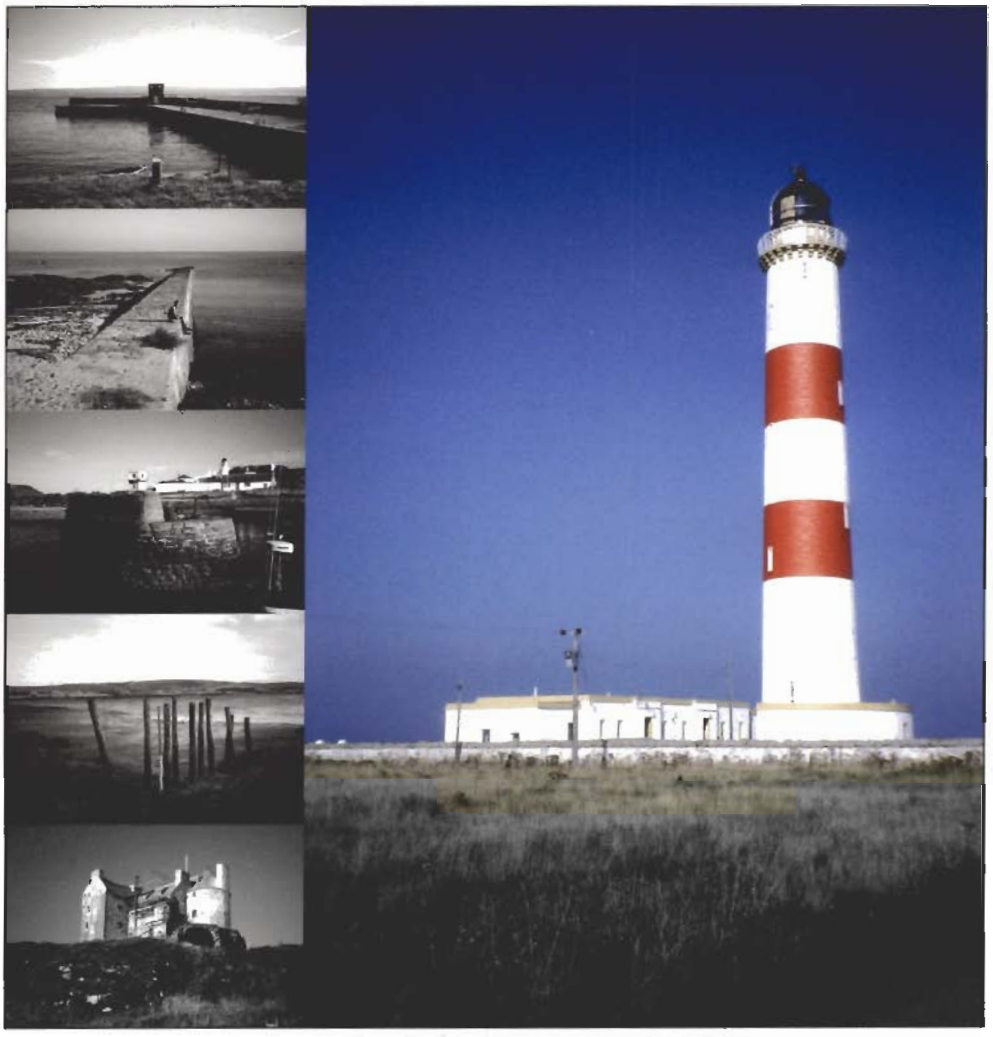
Coastal Assessment Survey
Inner Moray Firth

Dingwall to Tarbat Ness

September 1998

VOLUME 2

Map sets 18-31



a report for
HISTORIC SCOTLAND

by the
CENTRE *for* FIELD ARCHAEOLOGY

Map 18: DINGWALL TO ARDULIE POINT

Hinterland Geology and Coastal Geomorphology: Middle Old Red Sandstone forms the basement geology in this unit of coastline. This is overlain by boulder clay and undifferentiated glacial drift deposits. Marine deposits are represented by two raised beaches at Ardulie Point. Here a small foreland forms the northern limit of the Cromarty Bridge crossing. The intertidal environment is dominated by tidal mudflats. Shingle and boulders continue the length of this unit and the foreshore narrows here in contrast to the proceeding coastal unit. The hinterland rises sharply away from the Cromarty estuary.

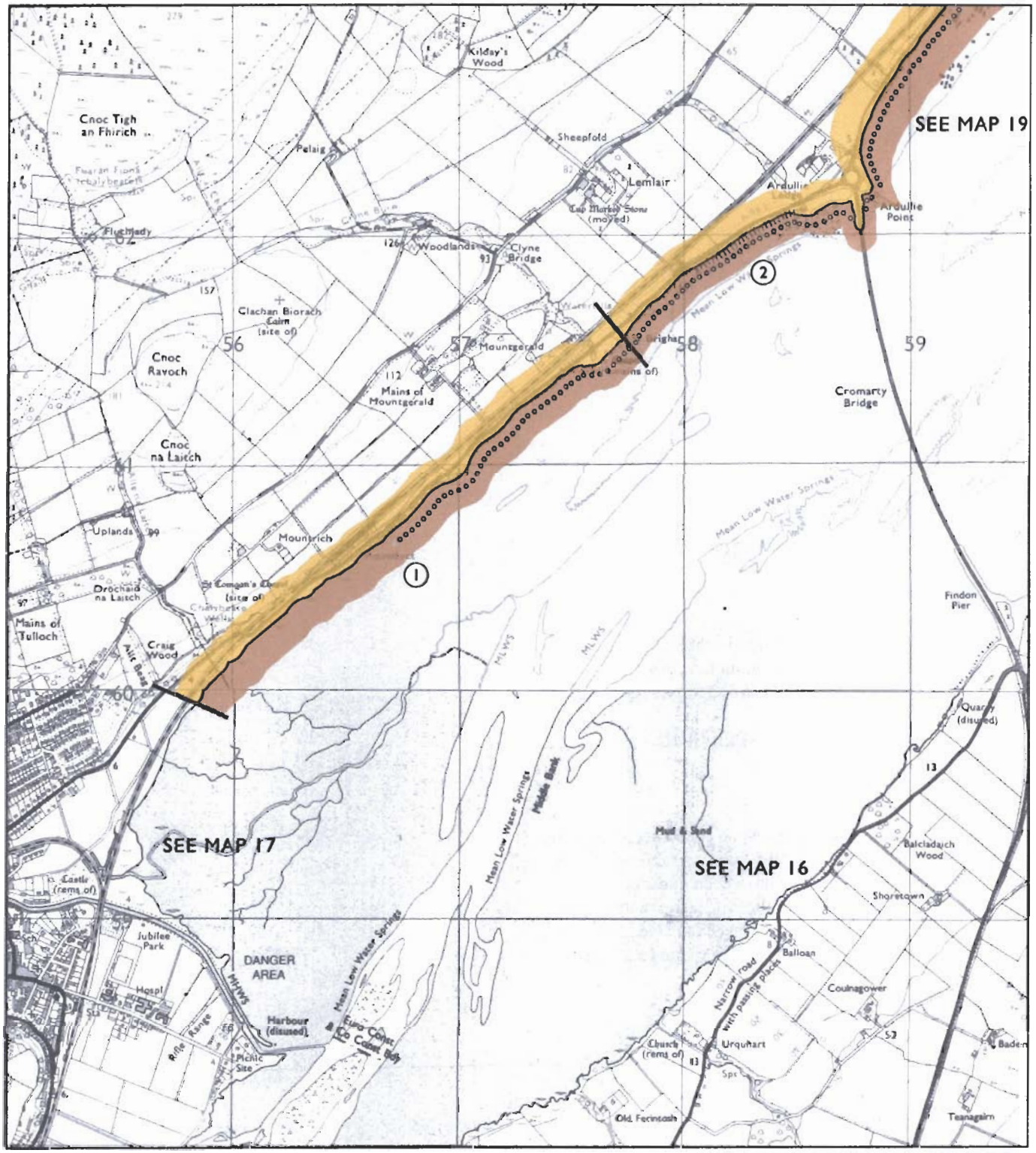
Erosion class: The sheltered position of this unit promotes stability with accretion of mud and shingle on the foreshore. At Ardulie point the bridge abutments and the flanking shoreline are defended by rock armour. The most notable section suffering erosion is the cliff at the ruin of St Brigh's Chapel (NH 577 615). An exposed section of cliff is seriously eroding exposing the buildings fabric. Exposed within the cliff is laminated marine sand and shingle. Attempts to stabilise the cliff edge have been made using seeded netting.

Built Heritage and Archaeology: The western foreshore sites in this area are the north shore complement to those on the preceding map. They consist of timber and stone remains associated with the Dingwall to Alcaig ferry which are possible beacon stances to aid navigation. They also include some fish trap sites, including one at LWM which consists of numerous wooden posts interwoven with wattling. This degree of preservation demonstrates the preservative nature of the intertidal sediments, however, where the post and wattle work are exposed they are prone to erosion by both water and the sediment load. The hinterland archaeology is varied and includes the Dingwall harbour and canal, designed by Telford, linking the former with the navigable channel in the Firth. At the mouth of the canal are the remains of the navigation beacon stances. North east of Dingwall is the Mountrich shell midden complex, situated on the top of a raised sea beach feature and prone to terrestrial weathering. At Lemlair the 12th century St. Brighs chapel and associated burial ground was recorded as being under active coastal erosion and during the survey a number of possible human bones was found on the foreshore below the site.

Map 18: Hinterland Geology and Coastal Geomorphology

1. East of DINGWALL TOWN to ST BRIGHS
NH 573 614
3.3km
Tidal mud flats
Low cliff (10-15m)
Raised beach and marine deposits
This unit comprises a linear stretch of estuarine coast with predominantly raised beach deposits on the hinterland. The foreshore consists of estuarine tidal flats with boulders at the MHWS mark.

2. ST BRIGH'S to ARDULLIE POINT
NH 589 626
2.6km
Mud flats/shingle
Low cliff (10m)
Raised beach and marine deposits
This coastal cell incorporates Ardulie Point a small headland forming the north side of the Cromarty Bridge. The foreshore consists of mud flats. The hinterland behind rises steeply and comprises raised beach deposits.



MAP 18: DINGWALL TO ARDULIE POINT

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 55-59/58-63

HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 15 September 1998

Hinterland:

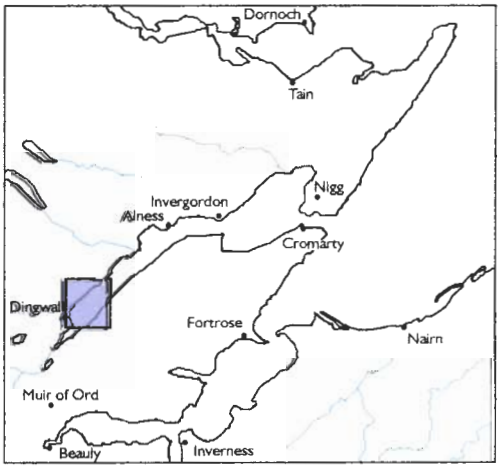
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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 18: EROSION

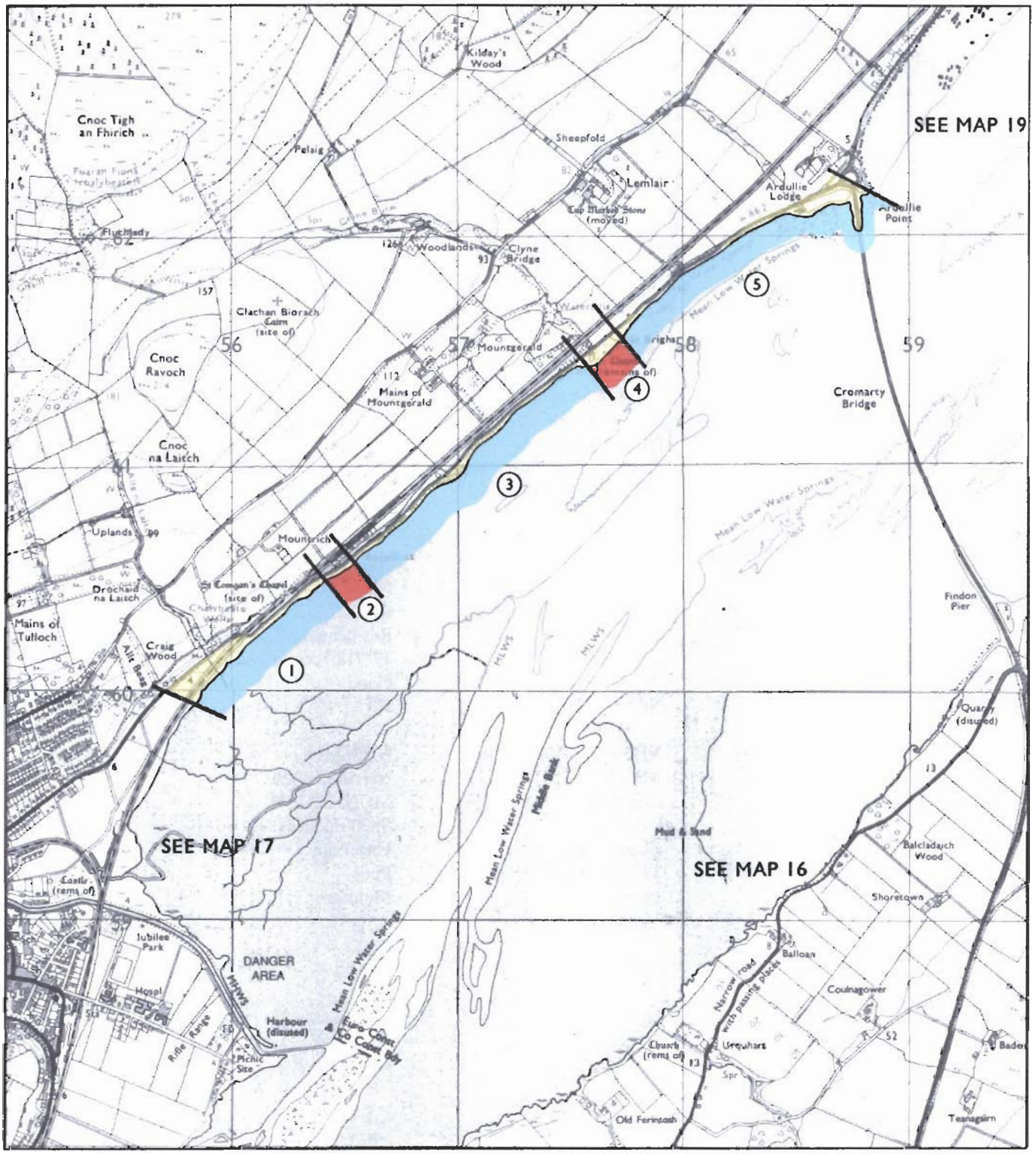
1. CRAIG WOOD to MOUNTRICH
NH 562 604
0.7km
Accreting or stable
Defended coastal edge with saltmarsh communities stabilising the backshore area. Shingle and mud are accreting on the foreshore.

2. MOUNTRICH
NH 565 606
c. 12-15m
Definitely eroding
Eroding saltmarsh at HWM with cobbles and mud exposed to the low watermark where conditions are accreting.

3. MAINS of MOUNTGERALD
NH 570 610
1.3km
Accreting or stable
Stable cobble and mud beach with extensive mudflats. Boulder dump sea defence protects the coastal edge and the A862 trunk road.

4. St BRIGH'S CHAPEL (RUIN)
NH 577 615
c. 75m
Definitely eroding
The c.3m high gravel and sand cliff is seriously eroding exposing the building fabric of the chapel. Recently attempts have been undertaken to stabilise the top of the cliff using matting and grass seeding. Erosion is extensive along this section of shoreline owing to the lack of hard defences.

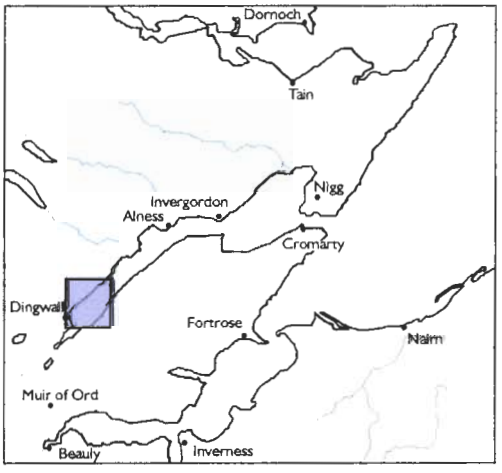
5. St BRIGH'S CHAPEL to ARDULIE POINT
NH 585 621
1.2km
Accreting or stable
This unit is defended by quarried stone to protect the A862 road and the headland of Ardulie Point that holds the northern piers of the Cromarty Bridge. The foreshore is accreting mud, cobbles and mud that are extensively exposed at the LWM.



MAP 18: DINGWALL TO ARDULIE POINT

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 55-59/58-63



EROSION CLASS

Assessment date: 15 September 1998

Key:

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

MAP 18: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 5720 6060
MOUNTGERALD
Complex fish trap
Uncertain
Poor
Survey

NH 5755 6140
MOUNTGERALD
Double fish trap
Uncertain
Good
Survey and monitor

NH 5880 6215
ARDULLIE LODGE
Wooden breakwater
20th century AD
Poor
Nil

Sites in the Hinterland

NH55NE 26
NH 5612 5848
DINGWALL
Harbour (disused)
18th/19th century AD
Poor
Monitor

NH55NE 24
NH 5494 5908 - 5615 5842
DINGWALL, River Peffrey
Canal designed by Telford
19th century AD; 1803-21
Fair
Nil

NH 5594 5867
DINGWALL
Firing range
20th century AD
Good
Nil

NH56SE 3 - Scheduled
NH 5765 6150
LEMLAIR, ST. BRIGHS CHAPEL
Chapel; burial ground
12th century AD or earlier
Poor
Monitor

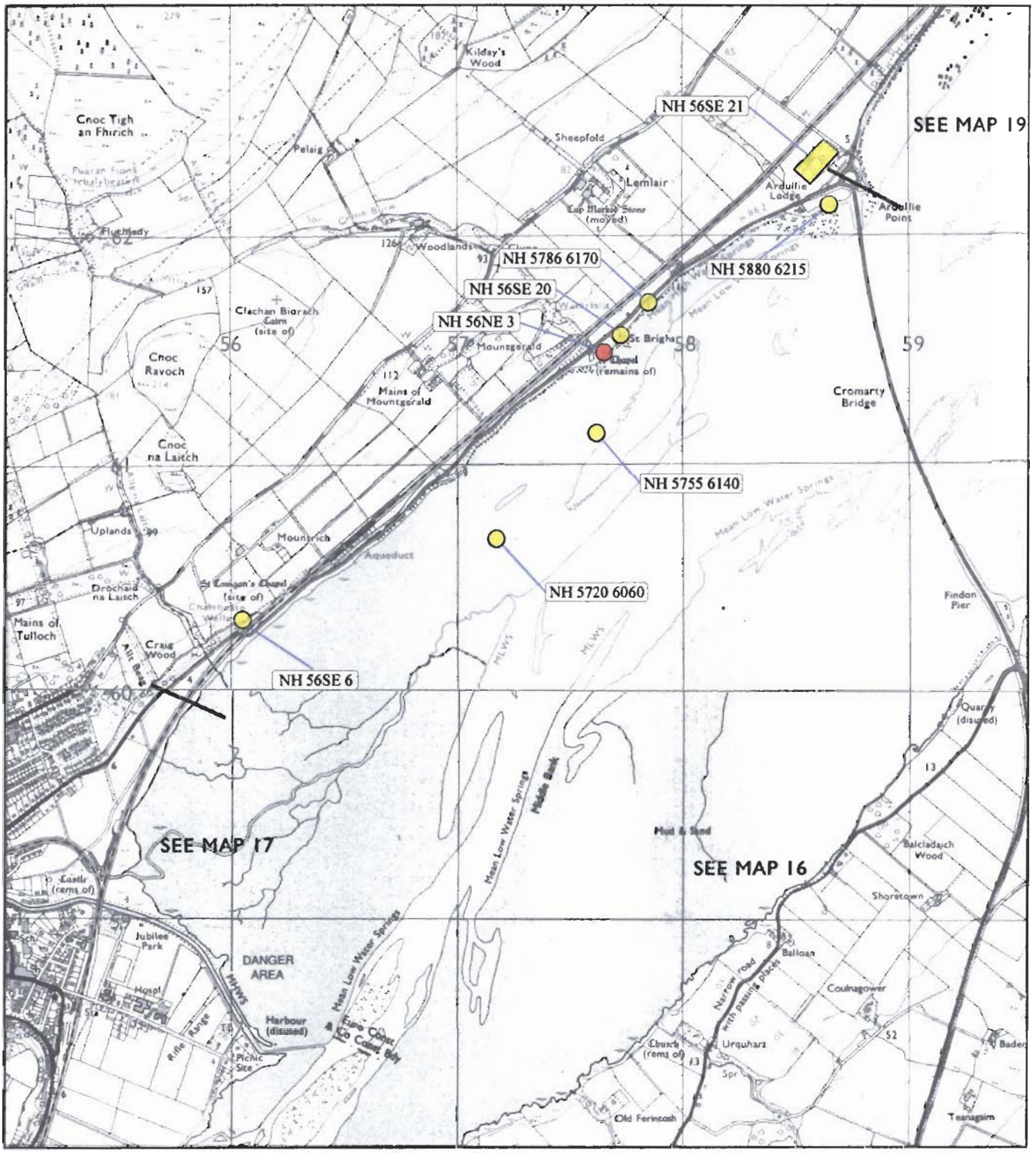
Sites in the Hinterland

NH56SE 20
NH 5772 6155
CILLE BHREA, St Brighs
Residential house
18th/19th century AD
Good
Nil

NH 5786 6170
LEMLAIR
Rectilinear structures
Uncertain
Good
Survey

NH56SE 21
NH 5861 6232
ARDULLIE LODGE
Residential house; designed
17th/18th century AD
Good
Nil

NH56SE 6
NH 5602 6029
MOUNTRICH
Shell middens
Uncertain
Poor
Monitor



MAP 18: DINGWALL TO ARDULIE POINT

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 55-59/58-63

Basemap: O.S. *Pathfinder* Series
Sheets 143 & 159
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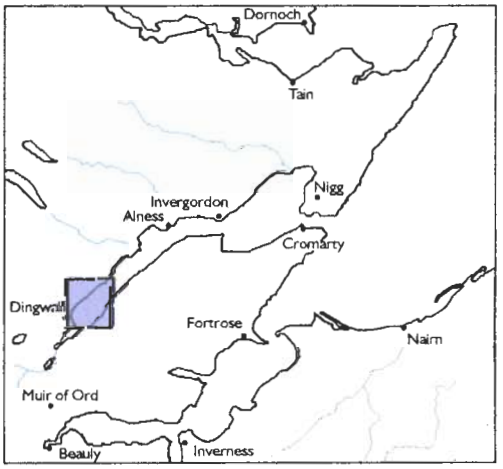
BUILT HERITAGE AND ARCHAEOLOGY

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
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 19: ARDULIE POINT TO BALCONIE POINT

Hinterland Geology and Coastal Geomorphology: Old Red Sandstone continues to underlie the drift deposits of mainly marine derived sand and gravel. Raised beach features continue eastwards along this unit of coastline. The narrower coastal plateau gives way to a broader expanse of marine modified landscape. Towards Balconie Point, freshwater alluvium has formed an outwash fan that is incised by river channels. The hinterland is low lying below 10m OD. Intertidal flats become much more extensive towards Alness Bay.

Erosion class: From Ardulie Point to Foulis Point conditions at the foreshore appear to be stable. The unit between Foulis Point to the west of Kiltearn Cottage is defended by rock armour and is stable. New gabion baskets have been placed at the cliff near Kiltearn Cottage and lend stability to the soft coastal edge. At NH 6232 6528 extensive rubble armouring has been dumped over derelict wooden sea defences but this material is being eroded by overtopping. Rabbits infest this soft shoreline and are exacerbating the problem. At Balconie Point the sea cliff is eroding and the softer merse deposits at the backshore are eroding due to wave hammer and overtopping on MHWS tides. Offshore conditions are stable with mud accreting on the tidal flats.

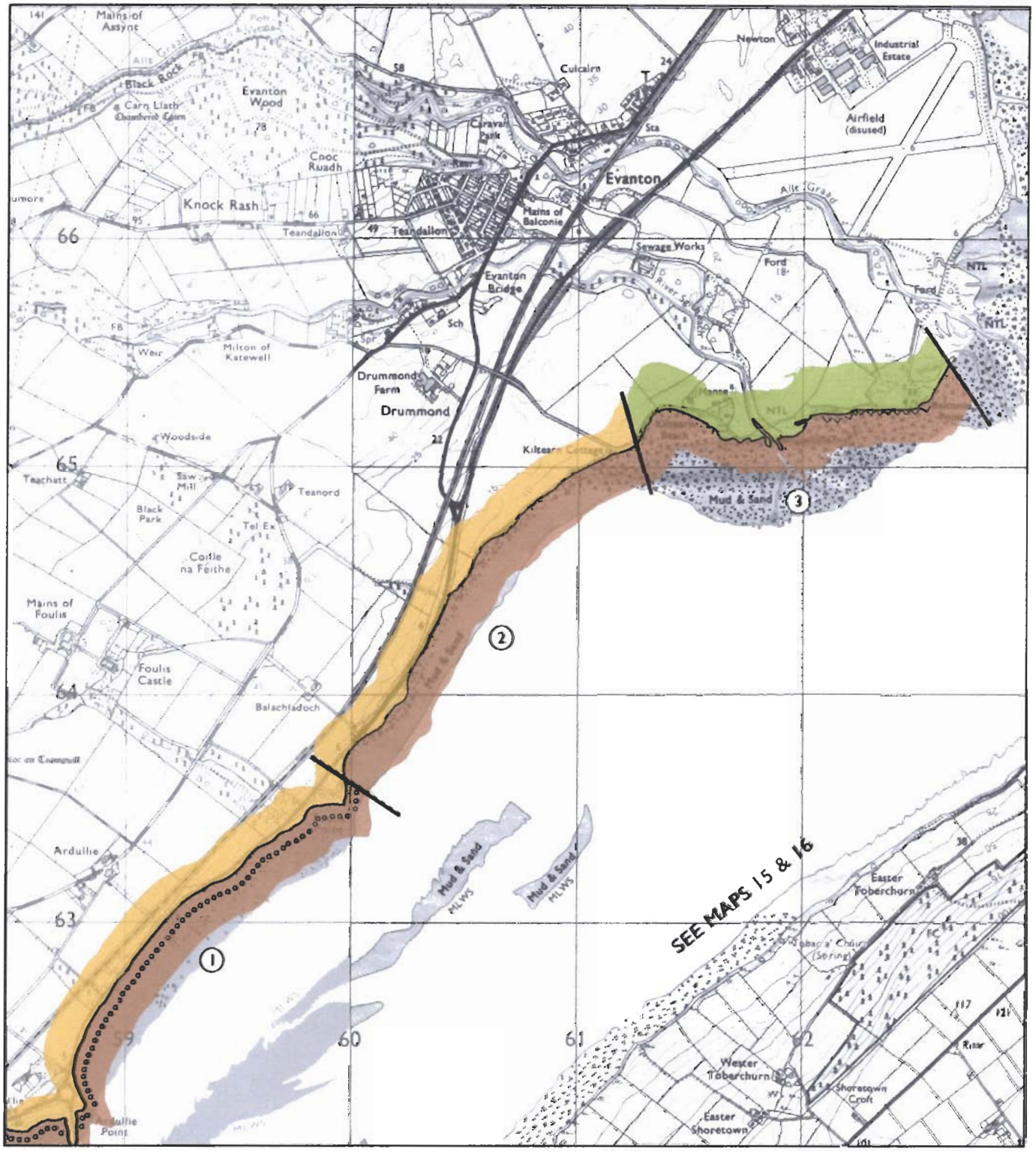
Built Heritage and Archaeology: The first site recorded on this area of the survey was the Cromarty road bridge. On the north east side of the bridge were two herring boat hulks that had been abandoned in the intertidal zone. Foulis Point was an important 18th and 19th century landing place and this was confirmed by the hulks on the north east shore of the point and the siting of a grain girnal, which has recently opened as a public heritage centre. The hinterland sites at Kiltearn indicate that the area was an important 18th and 19th century religious centre. Beneath a modern levee a wooden drainage trough was found associated with a small pond beneath the parish church. The fishing station on Balconie Point was built to represent a chapel.

Map 19: Hinterland Geology and Coastal Geomorphology

1. ARDULLIE POINT to FOULIS POINT
NH 592630
Mud, sand and shingle
1.9km
Low cliff (10m)
Raised beach deposits
Mud and shingle dominate the foreshore. Raised beach deposits cover the hinterland.

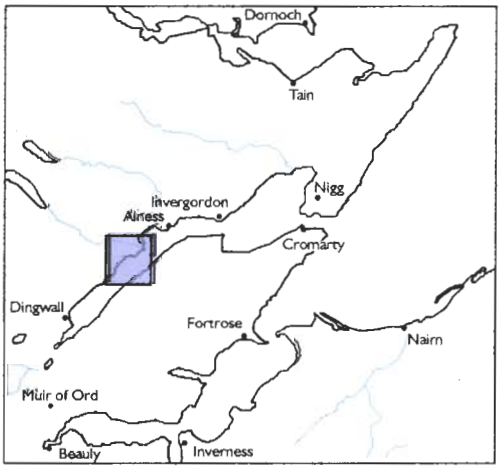
2. FOULIS POINT to KILTEARN COTTAGE
NH 605 645
Mud, sand and shingle
2.9km
Low cliff (10m)
Raised beach deposits
Irregular coastal edge with a foreshore of mud and shingle. The hinterland consists of raised beach deposits, which support pasture.

3. KILTEARN COTTAGE to BALCONIE POINT
NH 619 652
Mud and sand
1.5km
Low edge (10m)
Alluvium
Promontory at the head of two rivers. The hinterland consists of freshwater alluvium below 10m OD. The foreshore is mud and sand with boulders and shingle. River channels are visible at low water.



MAP 19: ARDULIE POINT TO BALCONIE POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 59-63/62-67



HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 15 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

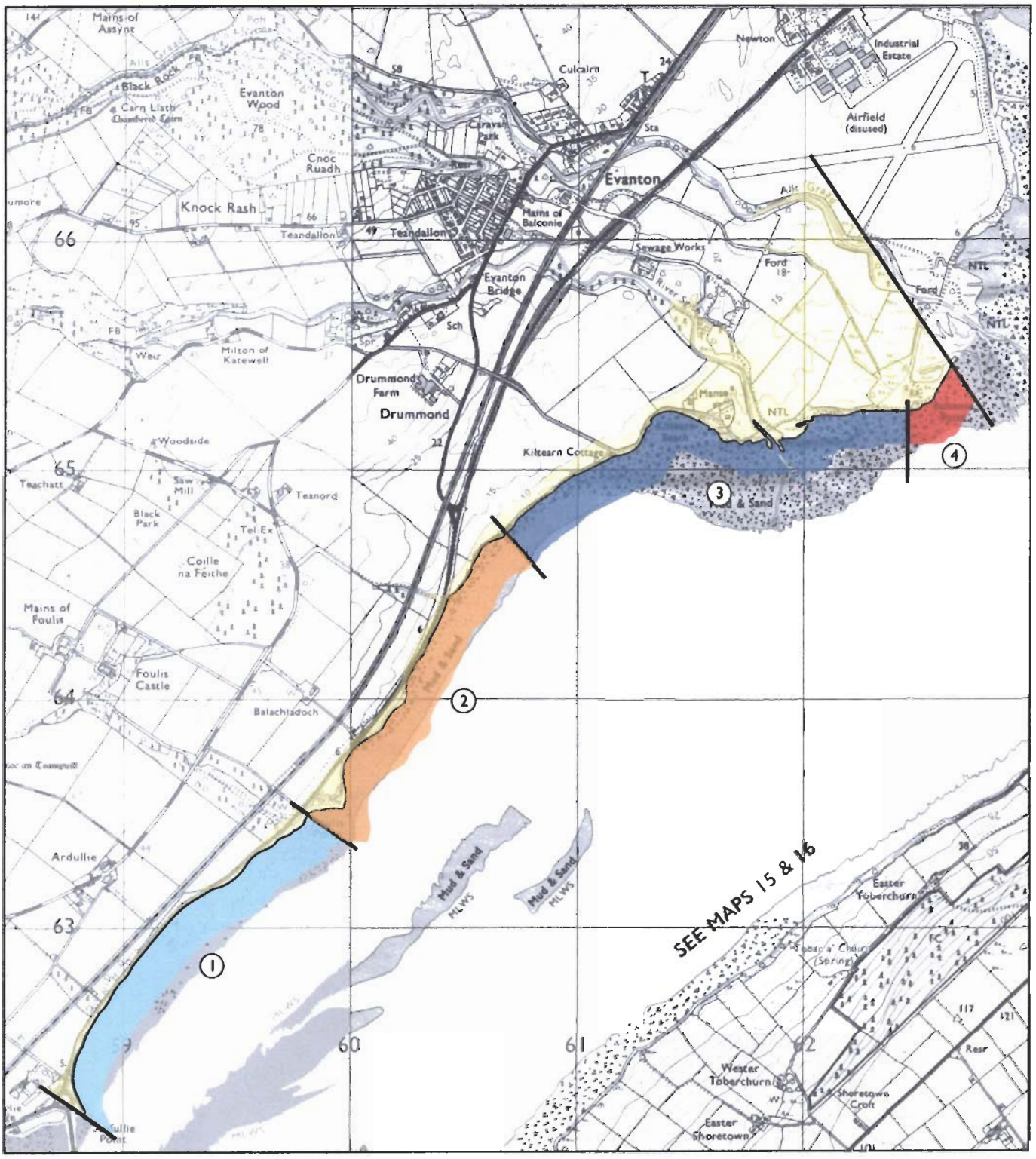
MAP 19: EROSION

1. ARDULIE POINT to FOULIS POINT
NH 592 630
1.6km
Accreting or stable
From Cromarty Bridge to Foulis Point the coastal protection continues as in the previous unit. The foreshore appears to be stable with occasional large boulders, cobbles and mud.

2. FOULIS POINT to south of KILTEARN COTTAGE
NH 655 644
1km
Stable or Eroding
This unit of coastline appears to be fairly stable with very localised patches of erosion on the foreshore where shingle is exposed and prone to displacement. Sea defences is lending stability to the backshore region.

3. South of KILTEARN COTTAGE to BALCARSE POINT
NH 620 650
1.9km
Definitely Accreting
New Gabion baskets have been placed along the shore west of Kiltearn church. Sediment loading is leading to accretion within the region of the river Sgitheach. Rubble dumping is extensive at NH 6232 6528 where the soft marine sand and gravel deposits are eroding by both overtopping and rabbit warrens. On the beach, conditions appear to be stable with mud and shingle accretion.

4. BALLONIE POINT
NH 626 653
0.2km
Definitely Eroding
The cliff is eroding in places and the softer merse deposits failing as a result of scouring at the low water mark. Rubble sea defence continues through this unit but their effectiveness appears to be poor.



MAP 19: ARDULIE POINT TO BALCONIE POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 59-63/62-67

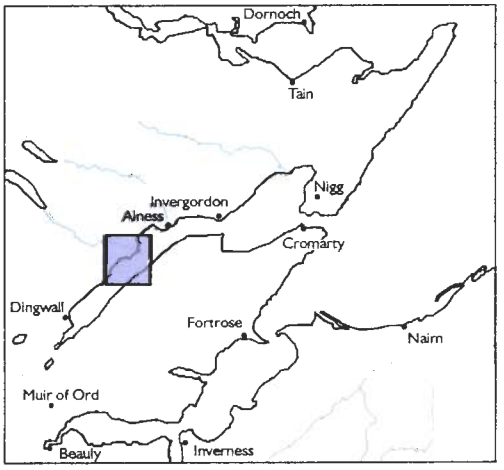
Basemap: O.S. *Pathfinder* Series
Sheets 143 & 144

EROSION CLASS

Assessment date: 15 September 1998

Key:

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



MAP 19: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH56SE 8550
NH 5895 6235
ARDULLIE POINT
Two abandoned herring boats
20th century AD
Poor
Survey and monitor

NH 5992 6335
FOULIS POINT
Fish trap
Uncertain
Poor
Survey

NH 5971 6340
FOULIS POINT
Stone pier
Uncertain
Poor
Monitor

NH56SE 25
NH 5998 6359
FOULIS POINT
Ferry; landing-place
18th/19th century AD
Good
Nil

NH 5998 6371
FOULIS POINT
Two hulks
Uncertain
Poor
Survey and monitor

NH 6025 6390
DRUMMOND
Stone alignments
Uncertain
Fair
Nil

Sites on the Coastal Edge & Foreshore

NH 6060 6470
DRUMMOND
Stone walling
Uncertain
Poor
Monitor

NH 612 650 - 616 650
KILTEARN BEACH
Fish trap
Uncertain
Poor
Survey

NH 6167 6518
KILTEARN
Wooden trough and associated pond
Uncertain
Poor
Survey and Monitor

NH 6232 6527
BALCONIE POINT
Fishing station (designed to look like a chapel)
Uncertain
Poor
Monitor

NH 6261 6529
KILTEARN BEACH
Fish trap
Uncertain
Poor
Survey

NH 6250 6552
BALCONIE POINT
Wall / levee
19th century AD
Fair
Nil

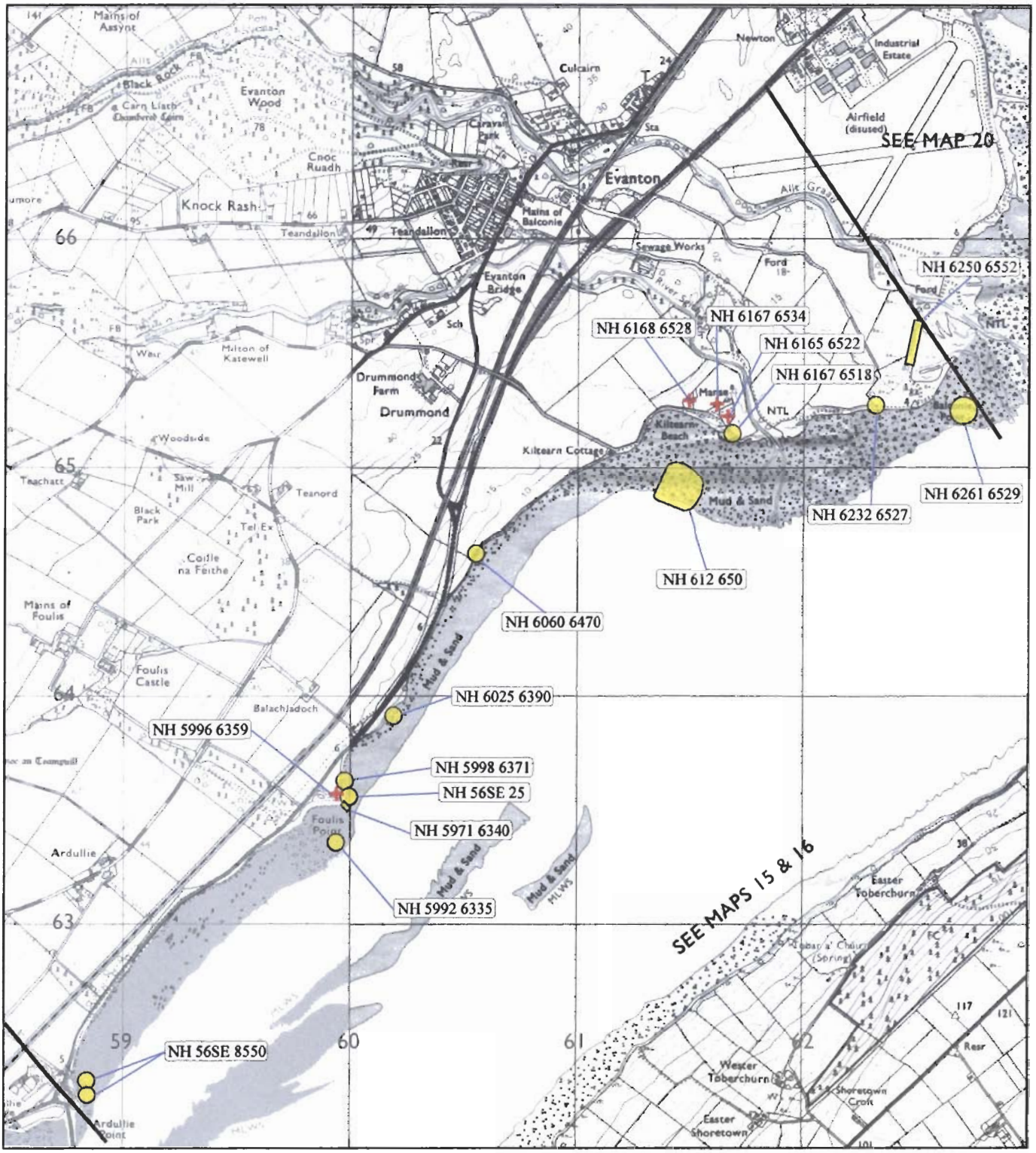
Sites in the Hinterland

NH56SE 19 - Listed C
NH 5996 6359
FOULIS POINT
Girnal
18th century AD
Good
Nil

NH66NW 1 - Listed B
NH 6165 6522
KILTEARN
Parish church
Built 1791
Poor
Monitor

NH66NW 48 - Listed B
NH 6168 6528
KILTEARN, Parish Manse
Steading
18th/19th century
Good
Nil

NH66NW 25 - Listed C (S)
NH 6167 6534
KILTEARN, Parish Manse
Barn
18th/19th century
Good
Nil



MAP 19: ARDULIE POINT TO BALCONIE POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 59-63/62-67

Basemap: O.S. *Pathfinder* Series
Sheets 143 & 144
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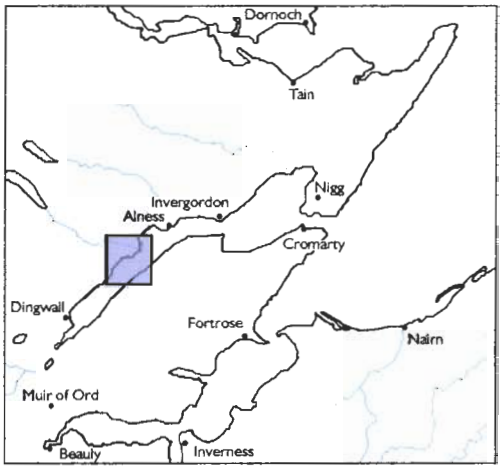
BUILT HERITAGE AND ARCHAEOLOGY

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 20: BALCONIE POINT TO ALNESS POINT

Hinterland Geology and Coastal Geomorphology: This stretch of coastline includes the Alness embayment which is sheltered behind a hinterland which is low-lying at below 10m OD. The basement geology is Old Red Sandstone overlain by raised beach sand and gravel.

Erosion class: The low-energy wave environment within the bay along with high sediment yields down the River Alness allows mud to accrete within the bay. Conditions along this unit of coastline are seen to be accreting with slight erosion noted in parts. Isolated patches of shingle showed evidence for scour on the foreshore.

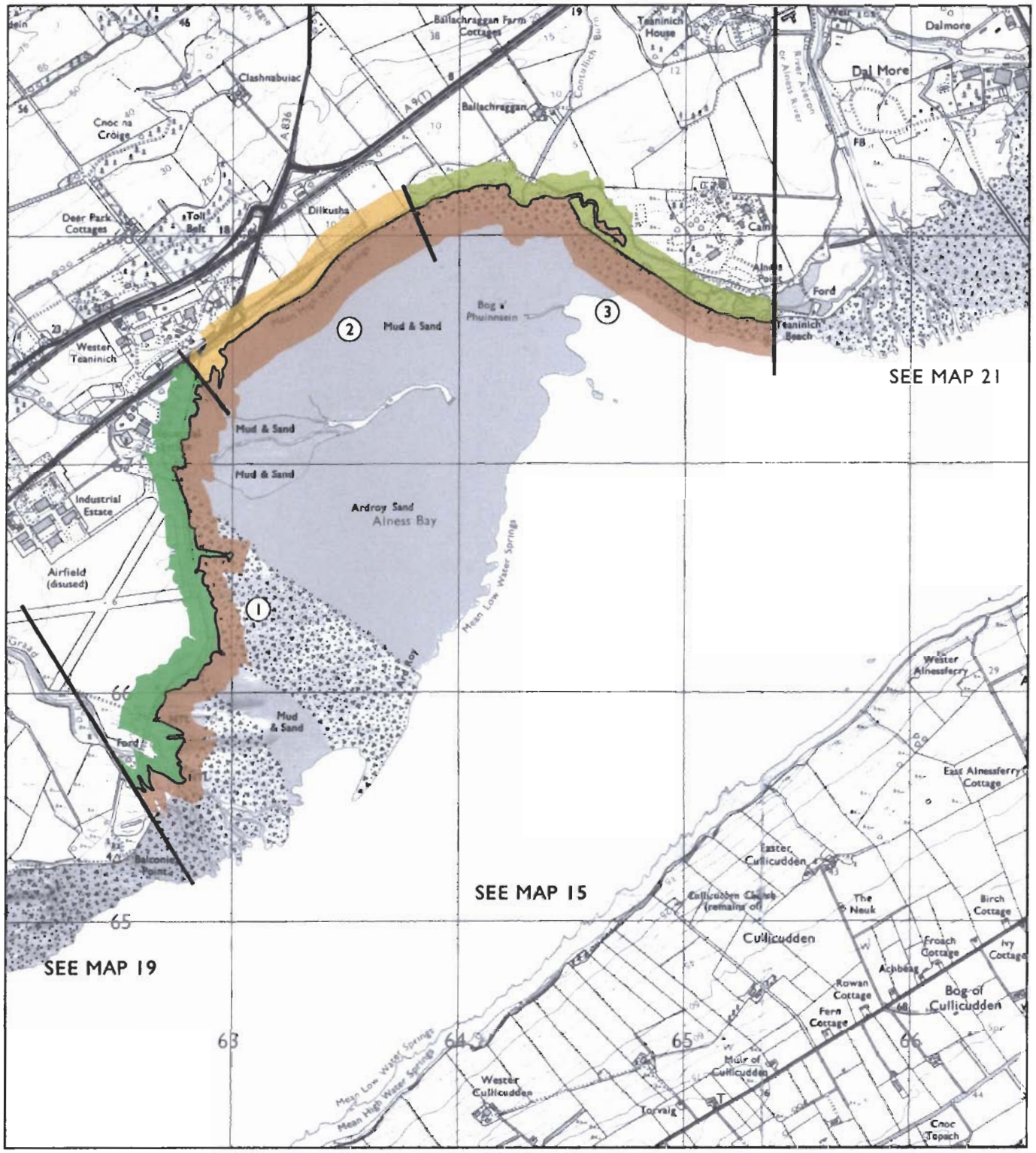
Built Heritage and Archaeology: One fish trap and a series of fish trap mounds were recorded in this area of the survey. There were also stone piers and the modern pier at Evanton airfield, which is used for coiling steel cable for the oil industry. On the hinterland of the area the archaeological remains included the military complex of the Evanton airfield and associated buildings, such as the pillboxes and aircraft hangers.

Map 20: Hinterland Geology and Coastal Geomorphology

1. BALCONIE POINT to WESTER TEANININCH
NH 627
1.8km
Mud and sand/tidal flats
Low edge (5m)
Alluvium
Irregular coastal edge consisting of incised saltmarsh. This overlooks a foreshore dominated by mud and shingle.

2. WESTER TEANININCH to south of BALLACHRAGGAN
NH 634 679
1km
Mud and sand/tidal flats
Low edge (10m)
Marine deposits
Head of Alness Bay, linear stretch of estuarine coast backed by marine sands and gravel. The foreshore is consists of mud and sand.

3. South of BALLACHRAGGAN to ALNESS POINT
NH646 680
1.9km
Mud/shingle
Low edge (<10m)
Raised beach and marine deposits
Small embayment with developing saltmarsh intersected by numerous drainage channels. The hinterland is low lying. The foreshore consists of mud and sand exposed over a wide area at low tide.



MAP 20: BALCONIE POINT TO ALNESS POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 62-66/64-69

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

HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 16 September 1998

Hinterland:

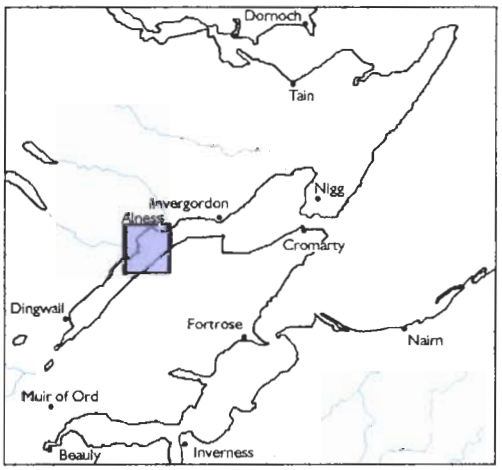
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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

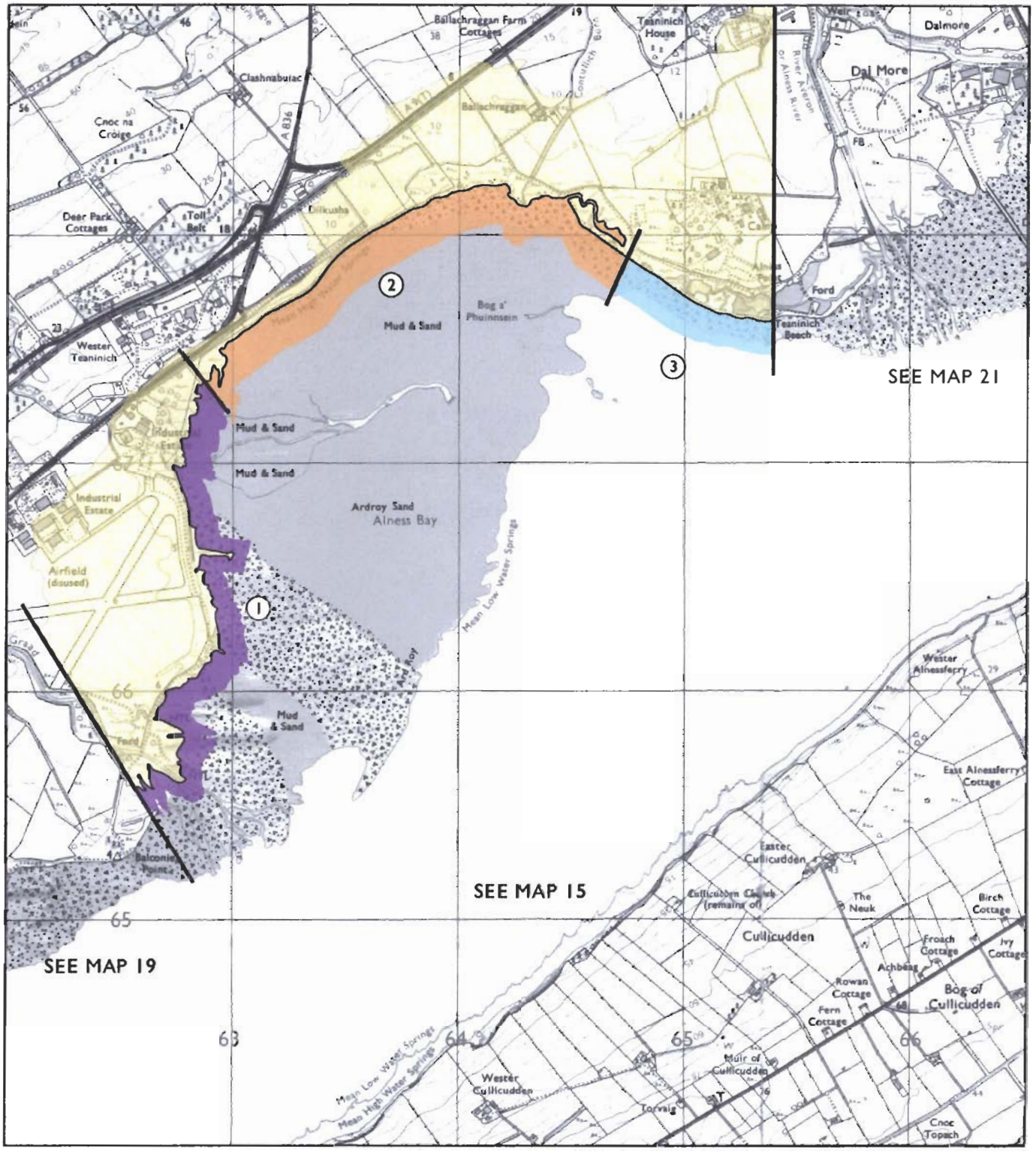


MAP 20: EROSION

1. BALCONIE POINT to WESTER TEANINCH
NH 630 660
1.8km
Accreting and eroding
Mud and sand has accreted at the MHWMS with salt marsh prone to erosion at the backshore. Mud and shingle are exposed at low water; here shifting river channels are leading to both accretion and some erosion.

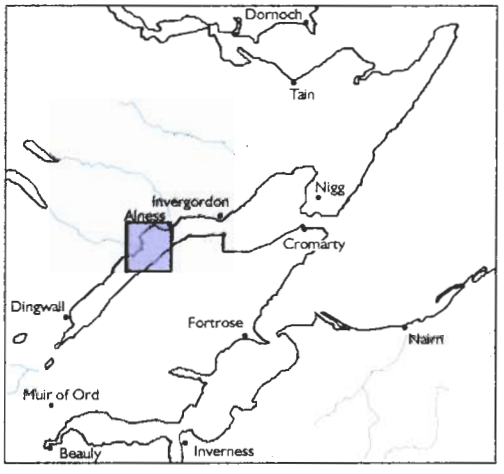
2. WESTER TEANINCH to west of TEANINCH BEACH
NH 635 680
1.8km
Eroding or stable
Scouring and sediment displacement is ongoing within Alness bay. The sheltered aspect of the bay favours sediment accumulation. Eroding parts may be delimited where channels are slowly migrating.

3. South of BALLACHRACHRAGGAN to TEANINICH BEACH
NH 650 677
0.7
Accreting or stable
Estuarine sediment is accreting at MHWS mark with shingle and merse colonised by saltmarsh. There is no indication to suggest that conditions here are not stable.



MAP 20: BALCONIE POINT TO ALNESS POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 62-66/64-69



EROSION CLASS

Assessment date: 16 September 1998

Key:

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

MAP 20: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 6288 6571
EVANTON AIRFIELD
Fish trap stone mounds
Uncertain
Poor
Survey

NH 6292 6619
EVANTON AIRFIELD
Two linear stone quays
20th century AD
Fair
Nil

NH 6295 6628
EVANTON AIRFIELD
Industrial pier
20th century AD
Good
Nil

NH 6295 6662
EVANTON AIRFIELD
Stone pier
Uncertain
Fair
Nil

NH 6395 6810
BALLACHRAGGAN
Possible fish trap
Uncertain
Poor
Survey

NH 6517 6763
ALNESS POINT
Ruined building
Uncertain
Poor
Monitor

NH 6537 6752
TEANINICH BEACH
Pier
Uncertain
Fair
Monitor

Sites in the Hinterland

NH66NW 34.00
NH 625 665 centre
EVANTON AIRFIELD
Airfield; Novar camp
20th century AD; WWII
Fair
Nil

NH66NW 34.07
NH 6279 6683
EVANTON AIRFIELD
Pillbox
20th century AD; WWII
Fair
Nil

NH66NW 34.08
NH 6283 6655
EVANTON AIRFIELD
Pillbox
20th century AD; WWII
Fair
Nil

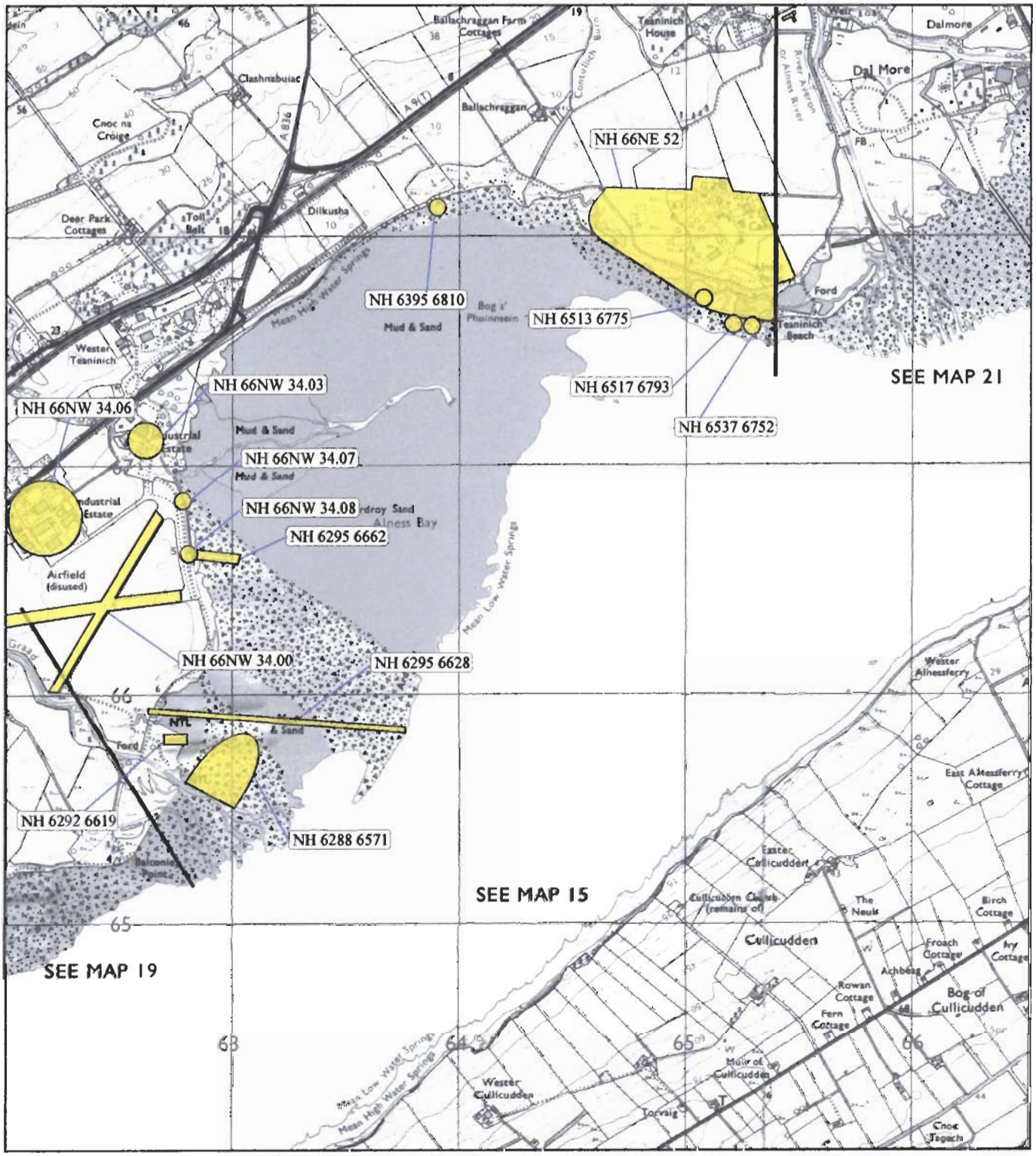
NH66NW 34.06
NH 6261 6708 centre
EVANTON AIRFIELD
Aircraft hangars; buildings; huts
20th century AD; WWII
Good
Nil

NH66NW 34.03
NH 6263 6755 centre
EVANTON AIRFIELD
Aircraft hangars; buildings; huts
20th century AD; WWII
Good
Nil

Sites in the Hinterland

NH 6568 6815
ALNESS POINT
Icehouse
19th/20th century AD
Good
Nil

NH 6624 6823
ALNESS POINT
Military camp, WWII
20th century AD
Fair
Nil



MAP 20: BALCONIE POINT TO ALNESS POINT 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 62-66/64-69

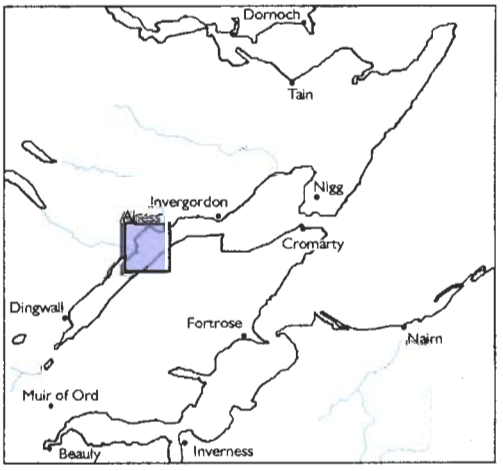
Basemap: O.S. *Pathfinder* Series Sheet 144

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 21: ALNESS POINT TO INVERGORDON

Hinterland Geology and Coastal Geomorphology: Old Red Sandstone forms the basement geology. Drift lithologies along this unit of coastline are mainly derived from marine deposits and freshwater alluvium. Freshwater alluvium derived from the River Alness has formed an extensive alluvial tail that extends out into the Cromarty Firth. Eighteenth and nineteenth century reclamation is also a factor in its development. Three marine incursions are represented by the positions of raised beach terraces that converge within the hinterland. Further inland morainic drift dominates the cover soil. The land behind Alness Point and along to Invergordon is low-lying at below 10m OD (NH 684 695). Invergordon is heavily developed and the foreshore is armoured and greatly modified.

Erosion class: Saltmarsh lends stability to the low coastal edge south of Dalmore (NH 660 680). Conditions on the foreshore along this unit of coast are stable or accreting. At Belle Port the shore is heavily armoured to defend the B817 trunk road. Mud is accreting against the concrete seawalls that protect the industrial installations of Invergordon.

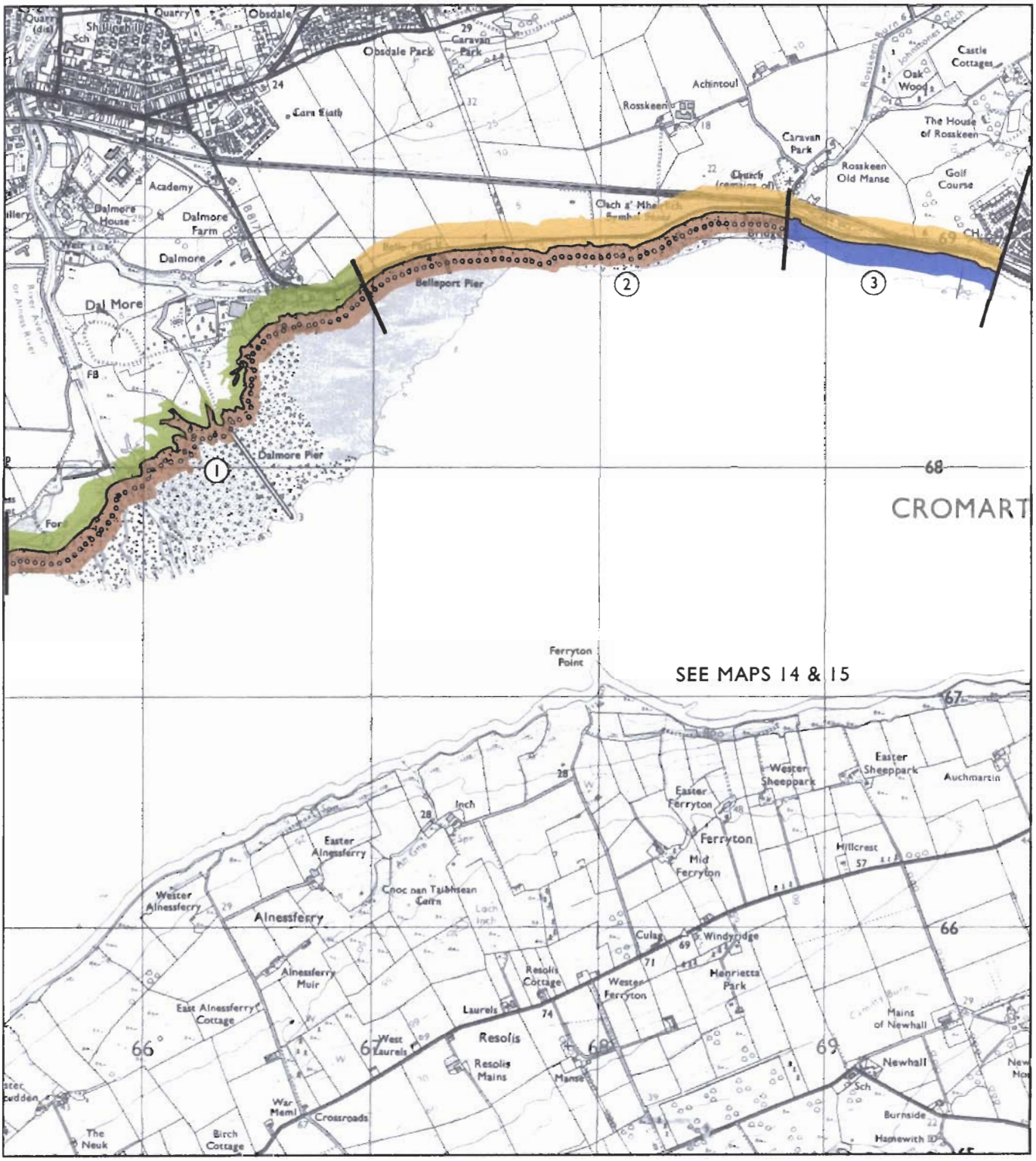
Built Heritage and Archaeology: The sites in this area are very diverse in both age and condition. The built heritage on the coastal hinterland ranges from the well preserved 17th century girnal and later icehouse at Alness Point to the limited remains of the RAF seaplane base to the west. Around Dalmore the forshore remains include timber pier posts, fish trap mounds and fish trap stone alignments. The Pictish Class I symbol stone at Rosskeen appears to be affected by coastal weather systems, especially westerlies which have eroded the side of the stone facing the shoreline. The railway bridges at Rosskeen are good examples of different bridge designs.

Map 21: Hinterland Geology and Coastal Geomorphology

1. ALNESS POINT to near BELLPORT PIER
NH 660 680
1.9km
Saltmarsh/mud and shingle
Low edge (<10m)
Alluvium (freshwater)
Deeply incised stretch of saltmarsh fronted by a foreshore dominated by mud and shingle. The hinterland consists of alluvial deposits in the form of an alluvial fan formed at the head of the Alness River.

2. BELLPORT PIER to ROSKEEN BRIDGE
NH 680 690
1.9km
Estuarine mud and shingle
Low edge (<10m)
Raised beach and marine deposits
The hinterland consists of raised beach and marine deposits and is low lying. The foreshore is narrower at this point and consists of mud and shingle.

3. ROSKEEN BRIDGE to INVERGORDON PIER
NH 680 690
1.9km
Estuarine mud, sand and shingle
Low edge (10m)
Raised beach and marine deposits
The hinterland consists of raised beach and marine deposits and has been heavily modified by industrial development. The foreshore is narrow and consists of mud and shingle



MAP 21: ALNESS POINT TO INVERGORDON

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 66-69/65-70

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

Assessment date: 16 September 1998

Hinterland:

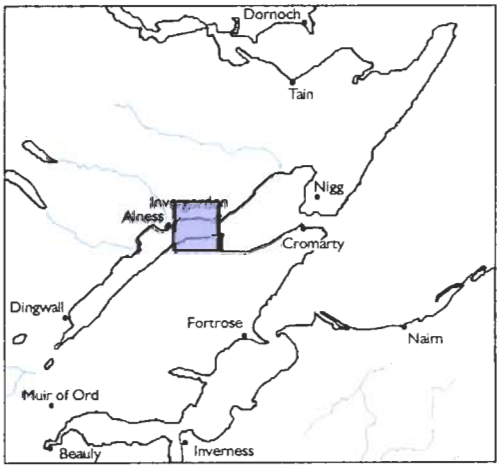
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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



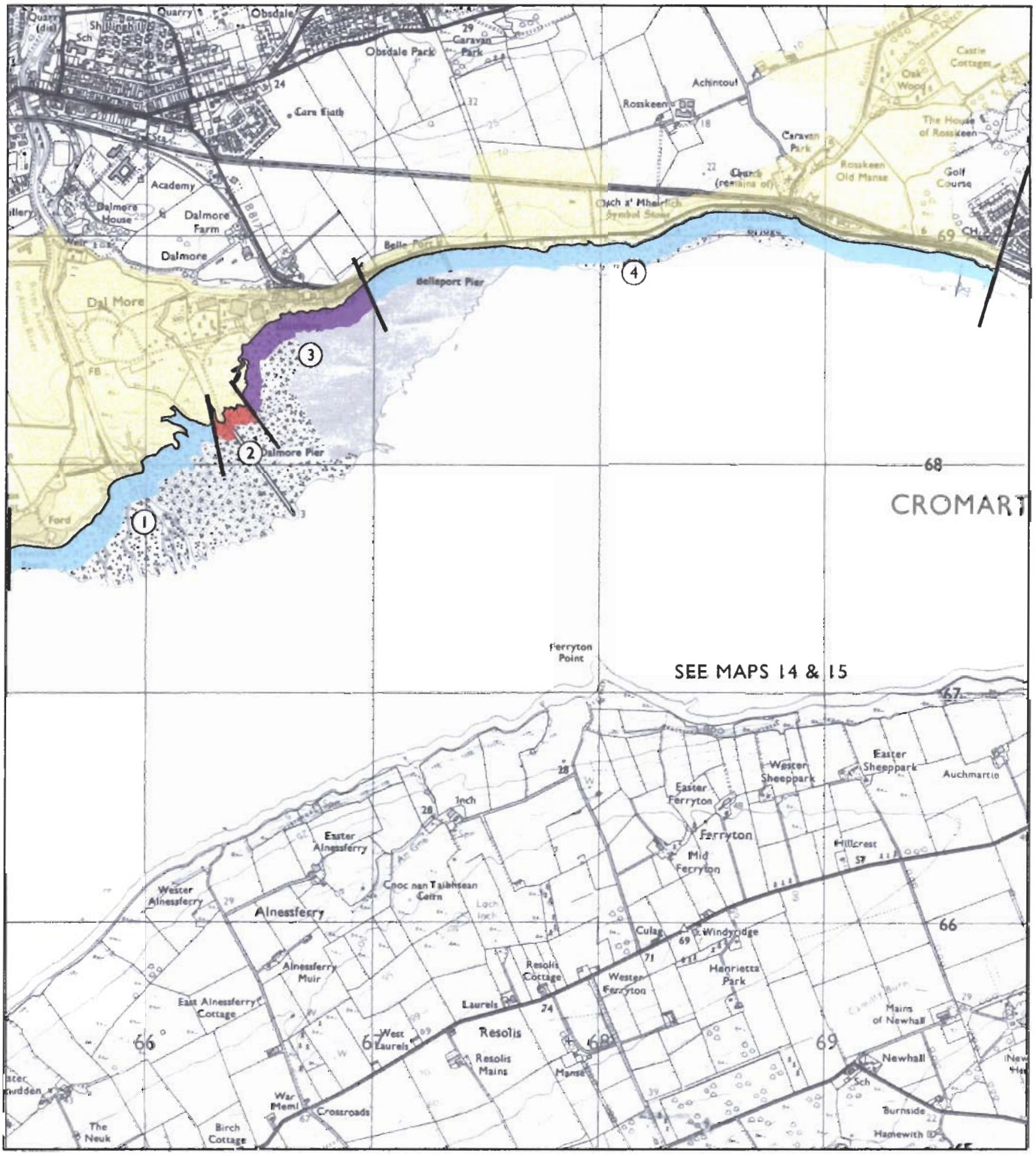
MAP 21: EROSION

1. TEANINICH BEACH to DALMORE PIER
NH 660 679
1km
Accreting or stable
Sediment loading and re-deposition is occurring at the mouth of the River Alness. Accreting mud forms low banks at around the MHWM down to LWMS. Conditions appear to be stable.

2. DLAMORE PIER
NH 664 680
0.2km
Definitely Eroding
Rubble from attempts to stabilise erosion of the pier is being scoured by wave action. Some accretion is occurring against other parts of the pier base.

3. DALMORE PIER to east of BELLE PORT PIER
NH 665 686
0.7km
Accreting or eroding
Accreting estuary mud and shingle is ongoing in front of the distillery sea wall. Erosion confined to scouring around pier base. Mud and shingle is accreting down to the LWM.

4. East of BELLE PORT to INVERGORDON
NH 676 689
2.8km
Accreting or stable
The foreshore appears to be stable with accreting mud. At Belle Port pier the shore is heavily armoured to defend the B817 trunk road.



MAP 21: ALNESS POINT TO INVERGORDON 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 66-69/65-70

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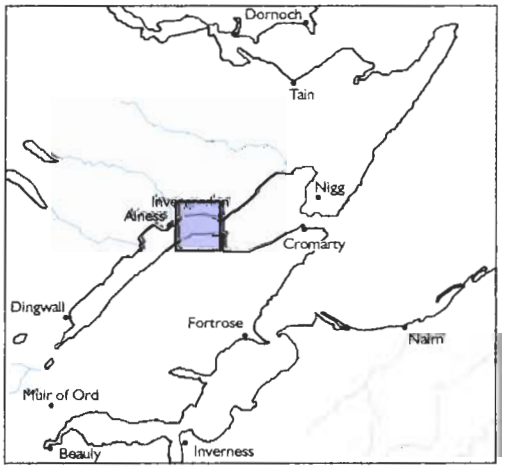
EROSION CLASS

Assessment date: 16 September 1998

Key:

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



MAP 21: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH66NE 50
NH 662 678 area
ALNESS POINT
Fishing cairns
19th-20th century AD
Poor
Survey

NH66NE 36
NH 6636 6819
DALMORE
Alness pier and harbour
19th century AD
Good
Nil

NH6645 6820
DALMORE PIER
Fish trap mound
Uncertain
Poor
Survey

NH 6688 6874
DALMORE
Timber pier posts
Uncertain
Poor
Monitor

NH 6695 6878
DALMORE
Fish trap
Uncertain
Poor
Survey

NH 6698 6878
DALMORE
Fish trap
Uncertain
Poor
Survey

Sites on the Coastal Edge & Foreshore

NH 6729 6892
BELLEPORT
Possible fish trap
Uncertain
Poor
Survey

NH66NE 30 - Listed C
NH 6732 6889
BELLEPORT
Jetty / pier
19th/20th century AD
Fair
Monitor

NH 6765 6885
BELLEPORT
Possible fish trap mound
Uncertain
Poor
Survey

Sites in the Hinterland
NH 6513 6775
ALNESS POINT
Ruined building
19th century AD or earlier
Poor
Monitor

NH66NE 52
NH 6515 6794
ALNESS POINT
Royal Air Force seaplane base (site of)
20th century AD; WWII
Fair
Nil

NH66NE 24 - Listed B
NH 6560 6794
ALNESS POINT
Girnal
17th/18th century AD
Good
Nil

Sites in the Hinterland

NH66NE 23
NH 6658 6870
DALMORE
Distillery
19th/20th century AD
Good
Nil

NH66NE 88 -Grade C
NH 6728 6896
BELLEPORT HOUSE
Residential house
19th century AD
Good
Nil

NH66NE 89
NH 6787 6915
ROSSKEEN
Anti-aircraft battery (site of)
20th century AD; WWII
Poor
Nil

NH66NE 12 - Scheduled
NH 6810 6902
ROSSKEEN, CLACH A' MHEIRLICH
Pictish Class I symbol stone
7th/8th/9th century AD
Fair
Monitor

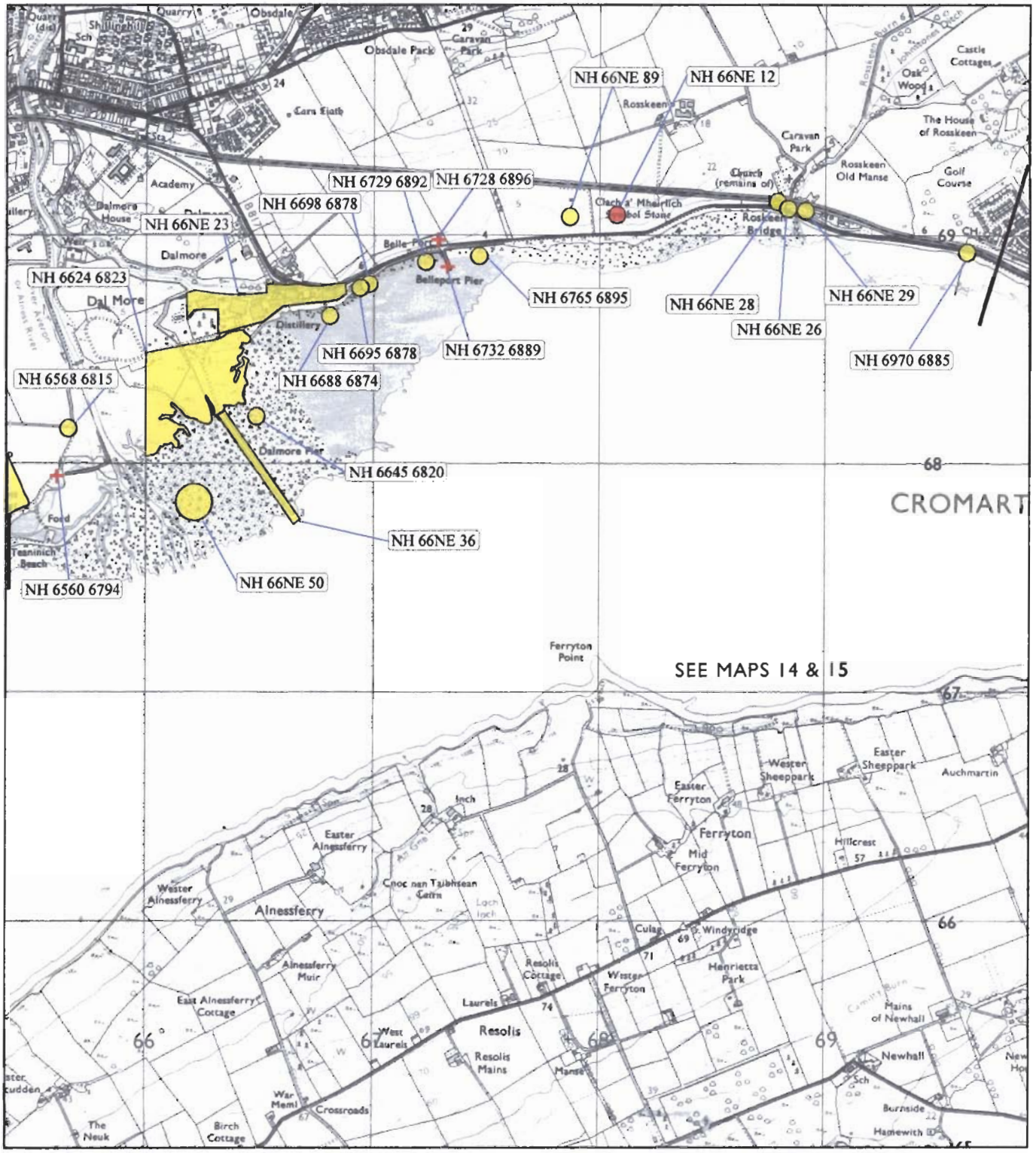
Sites in the Hinterland

NH66NE 28
NH 6886 6914
ROSSKEEN
Railway bridge
19th/20th century AD
Good
Nil

NH66NE 26
NH 6886 6915
ROSSKEEN
Railway bridge
19th/20th century AD
Good
Nil

NH66NE 29
NH 6893 6913
ROSSKEEN
Railway bridge, ornamental
19th/20th century AD
Good
Nil

NH 6970 6885
INVERGORDON
Military pillbox
20th century AD, WW II
Good
Nil



MAP 21: ALNESS POINT TO INVERGORDON

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 66-69/65-70

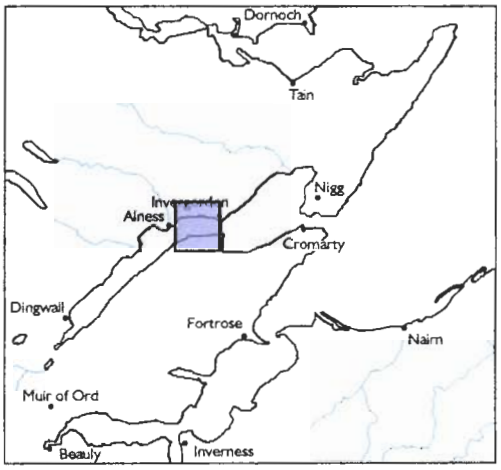
Basemap: O.S. *Pathfinder* Series Sheet 144

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 22: INVERGORDON TO BARBRAVILLE

Hinterland Geology and Coastal Geomorphology: Old Red Sandstone forms the basement geology. The drift component within this unit is derived from marine incursions with sand and gravel forming three distinct regions of fossil shoreline. The terraces are discontinuous overlying patches of glacial deposits in the region of Invergordon harbour. The raised beach escarpments are mapped for up to 2.5km and run parallel with the present shoreline.

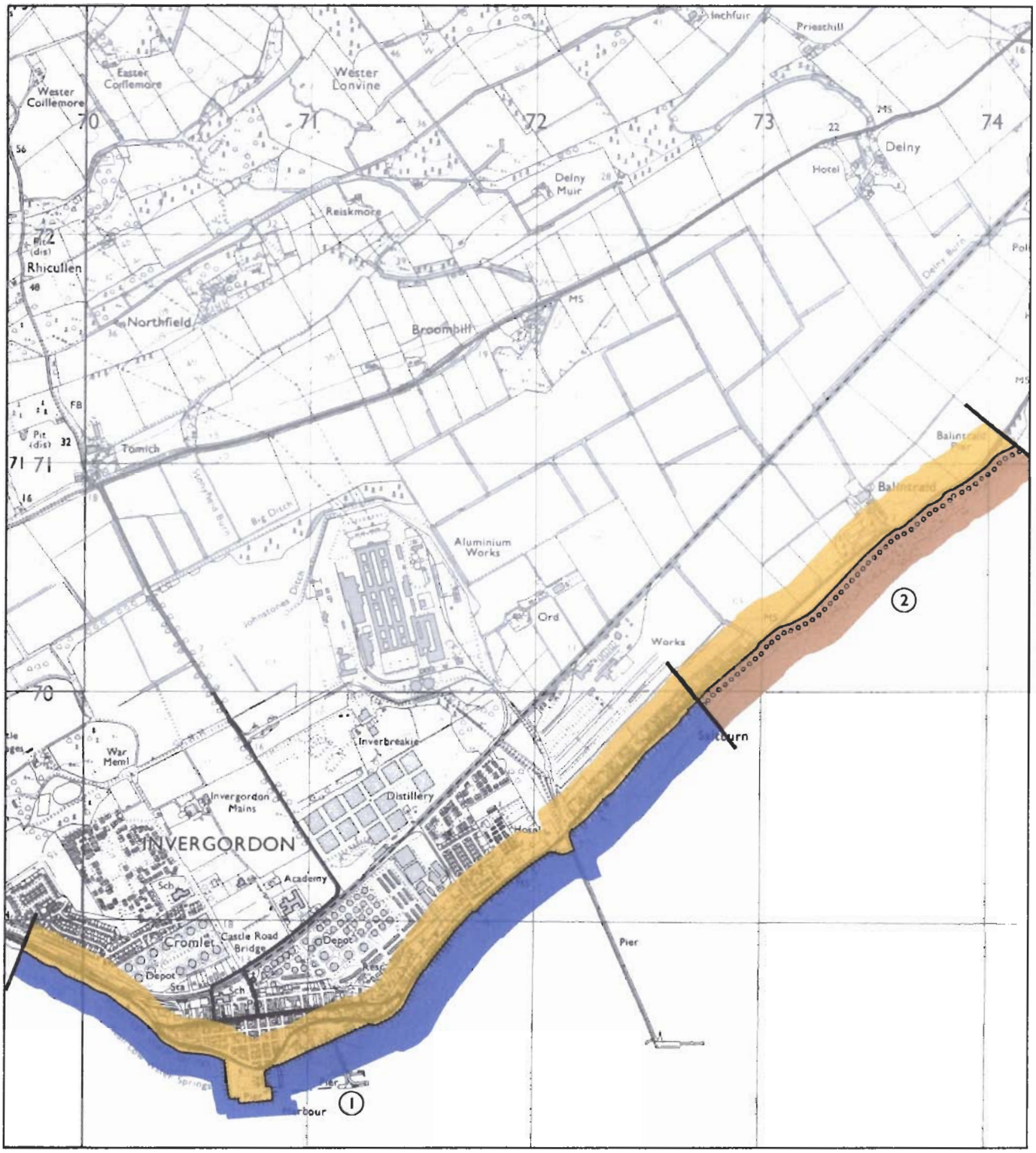
Erosion class: A concrete promenade with fronting rock armour protects most of this coastal unit. In front, mud is accreting. The intertidal area is mainly mud and shingle and at the time of the survey there was no indicators of active erosion.

Built Heritage and Archaeology: The built heritage in this area is mainly the various sites in Invergordon town. These include the warehouses, girnal and residential housing along the coastal hinterland strip. On the foreshore the sites include the harbour, Naval dockyard and the ferry pier designed by Telford. Further to the east Saltburn is a good example of a late 19th century planned linear village.
Balintraid pier, designed by Telford, appears to be in a poor state of repair. Further fish trap mounds were recorded below HWM to the east of the pier

Map 22: Hinterland Geology and Coastal Geomorphology

1. INVERGORDON to SALTBURN
NH 714 686
3.7
Mainly sand
Low edge (<10m)
Raised beach and marine deposits
Industrially modified hinterland. The underlying geology is marine deposits. The foreshore consists of mainly sand

2. SALTBURN to BALINTRAID PEIR
NH 733 750
1.8km
Estuarine mud, sand and shingle
Low edge (<10m)
Raised beach and marine deposits
The hinterland consists of raised beach deposits behind a linear coastal edge. The foreshore consists of a mud and shingle on tidal flats.



MAP 22: INVERGORDON TO BALINTRAID

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 70-74/68-73

Basemap: O.S. *Pathfinder* Series
Sheets 133 & 144
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 17 September 1998

Hinterland:

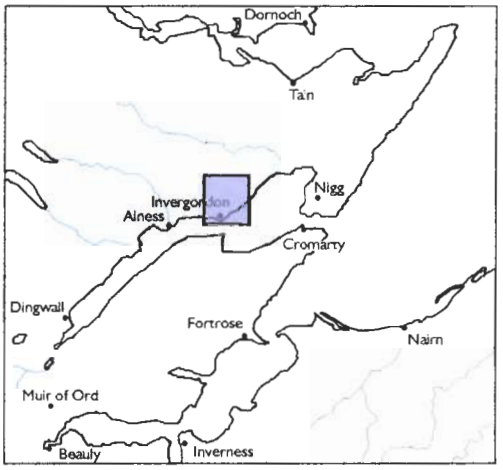
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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

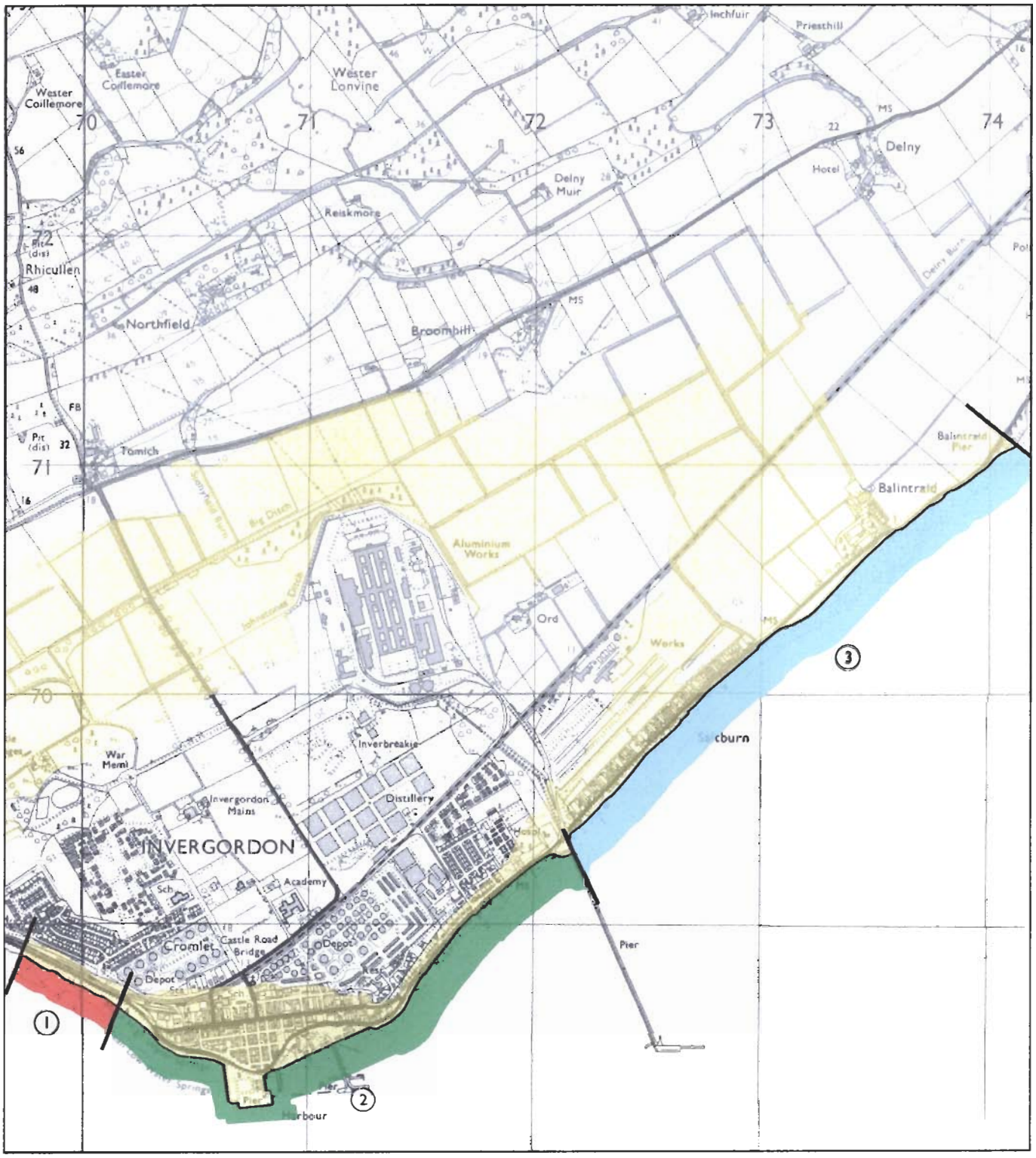


MAP 22: EROSION

1. INVERGORDON
NH 270 686
0.5km
Definitely eroding
This unit is defended by quarried rubble. Local erosion is occurring where the base of the rubble is scoured by wave action. The foreshore comprises mud and shingle that appears to be stable.

2. INVERGORDON to INVERGORDON PIER
NH 710 684
2.4km
Stable
Sea defences are at the present lending stability to this unit of coastline that is heavily developed by oil and fabrication installations. Mud flats are accreting along the foreshore.

3. SALTBURN PIER to BARBRAVILLE
NH 740 710
2.5km
Accreting or stable
Saltburn town is defended by a concrete promenade fronted by quarry stone and there no indication of erosion. The beach is mainly sand and appears to be stable. At Pollo House region the shore is protected by natural outcropping sandstone.



MAP 22: INVERGORDON TO BALINTRAID

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 70-74/68-73

Basemap: O.S. *Pathfinder* Series
Sheets 133 & 144
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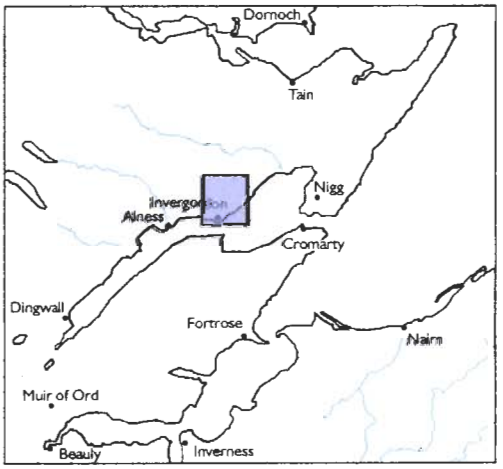


EROSION CLASS

Assessment date: 17 September 1998

Key:

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

MAP 22: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH77SW 11 - Listed C
NH 7415 7106
BALINTRAID PIER
Pier designed by Telford
19th century AD; 1803-21
Poor
Monitor

NH 7425 7115
BALINTRAID PIER
Fish trap mounds
Uncertain
Fair
Survey

NH 7028 6843
INVERGORDON
Fish traps
Uncertain
Poor
Survey

NH76NW 21
NH 7086 6832
INVERGORDON
Harbour
18th/19th century AD
Good
Nil

NH76NW 64
NH 7102 6848
INVERGORDON
Naval dockyard
20th century AD
Good
Nil

Sites on the Coastal Edge & Foreshore

NH76NW 23
NH 7101 6841
INVERGORDON, Ferry Pier
Pier designed by Telford
19th century AD; 1803-21
Good
Nil

NH 7151 6876
INVERGORDON
Timber jetty posts
Uncertain
Poor
Monitor

NH 7177 6902
INVERGORDON
Slipway
20th century AD
Good
Nil

NH 7300 7021
SALTBURN
Concrete breakwater and pipe
20th century AD
Poor
Nil

NH 7442 7158
POLLO HOUSE
Fish trap mound
Uncertain
Good
Survey

Sites in the Hinterland

NH76NW 22
NH 7079 6836
INVERGORDON, 37 Shore Rd
Warehouse
18th/19th century AD
Good
Nil

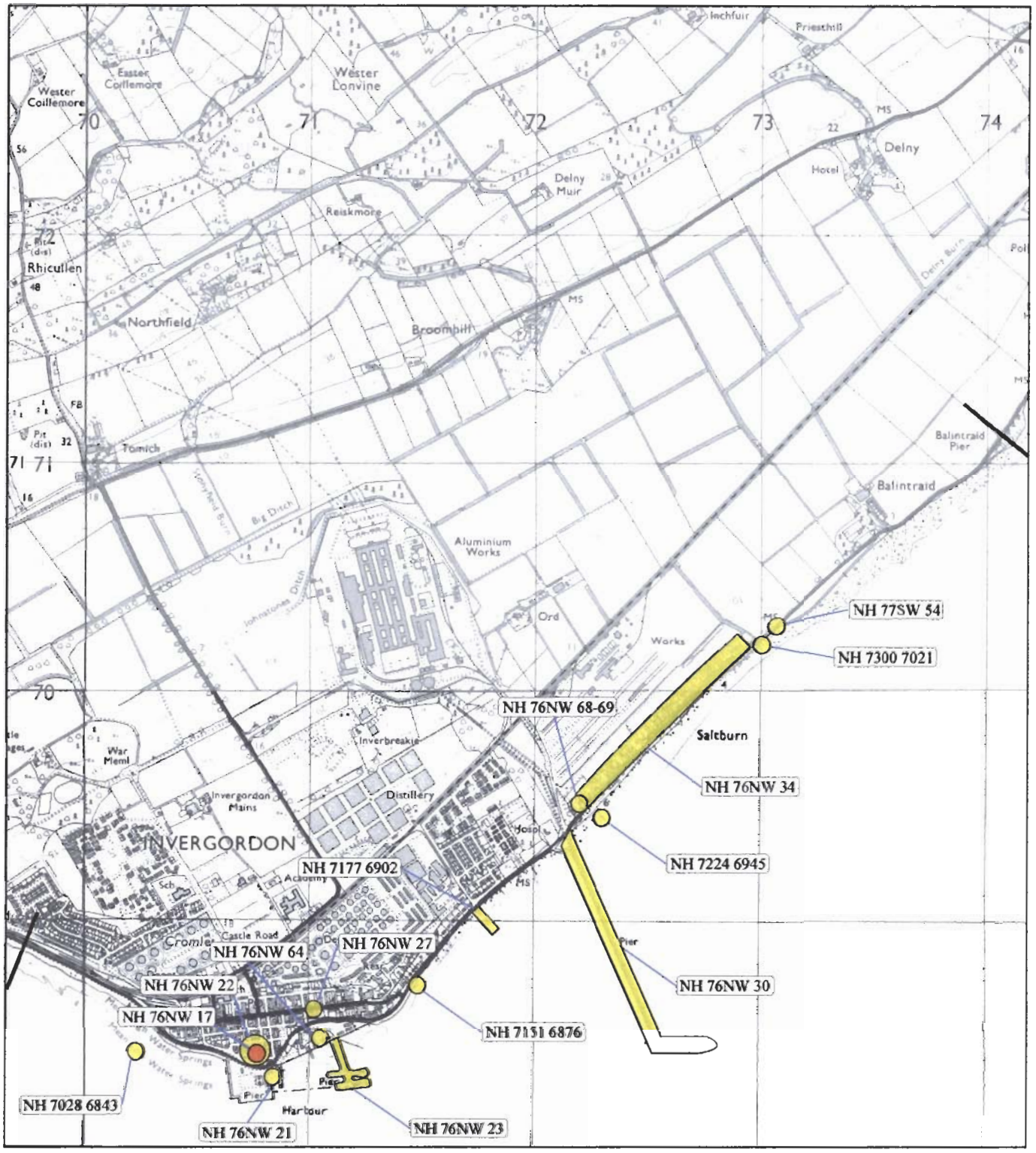
NH76NW 17 - Listed B
NH 7096 6849
INVERGORDON, Shore Rd
Girnal or storehouse
17th/18th century AD
Good
Nil

NH76NW 27
NH 7101 6856
INVERGORDON, High St
Warehouse
18th/19th century AD
Good
Nil

NH76NW 68-69
NH 7220 6948
SALTBURN
Residential buildings
19th century AD
Good
Nil

NH76NW 34
NH 7255 6983 centre
SALTBURN
Village
19th century AD
Good
Nil

NH77SW 54
NH 7305 7037
SALTBURN
Anti-aircraft battery (site of)
20th century AD; WWII
Poor
Monitor



MAP 22: INVERGORDON TO BALINTRAID

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 70-74/68-73

Basemap: O.S. *Pathfinder* Series
Sheets 133 & 144
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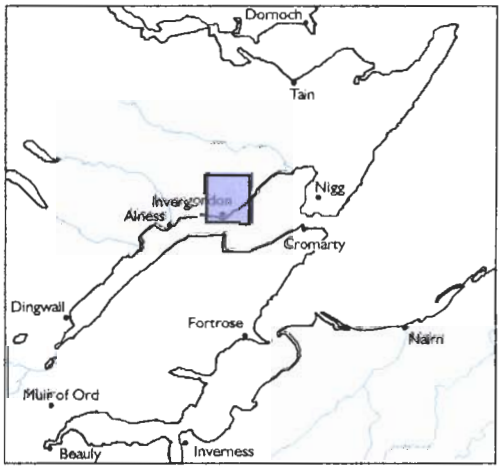
BUILT HERITAGE AND ARCHAEOLOGY

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 23: BARBRAVILLE TO EAST OF MILTOWN CASTLE

Hinterland Geology and Coastal Geomorphology: This unit of coastline forms the sheltered head of Nigg Bay and is underlain by Upper Old Red Sandstone. The drift cover in this area is dominated by marine deposits. Raised beach deposits are extensive forming a series of sinuous degraded cliff-lines that converge into a single cliff towards Tarbat House. A plateau below 10m OD has been formed. Development in the area is low.

Erosion class: Nigg Bay has extensive intertidal flats that are exposed for about 3km. The bay is sheltered according to the low-energy wave environment promoted by the position of the North Sutor cliffs which defuses the impact of wave swell from gales emanating from the NE quadrant. The backshore is predominantly banked shingle leading down to the mudflats. Gabion baskets protect the shoreline east of Milton Castle. Erosion at the base of the merse was noted, this is due to overtopping in adverse conditions.

Built Heritage and Archaeology: The foreshore archaeology in the south west of this area contains many examples of linear and mound type fish traps. Towards the east the foreshore sites include a target stance situated in the intertidal zone and a maritime wreck of unknown age or type. The hinterland built heritage includes the 18th century Barbaraville watermill, now a well maintained residential property and other 18th and 19th century houses in the Barbaraville village.

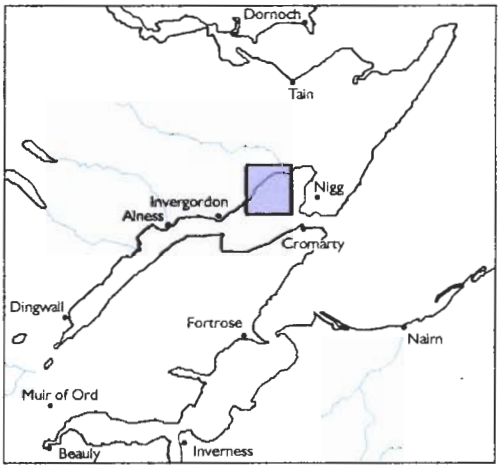
Map 23: Hinterland Geology and Coastal Geomorphology

1. South POLLO FARM to south of MILNTOWN CASTLE
NH 760 728
4km
Estuarine mud, sand and shingle
Low edge (<10m)
Raised beach and marine deposits
Unbroken stretch of coastline consisting of mud flats. The hinterland contains raised beach deposits of sand and gravel.

2. South of MILNTOWN to south of CAMPACK BURN
NH 780 733
2.7km
Estuarine mud/saltmarsh
Low edge (10m)
Raised beach and marine deposits
Upper reaches of Nigg Bay consisting of a coastal edge colonised by saltmarsh. The hinterland is defended by flood banks and is low lying. The basal deposits consist of marine derived sand and gravel.

MAP 23: BALINTRAD TO MILTOWN CASTLE 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 76-80/70-75



HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 17 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

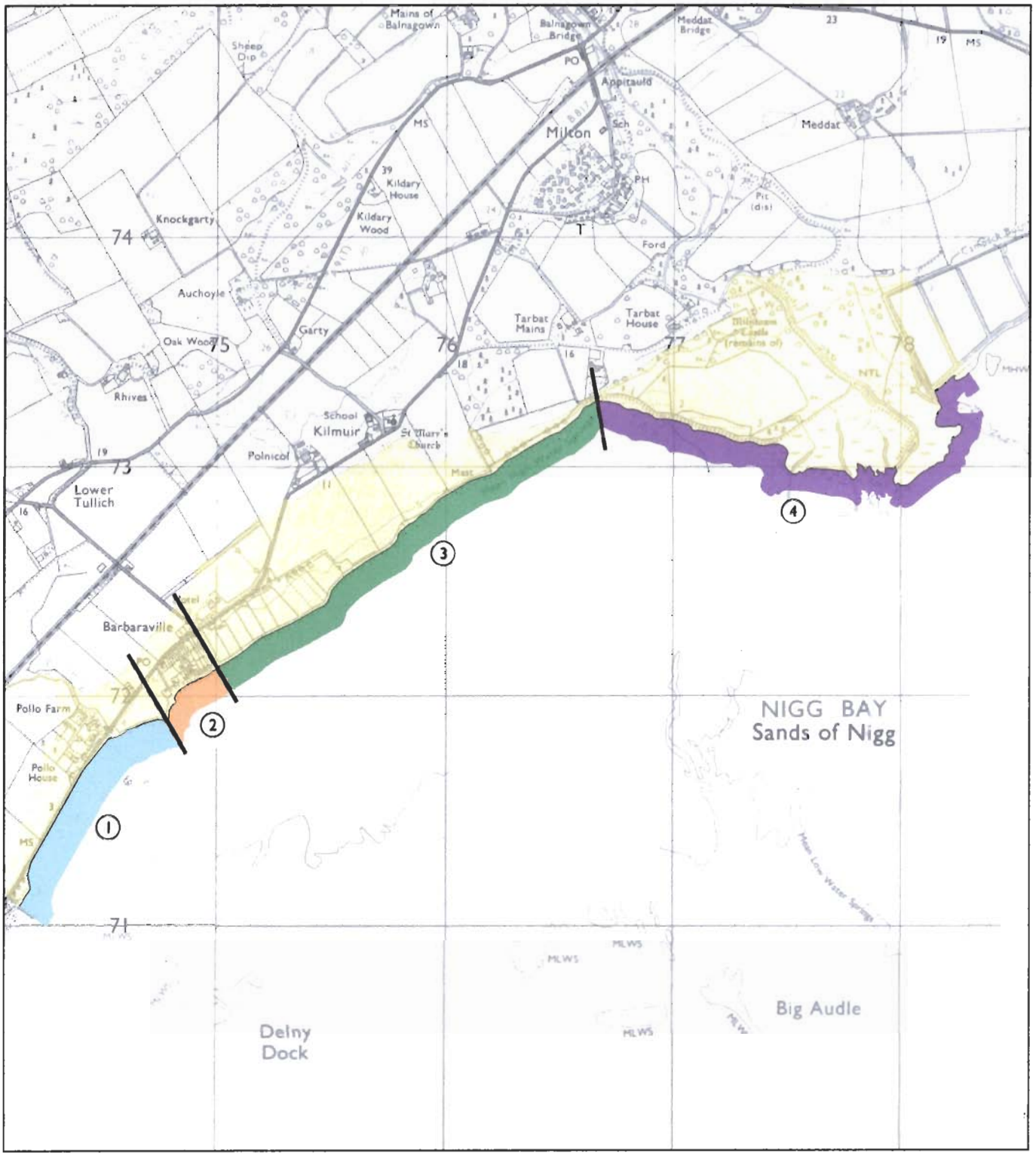
MAP 23: EROSION

1. POLLO HOUSE
NH 564457
1km
Accreting or stable
The shoreline is dominated by mud and shingle and is well exposed at low tides. The is no indication that conditions are not stable.

2. BARBRAVILLE
NH 749 720
0.3km
Stable and eroding
Quarried stone defences protect this small hamlet. The shoreline is mainly shingle and at the time of the survey there was no indication that conditions are not stable.

3. BARBRAVILLE to TARBAT MAINS
NH 758 726
1.9km
Stable
This unit of coastline consist of exposed sandstone with some rubble defences towards Tarbat Mains. The beach is stable with banked cobble and shingle leading down to accreting mudflats.

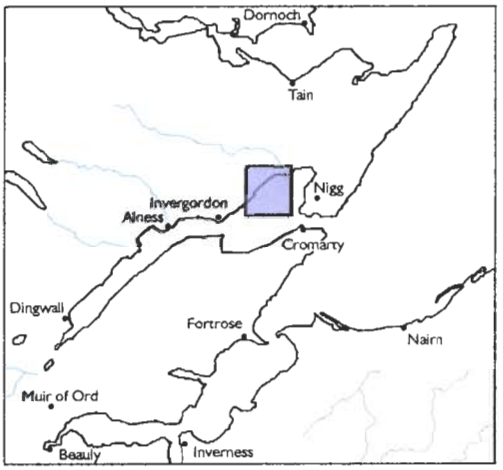
4. TARBAT MAINS to south of MILTON CASTLE
NH 776 730
1.2km
Both accreting and eroding
Mudflats show evidence of accretion but in parts channel migration where the Balnagowen River outfalls into the Cromarty Firth. At the MHWM shingle is banking up.



MAP 23: BALINTRAD TO MILTOWN CASTLE 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 76-80/70-75

Basemap: O.S. *Pathfinder* Series Sheet 133



EROSION CLASS

Assessment date: 17 September 1998

Key:

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

MAP 23: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 7455 7180
BARBRAVILLE
Fish trap mounds
Uncertain
Good
Survey

NH 7466 7170
BARBRAVILLE
Possible fish trap mound
Uncertain
Good
Survey

NH 7475 7175
BARBRAVILLE
Fish trap mounds
Uncertain
Good
Survey

NH 7485 7196
BARBRAVILLE
Fish trap
Uncertain
Good
Survey

NH 7500 7209
BARBRAVILLE
Fish trap
Uncertain
Good
Survey

NH 7521 7224
BARBRAVILLE
Fish trap
Uncertain
Good
Survey

NH77SW 12
NH 7450 7186
BARBARAVILLE MILL
Watermill
18th/19th century AD
Good
Nil

Sites on the Coastal Edge & Foreshore

NH 7655 7312
TARBAT HOUSE
Possible fish trap
Uncertain
Poor
Survey

NH 7700 7316
TARBAT HOUSE
Timber posts, possible fish trap
Uncertain
Good
Survey

NH 7750 7310
TARBAT HOUSE

Timber posts, possible fish trap
Uncertain
Poor
Survey

NH 7760 7300
TARBAT HOUSE
Hulk
20th century AD
Poor
Nil MAP 24

NH783 733- 796 738
MEDDAT
Embankment and quarry pits
20th century AD
Fair
Nil

NH 7460 7186
BARBARAVILLE
Two roofed buildings
18th/19th century AD
Good
Nil

Sites in the Hinterland

NH77SW 53 - Listed C
NH 7407 7108
BALINTRAID PIER
Residential house
19th century AD
Good
Nil

NH77SW 52
NH 7435 7174
POLLO HOUSE
Residential house
18th/19th century AD
Good
Nil

NH77SW 7
NH 7492 7211 - 7497 7213
BARBARAVILLE, Sea View
Residential cottages
18th/19th century AD
Good
Nil

NH77SW 48
NH 7497 7214
BARBARAVILLE, Rossyln
Residential house
19th century AD
Good
Nil

NH77SW 49
NH 7495 7213
BARBARAVILLE, The Shore
Residential house
19th century AD
Good
Nil

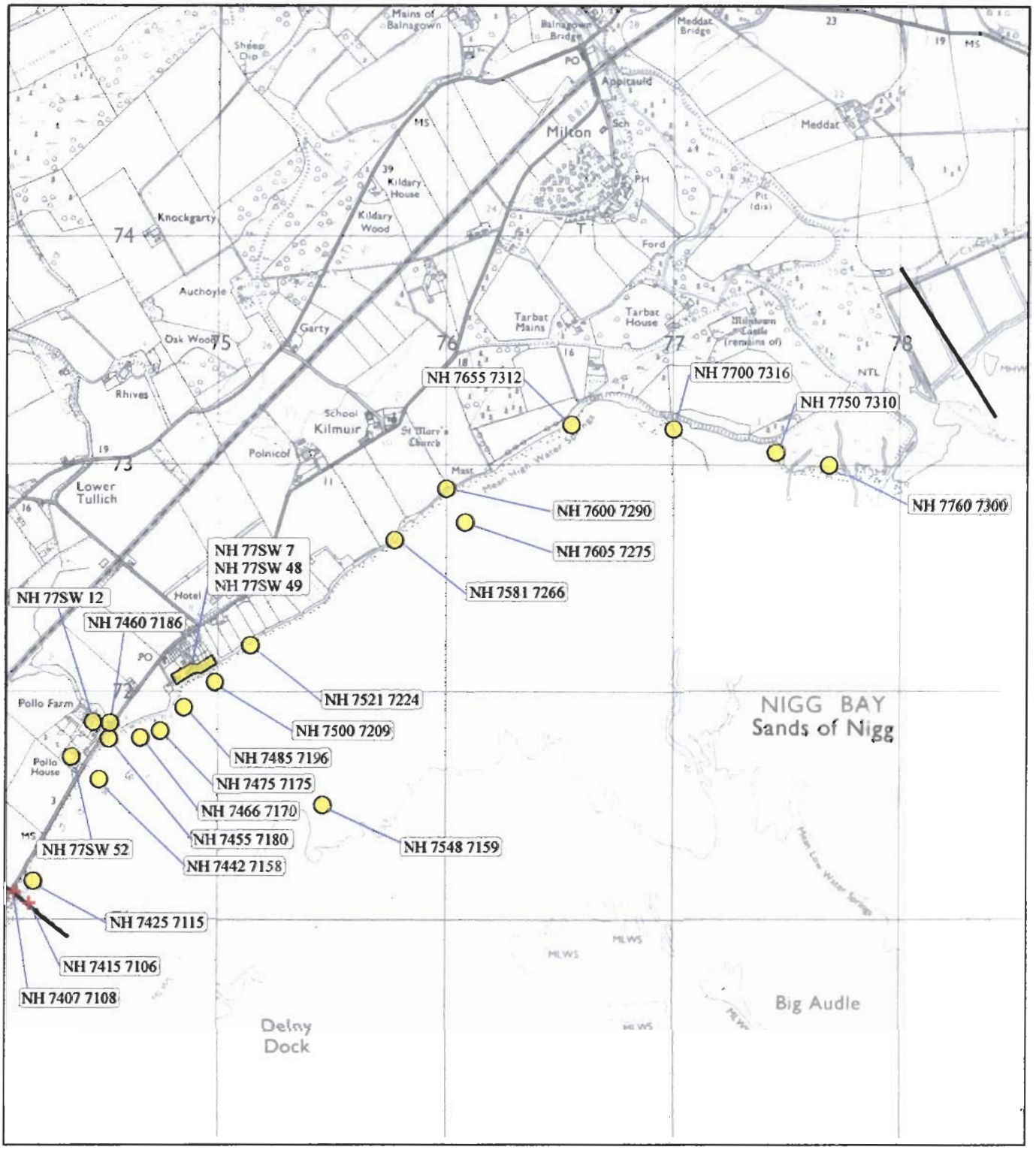
NH 7600 7290
KILMUIR
Target butts
20th century AD, WW II
Fair
Nil

Sites in the Hinterland

NH 7548 7159
NIGG BAY
Maritime craft: wreck
Uncertain
Poor
Monitor

NH 7581 7266
KILMUIR
Timber breakwater
Uncertain
Poor
Monitor

NH 7605 7275
KILMUIR
Military target stance
20th century AD
Poor
Monitor



MAP 23: BALINTRAD TO MILTOWN CASTLE

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 76-80/70-75

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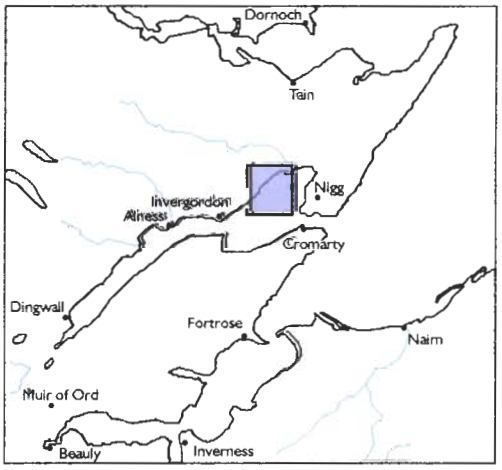
BUILT HERITAGE AND ARCHAEOLOGY

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
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile

Map 24: MILTON CASTLE TO CARSE OF BAYFIELD

Hinterland Geology and Coastal Geomorphology: This unit of coastline is very sheltered and low-lying with a basal geology derived from Middle Old Red Sandstone. Raised marine deposits dominate the drift geology and these continue inland forming the lowland eastwards to Balintore. Fossil shorelines are discontinuous but are attributed to at least three marine incursions. Alluvial deposits underlie saltmarsh development in the region of Milton Castle. Floodbanks defend the carse clay which is intersected by drainage channels relating to reclamation in the last two centuries.

Erosion class: The sheltered position behind the land mass of the North Sutor and the low energy wave environment is controlling accretion of mud on the foreshore. Saltmarsh is well distributed and lends greater stability to the backshore.

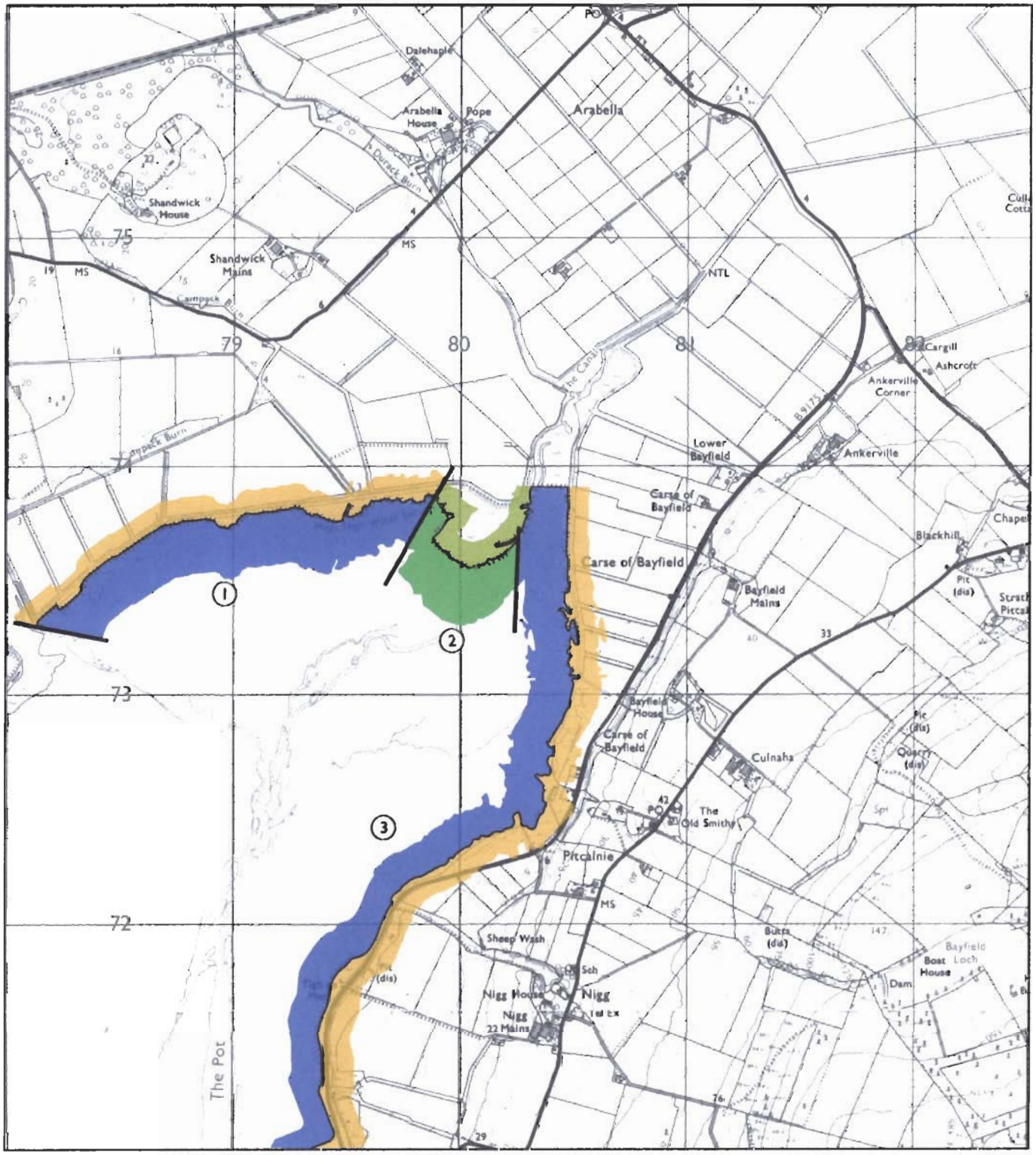
Built Heritage and Archaeology: The extensive embankment and drainage system from Meddat to Carse of Bayfield was constructed to create large tracts of fertile farmland at the head of Nigg Bay. The construction included the cutting of small square quarry pits in front of the embankment.

Map 24: Hinterland Geology and Coastal Geomorphology

1. CAMPACK BURN to west of CARSE OF BRAYFIELD
NH 805 736
1.8km
Estuarine mud/saltmarsh
Low edge (<5m)
Carse clays overlying marine deposits
Head of Nigg Bay defended by flood banks and low lying. Saltmarsh and tidal flats with mud and sand flank the foreshore.

2. Head of NIGG BAY
NH 800736
0.5km
Saltmarsh
Low edge (<5m)
Carse clays overlying marine deposits
Head of Nigg Bay. A small alluvial fan overlies carse clays. The foreshore is dominated by saltmarsh.

3. South of CARSE of BRAYFIELD to LOWER PITCALZINE
NH 794 716
2.7km
Estuarine mud and sand
Low edge (<10m)
Raised beach and marine deposits
Irregular shoreline with carse clays overlying marine sand and gravel in a low-lying hinterland. The foreshore consists of tidal sand and mud flats.



MAP 24: MILTOWN CASTLE TO NIGG MAINS

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 78-82/71-76

HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 18 September 1998

Hinterland:

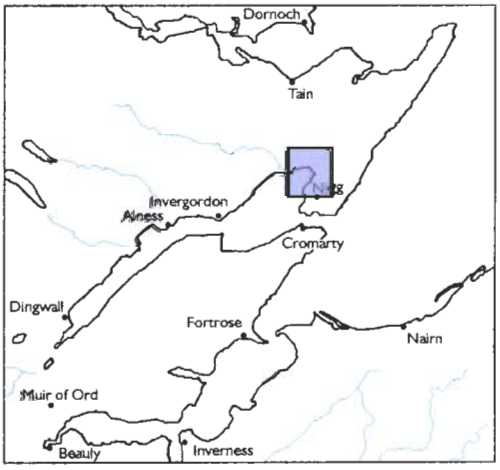
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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

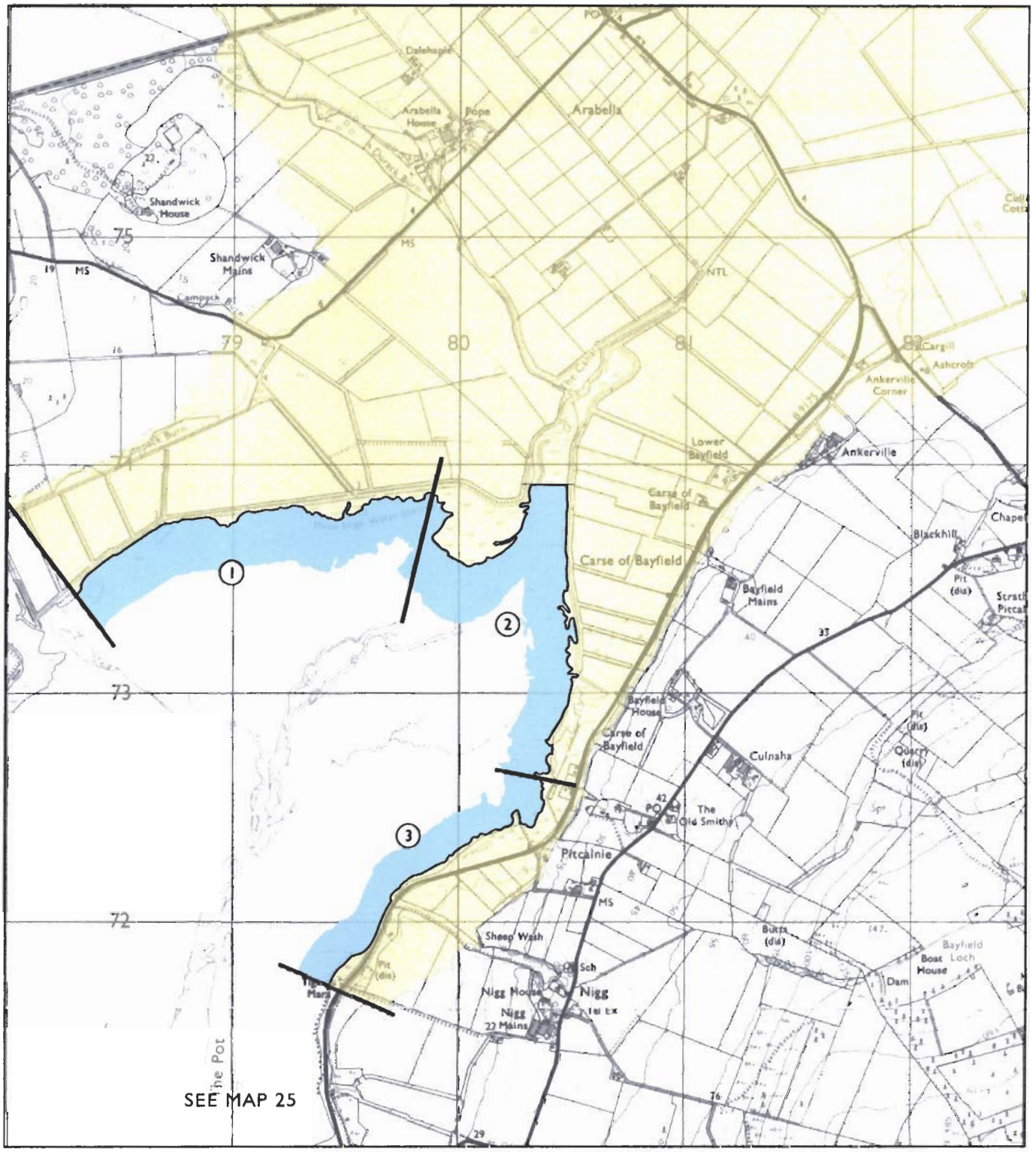


MAP 24: EROSION

1. East of MILTOWN CASTLE
NH 790 738
1.7
Accreting or stable
Gabbion basket sea defences protect part of this unit of coastline. Conditions are on the whole stable with mud accreting up to the HWM. The sheltered aspect of this stretch of coastline will be promoting sediment deposition. Erosion of the shore is due to the weak nature of the merse clays.

2. NIGG BAY
NH 800 738
3.5km
Accreting or stable
Modified by reclamation and flood banks the shoreline is stable. An additional factor leading to the stability of the foreshore is saltmarsh that extends down onto a muddy beach. Extensive mud flats are accreting in this sheltered bay.

3. East of NIGG
NH 800 723
1.5km
Accreting or stable
Hard sea defences protect the coastal road. Saltmarsh vegetation is lending stability to the softer carse clays that outcrop along the foreshore. Further offshore mudflats are accreting.



MAP 24: MILTOWN CASTLE TO NIGG MAINS

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 78-82/71-76

Basemap: O.S. *Pathfinder* Series
Sheet 134
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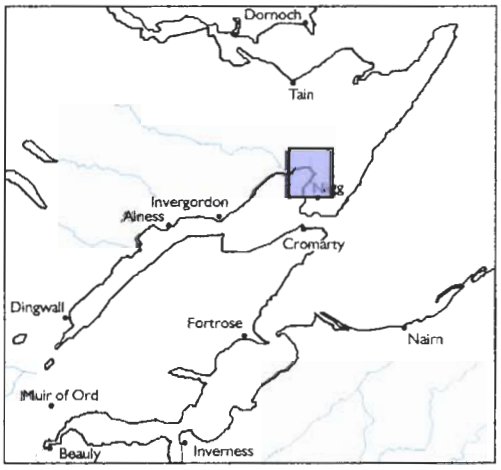
EROSION CLASS

Assessment date: 18 September 1998

Key:

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



MAP 24: BUILT HERITAGE AND ARCHAEOLOGY

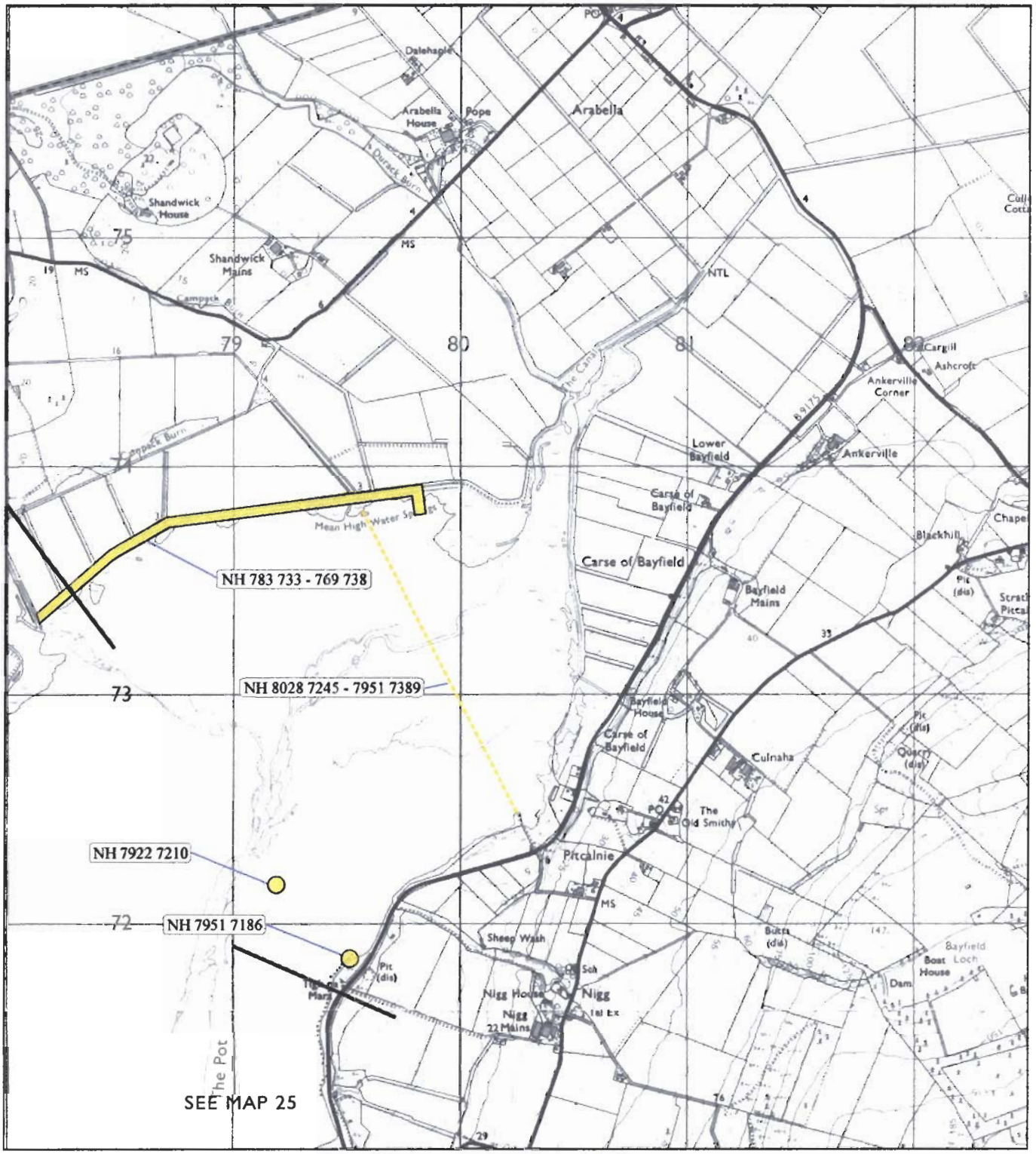
Sites on the Coastal Edge & Foreshore

NH783 796 738
MEDDAT
Embankment and quarry pits
20th century AD
Fair Nil

NH 8028 7245 - 7951 7389
NIGG BAY
Site of track across bay
19th century AD or earlier
Poor
Nil

NH 7922 7210
TIGH NA MARA
Fish traps
Uncertain
Poor
Survey

NH 7951 7186
TIGH NA MARA
Hulk
20th century AD
Poor
Nil



MAP 24: MILTOWN CASTLE TO NIGG MAINS

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 78-82/71-76

BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

Key:

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- Listed Historic Building
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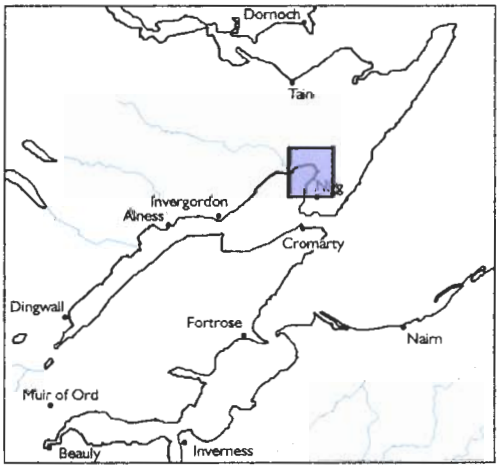
- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile



Map 25: NIGG BAY

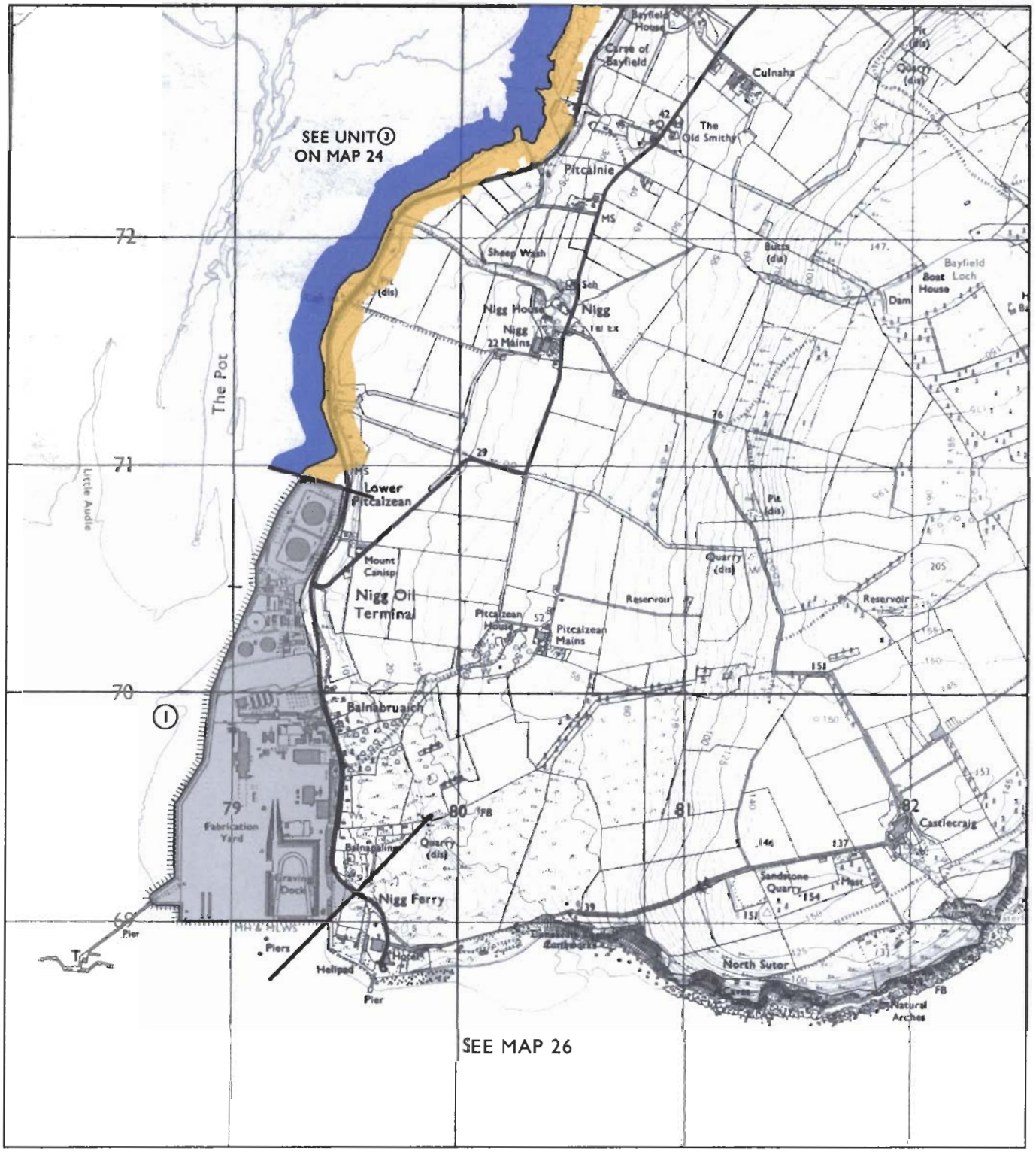
Hinterland Geology and Coastal Geomorphology: This section of coastline comprises the eastern side of Nigg Bay. The head of the bay lies below 10m OD. Underlying Old Red Sandstone continues with an extensive cover of marine sand and gravel. The development of the artificial land mass of the Nigg Fabrication Terminal dominates this area of the coastline.

Erosion class: The coastal edge towards the east of the bay is sheltered and accreting with extensive saltmarsh developed at the backshore. Here conditions are stable. Extensive mud flats are exposed for several kilometres down to the LWMS tide mark.

Built Heritage and Archaeology: The remnants of a trackway or route across Nigg Bay was re-located on both the northern shoreline and eastern edge of the bay. The northern point was not marked, however, the eastern side was marked by a large concrete block in the intertidal zone and a trackway leading from above HWM towards the northern shoreline. The oil industries s fabrication yard at Nigg is a huge modern complex built partially on reclaimed intertidal zone. The remains of a sandstone quay at Nigg ferry has been used as the setting for a military pillbox. The hinterland sites at Nigg ferry village includes the 17th century girnal which is now a hotel.

Map 25: Hinterland Geology and Coastal Geomorphology

1. NIGG OIL TERMINAL AND OFF SHORE FABRICATION YARD
NH 710 700
2.5km
Artificial land form
A full account is given on its construction in Smith and Mather 1973. Shows plate under construction. Major effect is the impact on longshore drift.



MAP 25: NIGG BAY

MORAY FIRTH SURVEY Grid ref: NH 78-82/68-73

1:25 000

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

Assessment date: 18 September 1998

Hinterland:

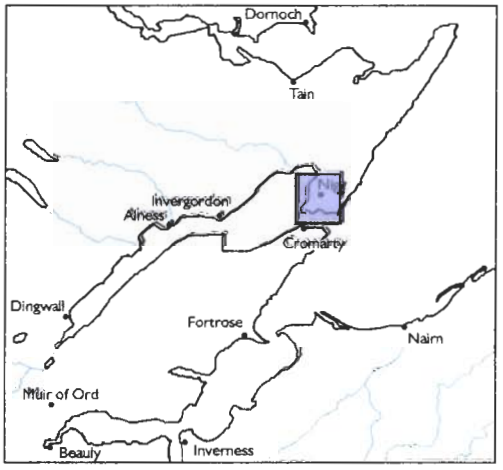
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

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

Foreshore:

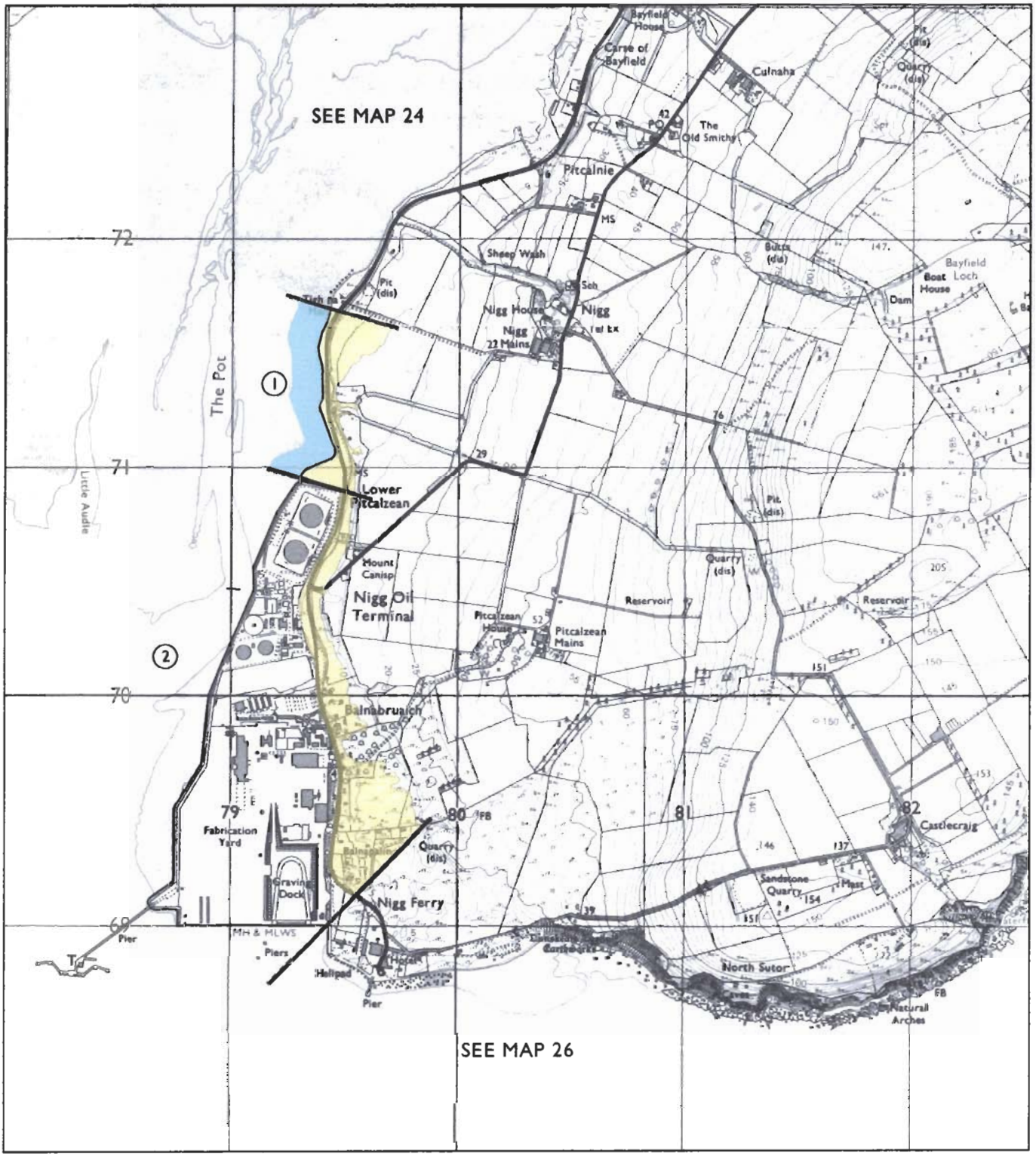
- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 25: EROSION

1. East of NIGG to LOWER PITCAIRN
NH 794 714
0.8km
Accreting or stable
Conditions remain stable with well-developed saltmarsh over carse clay. The foreshore is mainly mud that is accreting.

2. NIGG OIL TERMINAL AND FABRICATION YARD
NH 790 870
2.7km
Not surveyed
This unit was not surveyed on the grounds that any archaeology associated with the former land surface was destroyed when the yard was constructed.



MAP 25: NIGG BAY

MORAY FIRTH SURVEY Grid ref: NH 78-82/68-73

1:25 000

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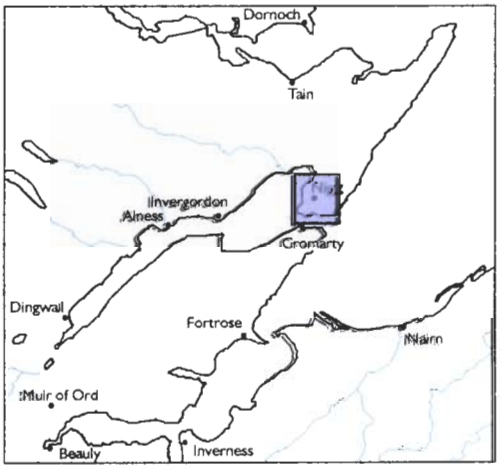
EROSION CLASS

Assessment date: 18 September 1998

Key:

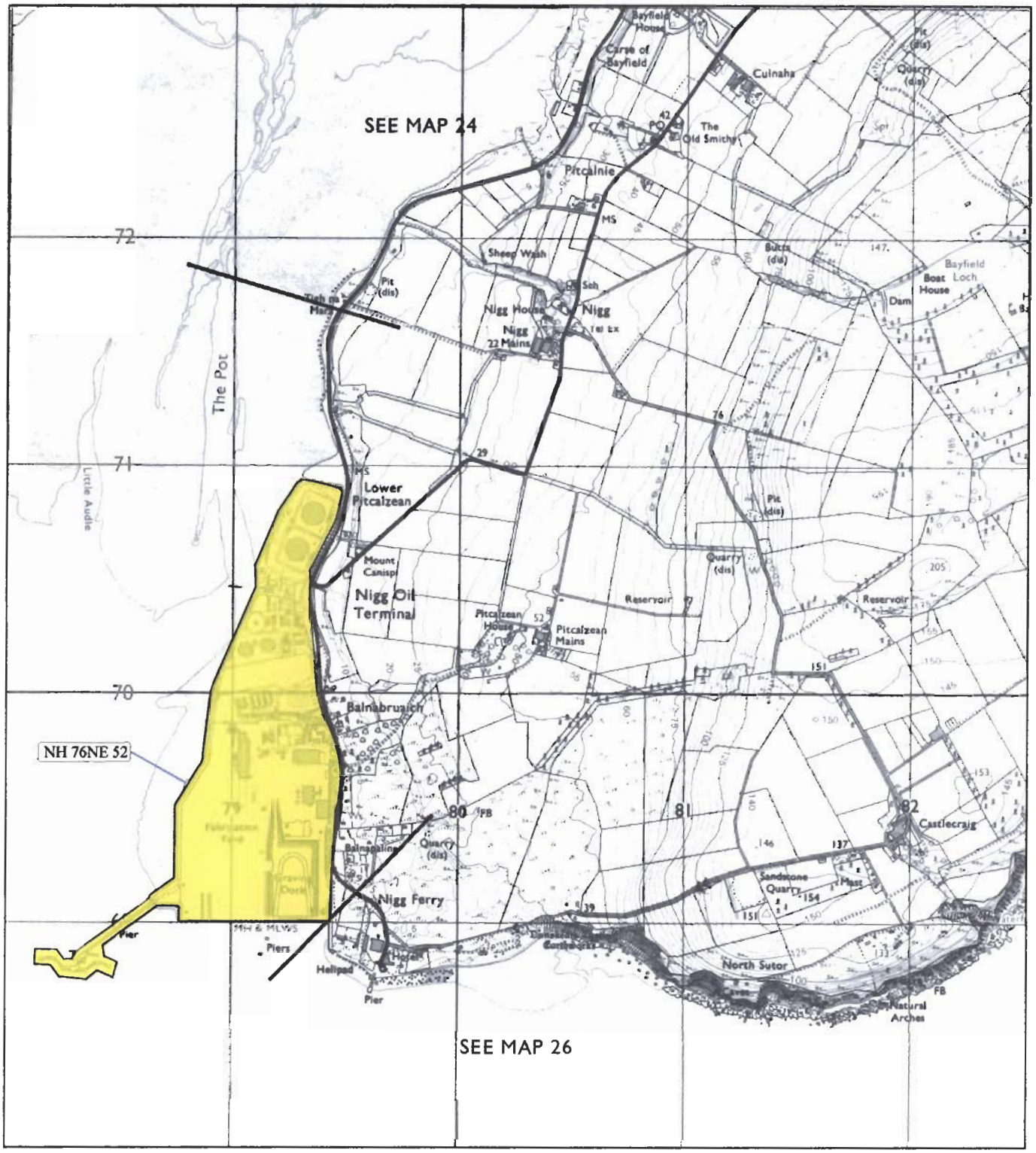
- Definitely accreting
- Accreting or stable
- Stable
- Eroding or stable
- Definitely eroding
- Both accreting and eroding
- No access
- Land below 10m



MAP 25: BUILT HERITAGE AND ARCHAEOLOGY

Sites in the Hinterland

NH76NE 52
NH 79 69 area
NIGG
Fabrication yard; oil industry
20th century AD
Good
Nil



MAP 25: NIGG BAY

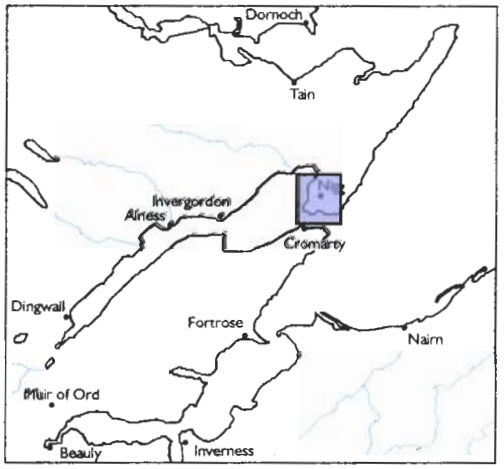
MORAY FIRTH SURVEY Grid ref: NH 78-82/68-73

BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 134



Key:

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- Other known Ancient Monuments, or Undesignated wreck
- Designated Landscape
- Insufficient information; more work needed
- Probably archaeologically sterile

Map 26: NIGG FERRY TO KINGS CAVE

Hinterland Geology and Coastal Geomorphology: North Sutor forms a headland overlooking Nigg Ferry and rises to a height of 635m. The basement geology is dominated by undifferentiated Moine schist and Old Red Sandstone. Nigg Ferry is a cuspate foreland built out at present and the post-glacial epoch. The foreland consists of a dune system the western side of which was used to create the fabrication yard.

Erosion class: The beach at Nigg Ferry is accreting with a high proportion of gravel and shingle increasing eastwards. Smith and Mather (1973) noted that the dune system fronting the low gradient beach was undergoing serious erosion. This was due to recreational use of the dune by a caravan park. Today the dune system is stable as it has only limited visitor pressure. The dune-beach margin is however undergoing rabbit erosion and dune blow-out. The latter was seen within the sides of the cuttings that are used as pathways. The low gradient beach is stable and becomes noticeably rockier eastwards where the sand ends and boulder cover dominates. Rock armour defends the shoreline immediately in front of Nigg Ferry Hotel.

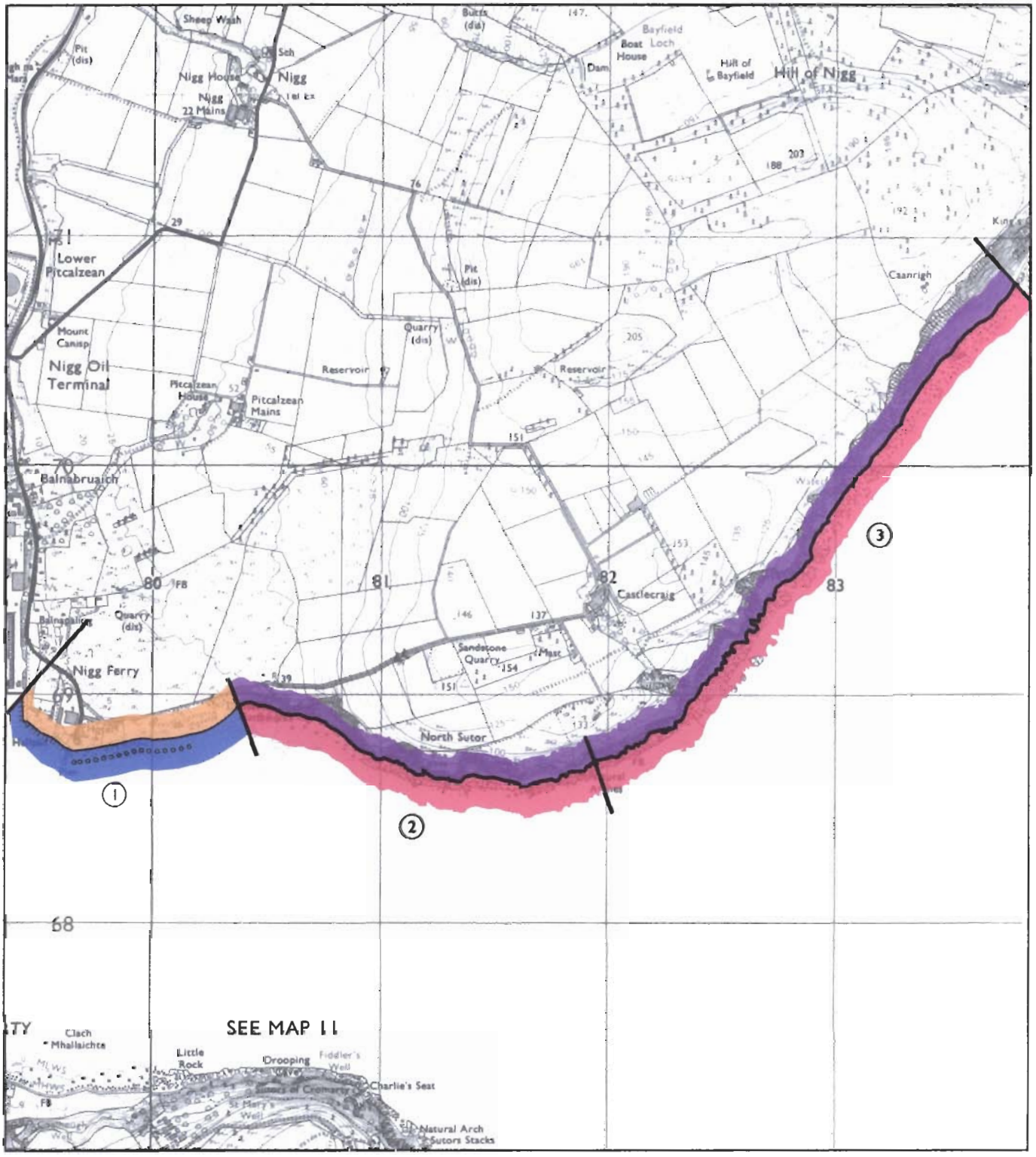
Built Heritage and Archaeology: The built heritage archaeology of this area includes the military complex and coastal batteries on both the hinterland, on top of the cliffs and near the HWM at the North Sutor and Dunskeath castle. The 12th century motte of Dunskeath castle was recorded in a fair state and the earthworks were damaged by rabbit erosion. The 19th century fishing station at Caarnrigh indicates one of the previous industries of this coastline and its current state demonstrates the erosion potential of the environment.

Map 26: Hinterland Geology and Coastal Geomorphology

1. NIGG FERRY
NH 796 689
1km
Sand
Low edge (<10m)
Blown sand/dune formation
Formed on a cuspate foreland is sequence of dune sand. Low lying at 10m below OD, the dune can be trace landwards for c. 0.3km. The beach is sandy. (Further note on dune significance in Smith and Mather 1973)

2. NIGG FERRY to south of CASTLECRAIG
NH 816 687
1.7km
Rock Platform
High cliff (25m)
Glacial deposits over exposed rock
Irregular high cliff of the North Sutor overlain by glacial drift on exposed rock. The cliff edge is irregular and precipitous with sea caves and rock platforms.

3. South of CASTLE CRAIG to south of Kings Cave
NH 823 690
2.8km
Rock platform
High cliff (c. 75-80m)
Glacial till over visible rock
Irregular sheer cliff-line with sea arches and offshore stacks. The hinterland geology is dominated by glacial till over exposed rock.



MAP 26: NIGG FERRY TO KING'S CAVE

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 80-84/67-72

HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 21 September 1998

Hinterland:

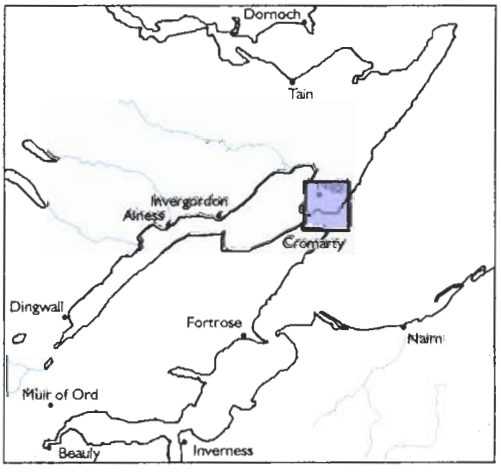
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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

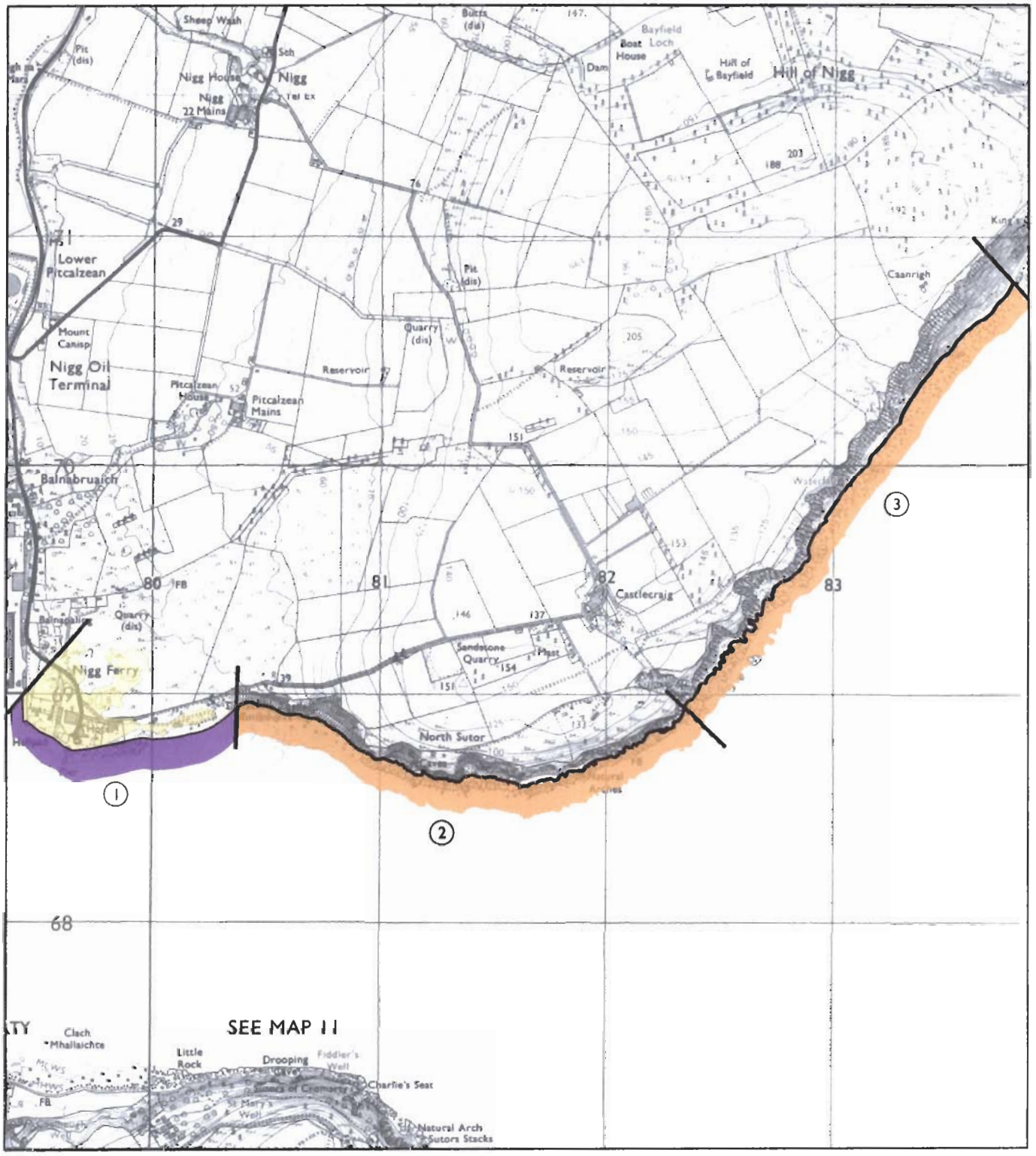


MAP 26: EROSION

1. NIGG FERRY
NH 800 688
0.9km
Accreting or eroding
Part defended by recent boulder armouring at the ferry terminal and pier region. Eastwards these hard defences give way to an extensive dune system that is undergoing erosion in parts by rabbit damage and visitor stress, particularly where tracks through the dune are well pronounced. The beach has a shallow gradient becoming increasingly stonier towards the east.

2. NORTH SUTOR
NH 814 686
2.km
Eroding or stable
This section of coast lies in front of precipitous cliffs that rise steeply. The coastline is strewn with large boulders and exposed rocky platforms that are under constant wear by wave action. Given the fairly resilient nature of the sandstone cliff erosion at the base is considered to be reasonably slow.

3. East of CASTLECRAIG to KINGS CAVE
NH 830 870
2.6km
Eroding or stable
Exposed precipitous cliffs overlook a rock platform shoreline. The cliff base is undergoing constant erosion by wave attack but the rate of erosion is considered to be slow owing to the resilient nature of the sandstone cliff and sea platforms.



MAP 26: NIGG FERRY TO KING'S CAVE

1:25 000

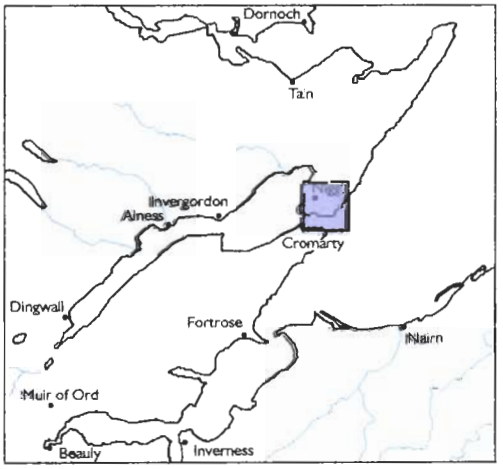
MORAY FIRTH SURVEY Grid ref: NH 80-84/67-72

EROSION CLASS

Assessment date: 21 September 1998

Key:

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



MAP 26: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH76NE 45
NH 7961 6869
NIGG FERRY
Pier
20th century AD
Good
Nil

NH 7973 7872
NIGG FERRY
Car ferry slipway
20th century
Good
Nil

NH 7965 6879
NIGG FERRY
Sandstone quay
Uncertain
Fair
Monitor

NH 8240 6867
NORTH SUTOR
Coastal defence lookout posts
20th century AD; WWI and WWII
Poor
Monitor

NH 8350 7050
CAANRIGH
Timber hut, salmon fishing station
19th/20th century AD
Poor
Survey and monitor

Sites in the Hinterland

NH 7965 6879
NIGG FERRY
Pillbox
20th century AD;WW II
Good
Nil

NH76NE 42
NH 7968 6882
NIGG FERRY
Girnal/hotel
17th/18th century AD
Fair
Nil

NH 8040 6898
NIGG FERRY
Concrete faced tunnel
20th century AD
Fair
Nil

NH86NW 7
NH 8048 6901
BALNAPALING
Shell midden
Uncertain
Fair
Survey and monitor

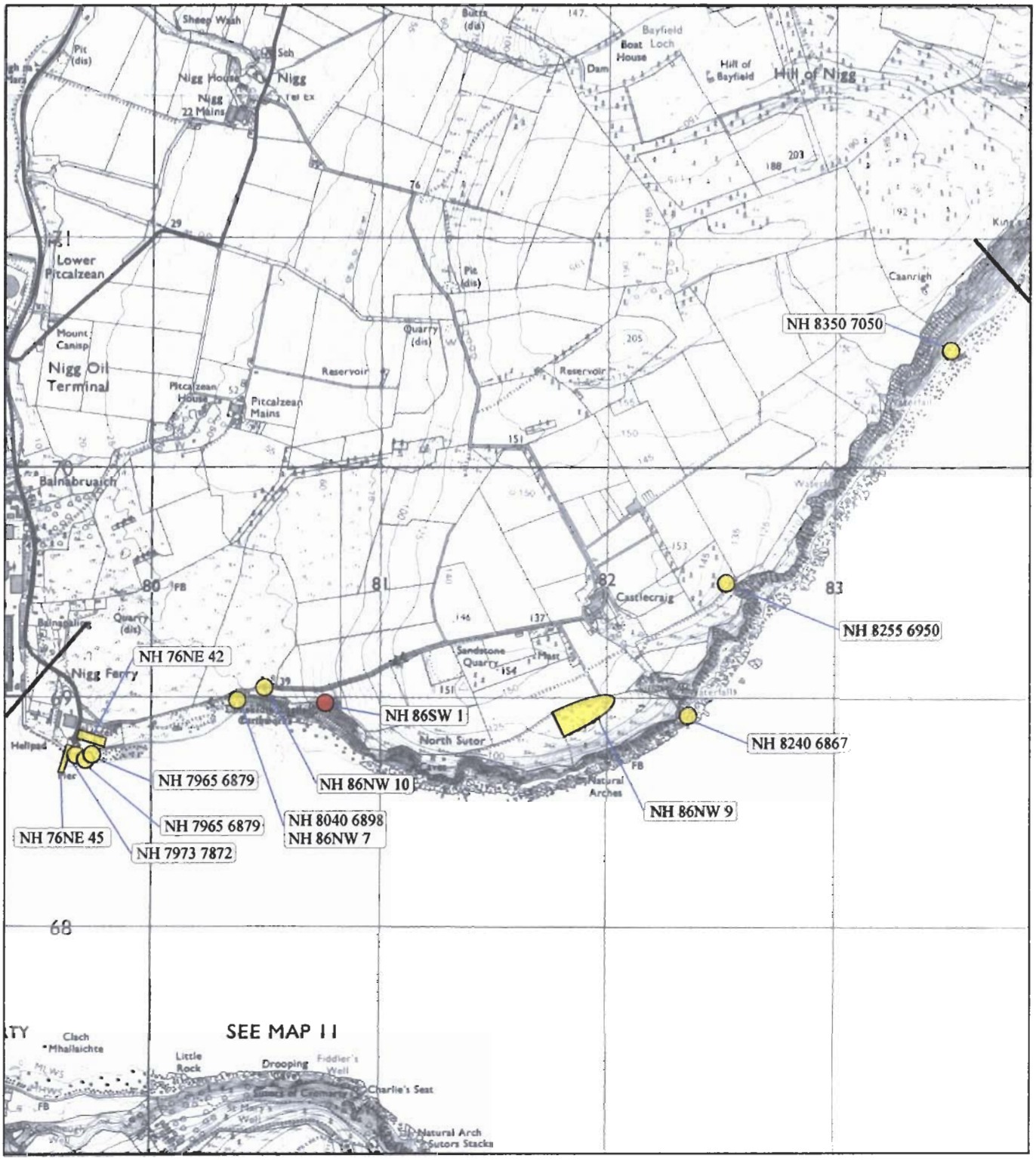
NH86NW 10
NH 8050 6903
DUNSKEATH CASTLE
Coastal battery
20th century AD
Poor
Monitor

Sites in the Hinterland

NH86NW 1 - Scheduled
NH 8070 6898
DUNSKEATH CASTLE
Motte
12th century AD
Fair
Monitor

NH86NW 9
NH 8210 6877 & 8195 6896
NORTH SUTOR
Coastal batteries; military
20th century AD; WWI and WWII
Fair
Monitor

NH 8255 6950
NORTH SUTOR
Military buildings
20th century AD; WWI and WWII
Good
Monitor



MAP 26: NIGG FERRY TO KING'S CAVE

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 80-84/67-72

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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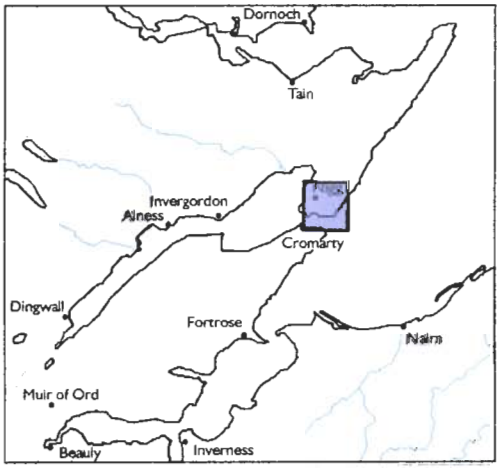


Map 27: KINGS CAVE TO PORT AN RIGH

Hinterland Geology and Coastal Geomorphology: This section of coastline is exposed to the full force of gales from the NE quadrant. Undifferentiated schist of the Moine Series extend northwards. Precipitous cliffs rise to above 150m. The cliff edge is highly indented overlooking exposed abrasion platform and gullies. A narrow discontinuous platform forming a marine terrace runs parallel with the shoreline. Morainic drift forms a thin mantle over the near-surface sandstone outcrops.

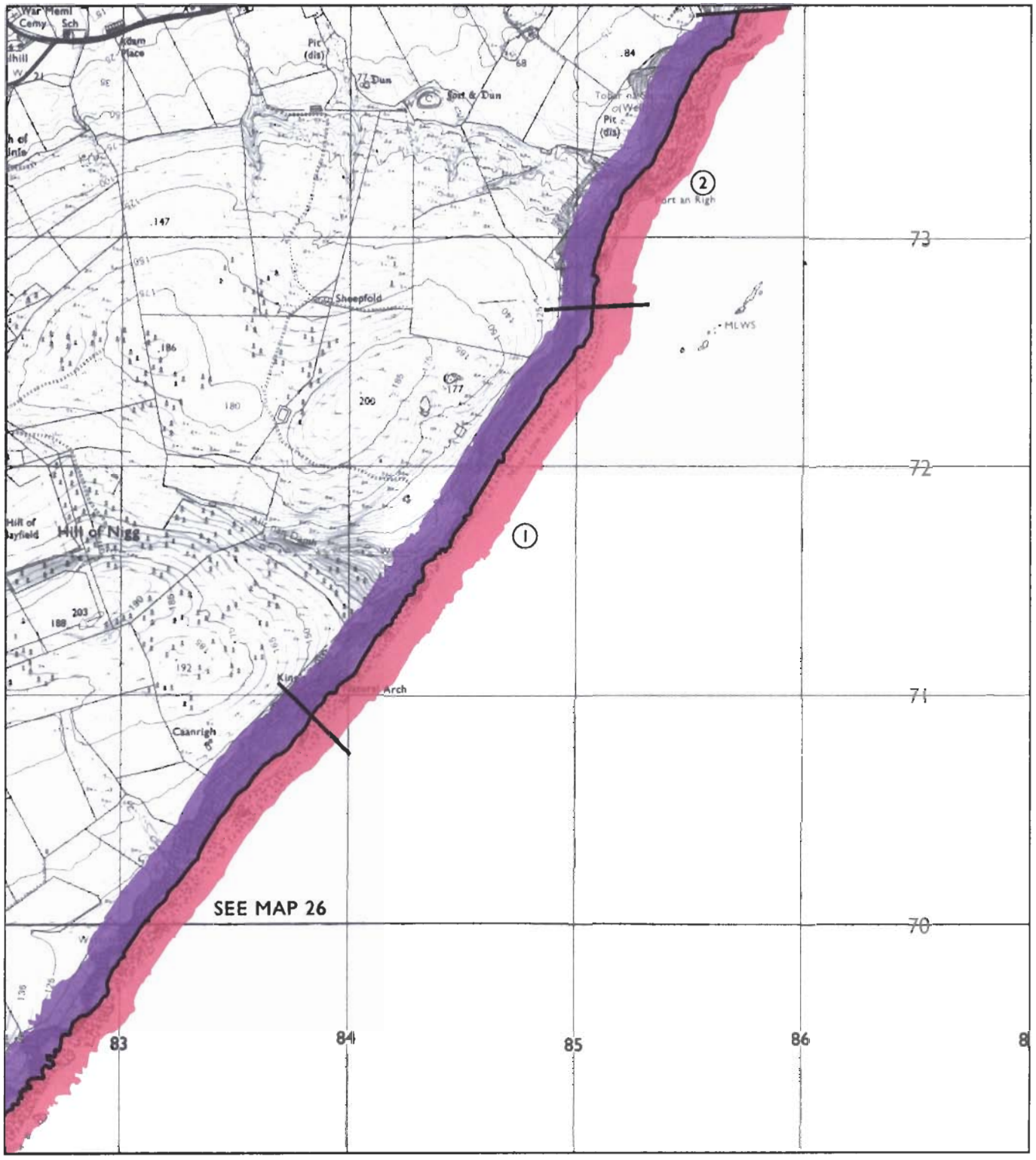
Erosion class: The exposed nature of the cliff to wave hammer and storm surges is sculpting the cliff base. The cliff cover soils are prone to loss by deflation. However, this unit is eroding at such an immeasurably slow rate that much of it has to be classified as stable.

Built Heritage and Archaeology: The King's cave is purportedly the abode of king Nechtan, although the site may also have earlier connections. The site of the $18^{th}/19^{th}$ century farm buildings was one of the few sites recorded. The shell midden at Port an Righ was found to be severely eroding and a whetstone and rubber stone were both found on the surface below the exposed section.

Map 27: Hinterland Geology and Coastal Geomorphology

1. South of KINGS CAVE to south of PORT AN RIGH
NH 830 707
2.2km
Rock platform/sea arches/boulders
High cliff (>75m)
Glacial till over visible rock
Exposed high cliff with irregular edge forming discontinuous platforms and terraces. The shoreline is composed of rock ledges of Old Red Sandstone.

2. South of PORT AN RIGH to OLD SHANDWICK
NH 854 735
1.3km
Rock platform/boulders
High cliff (100m)
Glacial deposits over visible rock
Exposed high cliff overlain by glacial drift over visible rock. Terrace formation with steep gradients. The foreshore is exposed rock platform.



MAP 27: KING's CAVE TO PORT AN RIGH

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 83-87/69-74

Basemap: O.S. *Pathfinder* Series
Sheet 134
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HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 21 September 1998

Hinterland:

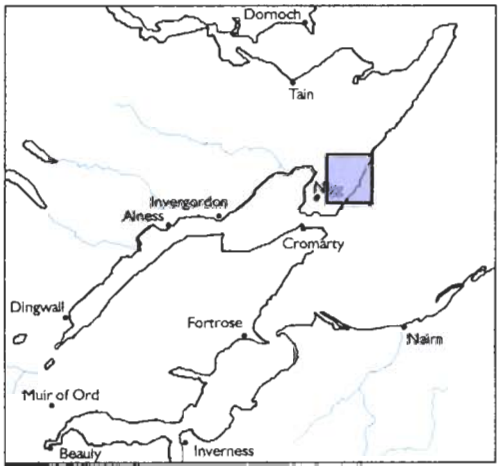
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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

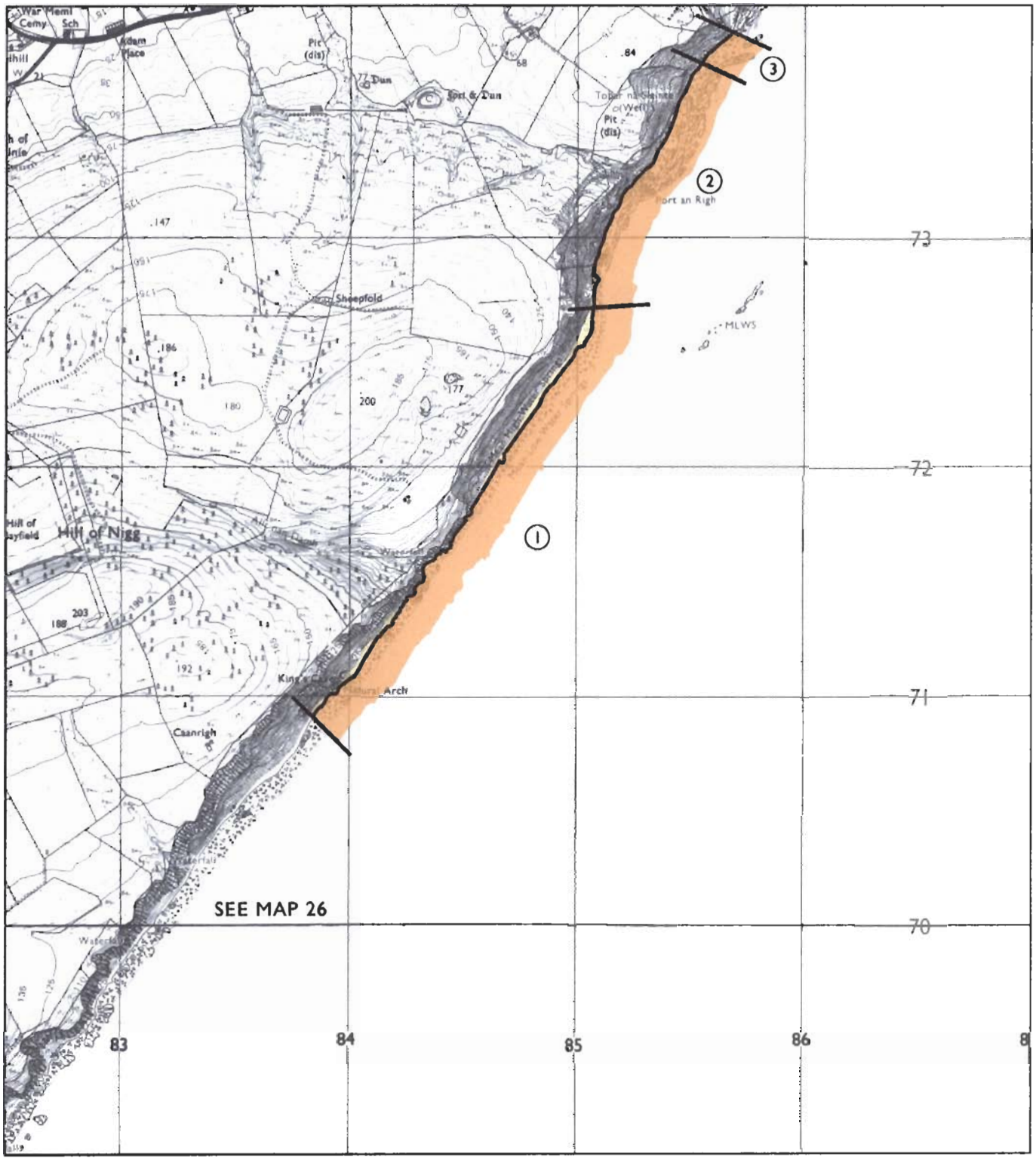


MAP 27: EROSION

1. KINGS CAVE to
NH 843 715
2.4km
Eroding or stable
Exposed precipitous cliffs continue northwards from Kings Cave. Stable rock platforms outcrop at the base of the cliff. Conditions are generally stable.

2. PORT AN RIGH
NH 852 732
1.3km
Eroding or stable
Exposed precipitous cliff and terrace overlook a rock and platform shoreline. Conditions are considered to be stable based on the hard nature of the outcropping sandstone.

3. North of PORT AN RIGH
NH 857 738
0.1km
Eroding or stable
Landslides have led to a steep inclining cliff face that is eroding onto the beach and being reworked at the cliff base. Gullies are scoured by wave attack albeit at a slow rate.



MAP 27: KING's CAVE TO PORT AN RIGH

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 83-87/69-74

Basemap: O.S. *Pathfinder* Series
Sheet 134
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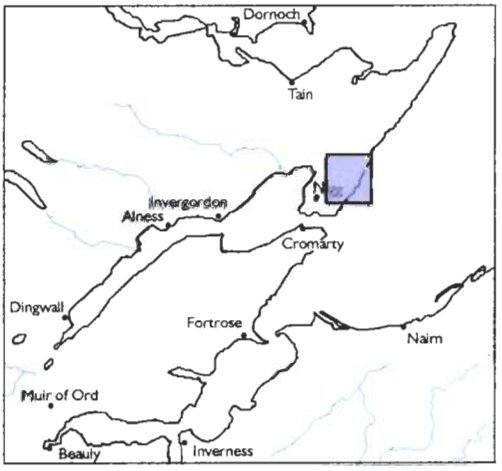
EROSION CLASS

Assessment date: 21 September 1998

Key:

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



MAP 27: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH87SW 15
NH 8393 7104 - 8365 7080
KING'S CAVE;
Two natural caves, alleged abode of
King Nechtan
8th century AD
Fair
Nil

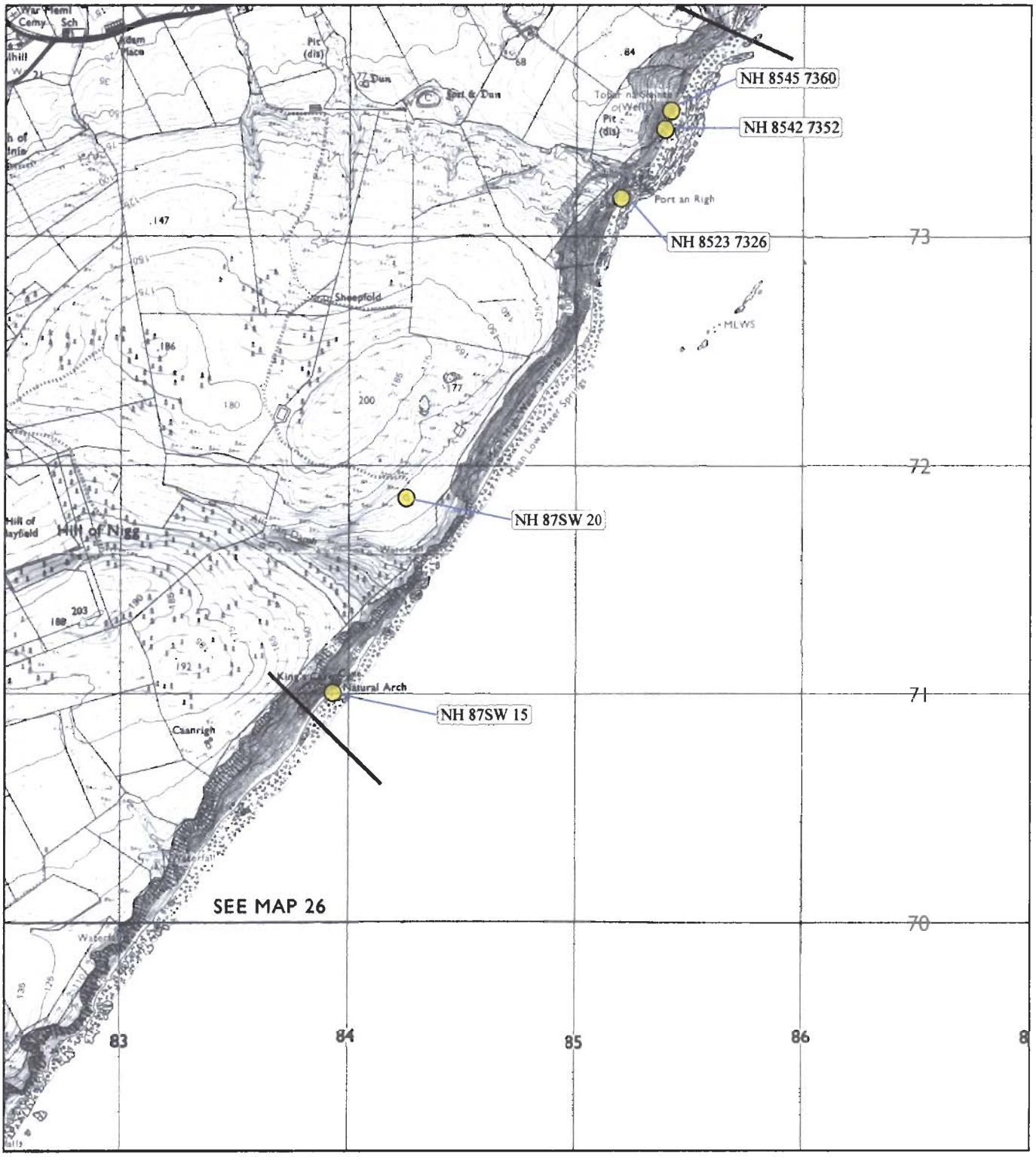
NH 8523 7326
PORT AN RIGH
Building remains
18th/19th century AD
Poor
Monitor

NH 8542 7352
PORT AN RIGH
Shell midden
Uncertain
Poor
Survey and monitor

Sites in the Hinterland

NH87SW 20
NH 8425 7185
HILL OF NIGG
Deserted farmstead; enclosure
Uncertain
Poor
Monitor

NH 8545 7360
TOBAR NA SLAINTE
Well
Uncertain
Good
Nil



MAP 27: KING's CAVE TO PORT AN RIGH

1:25 000

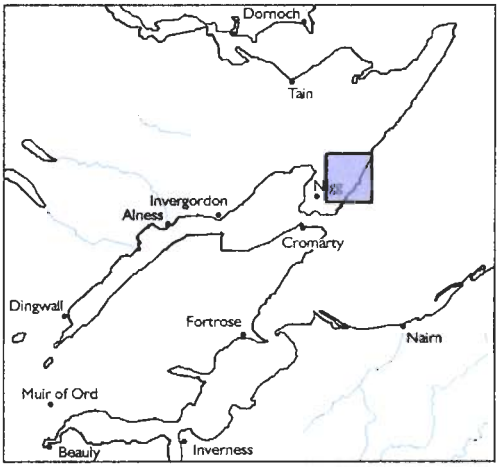
MORAY FIRTH SURVEY Grid ref: NH 83-87/69-74

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 28: PORT AN RIGH TO CADBOLL

Hinterland Geology and Coastal Geomorphology: This coastal unit is underlain by Middle Old Red Sandstone which is itself overlain by boulder clay and morainic drift deposits. The coast cliff overlooks block-strewn abrasion platforms. The settlement of Shandwick Bay and Balintore are within this unit of coastline and occupy part of the only embayment in the largely cliff-girt eastern coastline of the Tarbat Ness Peninsula. The villages are built on an old cliff line at the point where a low coll leads over to the Fern-Nigg lowland. North of Ballintore Harbour the shoreline consists of soft shingle set between abrasion platform. A wide beach and dune complex occupies the area south of Ballintore. Here, Middle and Upper Jurassic sediments are well exposed on a wave-planed foreshore.

Erosion class: Concrete seawalls protect part of the Shandwick Bay. At Ballintore Harbour adjacent to the parking area, rip-rap armouring is now falling away from a low cliff. Beyond Ballintore, the coastline is very rugged with block-strewn abrasion platform and isolated sporadic sand patches. In 1973, Smith and Mather noted that the dune system at Shandwick Bay was stable, but armour defence works are now present presumably showing that at sometime prior to this year, parts of the dune had become unstable.

Built Heritage and Archaeology: This section of coastline includes two of the accessible foreshore areas, where the villages of Balintore and Hilton of Cadboll are situated. The sites in this area include landing places and harbours and a number of piers and breakwaters, affording shelter from the north easterly exposure. At Shandwick the remains of the 15th century castle, chapel and burial ground are important sites.

Map 28: Hinterland Geology and Coastal Geomorphology

1. South of PORT AN RIGH to OLD SHANDWICK
NH 854 735
1.3km
Rock platform/boulders
High cliff (100m)
Glacial deposits over visible rock
Exposed high cliff overlain by glacial drift over visible rock. Terrace formation with steep gradients. The foreshore is exposed rock platform.

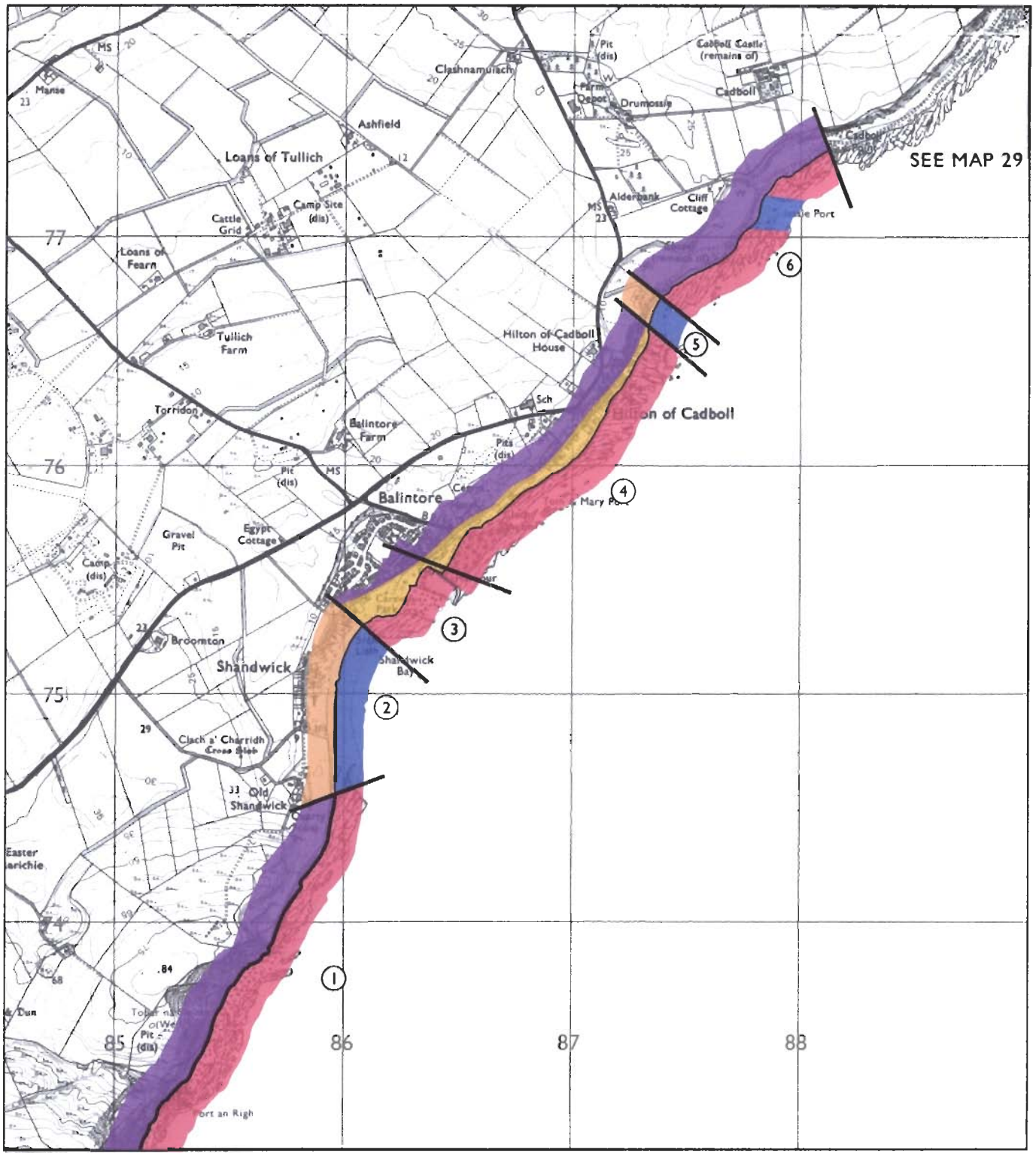
2. SHANDWICK
NH 860750
0.8km
Mainly Sand
Low cliff
Blown sand over marine deposits
Shandwick Bay has a sandy beach backed by a low cliff edge. The hinterland consists on wind blown sand forming a low dune system. The underlying geology is predominantly marine sand and gravel.

3. BALINTORE HARBOUR
NH 862 755
0.5k
Rock platform/blown sand
Low edge (<10m)
Raised beach deposits
An outcrop of Old Red Sandstone forms the harbour where raised beach deposits form the backshore region.

4. BALINTORE HARBOUR to north of HILTON OF CADBOLL
NH 871 763
1.5km
Rock platform/sand
Low edge (<10m)
Raised beach deposits
Raised beach deposits are distributed along this unit of coastline. The foreshore consists of rocky scars with sand and shingle also present. The hinterland is low lying.

5. North east of CADBOLL HOUSE
NH 873 767
0.2km
Sand bordered by rock outcrop
Low edge (<10m)
Blown sand/raised beach deposits
A small bay formed in a cleft of Old Red Sandstone outcrop. Sand entrapment with blown sand towards the backshore zone. The hinterland is low lying.

6. North-east of CADBOLL HOUSE to CADBOLL POINT
NH 872 772
1.2km
Rock platform/.sand
Low cliff (10m)
Boulder drift over visible rock
Raised beach deposits front backshore terrace. The foreshore consists of rock platform broken by small bay at Jessie Port.



MAP 28: PORT AN RIGH TO CADBOLL

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 85-89/73-78

HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment dates: 21-23 September 1998

Hinterland:

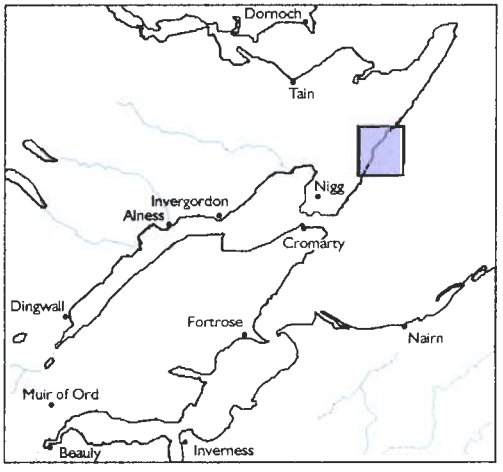
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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 28: EROSION

1. OLD SHANDWICK
NH 859 742
0.9k
Eroding or stable
The cliff face is less precipitous than in the previous units and is mantled in parts by marine sands and gravel. These are actively eroding above the cliff caused by weathering. The shoreline consists of rock platform with deep gullies. Again as in the previous units erosion is considered to be constant but slow.

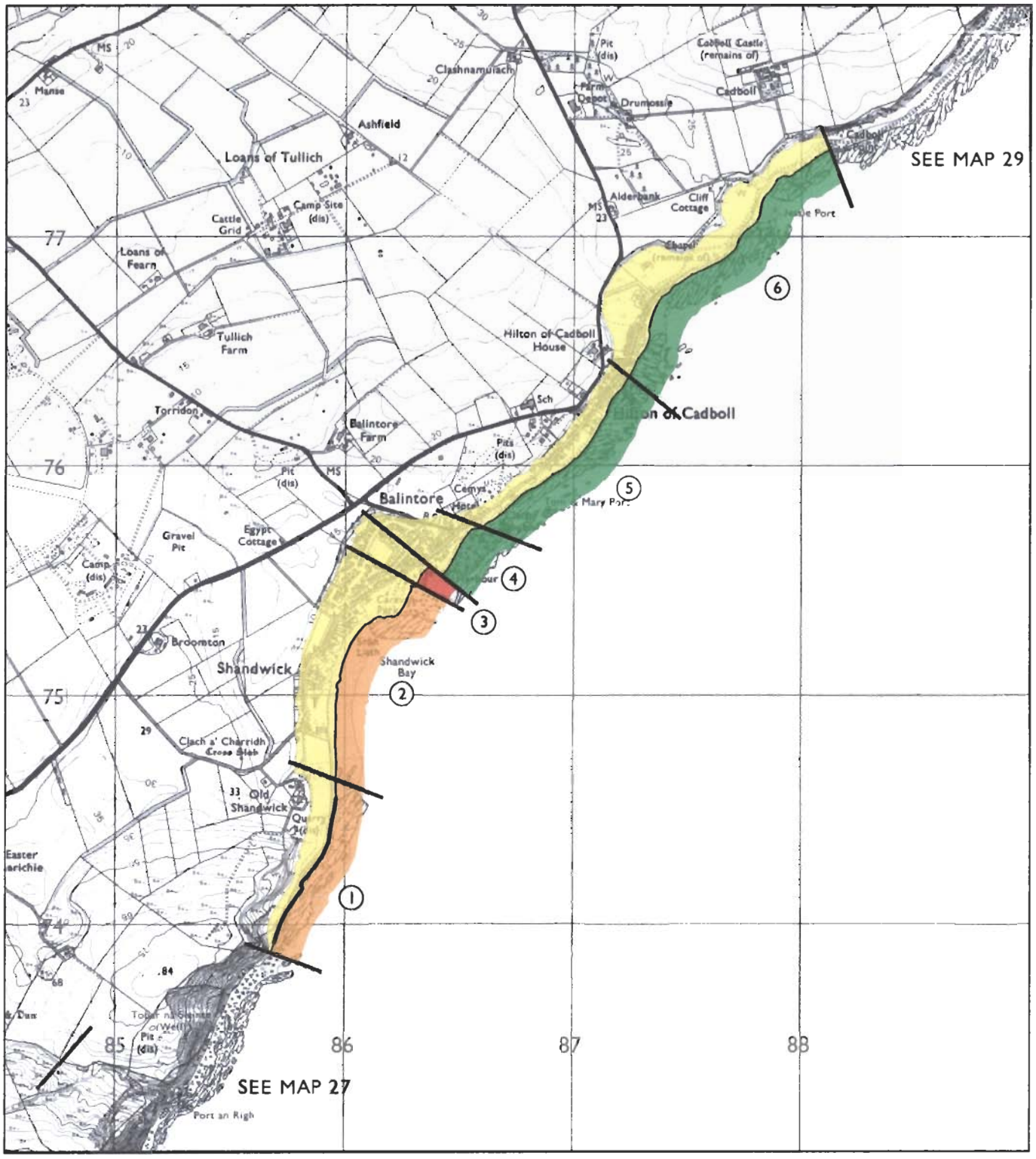
2. SHANDWICK BAY
NH 860 754
0.8km
Eroding or stable
Sand dunes and concrete sea walls protect the bay. Rock and sand are exposed and appear to be stable. Conditions are generally stable with some erosion of rubble tipping that is being scoured by wave action.

3. BALINTORE HARBOUR
NH 8633 7558
c.20m
Definitely eroding
Rip Rap stone defences are collapsing out of the face immediately behind the harbour. Where the stones have collapsed marine sand is exposed and prone to further erosion by deflation.

4. BALLINTORE VILLAGE
NH 865 755
0.2km
Stable
Conditions here are stable owing to sea defences. The beach is sandy with no evidence of erosion.

5. BALLINTORE to HILTON OF CADBOLL
NH 870 760
1km
Stable
Exposed rock platform and sand filled gullies dominate are present throughout this unit of coastline. Conditions are stable owing to the stabilising effect of the rock platforms that absorb the effect of wave attack on the backshore.

6. HILTON OF CADBOLL to JESSIE PORT
NH 878 770
1.4km
Stable
Exposed rock platform with accreting sand and shingle. No evidence for active erosion was seen.



MAP 28: PORT AN RIGH TO CADBOLL

MORAY FIRTH SURVEY Grid ref: NH 85-89/73-78

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 134
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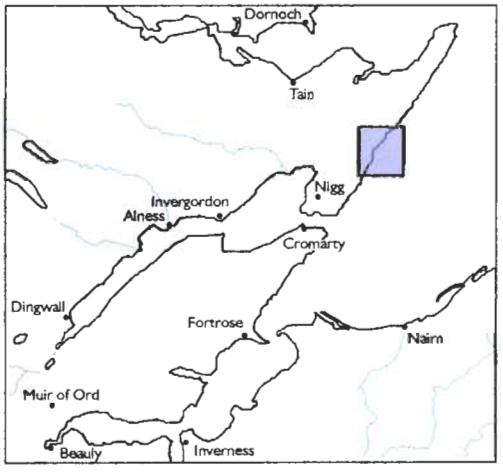


EROSION CLASS

Assessment dates: 21-23 September 1998

Key:

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

MAP 28: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH87NE 19
NH 8598 7515
SHANDWICK
Landing place
Uncertain
Poor
Monitor

NH87NE 17
NH 8649 7549
BALINTORE
Harbour
19th/20th century AD
Good
Nil

NH87NE 18
NH 8728 7634
HILTON OF CADBOLL
Pier
19th/20th century AD
Good
Nil

NH 8731 7657
HILTON OF CADBOLL
Pier
Uncertain
Poor
Nil

NH 8737 7683
CADBOLL
Breakwater
20th century AD
Fair
Nil

NH 8776 7690
CADBOLL
Breakwater
20th century AD
Fair
Nil

NH 8788 7716
JESSIE PORT
Natural enhanced harbour
Uncertain
Poor
Nil

Sites in the Hinterland

NH 8582 7427
SHANDWICK
Buildings, possible WW II installations
20th century AD
Good
Nil

NH 8582 7450
SHANDWICK
Quarry and associated buildings
20th century AD
Fair
Monitor

NH87SE 2
NH 8582 7451
SHANDWICK
Castle (remains)
15th century AD
Poor
Monitor

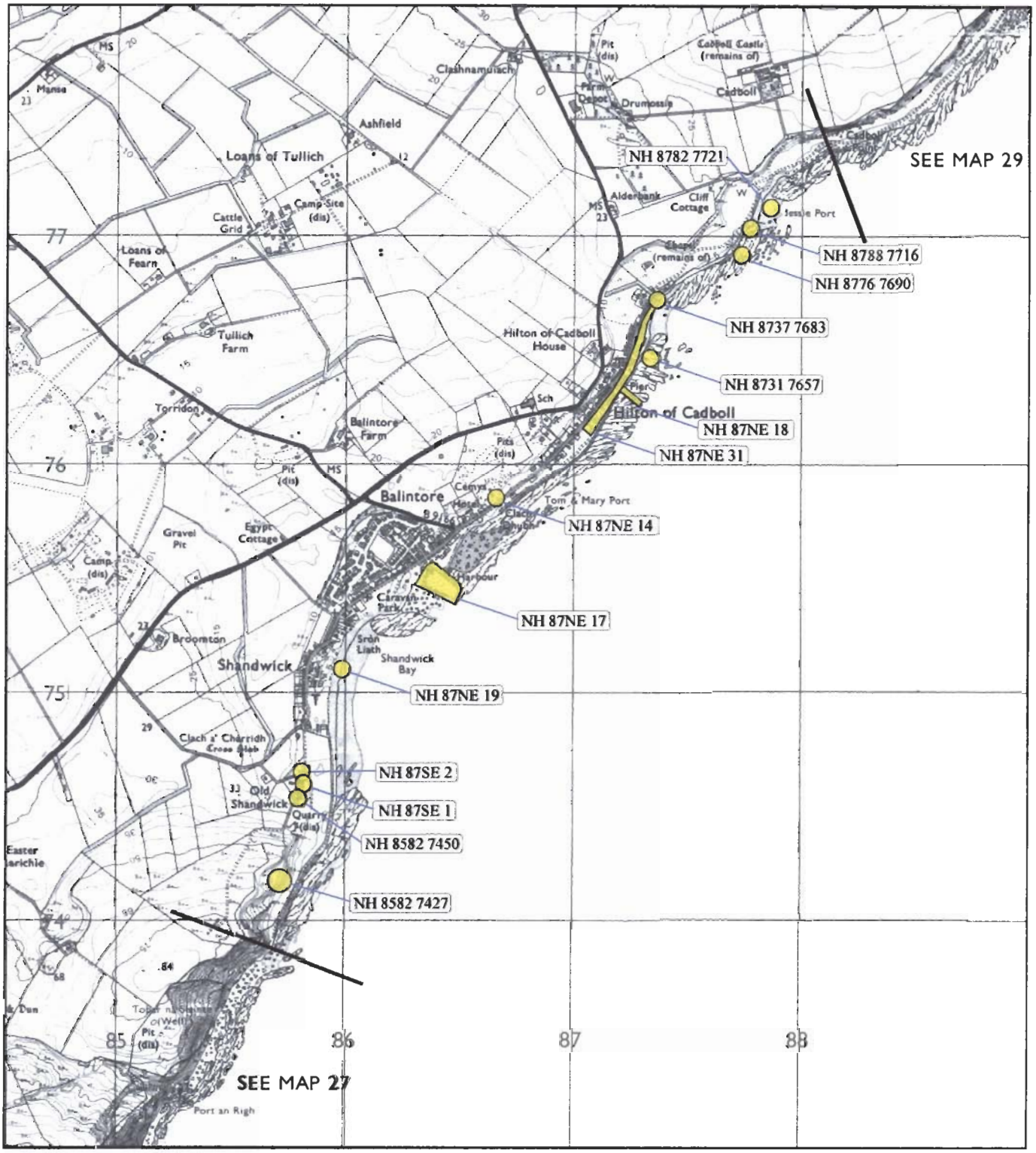
NH87SE 1
NH 8582 7453
SHANDWICK
Chapel; burial ground
15th century AD
Poor
Monitor

NH87NE 14
NH 8667 7585
BALINTORE
Cist burials
Uncertain
Fair
Monitor

Sites in the Hinterland

NH87NE 31
NH 871 763
HILTON OF CADBOLL
Village
18th/19th century AD
Good
Nil

NH 8782 7721
CADBOLL
Gravel pit
19th/20th century AD
Fair
Nil



MAP 28: PORT AN RIGH TO CADBOLL

1:25 000

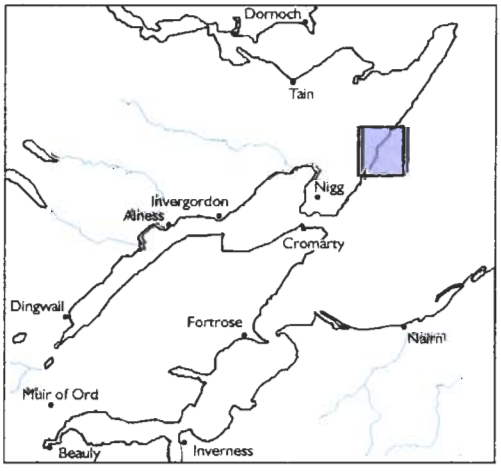
MORAY FIRTH SURVEY Grid ref: NH 85-89/73-78

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 29: CADBOLL TO MEIKLE TARREL

Hinterland Geology and Coastal Geomorphology: This unit of coastline forms the lower section of Tarbat Ness and has a linear coastal edge. The basement geology continues with Old Red Sandstone. This is overlain with a well pronounced wave cut platform forming the Post-glacial raised beach. Boulder clays mantle the higher cliff edge. The foreshore continues to be extremely rugged with abrasion platform and gullies.

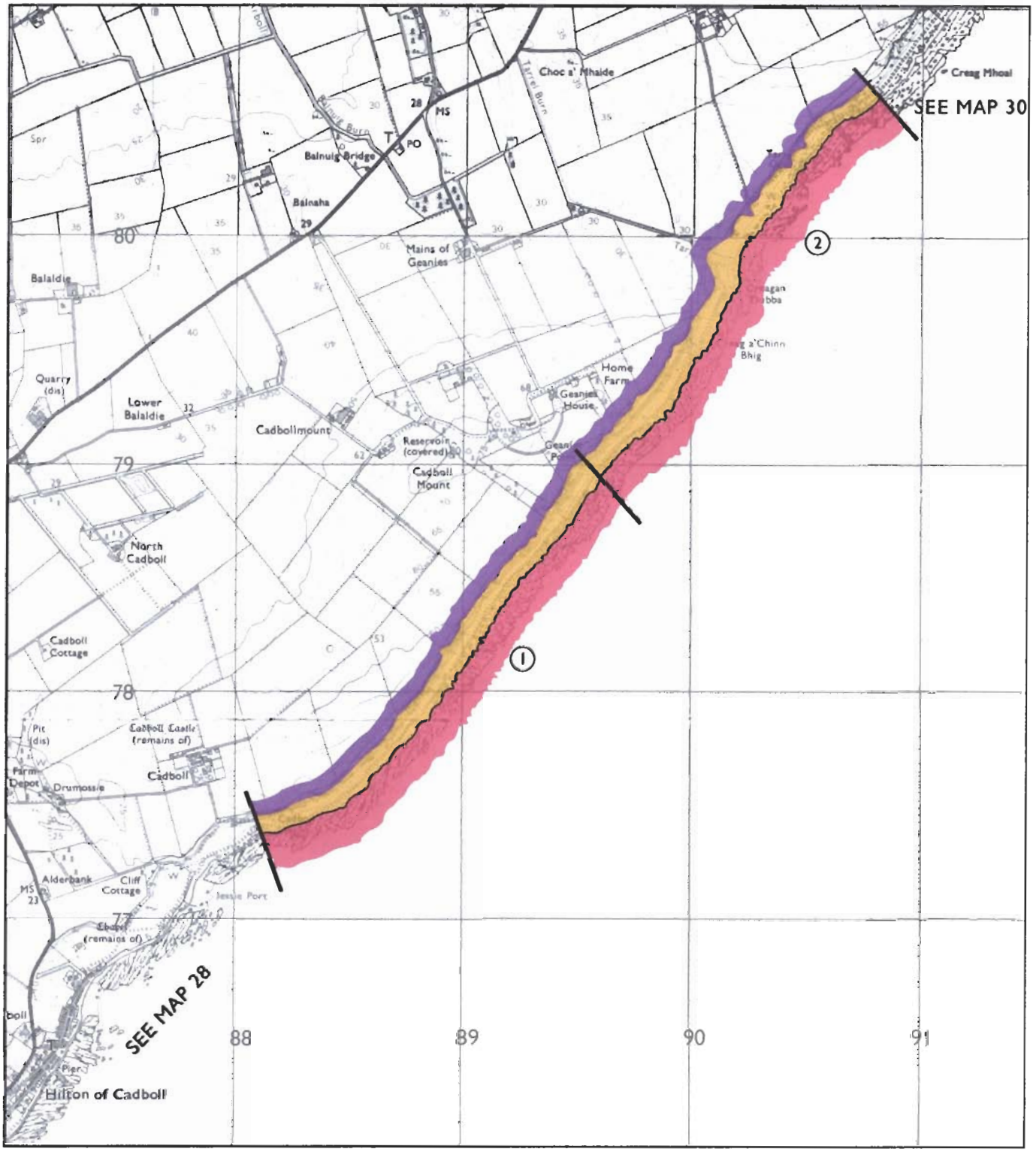
Erosion class: This section of coast, as in the previous two sections, is very exposed. Wave hammer and scour is effecting the cliffs base albeit at a very slow rate. Attrition of the upper cliff face is ongoing but cliff fall will be occurring at an immeasurably slow rate.

Built Heritage and Archaeology: At Cadboll point the modern fishing station demonstrates continued use of this part of the coastline and a number of other sites in the area are the remains of previous stations. The hinterland archaeology includes the 18th century listed Geanies House and designed landscape. A number of ruined buildings on the foreshore around Meikle Tarrel may be the remains of fishing stations along this area of exposed coastline.

Map 29: Hinterland Geology and Coastal Geomorphology

1. CADBOLL POINT to GENIES POINT
NH 892 785
2.1km
Rock platform
High cliff (40m)
Raised beach platform
Raised beach deposits of postglacial age are mantled by boulder clay. The foreshore consists of rock platform and boulders.

2. GENIES POINT to south of CREAG MHOAL
NH 910 810
2km
Rock platform
High cliff (20m)
Raised beach platform/boulder clay
Exposed cliff with raised beach deposition and wave cut platform of Postglacial age. Boulder clays occur above the raised beach deposits.



MAP 29: CADBOLL TO MEIKLE TARREL

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 87-91/76-81

HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 24 September 1998

Hinterland:

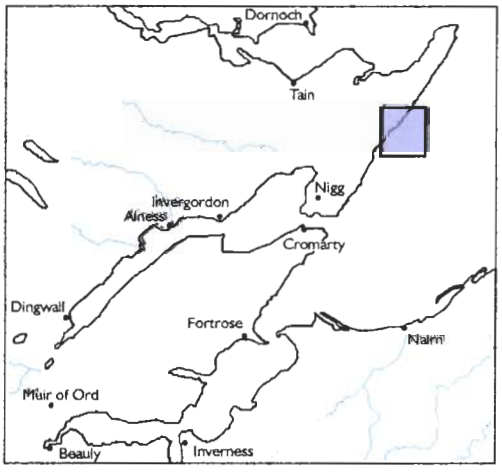
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

Coast edge:

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

Foreshore:

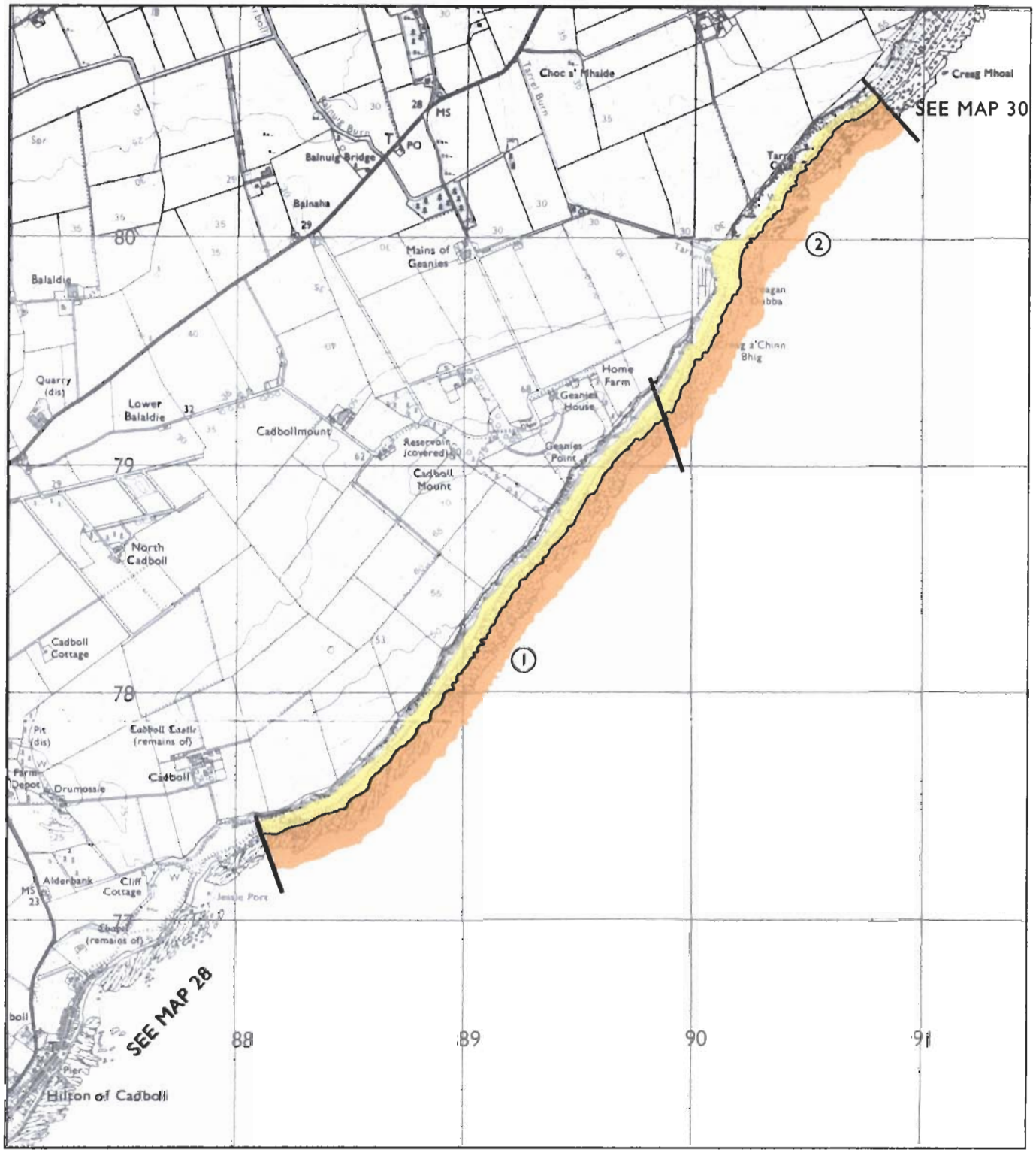
- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh



MAP 29: EROSION

1. JESSIE PORT to GEANIES POINT
NH 890 780
2.4km
Accreting or stable
Accreting cobble beach behind exposed rock platforms. No indicators of active erosion were encountered at the time of the survey.

2. HOME FARM to south of CREAG MHOAL
NH 910 810
4.5km
Stable or eroding
This unit of coastline contains steep rock ledges locally exposed at low tides. The cliff is discontinuous with deposits from relict shorelines. Erosion tends to be isolated slips the cliff. Conditions at the cliff base are eroding slowly.



MAP 29: CADBOLL TO MEIKLE TARREL

1:25 000

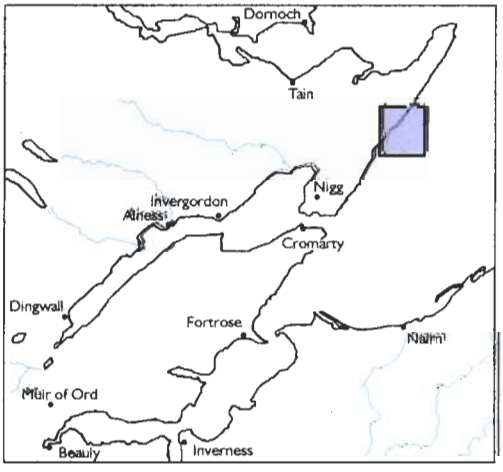
MORAY FIRTH SURVEY Grid ref: NH 87-91/76-81

EROSION CLASS

Assessment date: 24 September 1998

Key:

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



MAP 29: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH 8815 7729
CADBOLL POINT
Fishing station complex; harbour, breakwater
20th century AD
Good
Nil

NH 8891 7809
CADBOLL
Breakwater
20th century AD
Good
Nil

NH 8951 7872
GEANIES POINT
Breakwater
20th century AD
Good
Nil

NH 8950 7885
GEANIES POINT
Roofed building
19th century AD or earlier
Poor
Monitor

NH 8952 7885
GEANIES HOUSE
Ruined rectangular buildings
Uncertain
Poor
Nil

NH98SW 39 Listed A
NH 9288 8365
BALLONE CASTLE
Enclosures
Uncertain
Poor
Monitor

Sites on the Coastal Edge & Foreshore

NH 9025 8000
MEIKLE TARREL
Ruined building
18th/19th century AD
Poor
Monitor

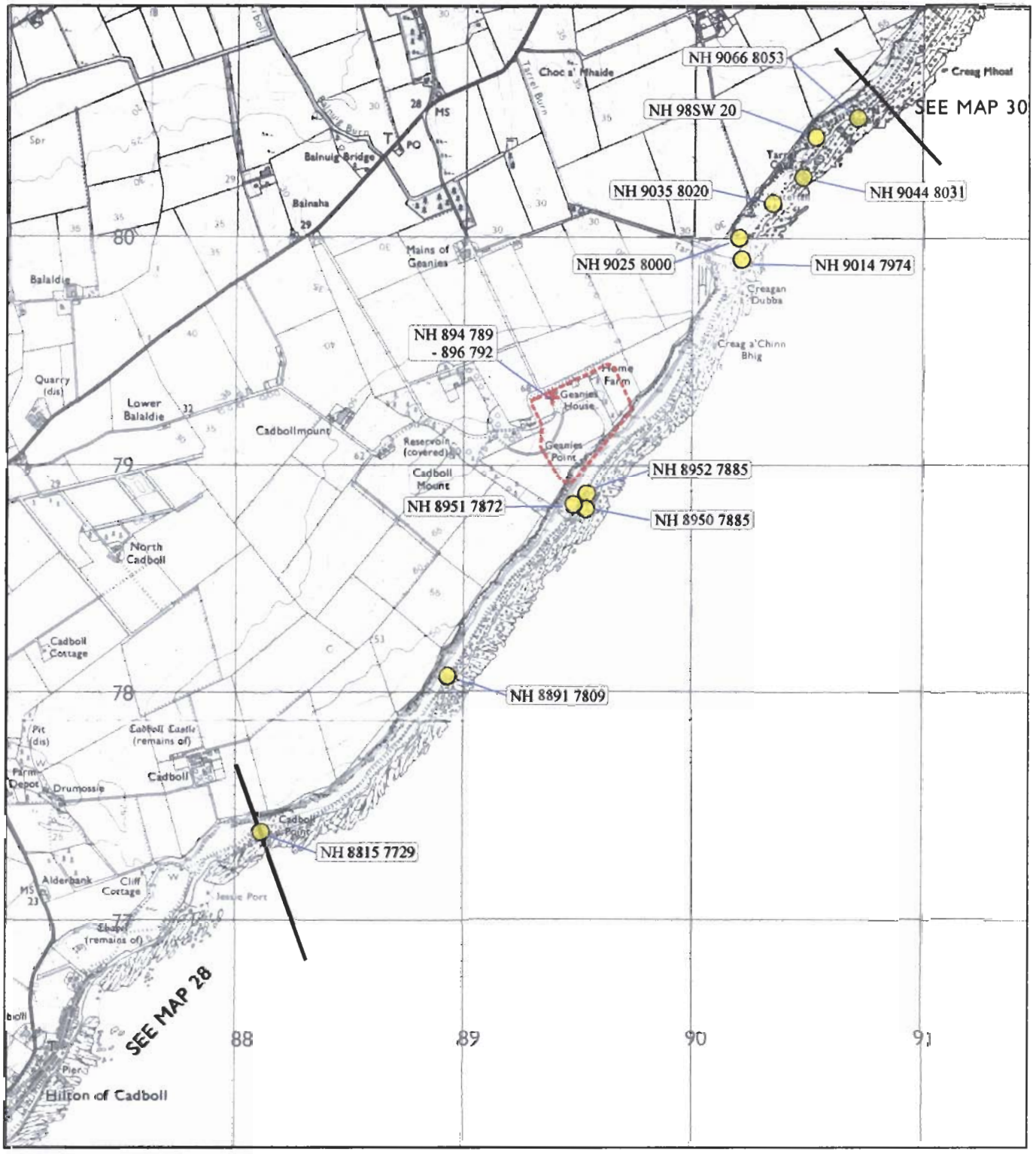
NH98SW 50
NH 9035 8020
MEIKLE TARREL
Ruined buildings
Uncertain
Poor
Monitor

NH 9044 8031
TARREL CAVE
Uncertain
Cave
Fair
Nil

Sites in the Hinterland

NH 894 789 - 896 792 Listed B
GEANIES HOUSE
House and designed landscape
18th /19th century AD
Good
Nil

NH 9014 7974
TARREL BURN
Ruined building
Uncertain
Poor
Nil



MAP 29: CADBOLL TO MEIKLE TARREL

1:25 000

MORAY FIRTH SURVEY Grid ref: NH 87-91/76-81

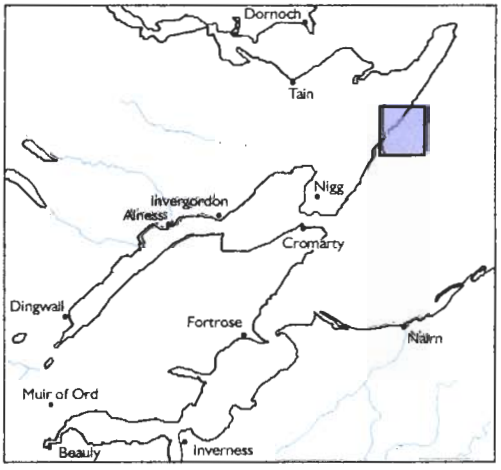
Basemap: O.S. *Pathfinder* Series
Sheet 124, 134

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 30: MEIKLE TARREL TO EASTER BINDEL

Hinterland Geology and Coastal Geomorphology: Old Red Sandstone extends northwards towards Tarbat Ness. The overlying drift is boulder clay with a thin strip of marine sands and gravel forming a discontinuous platform along the cliff edge. The cliff is very indented, with a section of terraces formed at Beacon Hill (NH 972 837). The cliff overlooks extensive abrasion platform.

Erosion class: This section is eroding at a slow rate due to its exposed position to gales from the NE quadrant. The configuration of the cliff edge is also being sculpted, but slow rate,therefore conditions along this unit are stable.

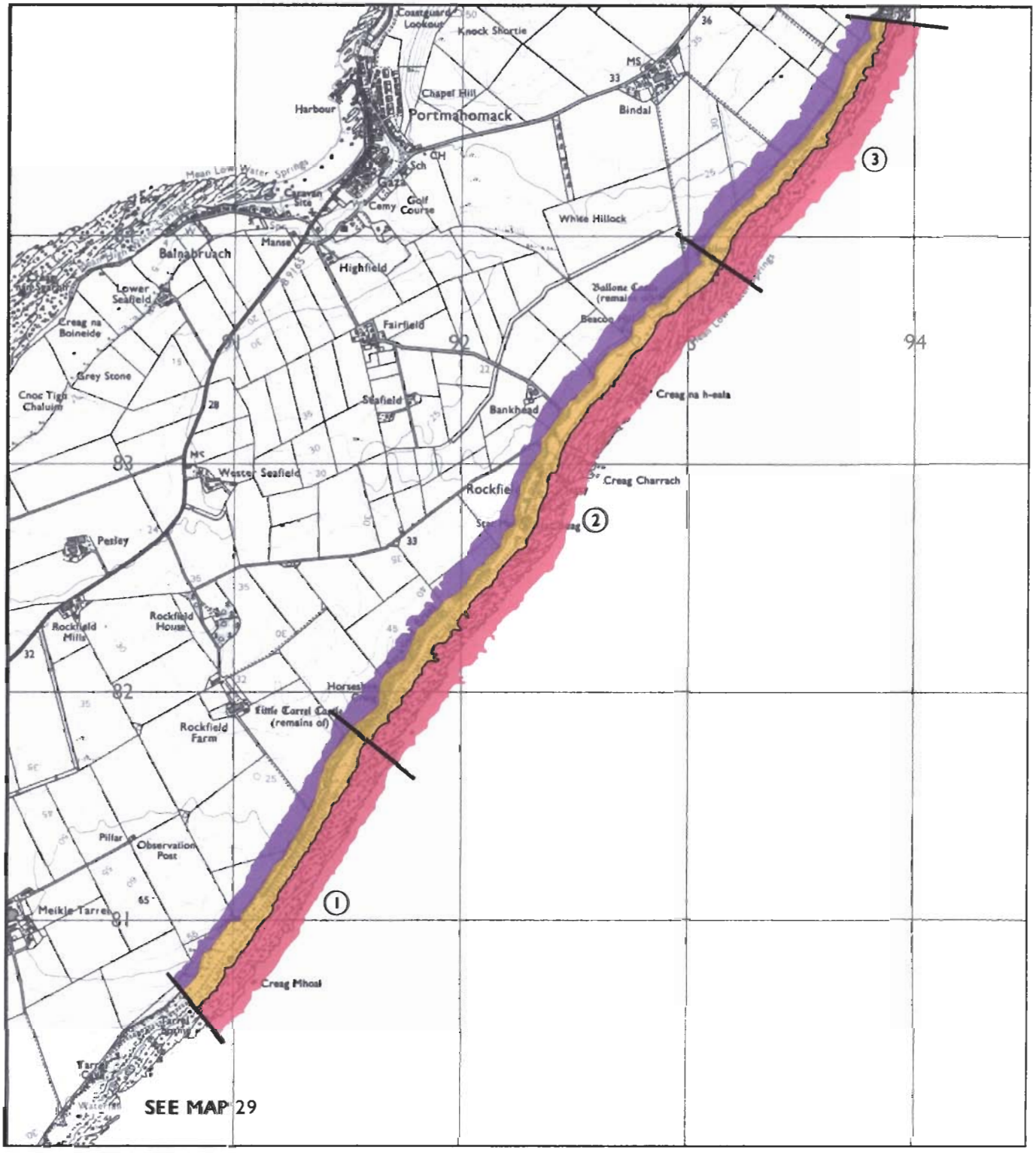
Built Heritage and Archaeology: The hinterland archaeology includes the village of Rockfield that comprises 18th, 19th and 20th century residential housing. Ballone castle, the scheduled and listed 16th century tower house, has recently been restored and has been protected from foreshore coastal erosion.

Map 30: Hinterland Geology and Coastal Geomorphology

1. CREAG MHOAL to HORSESHOE CRAIG
NH 912 830
1.4km
Rock platform/boulders
High cliff (25m)
Raised beach deposits/boulder clay
Exposed coastal edge consisting of high cliff with raised beach platform. The foreshore is rock platform with boulders. Boulder clay mantles the cliff edge.

2. HORSESHOE CRAIG to WHITE HILLOCK
NH 924 830
2.6
Rock platform/boulders
High cliff (20m)
Raised beach deposits
Post Glacial raised shoreline mantled by boulder clay. The shoreline consists of rock platform and boulders.

3. WHITE HILLOCK to EASTER BINDELL
NH 935 835
1.3 km
Rock platform/boulders
High cliff (c.20m)
Raised beach deposits
Wide Post Glacial raised platform mantled by boulder clay. The shoreline consists of rock platform and boulders.



MAP 30: MEIKLE TARREL TO EASTER BINDAL 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 90-94/80-85

HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 24 September 1998

Hinterland:

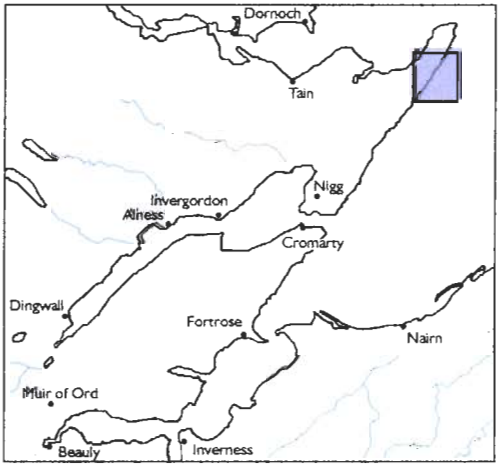
- Drift, boulder clay
- Drift, boulder clay over visible rock
- Raised beach and marine deposits
- Blown sand
- Glacial sand and gravel
- Alluvium

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



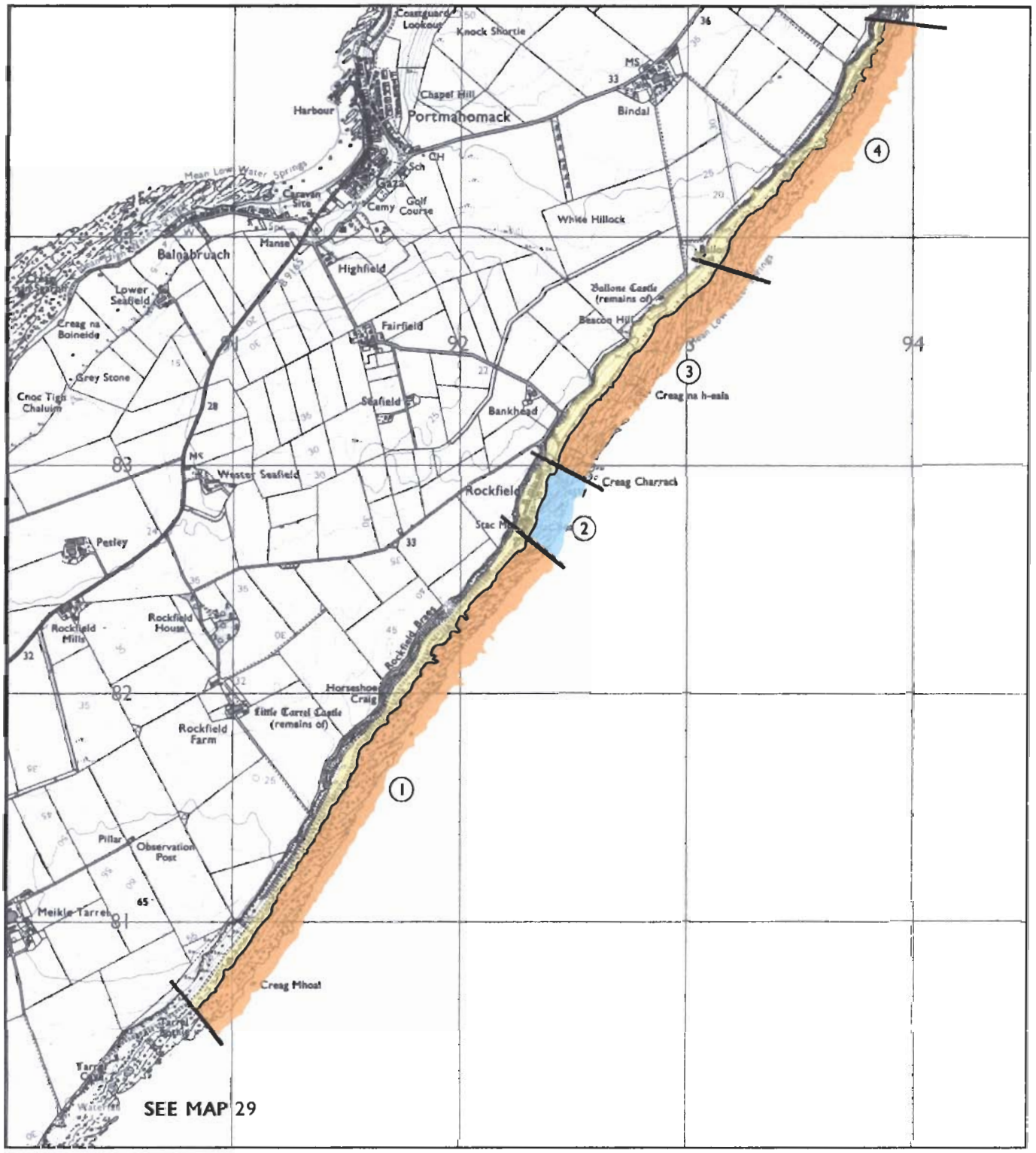
MAP 30: EROSION

1. CREAG MHOAL to ROCKFIELD
NH 917820
2.5km
Eroding or stable
Exposed shoreline of Old Red Sandstone cut into gullies and abrasion platforms. Erosion is occurring albeit at a slow rate.

2. ROCKFIELD
NH 924 829
0.3km
Accreting or stable
Sheltered behind the cliff and built on a relict sea cut platform Rockfield is protected by sea defences. The cobble beach is stable.

3. BEACON HILL
NH 927 835
1.2km
Stable or eroding
A series of wave cut terraces overlook a rocky shore with exposed rock platforms and gullies. Rubble sea defences have been placed at Ballone.

4. East of EASTER BINDAL
NH 936 856
1.3km
Stable or eroding
Incised shoreline of exposed rock platform scoured into a series of discontinuous platforms. Scour and cliff fall is ongoing but at a slow rate.



MAP 30: MEIKLE TARREL TO EASTER BINDAL 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 90-94/80-85

Basemap: O.S. *Pathfinder* Series Sheet 124
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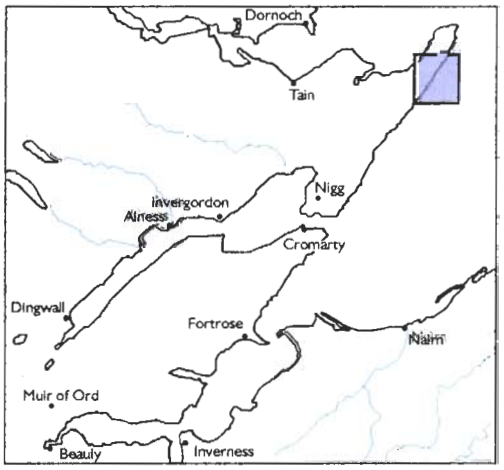
EROSION CLASS

Assessment date: 24 September 1998

Key:

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



MAP 30: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH98SW 51
NH 9082 8065
MEIKLE TARREL
Enclosure
Uncertain
Poor
Monitor

NH98SW 29
NH 9245 8293
ROCKFIELD
Pier
19th century AD
Good
Nil

NH98SW 30
NH 9240 8298
ROCKFIELD
Fishing station
18th/19th century AD
Good
Nil

NH98SW 7
NH 9265 8343
BALLONE CASTLE
Chapel; graveyard
18th/19th century AD
Poor
Monitor

NH98SW 39
NH 9288 8365
BALLONE CASTLE
Enclosures
Uncertain
Poor
Monitor

NH 9375 8480
EASTER BINDAL
Ruined building
Uncertain
Poor
Nil

Sites in the Hinterland

NH98SW 22
NH 9235 8285
ROCKFIELD
Village; houses
18th/19th century AD
Good
Nil

NH 9238 8302
ROCKFIELD
Building
20th century AD
Fair
Nil

NH 9242 8310
ROCKFIELD
Ruined building
Uncertain
Poor
Monitor

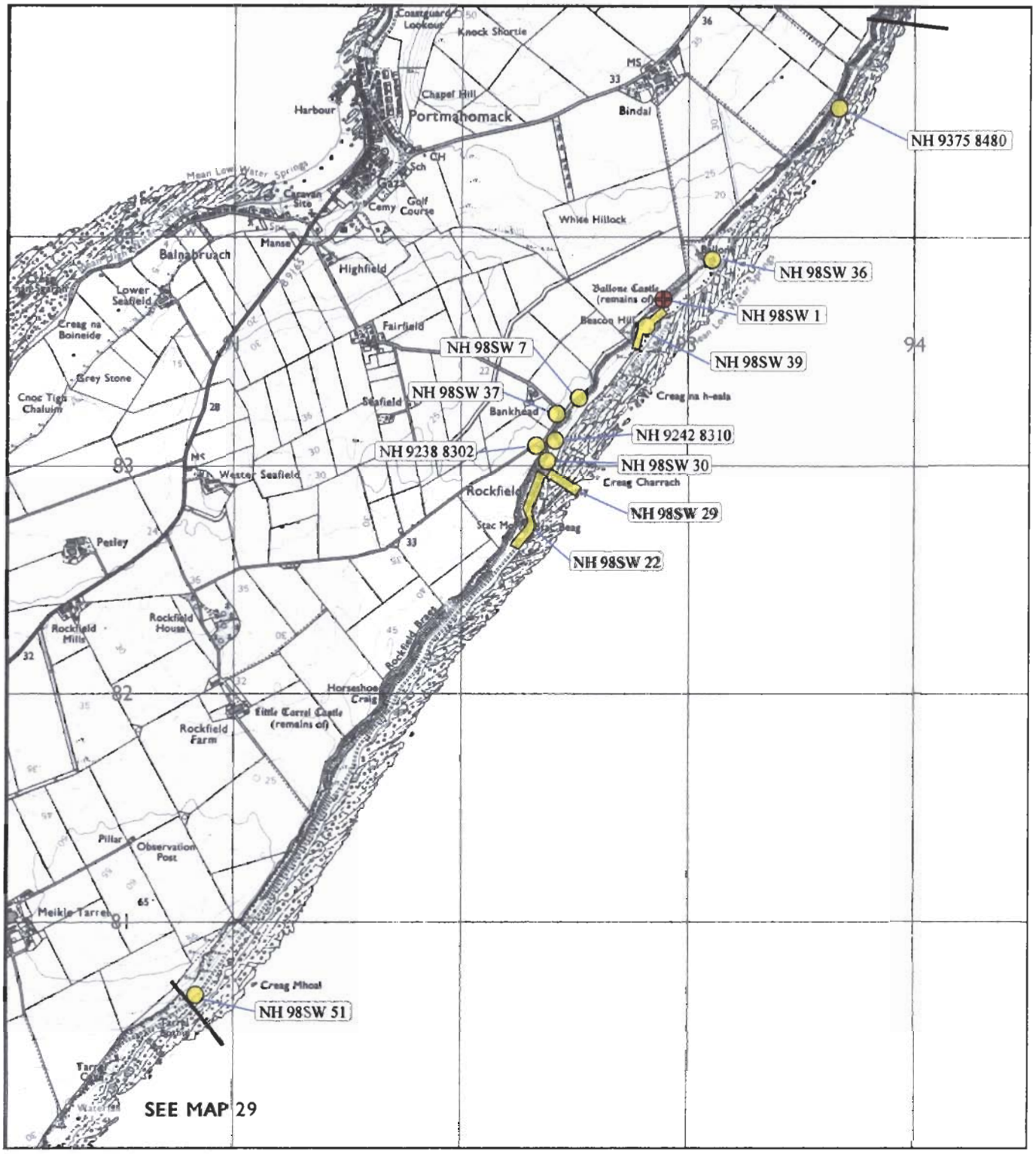
NH 9238 8302
ROCKFIELD
Roofed building
18th/19th century AD
Fair
Nil

NH98SW 37
NH 9242 8310
BANKHEAD
Two deserted cottages
18th/19th century AD
Fair
Nil

NH98SW 1 - Scheduled & Listed A
NH 9288 8373
BALLONE CASTLE
Residential castle
16th/17th/18th centuries AD
Good
Nil

Sites in the Hinterland

NH98SW 36
NH 9309 8390
BALLONE MILL
Water mill; pond
18th/19th century AD
Poor
Monitor



MAP 30: MEIKLE TARREL TO EASTER BINDAL 1:25 000

MORAY FIRTH SURVEY Grid ref: NH 90-94/80-85

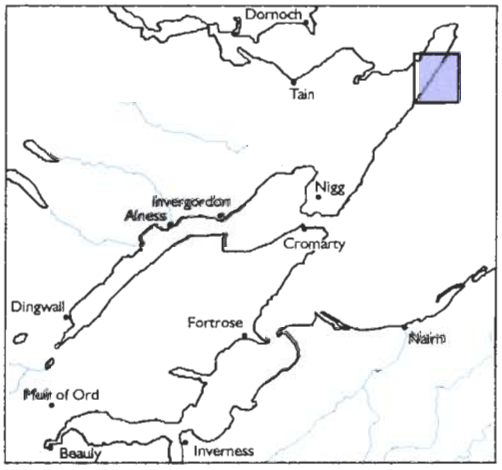
Basemap: O.S. *Pathfinder* Series Sheet 124

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 31: TARBAT NESS

Hinterland Geology and Coastal Geomorphology: The rock bounded coast of Tarbat Ness rests on Old Red Sandstone which is mantled by a cover of boulder clay and morainic drift. Raised beach platform continues to the point of the Ness. At Wilkhaven a small fringing beach near the tip of the rock bounded peninsula is about 10m wide with banking shingle. The till capped cliffs behind the beach are about 20m high and capped by marine deposits.

Erosion class: Although the peninsula is exposed to the NE gales the cliff is resilient in terms of erosion and is considered to be stable at the present. Some rubble dumping was noted at the tip of the Ness but this is not connected with sea defence, rather tipping of demolition material.

Built Heritage and Archaeology: The hinterland archaeology in the southern part of this area comprises the possible hermitage site at Bindal Muir, consisting of a walled enclosure. In the north, the Tarbat Ness lighthouse, cottages and helipad are the built heritage. The foreshore archaeology in this area includes the possible promontory fort at Wilkhaven, which is a poor state of repair. Other sites include the ruined building and

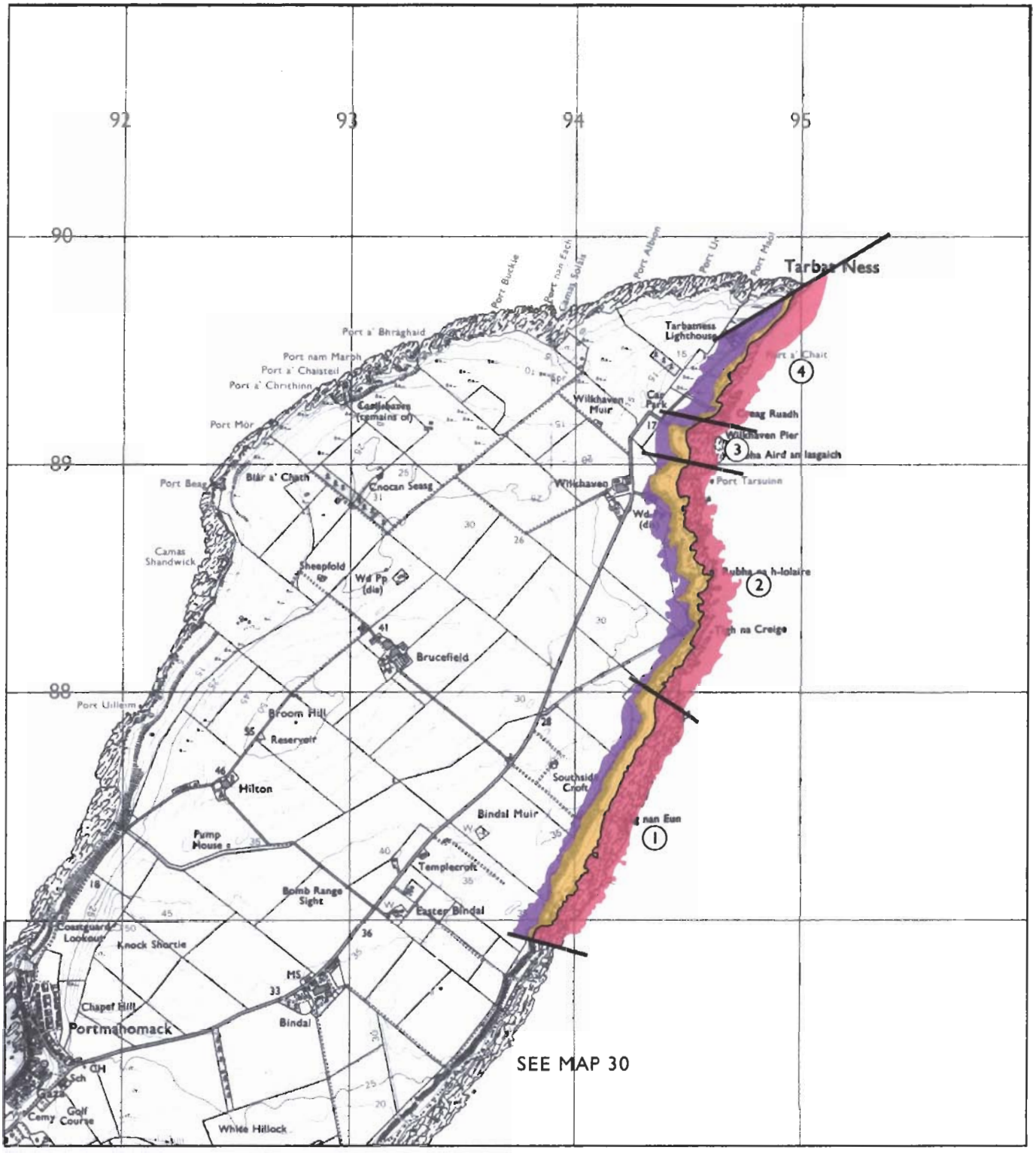
Map 31: Hinterland Geology and Coastal Geomorphology

1. EASTER BINDELL to south of TIGH NA CREIGE
NH 945 867
1km
Rock platform/boulders
High cliff (c.20m)
Raised beach deposits
Wide Post Glacial raised platform mantled by boulder clay. The shoreline consists of rock platform and boulders.

2. South of TIGH NA CREIGE to WILKHAVEN
NH 945 866
0.1km
Rock platform
High cliff (20m)
Raised beach deposits
Wide Post Glacial raised platform mantled by boulder clay. The shoreline consists of rock platform and boulders.

3. WILKHAVEN PEIR
NH 945 871
0.2km
Rock platform
High cliff (c.20m)
Raised beach deposits
Small cliff girt beach with a sand component comprising fringing beach extending to the foot of the degrading cliff. Boulder clay mantles relict shore platform.

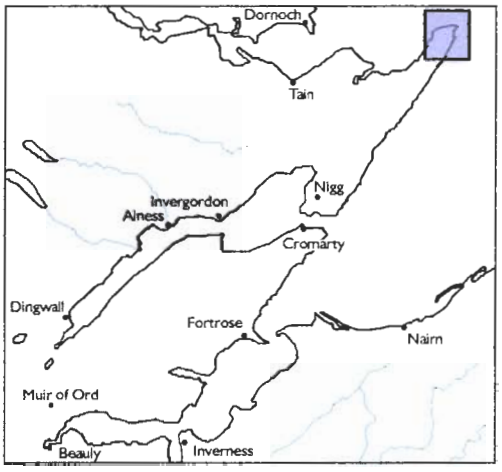
4. WILKHAVEN PEIR to TARBAT NESS
NH 948 876
0.8km
Rock platform
High cliff (>10m)
Raised beach deposits
Peninsula with raised beach deposits overlying exposed rock platforms. The foreshore is exposed comprising of rock platform and boulders.



MAP 31: TARBAT NESS

MORAY FIRTH SURVEY Grid ref: NH 92-96/86-91

1:25 000



HINTERLAND GEOLOGY AND FORESHORE GEOMORPHOLOGY

Assessment date: 24 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:

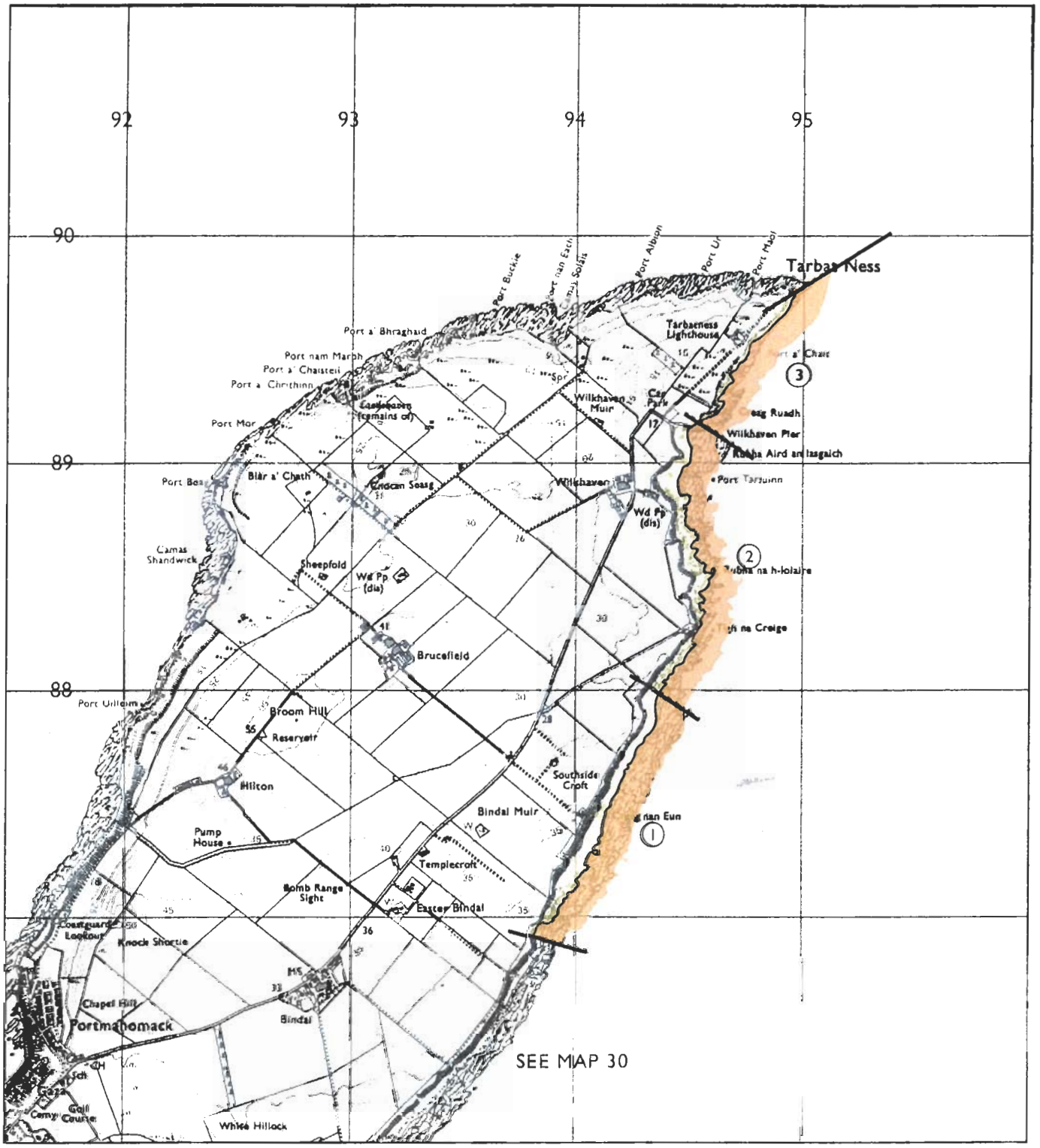
- Mainly rock platform
- Mainly sand
- Mainly alluvial/marine mud
- Marsh

MAP 31: EROSION

1. EASTER BINDAL to south of TIGH NA CREIGE
NH 942 945
1.1km
Stable or eroding
Wide wave cut platform overlooking exposed rock platform scoured into a deep gullies scoured by wave action. Attrition at the base of the cliff is constant owing to exposure to easterly gales. Erosion considered to be slow owing to the fairly resilient nature of the Old Red Sandstone.

2. WILKHAVEN
NH 945 869
1.2km
Stable or eroding
Irregular coastal edge modified by wave action overlooking gullies and rock platforms. The beach at Wilkhaven is receiving sufficient sand supply and is classified as stable.

3. TARBAT NESS
NH 947 875
0.8km
Stable or eroding
Exposed peninsula consisting of irregular cliff face overlooking exposed rock platforms. As described in the previous units the coastal edge is undergoing constant erosion but at a considerably slow rate.



MAP 31: TARBAT NESS

MORAY FIRTH SURVEY Grid ref: NH 92-96/86-91

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 124
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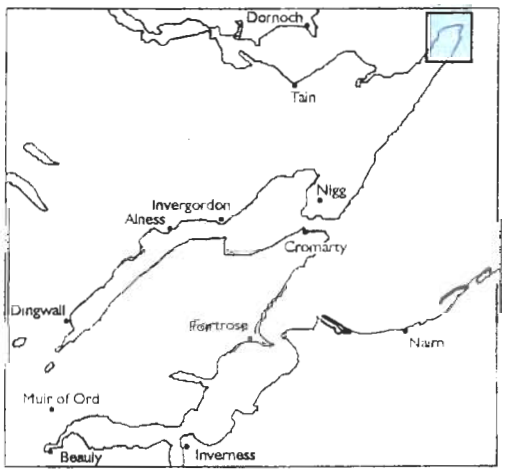


EROSION CLASS

Assessment date: 24 September 1998

Key:

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

MAP 31: BUILT HERITAGE AND ARCHAEOLOGY

Sites on the Coastal Edge & Foreshore

NH98NW 9
NH 9443 8662
WILKHAVEN
Promontory fort (possible)
Uncertain
Poor
Monitor

NH 9437 8683
WILKHAVEN
Roofed terrace above scarp
18th/19th century AD
Fair
Nil

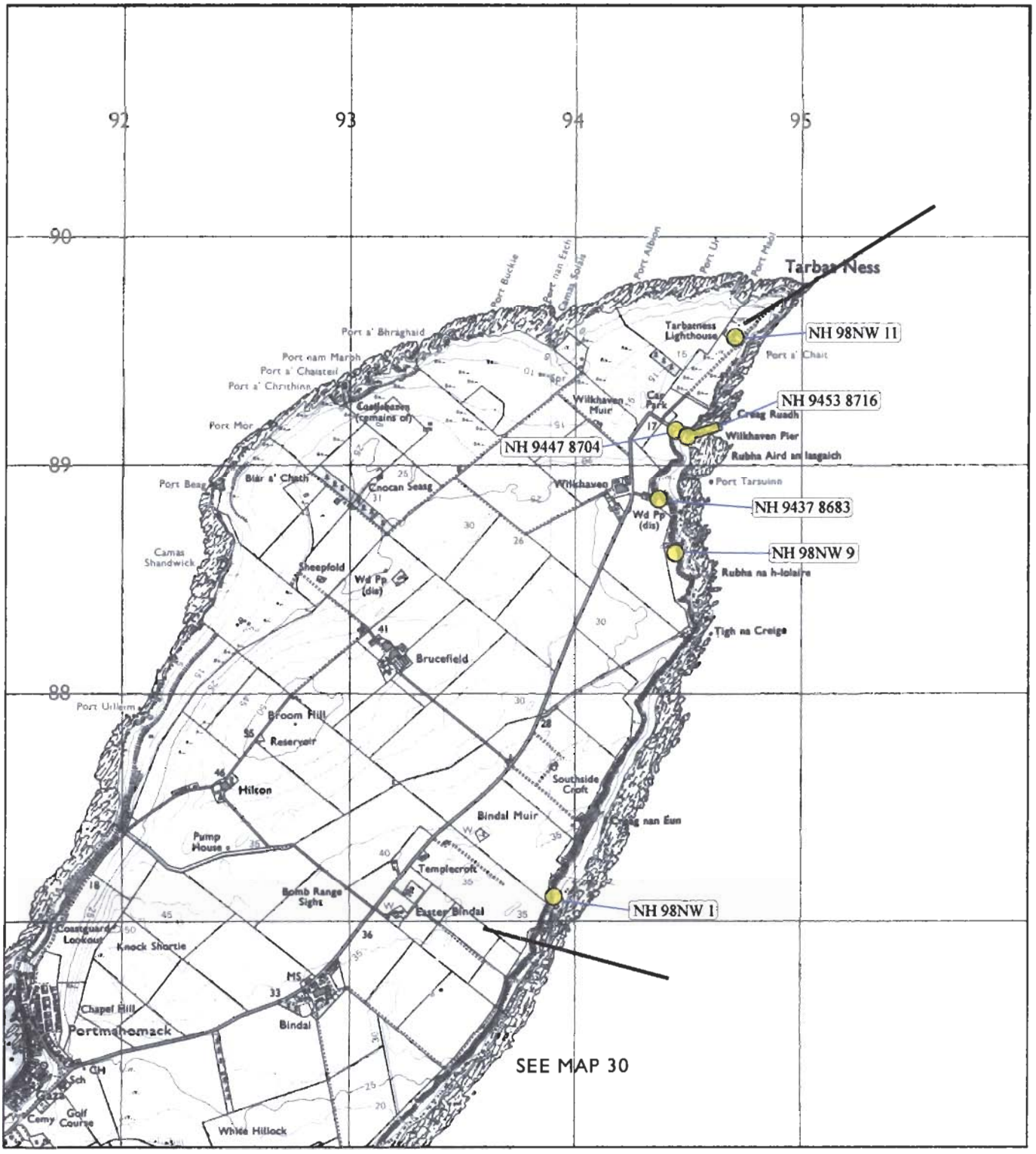
NH 9447 8704
WILKHAVEN
Ruined building
Uncertain
Poor
Monitor

NH 9453 8716
WILKHAVEN
Pier and buildings
19th century AD
Fair
Nil

Sites in the Hinterland

NH98NW 1
NH 9387 8502
BINDAL MUIR
Hermitage (site of); walled enclosure
18th/19th century AD
Good
Monitor

NH98NW 11
NH 9469 8756
TARBAT NESS
Lighthouse, keeper's cottages and helipad
19th century AD
Good
Nil



MAP 31: TARBAT NESS

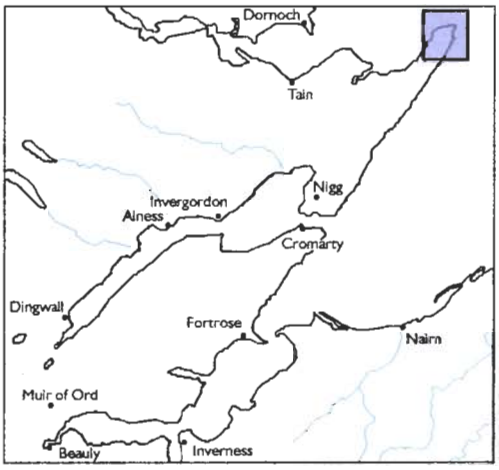
MORAY FIRTH SURVEY Grid ref: NH 92-96/86-91

BUILT HERITAGE AND ARCHAEOLOGY

Assessment period: September 1998

1:25 000

Basemap: O.S. *Pathfinder* Series
Sheet 124



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

3. SURVEY RESULTS

Introduction

Based on the results of the field survey this section examines the findings concerned with the erosion record of the Beauly, Moray and Cromarty Firths. The percentage of the total length of coastline cited is based on the straight- line measurement of each unit as mapped on each of the coloured 1:25,000 map sheet (Maps 1-31). The combined length of all units is 166.8km. This figure was used to establish the percentage frequency of each erosion class. 166.8km is an underestimate of the true length of the coastline surveyed, as it does not incorporate the mean length of meandering rivers, deeply incised cliff-edges and indeed other topographical irregularities along this coast, but it does provide an indication of the relative significance of the results.

Erosion Survey

Erosion classes are used as defined in the Historic Scotland procedure document. An analysis of the results are shown in a series of histograms (Figures 3-8) and summarised in Table 2.

The *Stable* and *Definitely accreting* class are more or less equal with 11.2 and 12.4% respectively (n= 14 and 13). The coastal units identified as *Eroding or stable* achieved the highest frequency with 40%. The *Definitely eroding* class is represented by 6.1% with a total of 15 individual coastal units. The *Accreting or eroding* or *Accreting or stable* class is represented by 9.8 and 20.4% respectively.

Erosion Class	Number of units	Total unit length (km)	Total length (%)
Stable	14	18.8	11.2
Eroding or stable	46	69.3	40.8
Definitely eroding	15	10.1	6.1
Definitely accreting	13	20.8	12.4
Accreting/eroding	14	16.5	9.8
Accreting/stable	22	34.1	20.4

Table 2 Summary statistics of the erosion class units lengths.

The results from the *Definitely eroding* class (Figures 5 and 6) confirm that only 6% of the total length of coastline examined is being effected by serious erosion. This class includes areas where there are breaches in existing sea defences (see South of Kiltearn Cottage to Balcarse Point NH 6232 6528) or on undefended cliffs such as St Brighs Chapel (NH 577 615 see below). A great majority of the *Eroding or stable* units are confined to the exposed rocky coastline of the North and South Sutors where erosion is ongoing albeit at a slow rate. Owing to the slow rate at which the cliff is eroding one could also classify the region as relatively stable.

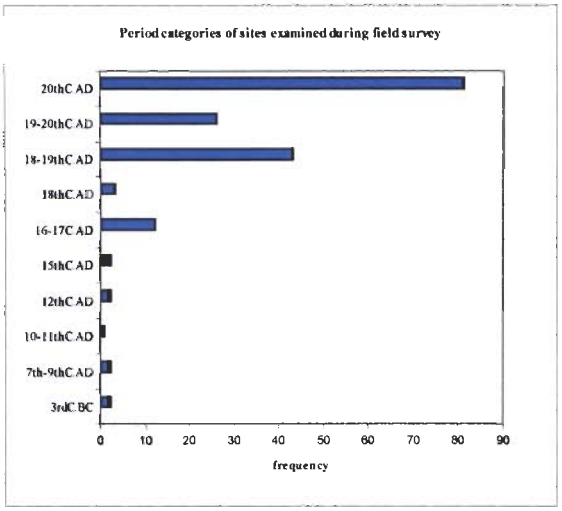


Figure 3. Period categories of sites identified during the survey

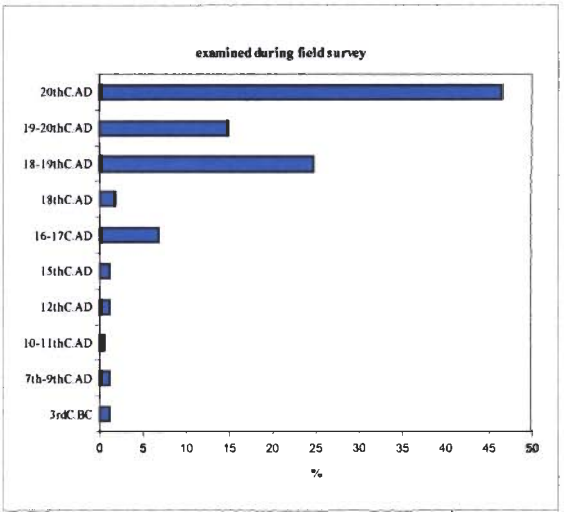


Figure 4. Percentage frequency of period categories

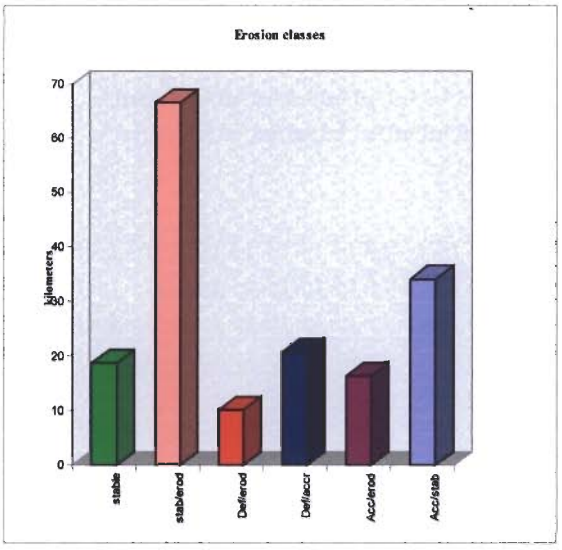


Figure 5. Distance versus erosion/stability classs

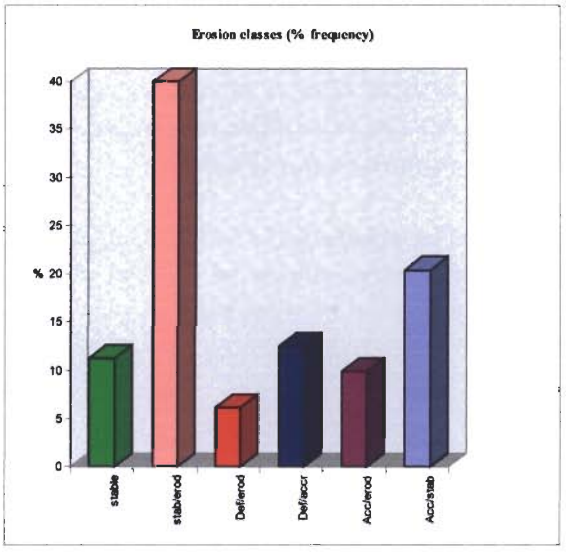


Figure 6. Percentage frequency of distance versus classification

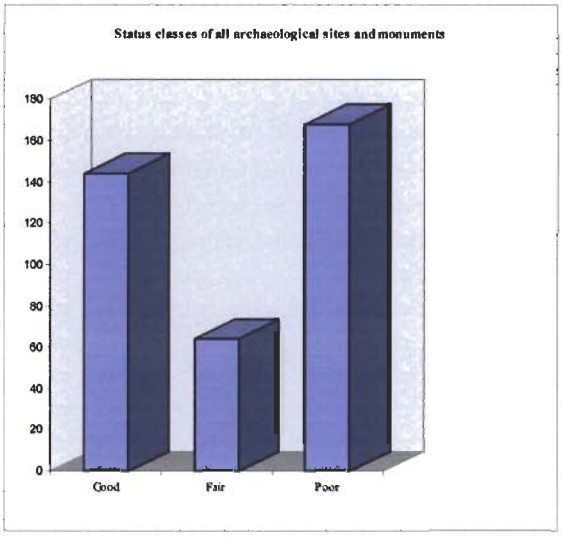


Figure 7 Frequency and condition of all archaeological sites

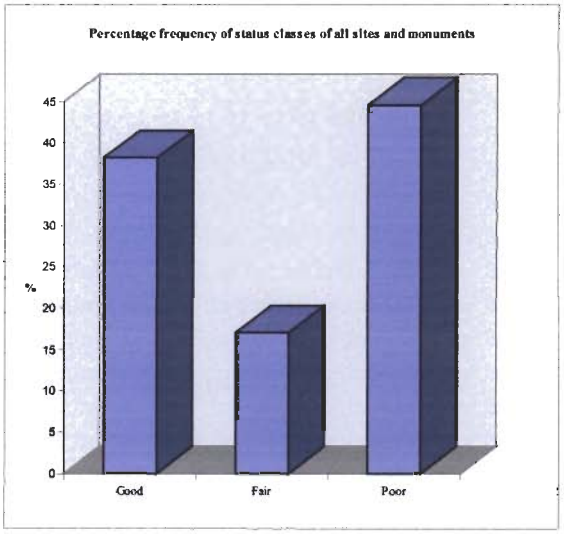


Figure 8. Percentage frequency and condition of all archaeological sites

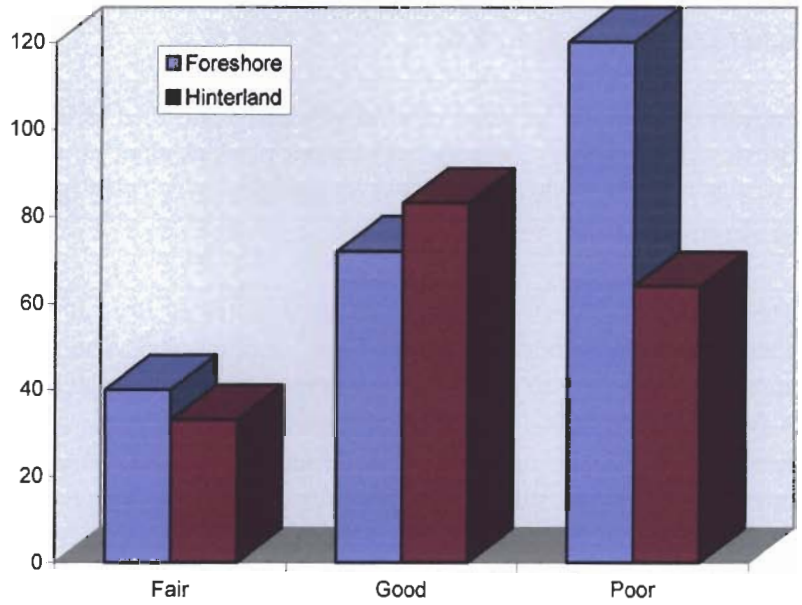


Figure 9. Erosion classes: Foreshore versus Hinterland.

Figure 9 demonstrates three preservation criteria for archaeological sites and monuments within the foreshore and hinterland. Within the foreshore category of sites, 40 are identified as *Fair*, Seventy-two sites were seen to be in a *Good* state of preservation whilst 120 were seen as *Poor*. In the hinterland category, 33 sites were found to be in a *Fair* state, 83 sites were found to in a *Good* state of preservation with 64 sites in a poor state of preservation.

These data show that there is a two-fold increase in the number of sites classified as *Poor* in the foreshore category. This pattern is not unexpected given the number of sites seen to be undergoing active erosion. Unlike sites located on the foreshore, archaeological sites and monuments in the hinterland are susceptible to other forms of attrition leading to their decline, these might include; neglect, abandonment, weathering, and quarrying.

Archaeology

Evidence of Mesolithic activity in the study area was confirmed by the excavations of two shell middens in Inverness (Myers & Gourlay 1991). Lithic scatters associated with shell middens suggested that one of the sites was a tool production site. The sites occupy a terrace on the delta at the mouth of the River Ness, at approximately 8-10 m above current sea-level. Worked flint tools of Mesolithic and Neolithic age are also recorded from Seafield West, near Inverness (NH 694 455).

South of the study area, Neolithic sites include Clava-cairn type sites whilst to the north, the Orkney-Cromarty types are common monuments. Additionally, henge and hengiform sites have been discovered, including the concentration of sites around Muir of Ord and Beauly.

Bronze Age sites include the two cist cemetery sites at Dalmore and Seafield. The site at Dalmore was adjacent to the survey area and contained a series of cists containing urns, vessels and burnt bone (Jolly 1879). The site at Seafield, Inverness was recently excavated and found a cist cemetery. One of the graves included a Butterwick type bronze dagger in a leather sheath (Cressey 1996).

Iron Age sites in the region include the hillforts of Craig Phadrig and Ord Hill at the mouth of the Beauly Firth. Additionally, forts and duns have been located on the hills to the south and west of the Beauly Firth. To the west of the Cromarty Firth lies the vitirfied hillfort site of Knockfarril.

There are large number of Pictish symbol stones located in the area of the survey. The Clach A'Mheirlich, class 1 symbol stone dates to the 7th-9th century AD. The stone is sandstone pillar bearing a step symbol on one side and a crescent above what appears to be a pair of pincers symbol on another. Other Pictish symbol stones in the region include the Rosemarkie cross-slab, now held in Groam House museum, Rosemarkie, the Nigg cross-slab and the Shandwick stone, now contained in a glass house. Although further from the current shoreline these two like Clach A'Mheirlich appear to have been positioned in close proximity to their contemporary coastal margins.

The pre-reformation chapel at Newhall point, now built on by recent housing, is associated with an extensive burial ground, from which radiocarbon dating on the skeletal remains produced dates of the 10th and 11th centuries AD (Reed 1986). A shallow ditch was found to surround the burial ground during the excavations. There was little evidence of the chapel buildings found by excavation. The Dunscaith castle site is the only motte site in the survey area. It was fortified by William the Lion in 1179 and currently consists of two concentric semi-circular ditches. Substantial plough damage has affected the upstanding remains of the site.

Four castles in the survey area dating from this period appear in various states of repair and condition. Shandwick castle was built around 1460 is completely destroyed. Stone was robbed freom the site in 1942 for road ballast. Castle Craig on the southern shore of the Cromarty Firth is the upstanding remains of a four storey vaulted floored tower house. The remains, which comprise the roofed NE wing and some low-lying walling, have been damaged by general climatic weathering, the effect of which has caused some large pieces of masonry to fall on to the foreshore below the castle. The Redcastle on the northern shoreline of the Beauly Firth is reported to be located on the site of Ederdour, erected by William the Lion in the 12th century AD. The castle was greatly added to in the 16th century and now stands as a roofless shell, affected by general climatic weathering and deterioration.

Surrounding the Inner Moray and Cromarty Firths are five 17th century grain stores or girnals. These large multi-storey, rectangular plan buildings were used by agricultural producing estates to store grain which could be accessed from both the production zones and the Firth. The girnals are associated with trackways leading from the hinterland to the shoreline, where landing places for boats have been located. In the case of the Foulis point girnal a number of hulks were recorded around the adjacent foreshore during the current survey.

The Caledonian canal was one of the largest engineering projects in the early 19th century in the survey area. The sea lock and associated basin, cottages, workshops and hand crane are currently all in good states of repair and are an excellent example of Industrial heritage of the region. Quarries and associated piers and quays are a feature in the Beauly Firth, providing stone for the canal and also a concentration of similar sites were recorded on the southern shore of the Cromarty Firth. The quays and stone piers are all in poor states and require monitoring and many of the quarries have suffered cliff failure and are now overgrown.

Early 20th century monuments include WWI and II military complexes on the North and South Sutors. This heavy military presence attests to the importance of the Cromarty Firth, especially as a Naval base during both wars. The Firth has had military connections since the mid 19th century during which Admiralty building occurred at places such as Cromarty harbour. Other later military sites include the remains of the large airfield at Evanton and the RAF seaplane base at Alness Point.

Currently the greatest visual impact in the survey area is the oil fabrication yard at Nigg and the various other associated sites around the Cromarty Firth. The Firth itself is a deep water terminal for oil rigs and platforms, which can often be seen along the middle of the firth, during periods of refitting and renovation.

4. CASE STUDIES

Introduction

Three case studies are provided to illustrate in further detail the range of coastal erosion or accretion that is effecting a variety of archaeological remains on the Moray coast. The first case study considers the marine crannogs in the Beauly Firth which have been dated recently using radiocarbon assay to the later 1st Millenium BC. The second case study is based on the chapel site of *Cille Bhrea* (also known as St. Brighs) where severe coastal erosion has truncated part of the site. The third case study concerns the various types of fish trap remains located along the entire length of the survey area. Examples of their typology and distribution within the survey area are presented. The archaeological importance of the case studies is contrasted by the affects of the various coastal processes reported in the previous chapter.

CASE STUDY ONE: BEAULY FIRTH MARINE CRANNOGS

Four large stone mounds have been recorded below high water mark in the Beauly Firth. These marine crannogs are large stone mounds situated on sandbanks or surrounded by mudflats. Although not visited during the current survey a number of physical characteristics were recorded from the fieldwork and the preliminary aerial photographic archive survey. The sites vary in size from approximately 20 to 70 m in length, they are oval in plan, with the exception of the Redcastle site which is irregular. The sites are all low mounds capped with large regular sized stones which appear similar to those on the current shorelines. They are all fully submerged at high tide and become exposed at various times during the ebb tide, depending on their relative heights

Brief history

Documentary evidence records descriptions and previous investigations of the marine crannogs in the Beauly Firth, including the following from the Old Statistical Account of Scotland (1799):

> "There are three cairns at considerable distances, one from the other. The largest is in the middle of the frith (sic), a huge heap of stones. This cairn is accessible at low water".

Odo Blundell, renowned for diving on Highland freshwater crannogs, visited the largest site in the middle of the firth, Carn Dubh in the summer of 1908 with the intention of diving. However, he discovered that it was high and dry on a sandbank. He rowed out to the site and found a number of large wooden timbers and possible artefacts (Blundell 1909).

Recent research

More recent research has surveyed and sampled all of the sites and produced a chronology based on radiocarbon dates from a sequence of structural timbers, showing that they were used during the 3rd century BC (DES 1995). Sampling specific to the Redcastle site has identified two structural sequences; the initial phase consisted of oval, wattle-sided pits, approximately 1-2 m diameter dug into the sub-surface sands. These pits appeared to be partially clay lined and were possibly used as hearths. The second phase was directly on top of the first and consisted of an extensive horizontal

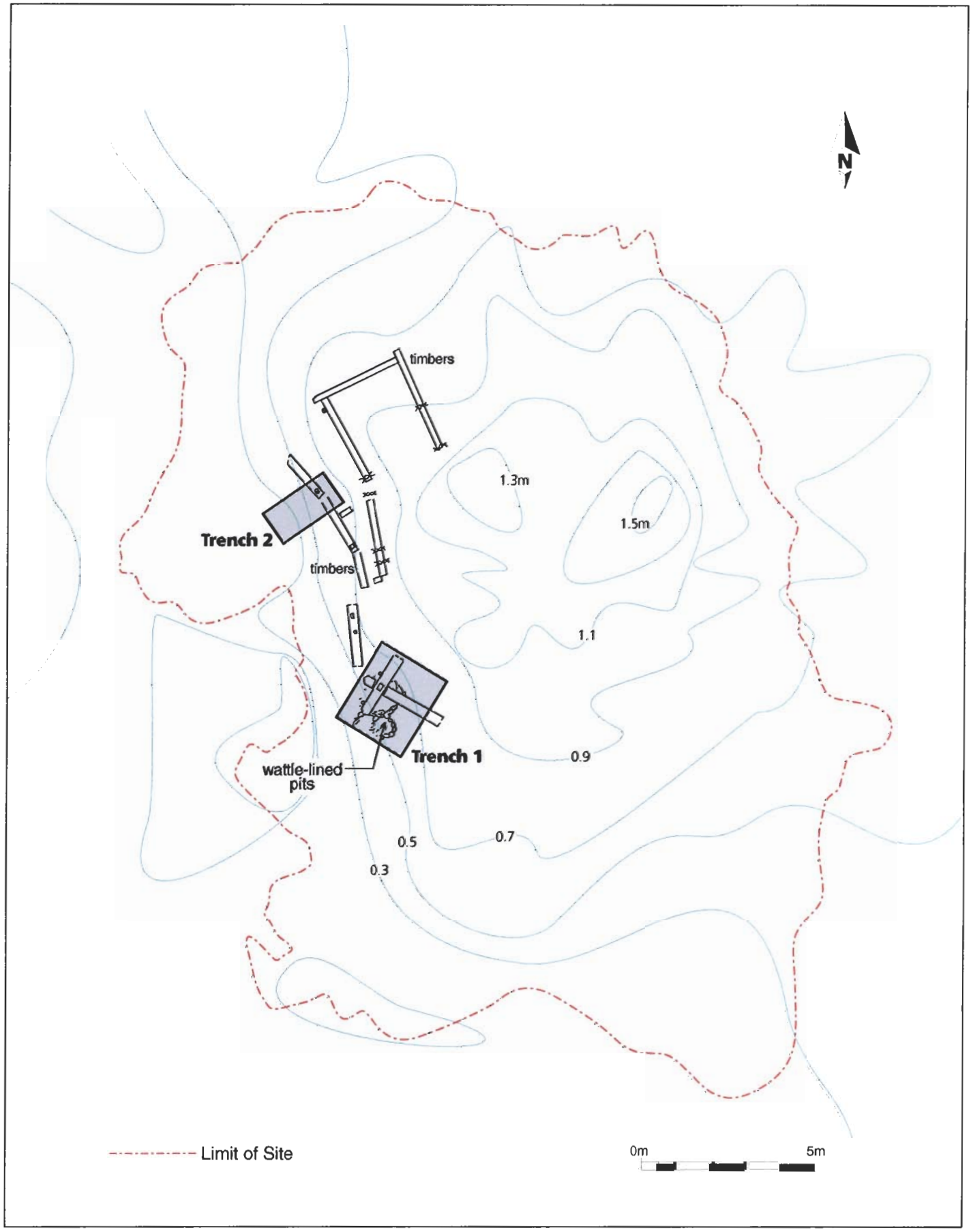


Figure 10. Contour plan of Redcastle Intertidal Crannog.

timber framework made up of large alder (*Alnus glutinosa*) planks that had been cut to shape with an adze-like tool. Associated with both construction phases were large quantities of animal bones, organic remains including woodchips and small fragments of leather. The research only investigated a small part of the site but the quality and variety of preservation of structural, artefacts and ecofacts was excellent

Sedimentary survey
Over a period of 18 months During 1996-7, the Redcastle crannog was monitored for sedimentary movement. The survey monitored points both on-site and adjacent to the exposed archaeology in undisturbed areas. There were also monitoring points off-site designed to measure changes of sediment levels on both the exposed and leeward sides of the site. During the survey a number of vulnerable areas were identified, these included the area sampled for both structural remains and radiocarbon dating. Disturbed by previous sampling, this area became consistently more exposed with animal bone loosened and occasionally removed. The timbers exposed during sampling were also subject to localised erosion and in the case of one horizontal timber, the western end became totally exposed. Despite protection measures using sandbags these areas continue to erode.

The results indicate various changes on and off-site which are identified as diurnal, seasonal or annual events, these included the erosion of sediment from the exposed south west edge of the site with accretion around the leeward north-east side. It was also evident that the surface stone cover and interstitial sediments act as protection of the underlying deposits. However, once exposed the underlying archaeological remains are threatened by a number of damaging processes ranging from plant colonisation, erosion of sediment, accretion and scouring by stone movement.

CASE STUDY TWO: CILL BHREA CHAPEL

Introduction
Cille Bhrea, Lemlair, Highland (NMRS ref: NH 56 SE 3) was chosen for this case study on the grounds that it provides an excellent example of coastal erosion directly effecting a medieval archaeological site. Recent excavations at the site are part of Historic Scotland's policy of *Managed Retreat* with the main criterion of removing skeletal material from an eroding cliff which are likely to be exposed as the cliff continues to recede.

Brief history
Cill Bhrea was reputedly founded in 1198 (Wordsworth 1997 citing Woodham). Cross slabs found at the site by R Gourlay in 1983 suggest that there may have been an earlier church. The present chapel is one of seven in the parish of Kiltearn (Wordsworth 1997). The church was first excavated in 1966 by Dr Tony Woodham. His unpublished excavation revealed a rectangular building with walls less than a metre high, a stone font, a possible communion table and grave slabs. Numerous burials were also recorded (Wordsworth *ibid*). The site was afforded *Scheduled Monument Protection* in 1970. A detailed survey of the site was carried out by RCHAMS in 1979. Further work was undertaken by Gourlay in 1983. His sketch of the site denotes that 15m of cliff with a height of 6m was actively eroding (see Figure 4 in Wordsworth 1997) with six burials exposed in the cliff section. Sometime after

1966 a revetment wall was built at the base of the cliff in an attempt to slow down the rate of erosion, this has subsequently been lost. Based on the findings of the *Damage Assessment Report* undertaken by Wordsworth 1997, which noted the exposure of human skeletal remains in the cliff section and scattered on the foreshore, further remedial work was undertaken in 1998.

Recent Record

Historic Scotland commissioned AOC Scotland to carry out an excavation and survey of the site, which resulted in the partial excavation of the chapel and graveyard covering a total area of 155 m^2. The strategy developed to address the objectives identified by Historic Scotland consisted of:

- cleaning and recording the site before excavation
- cleaning and recording the erosion face
- excavating the church, complete with a 2m wide strip all round it (Areas A, B, C & D in (Figure 4*)
- excavating a 3m wide strip along the erosion front of the site (Areas E & F in (Figure 11)
- recording the church structure in full.

Further work following the excavation at the cliff-edge included sowing grass seed over geotextile matting to promote greater stability.

The results of the excavation (carried out between 10th-31st August 1998) recovered valuable information on the density and nature of burials within the graveyard and chapel. In particular the presence of deep, complex archaeological deposits beneath the chapel suggest a long and complex use of the site (Rees 1998). The archaeological deposits were found to be shallow within the exposed cliff section (c0.90m) resting on unconsolidated marine sand and gravel.

Erosion

It would appear that the sites along this stretch of coastline are effected by predominantly south-easterly gales and high storm-tide surges, this appears to be the only explanation to account for causative factors leading to erosion in what is considered to be a fairly sheltered location Prior to the recent excavation, the unconsolidated nature of the exposed cliff was estimated to be retreating at about 1m every 10 years. The archaeological and remedial work mentioned will undeniably reduce the loss of skeletal material from the cliff section for the next 20 years. However we are of the opinion that until the cliff is better protected by rock armour to effectively reduce direct wave hammer and cliff under-cutting, erosion will continue to effect the site. In conclusion this case study demonstrates that the soft character of the underlying geology is a causative factor in coastal erosion at this site and further east along the Kiltearn Parish shoreline (see MAP 19 NH 620650). It can be concluded that erosion has been active over a long period of time thus resulting in the loss of part of the chapel and skeletal remains.

Figure 11: Site plan of Cille Bhrea chapel (courtesy of AOC Scotland).

CASE STUDY THREE: INTERTIDAL FISHTRAPS

Fish-traps are one of the most common foreshore monuments to be recorded during this survey and their forms and uses deserve further discussion. Similar features have been recorded in both Welsh and Irish estuaries and this research aims to complement their study.

Location

The fish-traps recorded during the survey are positioned in the intertidal zone between Mean High Water Mark and Mean Low Water Mark. They are concentrated in two main locations; the Beauly Firth and the Cromarty Firth. They were designed primarily to catch salmon that were abundant in the Moray Firth during and prior to the 17th, 18th and 19th centuries. Seasonal runs of migratory salmon and sea trout swim through marine river channels that at low water often act as holding pools. The fish then use the flood tide to progress further upstream. The traps were placed at right-angles or oblique to the channel so the fish could be funnelled into the traps interior. The remains currently vary from low mounds or arcs of stone, small concentrations of wooden stakes protruding from the foreshore and composite wooden and stone structures.

Brief history

Fish-traps or 'yairs' in the Moray Firth have been in use as early as 1638 (RHP 561, 1820). The 1837-8 'Chart of the Firth of Cromarty' showed the different yair and stake net sites. A record in the Old Statistical Account for Scotland describes their use:

'there are a good number of salmon caught on the sea coast, chiefly by means of yaires, or small enclosures, built in a curve or semicircular form near the shore. At high water the salmon comes within these yaires, and at low water is easily taken, having no way of escape. This is the simplest and cheapest mode of fishing that can be derived. There are usually four or five yaires kept up in the parish; and each proprietor takes enough to supply himself and a few friends. In a good season he can send some to market. Flounders, herring-fry or sprats are frequently taken in these yaires' (OSA 1799, 488).

The siting of the traps appears to have been a critical factor in their productivity and both good and bad seasons were encountered. An OSA entry for Dingwall Parish provides an interesting pointer to low catch-rates:

'Owing to the distance to which the tide recedes at ebb, the muddy nature of the bottom, the freshness of the water from the influx of the Conon, and the other streams which discharge themselves into it here, the firth in this parish is very unproductive, - affording no fish, with the exception of a few flounders and some salmon, the latter of which are taken in yairs in the summer' (Vol.14 214)

The fish-traps were built up until the late 1830s when they were declared illegal, in favour of portable fishing rights. A map of all fish traps recorded between 1817 and 1909, has been compiled to show their distribution with previously unrecorded traps (see Figure 12).

Structural variations

Three different types of fish-trap were identified from the documentary evidence these include; yairs, stake nets and bag nets. Yairs are curvilinear stone mounds that are positioned perpendicular to the shore. They bend almost at right angles in places at which point small semicircular features are included in the plan. In places, wooden stakes were recorded in the semicircular features and evidence from English, Welsh and Irish examples point to the use of wattle panels in their construction (Aston 1988, O'Sullivan 1995). Some yairs show double semicircular features at points along their length and others have curved features towards Low Water Mark. Others fishtraps are recorded as a zig-zag plan that also included semicircular features. Cruives-type traps were recorded on the lower stretches of the River Beauly in *Country Life Magazine*, (1904) and they were designed to restrict the available passage for the migrating salmon. Yairs were built in the shallow estuarine areas of the Moray Firth and were also designed to trap salmon, although other fish were caught.

Stake nets were illustrated on the 1837-8 map of the Cromarty Firth with lines of stone mounds interconnected by netting. The stone mounds were small, often circular and supporting posts onto which the nets were strung. During the survey, one of the mounds still contained the remains of wooden stakes.

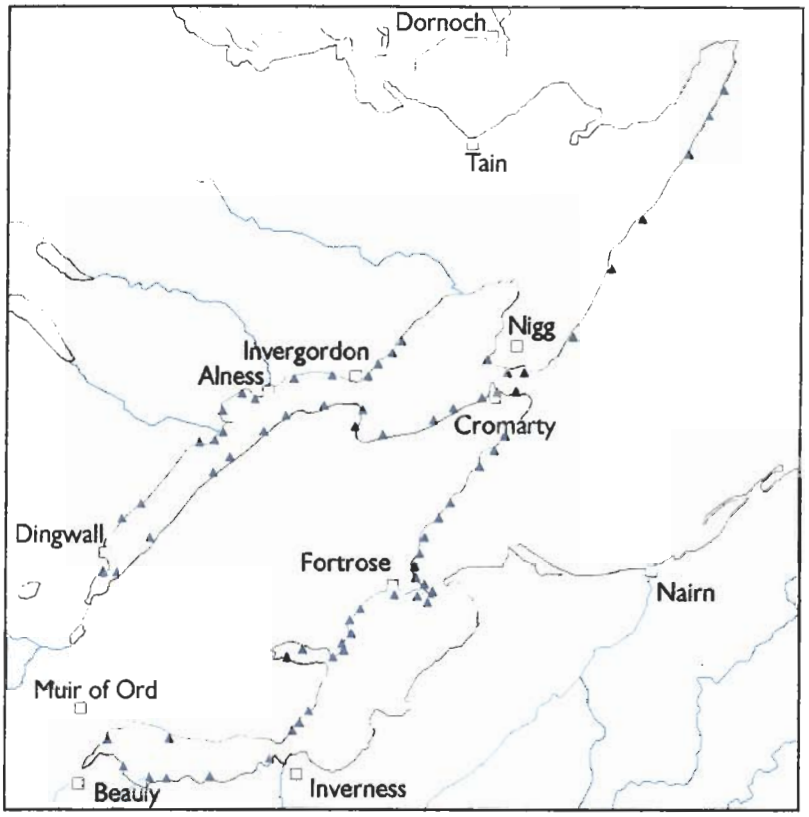
The third group of sites are bag nets that consist of single lines of nets with a stake at the Low Water end of the structure and at right angles to the main net line was a shorter net. During the current survey evidence of these types of yairs were found only as single mounds in the intertidal zone.

Current condition

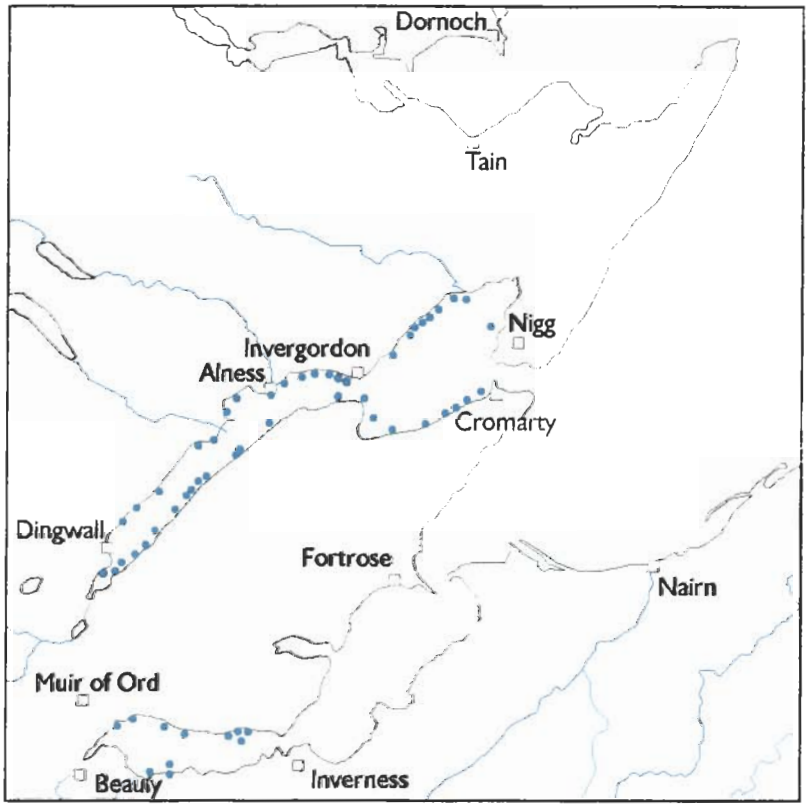
All the sites recorded were in poor condition that indicates both their fragility and the extent to which they have been affected by coastal erosion or accretion. Sixty-two remaining fish traps were recorded along the length of the survey area and the different forms and frequency are shown in Table 3.

Fishtrap Type	Morphology	Frequency
Yairs	Curvilinear	8
-----	Curvilinear, complex	7
-----	Zig-zag	0
Stake net mounds	Linear	3
-----	Linear, multi-mound	2
-----	Curvilinear, multi-mound	3
Bag nets	----	0
Uncertain	Wooden piles	5
-----	Stone mounds	9
-----	Stone lines	13
-----	Unclear	12
-----	-----	**62 Total**

Table 3 Summary table showing the frequency and a preliminary typology of fish-traps within the survey area.



Distribution of fishtraps observed from cartographic sources (1817 - 1909)



Distribution of fishtraps observed during the 1998 Coastal Survey

FIGURE 12: DISTRIBUTION OF FISHTRAPS IN THE SURVEY AREA

5. SUMMARY AND RECOMMENDATIONS

Coastal Erosion

The survey results are summarised in Table 4 below. Within the classification associated with erosion, 69km (40%) of the coastline was seen to be *Stable or eroding* and 10.8km (6.1%) was classified as *Definitely eroding*. A distance of 18.8km (11.2%) was classified as *Stable*. The *Accreting or stable* and *Accreting or eroding* class attained a distance of 34.1 (20%) and 16.5km (9.8%) respectively.

Erosion classification	distance	% frequency
Stable	18.8	11.2
Stable or eroding	69.3	40.8
Definitely eroding	10.18	6.1
Definitely accreting	20.8	12.4
Accreting or eroding	16.5	9.8
Accreting or stable	34.1	20.4
Total unit distance	**169.68**	**100.7**

Table 4 Summary table of classification units by distance and % frequency

The study also demonstrates that coastal units formed in areas derived from Holocene marine sand and gravel which are found mainly within the Beauly and Cromarty Firths are more susceptible to erosion than the harder sandstone geologies of the North and South Sutors. The survey has identified a number of other important factors controlling erosion within given coastal units. Erosion is not only occurring as a result of wave hammer and scouring during storm conditions, but also as a result of continuing wastage through water currents and shifts in river channel configuration at the head of the Beaulay and Cromarty Firths. A good example at the latter location can be seen in the partial loss of the fishtrap on the foreshore at Dingwall (NH 5619 5818 Map 17). There are a number of other factors occurring that may have little to do with storm-wave activity and these have to be considered as part of the ongoing processes of erosion. These include heavy rain and run off, cryoturbation (freeze-thaw action in the case of exposed soft sections), local topography and geological structure. Recent land use and drainage regime along with modern or 19th century sea defences can also be a contributing factor in limiting or promoting erosion.

Short- term effects on archaeological sites and monuments

Within the limitations of the rapid survey methodology, our results show that post-medieval archaeology is well represented and that many of these archaeological sites are located well within the intertidal area. We have also demonstrated that a great deal of the intertidal archaeology is being severely eroded. With reference to the fish trap sites we have increased the number from 31 previously known sites to 62 an increase of 31. Table 5 below demonstrates the disparity and general condition at the time of the survey between sites and monuments located on the foreshore and those recorded in the hinterland.

LOCATION	FAIR	GOOD	POOR
FORESHORE	40	72	120
HINTERLAND	33	83	64

Table 5 Summary of relative condition of archaeological sites and monuments

General Recommendations

It is recommended that all the sites identified as fish-traps that are currently effected by active erosion should be surveyed as soon as possible. The final loss of these sites is imminent and their remains should be subjected to detailed analyses and survey. These sites are part of the local economic history and should be afforded full recognition as important wetland sites.

The marine crannogs in the Beauly Firth are a part of the total sample of similar sites from around the Scottish coastline and as such represent an important resource. Their survival in the intertidal environment appears to be under threat and future research is recommended to assess the nature of these sites, their use and propose measures to protect the resource.

The severe erosion on the south-east facing cliff around Port an Righ and the discovery of a new shell midden containing possible Iron Age artefacts demonstrates the need for more detailed survey. Excavation and sampling of the midden with adjacent landscape survey would explorethe hypothesis that the area was an important locality of Iron Age occupation, given the proximity to the hinterland fort and dun at NH 8434 7362.

The results of this coastal survey should be fully integrated into any future policy on Coastal Zone Management and future Shoreline Management Plans.

This work must be considered only as a snapshot and reflecting observations during the months of August and September 1998. A new survey should be commissioned within five years to compare and assess the changes that have occurred since this present work was carried out.

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BIBLIOGRAPHY

Ashmore P. J. 1994 Archaeology and the Coastal Erosion Zone: Towards a Historic Scotland Policy. Historic Scotland, Edinburgh.

Ashmore P. J. 1996 Archaeology Procedure Paper 4, Coastal Zone Assessment Survey, Historic Scotland, Edinburgh.

Ashton M. (ed.) 1988 *Medieval fish, fisheries and fish ponds in England.* British Archaeological Reports, British Series 182.

Ash Consulting Group 1994. Coastal erosion and tourism in Scotland SNH Review No 12, Edinburgh, Scottish Natural Heritage.

Burgess, C. and Church, M. 1997 Coastal Erosion Assessment Lewis; A Report for Historic Scotland Vol. 1-2.

Butt, J. 1967 The industrial Archaeology of Scotland. David and Charles: Newton Abbot ,170-174.

Cressey, M., 1996 Archaeological Excavations of a Bronze Age Cemetery at Seafield West, Inverness, Highland Region. Centre for Field Archaeology Report No. 288. Commissioned by Inverness retail Park Ltd.

Cressey M, and Toolis, R. 1996 Coastal Assessment Survey Solway North Coast. CFA Report No.312. Vols 1-3. Commissioned by Historic Scotland.

Cressey, M., Dawson, A, Dawson, S., Milburn, P., Long, D. and Bunting, J. 1998 Solway Firth Coastal Assessment Survey Phase 2 1977. CFA Report 384 Commissioned by Historic Scotland.

Baldwin, J.R. 1986 (eds) Firthlands of Ross and Sutherland. Scottish Northern Studies, Edinburgh.

Blundell O. 1910 'On Further Examination of Artificial Islands in the Beauly Firth, Loch Bruiach, Loch Moy, Loch Garry, Loch Lundy, Loch Oich, Loch Lochy and Loch Treig', Proceedings of the Society of Antiquaries of Scotland, 44 (1909-10), 12-33.

Haggart, B.A. 1986 Relative sea-level changes in the Beauly Firth, Scotland. *Boreas vol* 15, 191-207.

Haggart, B.A. 1987 Relative sea-level changes in the Moray Firth area, Scotland. p67-108 In: Shennan, I and Tooley, M.J. (eds) *Sea Level Changes,* Institute of British Geographers Special Publication, Vol 20, Oxford Blackwell.

Haggart, J.B. 1988 The stratigraphy, depositional environment and dating of a possible tidal surge deposit in the Beauly Firth area, northeast Scotland. Palaeogeography, palaeoclimatology, palaeoecology, vol.66, 215-230.

Hale A. G. C. 1995 Discovery and Excavation in Scotland p 44.

Leask, C. 1996 Sea Level variation and coastal sand movements in Scotland: their inclusion in the Statistical Accounts of Scotland. Historic Scotland.

Lamb, H. 1991 Historic Storms of the North Sea, British Isles and Northwest Europe. Cambridge University Press.
Firth, C.R. and Haggart, J.B. 1989 Loch Lomond Stadial and Flandrian shorelines in the inner Moray Firth area Scotland. *Journal of Quaternary Science* vol.4, 37-50.

Firth, C.R. 1990 Late-Devensian relative sea-level changes associated with the deglaciation of the Inverness Firth and Beauly Firths In: Beauly to Nairn Fiêld Guide C.A. Auton, C.R. Firth & Merrit, J.W. (eds)1990 Quaternary Research Association p. 5-9.

Jolly, W. 1879 Notice of the excavation and contents of ancient graves at Dalmore, Alness, Ross-shire, *Proceedings of the Society of Antiquaries of Scotland* 13 1878-9, 252-64.

James, H. 1996 Coastal Assessment Survey: The Firth of Forth from Dunbar to the Border of Fife. GUARD 346, on behalf of Historic Scotland.

Jardine, W.G. 1979 The Western (UK) shore of the North Sea in late Pliestocene and Holocene times. In Oele, E. Schuttenhelm, R.T.E. and Wiggins, A.J. (eds), *The Quaternary History of the North Sea.* Acta Universitatis Uppsaliensis, Upsala 159-174.

Long, A. 1996 Coastal Assessment Survey Ullapool to Lochinver, University of Glasgow and Historic Scotland Vol. 1-2.

Maizels, J. and Aitken, J, *Palaeohydrological change during deglaciation in upland Britain: A case study from Northeast Scotland.* Ch6, 105-145. in Starkel, L., Gregory, K.J., and Thornes, J.B. (eds) 1991 Temperate Palaeohydrology; Fluvial Processes in the Temerate Zone during the last 15000 years. John Wiley pub.

Myers A. M. and Gourlay R. B. 1991 'Muirtown, Inverness: preliminary investigation of a shell midden' *Proceedings of the Society of Antiquaries of Scotland* 121 1991, 17-26.

Moore, H, and Wilson G. 1997 Report on a Coastal Zone Assessment Survey of Orkney: (Burray, Flotta, Graemsay, Hoy & South Ronaldsay) Ease Archaeological Consultants. Historic Scotland Publication.

Moore, H. and Wilson, G. 1997 Report on a Coastal Zone Assessment Survey of Northmavine, Shetland. Ease Archaeological Consultants Historic Scotland Publication.

Moray Firth Partnership; Geomorphology & Coastal Defence Topic Group Paper 1997

O'Sullavan, A. 1995 Medieval fishtraps within the Dee Estuary, county Limerick. *Archaeology Ireland* 32, 15-17.

Old Statistical Account of Scotland 1791-99, volume 17, Kiltearn Parish, pp. 488.
Reed, D 1986 Resolis Chapel *Discovery and Excavation, Scotland* (1986) 16.

Omand, D. 1984 The Ross and Cromarty Book. The Northern Times Ltd.

Robertson, P and Miller, K 1997 Coastal Assessment Survey for Historic Scotland, Fife-Fife Ness to Newburgh. Maritime Fife.

Reed, D. 1995 The excavation of a cemetery and putative chapel site at Newhall Point, Balblair, Ross and Cromarty, *Proc. Soc. Antiq. Scot.* 1995, 125.

Rees, T. 1998 An Archaeological Investigation of Cille Bhrea, Chapel: The Data Structure Report. AOC Archaeology Group Report. Commissioned by Historic Scotland, pages 1-24.

Smith, J.S. and Mather, A.S. 1973 The beaches of East Sutherland and Easter Ross. Commissioned by the Countryside Commission for Scotland, Department of Geopgraphy, Aberdeen University.

Sissons, J.B. 1969 Drift stratigraphy and buried morphological features in the Grangemouth-Falkirk area, central Scotland.

Sissons, J.B. 1974. Lateglacial marine erosion in Scotland. *Boreas* Vol 3, 41-48.

Sissons, J.B. 1976 Lateglacial marine erosion in south east Scotland. *Scottish Geographical Magazine* vol. 92,17-29.
Worsdworth, J 1997. *Cille Bhrea Chapel and Graveyard: Damage Assessment Report* commissioned by Historic Scotland. pages 1-11.

Stevenson, R.B.K. (1955) Pins and the chronology of brochs, *Proc. Prehist. Soc. New. Ser.*, 21. 1955, 286.

Shoreline Management Olan; Inver4ness Firth and part of the Moray Firth September 1996 HR Wallingford Report EX 3230

Cartographic sources examined at West Register House, Scottish Records Office Edinburgh.

Johnston's map of the County of Ross and Cromarty marked with salmon fishings. Date 1870-1871 Ex. cr 1/12-15 RHP RHP 4485-4486

Plan of the Firths of Beauly, Inverness with part of the Moray Firth accurately extended for the land and aquatic survey by M.S. Telford and Dohnie with the stations of stake net and fishings. Date 1820 RHP 561.

Plan of the mouth of the River Ness and Beauly and part of the Moray Firths, coasts and adjoining; showing stake nets. Dated 1860. RHP 6341.

Alness Ordnance Survey 6" Plan marked to show the agreed march between the Salmon fishings *ex adverso* the lands of Easter Teininch and Wester Teininch (formerly Culmolockie) and Culcraggie. Dated 1909 RHP 2923

Chart of the Cromarty Firth from Invergordon to Cromarty showing stone nets and fishings in Udale Bay. Dated 1851 RHP 159/1

Chart of part of Udale Bay showing stake nets and fishing stations. Dated 1851 RHP 159/2

Admiralty Chart of the Firth of Cromarty and part of the River Conon from Admiralty Survey. Dated 1837-1838. RHP 1461/1-3

Ordnance Survey 1" Plan marked to show the fishings in Moray Firth, Cromarty Firth and River Conon. Dated 1876. RHP 1702

Cartographic Sources

British Geological Survey *Nairn* Sheet 84 Solid Edition One 1:50 000
British Geological Survey *Inverness* Sheet 83 Drift Edition 1:50 000
British Geological Survey *Cromarty* Sheet 94 Drift & Solid Edition 1:50 000
British Geological Survey North Sheet, Solid 1:625 000 3rd edition.
British Geological Survey North Sheet, Drift 1:625 000 3rd edition
British Geological Survey *Alness* Sheet 93 1:50000 3rd edition

Ordnance Survey 1988 *Inverness & Culloden Muir* Sheet 177 NH64/74. 1:25 000
Ordnance Survey 1988 *Cromarty & Balintore* Sheet 134 NH 86/87 1:25 000
Ordnance Survey 1988 *Ben Wyvis* Sheet 143 NH 46/561:25 000
Ordnance Survey 1988 *Strath Rory & Nigg* Bay Sheet 133 NH 67/77 1:25 000
Ordnance Survey 1988 *Invergordon* Sheet 144 NH66/76. 1:25 000
Ordnance Survey 1988 *Dingwall & Stathpeffer* Sheet 159 NH 45/55 1:25 000
Ordnance Survey 1988 *Fortrose & Munlochy* Sheet 160 NH 65/75 1:25 000
Ordnance Survey 1988 *Beauly* Sheet 176 NH 44/54 1:25 000

Ordnance Survey 1989 Dornoch, Alness & Invergordon Area Landranger 21.1:50 000
Ordnance Survey 1989 Invergordon and Srathglass Area Landranger 26. 1:50 000

Aerial photographs (RCAHMS)

Monochrome series:
1946 photograph run B663, B40, B663 1066/SCOT/UK 112 & 114 23.5.46
Frame numbers; 3036-3038, 3041-3043, 3053-3058, 3065-3063, 3083-3090, 3097-3103, 3142-3148, 3179-3181, 3186-3190, 3214-3226, 3302-3304, 3306-3308, 3338-3341, 4001-4404, 4032-4138, 4160-4158, 4169-4172, 42010-4204, 4208-4213, 4235-4238, 4247-4250, 4358-4366.

Clyde Colour series:
1977 photograph run 7343.
Frame numbers:
B743 5: 409-436
B771 32: 730, 731, 736-742, 748-754, 756-763, 765-784, 786-790
B743 5: 392-400,402-405, 437-448, 452-465, 473-506,508-511, 515-520, 522-529
B744 6: 553-562, 604-608

Aerial Photographic survey also included searching the collections held by SNH, Foddarty Way, Dingwall, Highland Region.

Plate 1. Chapel site at Cille Bhrea and eroding cliff edge

Plate 2. Kilmuir foreshore showing dump defence and erosion.

Appendix1

Plate 3. Eroding shell midden at Port An Righ.

Appendix 1