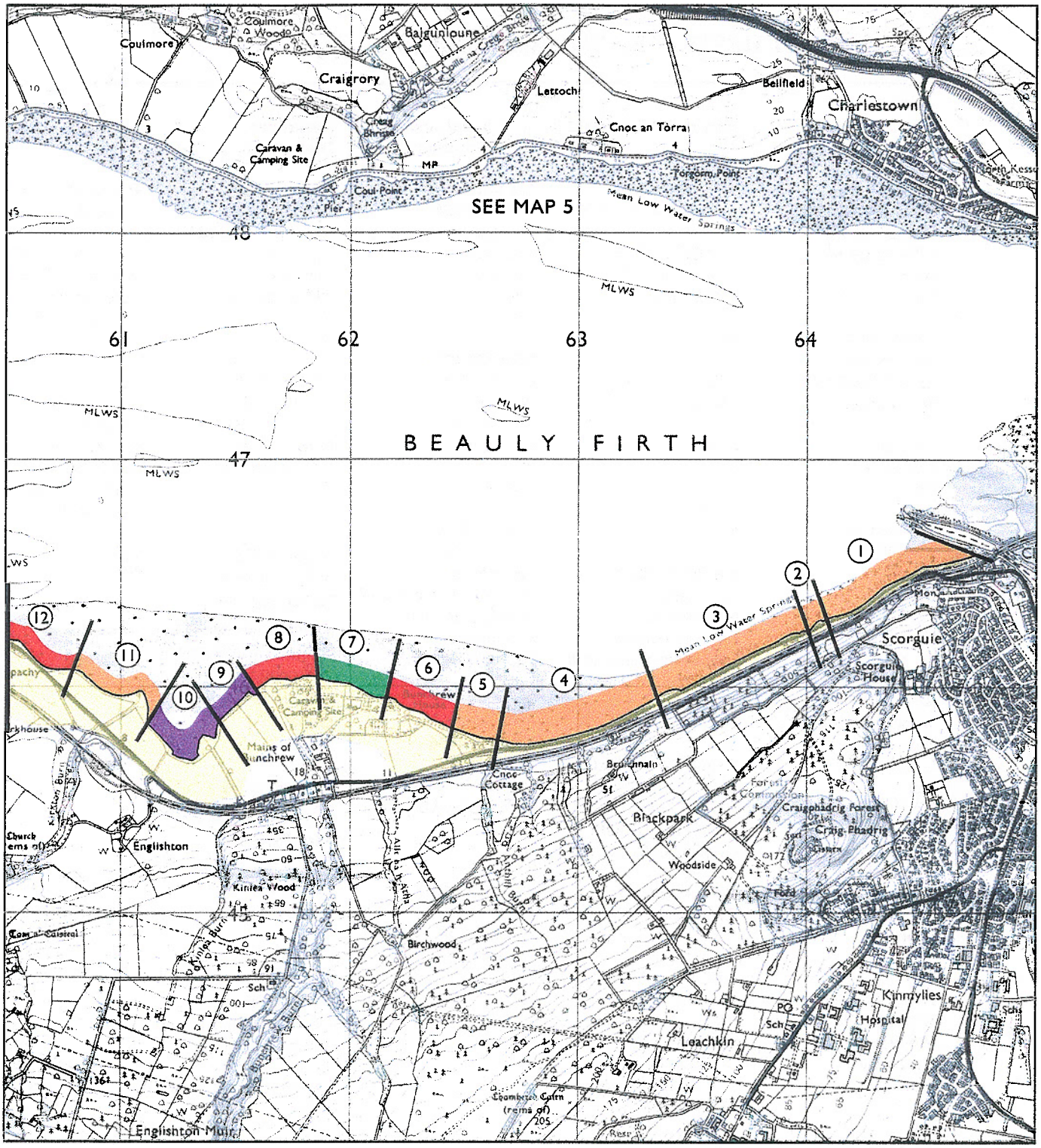
8. BUNCHREW CARAVAN SITE
NH 618 461
2.8km
Definitely Eroding
Demolition rubble and large tree stumps have been dumped at the HWM in an attempt to defend this section of shoreline. In parts the sea has scoured out some of this material from the base of the rubble. The foreshore is well exposed with boulders and shingle

9. MAINS of BUNCHREW
NH 615 459
0.2km
Both Accreting and Eroding
This unit has a noticeable lack of saltmarsh and the fronting cobble beach appears to be eroding. Mud and shingle is accreting on the wide foreshore.

10. North of ENGLISTON
NH 613 457
0.4km
Both Accreting and Eroding
Saltmarsh development is leading to accretion in parts of this sheltered bay. Out towards the intertidal flats a series of piles are exposed and it is not clear if these are old sea defences. Owing to the sheltered position mud is accreting on the foreshore.

11. North of PARKHOUSE
NH 610 460
0.4km
Eroding or stable
The hinterland is well vegetated but saltmarsh is slowly eroding from the HWM. The beach consists of shingle and mud which appears to be accreting on foreshore.

12. PHOPACHY
NH 607 461
3.2km
Definitely Eroding
Backshore well vegetated with an eroding saltmarsh at the HWM caused by scouring in storm conditions. Mud and shingle are exposed on the tidal flats.



MAP 1: CLACHNARRY TO PHOPACHY

MORAY FIRTH SURVEY Grid ref: NH 61-65/44-49

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 177

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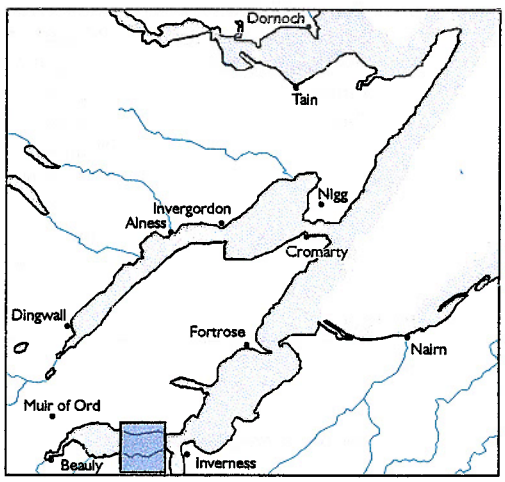
EROSION CLASS

Assessment date: 08 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 1: BUILT HERITAGE AND ARCHAEOLOGY

Coastal Edge & Foreshore

NH 6452 4653
CLACHNAHARRY
Disused pier
19th century AD
Poor
Nil

NH64NW 2
NH 645 465
CLACHNAHARRY
Shell midden (not located)
Uncertain
Unknown
Nil

NH 6264 4577
ANTHILL
Groyne
Unknown
Fair
Nil

NH 6222 4591
BUNCHREW
Wooden posts and concrete pipe
Unknown
Fair
Nil

NH 6220 4599
BUNCHREW
Concrete slipway
20th century AD
Poor
Nil

NH 6198 4600
BUNCHREW
Wooden piles
Uncertain
Good
Nil

NH 6195 4610
BUNCHREW
Metal pipe, land drain
20th century AD
Good
Nil

Sites in the Hinterland

NH64NW 30.00
NH 6442 4676 - 6500 4645
CLACHNAHARRY
Caledonian Canal
19th century AD
Good
Nil

NH64NW 30.01
NH 6479 4649
CLACHNAHARRY
Caledonian Canal, hand crane
19th century AD
Good
Nil

NH64NW 30.02 - Scheduled
NH 6488 4656
CLACHNAHARRY
Caledonian Canal, lock
19th century AD
Good
Nil

NH64NW 27 - Listed C
NH 6487 4653
CLACHNAHARRY
Caledonian Canal; lock, workshops
19th century AD
Good
Nil

NH64NW 33
NH 6483 4659
CLACHNAHARRY
Caledonian Canal, railway swing bridge
20th century AD; built 1909
Good
Nil

NH64NW 34
NH 6481 4657
CLACHNAHARRY,
Station
Railway signal box
20th century AD
Good
Nil

Coastal edge & Foreshore

NH 6148 4595
BUNCHREW
Wooden piles forming fence line
Uncertain
Good
Nil

NH 6130 4574
BUNCHREW
Wooden posts across inlet, possible fish trap
Uncertain
Poor
Survey

NH64NW 37
NH 6085 4610
PHOPACHY
Stone rubble remains of landing place and storehouse
18th/19th century AD
Poor
Survey

NH6070 4606
PHOPACHY
Land drain outfalls
20th century AD
Good
Nil

NH 6058 4620
PHOPACHY
Wooden piles
Uncertain`
Poor
Nil

Sites in the Hinterland

NH64NW 29
NH 6473 4657
CLACHNAHARRY,
2 Low St
Cottages
19th century AD
Good
Nil

NH64NW 32
NH 6471 4667
CLACHNAHARRY
Canal cottages
19th century AD
Good
Nil

NH64NW 5
NH 6217 4591
BUNCHREW
Residential house; designed landscape
17th century AD; built 1615
Good
Nil

NH64NW 72
NH 6044 4612
PHOPACHY
Residential country house
18th/19th century AD
Good

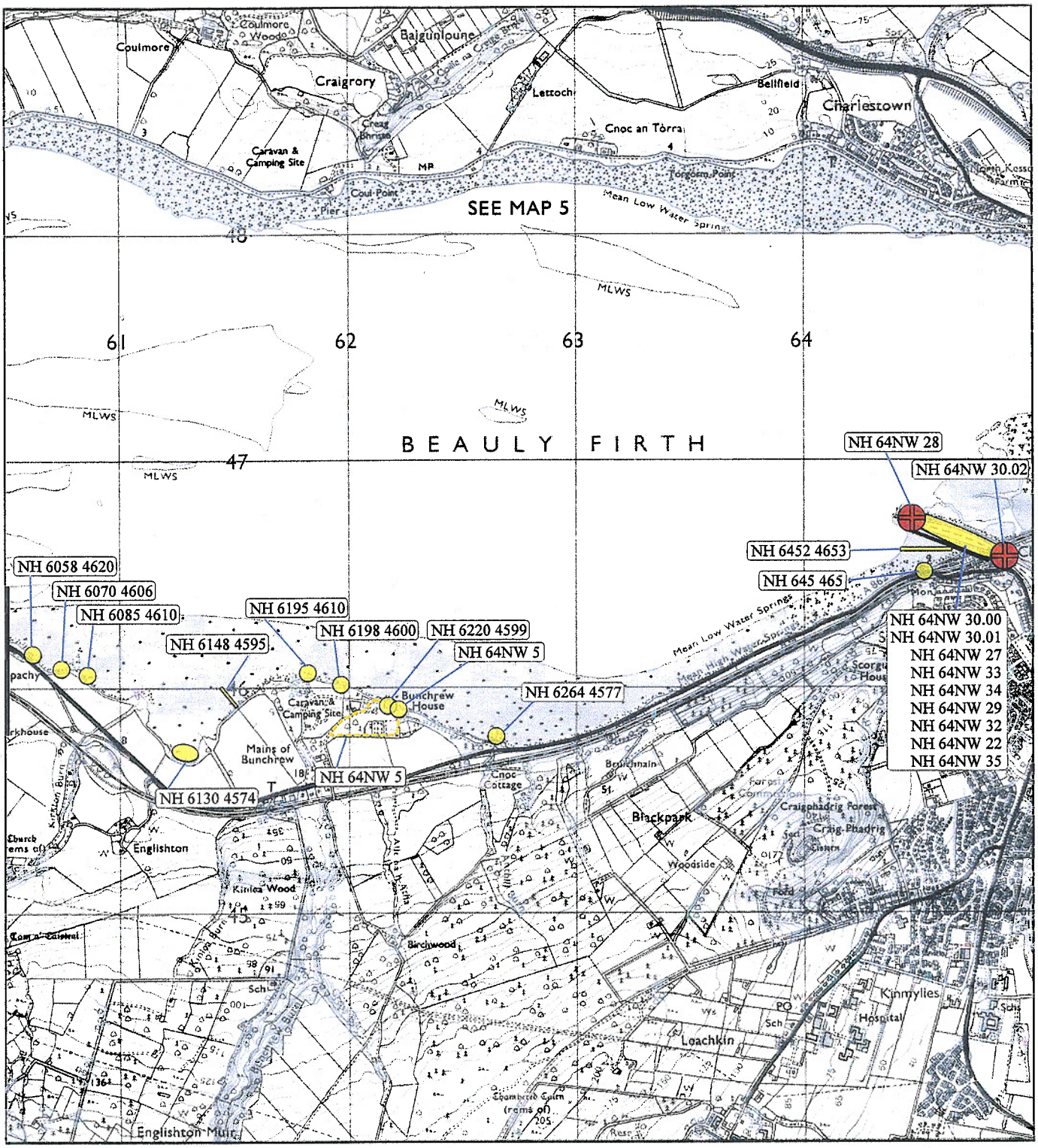
NH 6466 4654
CLACHNAHARRY,
10 Low St
Cottages
19th century AD
Good
Nil

NH64NW 35 Listed B
NH 647 466
CLACHNAHARRY
Caledonian Canal, sea lock basin
19th century AD
Good
Nil

Sites in the Hinterland

NH64NW 28 - Scheduled & Listed C
NH 6447 4673
CLACHNAHARRY
Caledonian Canal; sea loc & lock keeper's cottage
19th century AD
Good
Nil
Nil

NH64NW 5
NH 6217 4591
BUNCHREW
Residential house; designe landscape17th century AD built 1615
Good
Nil



MAP 1: CLACHNARRY TO PHOPACHY

MORAY FIRTH SURVEY Grid ref: NH 61-65/44-49

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 177

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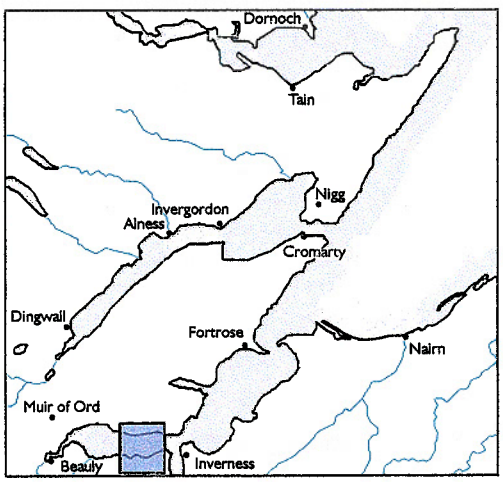
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



MAP 2: PHOPACHY TO EASTER LOVAT

Hinterland Geology and Coastal Geomorphology: Middle Old Red Sandstone continues to form the dominant basal geology with quartz and feldspars attributed to the Moine Series occurring in the vicinity of Kirkhill. Within the area Quaternary age drift deposits derived exclusively from boulder clay have been sculptured by a series of raised shoreline terraces. Towards Easter Lovat marine carse clay development becomes extensive at the head of the firth. This low lying flood plain was reclaimed in the historic period to create field systems which are now defended by flood banks. Saltmarsh development is extensive alongside the outer tidal reach of the River Beaulay.

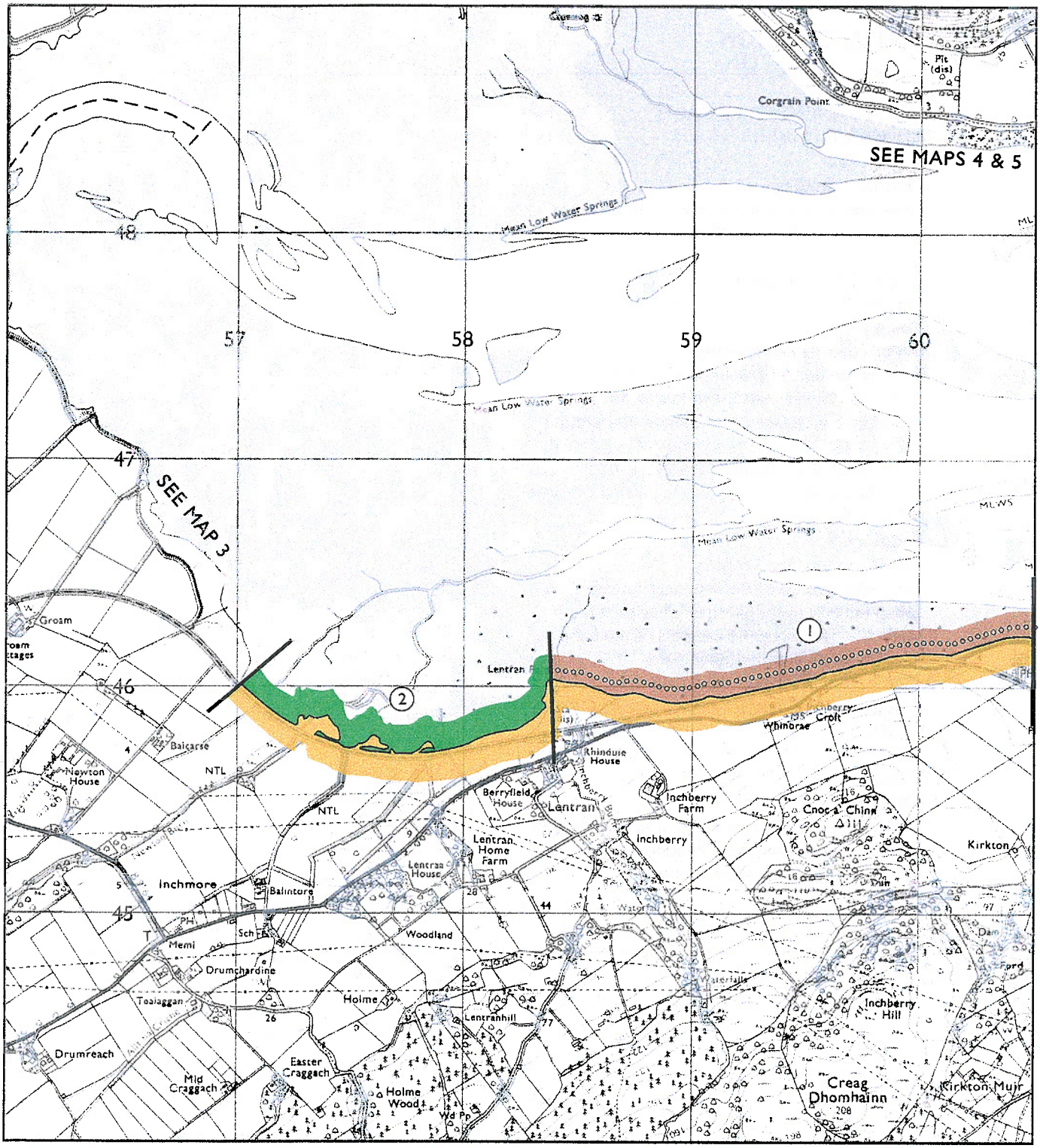
Erosion class: Erosion is minimal with accretion the dominant class in this area. This unit of coastline benefits from shelter afforded by the narrow isthmus at Kessock which absorbs the effect of storm waves and swell. This has a tendency to promote increased sedimentation and accretion on the shallow foreshore. Fine suspended silts carried down the River Beulay are circulated at the head of the Firth and deposited along the main river channel. Channel migration leads to sediment movement and accretion where the currents are slacker. In front of flood banks saltmarsh vegetation is well established, some of which is eroding at Inchberry Croit. Intertidal mudflats are extensive and exposed to at least over 1km between the HWM and LWM.

Built Heritage and Archaeology: Two distinct intertidal archaeological monuments found in this area are the remnants of fish traps or 'yairs'. These complex wooden and stone structures were designed to trap fish on both the ebb and flow tides. Their exact period of inception is unknown but they were recorded in use as late as the 1830s. Extensive 19th century land reclamation included the building of embankments to increase fertile farming land on the Lovat estate. The reclamations also included the construction of a major network of drainage channels and canals, one of which is within the survey area at Balintore. At the eastern margin of this area the Phopachy intertidal crannog is located. Sub-surface timber remains from structural features have been dated to the 1st century BC. The condition of the site appears to be relatively poor.

Map 2: Hinterland Geology and Coastal Geomorphology

1 East of PHOPACHY FARM to LENTRAN POINT
NH 595 460
km 1.7km
Mainly estuarine mud
Low edge (<10m)
Marine deposits overlain by carse clays
This unit comprises the commencement of carse deposition over marine derived sand and gravel. The low edge is fairly regular. Intertidal mud flats and shingle present at MHWMS.

2 LENTRAN POINT to north of BALCARSE
NH 575 475
1.8km
Low edge (<10m)
Mainly mud
Carse clay over marine derived sand and gravel
This unit consists of a large alluvial fan developed over carse clays, which in turn mantle marine sand and gravel. The intertidal area is estuarine mud and shingle incised by drainage channels. Saltmarsh has developed along at the shoreline.



MAP 2: PHOPACHY TO BALCARSE

MORAY FIRTH SURVEY Grid ref: NH 56-60/44-49

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 176
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 08 September 1998

Hinterland:

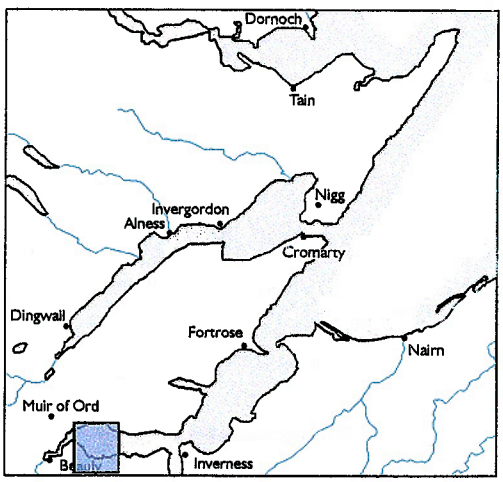
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



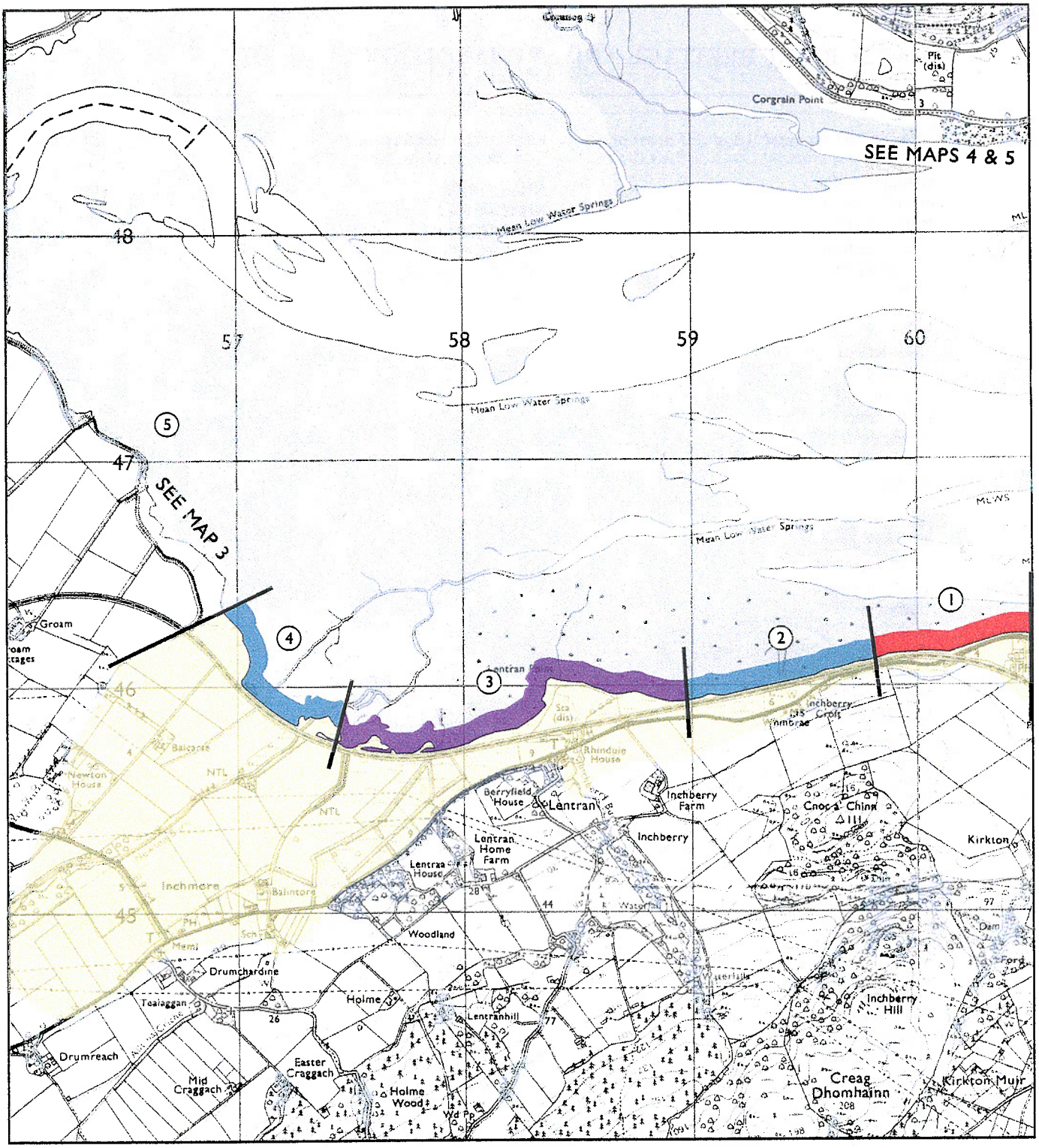
MAP 2: EROSION

1. East of INCHBERRY CROIT
NH 599 462
0.2km
Definitely Eroding
Low-lying coastal edge with eroding saltmarsh defended by rubble sea defence.

2. INCHBERRY CROIT
NH 585 459
1.6km
Both Accreting and Eroding
Exposed section of coastline with eroding saltmarsh. The foreshore sediments consist of mud and shingle which shows evidence of accretion.

3. North of INCHBERRY FARM WEST to east of BALCARSE
NH 585 459
1.6km
Both Accreting and Eroding
This section of coastline is undergoing erosion due to the loss of the saltmarsh buffer at the MHWM. The foreshore consists of mud and shingle, which is accreting in parts

4. East of BALCARSE to north of BALCARSE FARM
NH 572 460
0.9km
Accreting
Sediment is accreting on the backshore owing to the presence of reed beds. Mud and shingle is also accreting on the wide foreshore



MAP 2: PHOPACHY TO BALCARSE

MORAY FIRTH SURVEY Grid ref: NH 56-60/44-49

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 176
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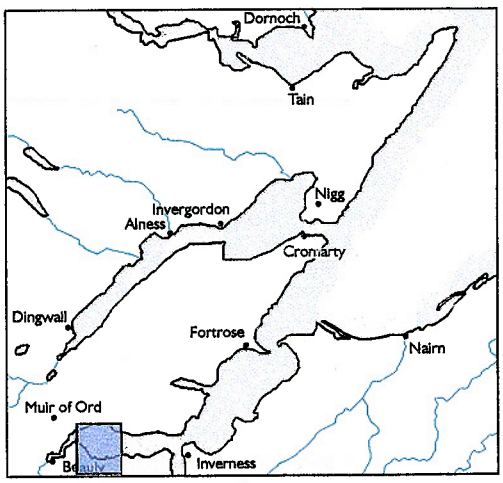
EROSION CLASS

Assessment date: 08 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m

N.B. The O.S. base map uses an imperial contour interval. Therefore on this sheet, the position of the land below 10m is an estimate.



MAP 2: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH64NW 40
NH 6025 4670
PHOPACHY
Marine crannog
1st century BC
Poor
Nil

NH54NE 30
NH 5939 4620
WHINBRAE
Double tidal fish trap
Uncertain
Poor
Survey

NH54NE 29
NH 5841 4622
LENTRAN POINT
Tidal fish trap
Uncertain
Poor
Survey

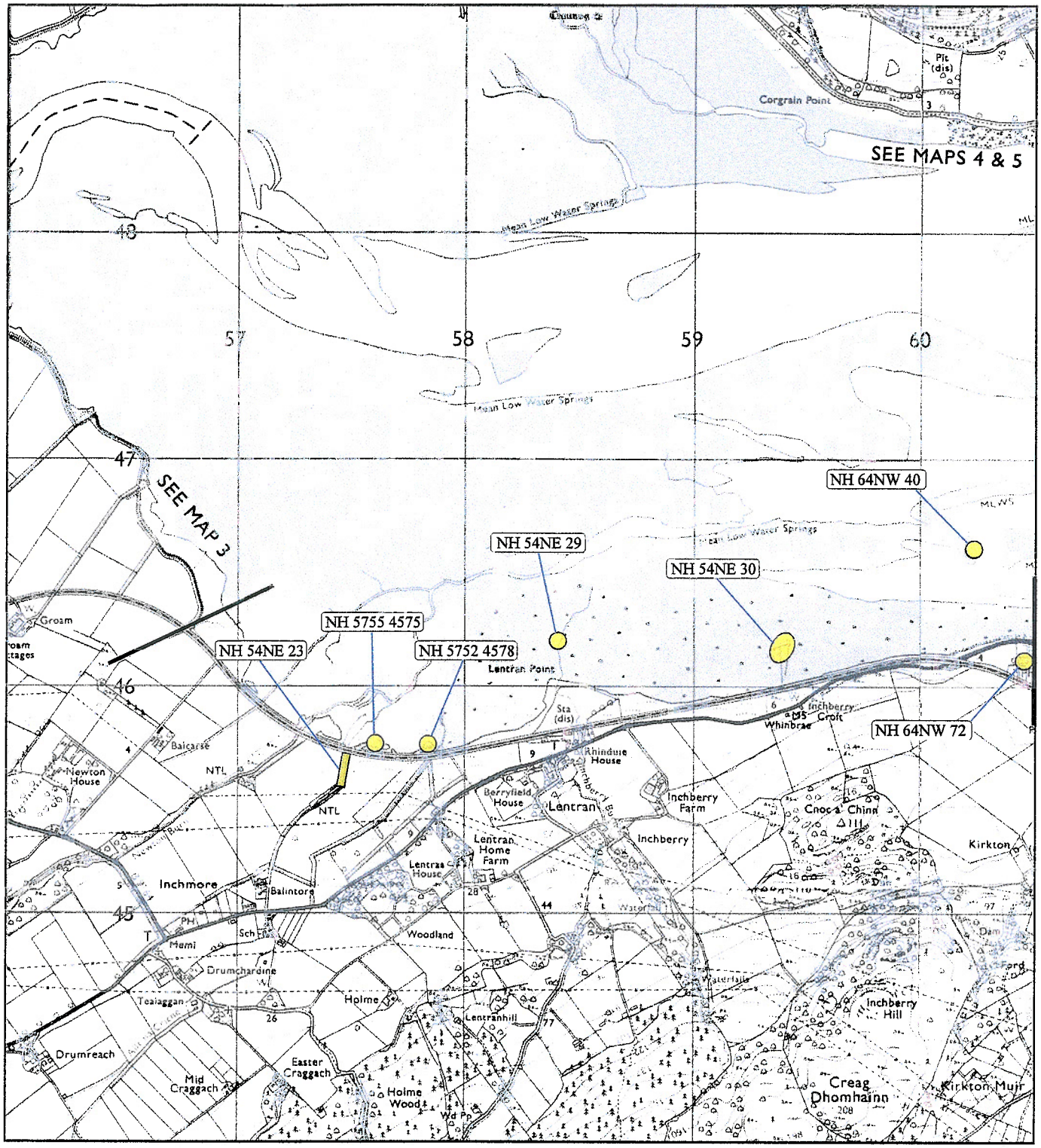
NH 5752 4578
LENTRAN POINT
Embankment
Unknown
Poor
Nil

NH 5755 4575
LENTRAN POINT
Railway embankment
19th/20th century AD
Good
Nil

NH54NE 23
NH 5744 4564
BALINTORE, Allt na Criche
Canal; sea wall
19th century AD
Fair
Nil

Sites in the Hinterland

NH64NW 72
NH 6044 4612
PHOPACHY
Residential country house
18th/19th century AD
Good



MAP 2: PHOPACHY TO BALCARSE

MORAY FIRTH SURVEY Grid ref: NH 56-60/44-49

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 176

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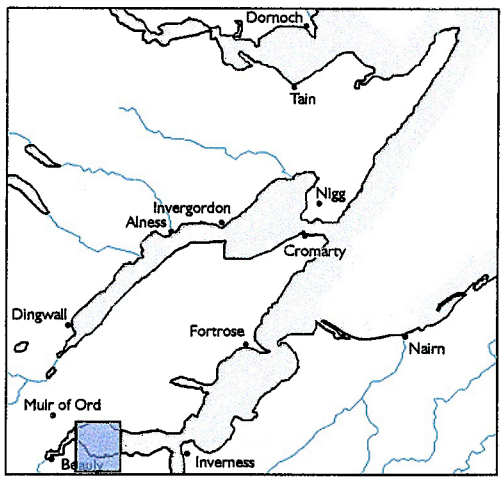
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 3: EASTER LOVAT TO TARRADALE HOUSE

Hinterland Geology and Coastal Geomorphology: This coastal unit forms the head of the Beulay Firth. Lower Old Red Sandstone underlie the low lying coastline. Fine-grained sedimentary units (carse) and buried peats are laterally extensive forming a flood plain. This is bounded by a Holocene raised shoreline that skirt the lowlands alongside the River Beulay. At Barnyards, sedimentary sequences have been investigated in detail by Firth and Haggart (1989) and provide a detailed record of relative sea-level changes in the Moray and Beulay Firths. Between Easter Lovat and Tarradale House the land is reclaimed and lies below 10m OD. Earthwork flood defences protect the hinterland.

Erosion class: Stability and accretion are the predominant class within this section of coastline. Here at the head of the Firth, the effect of storm conditions are reduced but currents are likely to be strong with high sediment loading brought down the River Beulay. This is leading to the accretion of mud against river channel sides and up against on the saltmarsh that fronts the flood-banks.

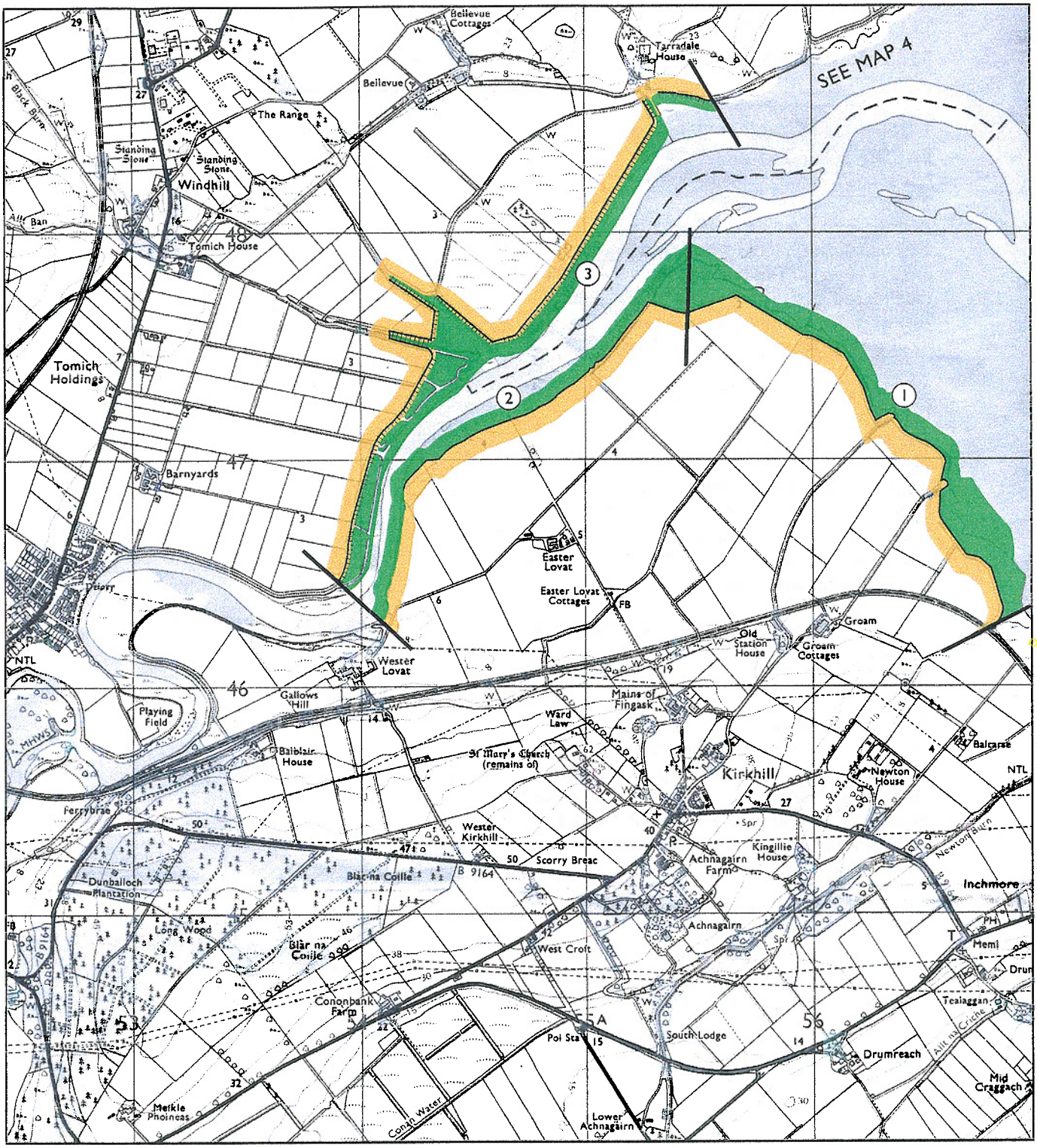
Built Heritage and Archaeology: The archaeological remains in this area are very sparse and consists of two relatively modern features. The first, a series of timber piles, were part of a 18th/19th century pier at Wester Lovat farm and built to service the Lovat estate. The second site consists of the extensive embankment system on the northern shore of the Firth, between Barnyards and Tarradale House. They consist of initial low banks at the high water mark (HWM), which appeared to have trapped sediment and initiated extensive reed bed growth, which are in turn backed by the main reclamation embankment. Behind the main bank are small drainage channels which interconnect and outflow into the Firth at particular points. The distinct absence of archaeological remains in this area may be due to the major reclamation works that took place in the 18th century, which has obscured much of the previous land surfaces and altered the estuarine and riverine interface.

Map 3: Hinterland Geology and Coastal Geomorphology

1 North of BALCARSE to north east of EASTER LOVAT.
NH 560 476
2.3km
Mainly mud
Low edge (<10m)
Carse clays overlying marine deposits
Delta formed on an alluvial fan. Carse clays overlay marine deposits of sand and gravel. The shoreline is irregular and defended by flood banks. Saltmarsh gives way to intertidal flats of estuarine mud.

2 North east of EASTER LOVAT to WESTER LOVAT
NH 543 470
1.9km
Mainly mud
Low edge (<10m)
Carse clays overlying marine deposits
Upper tidal reach of the River Beulay with carse clays overlying marine derived deposits of sand and gravel. Riverbanks defended by flood banks. Saltmarsh colonisation formed on alluvial mud.

3. South of BARNYARDS FARM to south of TARRDALE HOUSE
NH 547 475
2.6km
Mainly mud
Low edge (<10m)
Carse clays overlying marine sand and gravel
This unit comprises the lower tidal reach of the River Beulay. Carse clays cover sequences of marine derived deposits in the hinterland. Floodbanks protect the riverside, which is colonised by saltmarsh vegetation. Meandering river channels are exposed at low tide.



MAP 3: BALCARSE TO TARRADALE HOUSE

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 53-57/44-49

Basemap: O.S. *Pathfinder* Series Sheet 176

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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 08 September 1998

Hinterland:

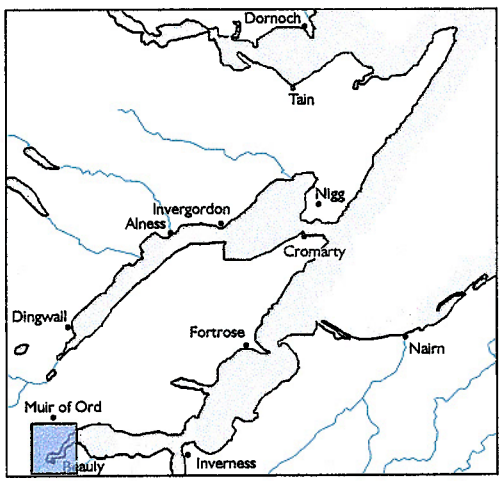
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh

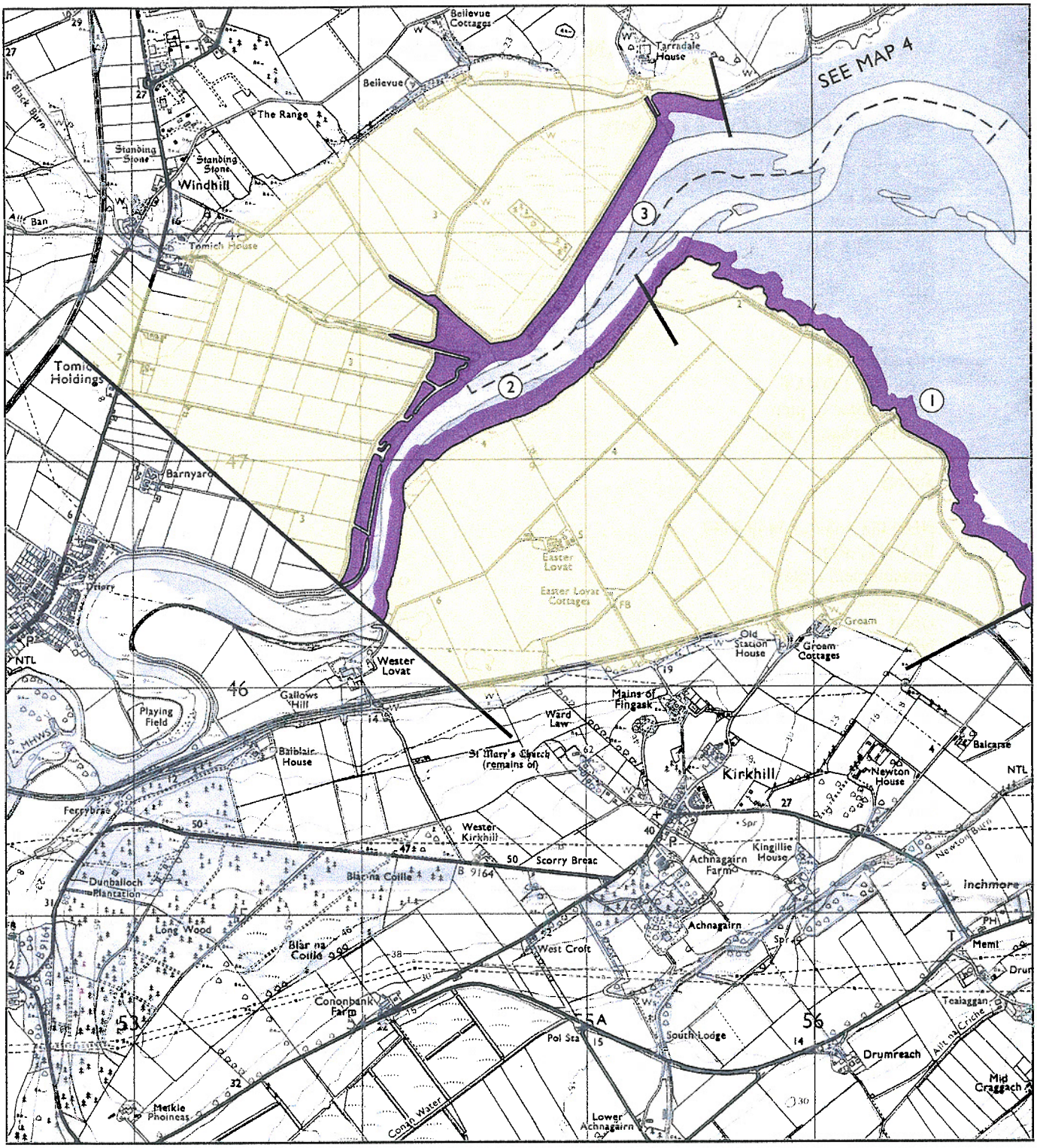


MAP 3: EROSION

1. North east of BALCARSE to north of EASTER LOVAT
NH 566 470
2.2km
Both Accreting and Eroding
This unit is defended by floodbanks that are eroding in parts. This unit is close to the head of the firth and its sheltered aspect implies fairly stable condition with accretion further enhanced by alluvial sediment supplied by the River Beulay

2. North east of BALCARSE to WESTER LOVAT
NH 543 470
2km
Both Accreting and Eroding
Southern shore of the outer tidal reach of the River Beulay. This stretch will be susceptible to erosion at the channel edge. Sediment focusing in parts is due to alluvial transport down the river.

3. North of GALLOWS HILL to TARRADALE HOUSE
NH 547 475
1.4km
Both Accreting and Eroding
Northern shore of outer tidal reaches of the River Beulay. Undergoing erosion in parts of the river channel and is leading to accretion of mud on the exposed banks. Suspended sediment from further upstream is liable to accrete at the mouth of the river.



MAP 3: BALCARSE TO TARRADALE HOUSE

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 53-57/44-49

Basemap: O.S. *Pathfinder* Series
Sheet 176
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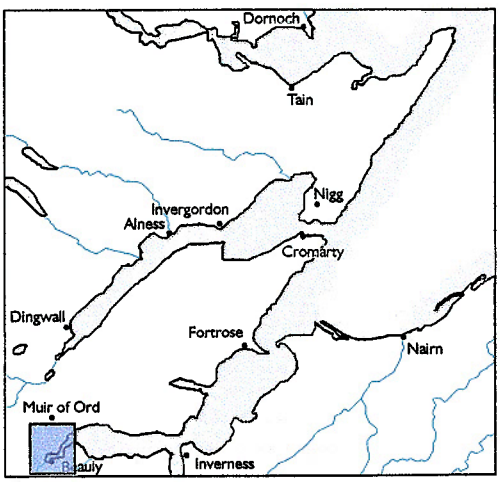
EROSION CLASS

Assessment date: 08 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m

N.B. The O.S. base map uses an imperial contour interval. Therefore on this sheet, the position of the land below 10m is an estimate.



Sites on the Coastal Edge & Foreshore

NH 5635 4720
EASTER LOVAT
Embankment
19th century AD
Good
Nil

NH54NW 40
NH 5412 4637
WESTER LOVAT
Timber piles of pier
18th/19th century AD
Poor
Survey

NH 5388 4642 to 5449 4747
BARNYARDS
Embankment system
18th century AD
Good
Nil

NH 5530 4855
TARRADALE HOUSE
Pier
18th/19th century AD
Fair
Nil

MAP 3: BALCARSE TO TARRADALE HOUSE

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 53-57/44-49

Basemap: O.S. *Pathfinder* Series
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BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
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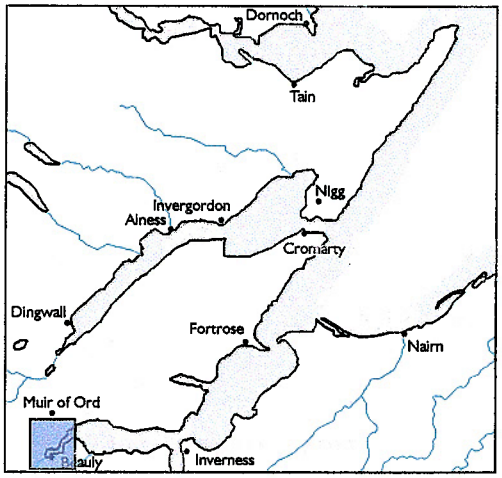


Map 4: TARRADALE HOUSE TO CORGRAIN POINT

Hinterland Geology and Coastal Geomorphology: Old Red sandstone underlies this unit of coastline which forms the head of the Beaulay Firth. In the vicinity of Tarradale House carse clay continue landward and were formed by a marine incursion. Earlier marine incursions are also represented by two eroded raised beach terraces immediately north of Tarradale house. Eastwards towards Redcastle, the coastal edge is narrow forming a coastal plateau which is bounded by land that rises steeply cut by a higher Post-glacial raised sea beach. Floodbanks and saltmarsh protect the head of the firth and the hinterland is low lying at below 10m Ordnance Datum. The foreshore consists of extensive intertidal mudflats.

Erosion class: Owing to the sheltered position of this section of estuarine coastline the condition of the low shore is stable and accreting. Estuarine mud is the dominant feature of the foreshore with isolated patches of shingle in parts. Some slight degradation of the carse clay platform is ongoing but recession of this low cliff is at the present only slight. Undercutting is leading to collapse but the fallen material is not being transported and appears to form a lower step of vegetation. It is the vegetation that is rendering stability in what is considered to be a fairly low wave energy environment.

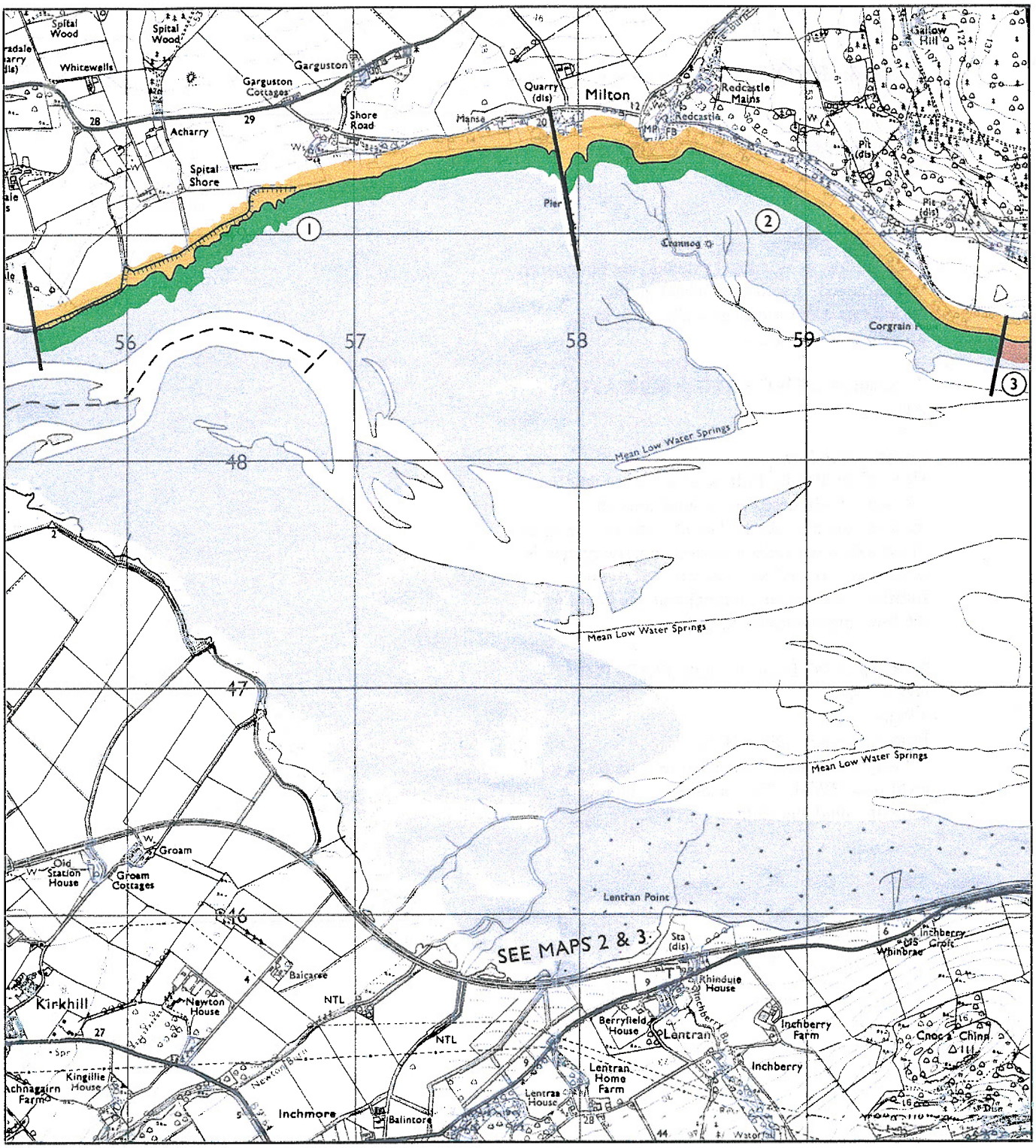
Built Heritage and Archaeology: The western part of this area consists of two separate archaeological site types on the foreshore; an embankment system, built in the 18th century AD, to prevent flooding of the adjacent land and two fish yairs. In the western part the hinterland archaeology consists of three 18th/19th century ruined buildings at Spital Shore. The Milton Pier was built to transport quarry stone from the shoreline quarry along a light railway, during the building of the Caledonian Canal. It was constructed to service the low water channel which has subsequently migrated south, leaving the pier approximately 500 m above low water mark (LWM). It was later used as a rifle range and remains in a poor state of repair. Milton village in the eastern part of the area is a small village with 19th century cottages, still inhabited and a smithy building in poor condition.

In the hintertland archaeology the Redcastle, a 17th/18th century tower house and designed landscape, is reputed to stand on the site of Ederdour erected by William the Lion in the 12th century AD. Today the castle is part of a large working estate and is in a poor state of repair. Off shore from the castle is the Redcastle intertidal crannog. The site is a complex Iron Age structure with at least two phases of construction and appears to have been constructed during a period of lower water level. A series of piles at low water mark near Corgrain Point are the remnants of a wooden fish trap, which requires survey and monitoring.

Map 4: Hinterland Geology and Coastal Geomorphology

1. South of TARRADALE HOUSE to MILTON PIER
NH 560 488
2.8km
Mud with shingle
Low edge (<10m)
Carse clays overlying marine sand and gravel
Flood defended head of the Beulay Firth. Intertidal mud flats backed by saltmarsh. The hinterland is predominantly carse clay overlying marine sand and gravel.

2. MILTON PIER to south west of COULMORE
NH 590 492
2.4km
Mud flats
Low edge (10m)
Carse clays overlying marine sand and gravel
Extensive tidal mud flats meet saltmarsh at the coastal edge. Hinterland wooded. This unit incorporates the site of the crannog at Redcastle.



MAP 4: TARRADALE HOUSE TO CORGRAIN POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 56-60/45-50

Basemap: O.S. *Pathfinder* Series
Sheet 176
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 08 September 1998

Hinterland:

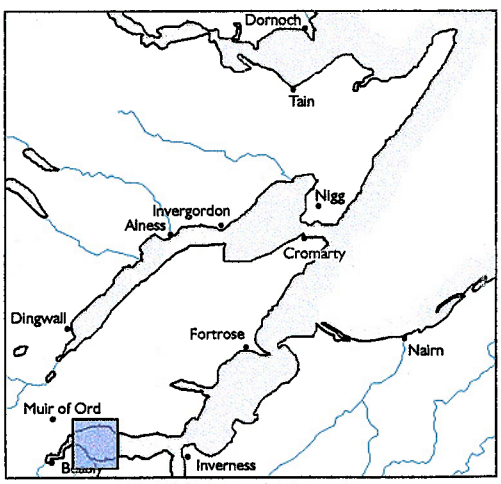
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh

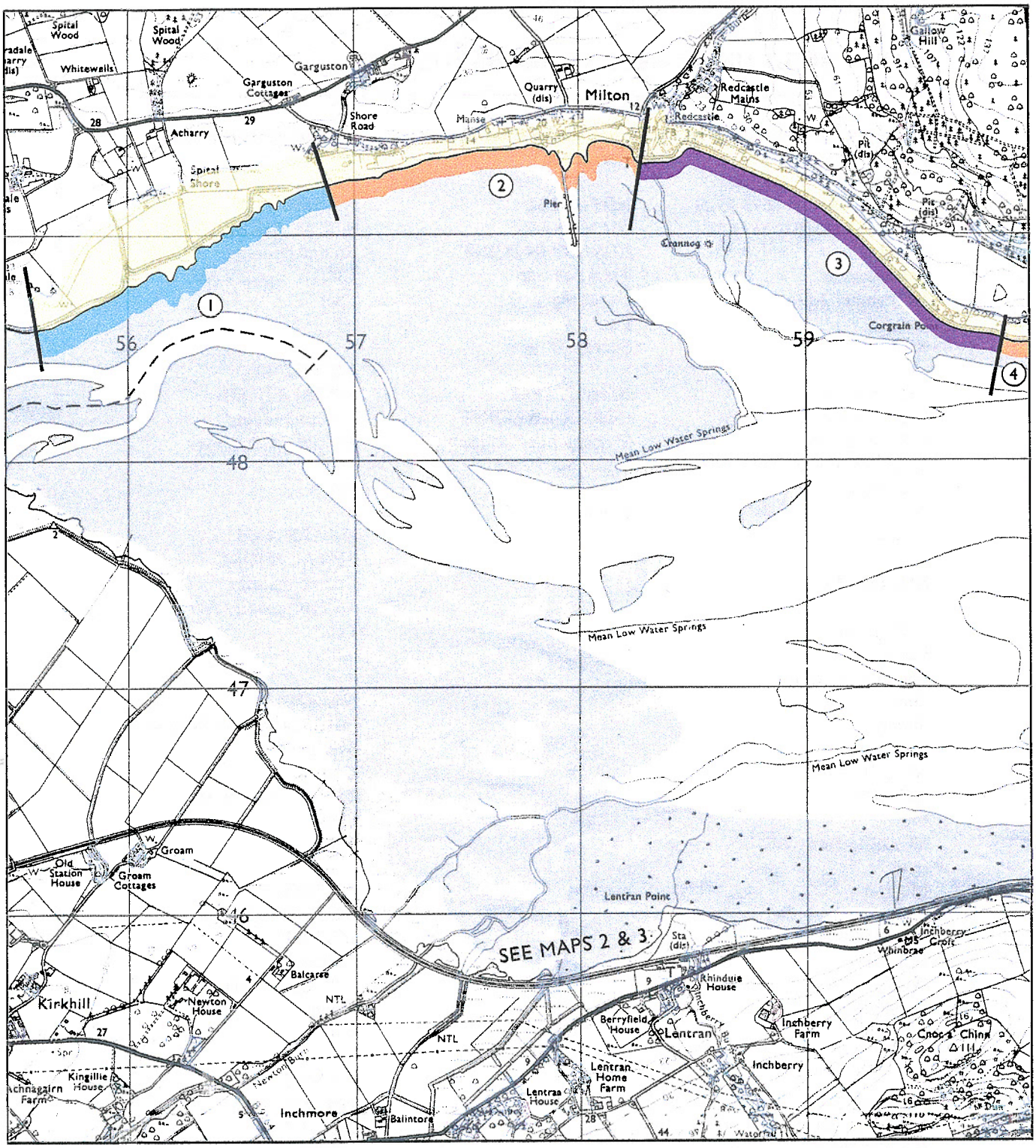


MAP 4: EROSION

1. East of TARRADALE HOUSE to south of SHORE ROAD
NH 565 490
1.4km
Accreting or Stable
High earthwork floodbanks defend the hinterland and saltmarsh is well established on the backshore. Conditions are stable with mud accreting on foreshore.

2. South of SHORE ROAD to REDCASTLE
NH 576 494
1.4km
Stable or Eroding
Head of the Beauly Firth with accreting mudflats owing to its sheltered aspect and constant sediment supply. At the HWM some local erosion of the saltmarsh vegetation and underlying clay is occurring. At Redcastle the clay is eroding forming a step as the material that has fallen from the low edge continues to grow.

3. REDCASTLE east to CORGRAIN POINT
NH 592 490
1.9km
Both Accreting and Eroding
A fairly stable stretch of coastline with some local erosion at HWM. The foreshore is wide with accreting mud and shingle



MAP 4: TARRADALE HOUSE TO CORGRAIN POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 56-60/45-50

Basemap: O.S. *Pathfinder* Series
Sheet 176
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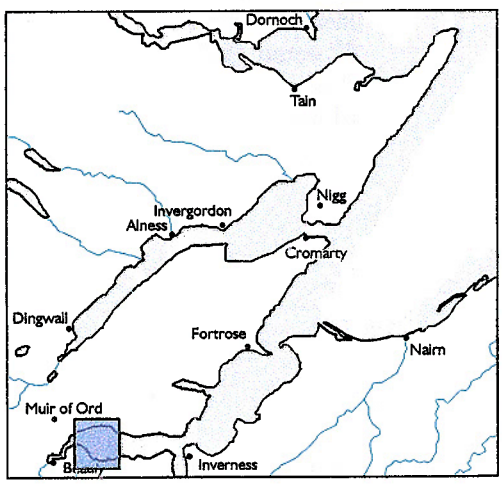
EROSION CLASS

Assessment date: 08 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m

N.B. The O.S. base map uses an imperial contour interval. Therefore on this sheet, the position of the land below 10m is an estimate.



MAP 4: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 5542 4861 to 5673 4920
TARRADALE TO SPITAL SHORE
Embankment
18th century AD
Good
Nil

NH54NE 34
NH 5604 4855
SPITAL SHORE
Tidal fish trap
Uncertain
Poor
Survey

NH54NE 33
NH 5693 4903
SPITAL SHORE
Uncertain
Possible fish trap
Poor
Survey

NH 5797 4906
MILTON
Pier
18th/19th century AD
Poor
Monitor

NH 5841 4932
MILTON
Wooden piles
Uncertain
Poor
Nil

NH54NE 2
NH 5858 4895
REDCASTLE
Intertidal crannog
3rd century BC
Poor
Monitor

Sites on the Coastal Edge & Foreshore

NH54NE 31
NH 5965 4860
CORGRAIN POINT
Tidal fish trap
Uncertain
Poor
Survey

NH 6012 4848
CORGRAIN POINT
Wooden piles of linear pier
Uncertain
Poor
Monitor

Sites in the Hinterland

NH 5698 4928
SPITAL SHORE
Ruined building
18th/19th century AD
Poor
Nil

NH 5723 4933
SPITAL SHORE
Ruined building
18th/19th century AD
Poor
Nil

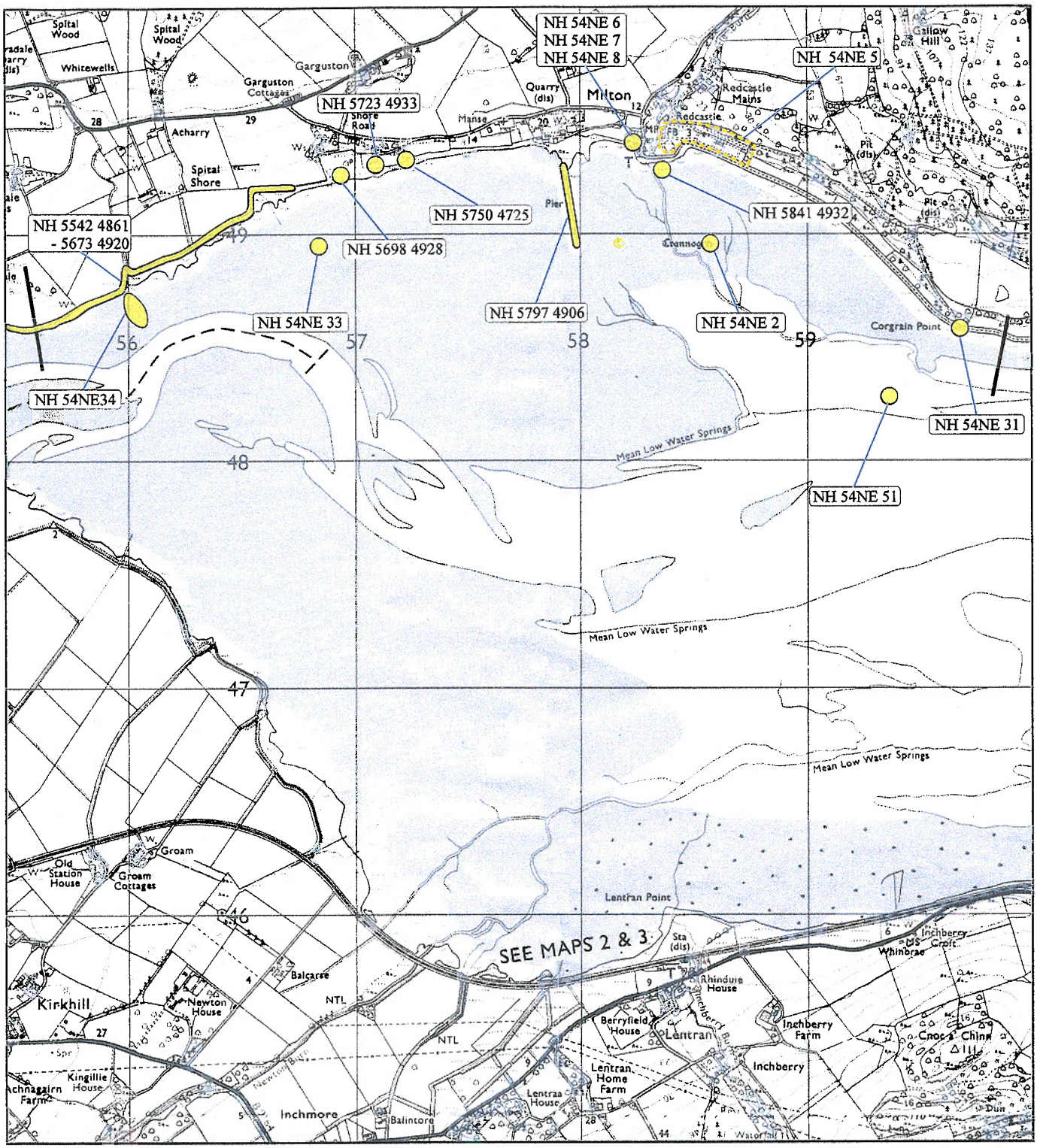
NH 5705 4725
SPITAL SHORE
Ruined building
18th/19th century AD
Poor
Nil

NH54NE 6
NH 5824 4943 & 5826 4942
MILTON
Cottages
18th/19th century AD
Good
Nil

NH54NE 7
NE 5825 4940
MILTON
Cottages
19th century AD
Good
Nil

NH54NE 8
NH 5826 4937
MILTON
Smithy
19th century AD
Poor
Monitor

NH 54 NE 5
NH 5838 4951
REDCASTLE
Castle and designed landscape
17th century AD
Poor
Monitor



MAP 4: TARRADALE HOUSE TO CORGRAIN POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 56-60/45-50

Basemap: O.S. *Pathfinder* Series Sheet 176
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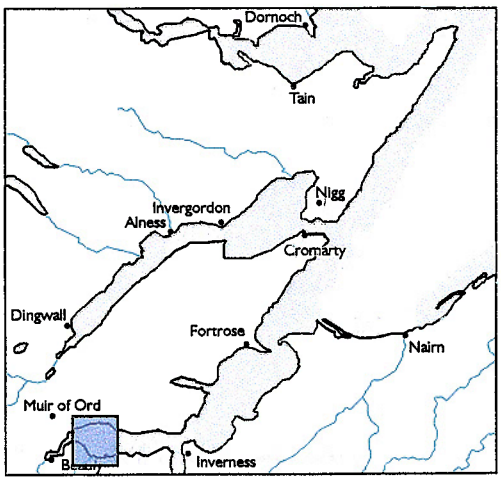
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 5: CORGRAIN POINT TO CHARLESTOWN

Hinterland Geology and Coastal Geomorphology: The basement geology is Upper Old Red Sandstone. This is overlain by Quaternary age marine deposits and boulder clay. Representing the limits of marine incursions, two terraces attributed to the Main Late-glacial and main Post-glacial shorelines run parallel with the present shoreline. The hinterland rises steeply behind Charlestown and North Kessock. The shoreline is defended by sea walls along the Kessock shore where mud and cobbles are exposed at the LWM. Towards Craigton Point, where the isthmus is crossed by Kessock Bridge, the coastal plateau and the foreshore narrow considerably.

Erosion class: This unit of coastline is sheltered from the effects of easterly gales. This creates a fairly low energy wave environment which is leading to accretion of mud and shingle on the foreshore. Where pockets of erosion do occur, then these are confined to saltmarsh resting on the top of the carse terrace that lies at the foreshore. Towards North Kessock the foreshore is armoured and defended by sea walls, here conditions are considered to be stable with mud and shingle.

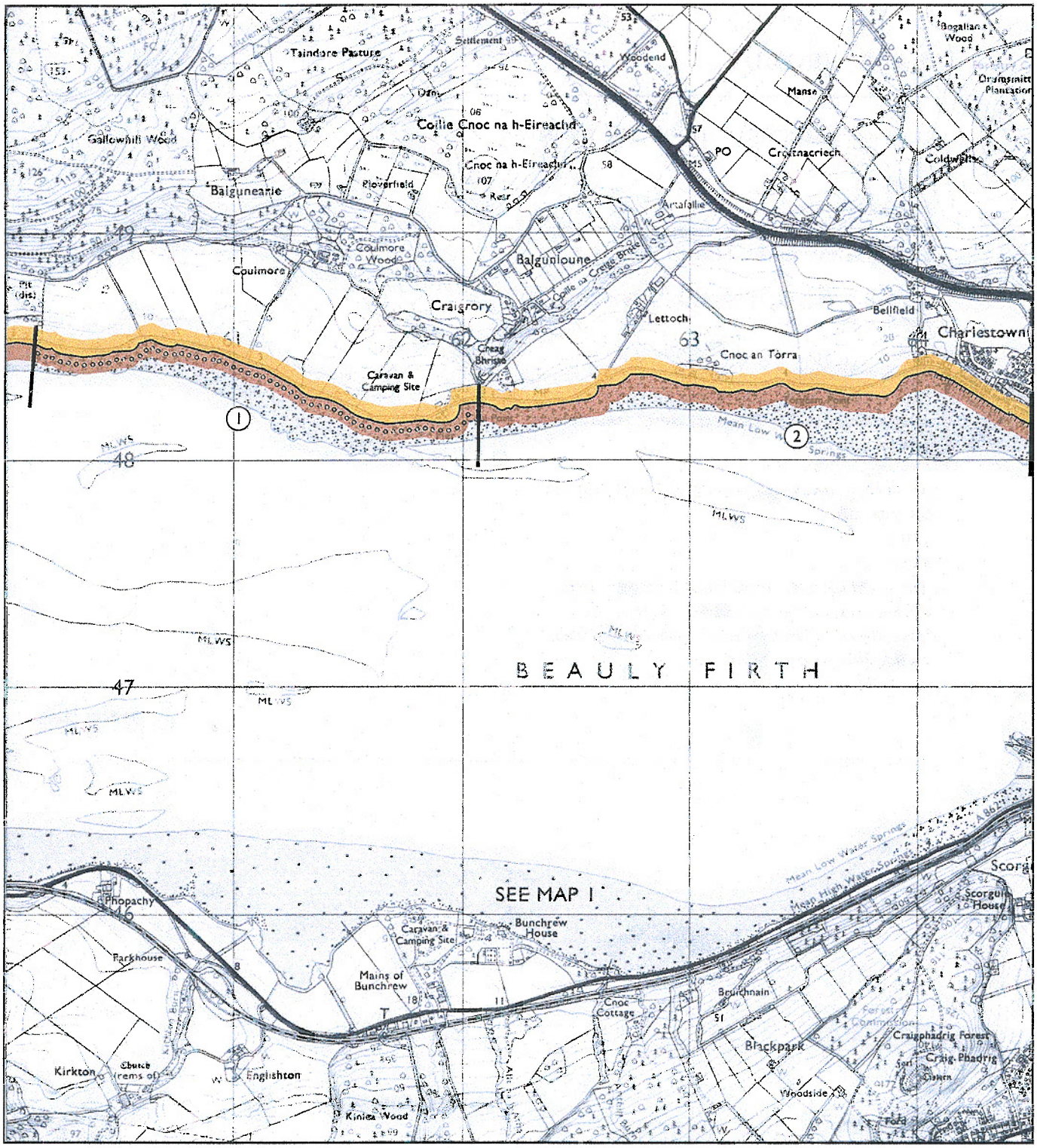
Built Heritage and Archaeology: The archaeology in this area is dominated by foreshore and intertidal remains, including a series of stone fish traps and two intertidal crannogs, one of which, Carn Dubh, has been radiocarbon dated to the late Iron Age. Towards the eastern part of this area are piers and boat slipways two of which are associated with boat houses. The boat at Lettoch, a 20th century clinker built cruiser was recorded due to its poor current state of preservation. The four fish traps at Torgorm Point consist of various stake net mounds and lines of stones.

Map 5: Hinterland Geology and Coastal Geomorphology

---

1. South west of COULMORE to COUL POINT
NH 610 485
2km
Mud flats
Low edge (<10m)
Mainly marine deposits
Foreshore derived of mud and shingle and extensive tidal mud flats. The hinterland comprises fields below 10m OD.

2. COULPOINT to CHARLESTOWN
NH 630 483
2.6km
Mainly mud and shingle
Low edge (<10m)
Marine deposits of sand and gravel
The hinterland is in part colonised by saltmarsh. Sea defences are present towards Charlestown. The hinterland consists of farmed land. Urban development occurs at Charlestown.



MAP 5: CORGRAIN POINT TO CHARLESTOWN 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 60-64/45-50

Basemap: O.S. *Pathfinder* Series
Sheet 177
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 08 September 1998

Hinterland:

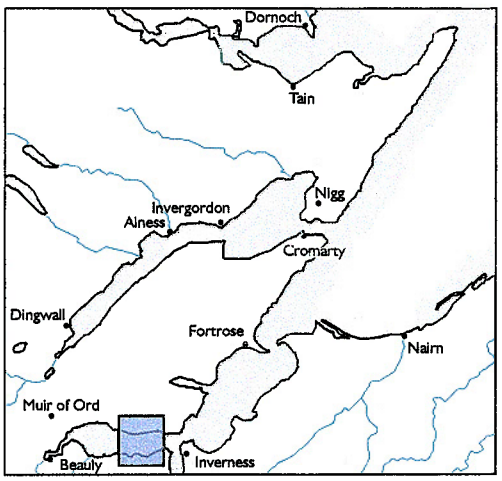
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh

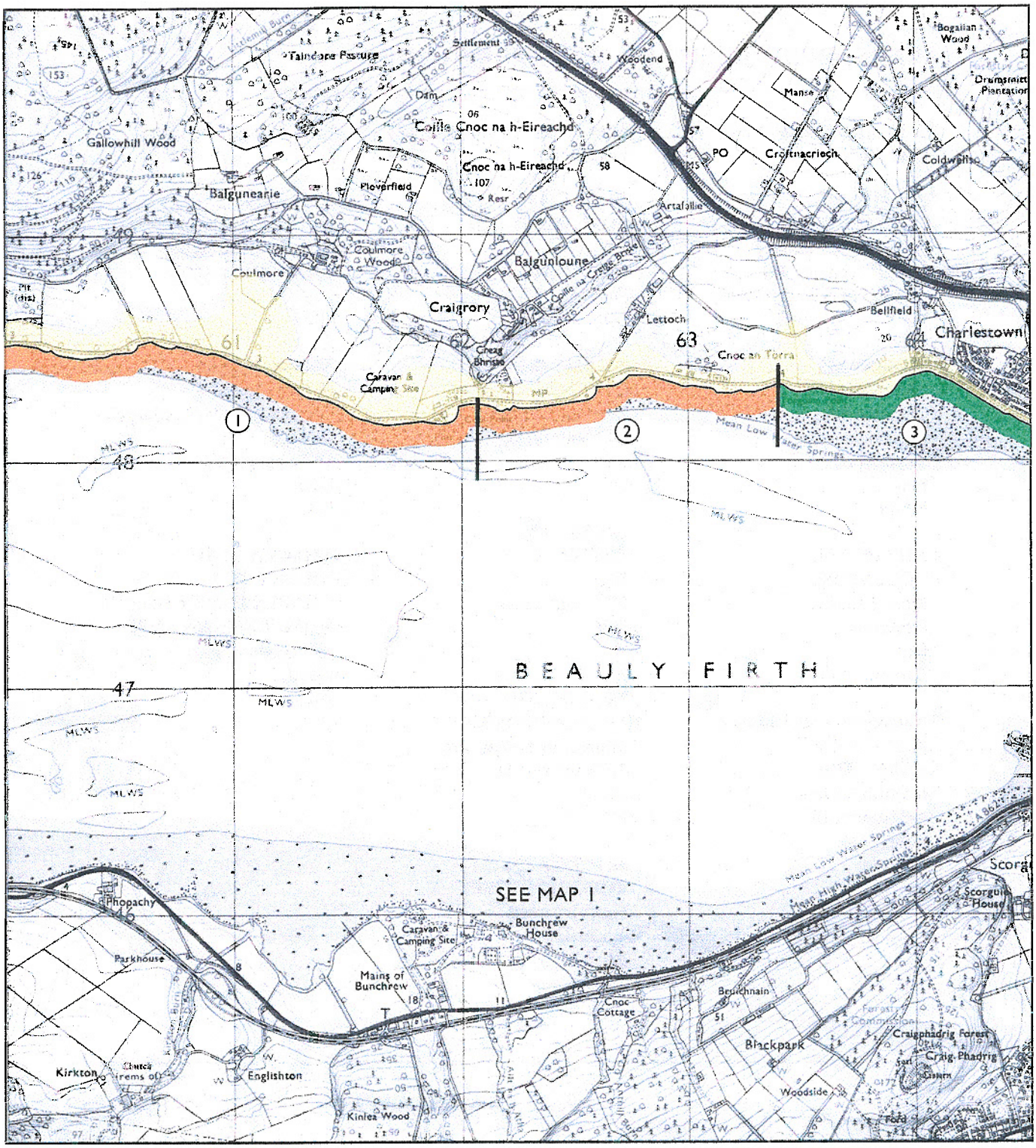


MAP 5: EROSION

1. East of CORGRAIN POINT to COUL POINT
NH 616 482
2.2km
Stable or Eroding
Mud and boulder foreshore eroding in parts but generally stable due its sheltered aspect.

2. COUL POINT to TOPRGORM POINT
NH 625 483
1.3km
Stable or Eroding
Stable with local patches of erosion on the saltmarsh at HWM. Sheltered aspect prevents any serious erosion.

3. TORGORM POINT to CRAIGTON POINT
NH 650 480
2.7km
Stable
The intertidal zone is noticeable narrower than further down the coast with no evidence of instability. At North Kessock stability is being maintained owing concrete sea walls.



MAP 5: CORGRAIN POINT TO CHARLESTOWN 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 60-64/45-50

Basemap: O.S. *Pathfinder* Series Sheet 177
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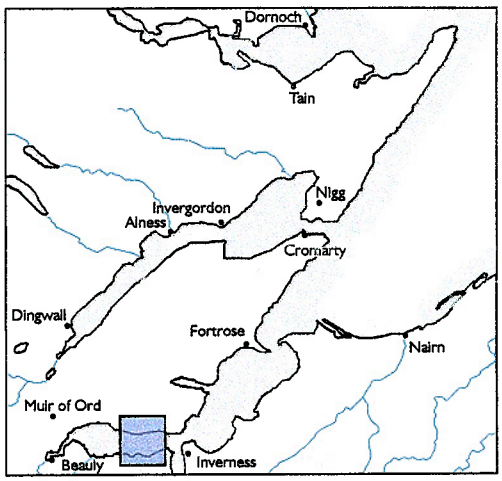
EROSION CLASS

Assessment date: 08 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 5: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 6052 4850
COULMORE
Boathouse & slipway
19th/20th century AD
Good & poor (respectively)
Nil

NH64NW 41
NH 6102 4764
COULMORE
Intertidal crannog
Uncertain
Poor
Monitor

NH 6124 4812
COULMORE
Stone fish trap
Uncertain
Fair
Survey

NH64NW 4 - Scheduled
NH 6175 4730
CARN DUBH
Intertidal crannog
3rd century BC
Poor
Monitor

Sites on the Coastal Edge & Foreshore

NH 6192 4815
COUL POINT
Pier
19th/20th century
Fair
Nil

NH 6255 4830
LETTOCH
Boathouse and pier
20th century AD
Poor
Nil

NH 6256 4830
LETTOCH
Hulk
20th century AD
Fair
Nil

NH 6300 4835
CNOC AN TORRA
Slipway and boathouse
20th century AD
Good
Nil

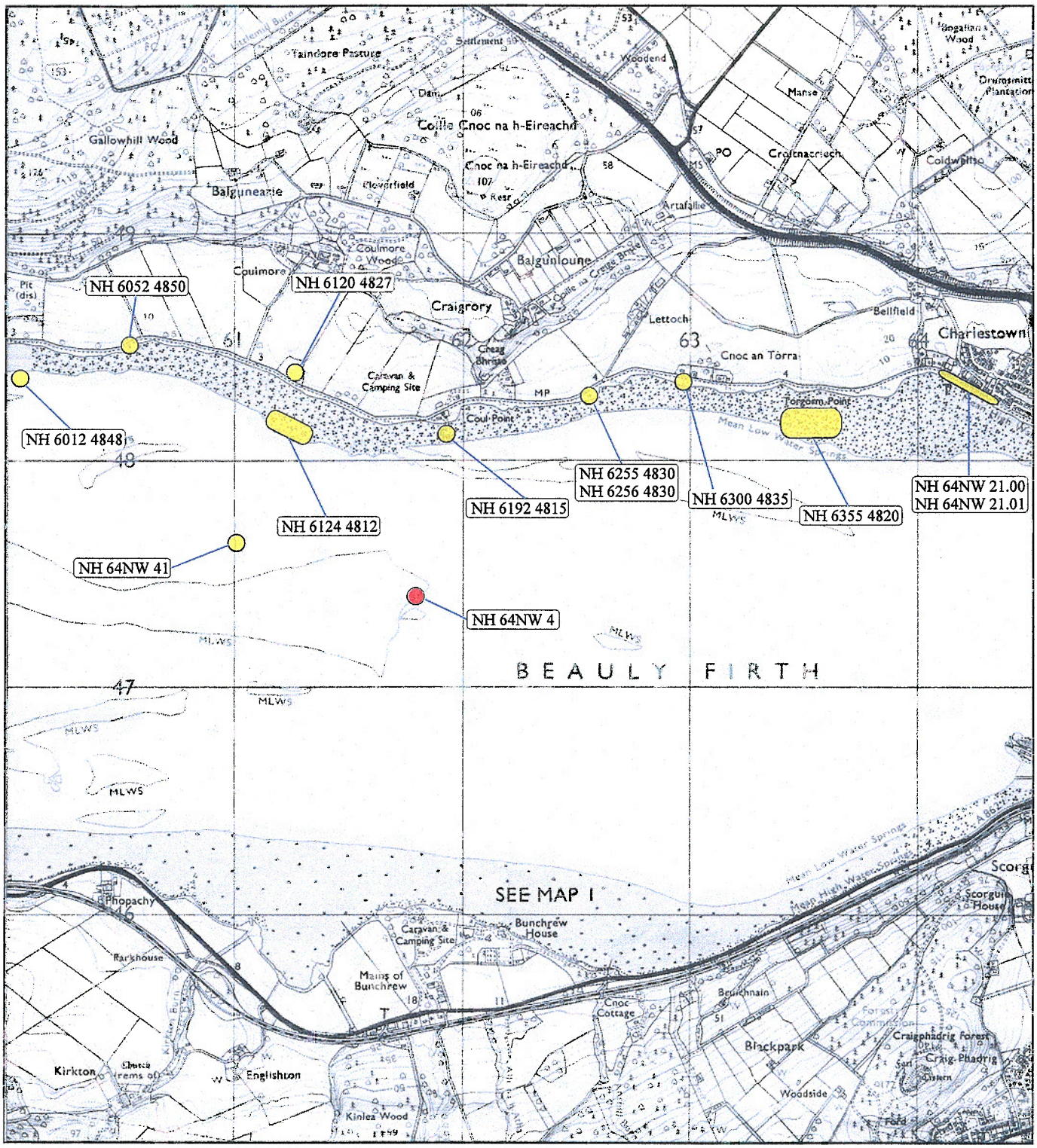
NH 6355 4820
TORGORM POINT
Four fish traps
Uncertain
Poor
Survey

Sites in the Hinterland

NH 6120 4827
COULMORE
Gravel pit (disused)
19th/20th century AD
Poor
Nil

NH64NW 21.00
NH 6425 4833
CHARLESTOWN, Main St
Cottages
19th century AD
Good
Nil

NH64NW 21.01
NH 6425 4832
CHARLESTOWN, Main St
House; Charlestown Villa
19th century AD
Good
Nil



MAP 5: CORGRAIN POINT TO CHARLESTOWN 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 60-64/45-50

Basemap: O.S. *Pathfinder* Series
Sheet 177
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BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
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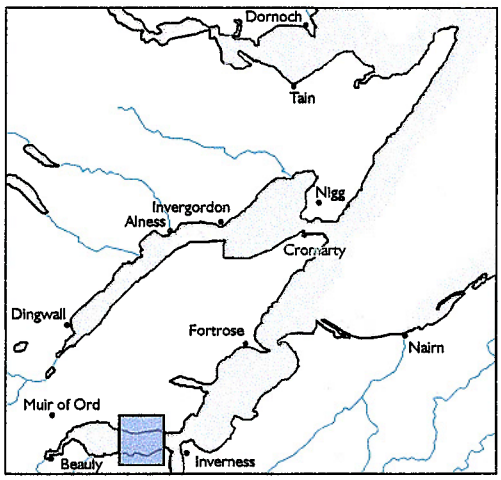
- Probably archaeologically sterile



Map 6: CHARLESTOWN TO KILMUIR

Hinterland Geology and Coastal Geomorphology: Brecciated conglomerates assigned to the Middle Old Red Sandstone Formation dominate the basal geology along this unit of coastline. Nearshore lithologies are exclusively marine in origin with raised beach terraces resting unconformably towards the base of the steeply rising hinterland. Late-glacial and Main Postglacial shorelines are represented. The latter masks the former at NH 664 487. Boulder clay outcrops between the brecciated deposits which continue further eastwards. The coastal edge is a fairly low plateau covered by a thin cover of marine deposits and alluvium. The foreshore is narrow owing to the position of the main river channel that runs close to the shore.

Erosion class: The coastal edge between Craigton Point and Kilmuir village was seen on the whole to be stable with only local isolated patches of scour on the foreshore. The narrow coastal plateau on which the village rests is exposed to locally generated waves travelling across the Murray Firth from the south west (the predominant wave direction). Rock armouring is effective at Kilmuir where the beach gradient is shallow and offers a good level of protection to the grass edge.

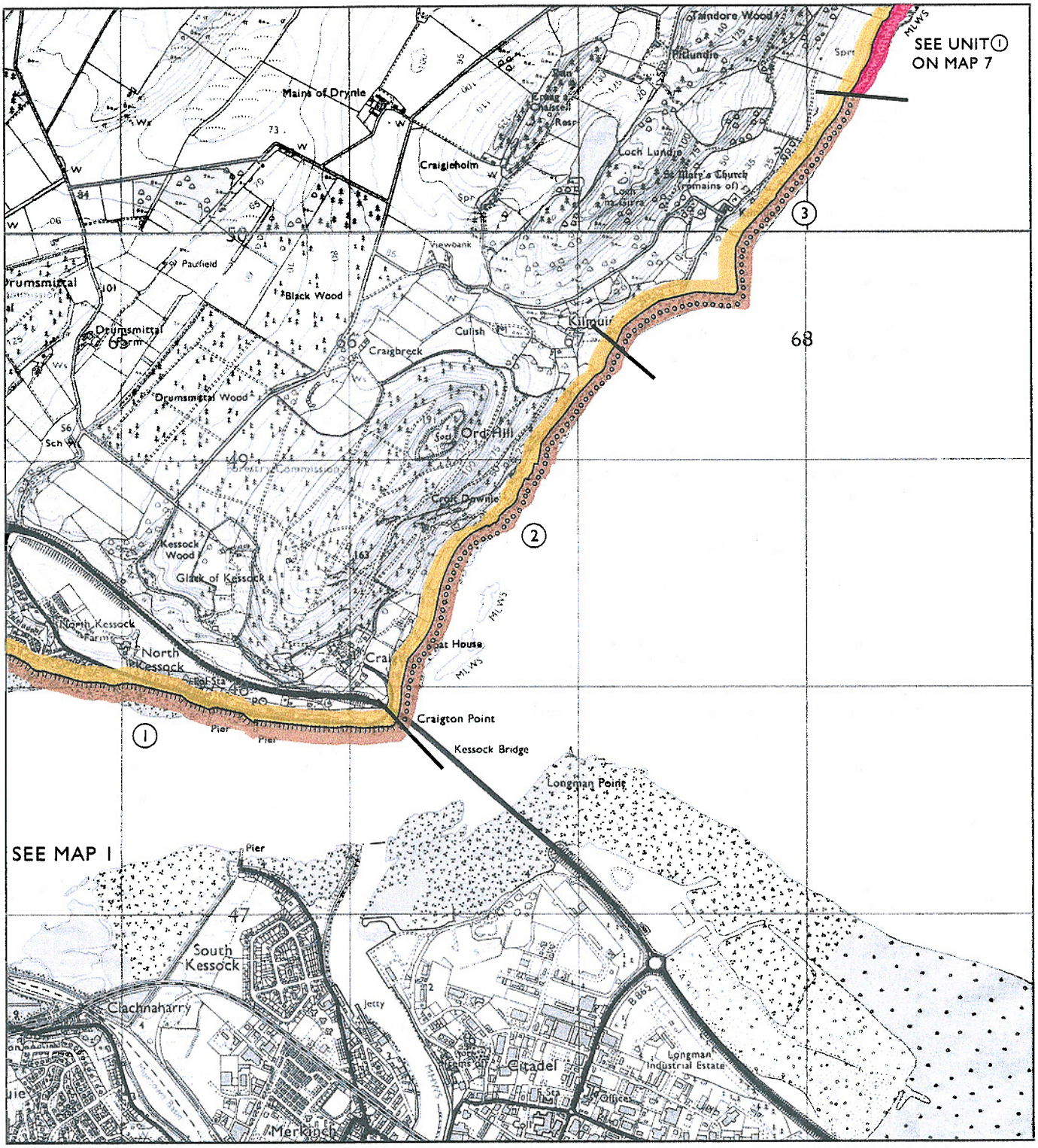
Built Heritage and Archaeology: The built heritage in this area is all 18th to 20th century and no earlier archaeological remains were located during the survey. Part of the built heritage of the North Kessock village was a direct result of the ferry which used to cross the mouth of the Beauly Firth, until the Kessock Bridge was completed in 1981. At Craigton and Croft Downie the built heritage includes two private slipways and a boat house.

Map 6: Hinterland Geology and Coastal Geomorphology

1. CHARLESTOWN to CRAGTON POINT at KESSOCK BRIDGE
NH 630 483
1.7km
Mainly mud and shingle/sea defences
Low edge (>10m)
Marine sands and gravel
Developed coastal edge with predominantly marine derived deposition in the immediate hinterland. Tidal mud flats are not as well exposed as in previous unit owing to deeper channel development towards the mouth of the inner estuary. Flood defences are present along the length of this unit.

2. CRAIGTON POINT to east of KILMUIRE
NH 668 490
1.9km
Mainly mud/boulders and shingle
Low edge (10m)
Raised beach and marine deposits
An exposed section of the Moray Firth with mud, boulders and shingle. The hinterland is wooded and fairly steep sided. Towards Ord Hill boulder clay is present.

3. East of KILMUIR to North of St Marys Church
NH 684 510
2.7km
Mud, boulders and shingle with exposed rock platform
Cliff (>10m)
Raised beach deposits
A small cuspate headland has been formed north east of Kilmuir consisting of marine sands over beach gravel. The foreshore is predominantly mud and shingle as far as east of Taindore Wood. From here northwards, exposed rock platform occurs terminating at the mouth of Munlochy Bay. Raised beach deposits extend throughout the length of this unit.



MAP 6: CHARLESTOWN TO KILMUIR

MORAY FIRTH SURVEY Grid ref: NH 65-69/46-51

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheets 160 & 177
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 08 September 1998

Hinterland:

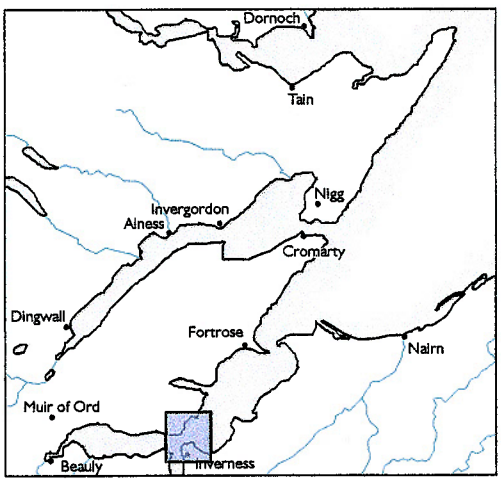
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



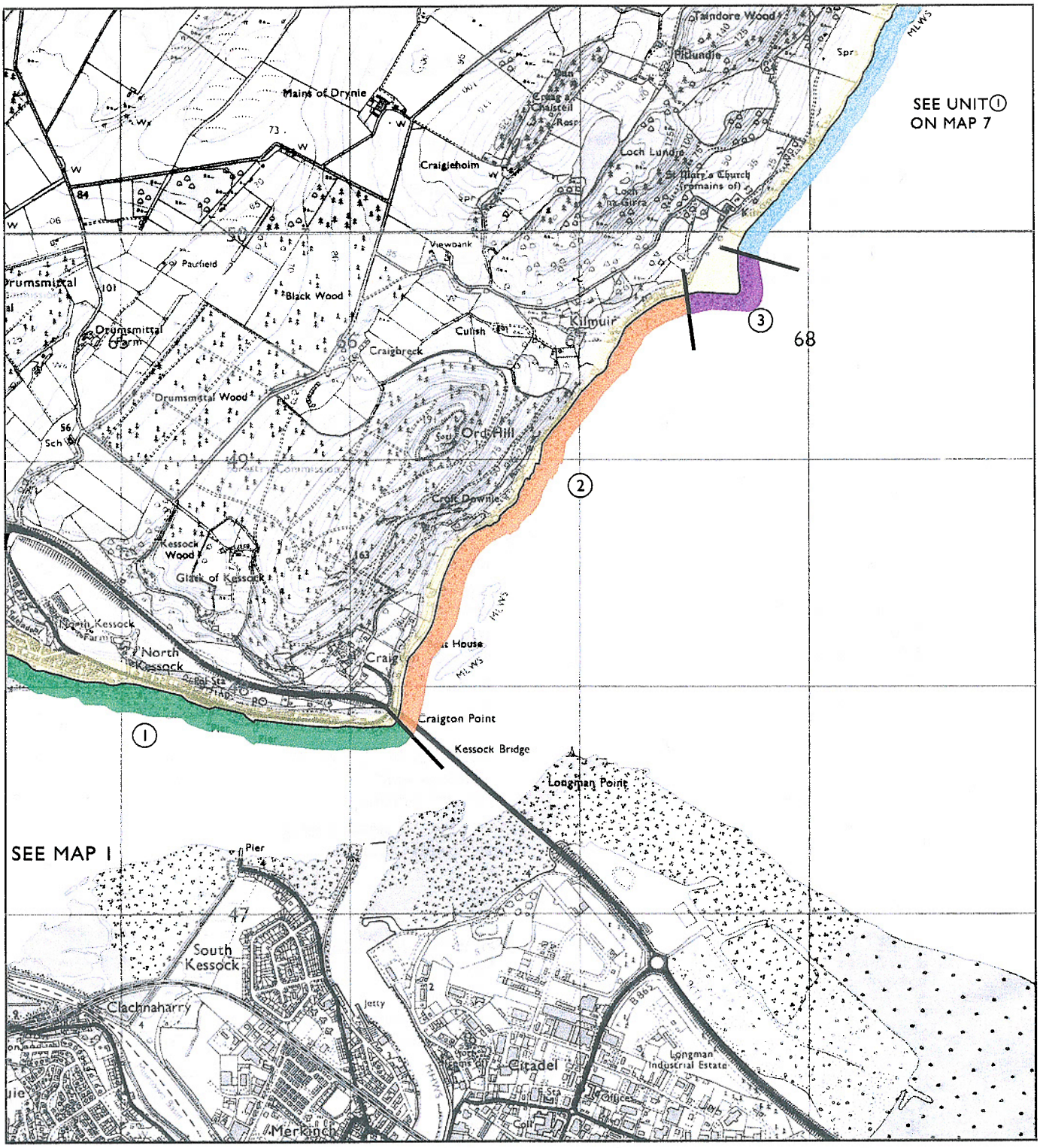
MAP 6: EROSION

1. TORGORM POINT to CRAIGTON POINT
NH 650 480
2.7km
Stable
The intertidal zone is noticeable narrower than further down the coast with no evidence of instability. At North Kessock stability is being maintained owing concrete sea walls.

2. CRAIGTON POINT to north east of KILMUIRE
NH 668 490
2.5km
Stable or Eroding
This unit of coastline appears to be stable with only slight evidence of scouring on the foreshore. At Kilmuir the shoreline is well defended.

3. North east of KILMUIR
NH 678 498
0.4km
Accreting and eroding
Immediately north east of Kilmuir a triangular headland projects out into the firth. This feature has shingle banks down to the LWM. The cliff behind the foreshore is undergoing rabbit erosion. This is leading to slope failure in parts.

4. North east of KILMUIR to CRAIGIEHOWE
NH 685 510
2.5km
Stable or accreting
This section of coastline appears to be stable owing to the resilient nature of the underlying sandstone geology. Towards the base of the cliffs rock fall is vegetated providing stability to this region.



MAP 6: CHARLESTOWN TO KILMUIR

MORAY FIRTH SURVEY Grid ref: NH 65-69/46-51

1:25 000

Basemap: O.S. *Pathfinder* Series
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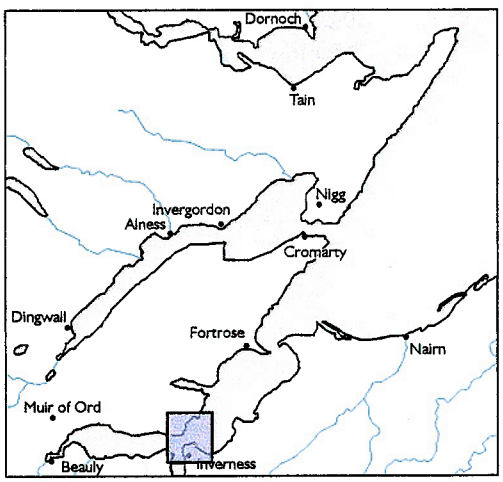
EROSION CLASS

Assessment date: 08 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 6: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH64NE 121 - Listed C (S)
NH 6538 4785
NORTH KESSOCK
Pier; Kessock Ferry
18th/19th century AD
Good
Nil

NH64NE 151
NH 6558 4782
NORTH KESSOCK
East Pier
19th century AD
Good
Nil

NH64NE 153
NH 662 478 - 669 472
KESSOCK BRIDGE
Bridge
20th century AD; built 1976-82
Good
Nil

NH 6632 4820
CRAIGTON
Boat house and slipway
19th century AD
Poor
Monitor

NH 6676 4896
CROFT DOWNIE
Boat house
19th/20th century AD
Poor
Monitor

NH 6722 4953
KILMUIR
2 boat slipways
19th/20th century AD
Poor
Monitor

Sites in the Hinterland

NH64NE 122 - Listed B
NH 6540 4794
NORTH KESSOCK
Kessock Hotel
18th/19th century AD
Good
Nil

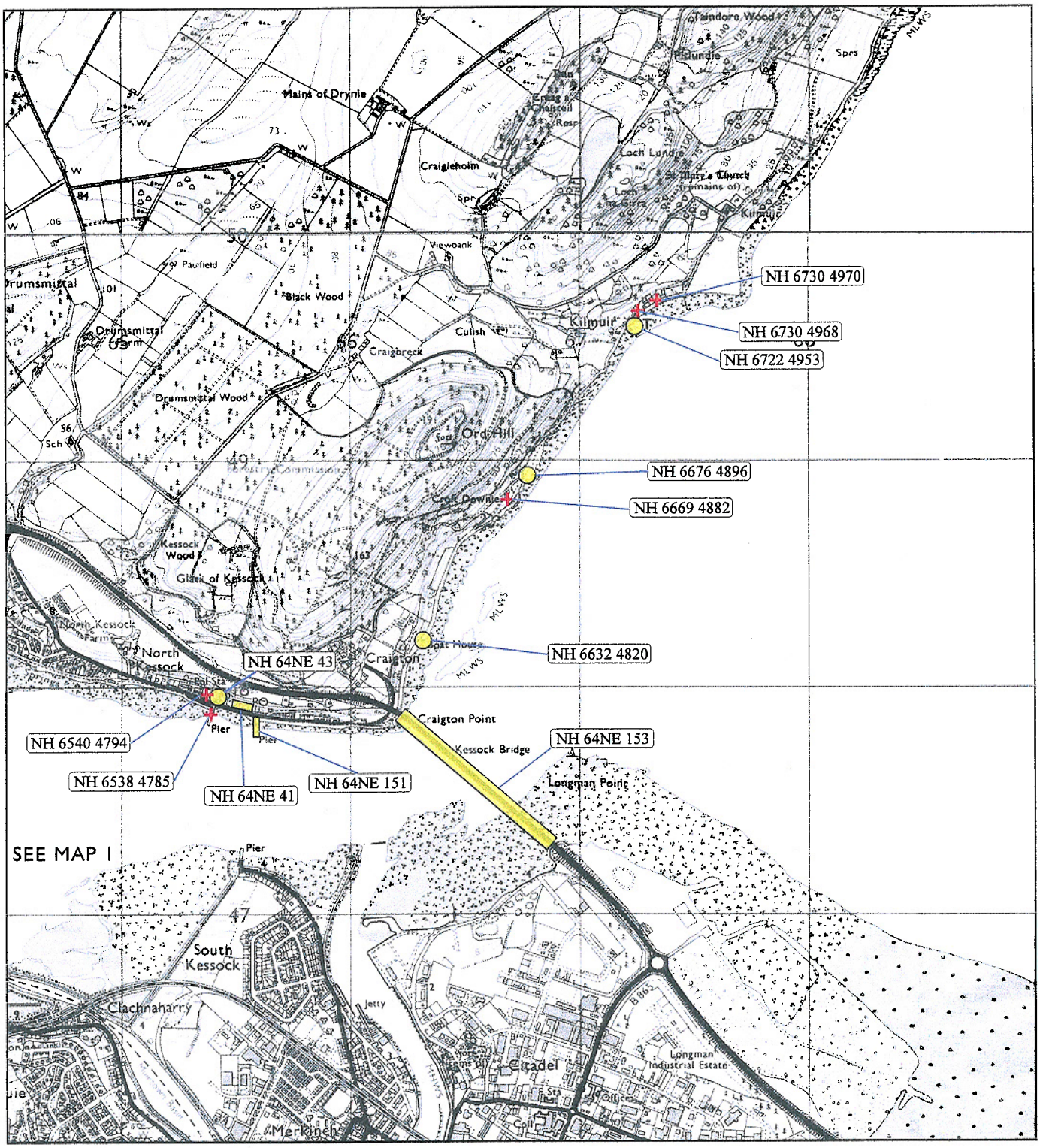
NH64NE 41
NH 655 478
NORTH KESSOCK
Cottages
19th century
Good
Nil

NH64NE 43
NH 6563 4787
NORTH KESSOCK
Hotel stables
18th/19th century AD
Good
Nil

NH64NE 44 - Listed, B
NH 6669 4882
CROFT DOWNIE
Cottage; 'Craigton Cottage'
19th century AD
Good
Nil

NH64NE 468 - Listed C(S)
NH 6730 4968
KILMUIR
Chisholm Cottage
19th century AD
Good
Nil

NH64NE 469 - Listed C(S)
NH 6730 4970
KILMUIR
Neuk Cottage
19th century AD
Good
Nil



MAP 6: CHARLESTOWN TO KILMUIR

MORAY FIRTH SURVEY Grid ref: NH 65-69/46-51

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheets 160 & 177
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BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
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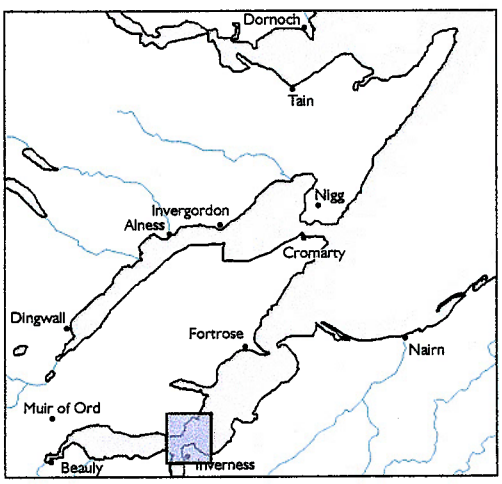


Map 7: KILMUIR TO AVOCH BAY

Hinterland Geology and Coastal Geomorphology: Brecciated conglomerates form the principal basement geology and these outcrop along the foreshore and into the hinterland. North east of Kilmuir, a cuspate foreland formed from marine deposits extends out into the Firth. The hinterland rises sharply behind the foreland and is well wooded. Further north, brecciated convex cliffs overlooks the mouth of Munlochy Bay. Munlochy Bay is a small isolated estuary surrounded by a shingle beach and mudflats. This bay is a key site for studies on Late-glacial and Flandrian relative sea level changes in the Moray Firth. It provides unique morphological evidence for three Late-glacial and five Flandrian beaches and also stratigraphic evidence for the Main Late-glacial shoreline and a possible Flandrian storm (tsunami) surge layer and established radiocarbon dated chronologies for the culmination of the Main Post-glacial transgression. The southern side of the bay has recently been afforested whilst the northern shore contains dense mature forest and fields.

Erosion class: Between Kilmuir and Munlochy Bay the coastline comprises a mixture of stable shingle beaches until east of Taindore Wood. From here, rock abrasion platforms outcrop. These are considered to be eroding but stable owing to their resilient nature. Towards the base of the cliff, rock falls are vegetated providing reasonable stability. Munlochy Bay is extremely sheltered and its entire shoreline is stable. Rabbit erosion was noted in the cliff at NH 6853 5292. Between Wood Hill to Ormond Hill, exposed sandstone rock platform are eroding at such a slow and immeasurable rate that they are for the present considered to be stable in the short term.

Built Heritage and Archaeology: The built heritage in this section varies from the listed cottages in Kilmuir village, both of which are inhabited and in very good condition, to the ruined building remains on the north shore of Munlochy Bay and Craiguch Well, also on the northern shore of Munlochy Bay. The archaeology of the foreshore dominates the total number of sites recorded, possibly as a result of the variety of geology and erosion classes. The archaeology includes the remains of jetties, walkways, and the extensive reclamation embankment system at the head of Munlochy Bay. The possible shell midden at the mouth of Munlochy Bay, on top of a low raised sea beach may be linked to the nearby cave system at Cragiehowe. On the northern shore of Munlochy Bay the remains of a hulk have been used to revet a narrow channel cut in order that the Bay quarry may be accessed. This small inlet is currently used for recreational purposes.

Map 7: Hinterland Geology and Coastal Geomorphology

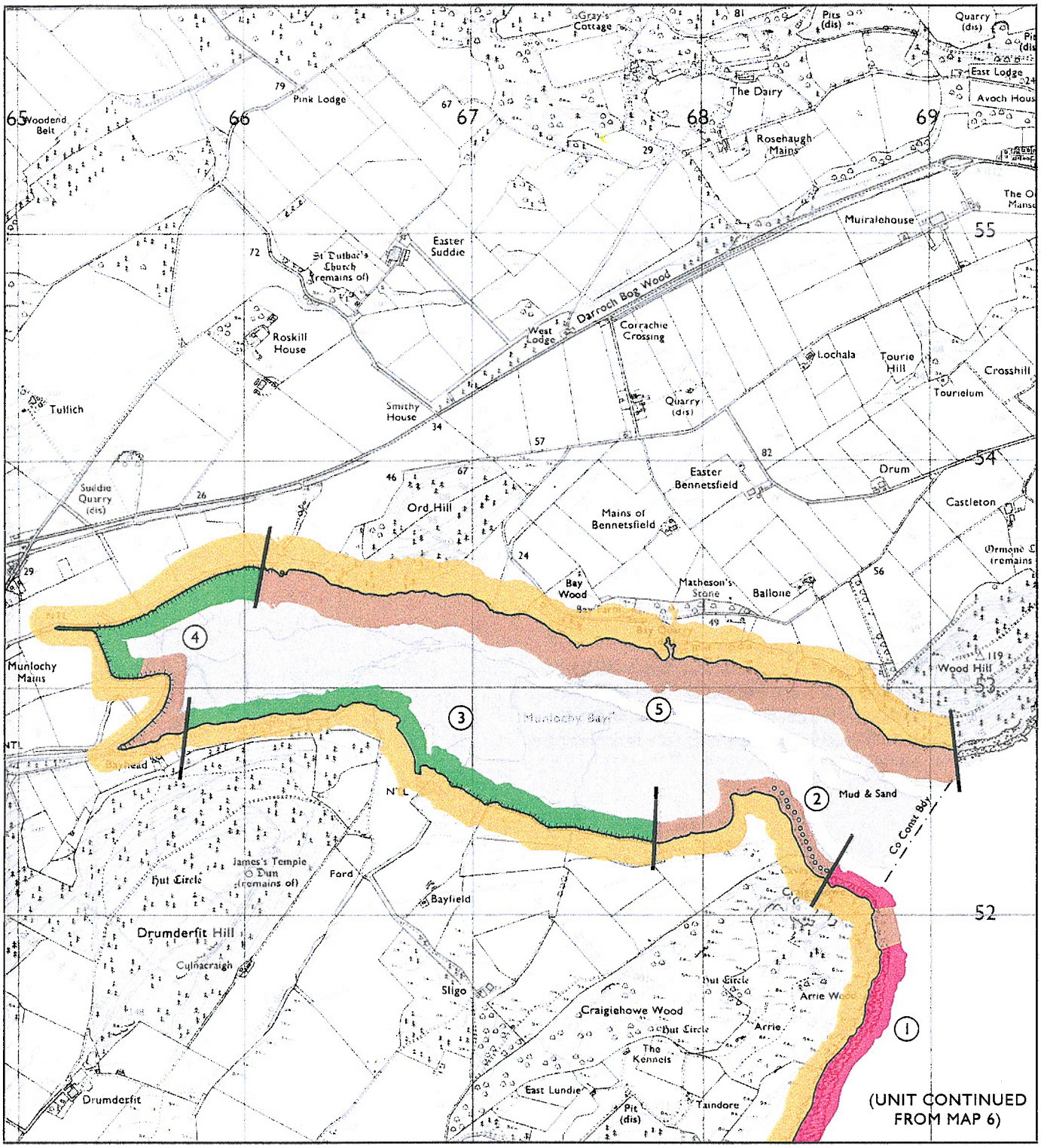
1. North of ST MARYS CHURCH to CRAIGHOWE
NH 685515
2 km
Mainly rock platform
Low edge (<10m)
Boulder clay and marine deposits
Boulder clay mantles raised beach deposits which rest above Old Red Sandstone. The coastal edge is irregular overlooking rocky platform which has been eroded into a series of gullies.

2. CRAIGIEHOWE to east of BAYFIELD
Irregular spur formed consisting of marine sand and gravel. Boulder clay mantles breccia deposits and marine terraces in parts. The foreshore is variable with shingle, mud and sand. Exposed rocky platforms are present at entrance to Munlochy Bay.

3. East of BAYFIELD to BAYHEAD
NH 670 525
2.3km
Mainly mud and sand
Low edge (<10m)
marine sand and gravel
Middle section of the south shore of Munlochy Bay. Foreshore of mud and sand colonised at HWM by saltmarsh. Hinterland defended by flood banks with marine deposits below 10m OD. Saltmarsh extends eastwards towards the head of the bay.

4. BAYHEAD to west of ORD HILL PLANTATION
NH 656 531
2km
Intertidal mud and sand
Low edge (<10m)
Marine deposits
Flood banks protect the head of Munlochy Bay. The foreshore consists of saltmarsh and tidal flats with mud and sand. The coastal edge is irregular and low-lying. Marine deposits continue into the hinterland.

5. West of ORD HILL PLANTATION to WOOD HILL PLANTATION
NH 675 532
3.2km
Mainly mud and sand
Low edge (<10m)
Raised beach and marine deposits
Forming the northern shore of Munlochy Bay this section of coast is linear and unbroken with uniformity to the mouth of the bay. The foreshore comprises mainly mud and sand. The hinterland is below 10m OD and consists of marine deposits.



MAP 7: KILMUIR TO WOOD HILL

MORAY FIRTH SURVEY Grid ref: NH 65-69/51-56

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 160
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 10 September 1998

Hinterland:

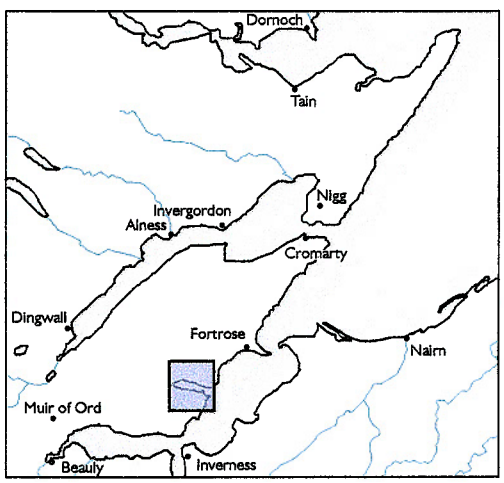
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh

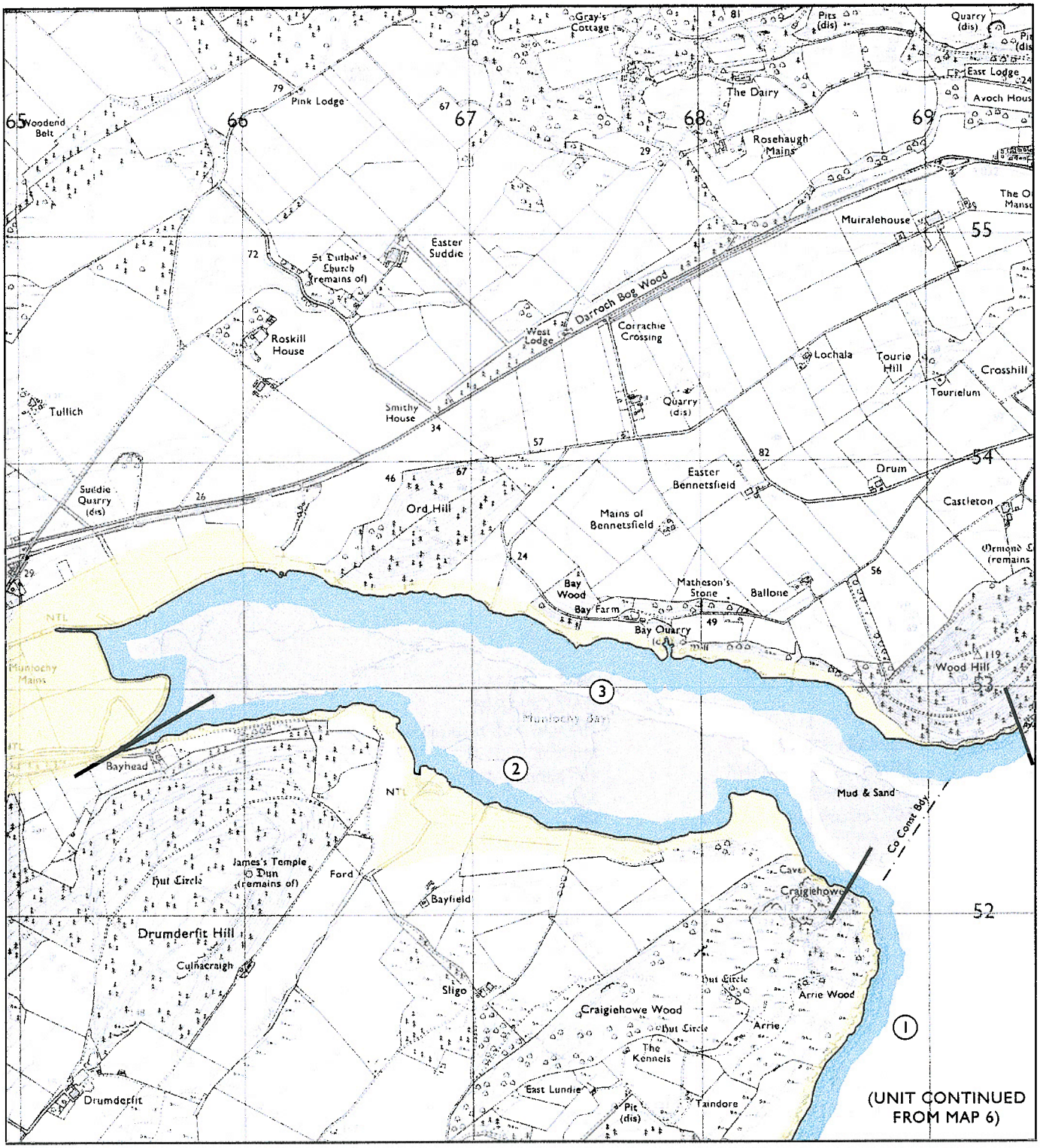


MAP 7: EROSION

1. North east of KILMUIR to CRAIGIEHOWE
NH 685 510
2.5km
Stable or accreting
This section of coastline appears to be stable owing to the resilient nature of the underlying sandstone geology. Towards the base of the cliffs rock fall is vegetated providing stability to this region.

2. CRAIGIEHOWE to BAYFIELD
NH 670 526
3.4km
Definitely Accreting
Southern shore of Munlochy Bay. The bay is very sheltered and this is leading to accretion of mud and shingle on the wide foreshore. At the HWM shingle is banked up and stabilised by vegetation.

3. BAYHEAD to south of WOOD HILL
NH 670 533
4.2km
Definitely accreting
The north shore of Munlochy Bay is sheltered leading to accretion of the exposed tidal flats caused by sediment entrapment within the bay. Rabbit erosion on a low cliff face is occurring at NH 6853 5292.



MAP 7: KILMUIR TO WOOD HILL

MORAY FIRTH SURVEY Grid ref: NH 65-69/51-56

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 160

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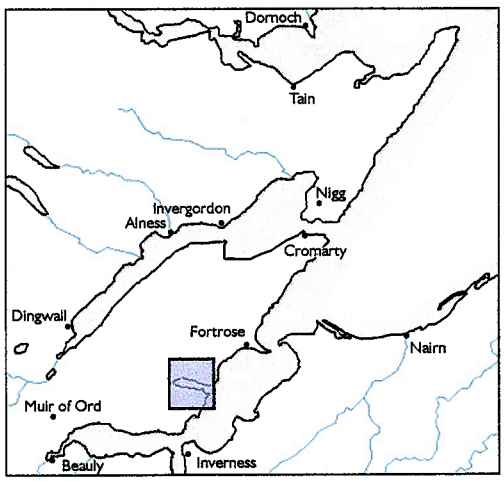
EROSION CLASS

Assessment date: 10 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 7: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH65SE 13
NH 6851 5216
CRAIGIEHOWE
Cave with Fingalian association
Uncertain
Good
Survey and monitor

NH 6840 5230
CRAIGIEHOWE
Possible shell midden
Uncertain
Poor
Survey

NH65SE 26
NH 6658 5293
MUNLOCHY BAY
Remains of jetty
19th century AD
Fair
Nil

NH 6555 5325
MUNLOCHY MAINS
Embankment
19th century AD
Good
Nil

NH 6536 5327
MUNLOCHY MAINS
Wooden bridge
Uncertain
Poor
Nil

NH 6550 5331
MUNLOCHY MAINS
Wooden walkway
20th century AD
Poor
Nil

Sites on the Coastal Edge & Foreshore

NH 6610 5354
ORD HILL
Wooden walkway
20th century AD
Poor
Nil

NH 6616 5351
ORD HILL
Pier and harbour
Uncertain
Fair
Monitor

NH 6700 5342
BAY WOOD
Hulk
Uncertain
Poor

NH 6790 5314
BAY QUARRY
Harbour wall revetted with hulk remains
19th century AD
Fair
Nil

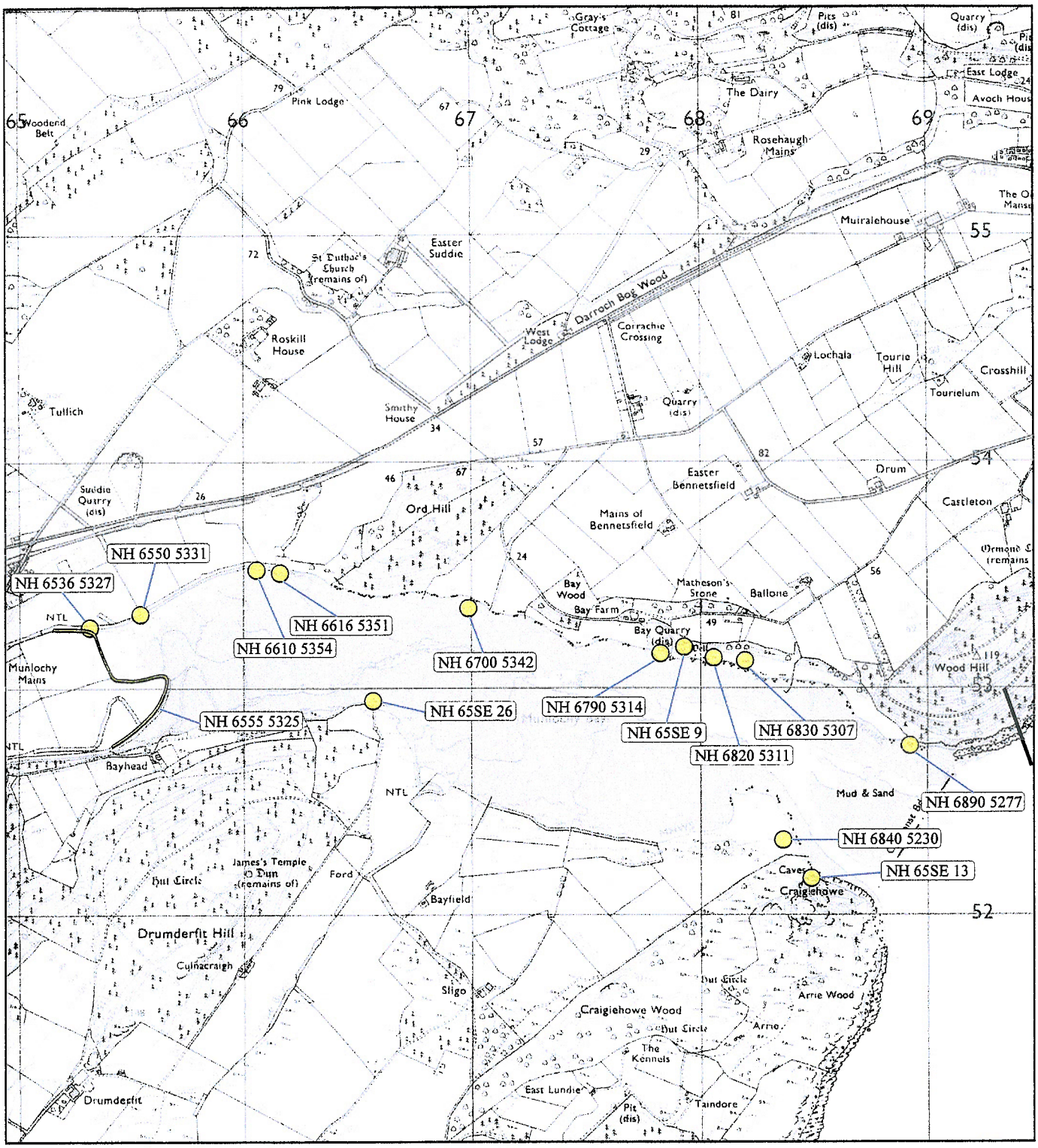
NH 6830 5307
BAY FARM
Boat house
20th century AD
Poor
Nil

NH 6890 5277
WOOD HILL
Mining cart
19th century AD
Poor
Nil

Sites in the Hinterland

NH65SE 9
NH 6793 5318
BAY FARM
Craiguch Well; rag well
Uncertain
Good
Nil

NH 6820 5311
BAY FARM
Remains of building
18th/19th century AD
Poor
Nil



MAP 7: KILMUIR TO WOOD HILL

MORAY FIRTH SURVEY Grid ref: NH 65-69/51-56

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 160

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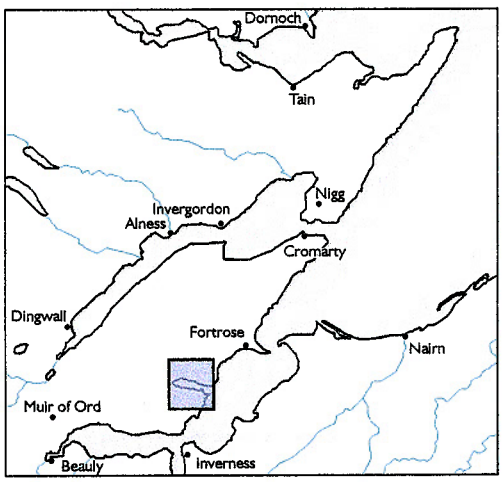
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 8: AVOCH BAY TO FORTROSE

Hinterland Geology and Coastal Geomorphology: Upper Old Red Sandstone continues as the basement geology. At Rosemarkie, boulder and undifferentiated drift deposits dominate the cover lithologies in the hinterland. The dominant geomorphic feature within this unit is the cuspate foreland of Chanory Ness and Point. This feature is postulated to have formed by the movement of material in a south westerly direction along the coastline of the Inner Moray Firth and in a westerly direction of the Beaulay Firth coastline (SMP 1996). From Avoch to Fortrose the shore frontage is developed with a coastal edge consisting of a low plateau of erodable marine deposits and alluvium. Channory Ness has dune cover and stepped shingle beaches. From the Ness to Rosemarkie Bay the predominant beach cover is sand.

Erosion class: South of Avoch fishing village a vertical concrete sea wall protects the shore road. Immediately south of the harbour and at the mouth of a small stream gabion basket protection has been utilised. Seawalls defend the road between Avoch and Fortrose. Rock armour protects the coast further towards Fortrose. The degraded condition of short stretches of seawall and timber groyne systems indicate minor backshore erosion taking place in the area. Chanory Ness is subjected to a relatively low fetch to the south west and has been undergoing wave induced erosion over a number of years (SMP 1996). In the short term, a greater part of the ness is stable or accreting with high banks of vegetated shingle. Chanory Point is accreting outwards but is at the same time eroding according to the nature of seasonal tide conditions.

Built Heritage and Archaeology: The built heritage in the western part of this area is the village of Avoch, which contains a number of maritime related buildings such as the ship chandler's and warehouse. The foreshore remains include the Telford designed Avoch harbour, built between 1803-21 and a modern slipway to the south west of the village, built to access the current fish farms in Avoch Bay. The eastern part of the area consists of the Fortrose village including a Telford designed harbour complex (1803-21).

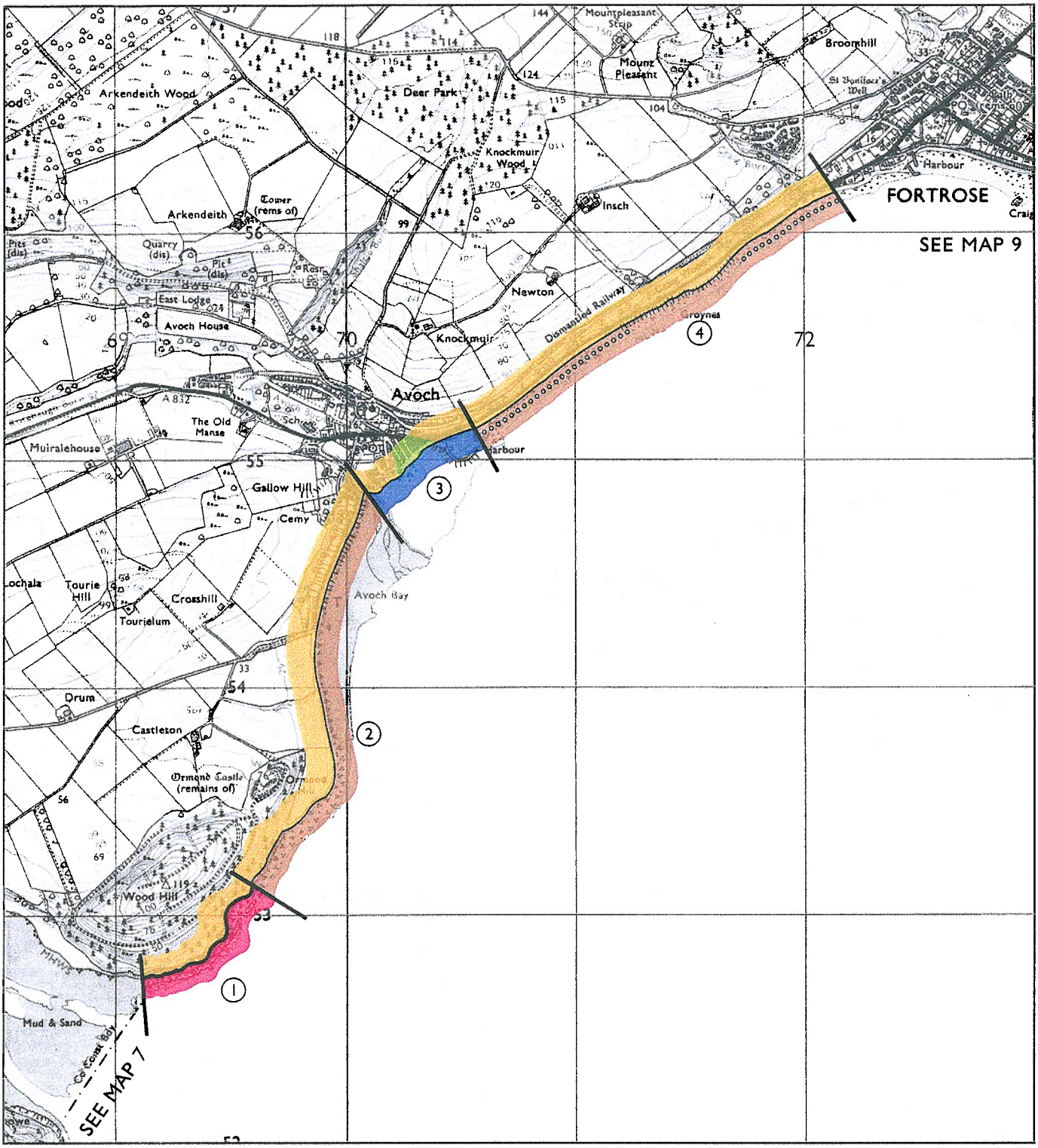
Map 8: Hinterland Geology and Coastal Geomorphology

1. South of WOOD HILL
NH 697 533
0.5km
Exposed rock platform and sand
Low cliff (>10m)
Raised beach and marine deposits
This coastal unit is fairly irregular with exposed rock platforms at the mouth of Munlochy Bay. Raised beach deposits cover the wooded hinterland.

2. WOOD HILL to AVOCH HARBOUR
NH 701 547
2.7km
Mainly mud and sand
Cliff (10m)
Raised beach and marine deposits/freshwater alluvium
Towards Avoch Bay mud and shingle are exposed at the LWM. Flood defence works defends the coastal edge. Marine deposits dominate the hinterland and alluvium derived from Avoch Burn.

3. AVOCH HARBOUR
NH 713 557
0.5km
Mainly shingle and mud
Cliff (<10m)
Raised beach and marine deposits
This unit consists of a shingle and mud foreshore with a near shore MLWS mark. Groynes form part of flood defence works along this stretch of coast. Freshwater alluvium is present.

4. AVOCH HARBOUR to FORTROSE
NH 712556
1.8km
Mainly single and mud
Cliff (<10m)
Raised beach and marine deposits
The hinterland is dominated by marine deposits, which support woodland. The foreshore is a mixture of mud and shingle with shore protection. This section of coastline is exposed.



MAP 8: WOOD HILL TO FORTROSE

MORAY FIRTH SURVEY Grid ref: NH 69-73/52-57

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 160
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 10 September 1998

Hinterland:

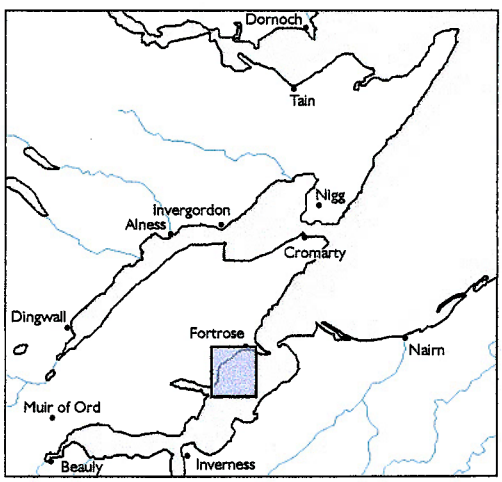
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 8: EROSION

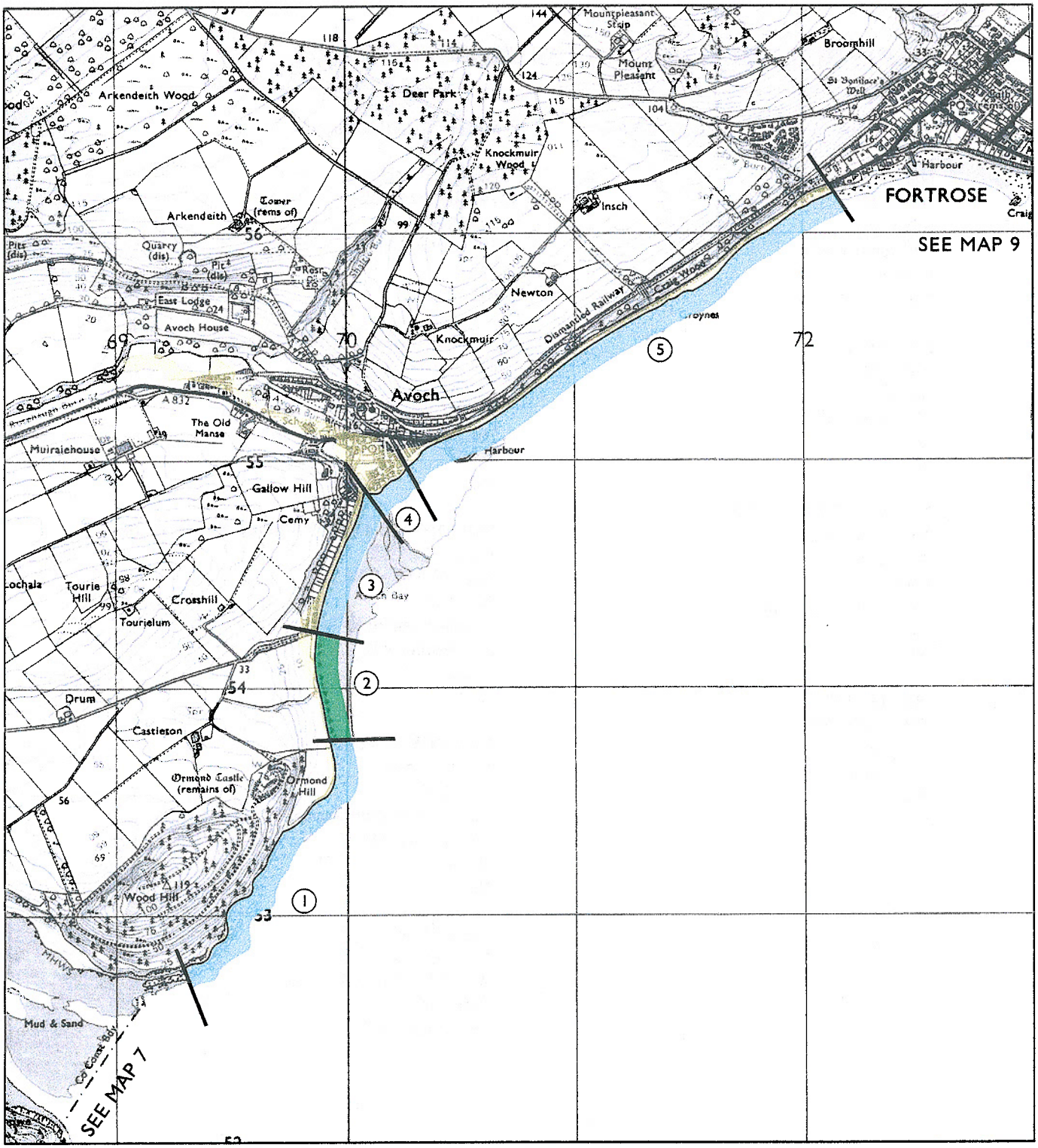
1. South of WOOD HILL to ORMOND HILL
NH 695 530
1.4km
Eroding or stable
Exposed rock platform of Upper Old Red Sandstone is eroding albeit slowly.

2. ORMOND HILL to start of AVOCH BAY
NH 699540
0.5km
Stable
Sandy beach with stable conditions.

3. AVOCH BAY
NH 699 540
0.5km
Stable
Small sheltered bay defended by sea walls. The shore is stable owing to sediment supply via longshore drift leading to build up of sand and shingle. In parts this material is stabilised by vegetation. Sand is exposed at the LWM.

4. AVOCH HARBOUR
NH 702549
0.2km
Stable
The sandy beach is protected by sea walls and is stable.

5. AVOCH to south west of FORTROSE
NH 715 557
2.4km
Stable
Rubble sea-defences and groynes on the shore. Shingle banks are stabilised by vegetation. Stable conditions prevail. A c.50m section of erosion has occurred on the neck of the pier at Avoch and is now defended by rubble. Turf behind has been scoured by wave action. On the whole conditions are stable.



MAP 8: WOOD HILL TO FORTROSE

MORAY FIRTH SURVEY Grid ref: NH 69-73/52-57

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 160
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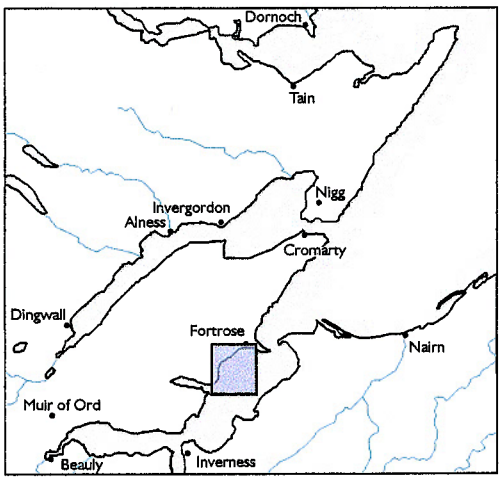
EROSION CLASS

Assessment date: 10 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 8: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 6989 5427
AVOCH
Slipway
20th century AD
Poor
Nil

NH 7030 5495
AVOCH
Metal piles
20th century AD
Good
Nil

NH75NW 72 - Listed B
NH 7050 5501
AVOCH
Harbour
19th century AD; 1803-21
Good
Nil

NH7156 5574
CRAIG WOOD
Groynes
20th century AD
Fair
Nil

Sites in the Hinterland

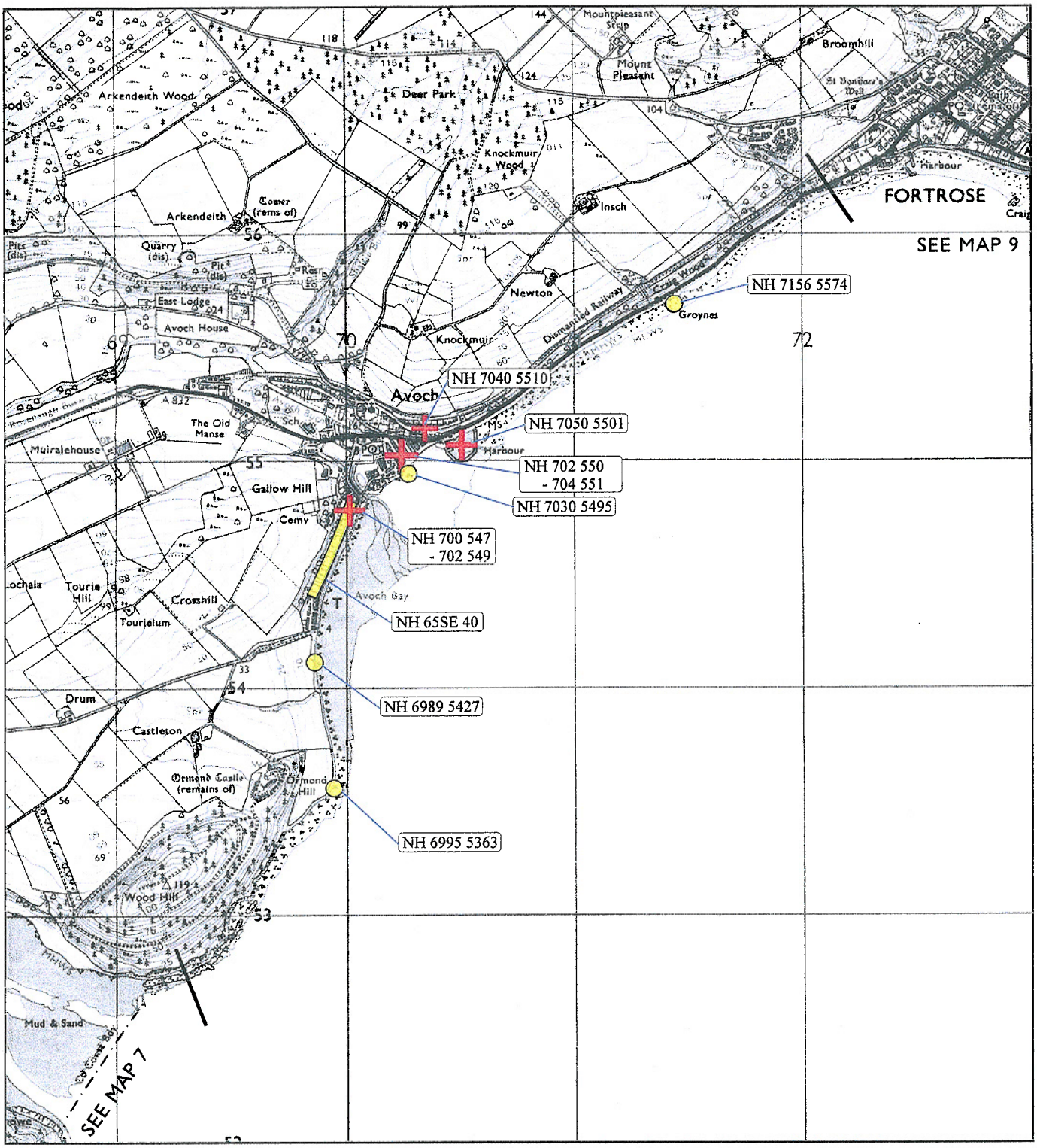
NH 6995 5363
ORMOND HILL
Boat house
20th century AD
Fair
Nil

NH75SW 4-22, 4 & 7-19 Listed B
NH 700 547 - 702 549
AVOCH
Houses; bridge; conservation area
20th century AD
Good
Nil

NH75NW 41, 45-49, 77-78. 41, 45, 49, & 78 Listed B
NH 702 550 - 704 551
AVOCH
Various residential houses
20th century AD
Good
Nil

NH75NW 71 - Listed C
NH 7040 5510
AVOCH
Commerical warehouse; shipchandler's
20th century AD
Good
Nil

NH65SE 40
NH 6990 5444
AVOCH, Ormond Terrace
Buildings
19th century AD
Good
Nil



MAP 8: WOOD HILL TO FORTROSE

MORAY FIRTH SURVEY Grid ref: NH 69-73/52-57

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 160

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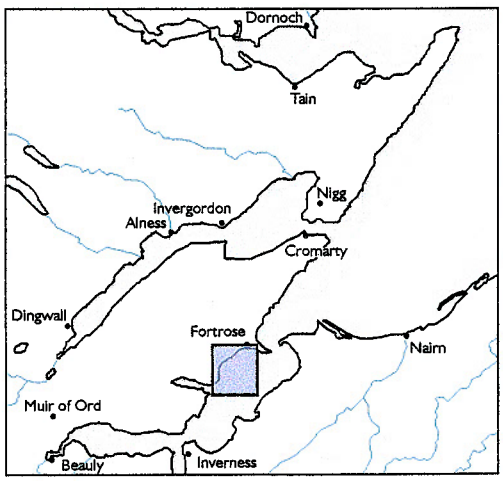
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 9: FORTROSE TO SCART CRAIG

Hinterland Geology and Coastal Geomorphology: With the exception of the Chanory Peninsula, the section of coastline at Scart Craig is rugged and inaccessible with near vertical cliffs fronted by a narrow strip of foreshore. The high steep cliffs of Old Red Sandstone are overlain by glacial deposits which somewhat soften the appearance of the coastline. At the southern end of the frontage, between Scart Craig and Rosemarkie there are raised beach deposits at the base of the cliffs. Rosemarkie village rests on undifferentiated schist and gneiss of the Moine Series. The beach unit from Chanory Ness to Scart Craig is just over 5km long with an average width at the LWM of 40m (Smith and Mather 1973).

Erosion class: This unit of coastline is classified as stable or accreting at Rosemarkie village and stable towards Scart Craig. Stability is maintained at Rosemarkie by a low concrete seawall. Glacial debris accumulates at the base of the cliff as a result of weathering and is then transported by wave action to the south and east in a direction of net littoral drift (SMP 1996). Sand is accreting on the upper foreshore south of Scart Craig where it is blown onshore resulting in minor dune development. Sand accretion also occurs in Rosemarkie Bay helped by longshore drift and the shelter provided by the sandstone ledges outcropping on the foreshore in the lee of Scart Craig.

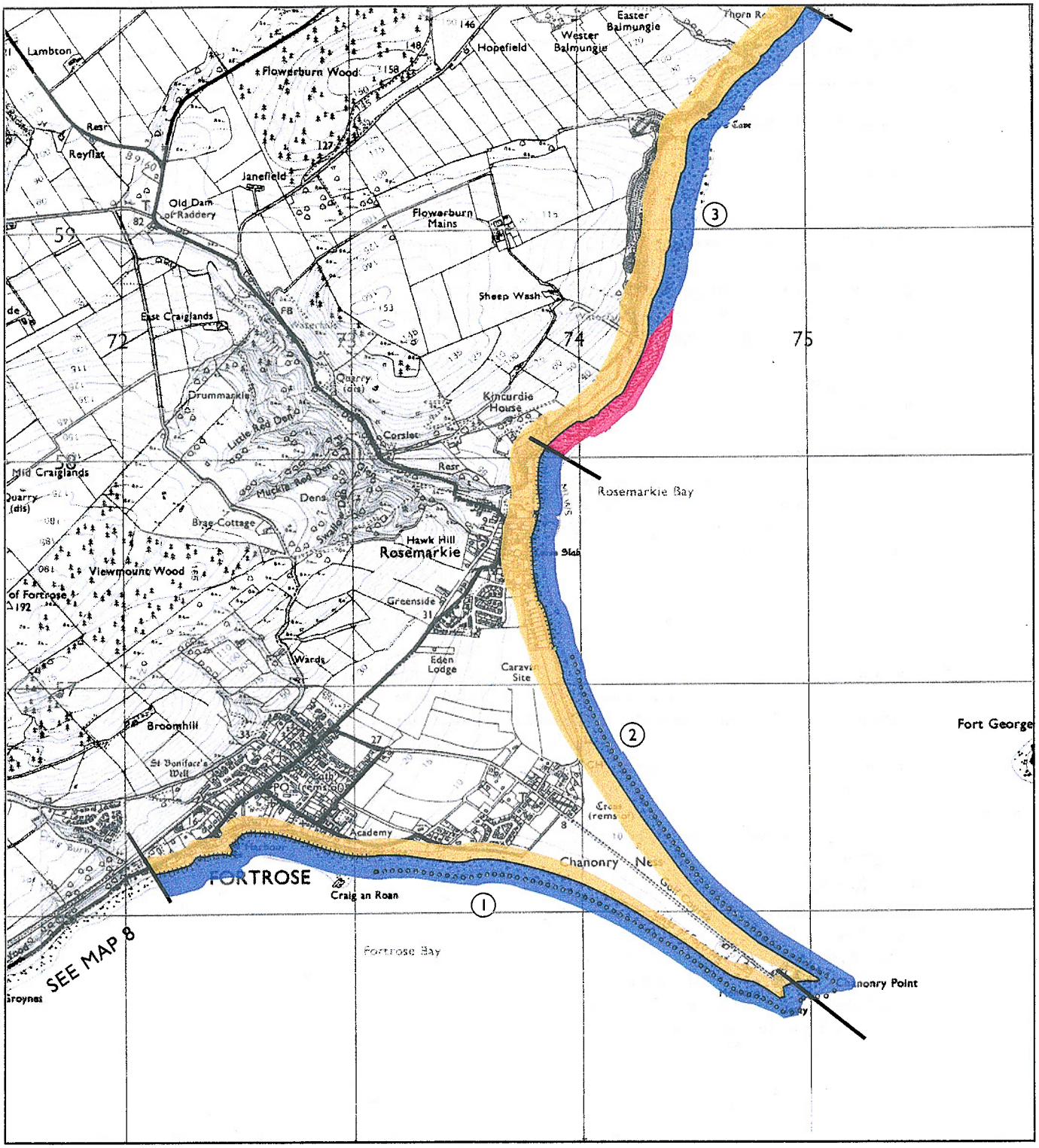
Built Heritage and Archaeology: The built heritage on Channory Point consists mainly of 18th/19th century buildings associated with the lighthouse and the ferry that used to run between here and Fort George. The foreshore remains tend to be modern in date, including three sites of concrete and metal piles. Their purpose is unclear but they may be associated with mooring craft.

Map 9: Hinterland Geology and Coastal Geomorphology

1. FORTROSE to CHANORY POINT
NH 735 563
3.1km
Fringing sand and shingle beach
Low edge(<10m)
Raised beach and marine deposits
South-eastern flank of a cuspate triangular foreland with fringing sand and shingle beach. Sea defences present at Fortrose. Marine sands and gravel dominate the hinterland.

2. CHANNERY POINT to KINGKURDY HOUSE
NH 741 566
2.8km
Fringing sand, gravel and shingle beach
Mostly Low edge (<10m)
Raised beach and marine deposits/beach gravel overlain by turf
The hinterland geology consists of raised beach deposits, with banks of shingle overlain by turf. Sand and shingle dominate the foreshore. A 2.5m high sea wall is present at Rosemarkie.

3. KINCURDIE HOUSE to THORN ROAN
NH 744 590
2 km
Exposed rock platform/sand and shingle with dune formation at Scart Craig
Cliff (>10m)
Raised beach and marine deposits/dune sands and machair vegetation.
The foreshore within this unit consists of exposed rock platform with sand and shingle exposed towards Scart Craig. Sea caves are present at this location. Marine deposits and relict shorelines of Postglacial age dominate the hinterland. Escarpments rise over c.20m above OD. A dune has been formed by accreting sand blown up onto the low postglacial platform, which lies at the base of the degraded cliff.



MAP 9: FORTROSE TO SCART CRAIG

MORAY FIRTH SURVEY Grid ref: NH 72-76/55-60

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 160
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 10 September 1998

Hinterland:

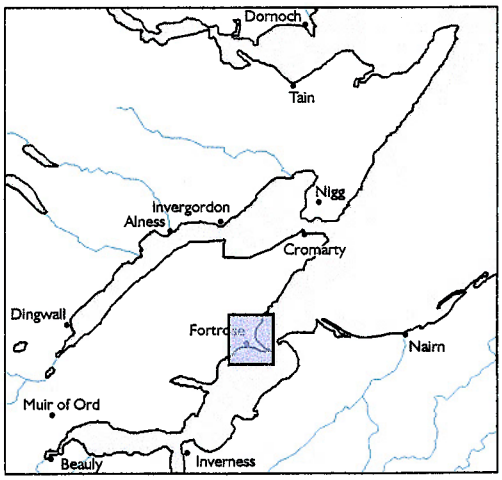
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 9: EROSION

1. FORTROSE BAY
NH 730 563
2.6km
Stable
Fortrose bay is sheltered in the lee of Channery Point. Two Gabion basket groins are now split but still control longshore drift. Sand is present between the groynes and appears to be shifting eastwards. No evidence to suggest that conditions at this point in time are unstable.

2. CHANNERY POINT
NH 750 557
1km
Stable or Eroding
The headland appears to be stable owing to focusing of sand and shingle from both sides of this cuspate foreland. The backshore is stable owing to vegetation cover.

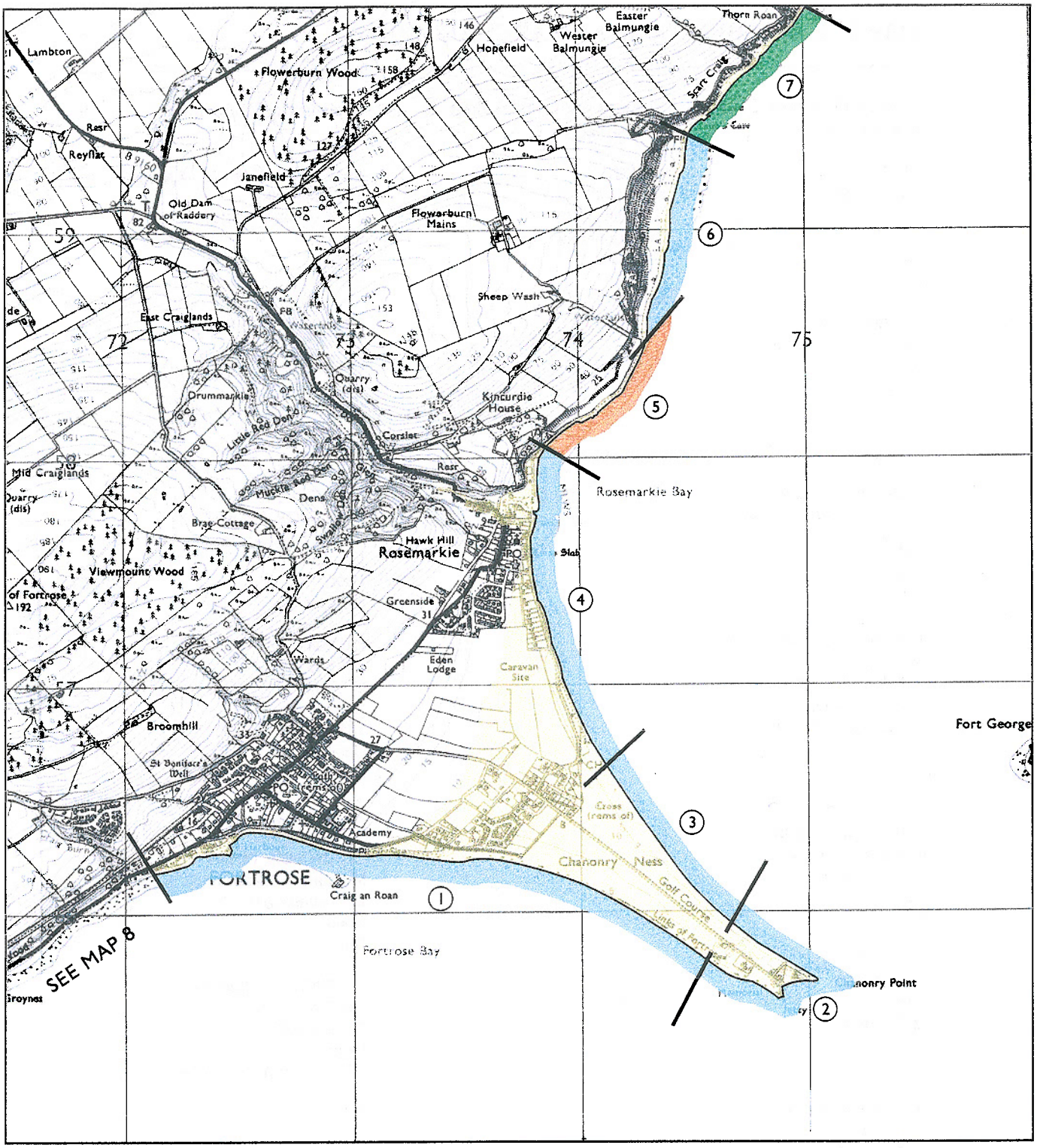
3. CHANNERY NESS
NH 745 563
0.9km
Definitely Accreting
Longshore drift is leading to the formation of shingle banks. The finer sediment is banked into a series of cusps. This zonation is noticeable towards the backshore where vegetation is leading to stability.

4. CHANNERY NESS to ROSEMARKIE NORTH
NH 740 570
1.4km
Accreting or Stable
A linear stretch of coastline with boulders and shingle banked at the backshore area. Exposed aspect leading to build up or sediment re-supply. Gabion basket defend the coastal edge at the caravan park (NH 7391 5710).

5. ROSEMARKIE NORTH to east of SHEEP WASH
NH 742 582
0.7km
Eroding or Stable
A low sea wall defends the play area south of Kincurdie House. Northwards the coastline contains a fossil dune system overlooking exposed rocky cliffs and exposed rock platform. Sand is accreting in the gullies, which suggest that conditions here are generally stable.

6. East of SHEEPWASH to SCART CRAIG
NH 749 598
0.8km
Accreting or Stable
Boulder strewn stretch of coastline which at the time of the survey appears to be stable.

7. SCART CRAIG
NH 749 598
0.8km
Stable
Outcropping Old Red Sandstone platform is fairly resilient to attrition by wave action. Shingle is banked up on a wide backshore. Conditions at the time of the survey remain stable.



MAP 9: FORTROSE TO SCART CRAIG

MORAY FIRTH SURVEY Grid ref: NH 72-76/55-60

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 160

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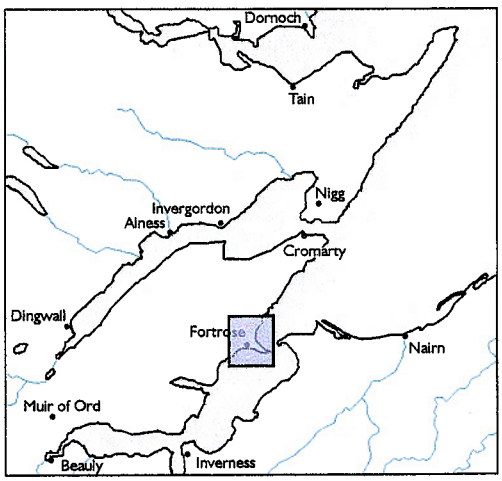
EROSION CLASS

Assessment date: 10 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



Sites on the Coastal Edge & Foreshore

NH 7299 5630
FORTROSE
Wooden piles; sea defence
Uncertain
Poor
Nil

NH 7348 5620
CHANNORY NESS
Storm drain
20th century AD
Poor
Nil

NH 7469 5564
CHANNORY NESS
Railway sleepers used as sea defence
20th century AD
Fair
Nil

NH75NW 52 - Listed C(S)
NH 7487 5562
CHANONRY POINT
Jetty and slipway
19th century AD; 1803-21
Good
Nil

NH 7475 5570
CHANONRY NESS
Concrete and metal piles
20th century AD
Poor
Nil

NH 7245 5630
FORTROSE
Slipway
20th century AD
Fair
Nil

NH75NW65.00 - Listed C
NH 7248 5629
FORTROSE
Harbour
19th century AD; 1803-21
Good
Nil

Sites on the Coastal Edge & Foreshore

NH75NW 5
NH 7447 5947
CAIRD'S CAVE
Excavated rock shelter
Uncertain
Good
Nil

Sites in the Hinterland

SMR: NH75NW 436 - Listed C
NH 7461 5585
CHANONRY POINT
Cottage
Good
Nil

NH75NW 55 - Listed C(S)
NH 7471 5574
CHANONRY POINT
Ice House
19th century AD or earlier
Good
Nil

NH 7471 5573
CHANNORY POINT
Ruined building, incorporated into golf course
Uncertain
Poor
Monitor

NH75NW 54
NH 7482 5572
CHANONRY POINT
Cottage
18th/19th century AD
Good
Nil

NH75NW 124
NH 7481 5563
CHANONRY POINT
Monuments; Brahan Seer's Stone
20th century AD
Good
Nil

NH75NW 53 - Listed C(S)
NH 7485 5570
CHANONRY POINT
Ferry House
19th century AD of earlier
Good
Nil

NH75NW 67, 65.00, 65.01, 66; some Listed C
NH 724 563 area
FORTROSE
Variety of buildings; conservation area
18/19th/20th century AD
Good

MAP 9: FORTROSE TO SCART CRAIG

MORAY FIRTH SURVEY Grid ref: NH 72-76/55-60

1:25 000

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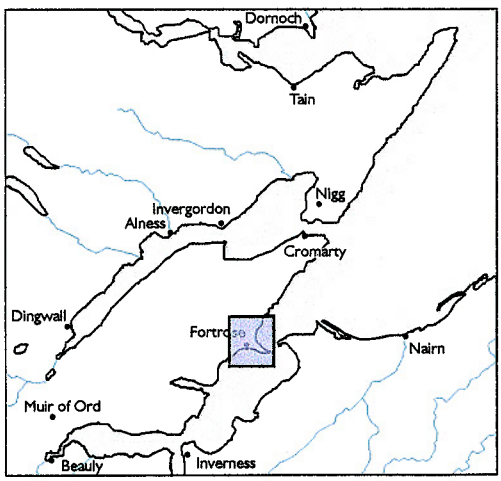
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998



Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile

Map 10: SCART CRAIG TO ETHIE FISHING STATION

Hinterland Geology and Coastal Geomorphology: Psammatic granulate and subordinate pelitic schist with horneblende with granite inclusions represent the basement rocks in this coastal unit. Some of these rock types are exposed at the surface but in general are mantled by a thin cover of boulder clay. The coastline is narrow with a discontinuous platform of Post-glacial raised beach. The cliffs are extremely precipitous with an indented cliff edge that overlook abrasion platform, sea caves and stacks. Towards Ethie Fishing Station multiple escarpments have been formed by boulder clay and marine land slips.

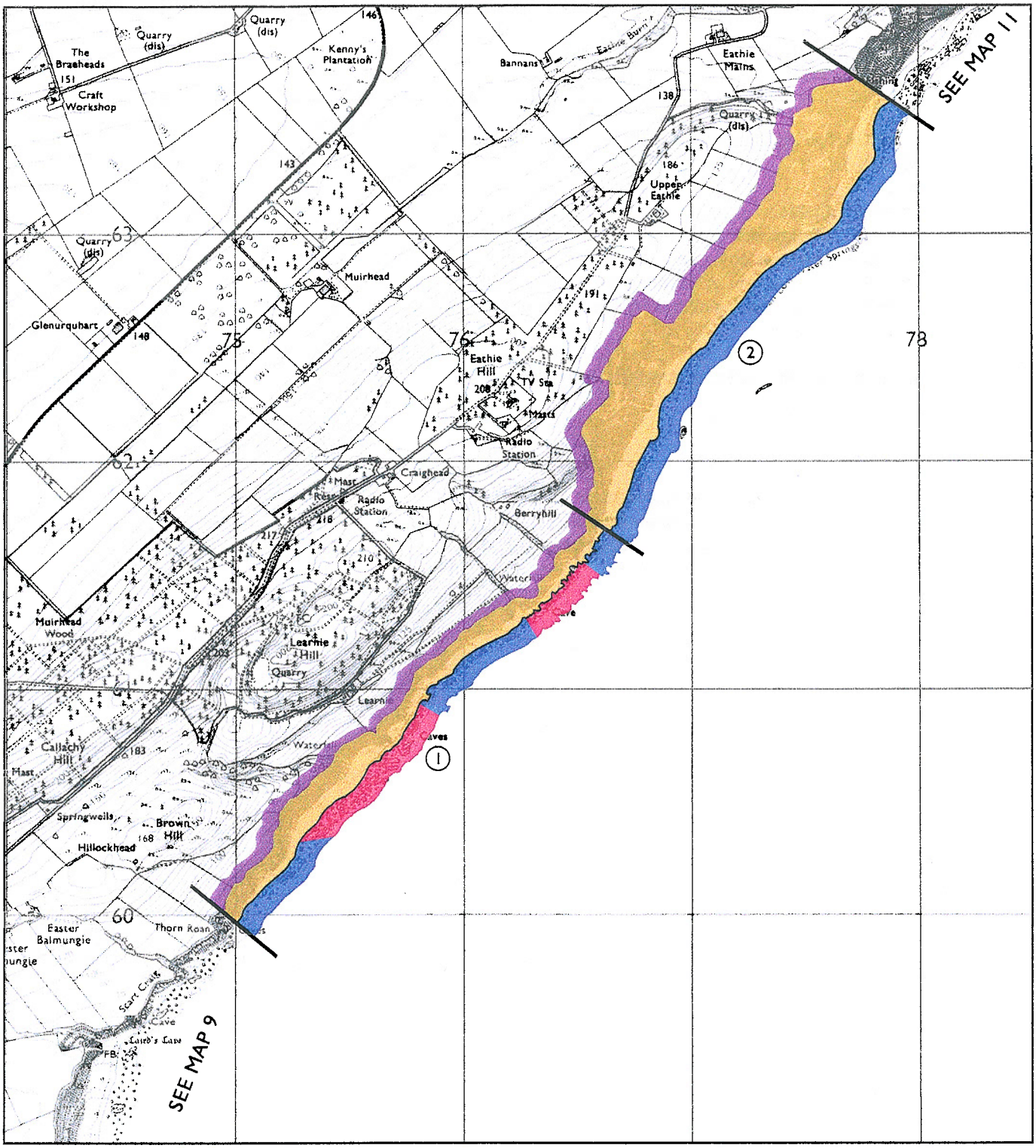
Erosion class: This unit of coastline is exposed to the impact of storms from the north easterly quadrant. Boulder clay is eroding from the crest of the cliff then wave impacted at the base. This imparts material which is then picked up and thrown back on the cliff base leading to abrasion. This loss from the cliff contributes to offshore sediment supply. In general the cliffs are eroding yet at an indeterminable slow rate and are therefore assigned to the classification of stable and eroding.

Built Heritage and Archaeology: The limited sites recorded in this area were Caird's cave, a rock shelter inhabited until the early 20th century which was excavated by Dr. Maclean in 1912 (Stevenson 1955). The other site is another cave near Learnie, where a low wall survived in front of the entrance. The limited archaeology recorded may in part be due to the inaccessibility of this shoreline and sites may be obscured due to heavy gorse growth on the cliff sections.

Map 10: Hinterland Geology and Coastal Geomorphology

1. THORN ROAN to east of BERRYHILL
NH 760 613
2.3km
Rock platform/boulders/shingle and sand
High cliff (25m)
Terraced raised beach and marine deposits
This unit consists of an exposed narrow discontinuous platform of postglacial raised beach. A series of terraces rise to over 25m above OD. The foreshore is mainly outcropping rock platform with boulder and shingle as a result of erosion processes.

2. East of BERRYHILL to north of ETHIE FISHING STATION
NH775 630
2.8km
Some exposed rock platform with mainly boulders, sand and shingle
High cliff (c.70-90m)
Terraced raised beach and marine deposits/glacial drift
Exposed rock platforms with boulders and shingle. The coastal edge is very irregular rising in parts to in excess of c.90m OD. The high cliff is terraced down to the MHWS line.



MAP 10: SCART CRAIG TO EATHIE FISHING STATION 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 74-78/59-64

Basemap: O.S. *Pathfinder* Series
Sheets 144 & 160
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 10 September 1998

Hinterland:

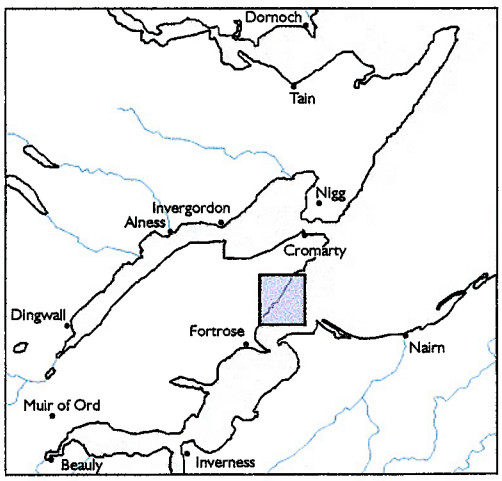
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

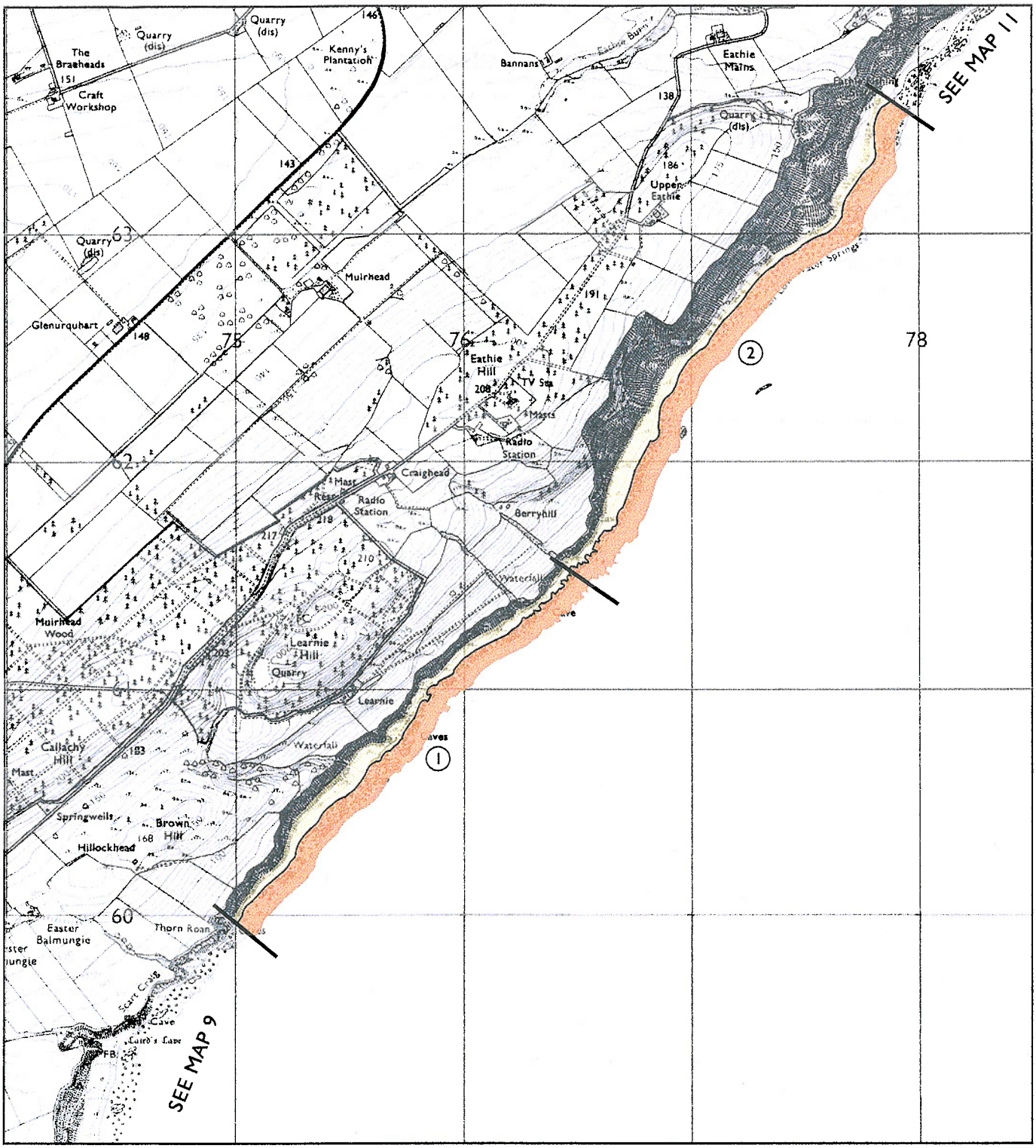
- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 10: EROSION

1. THORN ROAN to south of BERRYHILL
NH 758 610
2km
Eroding or Stable
Indented cliff edge with steep slopes. This unit is exposed to north-easterly gales. Beach boulders scour the rock platform. Attrition of the foreshore is likely to be slow owing to the resilient nature of the local sandstone.

2. South of BERRYHILL to EARHIE FISHING STATION
NH 773 630
2.3km
Eroding or stable
The coastline is irregular and incised at the base by scouring of boulders at the base of the cliff. Exposed to easterly gales erosion is constant on the foreshore albeit slow.



MAP 10: SCART CRAIG TO EATHIE FISHING STATION 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 74-78/59-64

Basemap: O.S. *Pathfinder* Series
Sheets 144 & 160
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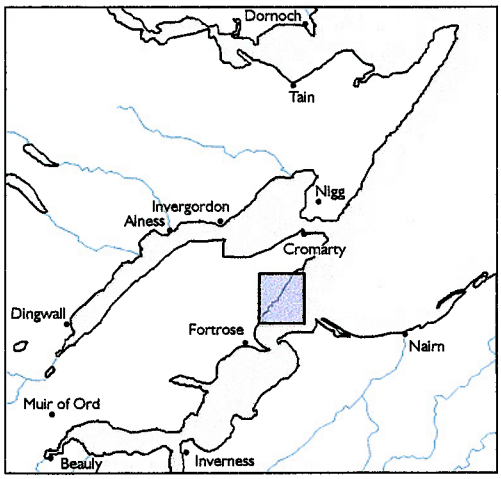
EROSION CLASS

Assessment date: 10 September 1998

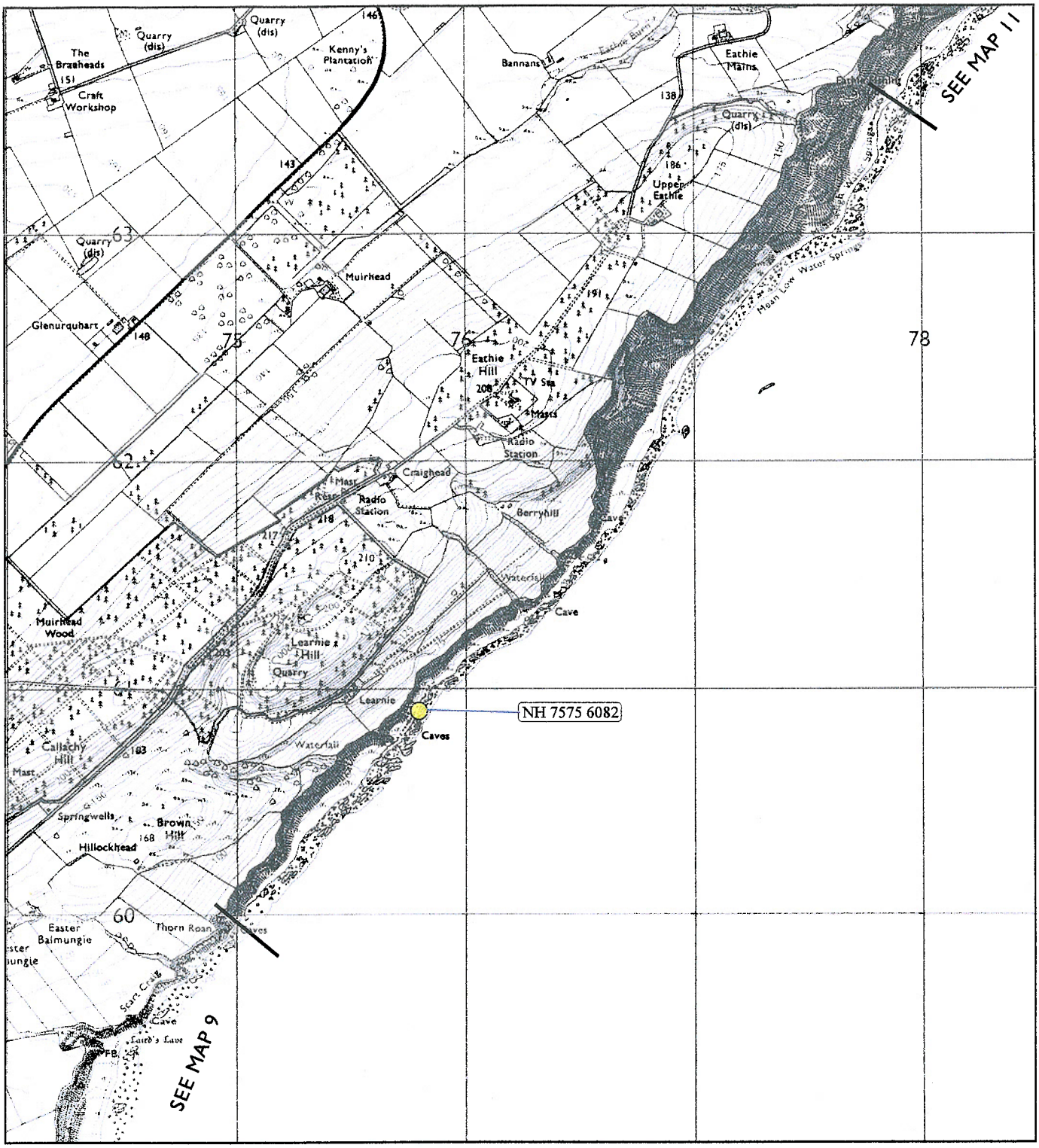
Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



Sites on the Coastal Edge & Foreshore

NH 7575 6082
LEARNIE
Cave and walled entrance
Uncertain
Good
Nil



MAP 10: SCART CRAIG TO EATHIE FISHING STATION 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 74-78/59-64

Basemap: O.S. *Pathfinder* Series
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BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

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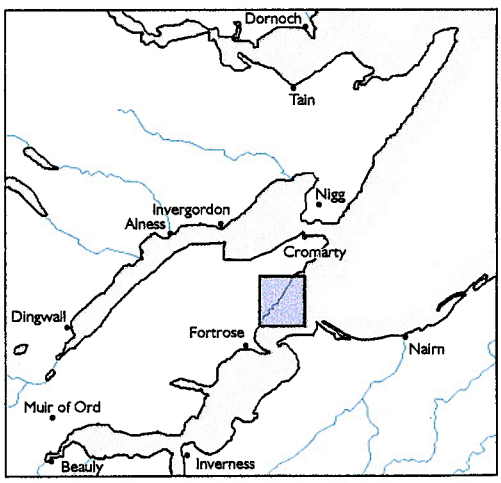


Map 11: EATHIE FISHING STATION TO CROMARTY

Hinterland Geology and Coastal Geomorphology: This unit of coastlines forms the southern peninsula called the South Sutor. Precipitous cliffs, abrasion platform, cave and stacks typify the ruggedness of this section of coastline that is exposed to the full fetch of storm waves from the north east quadrant. The basement geology is Middle Old Red Sandstone. North of Eathie Fishing Station a series of folds and intrusive epidiorite dykes outcrop against the cliff. The eastern side of the South Sutor is overlain by schist deposits and various igneous intrusions. Drift lithologies include boulder clay and morainic drift. A narrow discontinuous platform of raised Post-glacial raised beach forms a lower cliff terrace. The former fishing village of Cromarty lies on the western flank of a cuspate foreland built out during the late and post-glacial period. The lowest raised beach is backed by a major degraded cliff line which extends to Jemmimaville as far as the cliff coast east of Cromarty. The beach consists of fine gravel.

Erosion class: At McFarquar's Cave to Rednose (NH 804 657) the cliff line is very precipitous and overlooks numerous abrasion platforms and gullies. Dowgate Cave area could not be surveyed due to lack of access to the cliff base. It remains a matter of conjecture at what rate these cliffs are eroding. Away from the South Sutor towards the inner entrance of the Cromarty Firth lends shelter to the Cromarty shoreline. Here conditions are considered to be stable and accreting.

Built Heritage and Archaeology: The hintertland archaeology consists of the Castledownie promontory fort which is currently under plough and the ramparts on the upper cliff edge appear to be under threat from erosion. The military complex on the South Sutor consists of an extensive camp on the top of the cliff and also a series of look out posts on the shoreline below the cliffs. The Cromarty Firth was an important naval base during both World Wars and the military presence is visible around various parts of the coastal zone. The built heritage on the east shore of Cromarty village includes numerous fishermans cottages, arranged in streets locally known as 'vennels' and attesting to the importance of Cromarty as a fishing port.

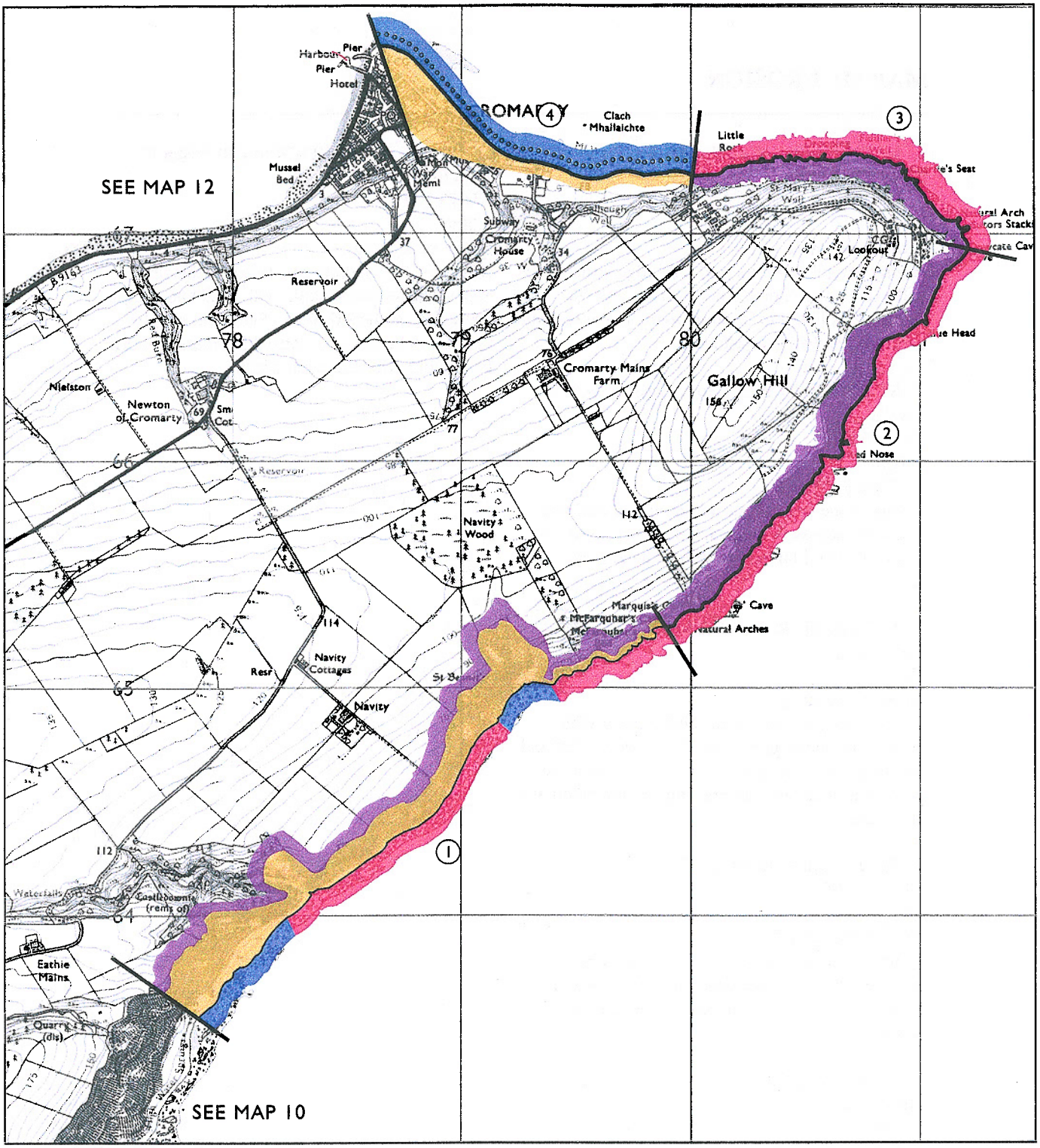
Map 11: Hinterland Geology and Coastal Geomorphology

1. North of ETHIE FISHING STATION to Mc FARQUHARS BED
NH720 647
1.7km
Exposed rock platform/sand and shingle
High cliff (50m)
Raised beach and marine deposits/glacial drift
Exposed coastline with rock platform and locally occurring boulder and shingle. The exposed cliff is steep with terrace formation. Glacial drift overlie relict raised beach deposits.

2. Mc FARQHAR'S BED to DOWGATE CAVE
NH 860 660
2.4 km
Sea stacks/sea caves/shelving rock platform
Cliff (50m)
Raised beach and marine deposits
Irregular coastal edge incised by exposure to easterly gales. Rock stacks arches and caves are present. Raised beach deposits extant at start of the unit giving way to high cliff composed of glacial deposits.

3. DOWGATE CAVE to east of LITTLE ROCK
NH 860 674
1.4km
Rock platform/boulder beds/shingle
High cliff (>75m)
Relict raised beach and marine deposits/glacial drift
Southern Sutors headland with deeply incised and irregular shoreline comprised of exposed rock platform and boulders. The cliff is steep and precipitous in parts comprised of glacial deposits.

4. East of LITTLE ROCK to CROMARTY HARBOUR.
NH 794 673
1.4km
Sand and shingle
Low edge (10m)
Raised beach and marine deposits
The Cromarty beach is ridged sand and shingle and no dunes are present. Sea defences protect Cromarty, which lies on a cuspate foreland overlooking the entrance to Cromarty Firth. Raised beach deposits falling below 10m OD dominate hinterland geomorphology.



MAP 11: EATHIE FISHING STATION TO CROMARTY 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 77-81/63-68

Basemap: O.S. *Pathfinder* Series
Sheets 134 & 144
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 10 September 1998

Hinterland:

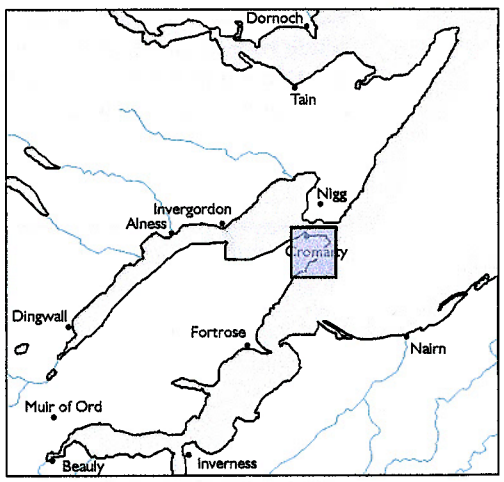
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 11: EROSION

1. EATHIE FISHING STATION to ST BENNET'S WELL
NH 787 644
2.6km
Eroding or stable
Highly irregular and incised cliff edge with gullies and exposed rock platforms. Attrition of the foreshore is likely to be slow owing to the resilient nature of the local sandstone.

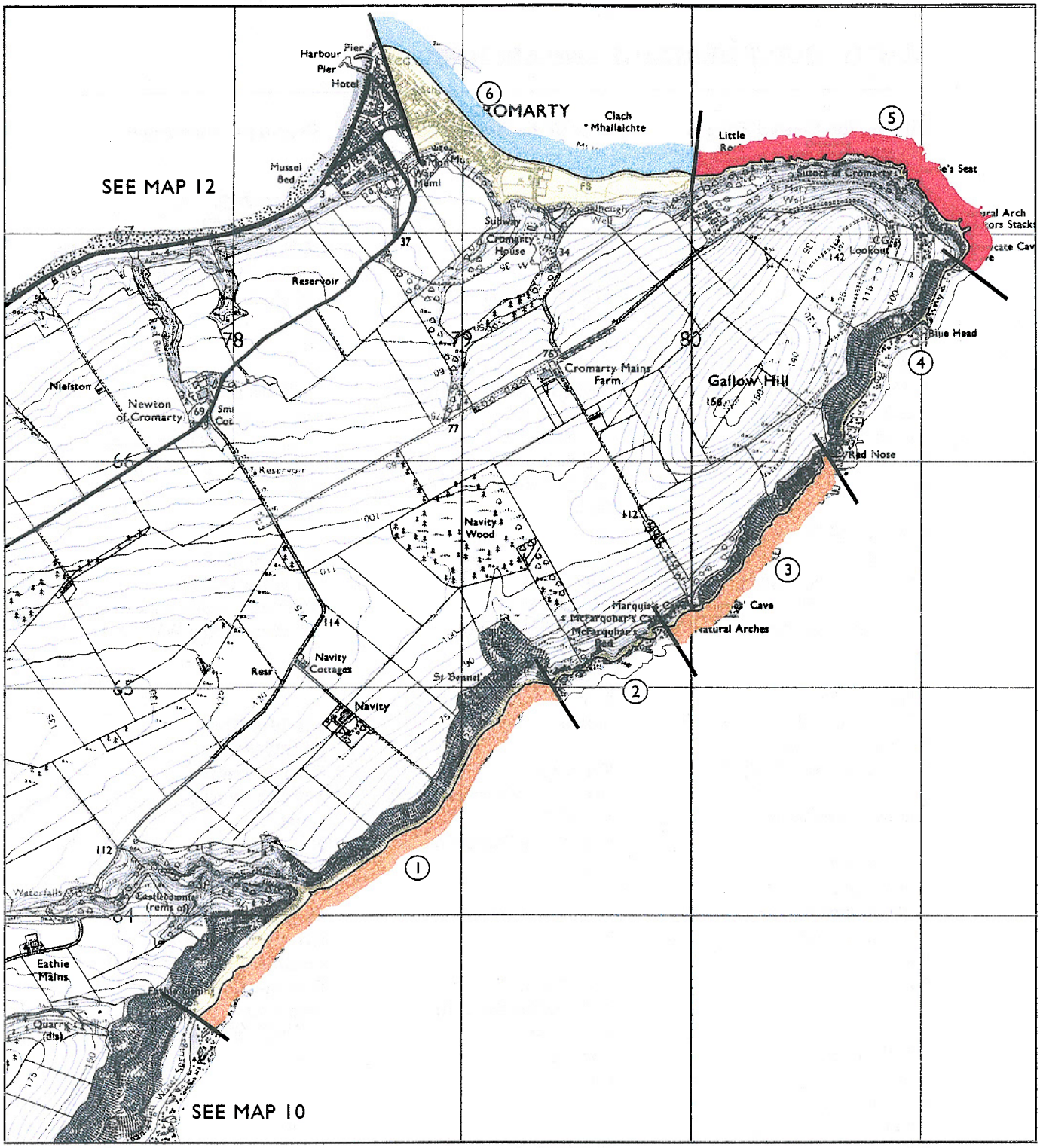
2. ST BENNETS WELL to McFARQUAR'S CAVE
NH 796 652
0.5km
NOT SURVEYED
Owing to the precipitous nature of this cliff and restricted access to the beach this unit could not be investigated on the grounds of health and safety.

3. McFARQUAR'S CAVE to RED NOSE
NH 804 657
1km
Stable or Eroding
Highly exposed precipitous cliff incised with gullies and rocky platforms. The base of cliff and outcropping platforms are prone to scouring by wave action and are undergoing erosion albeit at a slow rate.

4. RED NOSE to DOWGATE CAVE
NH 807 665
1km
NOT SURVEYED
Owing to the precipitous nature of this cliff and restricted access to the beach this unit could not be investigated on the grounds of health and safety.

5. DOWGATE CAVE to east of LITTLE ROCK
NH 808 674
1.5km
Definitely Eroding
Exposed headland of the South Sutor. Erosion is active with constant attrition of the cliff base by wave action that has led to the formation of sea caves and isolated sea stacks.

6. East of LITTLE ROCK to CROMARTY HARBOUR
NH 795 675
1.6km
Stable or eroding
Defended by concrete sea defences this unit appears to be fairly stable with sand and shingle banked up at the MHWM. Sediment supply appears to be ongoing caused by longshore drift from within the Cromarty Firth.



MAP 11: EATHIE FISHING STATION TO CROMARTY 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 77-81/63-68

Basemap: O.S. *Pathfinder* Series
Sheets 134 & 144
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EROSION CLASS

Assessment date: 10 September 1998

Key:

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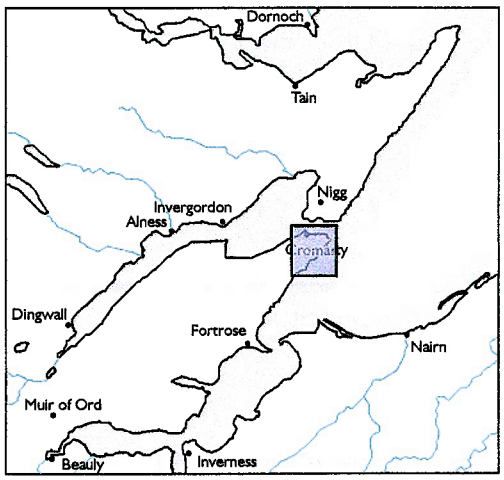
- No access
- Land below 10m



MAP 11: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 7785 6350
EATHIE
Sand slipways
Uncertain
Good
Nil

NH 7915 6497
NAVITY
Trackway
Uncertain
Fair
Nil

NH 7928 6497
NAVITY
Boat house and slipway
19th/20th century AD
Poor/ fair (respectively)
Nil

NH 8094 6734
SOUTH SUTOR
Military pillboxes
20th century AD; WWI&II
Fair
Survey and monitor

NH 7863 6772
CROMARTY
Rails for boat launch slipway
20th century AD
Fair
Nil

NH 7867 6783
CROMARTY
Concrete slipway
20th century AD
Good
Nil

Sites in the Hinterland

NH76NE 43
NH 7864 6775
CROMARTY
Girnal
17th/18th century AD
Poor
Nil

NH76NE 38.00 - Listed A
NH 7867 6773
CROMARTY
Lighthouse
19th-20th century AD
Good
Nil

NH76SE 4
NH 7788 6400
CASTLEDOWNIE
Promontory fort
Uncertain
Poor
Monitor

NH76NE 1
NH 7913 6508 & 7923 6502
NAVITY
St Bennet's Chapel (site of) and well
16th/17th century AD
Fair
Nil

NH 7995 6535
McFARQUHAR'S BED
Boathouse
Uncertain
Fair
Nil

NH86NW 11
NH 8103 6695
SOUTH SUTOR
Military coastal battery; bunkers
20th century AD; WWI&II
Fair
Survey and monitor

Sites in the Hinterland

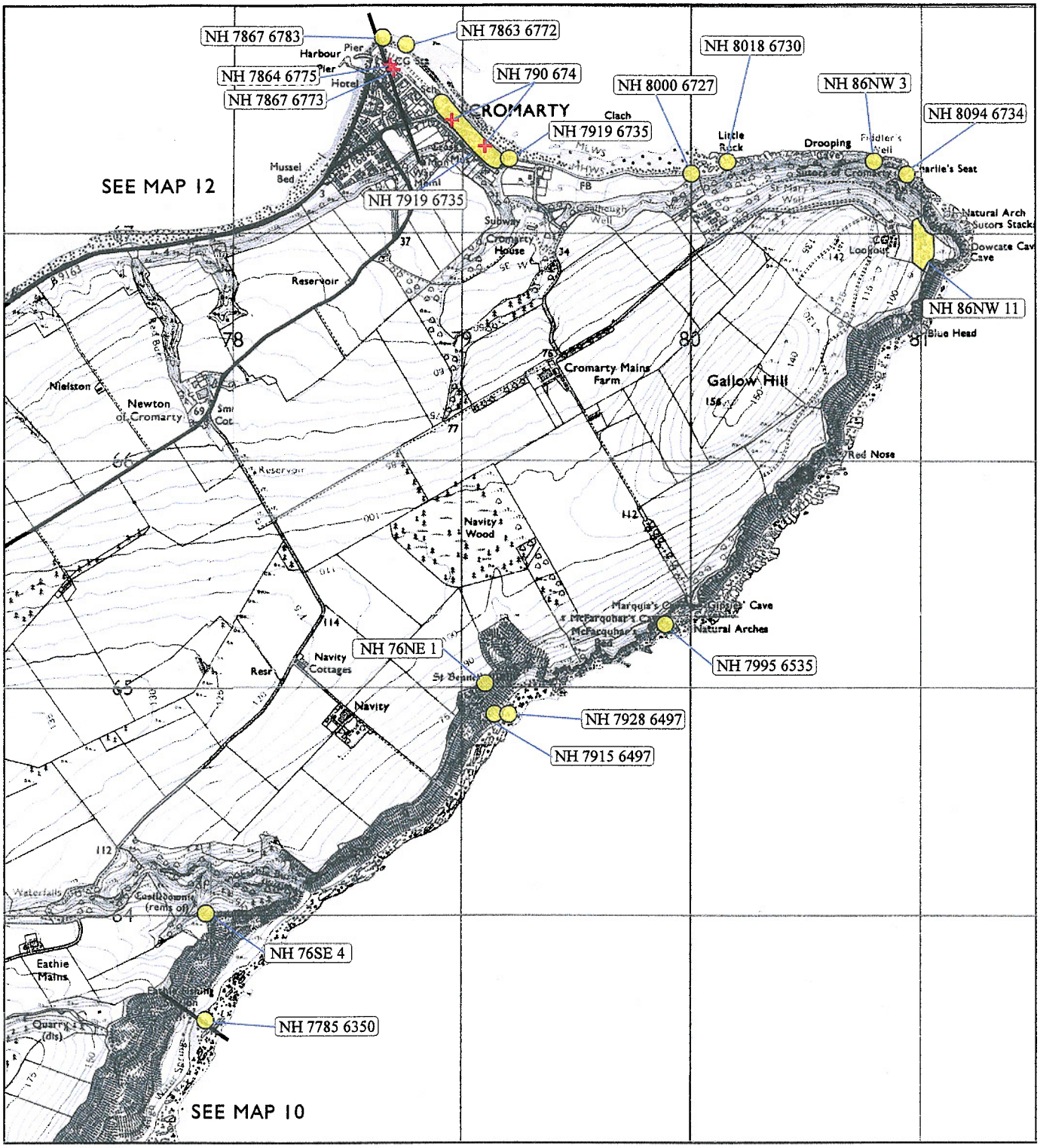
NH86NW 3
NH 8075 6733
SUTORS OF CROMARTY
Fiddler's Well; healing well
Uncertain
Good
Nil

NH 8018 6730
LITTLE ROCK
Target butt and target frame
20th century AD; WW I & II
Fair
Monitor

NH 8000 6727
LITTLE ROCK
Footbridge made of metal target
20th century AD; WW I & II
Fair
Nil

NH 7919 6735
CROMARTY
Canalised stream
19th century AD
Good
Nil

NH76NE 20-4, 31-3, 35-6, 39, 48, 58 - Various Listed B
NH 790 674 area
CROMARTY (East shore)
Residential & industrial properties
17th/18th/19th century AD
Good
Nil



MAP 11: EATHIE FISHING STATION TO CROMARTY 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 77-81/63-68

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BUILT HERITAGE AND ARCHAEOLOGY

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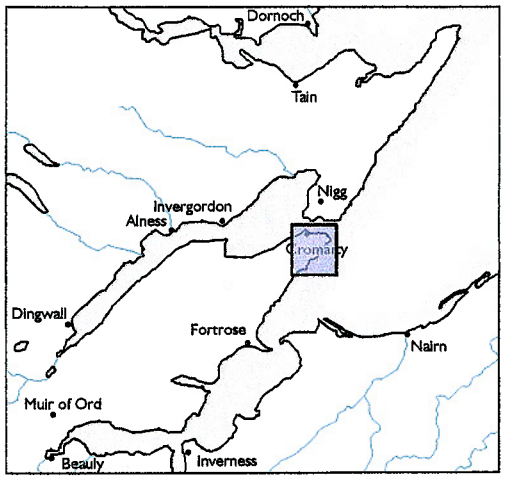


Map 12: CROMARTY TO SHORE MILL

Hinterland Geology and Coastal Geomorphology: The underlying basement geology in this sector of coastline is undifferentiated thin bedded Lower Red Sandstone. The drift deposits consist of boulder clay which has been sculpted at the coast by post-glacial marine terraces. The raised beaches continue west along the shore of the Cromarty Firth. The wide foreshore is dominated by shingle and mud which are exposed as mudflats down to the LWM.

Erosion class: This section is sheltered by the promontories of the Sutors. The low coastal edge has easily eroded sands and gravel which are prone to erosion by wave action. At Cromarty a promenade defends the town. Parts of the coastline beyond Cromarty shows evidence of accretion and stability. Local erosion has been observed as effecting saltmarsh at the backshore. The mud flats toward the LWM are accreting.

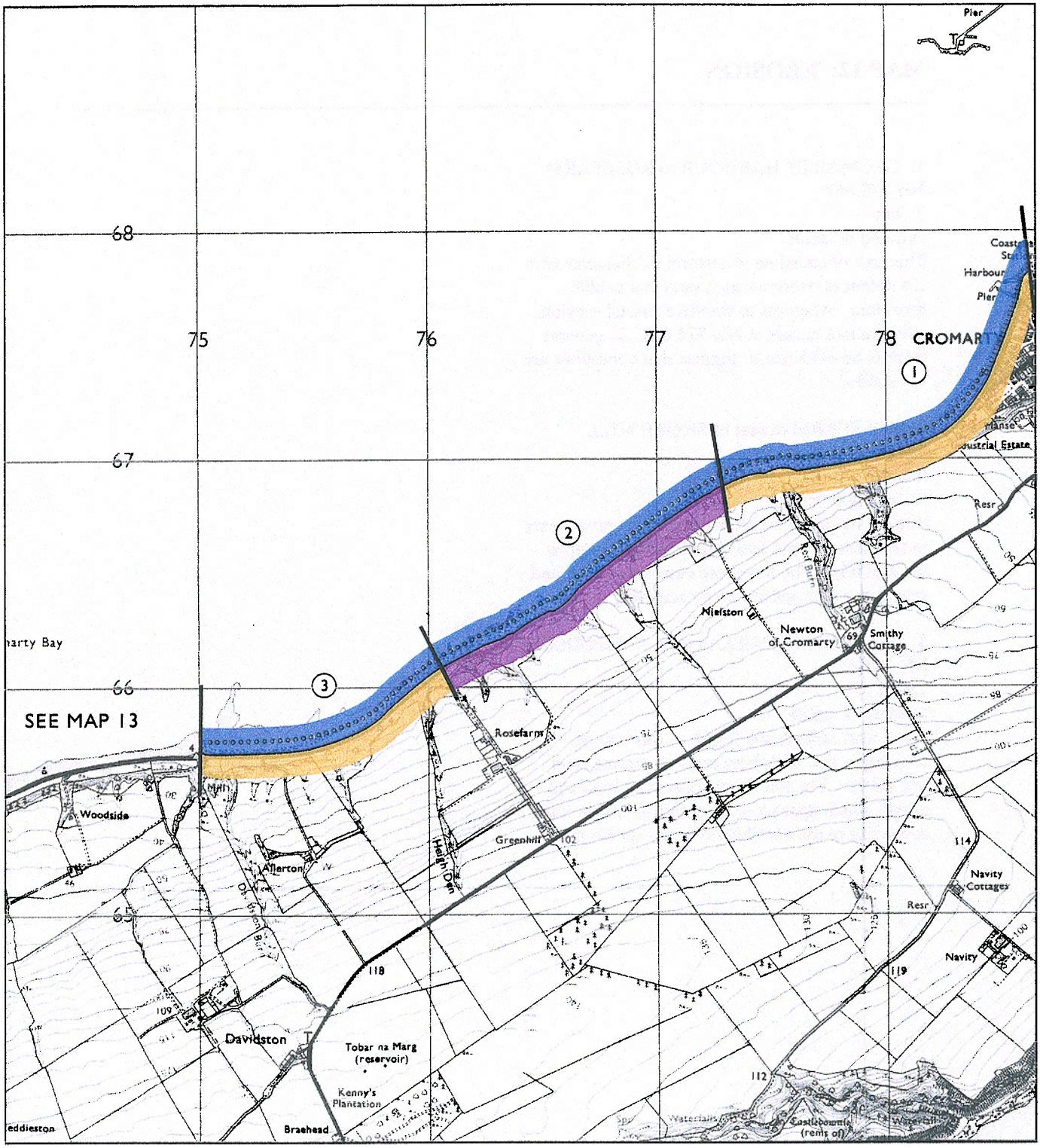
Built Heritage and Archaeology: The foreshore archaeology in the eastern part of this area consists of the recent sites around Cromarty such as slipways and the extensive harbour. In the middle and western sections the forshore archaeology is dominated by fish trap remains; both wooden and stone examples. The hinterland sites consist of the built heritage in Cromarty village of the lighthouse, a girnal, and the large hemp works. Finally, at the western extreme of this area are the remains of a large quarry, used to supply the stone for Cromarty harbour.

Map 12: Hinterland Geology and Coastal Geomorphology

1. CROMARTY HARBOUR to north of NIELSTON
NH 780 670
1.6km
Shingle
Low edge (10m)
Raised beach and marine deposits
Western side of the triangular foreland with a foreshore consisting of banked shingle. The backshore geomorphology consists of raised beach deposits.

2. North of NIELSTON to north of ROSEFARM
NH 766 664
1.3 km
Sand and shingle
Cliff (c.25m)
Raised beach and marine deposits
The foreshore consists of sand and gravel. The hinterland consists of glacial drift over exposed rock.

3. North of ROSEFARM to east of WOODSIDE
NH 750 657
2.4km
Shingle and sand
Low edge in parts (<10m)
Raised beach and marine deposits
Relict Postglacial shoreline on south side of Cromarty Bay. Foreshore dominated by shingle. Hinterland consists of marine sand and gravel.



MAP 12: CROMARTY TO SHORE MILL

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 75-78/64-69

Basemap: O.S. *Pathfinder* Series
Sheet 144
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 10 September 1998

Hinterland:

- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
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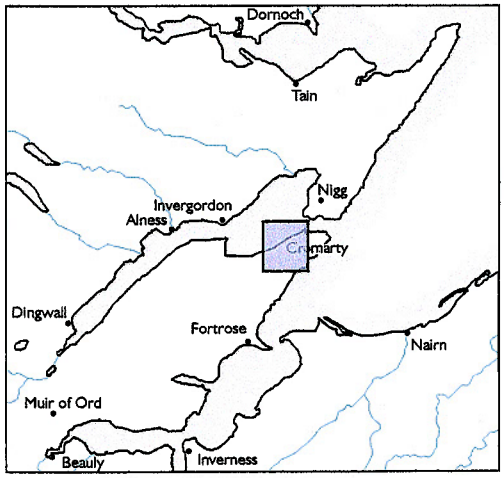
- Marsh

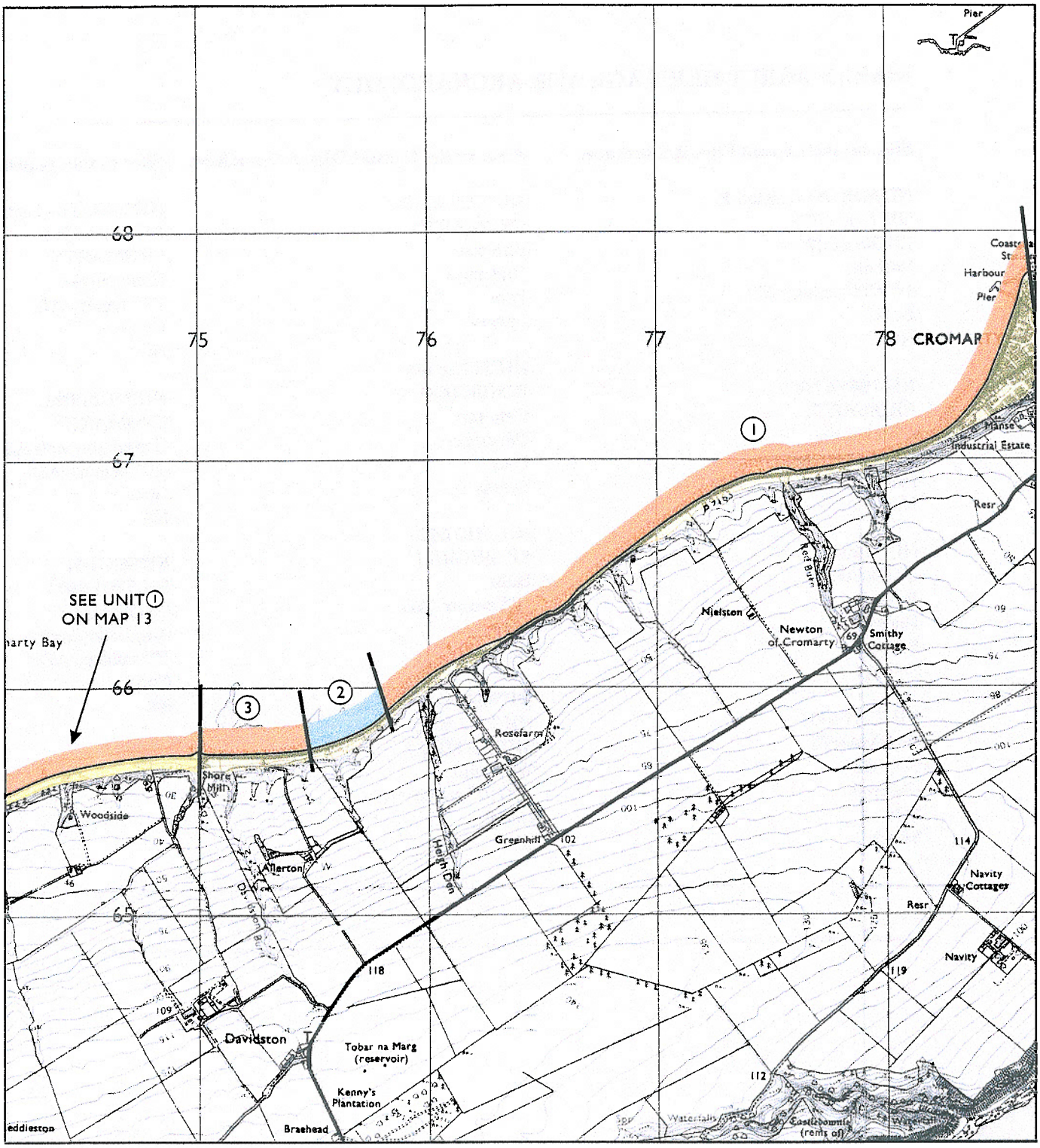


MAP 12: EROSION

1. CROMARTY HARBOUR to ROSEFARM
NH 770 667
3.7km
Eroding or stable
This unit of coastline is uniform in character with sea defences overlooking a sand and pebble foreshore. Attempts to stabilise coastal erosion using rubble occurs at NH 773 669. In general there is no evidence to suggest that conditions are not stable.

2. ROSEFARM to east of SHORE MILL
NH 756 658
0.4km
Accreting or stable
Backed by raised beach deposits this unit appears to be stable as sand and shingle is banked up at the MHWM. The foreshore consists of sand and gravel and also appears to be accreting in parts.

3. East of SHORE MILL to west of WOODSIDE
NH 745 657
1.9km
Eroding or stable
A sea wall defends the length of this unit of coastline. The backshore rests on marine sand and gravel. The foreshore consists of mud and gravel which appears to be accreting and eroding according to the distribution of the sediment.



MAP 12: CROMARTY TO SHORE MILL

MORAY FIRTH SURVEY Grid ref: NH 75-78/64-69

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 144
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EROSION CLASS

Assessment date: 10 September 1998

Key:

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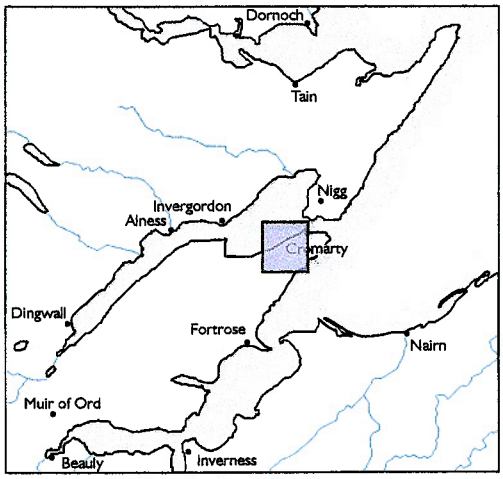


MAP 12: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH76NE 49 - Listed B
NH 7858 6775
CROMARTY
Harbour
19th/20th century AD
Good
Nil

NH 7844 6738
CROMARTY
Mooring ring
20th century AD
Fair
Nil

NH 7769 6720
CROMARTY
Fish trap
Uncertain
Poor
Survey

NH 7735 6731
CROMARTY
Fish trap
Uncertain
Poor
Survey

Sites on the Coastal Edge & Foreshore

NH 7723 6730
CROMARTY
Fish trap
Uncertain
Poor
Survey

NH 7577 6595
ROSEFARM
Fish trap
Uncertain
Poor
Survey

NH 7510 6572
SHORE MILL
Hulk
20th century AD
Poor
Nil

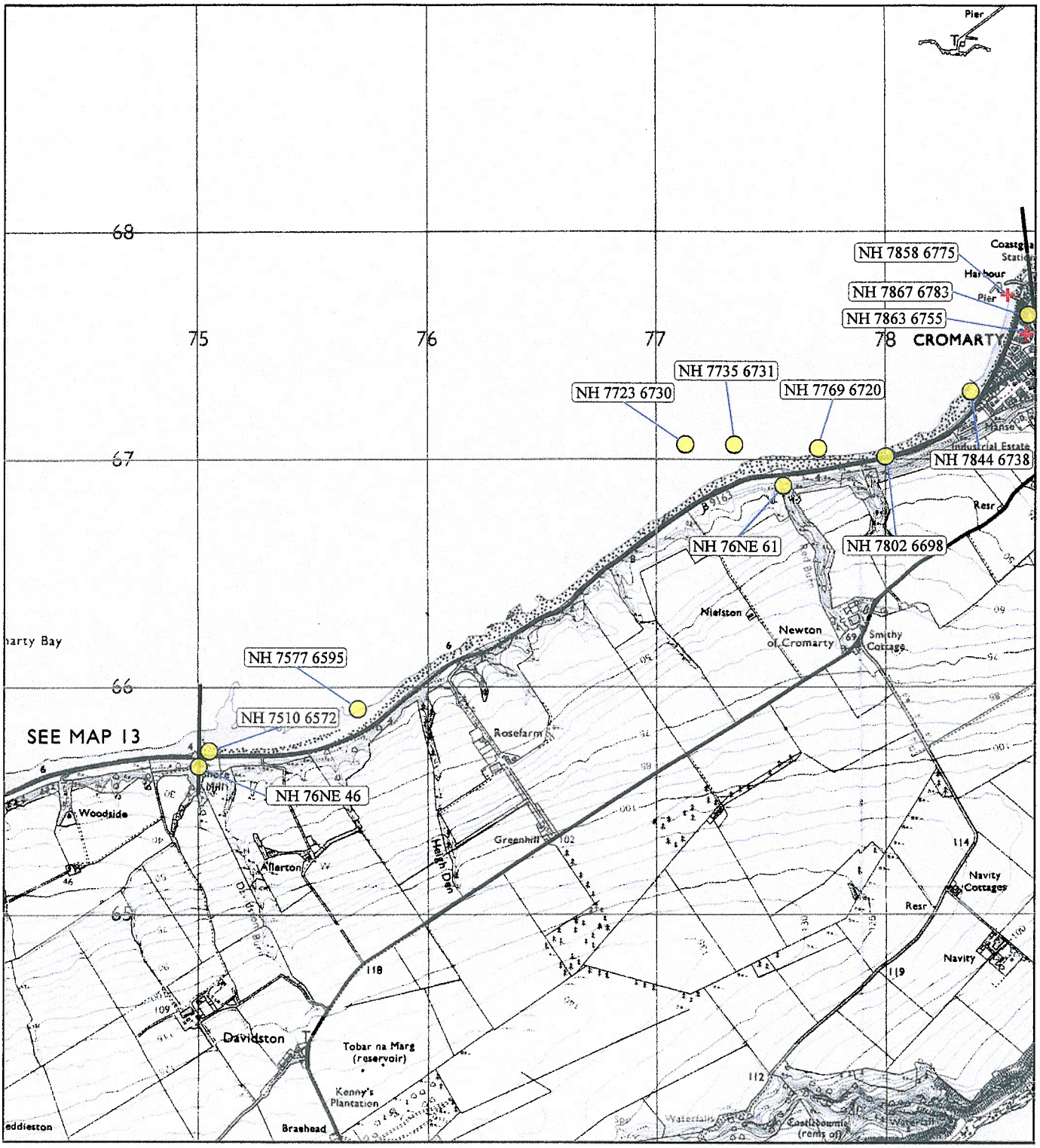
NH76NE 46
NH 7502 6565
SHORE MILL
Watermill
18th/19th century AD
Good
Nil

Sites in the Hinterland

NH76NE 51 - Listed B
NH 7863 6755
CROMARTY
Hemp works
19th century AD
Good
Nil

NH 7802 6698
CROMARTY
Coronation well (1911)
20th century AD
Good
Nil

NH76NE 61
NH 7750 6694
CROMARTY
Admiralty quarry
19th century AD
Good
Nil



MAP 12: CROMARTY TO SHORE MILL

MORAY FIRTH SURVEY Grid ref: NH 75-78/64-69

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 144

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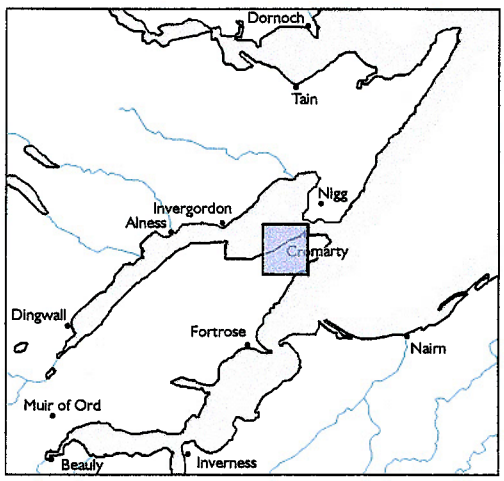
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 13: SHOREMILL TO UDALE BAY

Hinterland Geology and Coastal Geomorphology: Undifferentiated thin bedded sandstone continue to dominate the basement geology. Boulder clay is the main cover lithology. The coastline is mantled by raised beach sand and gravel of post-glacial age. At Udale bay raised beach cliffs of post-glacial age are well represented. Further inland from the bay the *Alt Dubhact* floodplain provides freshwater alluvium. The hinterland is low lying at below 10m OD.

Erosion class: This section of estuarine coastline is sheltered with an accreting foreshore. Within Udale Bay sediment development is stabilising the saltmarsh on the backshore. At Jemmimaville (NH 719 653) sea defences are eroding at their base as a result of wave hammer.

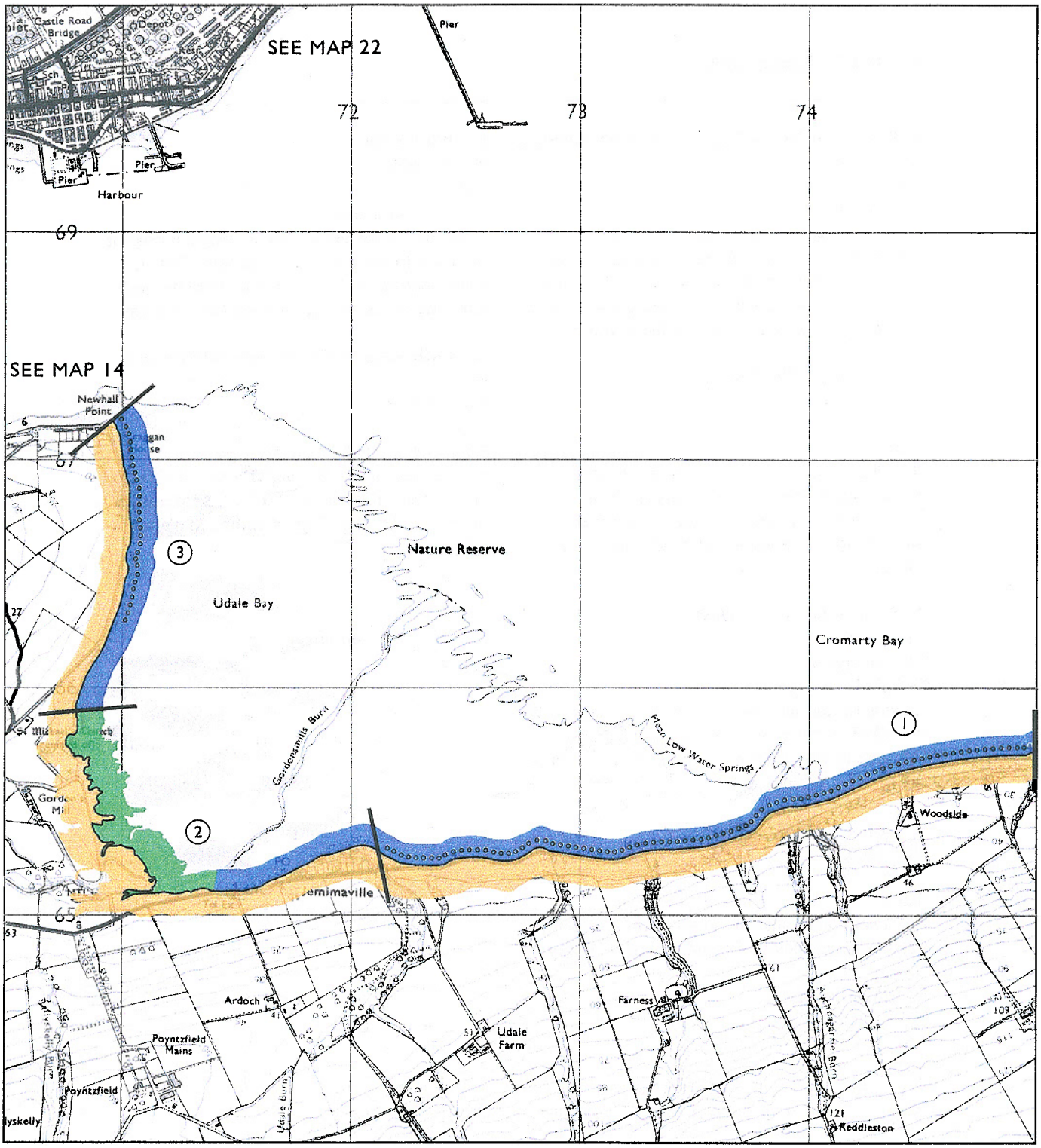
Built Heritage and Archaeology: The built heritage in this area include an 18th century water mill at Shore Mill, with the water wheel still present. The other site is the village of Jemimaville; an 18th century village with various residential, commercial and religious buildings. The foreshore archaeology includes two fish trap sites and the Resolis free church in Jemimaville which is currently being undercut by coastal erosion. At the northern part of this area at Newhall Point are the remains of a Pre-Reformation chapel and burial ground and on the foreshore a stake net mound, the remnants of a large fish trap.

Map 13: Hinterland Geology and Coastal Geomorphology

1. West of WOODSIDE to JEMIMAVILLE
NH 730 652
1.8km
Shingle/mud and sand
Low edge (<10m)
Raised beach and marine deposits
Low linear coastal edge with a foreshore consisting of shingle. The hinterland consists of a relict shoreline containing a backshore of marine sand and gravel.

2. JEMIMAVILLE to St MICHAEL'S CHURCH
NH 710 668
1.3 km
Saltmarsh tidal flats with mud and shingle beds
Low edge (<10m)
Raised beach and marine deposits
This unit lies at the head of Udale Bay formed behind the headland at Newhall point. The foreshore is flanked by saltmarsh incised by a river channel. The backshore consists of relict raised beach behind which the land is low lying at below 10m OD.

3. St MICHAEL'S CHURCH to NEWHALL POINT
NH 710 668
1.3km
Mud/sand/shingle
Low Cliff (<10m)
Raised beach and marine deposits
Eastern side of Newhall Point. The foreshore is dominated by sand and shingle overlooking tidal flats. The hinterland consists of marine deposits and relict raised shoreline.



MAP 13: SHORE MILL TO UDALE BAY

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 71-75/64-69

Basemap: O.S. *Pathfinder* Series Sheet 144
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 10 September 1998

Hinterland:

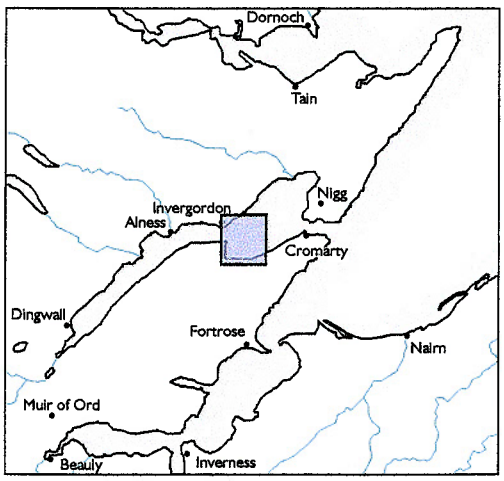
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 13: EROSION

1. East of SHORE MILL to west of WOODSIDE
NH 745 657
1.9km
Eroding or stable
A sea wall defends the length of this unit of coastline. The backshore rests on marine sand and gravel. The foreshore consists of mud and gravel which appears to be accreting and eroding according to the distribution of the sediment.

2. North east of FARNESS
NH 735 653
1km
Accreting or stable
A cobble beach overlooks accreting mud flats. Raised beach deposits at the backshore are stabilised by saltmarsh. At the present there are no indicators to suggest that conditions are not stable.

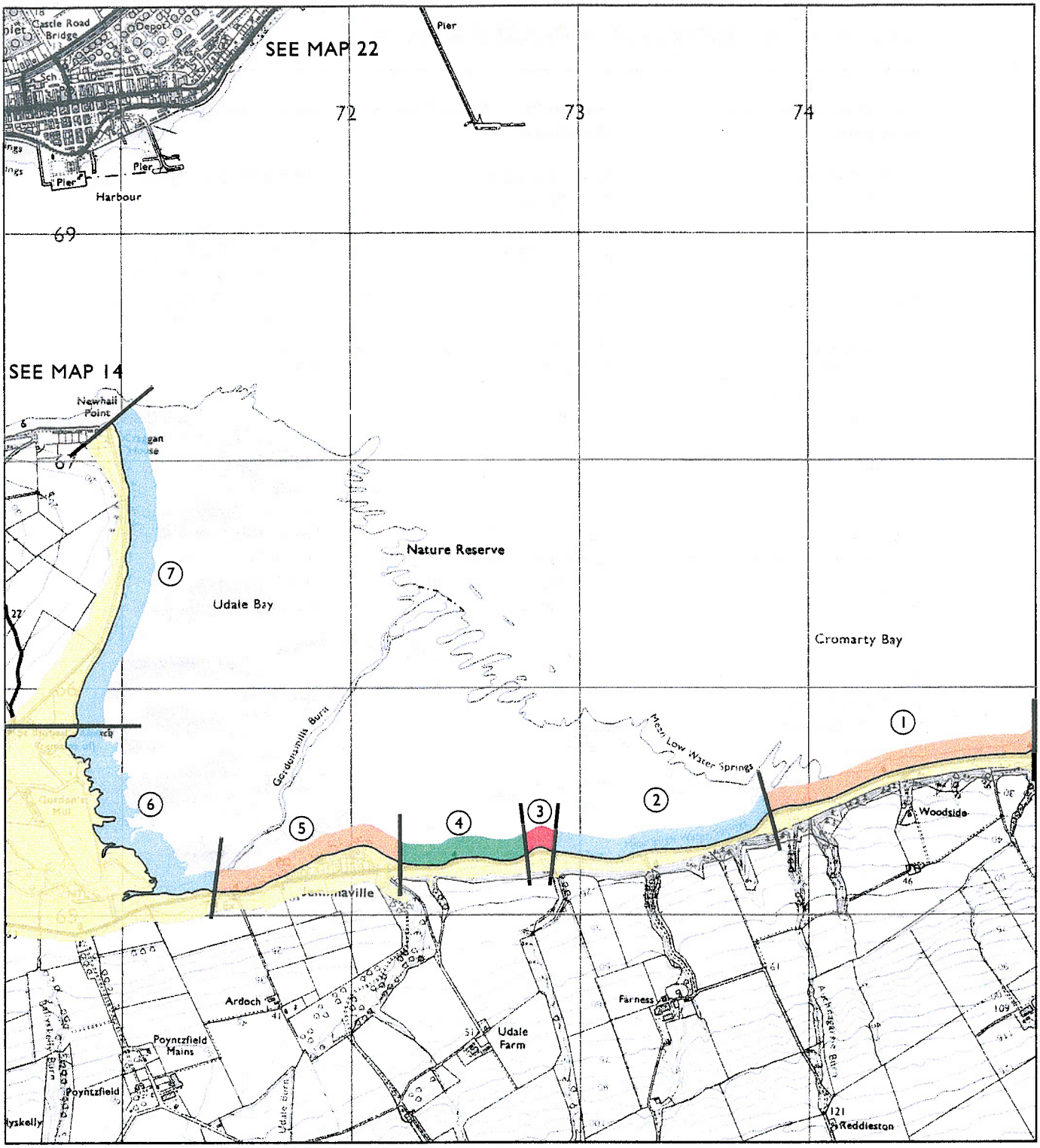
3. North of UDALE FARM
NH 728 653
12-15m approx.
Definitely eroding
Erosion of marine sand and gravel is occurring at the MHWM due to the loss of saltmarsh. Offshore mud and shingle is present and appears stable.

4. East of JEMIMAVILLE
NH 725 653
0.5km
Stable
A sea wall lends stability to this unit of coastline. Offshore mud flats show evidence of accretion.

5. JEMIMAVILLE
NH 719 653
0.6km
Stable or eroding
Sea defences are being eroded at the base by shingle scour. Offshore mud flats are accreting.

6. UDALE BAY
NH 710 653
1.2km
Accreting or stable
Udale bay is sheltered with an irregular coastal edge due to saltmarsh development. This is consolidating the MHWM. Offshore the wide tidal flats are accreting with mud and shingle.

7. St MICHAELS CHURCH to NEWHALL POINT
NH 710 666
1.4km
Accreting or stable
Sea defences guard Newhall Point. Cobble and sand is banked up at the HWM. The foreshore is accreting with mud flats extending to about 1.5km.



MAP 13: SHORE MILL TO UDALE BAY

MORAY FIRTH SURVEY Grid ref: NH 71-75/64-69

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 144

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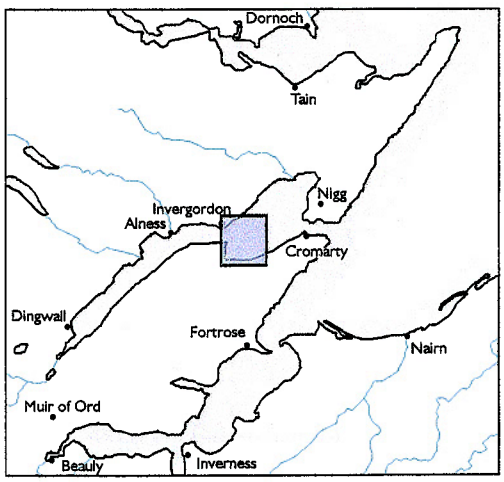
EROSION CLASS

Assessment date: 10 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 13: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 7418 6590
WOODSIDE
Fish trap
Uncertain
Poor
Survey

NH 7186 6523
JEMIMAVILLE
Resolis Free church
19th century AD
Poor
Monitor

NH 7204 6530
JEMIMAVILLE
Partially upstanding building
Uncertain
Poor
Nil

NH 7218 6576
JEMIMAVILLE
Complex fish trap
Uncertain
Poor
Survey

NH 7157 6512
UDALE BAY
Slipway
20th century AD
Poor
Nil

NH 7185 6640
UDALE BAY
Fish trap
Uncertain
Poor
Survey

Sites on the Coastal Edge & Foreshore

NH 7084 6603
KIRKTON
Metal boat boiler
20th century AD
Fair
Nil

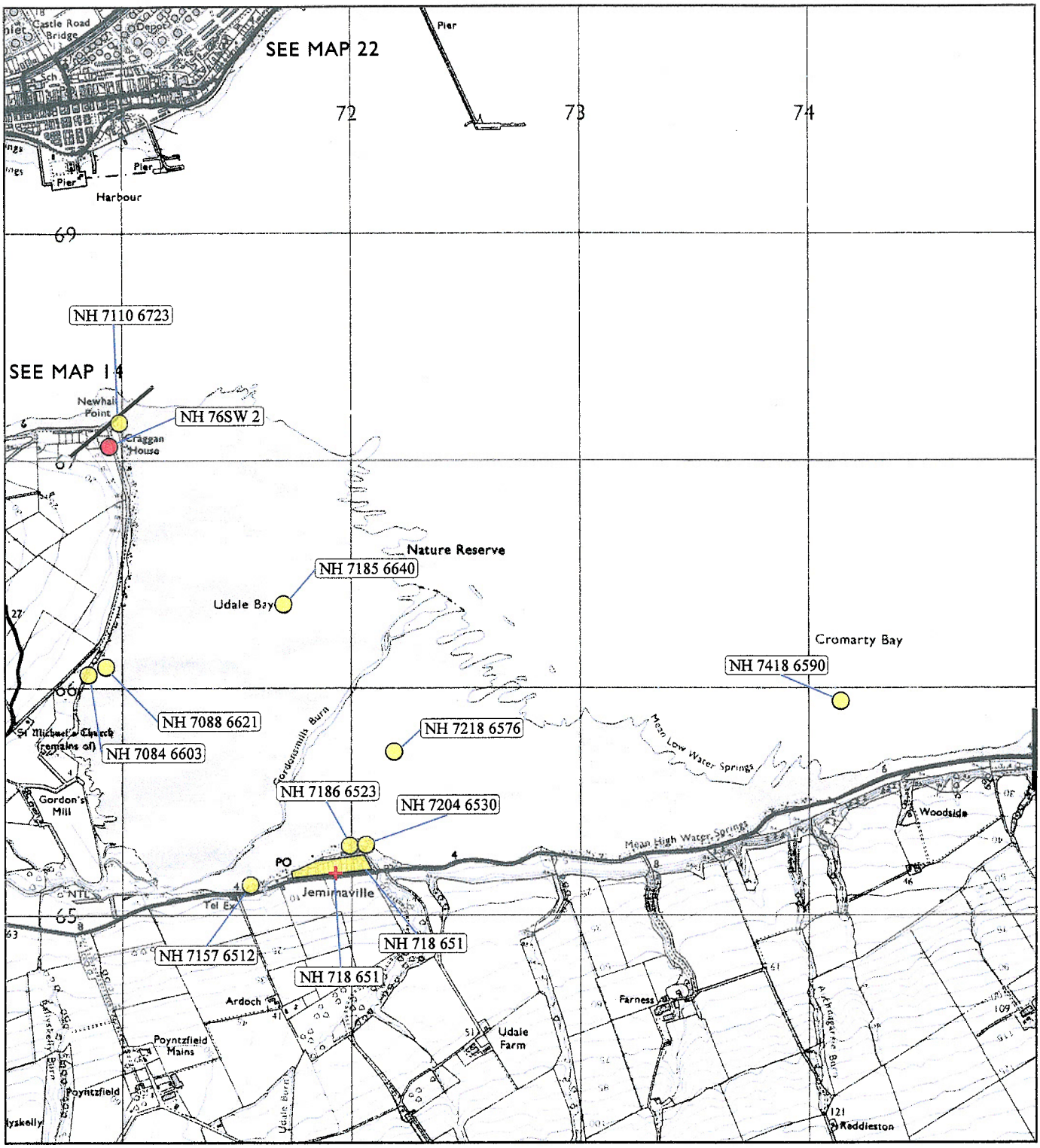
NH 7088 6621
KIRKTON
Hulk
Uncertain
Poor
Monitor

NH 7110 6723
NEWHALL POINT
Fish trap stake net mound
Uncertain
Poor
Survey

Sites in the Hinterland

NH76NW 4, 6, 72-95 - Various Listed C
NH 718 651 area
JEMIMAVILLE
Residential, religious & commercial buildings; lamp post
18th/19th century AD
Good
Nil

NH76NW 2 - Scheduled
NH 7088 6707
NEWHALL POINT, BALBLAIR
Pre-Reformation chapel and burial ground
10th-11th century AD
Poor
Monitor



MAP 13: SHORE MILL TO UDALE BAY

MORAY FIRTH SURVEY Grid ref: NH 71-75/64-69

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 144

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BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
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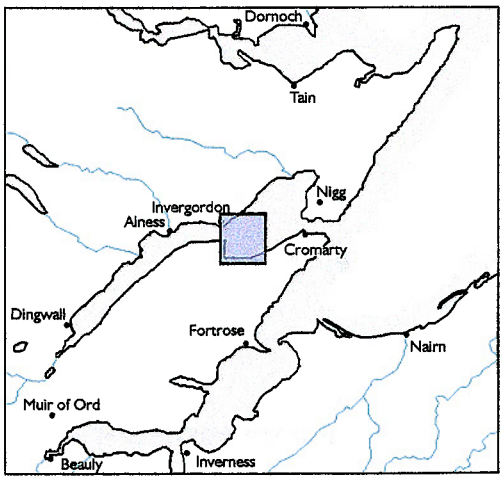


Map 14: NEWHALL POINT TO ALNESS FERRY

Hinterland Geology and Coastal Geomorphology: Middle and Old Red Sandstone continues to form the basement geology. This is overlain by boulder clay and morainic drift deposits. Well defined Post-glacial raised beach platform extends westwards along the coast. The foreshore is a mixture of shingle, boulders and sand. Extensive mudflats are exposed down to the LWM.

Erosion class: Sea defences protect Newhall Point where cobble and sand is banked up at the HWM. Here conditions were seen to be stable. North west of Inch, rubble armouring down to the foreshore margin is eroding. Unvegetated soft marine deposits are prone to erosion by deflation and overtopping at the backshore. Rabbit erosion within the cliff is occurring at NH 728 653.

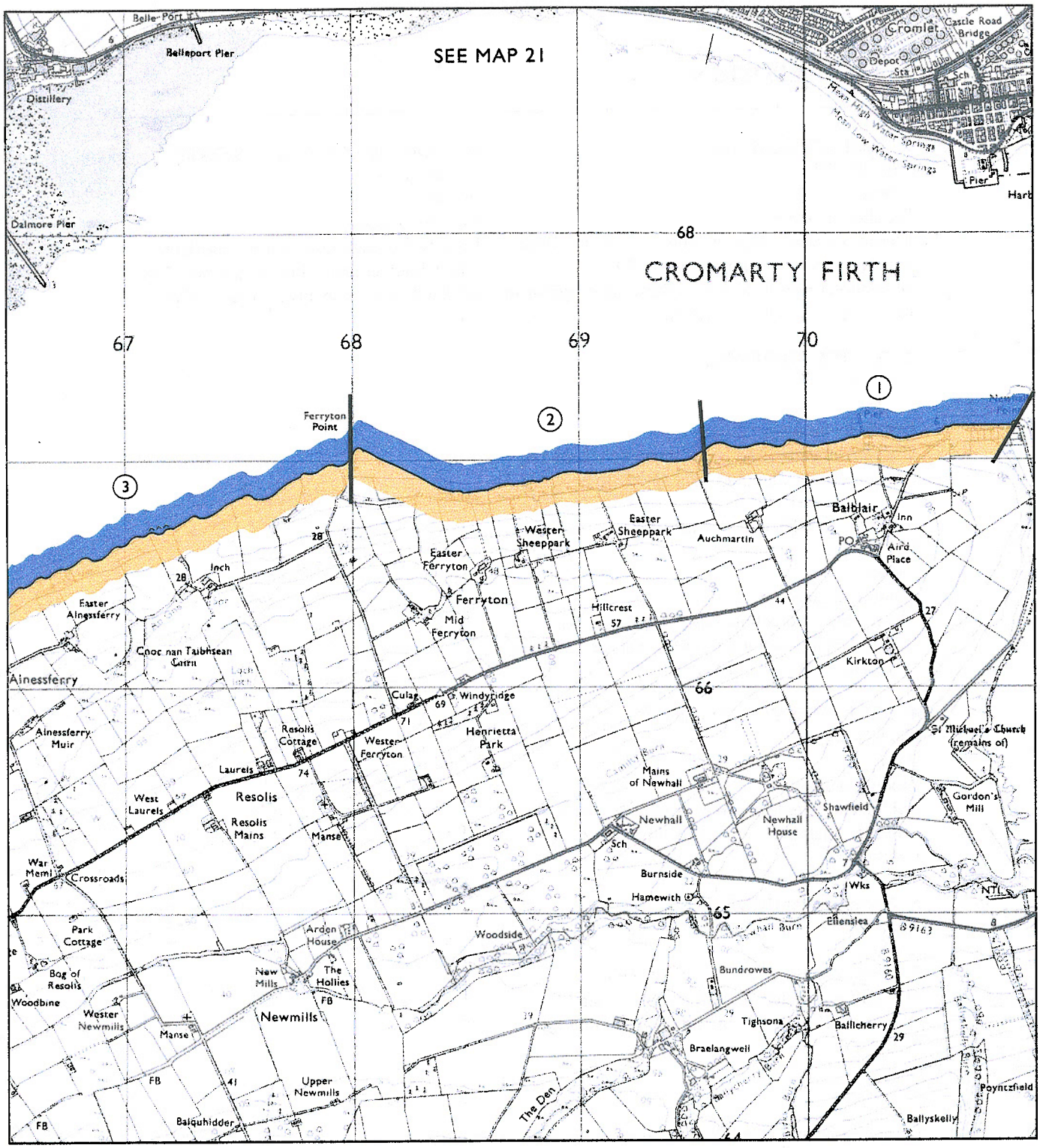
Built Heritage and Archaeology: At Balblair the built heritage consists of a boatyard and Inverbreakie pier, both in current use. The second group of foreshore and hinterland sites is concentrated around Ferryton Point and includes a modern wooden jetty and the stone remains of a fish trap. The girnal at Ferryton point and associated trackway suggest that this was once an active fishing station and the girnal is currently a well maintained house.

Map 14: Hinterland Geology and Coastal Geomorphology

1. NEWHALL POINT to north of AUCHMARTIN
NH 705 671
1.4km
Sand and shingle
Low edge (<5m)
Raised beach and marine deposits
Linear stretch of coastline forming the southern shore of the inner channel of the Cromarty Firth. The shoreline comprises sand and shingle backed by raised beach deposits.

2. North of AUCHMARTIN to FERRYTON POINT
NH 685 669
1.5km
Sand and shingle
Low edge (<5m)
Raised beach and marine deposits
Raised beach backs onto a sand and shingle foreshore. Wave cut platform is present at the backshore.

3. FERRYTON POINT to WESTER ALNESSFERRY
NH 670 667
2.6km
Sand and shingle
Low edge(<5m)
Raised beach and marine deposits
Linear stretch of coastline with raised beach deposits overlooking sand and shingle foreshore.



MAP 14: NEWHALL POINT TO ALNESS FERRY 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 67-71/64-69

Basemap: O.S. *Pathfinder* Series
Sheet 144
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 11 September 1998

Hinterland:

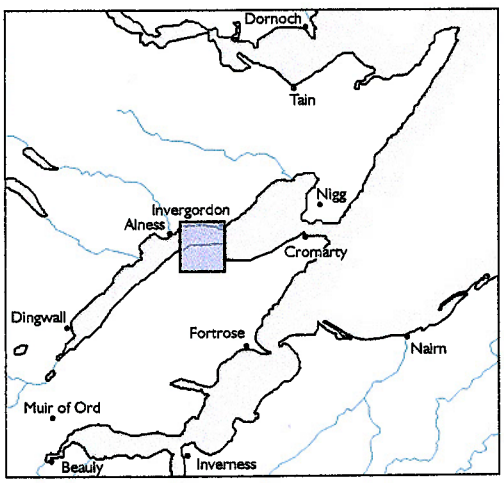
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 14: EROSION

1. North of BALBLAIR
NH 270 671
1.5km
Eroding or stable
Raised sea beach deposits outcrop onto the shore but are generally well vegetated. Where vegetation cover is poor then these areas appear to be susceptible to local erosion.

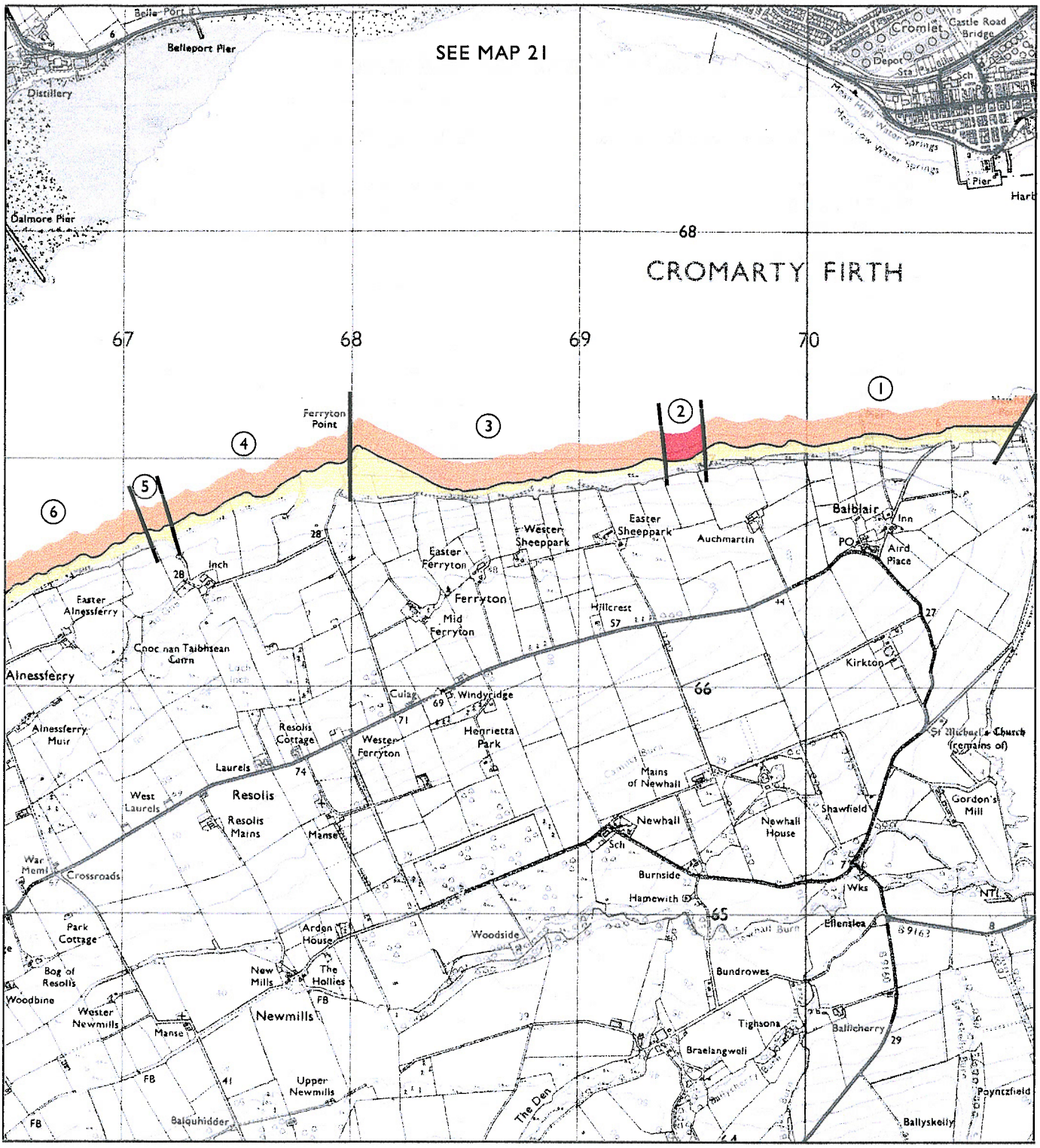
2. EASTER SHEEPARK
NH 695 671
c. 12m
Definitely eroding
Unconsolidated raised beach deposits affected by rabbit erosion. The mud flats appear to be stable.

3. North of WESTER SHEEPPARK
NH 685 669
1.4km
Eroding or stable
The boulder and pebble beach appears to be stable. Isolated patches of erosion at the cliff base as a result of the lack of vegetation.

4. FERRYTON POINT to INCH
NH 676 669
0.8km
Eroding or stable
Cobble and pebble beach backed by raised beach deposits. Stability is maintained here by vegetation.

5. North west of INCH
NH 672 667
c. 10m
Eroding or stable
This unit is effected at the foreshore by rubble dumping. The shingle and mud foreshore appears to be stable

6. North of EASTER ALNESFERRY
NH 667 666
0.8km
Eroding or stable
Locally eroding raised beach deposits backing onto a boulder and cobble beach that shows no evidence of erosion down to the LWM.



MAP 14: NEWHALL POINT TO ALNESS FERRY 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 67-71/64-69

Basemap: O.S. *Pathfinder* Series
Sheet 144
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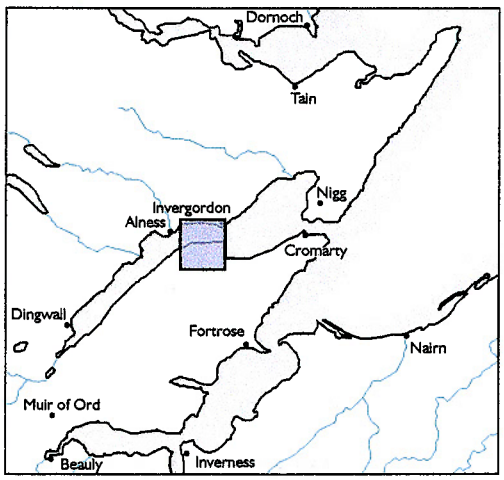
EROSION CLASS

Assessment date: 11 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 14: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH76NW 19
NH 7026 6709
BALBLAIR
Inverbreakie Pier
19th century AD; built 1817
Good
Nil

NH76NW 18
NH 7024 6715
BALBLAIR,
Boatyard and associated buildings
19th/20th century AD
Good
Nil

NH 6875 6689
WESTER SHEEPPARK
Metal boat trailer
20th century AD
Poor
Nil

NH 6799 6702
FERRYTON POINT
Wooden Jetty
20th century AD
Poor
Nil

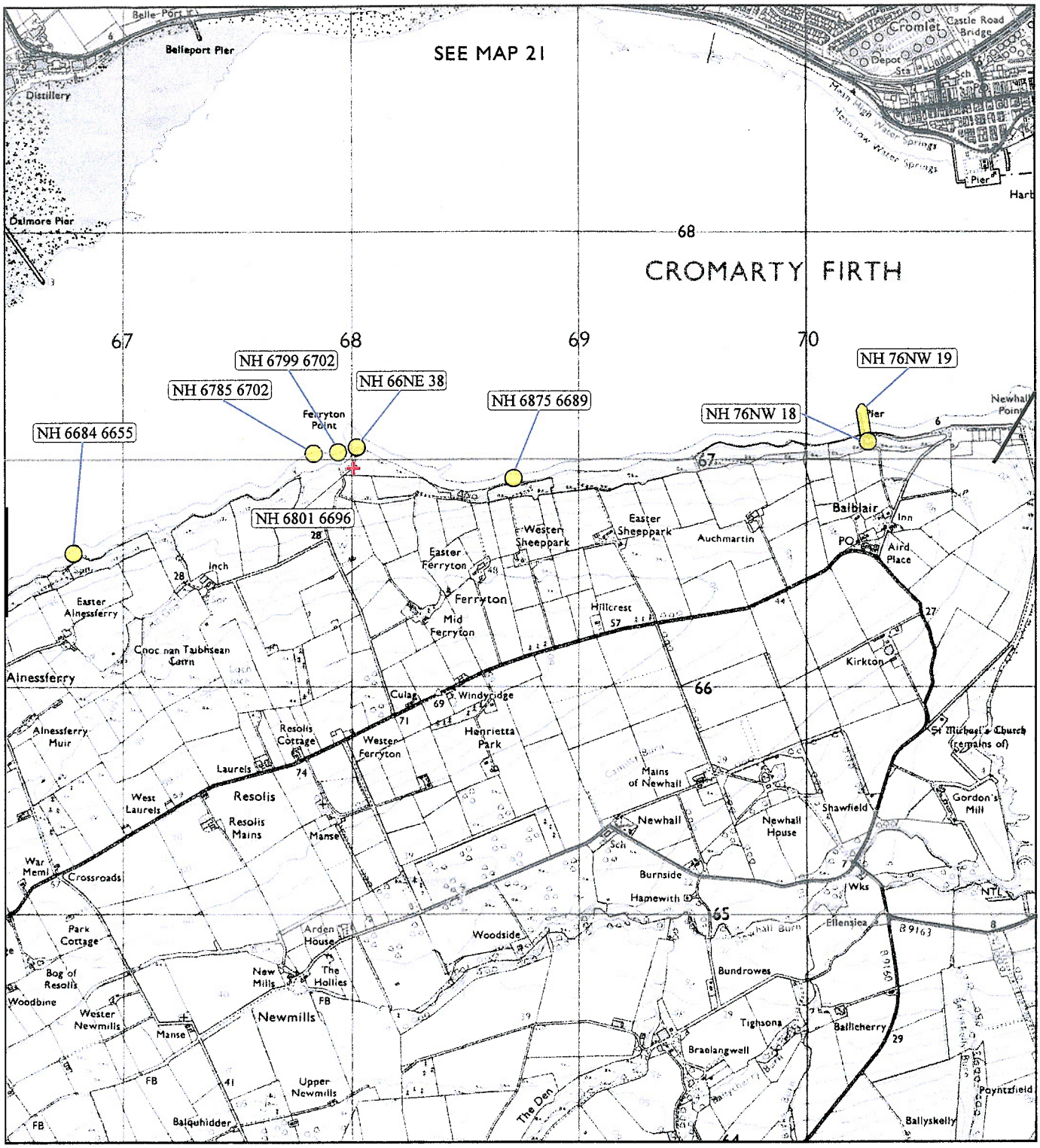
NH 6785 6702
FERRYTON POINT
Fish trap
Uncertain
Poor
Survey

NH 6684 6655
WESTER ALNESSFERRY
Stone pier and slipway
Uncertain
Poor
Monitor

Sites in the Hinterland

NH66NE 39 - Listed C
NH 6801 6696
FERRYTON POINT
Girnal
17th/18th century AD
Good
Nil

NH66NE 38
NH 6803 6706
FERRYTON POINT
Trackway
Uncertain
Fair
Nil



MAP 14: NEWHALL POINT TO ALNESS FERRY 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 67-71/64-69

Basemap: O.S. *Pathfinder* Series Sheet 144
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BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
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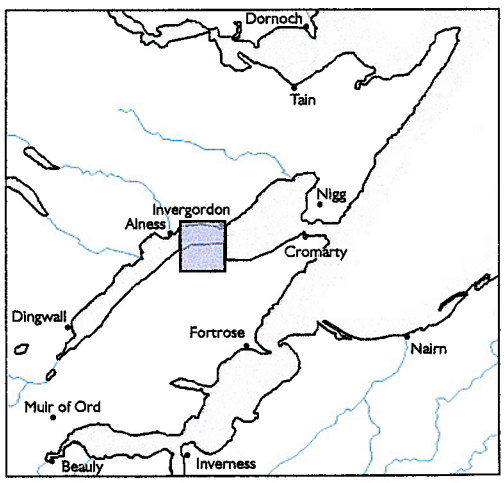


Map 15: ALNESS FERRY TO EASTER TOBERCHURN

Hinterland Geology and Coastal Geomorphology: The basement geology within this unit of coastline is Middle Old Red Sandstone overlain by boulder clay and morainic drift. At the shoreline a narrow coastal plateau is backed by a raised sea platform. This is fronted by another wave cut platform closed to the shore and is attributed to the Post-glacial shoreline. These features overlook a linear coastal edge with intertidal mud flats.

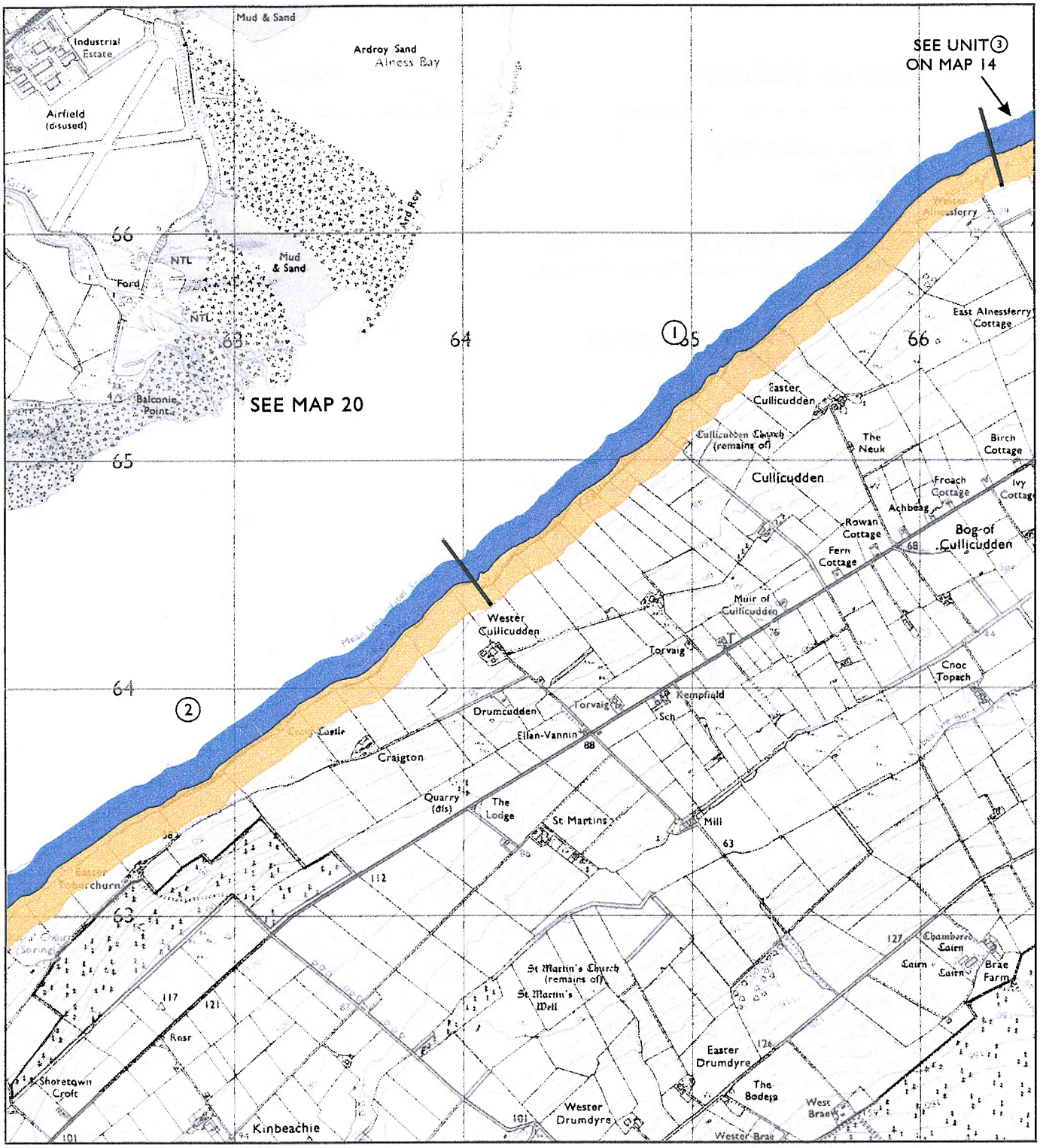
Erosion class: This unit of coastline is predominantly stable owing to its sheltered position. The intertidal area is accreting mud flats with accreting cobbles and shingle on the foreshore. Fine bedded sandstone is exposed in the region of Craig Castle at the base of a steep cliff which is densely vegetated and stable.

Built Heritage and Archaeology: The foreshore archaeology along this area consists of seven stone piers or quays associated with shoreline quarries, between Wester Alnessferry and Wester Cullicudden. Castlecraig is a scheduled and listed late 16th century tower house affected by severe erosion, some of which is marine. The cliffs on which it is built are stable but evidence of erosion was noted when a gun loop was found on the foreshore 100 m to the west of the tower house. The gun-loop masonry has fallen from the eroding tower wall.

Map 15: Hinterland Geology and Coastal Geomorphology

1. WESTER ALNESSFORD to WESTER CULLICUDDEN
NH 654 657
2.6km
Sand and shingle
Low edge (<15m)
Raised beach and marine deposits
Linear stretch of coastline backed by raised beach deposits becoming with the low cliff becoming steeper towards Wester Cullicudden. The foreshore is comprised of sand and shingle.

2. WESTER CULLICUDDEN to EASTER TOBERCHURN
NH 632 638
2.4km
Sand and shingle
Low cliff (<15m)
Raised beach and marine deposits
Linear stretch of coastline with cliff becoming steeper towards Wester Cullicudden. Raised beach deposits continue backing onto a foreshore dominated by sand and shingle.



MAP 15: ALNESS FERRY TO EASTER TOBERCHURN 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 62-66/62-67

Basemap: O.S. *Pathfinder* Series Sheet 144
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 14 September 1998

Hinterland:

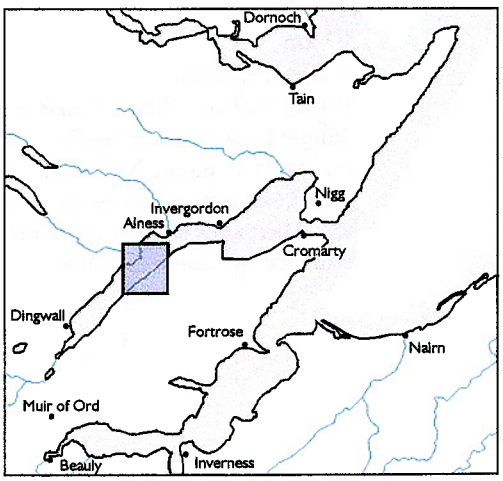
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 15: EROSION

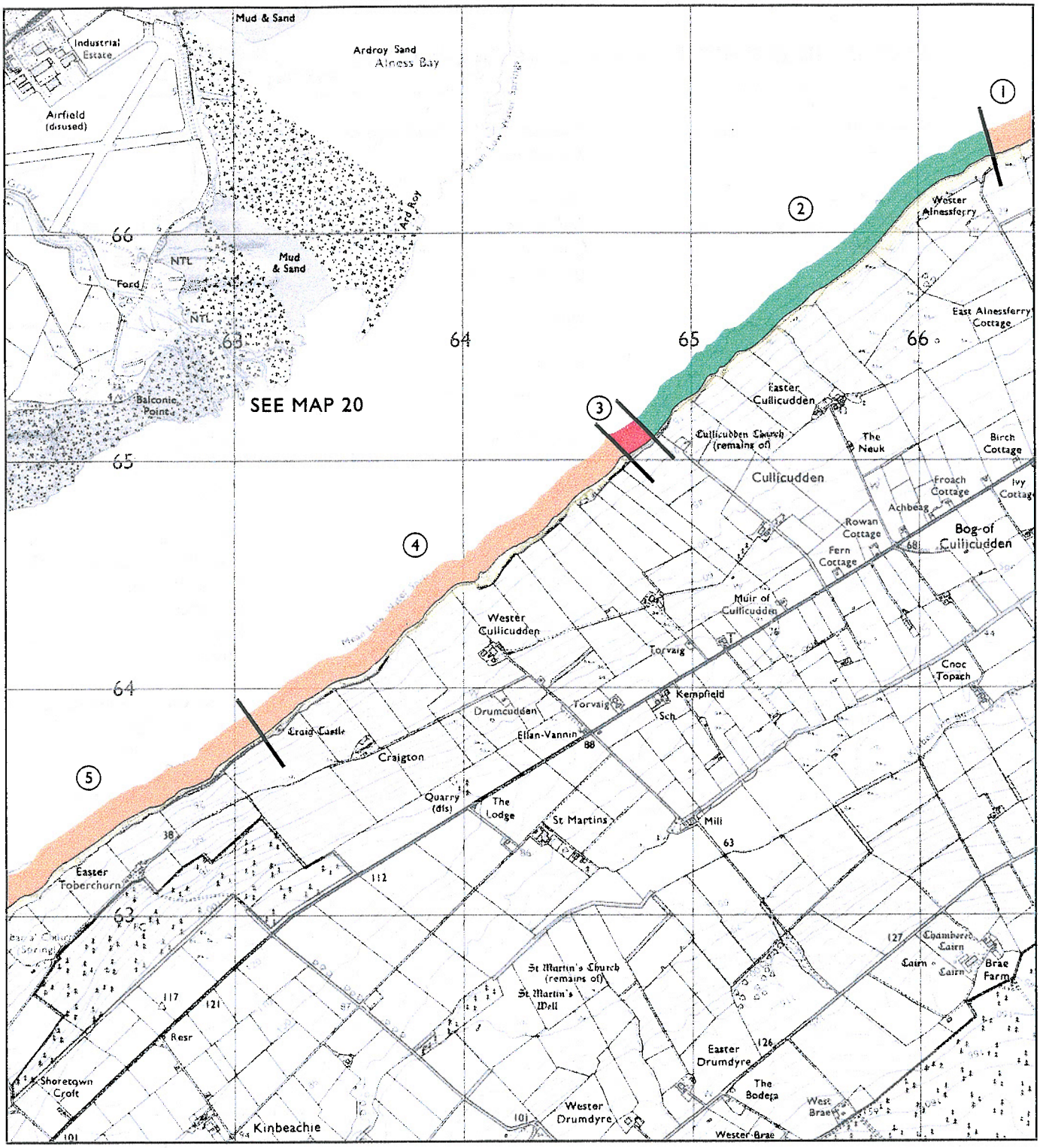
1. East of ALNESFERRY
NH 664 664
0.2km
Eroding or Stable
Sea defences are being eroded by wave action. Cobbles and shingle is banked at the HWM and appears to be stable.

2. North of ALNESFERRY to EASTER CULICUDEN CHURCH
NH 655 657
2km
Stable
The build up of shingle and cobbles at the MHWMS suggest that conditions are stable with a sandy beach towards the LWM. There are no indicators to suggest conditions are not stable.

3. East of CULICUDEN CHURCH
NH 647 651
0.1km
Definitely Eroding
A short stretch of exposed cliff is eroding where softer raised beach deposits outcrop over the hard laminated sandstone.

4. East of CULLICUDEN CHURCH to CRAIG CASTLE
NH 640 646
2km
Stable or Eroding
Large boulders and shingle are accreting on the foreshore. The cliff margins are dense with trees. Quarrying has been carried out in the past along this section leading to exposed cliff sections. The vestigial remains of piers connected with this industry can just be made out among the rocky shore. At Craig Castle erosion of the cliff has led to the wide distribution of building fabric along the foreshore.

5. CRAIG CASTLE to WEST OF BROOMTOWN WOOD
NH 625 634
3.7 km
Stable or Eroding
This unit of coastline consists of cobbles and shingle banked at the HWM. Slight erosion is occurring along the MHWMS where marine gravel outcrops or where vegetation is poor. The beach becomes sandier offshore but there is no evidence for active erosion.



MAP 15: ALNESS FERRY TO EASTER TOBERCHURN 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 62-66/62-67

Basemap: O.S. *Pathfinder* Series Sheet 144

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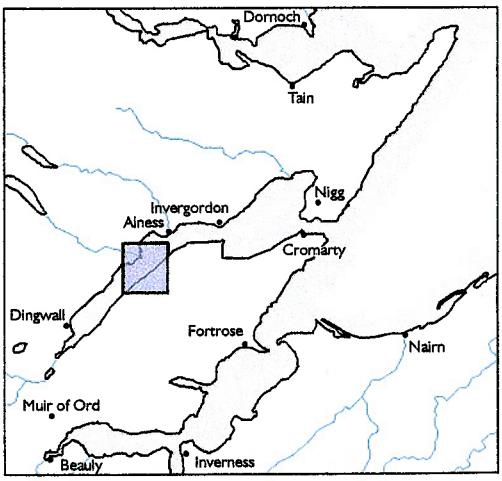
EROSION CLASS

Assessment date: 14 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 15: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 6516 6539
WESTER CULLICUDDEN
Stone pier
Uncertain
Poor
Monitor

NH 6500 6532
WESTER CULLICUDDEN
Stone pier
Uncertain
Poor
Monitor

NH 6480 6509
WESTER CULLICUDDEN
Stone pier associated with shoreline quarry
Uncertain
Poor
Monitor

NH 6470 6501
WESTER CULLICUDDEN
Stone pier
Uncertain
Poor
Monitor

NH 641 645
WESTER CULLICUDDEN
Quay and associated quarry
19th/20th century AD
Fair
Monitor

Sites on the Coastal Edge & Foreshore

NH 6367 6422
WESTER CULLICUDDEN
Quay and associated quarry
19th/20th century AD
Poor
Monitor

NH 6319 6382
CASTLE CRAIG
Carved stone gun loop
Late 16th century
Fair
Monitor

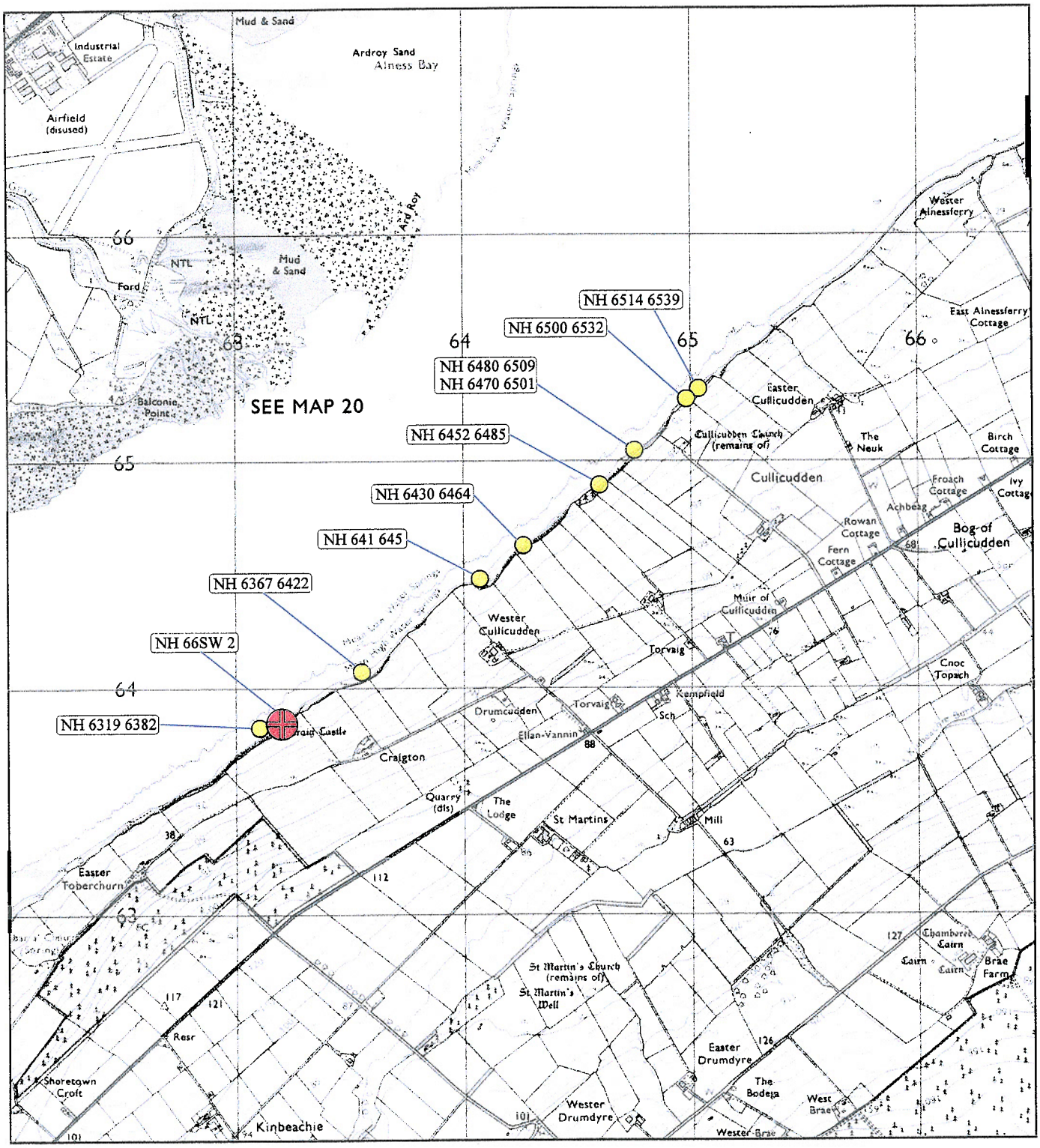
Sites in the Hinterland

NH 6514 6539
EASTER CULLICUDDEN
Quarry
Uncertain
Good
Nil

NH 6452 6485
WESTER CULLICUDDEN
Stone building
Uncertain
Poor
Monitor

NH 6430 6464
WESTER CULLICUDDEN
Stone building
Uncertain
Poor
Monitor

NH66SW 2 - Scheduled & Listed
NH 6319 6381
CASTLECRAIG
Tower-house
Late 16th century AD
Poor
Monitor



MAP 15: ALNESS FERRY TO EASTER TOBERCHURN 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 62-66/62-67

Basemap: O.S. *Pathfinder* Series Sheet 144

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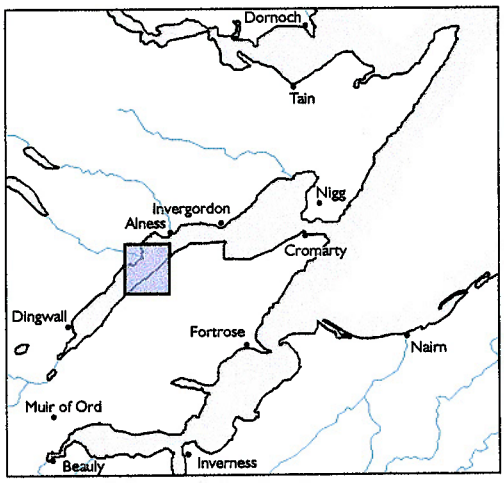
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 16: EASTER TOBERCHURN TO ALCAIG

Hinterland Geology and Coastal Geomorphology: Middle Old Red Sandstone continues through this section of coastline. Boulder clay and morainic drift deposits form the main cover soils. At Toberchurn two raised beach terraces run parallel with the present shoreline. At Milton three raised beach platforms represent the Main Perth Shoreline, The Main Late-glacial and the Post-glacial marine incursion. These features continue along the Conon river valley. Extensive tidal flats dominate this coastline.

Erosion class: This unit of coastline comprises sections that show evidence of stability with only isolated patches of erosion. This is mainly coincident with exposures of raised beach deposits which have become unstable due to poor vegetation cover. The shoreline is boulder strewn with mud that is accreting on the foreshore as a result of shelter in this low energy wave environment.

Built Heritage and Archaeology: The hinterland archaeology consists of three relatively modern sites; one a ruined building associated with the second 19th century stone quarry. The third site is a possible cairn which was overgrown and difficult to distinguish when recorded. The foreshore archaeology includes the pier for the 19th century Wester Toberchurn to Foulis Ferry, which is in a poor condition, a number of other pier remains and twelve fish traps. These include a complex of four sites near Findon.

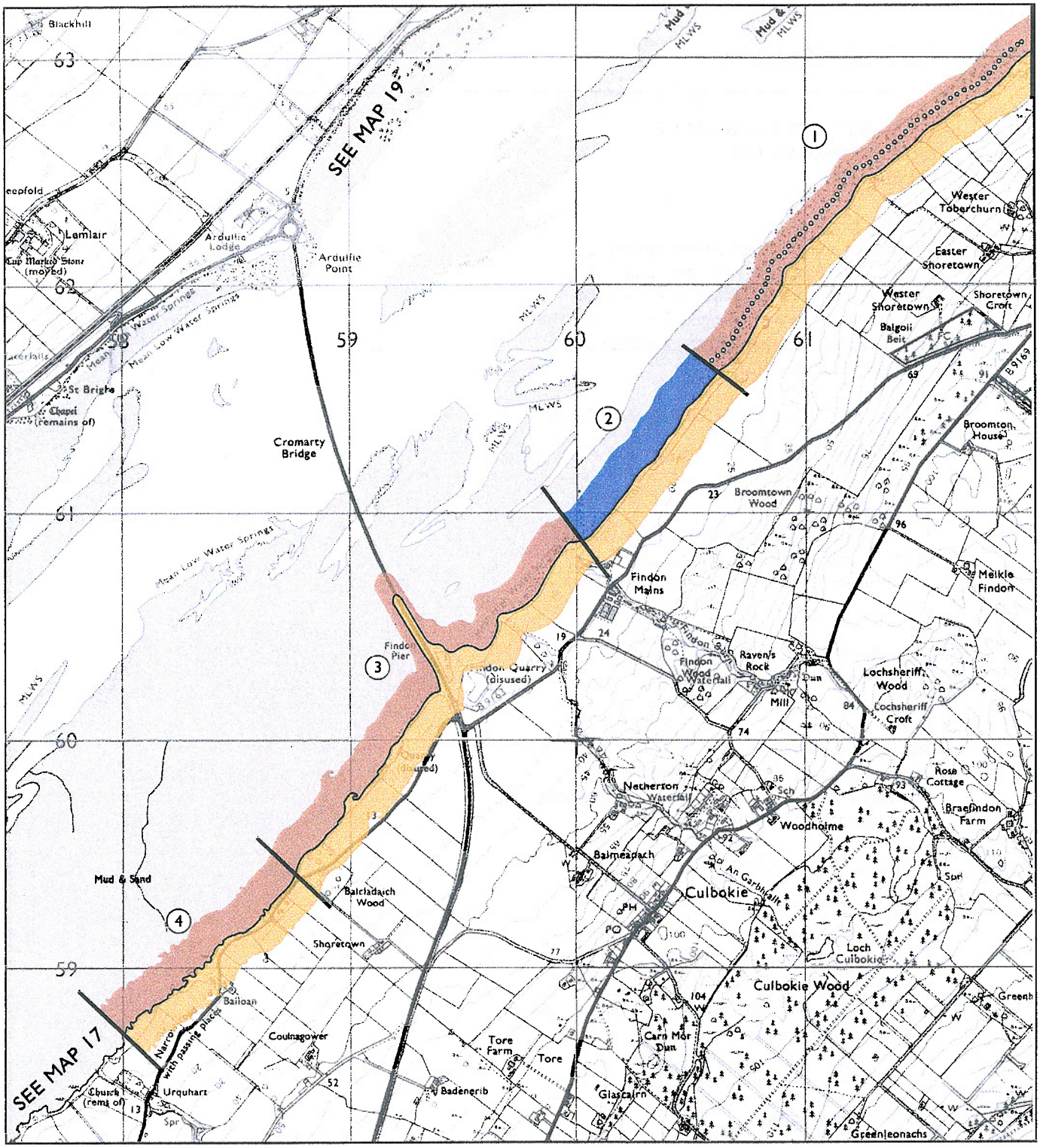
Map 16: Hinterland Geology and Coastal Geomorphology

1. EASTER TOBERCHURN to north of BROOMTOWN WOOD
NH 610 622
km 2.5km
Mud and shingle
Low edge (<10m)
Raised beach and marine deposits
Raised beach deposits continue. Mud and shingle dominate the shoreline.

2. North of BROOMTOWN WOOD to north of FINDON MAINS
NH 604 613
0.9km
Low edge (m)
Raised beach and marine deposits
Lower reach of the Cromarty Firth with a shoreline dominated by mud and sand. Hinterland geomorphology consists of raised beach deposits.

3. FINDON MAINS to BALCLADAICH WOOD
NH 596 664
Mud/boulders/gravel/tidal flats
2 km
Low edge (<10m)
Raised beach and marine deposits
Lower tidal reach of the Cromarty Firth with a foreshore dominated by mud, boulders and shingle. The hinterland comprises of raised beach deposits. The Cromarty Bridge traverses this coastal unit.

4. BALCLADAICH WOOD to URQUHART
NH 573 582
1 km
Mud/sand/shingle/tidal flats
Low edge (<10m)
Raised beach and marine deposits
This section forms the lower reach of the Cromarty Firth with an irregular shoreline. Estuarine mud and shingle dominate the foreshore.



MAP 16: EASTER TOBERCHURN TO ALCAIG 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 58-62/59-63

Basemap: O.S. *Pathfinder* Series
Sheets 143, 144, 159, 160
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 14 September 1998

Hinterland:

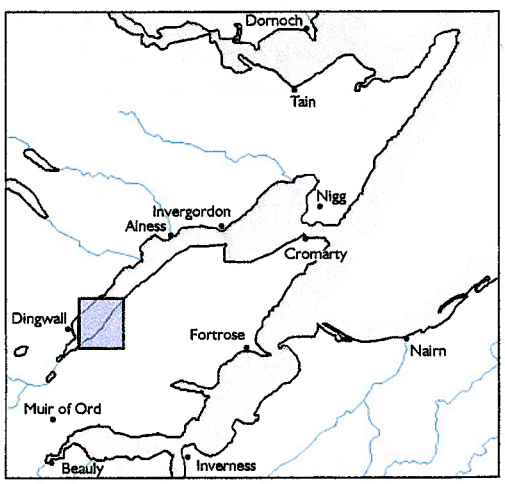
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 16: EROSION

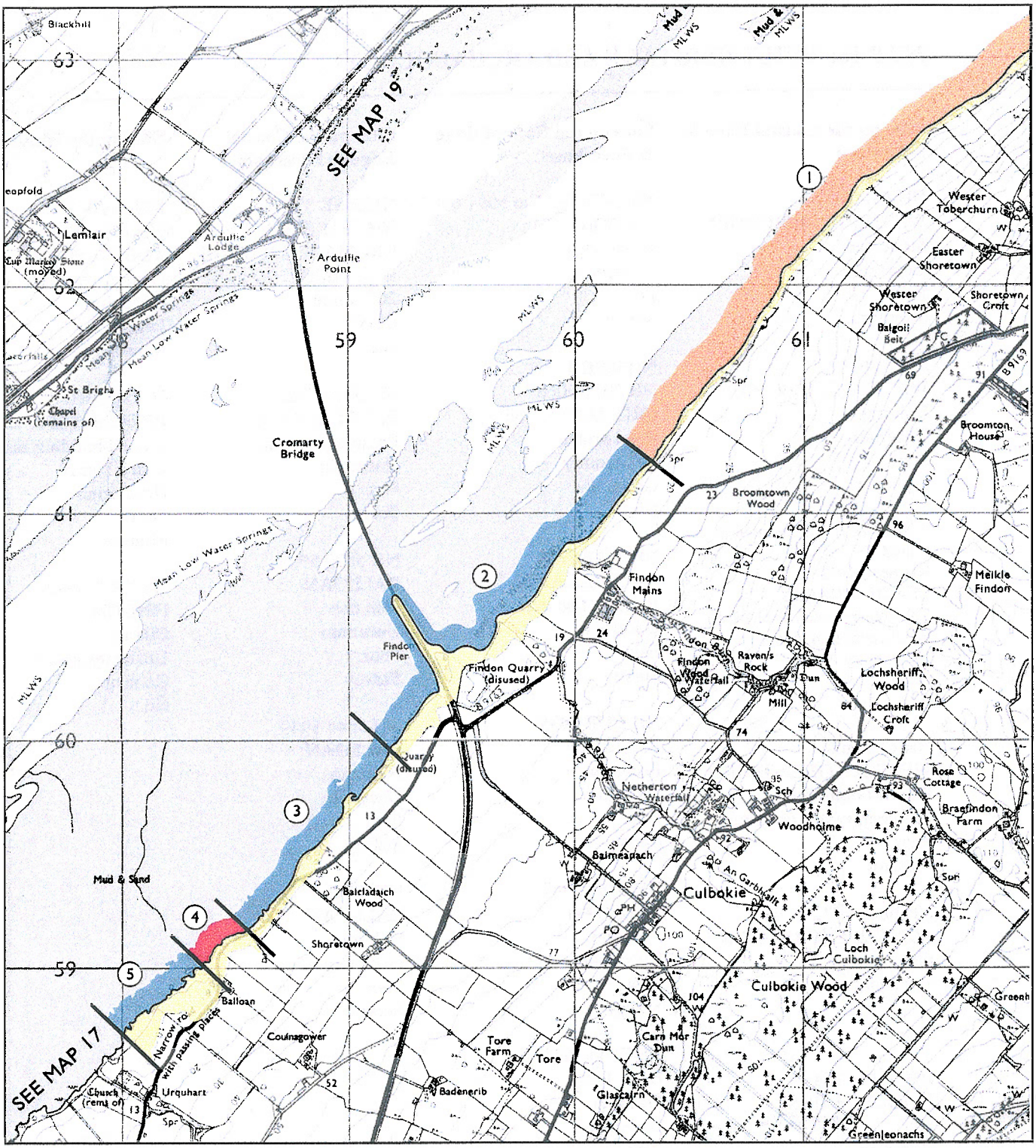
1. CRAIG CASTLE to WEST OF BROOMTOWN WOOD
NH 610 622
3.7 km
Stable or Eroding
This unit of coastline consists of cobbles and shingle banked at the HWM. Slight erosion is occurring along the MHWMS where marine gravel outcrops or where vegetation is poor. The beach becomes sandier offshore but there is no evidence for active erosion.

2. East of BROOMTOWN WOOD to FINDON QUARRY
NH 595604
1.7
Stable or Eroding
A stable foreshore of mud and cobbles. Slight erosion is occurring at the HWM. Rock armouring protects the base of the Cromarty Bridge.

3. South of FINDON PIER to east of SHORETOWN
NH 588 579
0.9km
Definitely Accreting
Localised erosion of raised beach deposits is occurring towards the backshore. Accreting mud flats dominate the foreshore.

4. East of SHORETOWN to BALLOAN
NH 585 595
0.3km
Definitely Eroding
Rubble deposition at the coastal edge attempts to limit the damage from erosion behind the cobble MHWM. Mud flats are extensive and show signs of accretion mid way from the shore.

5. BALLOAN to north of URQUART
NH 582 589
0.4
Definitely Accreting
Accreting mud and sand on the foreshore with channels exposed at the LWM. Shingle build up suggests stable conditions.



MAP 16: EASTER TOBERCHURN TO ALCAIG 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 58-62/59-63

Basemap: O.S. *Pathfinder* Series
Sheets 143, 144, 159, 160
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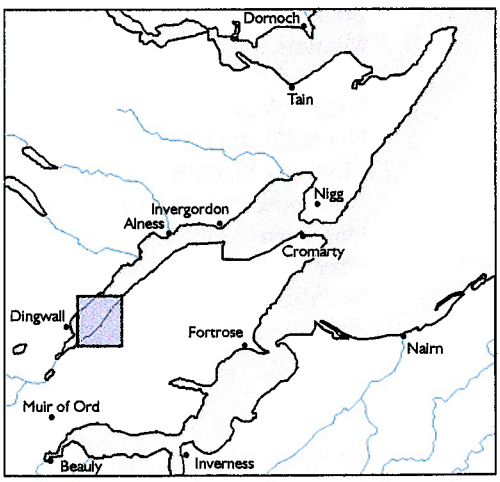
EROSION CLASS

Assessment date: 14 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 16: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 6160 6270
WESTER TOBERCHURN
Stone pier
Uncertain
Poor
Monitor

NH 6140 6270
WESTER TOBERCHURN
Fish trap
Uncertain
Poor
Survey

NH64NW 28 - Scheduled & Listed C
NH 6447 4673
CLACHNAHARRY
Caledonian Canal; sea lock & lock keeper's cottage
19th century AD
Good
Nil

NH 6131 6247
WESTER TOBERCHURN
Pier of Foulis Ferry
19th century AD or earlier
Poor
Monitor

NH 6083 6212
WESTER SHORETOWN
Fish trap
Uncertain
Poor
Survey

NH 6014 6104
FINDON MAINS
Pier
Uncertain
Poor
Monitor

NH66SW 26
NH 6000 6083
FINDON MAINS
Boathouse foundations
Uncertain
Poor
Monitor

Sites on the Coastal Edge & Foreshore

NH 5970 6071 to 5991 6087
FINDON
4 fish traps
Uncertain
Poor
Survey

NH56SE 37
NH 5921 6063
CROMARTY BRIDGE
Road bridge
20th century
Good
Nil

NH 5915 5922
BALCLADAICH
Possible fish trap
Uncertain
Fair
Survey

NH 5870 5935
BALLOAN
Fish trap
Uncertain
Poor
Survey

NH 5862 5947
BALLOAN
Fish trap
Uncertain
Poor
Survey

NH 5844 5949
BALLOAN
Fish trap
Uncertain
Poor
Survey

NH 5722 5859
OLD FERINTOSH
Fish trap
Uncertain
Poor
Survey

Sites on the Coastal Edge & Foreshore

NH56SE 37
NH 5921 6063
CROMARTY BRIDGE
Road bridge
20th century
Good
Nil

NH 5915 5922
BALCLADAICH
Possible fish trap
Uncertain
Fair
Survey

NH 5870 5935
BALLOAN
Fish trap
Uncertain
Poor
Survey

NH 5844 5949
BALLOAN
Fish trap
Uncertain
Poor
Survey

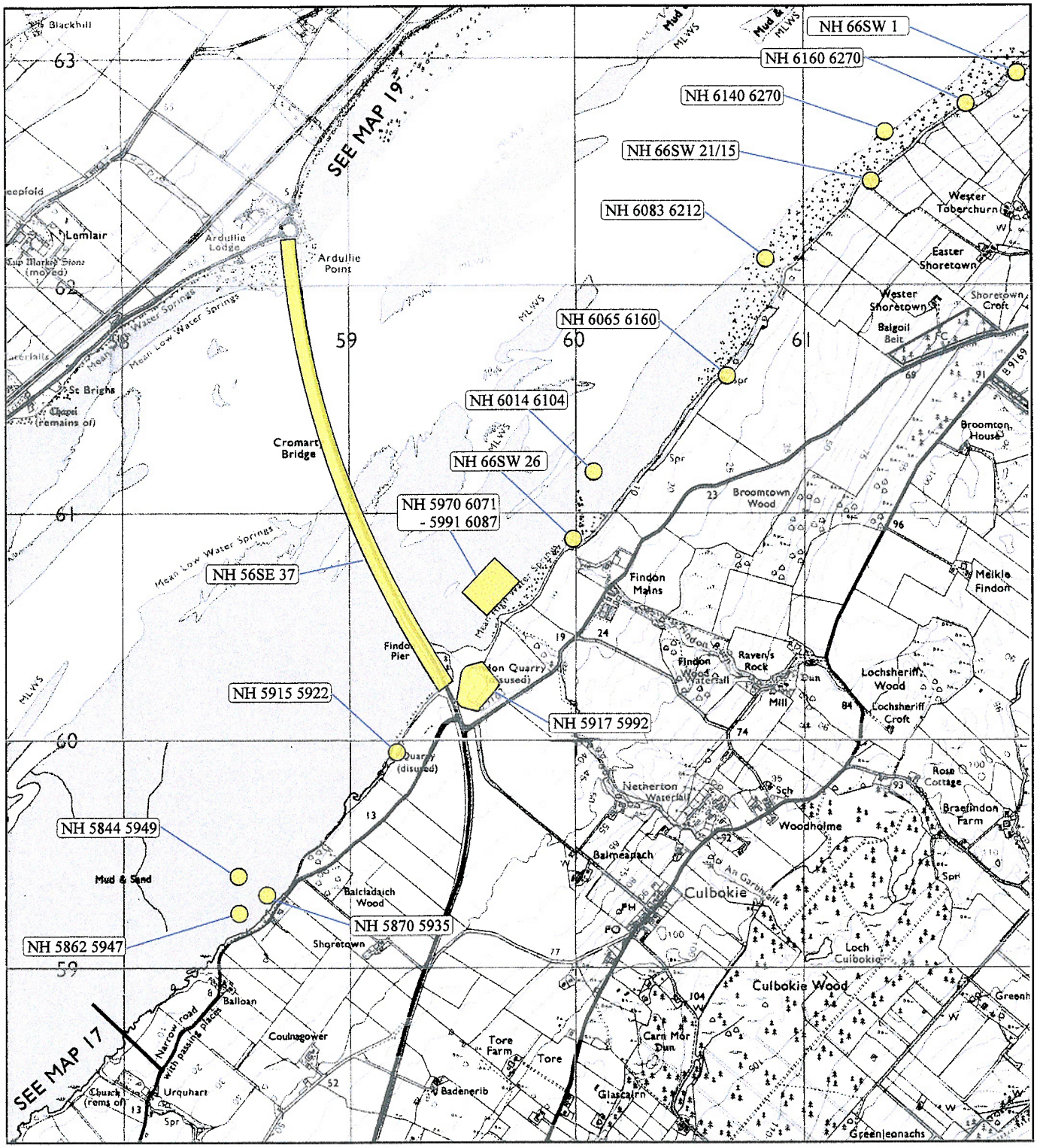
NH 5862 5947
BALLOAN
Fish trap
Uncertain
Poor
Survey

Sites in the Hinterland

NH66SW 1
NH 6195 6292
TOBERCHURN
Cairn (possible)
Uncertain
Poor
Monitor

NH6065 6160
BROOMTOWN WOOD
Ruined building associate with a quarry
Uncertain
Poor
Monitor

NH 5917 5992
FINDON
Quarry
19th century AD
Good
Nil



MAP 16: EASTER TOBERCHURN TO ALCAIG 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 58-62/59-63

Basemap: O.S. *Pathfinder* Series
Sheets 143, 144, 159, 160
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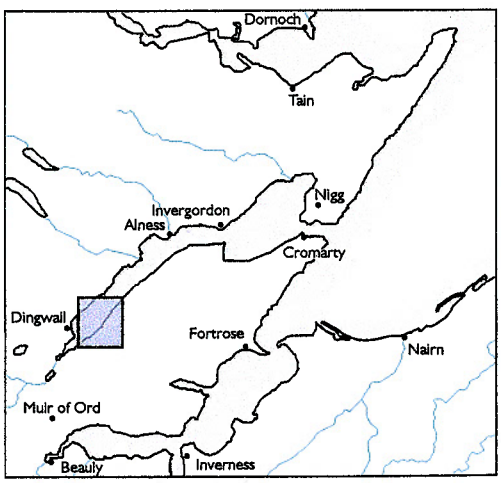
BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 17: ALCAIG TO DINGWALL

Hinterland Geology and Coastal Geomorphology: This section forms the macro-tidal head of the Cromarty Firth. The basement geology to Conon Bridge is Middle Old Red Sandstone. Drift lithologies are predominantly boulder clay and morainic drift. Towards Conon Bridge the three aforementioned marine incursions are represented and marine terraces are present at Dingwall. The Conon floodplain is comprised of alluvium and colonised with alder carr. Towards the outer basin of the river sinuous bends and mid channel shoals traverse extensive mud flats that dominate the intertidal area.

Erosion class: This section of the estuary is very sheltered. The upper reach of the River Conon is managed by a hydro-electrical company and the sediment load is likely to vary according to the requirements of the industry. At the time of the survey, flotsam was extensive on the outer shoals of the mudflats. Alteration to the configuration of the sinuous channels are impacting on the intertidal archaeology (see SMR NH 55 NE013 at NH 5619 5818 map sheet 17). Extensive accretion is evident up to the MHWM where mud meets the stable foreshore.

Built Heritage and Archaeology: The foreshore sites in this area include evidence of the 19th century Alcaig to Dingwall ferry, such as the ferry pier, causeway and wooden jetty posts. The multitude of sites indicate a dynamic environment in which sites are both damaged by coastal erosion and rendered unusable due to silting and accretion. On the northern shoreline four salmon bothies were recorded all in poor states of repair. This area of the firth was used as a ferry route prior to the construction of the railway to Dingwall in the late 19th century, consequently the area contains a number of sites pertinent to the ferry. The mid-channel features require future monitoring using a boat for access.

Map 17: Hinterland Geology and Coastal Geomorphology

1. URQUHART to TIGHNAHINCH
NH 570580
1.7km
Esturine mud/tidal flats
Low edge (<1om)
Raised beach and marine deposits
Outer tidal reach of the River Conon. The foreshore consist of mud flats. The hinterland has a low irregular edge consisting of marine sand and gravel. A low raised sea cliff is present.

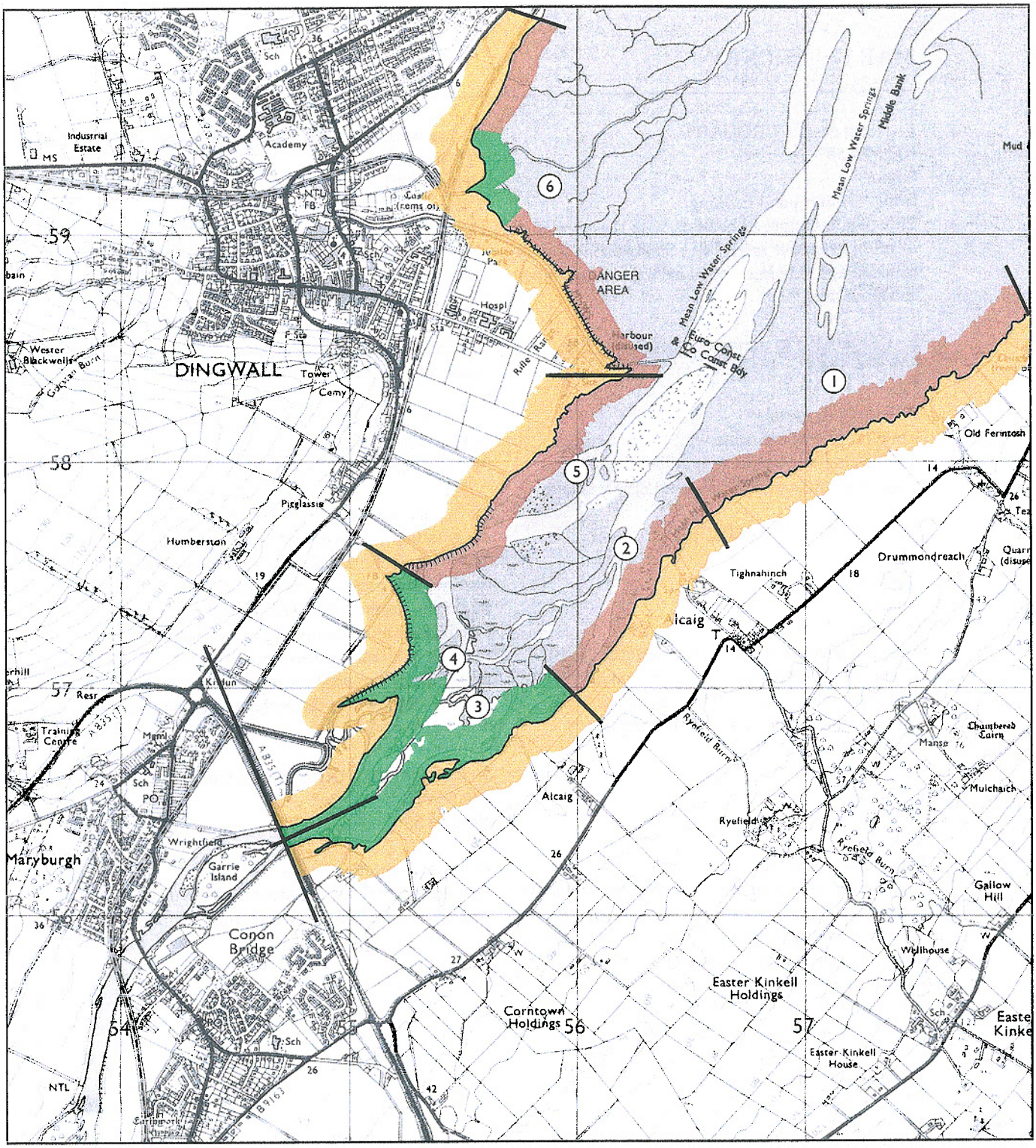
2. TIGHNAHINCH to south west of ALCAIG
NH 564 576
2.8km
Estuarine mud/tidal flats
Low edge (<10m)
Raised beach and marine deposits
Irregular coastline towards the head of the Cromarty Firth. Raised beach deposits dominate the hinterland.

3. West of ALCAIG to CONON BRIDGE
NH 553 565
1.3km
Saltmarsh/tidal creeks
Low edge (<10m)
Raised beach and marine deposits
Head of the Cromarty Firth with a foreshore dominated by saltmarsh and tidal creeks. Raised beach deposits are present within the hinterland. The land behind is low lying.

4. CONON BRIDGE to south of PITGLASSIE
NH 550 570
1.2km
Estuarine mud/saltmarsh/tidal creeks
Low edge (<10m)
Carse clays over marine deposits
The foreshore is colonised by salt marsh and estuarine mud. Tidal creeks present. Flood banks protect the hinterland.

5. South of PITGLASSIE to DINGWALL HARBOUR (disused)
NH 558 580
1.3
Estuarine tidal mud flats/tidal creeks
Low edge (<0m)
Estuarine clay over marine sand and gravel
North shore of head of Cromarty Firth forming the arm of a cuspate triangular headland. Defended by flood banks the hinterland is low lying carse clay overlying marine sand and gravel. The foreshore consists of mud and shingle.

6. DINGWALL HARBOUR to north of DINGWALL
NH 555 597
1.8km
Tidal mud flats
Low edge (<10m)
Marine deposits
Marine sands and gravel underlie carse clays within the hinterland that is low lying and developed. This unit incorporates the canalised channel for the disused harbour with saltmarsh formation towards the town of Dingwall. Estuarine mud flats continue.



MAP 17: ALCAIG TO DINGWALL

MORAY FIRTH SURVEY Grid ref: NH 54-58/55-60

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 159

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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 14 September 1998

Hinterland:

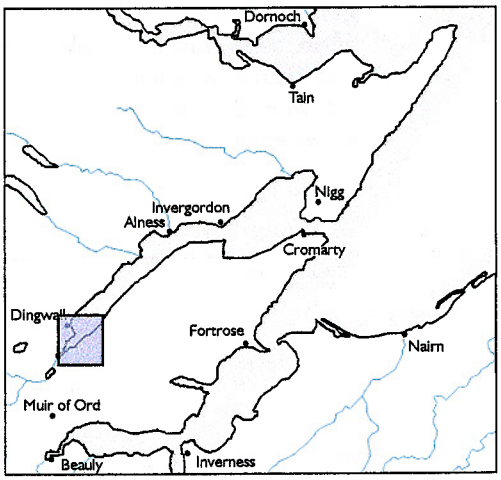
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

- Low edge (< 5m tall)
- Cliff over 5m tall
- Man made barrier
- Shingle/storm bank
- Human disturbance

Foreshore:

- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 17: EROSION

1. North east of URQUART
NH 579 587
0.2km
Both Accreting and Eroding
This unit has exposed bedrock with accreting mud forming extensive mud flats. Sandstone is locally exposed and is being eroded by wave action albeit at a slow rate.

2. URQUART to north of TIGHNAHINCH
NH 576 584
1km
Definitely Accreting
Irregular unit of coastline with accreting mud flats. Shingle is banking up at the MHWM suggesting that conditions are relatively stable.

3. North of TIGHNAHINCH to North of ALCAIG
NH 564 578
1.6km
Definitely Accreting
This unit shares the same characteristics as its neighbouring units with mud accretion on the expansive tidal flats. Conditions appear to be stable owing to the amount of shingle that is accumulating at the MHWM.

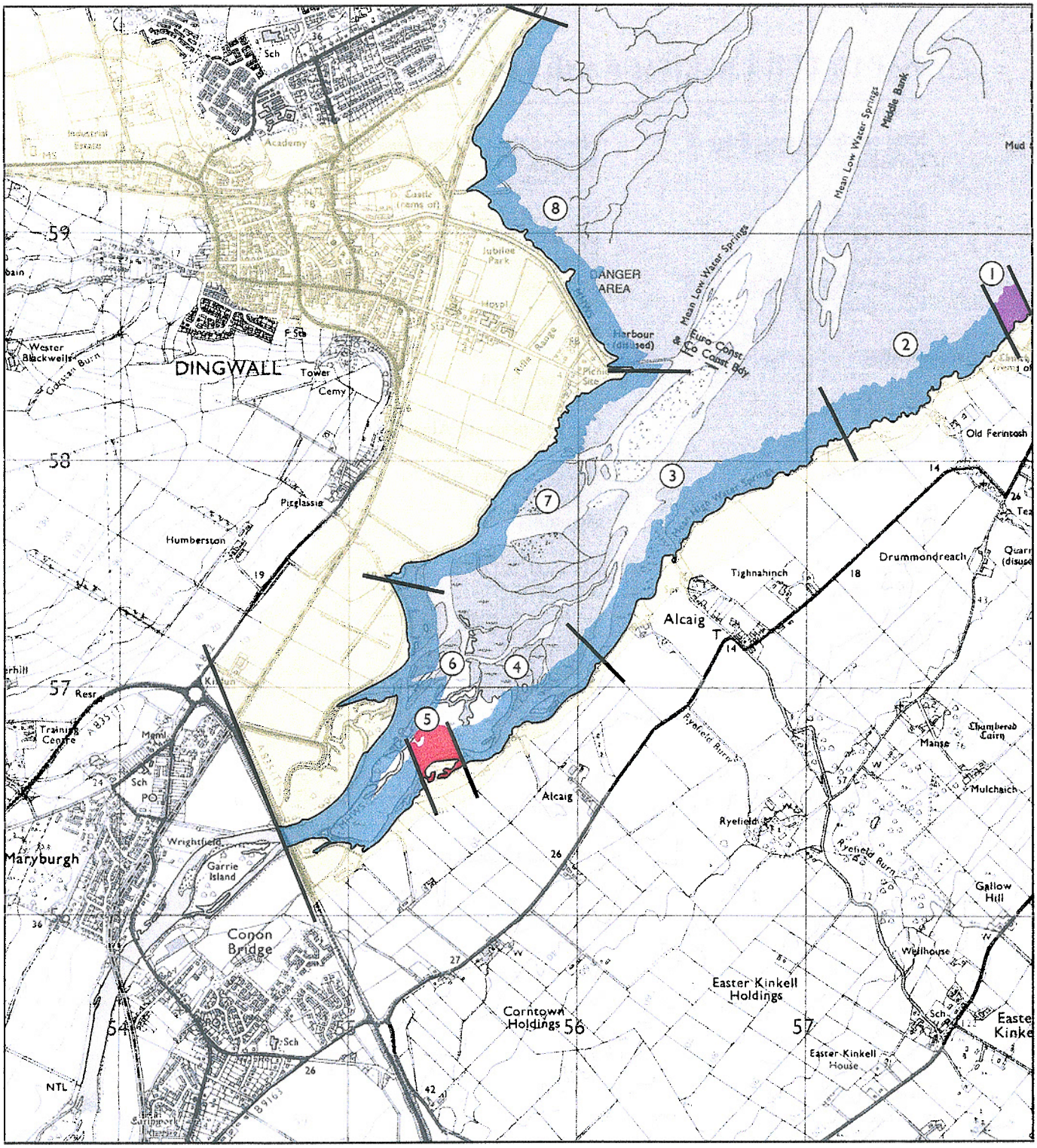
4. ALCAIG
NH 557 569
0.8km
Definitely Accreting
Mud and shingle is accreting with a trend towards increased alluvial deposition released from the River Conon where alluvial deposits. The large quantity of driftwood suggests that sediment loading is active along the tributaries leading from the main river channel. Saltmarsh vegetation lends increased stability at the HWM.

5. South west of ALCAIG
NH 554 566
0.1km
Definitely Eroding
Flood terrace formation effected by slope failure where carse deposits is effected by wave action. Defoliation of saltmarsh vegetation appears to be a crucial factor in controlling in the speed of active erosion.

6. South west of ALKAIG to south east of PITGLASSIE
NH 551 570
1.3km
Definitely Accreting
This unit consists of the mouth of the Conon River. The riverbanks are stabilised by saltmarsh vegetation and wooded with alder carr behind which lie earthwork flood banks. Channels are accreting with alluvium derived from further upstream.

7. South east of PITGLASSIE to DINGWALL HARBOUR
NH 561 580
1.5km
Definitely accreting
As with unit 7 above mud deposition is at present accreting on the foreshore. The main river channel is at present c. 50m offshore and migrating northwards. This is leading to the loss of sediment by undercutting and effecting the remains of a fishtrap (See record ****). The shoreline is armoured for much of this unit, particularly towards the recreation area adjacent to the disused harbour.

8. DINGWALL HARBOUR towards north east DINGWALL
NH 559 590
2km
Definitely accreting
Saltmarsh and flood defences traverse this unit of coastline. Mud is accreting on the foreshore.



MAP 17: ALCAIG TO DINGWALL

MORAY FIRTH SURVEY Grid ref: NH 54-58/55-60

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 159
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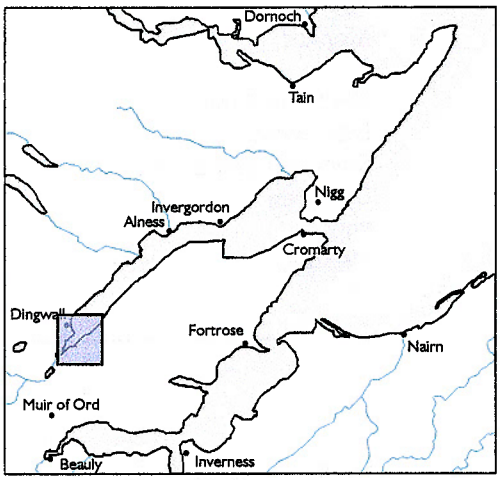
EROSION CLASS

Assessment date: 14 September 1998

Key:

- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 17: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH55NE 27
NH 5638 5762
ALCAIG
Pier for Alcaig-Dingwall ferry
19th century AD
Fair
Monitor

NH 5638 5745
ALCAIG
Stone causeway
Uncertain
Poor
Monitor

NH 5555 5768
PITGLASSIE
Wooden jetty posts
Uncertain
Poor
Monitor

NH 5574 5785
PITGLASSIE
Timber mooring posts
Uncertain
Poor
Monitor

NH 5722 5859
OLD FERINTOSH
Fish trap
Uncertain
Poor
Survey

NH 5582 5803
DINGWALL
Wooden pier
Uncertain
Poor
Monitor

NH 5580 5800
DINGWALL
Stone and timber jetty
Uncertain
Poor
Monitor

Sites on the Coastal Edge & Foreshore

NH 5620 5765
DINGWALL
Stone mound, possible beacon stance
Uncertain
Poor
Monitor

NH 5587 5814
DINGWALL
Landing-place for Alcaig-Dingwall ferry
18th/19th century AD
Poor
Monitor

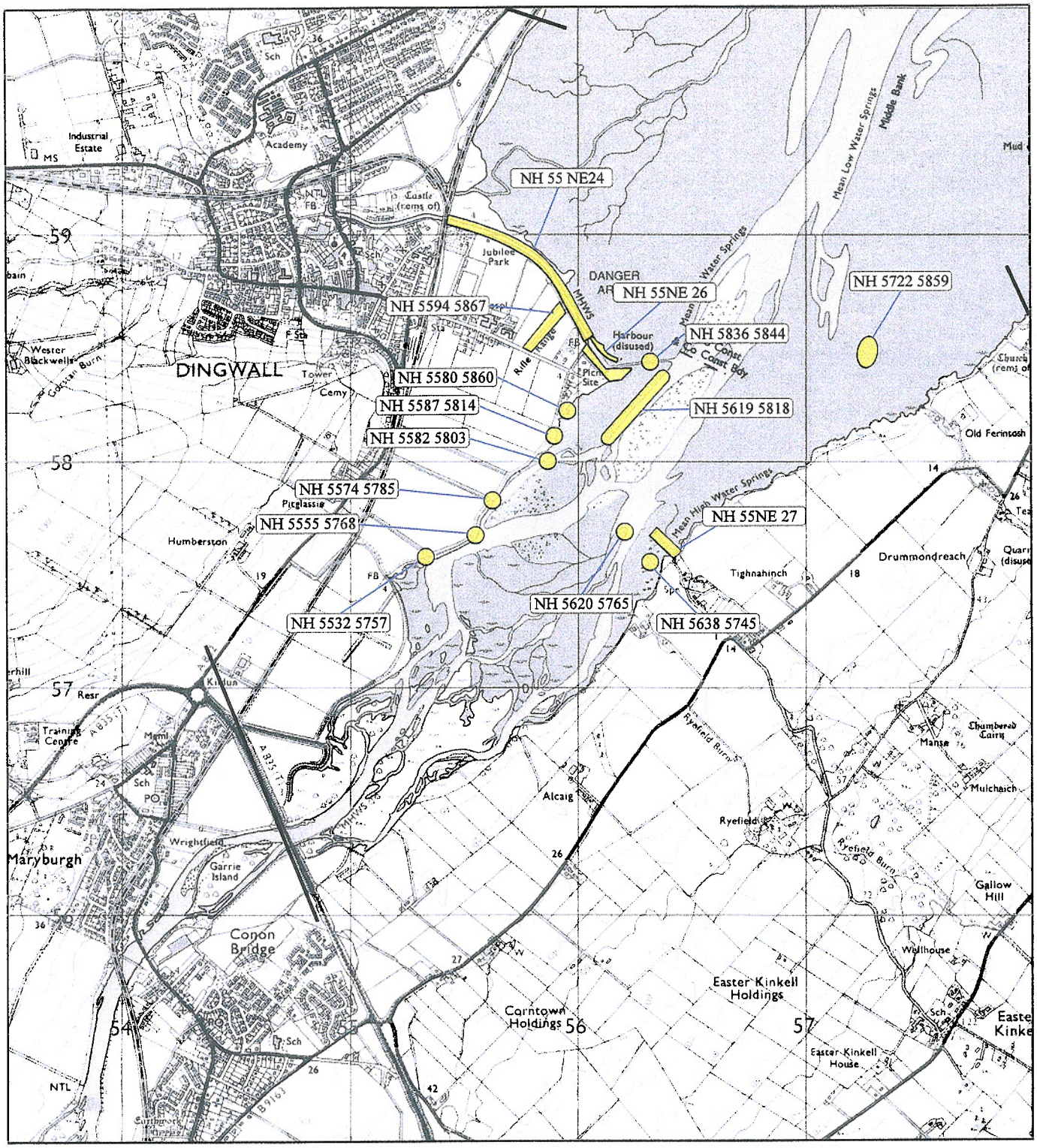
NH 5600 5827
DINGWALL
Timber jetty posts
Uncertain
Poor
Monitor

NH 5619 5818
DINGWALL
Fish trap
Uncertain
Fair
Survey and Monitor

NH 5636 5844
DINGWALL
Beacon stances
19th century AD
Poor
Monitor

Sites in the Hinterland

NH 5532 5757
PITGLASSIE
Four salmon bothies
20th century AD
Poor
Monitor



MAP 17: ALCAIG TO DINGWALL

MORAY FIRTH SURVEY Grid ref: NH 54-58/55-60

1:25 000

Basemap: O.S. *Pathfinder* Series Sheet 159

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BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

- Protected Ancient Monument, or area of designated wreck
- Listed Historic Building
- Monument formally proposed by Historic Scotland for scheduling, or wreck for designation
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