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NATIONAL SAND DUNE VEGETATION SURVEY
SOUTH WALES DUNE SURVEY
SITE REPORT NO. 52
PEMBREY COAST
1989

T C DARGIE

Contract HF3-03-434

Nominated Officer: G. Radley, CSD

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NCC COASTAL ECOLOGY RESEARCH PROGRAMME

The Coastal Ecology Branch of the Chief Scientist Directorate was established in August 1979. One of the functions of the branch is to co-ordinate a programme of research and survey in the field of terrestrial coastal conservation. To this end a research programme has been developed with four main aims:

1. To describe the size, location and quality of the main coastal habitats in Great Britain (saltmarshes, sand-dunes, vegetated shingle, sea cliffs, strandlines, 'reclaimed' land and maritime islands).
2. To assess the impact of major development projects on sites of national importance for nature conservation.
3. To provide guidance on the management of the main coastal habitats for nature conservation.
4. To investigate the role of physical and biological processes in the maintenance of natural and semi-natural coastal habitats.

The results are disseminated in a variety of Nature Conservancy Council publications.

- a. *CSD Contract reports:* limited numbers with specialist interest are produced. Copies are usually prepared by the contractor and made available as a Chief Scientist Directorate Report in microfiche through the Nature Conservancy Council's Information and Library Services.
- b. *Contract survey reports*
- c. *Research and survey in nature conservation*
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If you would like any further information on this report or on the research programme please contact Dr Doody in Peterborough.

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1. BACKGROUND AND OBJECTIVES

The Pembrey Coast was surveyed as part of the Sand Dune Survey of Great Britain. This project is one of a series of strategic surveys of coastal habitats currently being undertaken by the Nature Conservancy Council. The Survey has two aims:

- i. To produce a vegetation map and description for each sand dune system which will be useful to those involved directly in its conservation;
- ii. To produce a national inventory of the range and extent of sand dune habitats in Great Britain. Such an inventory will then allow the interest of any particular site or group of sites to be placed in its national context.

This contract (HF3-03-434) involved a survey of dunes in South Wales. The specification involved the production of a vegetation map(s) and a botanical survey report for **each** of the following sites or site sets:

- i. Pembrey Coast
- ii. Whiteford Burrows
- iii. Hillend-Llangennith-Broughton-Delvid-Hills Tor Burrows
- iv. Port-Eynon to Horton
- v. Oxwich-Nicholaston-Penmaen-Pennard Burrows
- vi. Black Pill to Bryn Mill
- vii. Crymlyn Burrows

This document is one of the above site reports. In addition, the overall information is synthesized in a Regional Report which reviews the following points: dune distribution, type, size, vegetation communities and relationships, management and special characteristics. This report should be read in conjunction with the regional document if the Pembrey Coast is to be considered in a broader geographical and ecological context.

2. METHODS

The Pembrey Coast was surveyed using the standard techniques of the Sand Dune Survey of Great Britain. Collecting data in a consistent manner will thus enable valid comparisons to be made between sites on a national basis.

The field survey technique and subsequent analysis of the data were carried out using methods similar to those of the National Vegetation Classification (NVC).

Further details of the field techniques, data analysis and vegetation mapping are included in Annex 1. The quadrat data set (in coded format) is presented in Annex 7. Quadrat membership of vegetation types is given in Annex 4.

3. SITE DESCRIPTION

Location, conservation status and land ownership

The Pembrey Coast is a large 10 km long x 1-3 km wide sand dune system running northwest - southeast between the Taf-Tywi-Gwendraeth estuary and the Burry Inlet at Burry Port (Fig. 1). It is within the Borough of Llanelli, Carmarthen, Dyfed.

The northern sector around Tywyn Point and the southern sector of Pembrey Burrows both lie within the Pembrey Coast SSSI (3180ha, renotified March 1984). The central sector of Pembrey Forest, Pembrey Country Park and a small dune area north of Pembrey Burrows all lie outside the SSSI boundary. The conservation value of Pembrey Forest (Brechfa Forest Division) is recognized by the Forestry Commission. A conservation plan has been completed for the area (Currie 1987).

The northern area is owned by the Ministry of Defence and is used as an aerial firing range operated by RAF Pembrey. Access is restricted to weekends and bank holidays. Pembrey Forest is owned by the Forestry Commission. Pembrey Country Park and Pembrey Burrows are owned by Llanelli Borough Council. Permission for access was obtained from all organisations.

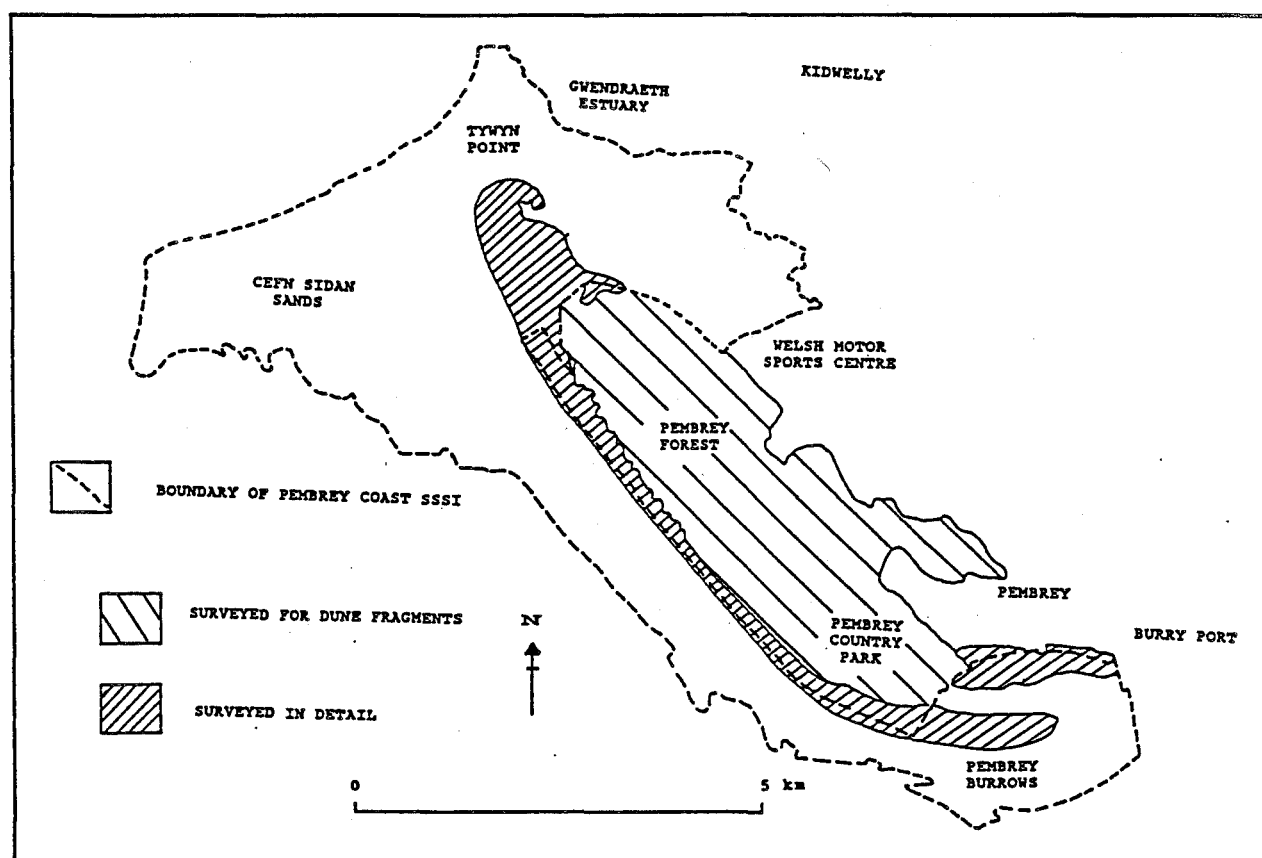


Figure 1. Survey and SSSI boundaries for Pembrey Coast

Geomorphology

Little information is available on the origin of this very large dune system. As elsewhere in South Wales the sand source is Devensian till and outwash materials deposited by piedmont glaciers fed from valleys and high ground further east. An end moraine running north-south is known from Whiteford, southeast of Pembrey Burrows across the Burry Inlet, and it is possible that there is a till core to some of the Pembrey system.

Equally likely is a shingle core generated offshore by a rising Flandrian sea level. This might have migrated landwards and become sand covered as it reached the intertidal zone. It could then have created an area of poor drainage between the shingle barrier beach and the shore. This badly drained depression may now be the very flat topography between Pembrey and Kidwelly to the north.

Storm conditions between the 14th and 18th centuries drove much sand inland elsewhere in South Wales. It is likely that this happened in the Pembrey system and such sand could be represented by the low dunes under forest at Pennybedd Wood, detached from Pembrey Forest. Alternatively, this latter dune area might be the remnants of an earlier small sand system.

In recent times there has been erosion in the centre of the Pembrey Coast. Material removed here, plus that in the estuaries to the northwest and southeast, has provided substantial sediment for the construction of rapidly accreting terminal spits at Tywyn and Pembrey Burrows. Overall the Pembrey Coast represents a large hindshore dune system behind a barrier beach with two fine recurved terminal spits. Such systems usually undergo cyclic erosion and stabilisation, with parabolic dunes creating extensive slacks. These features have, however, probably largely disappeared under forest.

Soils

All soils sampled proved to be neutral or alkaline (pH range 7.0-8.2) apart from some acidity under a forest cover (pH 6.3-6.8). These results suggest that calcareous dune sand (or an alkaline/brackish watertable in slacks or the transition to saltmarsh) is responsible. In a dune environment the implication is that the dunes are a young system and lack stable surfaces which over a longer time would become acidic by leaching.

Management

Past and present management are varied. The aerial firing range at Tywyn Point has been in operation for some while and the dunes and saltmarsh are fenced to exclude people and stock.

Pembrey Forest has been owned by the Forestry Commission since the 1920's and much was planted (mainly with Corsican Pine) from the early 1930's. Second generation planting is now in progress using mainly Corsican Pine and some Sitka Spruce. Areas of conservation interest, including many sectors of track and ride, are subject to specific procedures in relation to forestry practice (Currie 1987).

Pembrey Country Park was formerly an explosives/munitions factory. It has now been restored by Llanelli Borough Council to provide a wide variety of recreational opportunities (e.g. golf, riding, cycling, miniature railway, dry skiing, picnic areas), a visitor centre and large areas of car parking for access to the beach or forest. A charge is made for admission. One car park has been built without NCC approval within the Pembrey Coast SSSI. Much of the Pembrey area is the subject of developments proposed by Llanelli Borough Council and these are reviewed by NCC(1983). There is also a small industrial estate, factory and caravan park on the eastern side of the country park.

Pembrey Burrows is managed in the north as a golf course. Former wetland along the northern dune edge has been drained to provide fairways. In the dunes there has been little fertiliser application and good-quality semi-natural grassland is present. North of Pembrey saltmarsh there is an area of fixed dune with pronounced 'hedgehog' topography not used for golf. Trailbikes use the area but erosion is not severe. Until recently the dunes south of Pembrey saltmarsh were largely unspoilt but a road has been cut through the centre of the dunes and the illegal car park (see above) built from it.

4. VEGETATION OF THE PEMBREY COAST

This section contains a general description of the vegetation of the Pembrey Coast. Thorough survey of Pembrey Forest and Pembrey Country Park was not done; instead, a search was made for dune vegetation fragments using aerial photographs in rapid reconnaissance.

The characteristic species composition of each community is outlined and the mapping legend number and equivalent NVC code(s) are included in brackets. An explanation of the NVC codes can be found in Annex 3 together with further information on the NVC communities, local variations and non-NVC vegetation types. The vegetation map(s) is provided at the end of the report and area data for vegetation is given in Annex 8.

Strandline

The strandline is poorly developed on the exposed outer dune edges and sand burial transforms it into a foredune. In more sheltered locations to leeward, on the transition between saltmarsh and dune, there is a species-rich community dominated by the foredune grass Sand Couch (*Elymus farctus*), and upper saltmarsh grasses Red Fescue (*Festuca rubra*) and Fiorin (*Agrostis stolonifera*). There are also additional indicators of strandline, saltmarsh and foredune/mobile dune: Sea Sandwort (*Honkenya peploides*), Spear-leaved Orache (*Atriplex prostrata*), Prickly Saltwort (*Salsola kali*), Sea Beet (*Beta vulgaris maritima*), Marram Grass (*Ammophila arenaria*) and Sea Holly (*Eryngium maritimum*). This is an intermediate community type which does not fit the NVC. It is mapped as 1 and coded as X1. It mainly occurs in a mosaic with Sea Couch-grass (*Elymus pycnanthus*) saltmarsh (17 - NVC SM24).

Foredune

Active scour at the dune foot in the centre of the Pembrey Coast has removed all foredunes. At Tywyn Point there is one extensive zone of low foredunes which straddle a buried strandline.

The lowest are embryo foredunes dominated by Sand Couch (*Elymus farctus*): Additional infrequent species suggest that the sand has buried a strandline: Spear-leaved Orache, Sea Rocket (*Cakile maritima*), Sea Sandwort and Sea Beet. This is mapped as 2 and the NVC code is SD4. Above this position the foredunes contain both Sand Couch and Marram grass. The strandline indicators above are often present if the foredunes are close to the drift line but higher up the beach additional species suggest mobile dune elements: Sea Holly (*Eryngium maritimum*), Sea Spurge (*Euphorbia paralias*), Evening Primrose (*Oenothera erythrosepala*) and Common Ragwort (*Senecio jacobaea*). This is mapped as 3 and the NVC code is SD6a.

At Pembrey Burrows the most extensive suite of foredunes in this South Wales survey is located at the front of the entire frontage of the southern exposed dune face. Both Type 2 (SD4) and Type 3 (SD6a) are present and in places the width of both reaches 160m (probably more in recent expansion since 1986 aerial photography). The foredunes even exist well below high water levels and saltmarsh species can be found with Sand Couch-grass. There is also a small patch close to Pembrey saltmarsh, on sand derived from tidal scour.

Dune grassland

Tywyn

Dune grassland is largely restricted to the western edge of this area. Mobile dune (4 - NVC SD6d) forms a western fringe up to 80m deep as a species-poor Marram Grass (*Ammophila arenaria*) sward. A large patch of mobile dune with both Marram and Red Fescue (*Festuca rubra*) as dominants (5 - NVC SD6e) is present in the relative shelter east of the dune ridge at Tywyn Point.

East of the mobile dunes is a series of several low sub-parallel dune ridges which curve northwards and which were probably foredunes in origin. The westernmost are part-stabilised with a semi-fixed dune grassland of sparse Marram and Red Fescue set in a patchy carpet of the moss *Tortula ruralis* ssp. *ruraliformis* and several annual species (7 - NVC SD7d). Many of these ridges are also invaded by young Sea Buckthorn (*Hippophae rhamnoides*) scrub.

There are three areas of fixed grassland. The first is a series of Red Fescue - Lady's Bedstraw (*Galium verum*) patches well to the east on the transition to saltmarsh. These locations are probably old foredunes which have developed from the Type 1 (X1) strandline transition. The second (also 8) is in the south of the point in an area of former Sea Buckthorn scrub which was cleared in 1985 (Currie 1987). The turf is patchy with much bare sand.

The final fixed grassland is Type 9 (NVC SD9) as a small patch on a slight rise close to the eastern boundary with Pembrey Forest. This is a rank grassland with False-oat Grass (*Arrhenatherum elatius*) mixed in a sward dominated by Red Fescue.

Pembrey Forest, Pembrey Country Park and Pembrey Burrows

There is no mobile dune community for most of the central 5km dune frontage west of Pembrey Forest. Coastal erosion appears to have eroded all foredunes and mobile dune grassland. Only a narrow (30-50m width) strip of semi-fixed grassland (6 - NVC SD7c) is found, a mix of Marram, Red Fescue and Common Restharrow (*Ononis repens*). Much of this is invaded by young Sea Buckthorn scrub.

South of the visitor centre for Pembrey Country Park there is a narrow ridge of mobile Marram (4) dune extending southeast for c.1.6km to where it merges into foredunes and then appears again as mobile dune in a 0.5km band at the eastern end of Pembrey Burrows.

Behind this outer dune ridge there is another wide zone of semi-fixed dune as at Tywyn, but here it is Type 6 (NVC SD7c) grassland with much Common Restharrow. This wide belt extends to the eastern end of Pembrey Burrows. Low ridge and swale topography suggests this grassland was formerly a foredune environment.

There is little Type 7 (NVC SD7d) semi-fixed dune in this area and most is on recently-constructed embankments around car parks close to the visitor centre. Further inland the main sward is a fixed dune of Red Fescue and Lady's Bedstraw (8 - NVC SD8). This extends into the southeastern corner of the country park and the southwest of Pembrey Burrows. It is even more extensive north of Pembrey Saltmarsh where much has been converted to golf course. Some patches show slight evidence of leaching (presence of the moss *Dicranum scoparium*) but in general the turf is fairly rank and is often invaded by Dewberry (*Rubus caesius*). There is no acidic grassland.

There are small patches of rank Type 9 grassland with False-oat Grass and Red Fescue, usually in corners used for dog-walking.

Most of the grassland in Pembrey Country Park is a re-seeded mesotrophic (i.e. circum-neutral) sward. Rank and infrequently mown areas away from trampling pressure are dominated by False-oat Grass (mapped as MG1). Heavily-used parts are seeded with Rye Grass (*Lolium perenne*) and are mapped as MG2. These types were not recorded in detail and hence not related to NVC mesotrophic grassland descriptions.

Dune slack

The largest extents of dune slack are at Tywyn. In Pembrey Forest drainage and shading have eradicated most cases but a few are still scattered in the area. At Pembrey Burrows they are confined to the northern part of the dune system.

Tywyn

A young slack system is developing from Sea Rush (*Juncus maritimus*) saltmarsh (16 - NVC SM18b) in the west close to the exposed dune ridge. Patches at the north end contain a species-rich sward with Glaucous Sedge (*Carex flacca*), Fiorin (*Agrostis stolonifera*), Variegated Horsetail (*Equisetum variegatum*), Red Fescue, patches of Creeping Willow (*Salix repens*), the mosses *Bryum pseudotriquetrum* and *Campylium stellatum*, and the liverwort *Aneura pinguis*. This was mapped as 12, is Type 12a, NVC code SD14c.

An important feature along most of the eastern side of Tywyn is transitional damp grassland dominated by Red Fescue, Yorkshire Fog (*Holcus lanatus*), Bird's-foot Trefoil (*Lotus corniculatus*), Fiorin, Sand Sedge (*Carex arenaria*), Self-heal (*Prunella vulgaris*) and Creeping Willow. This was mapped as 14 (NVC SD16).

Further east in wetter positions there is an extensive area dominated by two slack types. In the south is an area covered by Creeping Willow and a carpet of the moss *Calliergon cuspidatum* (Type 12b, mapped as 12, NVC SD15). This has plentiful occurrences of the Marsh Helleborine orchid (*Epipactis palustris*). Further north there is a tall-herb community (13 - NVC SD15c) dominated by a mix of Fleabane (*Pulicaria dysenterica*), Yorkshire Fog, Water Mint (*Mentha aquatica*), Silverweed (*Potentilla anserina*), Sea Rush, Creeping Willow, Yellow Iris (*Iris pseudacorus*) and a moss carpet of *Calliergon cuspidatum*.

Pembrey Forest and Pembrey Burrows

Within Pembrey Forest there are a few Type 12b, 13 and 15 slacks. These generally show signs of shading. In Pembrey Burrows drier slacks containing Common Restharrow and Creeping Willow are found amongst fixed dune north of Pembrey saltmarsh. In one area they form pronounced 'hedgehog' dunes, the probable site of a former blowout in which slack shrubs were able to grow up through a steady accumulation of sand to form this type of dune.

Woodland and scrub

An impressive quantity of Sea Buckthorn (*Hippophae rhamnoides*) is present in all sectors of the Pembrey Coast. Two types can be recognised: a stage of early invasion when Red fescue is still present in some quantity (21 - NVC SD18a), and a late stage (22 - NVC SD18b) which is shaded and enriched by leaf litter and bird excreta, shown by Stinging Nettle (*Urtica dioica*) in the understorey. Patches of both exist in partly-zoned patches at Tywyn and Pembrey Burrows where invasion is recent. For the entire coastal front of Pembrey Forest the zonation of types is perfect, with the mature stands against forest (planted originally for dune stabilisation) and the early stage to the west entering grassland.

Other scrub types are much smaller in extent and none is found at Tywyn. Blackthorn (*Prunus spinosa*, 26 - W22), Gorse (*Ulex europaeus*, 27 - W23) and Blackberry (*Rubus fruticosus*, 28 - W24) are scattered around the edges of Pembrey Forest and Pembrey Burrows.

There is a marked contrast in the distribution of woodland types, with wetland types (slack woodland) largely confined to Tywyn and dry dune coniferous woodland to sectors further south. At Tywyn there are many patches of young and rapidly expanding Common Sallow (*Salix cinerea*, 23 - NVC W1) and Alder (*Alnus glutinosa*, 30 - X2). These often mix to form thick copses. The understorey of both usually contains Marsh Bedstraw (*Galium palustre*) and Yellow Iris (*Iris pseudacorus*). Alder woodland (30) is also found in old Pembrey Forest slacks but here it is more mature and heavily shaded, with a poor ground flora.

The coniferous woodland of Pembrey Forest is dominated by Corsican Pine (*Pinus nigra*) and covers a very large proportion of the Pembrey Coast survey area (c. 950ha). Unthinned plantations support a poor groundflora but older thinned stands (35-55 years) have a diverse tall shrub understorey (Hawthorn, Common Oak, Sycamore, Cotoneaster) and a groundlayer of various herbs, perhaps ferns and very frequent and thick Blackberry. Recently felled areas do not seem to regenerate via a dune succession but a weedy community develops, usually with Rosebay Willowherb (*Epilobium angustifolium*). Replanting generally takes place quickly and succession in clearings is not easily observed. Former heavily shaded slacks usually have some relict Creeping Willow but little else. In more open stands Sea Buckthorn can tolerate shading by leggy growth.

Other habitats

There are small areas of swamp and large expanses of saltmarsh with good transitions to dune. Pembrey Forest contains a small reed-bed dominated by Common Reed (*Phragmites australis*) at the edge of one slack in the north (18 - NVC S4a) and the western end of the saltmarsh at Pembrey Burrows has a mosaic of Common Reed and Sea Club-rush (19 - NVC S4d/S21b) which may relate to discharges from a small adjacent sewage treatment plant. Small excavations by RAF Pembrey at Tywyn have been revegetated with a Bulrush swamp (*Typha latifolia*), 20 - NVC S12b.

Transitions to saltmarsh at Tywyn involve both dune grassland and slack. In damp areas the change is to Sea Rush (*Juncus maritimus*) saltmarsh (16 - NVC SM18b) but drier areas usually grade into Sea Couch-grass (*Elymus pycnanthus*) saltmarsh (17 - NVC SM24). This last type is the commonest at Pembrey where dry types of transition are dominant.

Recent changes in vegetation

No early air photos were available to compare with 1986 survey material for an analysis of change. Field survey suggested that active accretion at Tywyn and Pembrey Burrows had created large areas of relatively new dune, saltmarsh and some slack. The dune scarp in the centre of the Pembrey Coast is retreating due to Coastal erosion. Reclamation schemes in Pembrey Country Park have had little effect on natural and semi-natural vegetation, though there has been a loss of semi-fixed dune to an illegal car park in the adjacent SSSI.

5. RARE PLANTS

The SSSI site description cites the following rare or local plant species: Sand Catchfly (*Silene conica*) - found during survey in Pembrey Country Park, Fen Orchid (*Liparis loeselii*) and Dune Gentian (*Gentianella uliginosum*).

6. SITE ASSESSMENT

The Pembrey Coast is important as a high-quality site of geomorphological and biological interest. It is a very large dune system and most communities are natural types with little anthropological influence. It has a good range of community diversity in its dune vegetation, including actively accreting foredunes and a range of mobile, semi-fixed and fixed grasslands. It lacks only acidic grassland and dune heath. The transition to saltmarsh is excellent at both Tywyn and Pembrey. There are also several local or rare species, most of which are present in reasonable numbers.

Conifer planting in Pembrey Forest has removed most of the vegetation interest for a very large proportion of the total survey area. The major interest is at Tywyn and Pembrey Burrows. There is no visitor pressure at the former and it has excellent slacks to complement its young dune grasslands, though Sea Buckthorn invasion is strong, as is slack woodland invasion. There has been some loss of fixed dune to golf course at Pembrey Burrows, plus the probable removal of slacks by drainage.

7. COMMENTS AND SUGGESTIONS

There is little need for concern at Tywyn unless slack woodland development is considered a threat to some rarities. There is massive Sea Buckthorn development which would now be very difficult to control. In Pembrey Forest there may be some scope for discussion with the Forestry Commission on experiments to attempt regeneration of dune grassland in small areas where clear-felling has been completed. There is a reasonable chance that acidic grassland or heath could be developed. Visitor impact is a potential threat to the dunes at Pembrey Burrows via overspill from Pembrey Country Park - foredune, mobile and semi-fixed dunes are fragile systems - and this should be raised with the park officials and Llanelli Borough Council.

ANNEX 1

METHODS

AERIAL PHOTOGRAPHY

Air photos were used for field navigation and vegetation mapping in all but one site. The following material was supplied or purchased:

Crymlyn Burrows	Cambridge University RC8K 27 May 1987 Colour (poor quality) c. 1:6000 Prints 88-92, 97-105, 121-125
Black Pill to Bryn Mill	None available - field positioning and mapping done by pacing in relation to features on 1:10000 OS map.
Pennard and Penmaen	Hunting Surveys HSL UK 86 023 19 March 1986 Panchromatic (excellent quality) c. 1:5000 Run 17 Prints 2563-2566 Run 18 Prints 2478-2482
Oxwich and Nicholaston	Cambridge University RC8KW 20 June 1983 Colour (fair quality) c. 1:5000 Prints 201-207, 209-213 (212 missing), 218-222.
Port-Eynon to Horton	Cambridge University RC8DA 26 June 1979 Panchromatic (good quality) c. 1:10000 Prints 268-270
Hillend to Whitford	MAFF/ADAS Hasselblad 7 May 1989 Colour (good quality) c. 1:10000 Run 89-18 Prints 43-51, 66-68 Run 89-27 Prints 08-09
Pembrey Coast	MAFF/ADAS 15 June 1986 Panchromatic (excellent quality) c. 1:11000 Film 291 Prints 24-36, 86-98, 157-8

FIELD SURVEY

All major types of vegetation at each site were located by a rapid reconnaissance. Each type was then visited and a visually homogeneous stand was picked out. Vegetation was recorded within 2m x 2m (strand, dune grassland, dune slack, dune heath), 5m x 5m (scrub) and 10m x 10m (woodland) quadrats. The quadrat position and number was located precisely on an acetate overlay fixed to air photos.

The recommended procedure for the National Vegetation Classification (NVC) was followed as often as possible. Most dune vegetation types in each site were recorded with a minimum of five quadrats. Transitional habitats to saltmarsh, swamp and scrub/woodland were sampled less intensively.

Each quadrat was recorded on a standard record sheet (see Annex 2) which incorporated species and special variable number codes for use in later rapid computer data entry. All vascular plants, bryophytes and lichens in a quadrat were recorded on the Domin cover/abundance scale, together with community structure data (strata height and cover). Occasional soil samples (0-10 cm) were collected for most vegetation types and were then air dried prior to pH analysis.

Target notes (see Annex 6) were used for several purposes:

- a. To note particular features;
- b. To comment on land use;
- c. To supplement quadrat records.

Target note positions were also marked in the field upon air photo overlays. Less emphasis was placed on these notes than in other National Sand Dune Survey studies because quadrat data was more intensive in this case.

A total of 640 quadrats was achieved for all sites, numbered as follows:

Crymlyn Burrows	1 - 146
Black Pill to Bryn Mill	147 - 169
Tywyn (Pembrey Coast)	170 - 271
Pembrey Burrows	272 - 347
Pembrey Country Park and Pembrey Forest	348 - 354, 627 - 640
Port-Eynon to Horton	355 - 390
Whiteford Burrows	391 - 468
Nicholaston Burrows	469 - 495
Penmaen Burrows	496 - 522
Oxwich Burrows	523 - 565
Pennard Burrows	566 - 596
Hillend and Llangennith Burrows	597 - 626

Access problems prevented any quadrat collection from Broughton, Delvid and Hills Tor Burrows. In traversing sites obvious vegetation boundaries were marked on air photo overlays and simple codes were marked for vegetation types, both to aid later photo-interpretation. Survey took place in two phases: June/early July and August/early September.

ANALYSIS

Quadrat records were entered into an IBM-XT compatible microcomputer using the RECORD program in the VESPAN2 suite devised by Andrew Malloch of Lancaster University.

An initial classification of all quadrats using the TWINSpan program enabled the clear separation of samples into three sub-sets: strand, dry dune and transitions; wet dune and transitions; scrub, woodland and transitions. Each sub-set of quadrats was then classified by TWINSpan to produce end groups of samples. Each end group was listed in full using the TABLE program to detail all quadrats and species.

These tables enabled a comparison with the keys, tables and descriptions of vegetation types in the various NVC chapters. In many cases there was a direct correspondence with an NVC community, but often not to sub-community level. Some non-NVC groups were found and required separate description. More importantly, the classifications were not perfect and several NVC vegetation types (notably swamp, scrub and woodland transitions represented by low quadrat totals) were scattered amongst other end groups. Once recognised these community samples were aggregated using the SELECT program in VESPAN2.

Several dune vegetation types with large quadrat totals had distinct non-NVC sub-groups and these were described as variants of the NVC community. This important scale of variability is covered under PROBLEMS (see below).

MAP PREPARATION

Following analysis and the recognition of vegetation types, a set of mapping units was created (see vegetation legend sheet in map pocket). For Black Pill to Bryn Mill those mapping units present were marked with approximate boundaries upon a 1:10000 OS map, given that air photos were not available. For all other sites fresh acetate overlays were mounted over field overlays and air photos. The mapping units were then marked on the top overlay using an Old Delft Scanning Mirror Stereoscope to position boundaries. In areas of small-scale rapid transition between communities (usually due to microtopography in slacks and around old small blowouts) the communities were mapped as a mosaic.

Features marked on 1:10000 OS maps were also accurately marked. The top overlay was then removed and OS map features were used to reproduce the photo-map at c. 1:7500 using a Zeiss Sketchmaster. All 1:7500 maps were then mosaiced and drawn as a final vegetation map on Permatrace at c. 1:7500 scale. This was then reduced to 1:10000 on an accurate zoom photocopier for reproduction on A3 paper.

A total of 14 final maps was involved. The legend was too lengthy to reproduce on each map and it is presented separately on A4 sheets in the map pocket of site reports.

AREA MEASUREMENT

One copy of each vegetation map was carefully dissected by cutting around vegetation boundaries with fine scissors. Excised polygons were aggregated into map units and weighed on an accurate balance. The weights were converted to area (hectares) using the known paper weight of a 1 km square (100 ha). Mosaic types had the area allocated equally between component types.

GENERAL INFORMATION

Additional information on sites was obtained from SSSI site descriptions (if an SSSI), discussions with regional staff of NCC and the National Trust, and by consulting reports held at the Oxwich Information Centre.

PROBLEMS

1. Access No permission was sought for the Broughton area due to local difficulties. This led to no quadrat recording but the area was visited by public footpaths and reasonable mapping was achieved.
2. Photo availability Stereoscopic cover of several sites was not available during survey. Additional cover was purchased for the Pembrey Coast and Pennard-Penmaen. Some cover for Oxwich-Nicholaston was out on loan and was returned late despite repeated requests from local NCC staff. This lack of stereoscopy prevented more emphasis on field boundary identification and slowed down accurate field navigation.
3. Nomenclature NVC dune community types and nomenclature changed in the course of survey. Details of the revision (new nomenclature and floristic tables, but no information on slacks) were received between the two field survey periods and required some revision of the first phase results, plus a little re-survey. Detailed descriptions (but only nomenclature and floristic tables for slack types) were received as an NVC strand/dune chapter in November 1989. A wholesale revision of slack types had taken place, to the extent that field mapping could not in most cases be accurately assigned to new units. To make matters worse, the computer groupings of slack communities in this survey did not closely agree with new or old types. All mapping of slack communities should therefore be regarded as very approximate.

4. NVC Community variability Several dune communities, notably *Festuca rubra* - *Galium verum* dune grassland and most slack types, were thoroughly sampled with a large number of quadrats. Classification produced distinct sub-types but these were not readily assigned to NVC sub-communities. The problem lies in continuous variation which is dissected in a parsimonious manner by TWINSpan analysis, both for this quadrat data set and for the more comprehensive set (in a geographical sense) on which NVC types are based.

The solution (i.e. extraction of readily-recognised and spatially recurrent vegetation types) can probably only come from a more rigorous analysis using ordination (to handle continuity) and sound interpretative methods to link continuous variation in several dimensions (succession, habitat gradients, geographical trends), e.g. seriation or canonical correspondence analysis. This was beyond the scope of this study but would be a very desirable feature of the complete national survey.

ANNEX 2

FIELD RECORDING SHEET

The sheet below is a reduced-size version of that used in the field. Space at the top and bottom was used for the field notes and listing of species not covered in the printed table. The NVC codes for species and special variables are present to aid rapid computer entry after fieldwork.

SITE

DUNE SURVEY SHEET

Tree hite 9	Shrb hite 10	Herb hite 11	Moss hite 12	Bare grnd 22
Tree covr 13	Shrb covr 14	Herb covr 15	Moss covr 16	
Achi bill 104	Achi ptar 105	Agro capi 123	Agro stol 122	Aira cary 124
Aira prae 125	Alnu glut 153	Alth offi 2656	Anno aren 159	Anae pyra 160
Anag tene 163	Anth odor 171	Anth vuln 176	Aren serp 196	Arae aari 195
Arrh elat 197	Atri hast 217	Atri laci 218	Atri patu 220	Aven prat 655
Aven pube 656	Bell pere 230	Beta vulg 2801	Caki aarit 268	Call vulg 278
Caly sold 283	Camp rotu 288	Card prat 295	Care aren 304	Care flac 323
Care nigr 333	Care pani 339	Carl vulg 362	Cent eryt 373	Cera diff 381
Cera font 384	Cera seni 385	Cirs arve 415	Cirs vulg 419	Coch dani 425
Coch offi 427	Cory cane 3075	Crep capi 447	Crit aari 452	Cyti scop 1193
Dact glon 465	Dact inca 467	Dact saja 2828	Dant decu 1249	Dauc caro 475
Desc cesp 477	Desc flex 478	Eleo palu 509	Elya fare 116	Elya oycn 117
Elya repe 118	Epil angu 391	Epip palu 531	Equi arve 532	Equi hyem 534
Equi palu 535	Equi vari 539	Erig acer 543	Erie lati 547	Erod cicu 549
Eryn vern 552	Eryn aari 555	Euph offi 568	Euph para 565	Euph port 567
Fest ovin 574	Fest rubr 576	Filli ulas 583	Gali apar 605	Gali palu 609
Gali veru 613	Gent ulig 3052	Glau flav 635	Glau aari 636	Hera sphe 661
Hier pilo 965	Hippo rhan 678	Hole lana 680	Honk pepl 682	Horn petr 686
Hydr vulg 690	Hypo glab 704	Hypo radi 706	Iris pseu 715	June acut 720
June arti 722	June bufo 725	June bulb 726	June gera 732	June aari 734
June squa 736	Koel saca 746	Leon autu 768	Leon tara 770	Lepi lati 3702
Linu bine 778	Linu cath 786	Lipa loes 3074	Lotu corn 800	Lotu ulig 802
Luzu camp 807	Lych flos 813	Lyco euro 823	Matr aari 1355	Matr sinu 841
Medi lupu 844	Ment aqua 855	Mibo aini 3183	Myos arve 884	Oena lach 911
Oeno bien 912	Onon repe 914	Ophr apif 918	Orob mino 928	Pedi palu 946
Phle aren 958	Phra aust 961	Plan coro 972	Plan lanc 973	Plan aari 975
Poa prat 988	Poa triv 990	Poly orys 1010	Poly vulg 995	Popu trem 1022
Pote anse 1043	Prun vulg 1059	Pter aui 1066	Puli dyse 1069	Pyra rotu 1073
Ranu acri 1081	Ranu flau 1089	Ranu repe 1095	Rhin mino 1106	Rubu frut 1136
Rume acet 1139	Rume cris 1143	Rume ella 1140	Rume aari 1146	Sagi proc 1158
Sali repe 1179	Sals kali 1186	Samb nigr 1187	Samo vale 1189	Scir aari 1213
Scir seta 1214	Sedu acre 1225	Sene jaco 1239	Sene vulg 1243	Sile conl 3235
Sile vulg 1259	Sola dule 1268	Soli virg 1270	Sone arve 1271	Sone aspe 1272
Stel aedi 1298	Tara offi 2982	Tees nudl 1320	Teuc scor 1321	Thys prae 1333
Trif camp 1342	Trif dubi 1343	Trif prat 1349	Trif repe 1350	Tris aari 1353
Trig palu 1354	Ulex euro 1363	Vero chae 1396	Vero offi 1401	Vici sati 2707
Viol cani 1422	Viol rivi 1429	Viol tric 1432	Vulp fasc 1434	
Brac albi 1510	Brac ruta 1519	Bryu algo 1545	Bryu sp. 2807	Call cusp 1445
Camp stel 1571	Cera purp 1586	Clad arbu 2340	Clad furc 2362	Clad rang 2381
Clin dend 1593	Corn acul 2410	Dicr scop 1638	Eury prae 1677	Hosa lute 1562
Hypn cuor 1766	Hypo phys 2416	Loph bide 2167	Pelt cani 2486	Plag undu 1807
Poly pili 1897	Pseu puru 1914	Rhyt squa 1940	Rhyt triq 1941	Tort rura 2023

ANNEX 3

VEGETATION TYPES

This section contains a description of each vegetation type (NVC and non-NVC) found in this survey of South Wales dunes. Some types may not be present in this site - see Annex 4 and the vegetation map(s) for details of community presence. The account includes variants of NVC dune communities which do not correspond with NVC sub-community types. Particular features of sites are given in some descriptions.

The account is partly based on the relevant chapters of the NVC written by John Rodwell. The codes mainly relate to the different NVC chapters as follows:

- SD Shingle, strandline and sand-dune communities
- S Swamps and tall-herb fens
- SM Saltmarsh communities
- W Woodland and scrubs
- H Heaths

- X Non-NVC or transition types identified in this survey.

One other chapter, mesotrophic grasslands (MG), was not consulted and cases were only mapped in terms of principal dominant (*Arrhenatherum elatius* or *Lolium perenne*).

Most emphasis is placed on SD communities and other vegetation descriptions are abbreviated, reflecting less-intensive quadrat sampling.

1 X1 Dry foredune/saltmarsh/strandline transition community

Strandline vegetation is normally found at the extreme high water mark where washed-up debris becomes buried by blown sand. The normal strandline community within the NVC (SD2 *Honkenya peploides* - *Cakile maritima* strandline) was not found in this survey.

Instead, on exposed shores, the strandline is rapidly buried and a foredune environment persists (see 2 SD4 *Elymus farctus* foredune community). In sheltered environments, to leeward of cusped spits, there is this distinct species-rich strandline transition. The species combination involves a mix of foredune (*Elymus farctus*), saltmarsh (*Festuca rubra*, *Agrostis stolonifera*, *Limonium binervosum*) and strandline (*Honkenya peploides*, *Atriplex prostrata*) indicators. *Cakile maritima* is rare in this environment. Unlike SD2 it is dominated by perennials and it is probably more persistent and less variable than the usual strandline community.

It grades upwards in wet areas to young salt-influenced slacks (see 12(a) SD14c *Salix repens* - *Campylum stellatum* dune slack, *Bryum pseudotriquetrum* - *Aneura pinguis* sub-community) and to a variety of dune grassland types in dry zonations. Downslope it usually grades into SM24 *Elymus pycnanthus* saltmarsh.

As a community type it perhaps deserves recognition in any revised NVC classification of strandline environments. In this survey it was repeatedly found in suitable locations at Crymlyn Burrows, Tywyn (Pembrey Coast) and Pembrey Burrows.

2 SD4 *Elymus farctus* foredune community

Elymus farctus normally dominates this community which is species-poor. Strandline species (notably *Salsola kali*, *Atriplex prostrata*, *Cakile maritima* and *Honkenya peploides*) are also frequent and suggest that in many localities these low dunes are ephemeral summer features forming on the drift line, usually extending by movement a short distance upslope. They are probably destroyed in autumn and winter storms.

In more sheltered locations, particularly at Crymlyn and Pembrey Burrows, the community is persistent and forms the initial phase of sand colonisation which then leads on to a rapid classic psammose via SD6 *Ammophila arenaria* dune. At Pembrey Burrows there has been a recent increase in sand supply (probably from dune erosion in the centre of the Pembrey Coast system) and there has been a very large increase in this community since aerial photography in 1986. The foredunes even extend well downslope into saltmarsh and can include *Puccinellia maritima* and other saline indicators in the species list, though these are rare.

3 SD6a *Ammophila arenaria* mobile dune community *Elymus farctus* sub-community

This type of mobile dune community normally occurs closest to the sea. It is very open (70% bare sand) and usually has only *Ammophila arenaria* and *Elymus farctus* as dominants. Two variants (3v1, 3v2) were recognised after analysis. These show gradation within the the sub-community which itself grades downbeach into SD4 and, upwards, into SD6d *Ammophila arenaria* mobile dune, Typical sub-community.

3v1 variant This is usually located above the position of the strandline and often contains *Eryngium maritimum* and *Euphorbia paralias*.

3v2 variant This is usually located on the position of the strandline and often contains strand indicators (*Salsola kali*, *Cakile maritima*, *Rumex crispus* and *Beta vulgaris maritima*). It is more species-rich than 3v1.

4 SD6d *Ammophila arenaria* mobile dune community Typical sub-community

This community has a high cover of *Ammophila arenaria* (Marram) and occurs in areas that have a very high rate of sand deposition, in part the effect of the grass itself in modifying windflow to induce sand burial through which it then grows, often in profusion. Areas recently planted with Marram look very similar to this natural community.

In many British systems the community is very species-poor but in this survey there are reasonable numbers of additional species in most samples. Only one monodominant sample (quadrat 270 at Tywyn) was recorded. This enhanced diversity suggests that sand accumulation rates in the South Wales area are lower than normal, allowing invasion by annuals and suitable perennials.

5 SD6e *Ammophila arenaria* mobile dune community *Festuca rubra* sub-community

Festuca rubra normally forms an open understorey beneath Marram in this sub-community. Sand accumulation is low but still significant, producing vegetation which is still species-poor.

As a mapping unit this community is not very extensive and is best developed on dunes with heavy recreational impact, as at Crymlyn, Black Pill, Port-Eynon and Hillend/Broughton. Trampling, sand burial and litter may make this type more nitrogen-rich than usual, allowing enhanced species diversity compared to the NVC description.

Floristic composition suggests that this vegetation is part of a gradation from SD6a and SD6d to SD7c *Ammophila arenaria* - *Festuca rubra* semi-fixed dune community (*Ononis repens* sub-community). Shrubs can invade (notably *Rubus caesius*) and, at Black Pill, *Populus tremula*.

6 SD7c *Ammophila arenaria* - *Festuca rubra* semi-fixed
dune community
Ononis repens sub-community

These dunes are usually dominated in Britain by Marram, plus substantial amounts of *Festuca rubra* and *Ononis repens*. Reduced sand deposition compared to other communities to seaward enables high vegetation cover and the start of dune stabilisation.

This vegetation type is very extensive in the dunes of this study and it is possible to recognise four variants (6v1-4).

6v1 variant *Ononis repens* is less common (frequency class III) and is often replaced by an alternative legume (*Anthyllis vulneraria* or *Lotus corniculatus*). Small gaps in the turf are frequent and these are often occupied by winter annuals (*Phleum arenarium*, *Sedum acre*, *Arenaria serpyllifolia*). This is the dominant type at Crymlyn Burrows and is transitional from SD6c to SD7d (*Tortula ruralis* ssp. *ruraliformis* sub-community).

6v2 variant *Ononis repens* is very common and achieves a reasonable cover. Other species suggest this is a community of damper ground (hollows and slack margins, especially at Crymlyn), with *Holcus lanatus* and *Agrostis stolonifera* the main moisture indicators. Mesic conditions in some stands may be created by shading from *Rubus fruticosus* agg..

6v3 variant This is the most typical form found, with high cover and a tall sward being invaded by *Rubus caesius*, *R. fruticosus* agg. or *Arrhenatherum elatius*. These successional transitions to shrub or mesotrophic grassland seem in part due to a lack of grazing in most large dune systems.

6v4 variant This is a small quadrat set which is difficult to interpret and may represent rather heterogeneous conditions. It is species-rich and this vegetation is either trampled dune being invaded by *Rubus caesius* (at Oxwich and Hillend), or is developed on thin sand over limestone on cliffs at Pennard.

The extensive quantities of type 6-SD7c vegetation reflect in part the rapid stabilisation of mobile dunes (and perhaps even foredunes at Crymlyn and Pembrey Burrows) which tend to be low in height and inextensive. In addition their extent shows stabilisation of dune systems with extensive parabolic dune blowouts which were recently mobile (Oxwich, Whiteford).

7 SD7d *Ammophila arenaria* - *Festuca rubra* semi-fixed
dune community
Tortula ruralis ssp. *ruraliformis*
sub-community

The usual characteristics of this community in Britain are similar to 6-SD7c: abundant Marram and frequent *Festuca rubra* and *Ononis repens*. It is normally distinguished from SD7c by common *Hieracium pilosella* agg., several species of annual, and often an abundant moss carpet of *Tortula ruralis* ssp. *ruraliformis*. Many of these features are found in South Wales dunes but there are local differences because *Festuca rubra* is comparatively rare and *H. pilosella* has a very weak presence. Winter annuals are a prominent component, especially *Phleum arenarium*, *Arenaria serpyllifolia*, *Cerastium diffusum* *diffusum*, *Vulpia fasciculata*, *Sedum acre* and *Aira praecox*. More rarely *Viola tricolor*, *Cerastium semidecandrum*, *Arabis hirsuta* and *Desmazeria rigida* can be found.

The community is very common in several locations, colonising SD6 mobile dunes either near actively extending foreshores (Crymlyn, Nicholaston, Tywyn) or on the steep slopes and flanks of vegetated blowouts (Oxwich, Llangennith/Broughton). It is rare at Pembrey Burrows, suggesting that dune orientation in that system is sheltered, not creating the sand burial rates which favour this community. It is very rare at Penmaen and Pennard, occurring only as very isolated and small coverage on thin sandy rendzinas overlying limestone. It was not mapped in these two latter places.

This community in Britain usually consists of a closed sward made up of grasses, dicotyledons and mosses. Marram may be only occasional and often lacks vigour. There is very little sand accumulation and the first signs of leaching impact are often found here in terms of indicators of soil acidity.

There are three potential sub-communities likely to be found in South Wales but none can be proposed with confidence. Instead, five variants can be recognised and related to local succession and moisture conditions. The absence of clear sub-communities is probably the result of no intensive grazing, a finding in studies elsewhere in Britain.

8v1 variant Marram and *Festuca rubra* are dominant, with appreciable quantities of the moss *Homalothecium lutescens* in the turf. *Ononis repens* and *Galium verum* are fairly common (frequency class III) and the variant is probably an early SD8 type emerging in succession from 7-SD7c.

8v2 variant There is little Marram and most cover is contributed by *Festuca rubra* and the moss *Homalothecium lutescens*. There is virtually no *Ononis repens*, *Galium verum* is infrequent and early leaching indicators are quite common (the moss *Dicranum scoparium* and the lichens *Cladonia rangiformis* and *C. impexa*). Soil samples had some of the lowest pH values of SD8 samples. It is probably the oldest SD8 grassland type, grading into 10-SD12 *Carex arenaria* - *Festuca ovina* - *Agrostis capillaris* grassland over time.

8v3 variant Both Marram and *Festuca rubra* are frequent but *Galium verum* is low (class II) in frequency. There is a high moss cover involving pleurocarps (*Homalothecium lutescens* and *Eurynchium praelongum*) and the acrocarp *Dicranum scoparium* to suggest a trend towards acidity. A large proportion of quadrats also shows shrub invasion by *Rubus caesius*. The high frequency of *Holcus lanatus* (class IV) suggests that moisture is an important determinant of the variant.

8v4 variant This is closest to the SD8a Typical sub-community and many quadrats did show signs of close rabbit grazing. It has abundant *Festuca rubra* and *Galium verum*, with plentiful *Plantago lanceolata*. There are, however, significant quantities of shrubs (notably *Rosa pimpinellifolia* and *Rubus caesius*) and other indicators of shading and invasion (*Pteridium aquilinum*, *Geranium sanguineum*). These suggest a former SD8a community in early transition towards scrub, probably following a relaxation in grazing pressure.

8v5 variant This variant is a more extreme form of 8v4. There is a high degree of invasion by *Pteridium aquilinum* and species typical of early scrub and rank growth: *Geranium sanguineum*, *Rubus caesius* and *Rosa pimpinellifolia*. This community is particularly common between Port-Eynon and Horton where there are a few more nitrophilous species to suggest trampling and dog-walking effects.

In Britain this community is found on less-heavily grazed stretches of fixed calcareous dune systems. There is no clear fit with NVC sub-communities because Marram is rare in variant 9v1 and infrequent in 9v2. The species composition of the two variants suggests that the community is seral in character and that it is undergoing rapid change towards scrub development.

9v1 variant *Arrhenatherum elatius* is relatively infrequent in a rank *Festuca rubra* and *Holcus lanatus* sward which contains large quantities of *Rubus caesius*. There are reasonable quantities of both *Ononis repens* and *Galium verum*, suggesting that the community has developed rapidly from SD7 and SD8 categories. The high quantity of *Holcus lanatus* and occasional presence of *Salix repens* suggest that moist conditions may be a characteristic of sites which have also had a relaxation in grazing.

9v2 variant This variant shows a more advanced stage of scrub development in SD9 communities. There is both a tree and shrub presence in many samples, with quadrats located in a grassland/scrub mosaic at the rear of several systems (notably Crymlyn Burrows, Black Pill, Hillend/Broughton, Pembrey Burrows).

Where both variants occur in a single system, 9v1 tends to be more seaward suggesting the community is currently extending towards younger dune grassland types.

This grassland is typical of grazed acidic sands in Britain and in systems which are initially calcareous it is found on older dunes where leaching has been effective. The rear of most South Wales dune systems, where such swards are likely, has been highly altered in most cases (often to provide golf courses). Reasonable examples of the community type can be found in the fringes of rough around fairways, notably at Crymlyn and Pennard Burrows (the latter system is also grazed by ponies). Further pony grazing by ponies at Penmaen probably also helps maintain the community. Elsewhere the dune systems are either too young or lack of grazing has allowed SD9 rank near-mesotrophic grassland to develop.

There is no very close agreement with NVC sub-communities but two local variants can be recognised.

10v1 variant This resembles in part the SD12a *Anthoxanthum odoratum* sub-community but lacks Marram and shows early bracken invasion. There is also floristic evidence of sufficient leaching to allow heath indicators (e.g. *Calluna vulgaris*) into the sward.

10v2 variant This is bracken-invaded and much more species-poor as a result of shading and litter accumulation. It is restricted to leached acidic sands on the cliff tops at Penmaen and Pennard. As in 9v1 there is strong floristic evidence of a trend towards heath vegetation.

Some good examples of heath developed on sand were found but in general these were rare. Communities with *Calluna vulgaris* dominant (and, less commonly, *Erica cinerea* and *Vaccinium myrtillus*) are restricted to leached sands banked against the old seacliff at the rear of Crymlyn Burrows, and to the thinner sands deposited on top of cliffs at Penmaen and Pennard. At Crymlyn the community grades into normal H10 *Calluna vulgaris* - *Erica cinerea* heath on the top of the cliff as the sand rapidly thins.

SLACK COMMUNITIES

Low-lying areas under the influence of the dune water table (slacks) are usually markedly different from dry dune grasslands. A major revision in NVC slack types took place after field mapping (though description of the new types was not provided). Computer analysis of quadrat data found end groups which did not closely fit old or new NVC classifications (see Annex 1 - Problems). The five quadrat groupings (12a, 12b, 13, 14, 15) are therefore presented as a series with what are probably their closest types in the revised NVC system of November 1989. The fit is far from perfect and all slack classification must be considered approximate.

12a SD14c *Salix repens* - *Campylum stellatum* dune slack
Bryum pseudotriquetrum - *Aneura pinguis*
sub-community

This community probably represents young slacks formed by the enclosure of depressions by spit extension (as at Tywyn) or in deflation hollows left after the passage of a parabolic dune blowout (north Whiteford). There is a slight saline influence at Tywyn shown by the low frequency of *Glaux maritima*. The community has patches of bare ground and *Salix repens* often shows a pattern of small circular and coalescing colonies, a feature of early succession. The community is very rich in species.

12b SD15a/b *Salix repens* - *Calliergon cuspidatum* dune slack
Carex nigra sub-community (a)
Equisetum variegatum sub-community (b)

There is abundant *Salix repens* over a carpet of *Hydrocotyle vulgaris* and the moss *Calliergon cuspidatum*. *Equisetum hyemale* is very common in this turf and orchids (commonly *Epipactis palustris* and *Dactylorhiza majalis*) are abundant. There is still a saline element in some slacks, shown by *Juncus maritimus*, *J. acutus* and *Oenanthe lachenalii*.

13 SD15c *Salix repens* - *Calliergon cuspidatum* dune slack
Carex flacca - *Pulicaria dysenterica*
sub-community

This slack community is one of the most distinctive due to the prominence of tall herbs, with much *Juncus maritimus*, *Pulicaria dysenterica*, *Eupatorium cannabinum*, *Filipendula ulmaria*, *Lotus uliginosus* and *Lychnis flos-cuculi*. It often features the start of slack woodland by *Salix cinerea* and *Alnus glutinosa* at Tywyn. At Whiteford it is very extensive on the eastern side, grading into saltmarsh. It seems to prefer steeper slack gradients and may reflect lateral subsurface water flow.

14 SD16a/b *Salix repens* - *Holcus lanatus* dune slack
Ononis repens sub-community (a)
Rubus caesius sub-community (b)

14 SD16c/d *Salix repens* - *Holcus lanatus* dune slack
Prunella vulgaris - *Equisetum variegatum*
sub-community (c)
Agrostis stolonifera sub-community (d)

A heterogeneous set of slack and slack transition habitats is represented in this group. The topographic differences within the quadrat set are not clearly distinguished by species composition which overall suggest relatively dry slack conditions. Three main types of topography are involved:

- drier slack margins receiving sand input from adjacent dunes (common at Whiteford in western slacks).
- clustered large hummocks ('hedgehogs') up to 2m high and 4-5m in diameter, usually with a strong cover of *Salix repens*. These are believed to be due to dune building controlled by upward growth by *Salix* in areas suffering sand burial in the past. These are present at Pembrey Burrows and Whiteford.
- a transition involving damp grassland at Tywyn which runs for much of the length of the dune system along its eastern side.

15 SD17 *Potentilla anserina* - *Carex nigra* dune slack
No clear NVC sub-community

This slack type is the least common in samples and in Britain is believed to be older and less calcareous than others. *Carex nigra* is usually a prominent feature but only *Mentha aquatica* is consistently present. Other species offer few clues to more precise habitat or successional relationships.

SALTMARSH

- 16 SM18b *Juncus maritimus* saltmarsh
Oenanthe lachenalii sub-community

This is common at Crymlyn, Oxwich (unsampled), Whiteford and Tywyn. It represents the highest saltmarsh community in areas which are also flushed by fresh and brackish water draining from dune slacks. It grades upwards into 13-SD15c dune slack, especially at Whiteford.

- 17 SM24 *Elymus pycnanthus* saltmarsh

This was noted (but not accurately mapped in terms of full extent) at Crymlyn, Pennard (very restricted), Oxwich-Nicholaston (not recorded), Whiteford, Pembrey and Tywyn. It represents the highest saltmarsh community in areas which are reasonably dry and uninfluenced by slack water. It also contains strandline indicators.

SWAMP COMMUNITIES

- 18 S4a *Phragmites australis* swamp and reed-beds
Phragmites australis sub-community

This tall reed-bed community is present in restricted quantity at Crymlyn Burrows and is abundant at Oxwich. Grazing by ponies at Whiteford has probably excluded it as a component of the wet eastern transition from slack to wet saltmarsh.

- 19 S4d *Phragmites australis* swamp and reed-beds
Atriplex hastata sub-community

- 19 S21b *Scirpus maritimus* swamp
Atriplex hastata sub-community

The sheltered strandline at Pembrey Burrows above saltmarsh is the only mapped location for a *Phragmites australis* - *Scirpus maritimus* mosaic (hence the presence of *Atriplex prostratus* and *Elymus pycnanthus*). Discharges from an adjacent sewage outfall pipe probably helps explain the thick growth in this area and the absence of these types from equivalent positions in other parts of the Pembrey Burrows marsh.

- 20 S12b *Typha latifolia* swamp
Mentha aquatica sub-community

This is rather restricted. At Whiteford it is found in a concentrated zone of flushing below a large slack on the transition to saltmarsh. At Tywyn it is found in two man-made slacks adjacent to targets, the sand having been excavated to provide a raised surface for the target zone. A reasonable aquatic flora (including *Chara* sp.) is developing in these excavated hollows.

SCRUB AND WOODLAND COMMUNITIES

- 21 SD18a *Hippophae rhamnoides* scrub
Festuca rubra sub-community

This sub-community did not appear as an end-group in computer analysis and was obtained by selecting all quadrats containing *Hippophae rhamnoides* and then rejecting those belonging to the 22-SD18b set. This vegetation type represents the early stage of dune scrub invasion, most cases coming from the Pembrey Coast where this process is very frequent. Associated species suggest that 4-SD6d, 5-SD6e and 7-SD7d are the initial invaded communities. This is clear in Pembrey Coast vegetation maps.

- 22 SD18b *Hippophae rhamnoides* scrub
Urtica dioica - *Arrhenatherum elatius*
sub-community

In this community *Hippophae rhamnoides* is the major dominant. Shading and excreta from birds feeding on berries helps produce a flora characteristic of soils enriched with nitrogen and phosphorus (e.g. *Urtica dioica*, *Galium aparine*). *Sambucus nigra* is occasional and suggests shrub diversification is taking place in larger and older stands. The sub-community is not fully typical of the NVC because *Arrhenatherum elatius* is rare.

- 23 W1 *Salix cinerea* - *Galium palustre* woodland

This community is dominated by *Betula pubescens*, with reasonable quantities of *Salix cinerea* in places. *Galium palustre* and *Iris pseudacorus* are consistently present. All small thickets of *Salix cinerea* were mapped as this category and a reasonable number of quadrats were recorded for this type. However, only seven quadrats formed this clear end-group. A larger number was scattered in various slack end-groups (especially 13), suggesting that such willow scrub is recent and that it has not developed a very distinct flora. Some stands of *Salix cinerea* showed signs of sand burial, notably at Llangennith and Whiteford.

- 24 W10c *Quercus robur* - *Pteridium aquilinum* -
Rubus fruticosus agg. woodland
Hedera helix sub-community

This community is dominated by *Quercus robur* and has a scattered tall-shrub understorey of *Crataegus monogyna* over a floor often dominated by *Rubus fruticosus* agg. Shading is effective and there is little *Pteridium aquilinum*. This category was not an end-group in analysis and was obtained by selection of high-cover *Quercus robur* stands. Only five such stands were found, scattered in end-groups representing well-developed scrub.

- 25 W21a *Crataegus monogyna* - *Hedera helix* scrub
Hedera helix - *Urtica dioica* sub-community

This is the commonest form of non-*Hippophae* scrub quadrat recorded in survey and shows active succession. The tall shrub or tree component rarely forms a continuous canopy and thick *Rubus fruticosus* agg. is the most consistent woody species present. A mix of trees and tall shrubs is present in the group in addition to *Crataegus*: *Quercus robur*, *Prunus spinosa*, *Acer pseudoplatanus*, *Fraxinus excelsior*, *Corylus avellana*, *Pinus nigra*. It seems a clear precursor to a variety of woodland types.

26 W22 *Prunus spinosa* - *Rubus fruticosus* agg. scrub
No clear NVC sub-community

A small number of samples was dominated by *Prunus spinosa* but these quadrats were scattered amongst scrub end-groups (especially 25-W21a) and were found by selection. One stand on the Pembrey Coast contained dead *Hippophae rhamnoides* beneath the closed *Prunus* canopy and this provides some evidence of active succession towards non-dune scrub and woodland types. No clear NVC sub-community can be distinguished within the small quadrat total (9) separated by selection.

27 W23 *Ulex europaeus* - *Rubus fruticosus* agg. scrub
No clear NVC sub-community

Ulex europaeus is a fairly common scrub type at the rear of the Crymlyn and Pembrey Burrows dune systems, and upon steep cliff slopes at Nicholaston, Penmaen and Pennard. It usually contains sizeable quantities of *Rubus fruticosus* agg. and sometimes *Pteridium aquilinum* or *Arrhenatherum elatius*. In some locations it seems to have developed from a lower scrub cover of *Rosa pimpinellifolia*. Several stands in cliffed sites showed regeneration after burning, especially at Pennard. This vegetation type did not form an end-group in analysis and had to be selected from other scrub-dominated end-groups.

28 W24 *Rubus fruticosus* agg. - *Holcus lanatus*
underscrub
No clear NVC sub-community

Rubus fruticosus agg. is very widespread in a variety of dune, scrub and woodland communities. In analysis it forms one heterogeneous end-group which has other shrub species patchily present (*Rosa pimpinellifolia*, *Ulex europaeus*, *Crataegus monogyna*). At Black Pill the community contains much *Populus tremula* and is dominant at the rear of the dune system.

29 W25 *Pteridium aquilinum* - *Rubus fruticosus* agg.
underscrub
No clear NVC sub-community

Bracken-invasion of dune and cliff vegetation is widespread in South Wales and *Pteridium aquilinum* is usually accompanied by a large cover of *Rubus fruticosus* agg.. A shaded community results which has woodland elements (e.g. *Geranium robertianum*, *Glechoma hederacea*, *Silene dioica*). Other shrub species are few (*Ulex europaeus* is rare) and *Acer pseudoplatanus* is the only (infrequent) tree to be recorded. Seral progression beyond this community stage may not therefore be very active.

30 X2 *Alnus glutinosa* slack woodland

This community represents the commonest woodland type found in damp habitats. It probably represents the most mature community development in slack conditions. *Alnus glutinosa* is the usual dominant but *Salix cinerea* is also present in large quantity. It probably develops from type 23-W1 woodland. There is no close affinity with other NVC alder woodland types.

Iris pseudacorus, *Galium palustre* and *Rubus fruticosus* agg. are frequent beneath the canopy, with a scatter of shade-tolerant herbs (notably *Oenanthe crocata*, *Berula erecta*, *Lycopus europaeus* and *Carex remota*).

In several locations the community is developed adjacent to saltmarsh (at Crymlyn, Oxwich and Whiteford). Young alder thickets are particularly common at Tywyn where rapid scrub succession is taking place. Old inland examples are found as scattered remnants within Pembrey Forest.

31 X3 *Pinus nigra/sylvestris* woodland

Pembrey Forest and Pembrey Country Park are dominated by very large expanses of *Pinus nigra* plantation, some dating back to the 1930's. Old and thinned stands support a reasonable woodland groundflora with some shrub development (a scatter of *Crataegus monogyna*, *Prunus spinosa* or *Ligustrum vulgare*, occasionally *Hippophae rhamnoides* in well-thinned places). Several small stands are also present at Whiteford where there is some regeneration from seed. In addition there has been removal and thinning at Whiteford designed to improve shaded dune communities beneath.

This category did not form a clear end-group in analysis and had to be selected. Of seventeen samples, twelve are represented here and the remaining five are shaded slacks which were classified correctly and were thus retained in slack classes. Shading effects were, however, very clear in each case.

32 X4 *Acer pseudoplatanus* woodland

Sycamore woodland did not form a classification end-group but five quadrats could be selected. The vegetation type is found at Whiteford on sand blown on to a hillslope at the south of the survey area, and it is present in small quantity at the Pembrey Coast. Young stands are developing between Port-Eynon and Horton. The community is rather species-poor and lacks much ecological interest.

ANNEX 4

QUADRAT MEMBERSHIP OF VEGETATION TYPES

Quadrat membership of vegetation types at these sites is listed below. Some quadrats appear in more than one vegetation type. These are transitional samples identified in classification and placed in more than one end group of the three main TWINSPAN hierarchies.

Only mapping unit numbers (plus variant type) are listed against quadrats. For full NVC nomenclature consult Annex 3 and the vegetation legend in the rear map pocket.

The floristic characteristics of each vegetation type are given in Annex 5. Descriptions of each vegetation type, plus notable characteristics of these sites, are given in Annex 3.

TYWYN

Q	VT	Q	VT	Q	VT	Q	VT
170 2		171 3v1		172 3v2		173 4	
174 4 21		175 4		176 2		177 3v1	
178 7 21		179 16		180 16		181 17	
182 1		183 1		184 1		185 6v1	
186 17		187 17		188 1		189 1	
190 4 21		191 22		192 7 21		193 6v1	
194 16		195 7		196 30		197 22	
198 22		199 14 21		200 12(b)		201 7	
202 12(b)		203 16		204 16		205 16	
206 7		207 7		208 4		209 12(b)	
210 30		211 22 28		212 8v2 8v3 21		213 30	
214 13 21		215 6v3 8v3 21		216 12(a)		217 16	
218 16		219 16		220 16		221 16	
222 13		223 13		224 16		225 6v3 8v3	
226 8v1 8v3		227 8v2 8v3 21		228 8v1 8v3 21		229 12(a)	
230 12(a)		231 16		232 9v2 23 30		233 6v2 14	
234 16		235 13		236 9v2		237 6v3 28	
238 12(a)		239 12(b)		240 30		241 12(b)	
242 12(b) 15		243 15 30		244 30		245 30	
246 6v2 6v3		247 4 21		248 6v1 8v3 21		249 22 28	
250 7 21		251 8v3 9v1 21		252 12(b)		253 13 21	
254 8v2 8v4		255 12(b)		256 16		257 13	
258 9v2 27		259 8v2 8v3		260 16		261 6v3 8v3	
262 16		263 12(a)		264 15 20		265 15 20	
266 20		267 7 21		268 7 21		269 4	
270 4		271 7 21					

PEMBREY BURROWS

Q	VT	Q	VT	Q	VT	Q	VT
272	9v2 28	273	8v4	274	22	275	8v4
276	9v2	277	8v4	278	8v4	279	8v4
280	8v4	281	8v4	282	8v4 9v1 14	283	9v2 27
284	27 28	285	9v2	286	13	287	9v2 21 23
288	9v1 21	289	6v3 8v4	290	16	291	16
292	8v2	293	8v1 8v4	294	8v4	295	8v2
296	27 28	297	27 28	298	27 28	299	27 28
300	24 25	301	25 27	302	9v2 26 28	303	17
304	17	305	17	306	17	307	4
308	1	309	4	310	6v1	311	2
312	2	313	2	314	7	315	6v3 8v3
316	8v1 8v3	317	22	318	8v1	319	6v2 6v3
320	22	321	22 28	322	8v1	323	1
324	17	325	6v3	326	6v3	327	17
328	14	329	17	330	6v3	331	14
332	16 19	333	16 19	334	16 19	335	16 19
336	16	337	17	338	14	339	21 22
340	21 22	341	6v3 21	342	5	343	6v1
344	6v1	345	22	346	25 26	347	9v2 26 28

PEMBREY COUNTRY PARK AND PEMBREY FOREST

Q	VT	Q	VT	Q	VT	Q	VT
348	26	349	13 15	350	15	351	8v4
352	9v1	353	23 30	354	13 30		
627	25 31	628	25 31	629	23 30	630	31
631	8v2 31	632	14 31	633	8v2 31	634	31 32
635	31	636	30	637	30	638	30
639	21	640	8v2 21 31				

ANNEX 5

FLORISTIC DETAILS OF
VEGETATION TYPES

The following pages include the vegetation types present in the site(s). Community structure data on height and cover are provided, plus information on bare ground, pH and mean species diversity. Species are listed in order of decreasing frequency:

V	=	>80%
IV	=	>60% - 80%
III	=	>40% - 60%
II	=	>20% - 40%

Very infrequent species are excluded to restrict table length. Domin values are the most common (i.e. they are modal scores).

MAP VEGETATION
UNIT UNIT

1 X1 Dry foredune/saltmarsh/strandline
transition community

Tree height (m) -
Shrub/bracken height (m) -
Herb height (cm) 20
Tree cover (%) -
Shrub cover (%) -
Herb cover (%) 60
Cryptogam cover (%) -

Bare surface (%) 60
pH 8.3
Mean species per quadrat 9.7

FREQ- DOMIN
UENCY VALUE

Elymus farctus V 4
Festuca rubra V 5
Aprostis stolonifera IV 5
Horkenya peploides III 5
Limonium binervosum III 4
Plantago maritima III 3
Ammophila arenaria III 2
Eryngium maritimum III 1
Halimione portulacoides III 4
Plantago coronopus III 3
Atriplex prostrata II 1
Sagina procumbens II 2
Beta vulgaris maritima II 2
Desmazeria marina II 3
Parapholis strigosa II 3
Carex arenaria II 3
Salsola kali II 1

MAP VEGETATION
UNIT UNIT

2 SD4 *Elymus farctus* foredune community

Tree height (m) -
Shrub/bracken height (m) -
Herb height (cm) 25
Tree cover (%) -
Shrub cover (%) -
Herb cover (%) 20
Cryptogam cover (%) -

Bare surface (%) 80
pH 8.1-8.5
Mean species per quadrat 5.2

FREQ- DOMIN
UENCY VALUE

Elymus farctus V 5
Salsola kali III 4
Atriplex prostrata III 4
Cakile maritima II 1
Horkenya peploides II 3
Beta vulgaris maritima II 3

MAP VEGETATION
UNIT UNIT

3 SD6a *Ammophila arenaria* mobile dune community
Elymus farctus sub-community
Variant 2

Tree height (m) -
Shrub/bracken height (m) -
Herb height (cm) 30
Tree cover (%) -
Shrub cover (%) -
Herb cover (%) 30
Cryptogam cover (%) -

Bare surface (%) 70
pH 7.9-8.1
Mean species per quadrat 6.0

FREQ- DOMIN
UENCY VALUE

Ammophila arenaria V 3
Elymus farctus V 4
Salsola kali V 3
Cakile maritima IV 2
Eryngium maritimum II 1
Euphorbia paralias II 1
Rumex crispus II 1
Beta vulgaris maritima II 3

MAP VEGETATION
UNIT UNIT

3 SD6a *Ammophila arenaria* mobile dune community
Elymus farctus sub-community
Variant 1

Tree height (m) -
Shrub/bracken height (m) -
Herb height (cm) 50
Tree cover (%) -
Shrub cover (%) -
Herb cover (%) 30
Cryptogam cover (%) -

Bare surface (%) 70
pH 7.9-8.2
Mean species per quadrat 4.6

FREQ- DOMIN
UENCY VALUE

Elymus farctus V 5
Ammophila arenaria V 4
Eryngium maritimum III 2
Euphorbia paralias III 4
Oenothera erythrosepala II 1
Senecio jacobaea II 2

MAP UNIT	VEGETATION UNIT		MAP UNIT	VEGETATION UNIT		MAP UNIT	VEGETATION UNIT		MAP UNIT	VEGETATION UNIT		MAP UNIT	VEGETATION UNIT	
4	SD6d	<i>Ammophila arenaria</i> mobile dune community Typical sub-community	5	SD6e	<i>Ammophila arenaria</i> mobile dune community <i>Festuca rubra</i> sub-community	6	SD7c	<i>Ammophila arenaria</i> - <i>Festuca rubra</i> semi-fixed dune community <i>Ononis repens</i> sub-community Variant 1	6	SD7c	<i>Ammophila arenaria</i> - <i>Festuca rubra</i> semi-fixed dune community <i>Ononis repens</i> sub-community Variant 2	6	SD7c	<i>Ammophila arenaria</i> - <i>Festuca rubra</i> semi-fixed dune community <i>Ononis repens</i> sub-community Variant 3
Tree height (m)	-		Tree height (m)	-		Tree height (m)	-		Tree height (m)	-		Tree height (m)	-	
Shrub/bracken height (m)	-		Shrub/bracken height (m)	-		Shrub/bracken height (m)	-		Shrub/bracken height (m)	-		Shrub/bracken height (m)	0.4	
Herb height (cm)	70		Herb height (cm)	50		Herb height (cm)	50		Herb height (cm)	30		Herb height (cm)	40	
Tree cover (%)	-		Tree cover (%)	-		Tree cover (%)	-		Tree cover (%)	-		Tree cover (%)	-	
Shrub cover (%)	-		Shrub cover (%)	-		Shrub cover (%)	-		Shrub cover (%)	-		Shrub cover (%)	10	
Herb cover (%)	50		Herb cover (%)	70		Herb cover (%)	70		Herb cover (%)	90		Herb cover (%)	90	
Cryptogam cover (%)	-		Cryptogam cover (%)	-		Cryptogam cover (%)	20		Cryptogam cover (%)	10		Cryptogam cover (%)	20	
Bare surface (%)	50		Bare surface (%)	30		Bare surface (%)	10		Bare surface (%)	10		Bare surface (%)	5	
pH	7.8-8.2		pH	7.8		pH	7.6-8.1		pH	7.4-8.2		pH	6.8-8.1	
Mean species per quadrat	7.1		Mean species per quadrat	9.4		Mean species per quadrat	13.8		Mean species per quadrat	12.6		Mean species per quadrat	14.0	
	FREQ- UENCY	DOMIN VALUE		FREQ- UENCY	DOMIN VALUE		FREQ- UENCY	DOMIN VALUE		FREQ- UENCY	DOMIN VALUE		FREQ- UENCY	DOMIN VALUE
<i>Ammophila arenaria</i>	V	7	<i>Ammophila arenaria</i>	V	6	<i>Ammophila arenaria</i>	V	5	<i>Festuca rubra</i>	V	6	<i>Festuca rubra</i>	V	7
<i>Senecio jacobaea</i>	III	3	<i>Festuca rubra</i>	IV	7	<i>Festuca rubra</i>	V	6	<i>Carex arenaria</i>	IV	3	<i>Ammophila arenaria</i>	V	5
<i>Hypochaeris radicata</i>	III	3	<i>Hypochaeris radicata</i>	IV	2	<i>Hypochaeris radicata</i>	IV	3	<i>Ononis repens</i>	IV	4	<i>Carex arenaria</i>	IV	4
<i>Eryngium maritimum</i>	III	3	<i>Elymus farctus</i>	III	3	<i>Leontodon hispidus</i>	III	3	<i>Ammophila arenaria</i>	IV	4	<i>Poa pratensis</i>	IV	3
<i>Sonchus asper</i>	III	2	<i>Carex arenaria</i>	III	3	<i>Ononis repens</i>	III	4	<i>Lotus corniculatus</i>	III	4	<i>Holcus lanatus</i>	IV	3
<i>Euphorbia paralias</i>	II	3	<i>Calystegia soldanella</i>	II	3	<i>Eryngium maritimum</i>	III	2	<i>Holcus lanatus</i>	III	4	<i>Ononis repens</i>	IV	5
<i>Elymus farctus</i>	II	3	<i>Ononis repens</i>	II	2	<i>Carex arenaria</i>	III	3	<i>Eurynchium praelongum</i>	III	4	<i>Eurynchium praelongum</i>	III	5
<i>Cerastium diffusum diffusum</i>	II	3	<i>Rubus caesius</i>	II	3	<i>Oenothera erythrosepala</i>	III	3	<i>Plantago lanceolata</i>	III	3	<i>Plantago lanceolata</i>	III	3
<i>Oenothera erythrosepala</i>	II	2	<i>Senecio jacobaea</i>	II	2	<i>Rubus caesius</i>	III	3	<i>Poa pratensis</i>	III	3	<i>Senecio jacobaea</i>	III	2
<i>Arenaria serpyllifolia</i>	II	3	<i>Taraxacum</i> sp.	II	2	<i>Anthyllis vulneraria</i>	II	4	<i>Taraxacum</i> sp.	III	3	<i>Lotus corniculatus</i>	II	3
<i>Rubus caesius</i>	II	3	<i>Euphorbia paralias</i>	II	2	<i>Cerastium diffusum diffusum</i>	II	2	<i>Hypochaeris radicata</i>	II	3	<i>Anthyllis vulneraria</i>	II	3
						<i>Senecio jacobaea</i>	II	3	<i>Rubus fruticosus</i> agg.	II	5	<i>Arrhenatherum elatius</i>	II	4
						<i>Eurynchium praelongum</i>	II	4	<i>Agrostis stolonifera</i>	II	5	<i>Dactylis glomerata</i>	II	3
						<i>Phleum arenarium</i>	II	2	<i>Senecio jacobaea</i>	II	2	<i>Galium verum</i>	II	4
						<i>Brachythecium rutabulum</i>	II	3	<i>Sonchus asper</i>	II	2	<i>Hypochaeris radicata</i>	II	2
						<i>Sedum acre</i>	II	3	<i>Anthyllis vulneraria</i>	II	3	<i>Rubus caesius</i>	II	5
						<i>Barbula vinealis</i>	II	4	<i>Arrhenatherum elatius</i>	II	5	<i>Rubus fruticosus</i> agg.	II	5
						<i>Arenaria serpyllifolia</i>	II	2	<i>Dactylis glomerata</i>	II	3	<i>Polypodium vulgare</i>	II	3
						<i>Poa pratensis</i>	II	3				<i>Taraxacum</i> sp.	II	2
						<i>Brachythecium albicans</i>	II	4				<i>Oenothera erythrosepala</i>	II	2
						<i>Taraxacum</i> sp.	II	3				<i>Hieracium pilosella</i> agg.	II	3
						<i>Rhynchosinapis cheiranthos</i>	II	2						

MAP VEGETATION UNIT UNIT			MAP VEGETATION UNIT UNIT			MAP VEGETATION UNIT UNIT			MAP VEGETATION UNIT UNIT			MAP VEGETATION UNIT UNIT		
7	SD7d	<i>Amophila arenaria</i> - <i>Festuca rubra</i> semi-fixed dune community <i>Tortula ruralis</i> ssp. <i>ruraliformis</i> sub-community	8	SD8	<i>Festuca rubra</i> - <i>Galium verum</i> fixed dune community No clear NVC sub-community Variant 1	8	SD8	<i>Festuca rubra</i> - <i>Galium verum</i> fixed dune community No clear NVC sub-community Variant 2	8	SD8	<i>Festuca rubra</i> - <i>Galium verum</i> fixed dune community No clear NVC sub-community Variant 3	8	SD8	<i>Festuca rubra</i> - <i>Galium verum</i> fixed dune community No clear NVC sub-community Variant 4
Tree height (m)	-		Tree height (m)	-		Tree height (m)	-		Tree height (m)	-		Tree height (m)	-	
Shrub/bracken height (m)	0.3		Shrub/bracken height (m)	0.3		Shrub/bracken height (m)	0.3		Shrub/bracken height (m)	0.4		Shrub/bracken height (m)	0.4	
Herb height (cm)	20		Herb height (cm)	20		Herb height (cm)	30		Herb height (cm)	40		Herb height (cm)	30	
Tree cover (%)	-		Tree cover (%)	-		Tree cover (%)	-		Tree cover (%)	-		Tree cover (%)	-	
Shrub cover (%)	5		Shrub cover (%)	10		Shrub cover (%)	10		Shrub cover (%)	10		Shrub cover (%)	20	
Herb cover (%)	40		Herb cover (%)	90		Herb cover (%)	60		Herb cover (%)	80		Herb cover (%)	90	
Cryptogam cover (%)	30		Cryptogam cover (%)	40		Cryptogam cover (%)	60		Cryptogam cover (%)	30		Cryptogam cover (%)	20	
Bare surface (%)	30		Bare surface (%)	5		Bare surface (%)	-		Bare surface (%)	1		Bare surface (%)	1	
pH	7.3-8.1		pH	6.8-7.6		pH	6.5-7.2		pH	6.9-7.1		pH	7.0-7.4	
Mean species per quadrat	16.2		Mean species per quadrat	19.0		Mean species per quadrat	17.1		Mean species per quadrat	15.8		Mean species per quadrat	15.0	
	FREQ- UENCY	DOMIN VALUE		FREQ- UENCY	DOMIN VALUE		FREQ- UENCY	DOMIN VALUE		FREQ- UENCY	DOMIN VALUE		FREQ- UENCY	DOMIN VALUE
<i>Phleum arenarium</i>	V	3	<i>Amophila arenaria</i>	V	5	<i>Festuca rubra</i>	V	6	<i>Festuca rubra</i>	V	7	<i>Festuca rubra</i>	V	7
<i>Amophila arenaria</i>	IV	5	<i>Festuca rubra</i>	V	7	<i>Homalothecium lutescens</i>	V	5	<i>Amophila arenaria</i>	V	5	<i>Galium verum</i>	IV	4
<i>Arenaria serpyllifolia</i>	IV	3	<i>Hypochaeris radicata</i>	V	3	<i>Dicranum scoparium</i>	V	5	<i>Carex arenaria</i>	IV	3	<i>Plantago lanceolata</i>	IV	4
<i>Cerastium diffusum diffusum</i>	IV	3	<i>Homalothecium lutescens</i>	V	6	<i>Carex arenaria</i>	IV	3	<i>Holcus lanatus</i>	IV	4	<i>Poa pratensis</i>	IV	3
<i>Hypochaeris radicata</i>	IV	3	<i>Ononis repens</i>	IV	4	<i>Holcus lanatus</i>	IV	4	<i>Homalothecium lutescens</i>	III	4	<i>Carex arenaria</i>	IV	3
<i>Carex arenaria</i>	IV	3	<i>Anthyllis vulneraria</i>	IV	5	<i>Amophila arenaria</i>	III	3	<i>Hypochaeris radicata</i>	III	3	<i>Dactylis glomerata</i>	III	4
<i>Oenothera erythrosepala</i>	IV	3	<i>Rubus caesius</i>	IV	5	<i>Anthoxanthum odoratum</i>	III	4	<i>Polypodium vulgare</i>	III	3	<i>Rosa pimpinellifolia</i>	III	5
<i>Tortula ruralis</i> ssp. <i>ruraliformis</i>	III	5	<i>Carex arenaria</i>	III	3	<i>Galium verum</i>	III	4	<i>Rubus caesius</i>	III	4	<i>Anthoxanthum odoratum</i>	III	4
<i>Leontodon hispidus</i>	III	3	<i>Galium verum</i>	III	5	<i>Hypochaeris radicata</i>	II	2	<i>Senecio jacobaea</i>	III	2	<i>Agrostis capillaris</i>	III	4
<i>Vulpia fasciculata</i>	III	4	<i>Hieracium pilosella</i> agg.	III	4	<i>Hieracium pilosella</i> agg.	II	3	<i>Anthyllis vulneraria</i>	III	3	<i>Sanguisorba minor</i>	III	4
<i>Senecio jacobaea</i>	III	2	<i>Crepis capillaris</i>	III	3	<i>Plantago lanceolata</i>	II	3	<i>Lotus corniculatus</i>	III	4	<i>Holcus lanatus</i>	II	4
<i>Sedum acre</i>	III	3	<i>Leontodon hispidus</i>	III	2	<i>Poa pratensis</i>	II	3	<i>Hieracium pilosella</i> agg.	III	3	<i>Rubus caesius</i>	II	5
<i>Ononis repens</i>	III	4	<i>Luzula campestris</i>	III	3	<i>Lotus corniculatus</i>	II	4	<i>Poa pratensis</i>	II	3	<i>Avenula pubescens</i>	II	4
<i>Festuca rubra</i>	II	4	<i>Sedum acre</i>	III	2	<i>Polypodium vulgare</i>	II	5	<i>Galium verum</i>	II	5	<i>Ononis repens</i>	II	3
<i>Ceratodon purpureus</i>	II	5	<i>Senecio jacobaea</i>	III	2	<i>Cladonia rangiformis</i>	II	4	<i>Hieracium vulgatum</i> agg.	II	2	<i>Pteridium aquilinum</i>	II	5
<i>Holcus lanatus</i>	II	4	<i>Poa pratensis</i>	III	3	<i>Taraxacum</i> sp.	II	1	<i>Hippophae rhamnoides</i>	II	5	<i>Thymus praecox arcticus</i>	II	4
<i>Rubus caesius</i>	II	4	<i>Cladonia pocillum</i>	III	3	<i>Anthyllis vulneraria</i>	II	4	<i>Leontodon hispidus</i>	II	2	<i>Veronica chamaedrys</i>	II	3
<i>Aira praecox</i>	II	3	<i>Polypodium vulgare</i>	II	4	<i>Crepis capillaris</i>	II	3	<i>Oenothera erythrosepala</i>	II	2	<i>Achillea millefolium</i>	II	4
			<i>Anacamptis pyramidalis</i>	II	1	<i>Rosa pimpinellifolia</i>	II	4	<i>Plantago lanceolata</i>	II	3	<i>Lotus corniculatus</i>	II	4
			<i>Centaureum erythraea</i>	II	3	<i>Cladonia impeia</i>	II	4	<i>Rubus fruticosus</i> agg.	II	4	<i>Pseudoscleropodium purum</i>	II	5
			<i>Cerastium fontanum triviale</i>	II	2				<i>Eurymchium praelongum</i>	II	5	<i>Geranium sanguineum</i>	II	5
			<i>Avenula pubescens</i>	II	4				<i>Taraxacum</i> sp.	II	2			
			<i>Oenothera erythrosepala</i>	II	2				<i>Arrhenatherum elatius</i>	II	4			
			<i>Phleum arenarium</i>	II	2				<i>Cerastium fontanum triviale</i>	II	2			
			<i>Thymus praecox arcticus</i>	II	4				<i>Ononis repens</i>	II	4			
			<i>Viola tricolor</i>	II	2				<i>Anacamptis pyramidalis</i>	II	1			
			<i>Peltigera canina</i>	II	3				<i>Luzula campestris</i>	II	3			
			<i>Aira praecox</i>	II	3				<i>Dicranum scoparium</i>	II	5			
			<i>Hieracium vulgatum</i> agg.	II	1									
			<i>Lotus corniculatus</i>	II	4									
			<i>Plantago lanceolata</i>	II	3									
			<i>Polygala vulgaris</i>	II	2									
			<i>Rhinanthus minor</i>	II	3									
			<i>Sonchus oleraceus</i>	II	1									
			<i>Brachythecium albicans</i>	II	6									

MAP VEGETATION UNIT UNIT		MAP VEGETATION UNIT UNIT		MAP VEGETATION UNIT UNIT		MAP VEGETATION UNIT UNIT		MAP VEGETATION UNIT UNIT	
9 SD9 <i>Amophila arenaria</i> - <i>Arrhenatherum elatius</i> dune grassland No clear NVC sub-community Variant 1		9 SD9 <i>Amophila arenaria</i> - <i>Arrhenatherum elatius</i> dune grassland No clear NVC sub-community Variant 2		12 SD14c <i>Salix repens</i> - <i>Campyllum stellatum</i> dune slack <i>Bryum pseudotriquetrum</i> - <i>Aneura pinguis</i> sub-community		12 SD15a/b <i>Salix repens</i> - <i>Calliergon cuspidatum</i> dune slack <i>Carex nigra</i> sub-community (a) <i>Equisetum variegatum</i> sub-community (b)		13 SD15c <i>Salix repens</i> - <i>Calliergon cuspidatum</i> dune slack <i>Carex flacca</i> - <i>Pulicaria dysenterica</i> sub-community	
Tree height (m)	-	Tree height (m)	0-6	Tree height (m)	-	Tree height (m)	-	Tree height (m)	-
Shrub/bracken height (m)	0.4	Shrub/bracken height (m)	0-6	Shrub/bracken height (m)	0.3	Shrub/bracken height (m)	0.4	Shrub/bracken height (m)	0.6
Herb height (cm)	40	Herb height (cm)	50	Herb height (cm)	20	Herb height (cm)	40	Herb height (cm)	80
Tree cover (%)	-	Tree cover (%)	0-60	Tree cover (%)	-	Tree cover (%)	-	Tree cover (%)	-
Shrub cover (%)	20	Shrub cover (%)	0-70	Shrub cover (%)	30	Shrub cover (%)	30	Shrub cover (%)	40
Herb cover (%)	90	Herb cover (%)	60	Herb cover (%)	80	Herb cover (%)	40	Herb cover (%)	80
Cryptogam cover (%)	20	Cryptogam cover (%)	10	Cryptogam cover (%)	30	Cryptogam cover (%)	70	Cryptogam cover (%)	30
Bare surface (%)	1	Bare surface (%)	1	Bare surface (%)	5	Bare surface (%)	-	Bare surface (%)	-
pH	5.8-6.5	pH	6.2-6.4	pH	7.7-8.2	pH	7.4-7.9	pH	7.6-8.3
Mean species per quadrat	16.6	Mean species per quadrat	14.1	Mean species per quadrat	24.6	Mean species per quadrat	16.8	Mean species per quadrat	15.6
FREQ- DOMIN UENCY VALUE		FREQ- DOMIN UENCY VALUE		FREQ- DOMIN UENCY VALUE		FREQ- DOMIN UENCY VALUE		FREQ- DOMIN UENCY VALUE	
<i>Festuca rubra</i>	V 6	<i>Arrhenatherum elatius</i>	IV 5	<i>Carex flacca</i>	V 4	<i>Hydrocotyle vulgaris</i>	V 6	<i>Pulicaria dysenterica</i>	IV 6
<i>Holcus lanatus</i>	V 5	<i>Eurynchium praelongum</i>	IV 4	<i>Campyllum stellatum</i>	V 4	<i>Salix repens</i> agg.	V 6	<i>Holcus lanatus</i>	IV 4
<i>Carex arenaria</i>	IV 3	<i>Festuca rubra</i>	III 4	<i>Agrostis stolonifera</i>	V 6	<i>Epipactis palustris</i>	IV 4	<i>Mentha aquatica</i>	IV 4
<i>Rubus caesius</i>	IV 5	<i>Rubus fruticosus</i> agg.	III 5	<i>Ranunculus acris</i>	V 4	<i>Equisetum variegatum</i>	IV 4	<i>Potentilla anserina</i>	III 4
<i>Arrhenatherum elatius</i>	III 5	<i>Holcus lanatus</i>	III 5	<i>Trifolium pratense</i>	V 3	<i>Calliergon cuspidatum</i>	IV 8	<i>Juncus maritimus</i>	III 5
<i>Dactylis glomerata</i>	III 4	<i>Dactylis glomerata</i>	III 4	<i>Aneura pinguis</i>	V 3	<i>Agrostis stolonifera</i>	III 4	<i>Salix repens</i> agg.	III 7
<i>Ononis repens</i>	III 3	<i>Carex arenaria</i>	II 3	<i>Festuca rubra</i>	IV 4	<i>Carex nigra</i>	III 5	<i>Rubus caesius</i>	III 5
<i>Plantago lanceolata</i>	III 3	<i>Heracleum sphondylium</i>	II 3	<i>Prunella vulgaris</i>	IV 4	<i>Holcus lanatus</i>	III 3	<i>Equisetum arvense</i>	III 3
<i>Poa pratensis</i>	III 3	<i>Plantago lanceolata</i>	II 3	<i>Salix repens</i> agg.	IV 5	<i>Juncus maritimus</i>	III 5	<i>Eupatorium cannabinus</i>	III 5
<i>Centaurea nigra</i>	III 3	<i>Rubus caesius</i>	II 6	<i>Equisetum variegatum</i>	IV 4	<i>Mentha aquatica</i>	III 4	<i>Festuca rubra</i>	III 5
<i>Galium verum</i>	III 3	<i>Amophila arenaria</i>	II 4	<i>Holcus lanatus</i>	IV 4	<i>Potentilla anserina</i>	III 4	<i>Hydrocotyle vulgaris</i>	III 5
<i>Heracleum sphondylium</i>	III 3	<i>Rumex acetosa</i>	II 3	<i>Bryum pseudotriquetrum</i>	IV 3	<i>Galium palustre</i>	III 3	<i>Agrostis stolonifera</i>	II 4
<i>Lophoclea bidentata</i>	III 3	<i>Senecio jacobaea</i>	II 3	<i>Hydrocotyle vulgaris</i>	III 2	<i>Iris pseudacorus</i>	III 3	<i>Carex nigra</i>	II 4
<i>Oenothera erythrosepala</i>	II 2	<i>Populus tremula</i>	II 6	<i>Hypochoeris radicata</i>	III 2	<i>Oenanthe lachenalii</i>	III 3	<i>Filipendula ulmaria</i>	II 5
<i>Senecio jacobaea</i>	II 2	<i>Ulex europaeus</i>	II 7	<i>Juncus articulatus</i>	III 3	<i>Ranunculus acris</i>	III 3	<i>Calliergon cuspidatum</i>	II 9
<i>Eurynchium praelongum</i>	II 5	<i>Centaurea nigra</i>	II 4	<i>Lotus corniculatus</i>	III 4	<i>Dactylorhiza majalis</i>	III 2	<i>Carex flacca</i>	II 3
<i>Rumex acetosa</i>	II 3	<i>Hedera helix</i>	II 4	<i>Mentha aquatica</i>	III 3	<i>Carex arenaria</i>	II 3	<i>Carex flacca</i>	II 3
<i>Salix repens</i> agg.	II 8	<i>Rumex crispus</i>	II 2	<i>Potentilla anserina</i>	III 3	<i>Carex flacca</i>	II 3	<i>Lychnis flos-cuculi</i>	II 3
<i>Pseudoscleropodium purum</i>	II 5	<i>Salix cinerea</i>	II 6	<i>Calliergon cuspidatum</i>	III 6	<i>Pulicaria dysenterica</i>	II 4	<i>Angelica sylvestris</i>	II 2
<i>Vicia sativa</i>	II 3	<i>Lophoclea bidentata</i>	II 4	<i>Anagallis tenella</i>	III 4	<i>Ranunculus flammula</i>	II 3	<i>Cirsium palustre</i>	II 3
<i>Anthyllis vulneraria</i>	II 3	<i>Vicia sativa</i>	II 3	<i>Cynosurus cristatus</i>	III 4	<i>Salix cinerea</i>	II 4	<i>Oenanthe lachenalii</i>	II 2
<i>Equisetum arvense</i>	II 3			<i>Euphrasia officinalis</i> agg.	III 4	<i>Carex otrubae</i>	II 3	<i>Plantago lanceolata</i>	II 4
<i>Hieracium vulgatum</i> agg.	II 3			<i>Radiola linoides</i>	III 3	<i>Festuca arundinacea</i>	II 3	<i>Salix cinerea</i>	II 4
<i>Hypochoeris radicata</i>	II 2			<i>Trifolium repens</i>	III 3	<i>Juncus acutus</i>	II 4	<i>Trifolium pratense</i>	II 3
				<i>Taraxacum</i> sp.	III 3	<i>Poa pratensis</i>	II 3		
				<i>Blackstonia perfoliata</i>	II 3	<i>Rubus fruticosus</i> agg.	II 4		
				<i>Carex arenaria</i>	II 3	<i>Trifolium pratense</i>	II 4		
				<i>Carex distans</i>	II 3				
				<i>Epipactis palustris</i>	II 4				
				<i>Glaux maritima</i>	II 4				
				<i>Lotus uliginosus</i>	II 4				
				<i>Pulicaria dysenterica</i>	II 3				
				<i>Ranunculus flammula</i>	II 4				
				<i>Dactylorhiza majalis</i>	II 2				

MAP VEGETATION
UNIT UNIT

14 SD16a/b *Salix repens* - *Holcus lanatus*
dune slack
Ononis repens sub-community (a)
Rubus caesius sub-community (b)
Prunella vulgaris - *Equisetum variegatum*
sub-community (c)
Agrostis stolonifera sub-community (d)

Tree height (m) -
Shrub/bracken height (m) 0.4
Herb height (cm) 40
Tree cover (%) -
Shrub cover (%) 40
Herb cover (%) 80
Cryptogam cover (%) 25

Bare surface (%) 1
pH 7.5-7.9
Mean species per quadrat 17.0

FREQ- DOMIN
UENCY VALUE

<i>Holcus lanatus</i>	IV	4
<i>Festuca rubra</i>	IV	6
<i>Lotus corniculatus</i>	IV	5
<i>Agrostis stolonifera</i>	IV	5
<i>Carex arenaria</i>	IV	3
<i>Salix repens</i> agg.	IV	7
<i>Carex flacca</i>	III	4
<i>Equisetum variegatum</i>	III	4
<i>Poa pratensis</i>	III	4
<i>Trifolium pratense</i>	II	4
<i>Plantago lanceolata</i>	II	4
<i>Epipactis palustris</i>	II	3
<i>Euphrasia officinalis</i> agg.	II	3
<i>Hypochaeris radicata</i>	II	3
<i>Ononis repens</i>	II	4
<i>Taraxacum</i> sp.	II	3
<i>Blackstonia perfoliata</i>	II	1
<i>Mentha aquatica</i>	II	3
<i>Phragmites australis</i>	II	3
<i>Prunella vulgaris</i>	II	4
<i>Juncus maritimus</i>	II	4
<i>Potentilla anserina</i>	II	6
<i>Radiola linoides</i>	II	3
<i>Rhinanthus minor</i>	II	3
<i>Rubus caesius</i>	II	4
<i>Callierpon cuspidatum</i>	II	6

MAP VEGETATION
UNIT UNIT

15 SD17 *Potentilla anserina* - *Carex nigra* dune slack
No clear NVC sub-community

Tree height (m) -
Shrub/bracken height (m) 0-3
Herb height (cm) 80
Tree cover (%) -
Shrub cover (%) 30
Herb cover (%) 90
Cryptogam cover (%) 30

Bare surface (%) -
pH 6.8-7.9
Mean species per quadrat 14.4

FREQ- DOMIN
UENCY VALUE

<i>Mentha aquatica</i>	V	5
<i>Carex nigra</i>	III	4
<i>Hydrocotyle vulgaris</i>	III	6
<i>Pulicaria dysenterica</i>	III	5
<i>Iris pseudacorus</i>	III	4
<i>Equisetum arvense</i>	III	3
<i>Filipendula ulmaria</i>	III	5
<i>Holcus lanatus</i>	III	4
<i>Potentilla anserina</i>	III	4
<i>Salix repens</i> agg.	III	6
<i>Juncus maritimus</i>	II	5
<i>Lythrum salicaria</i>	II	4
<i>Callierpon cuspidatum</i>	II	9
<i>Agrostis stolonifera</i>	II	4
<i>Eupatorium cannabinum</i>	II	5
<i>Lotus uliginosus</i>	II	4
<i>Salix cinerea</i>	II	4
<i>Oenanthe lachenalii</i>	II	2
<i>Rubus caesius</i>	II	3
<i>Rubus fruticosus</i> agg.	II	5
<i>Angelica sylvestris</i>	II	2
<i>Arrhenatherum elatius</i>	II	4
<i>Eleocharis palustris</i>	II	4
<i>Lychnis flos-cuculi</i>	II	3
<i>Juncus subnodulosus</i>	II	5

MAP VEGETATION
UNIT UNIT

16 SH18b *Juncus maritimus* saltmarsh
Oenanthe lachenalii sub-community

Tree height (m) -
Shrub/bracken height (m) -
Herb height (cm) 50
Tree cover (%) -
Shrub cover (%) -
Herb cover (%) 80
Cryptogam cover (%) 30

Bare surface (%) 10
pH 7.8-8.3
Mean species per quadrat 12.3

FREQ- DOMIN
UENCY VALUE

<i>Oenanthe lachenalii</i>	V	3
<i>Agrostis stolonifera</i>	V	6
<i>Juncus maritimus</i>	III	4
<i>Juncus gerardi</i>	III	5
<i>Glaux maritima</i>	III	5
<i>Festuca rubra</i>	III	6
<i>Potentilla anserina</i>	III	5
<i>Juncus acutus</i>	II	5
<i>Carex distans</i>	II	3
<i>Carex otrubae</i>	II	4
<i>Plantago maritima</i>	II	3
<i>Carex extensa</i>	II	3
<i>Rumex crispus</i>	II	2
<i>Samolus valerandi</i>	II	3
<i>Scirpus maritimus</i>	II	5
<i>Eleocharis palustris</i>	II	4
<i>Hydrocotyle vulgaris</i>	II	4
<i>Mentha aquatica</i>	II	3
<i>Phragmites australis</i>	II	4
<i>Drepanocladus aduncus</i>	II	6
<i>Plantago coronopus</i>	II	5
<i>Triglochin maritima</i>	II	2

MAP VEGETATION
UNIT UNIT

17 SH24 *Elymus pycnanthus* saltmarsh

Tree height (m) -
Shrub/bracken height (m) -
Herb height (cm) 30
Tree cover (%) -
Shrub cover (%) -
Herb cover (%) 50
Cryptogam cover (%) 10

Bare surface (%) 40
pH 7.7-8.2
Mean species per quadrat 9.2

FREQ- DOMIN
UENCY VALUE

<i>Elymus pycnanthus</i>	IV	5
<i>Festuca rubra</i>	IV	6
<i>Agrostis stolonifera</i>	IV	6
<i>Plantago coronopus</i>	II	4
<i>Carex extensa</i>	II	3
<i>Limonium binervosum</i>	II	4
<i>Atriplex prostrata</i>	II	4
<i>Carex arenaria</i>	II	2
<i>Centaurium erythraea</i>	II	3
<i>Hypochaeris radicata</i>	II	3
<i>Leontodon hispidus</i>	II	3
<i>Lotus corniculatus</i>	II	4
<i>Plantago maritima</i>	II	2

MAP VEGETATION
UNIT UNIT

18 S4a *Phragmites australis* swamp and reed-beds
Phragmites australis sub-community

19 S4d *Phragmites australis* swamp and reed-beds
Atriplex hastata sub-community
19 S21b *Scirpus maritimus* swamp
Atriplex hastata sub-community

20 S12b *Typha latifolia* swamp
Mentha aquatica sub-community

	S4a	S4d	S21b	S12b
Tree height (m)	-	-	-	-
Shrub/bracken height (m)	-	-	-	-
Herb height (cm)	200	200	100	40-100
Tree cover (%)	-	-	-	-
Shrub cover (%)	-	-	-	-
Herb cover (%)	100	100	100	20-40
Cryptogam cover (%)	-	-	-	80
Bare surface (%)	-	-	-	-
pH	-	-	-	-
Mean species per quadrat	2.7	2.5	3.0	11.3

DOMIN VALUES

<i>Phragmites australis</i>	10	10	-	-
<i>Lythrum salicaria</i>	1	-	-	-
<i>Rubus fruticosus</i> agg.	4	-	-	-

<i>Scirpus maritimus</i>	-	-	8	4
<i>Atriplex prostrata</i>	-	4	4	-
<i>Elymus pycnanthus</i>	-	8	8	-
<i>Juncus maritimus</i>	-	-	6	-

<i>Typha latifolia</i>	-	-	-	5
<i>Mentha aquatica</i>	-	-	-	4
<i>Chara</i> sp.	-	-	-	9
<i>Carex nigra</i>	-	-	-	3
<i>Eleocharis palustris</i>	-	-	-	3
<i>Galium palustre</i>	-	-	-	3
<i>Hydrocotyle vulgaris</i>	-	-	-	3
<i>Juncus articulatus</i>	-	-	-	3
<i>Ranunculus flammula</i>	-	-	-	3
<i>Salix repens</i> agg.	-	-	-	4
<i>Scirpus lacustris tabernaem.</i>	-	-	-	4
<i>Drepanocladus aduncus</i>	-	-	-	6

MAP VEGETATION
UNIT UNIT

21 SD18a Hippophae rhamnoides scrub
Festuca rubra sub-community

Tree height (m) -
Shrub/bracken height (m) 0.4-2
Herb height (cm) 40
Tree cover (%) -
Shrub cover (%) 40
Herb cover (%) 60
Cryptogam cover (%) 20

Bare surface (%) 10
pH 7.4-7.8
Mean species per quadrat 14.4

FREQ- DOMIN
UENCY VALUE

Hippophae rhamnoides V 5
Amaophila arenaria IV 5
Carex arenaria III 3
Festuca rubra III 6
Holcus lanatus III 5
Rubus caesius III 6
Hypochoeris radicata III 3
Senecio jacobaea III 3
Rubus fruticosus agg. II 4
Cerastium diffusum diffusum II 3
Oenothera erythrosepala II 3
Agrostis stolonifera II 4
Arenaria serpyllifolia II 3
Leontodon hispidus II 3
Lotus corniculatus II 4

MAP VEGETATION
UNIT UNIT

22 SD18b Hippophae rhamnoides scrub
Urtica dioica - Arrhenatherum elatius
sub-community

Tree height (m) -
Shrub/bracken height (m) 2-6
Herb height (cm) 40
Tree cover (%) -
Shrub cover (%) 80
Herb cover (%) 60
Cryptogam cover (%) 20

Bare surface (%) 10
pH 6.6-7.5
Mean species per quadrat 9.7

FREQ- DOMIN
UENCY VALUE

Hippophae rhamnoides V 8
Galium aparine V 4
Eurychium praelongum IV 5
Rubus fruticosus agg. IV 5
Urtica dioica IV 6
Brachythecium rutabulum III 5
Sambucus nigra III 5
Solanum dulcamara III 4
Holcus lanatus II 3
Polypodium vulgare II 3
Evernia prunastri II 2

MAP VEGETATION
UNIT UNIT

23 W1 Salix cinerea - Galium palustre woodland

Tree height (m) 4-8
Shrub/bracken height (m) 0-6
Herb height (cm) 20-150
Tree cover (%) 30-80
Shrub cover (%) 0-80
Herb cover (%) 30
Cryptogam cover (%) 40

Bare surface (%) -
pH 6.7
Mean species per quadrat 10.3

FREQ- DOMIN
UENCY VALUE

Betula pubescens V 6
Galium palustre V 5
Iris pseudacorus V 4
Agrostis stolonifera IV 4
Ophioglossum vulgatum IV 3
Phragmites australis IV 6
Rubus fruticosus agg. IV 2
Salix cinerea IV 5
Calliergon cuspidatum IV 5
Juncus effusus III 4
Solanum dulcamara III 2
Epilobium palustre II 3
Equisetum sylvaticum II 3
Eriophorum angustifolium II 2
Hydrocotyle vulgaris II 3
Salix repens agg. II 4

MAP VEGETATION
UNIT UNIT

24 W10c Quercus robur - Pteridium aquilinum -
Rubus fruticosus agg. woodland
Hedera helix sub-community

Tree height (m) 2-14
Shrub/bracken height (m) 0-2
Herb height (cm) 30
Tree cover (%) 60-100
Shrub cover (%) 0-100
Herb cover (%) 30-100
Cryptogam cover (%) 0-30

Bare surface (%) -
pH 5.9
Mean species per quadrat 14.4

FREQ- DOMIN
UENCY VALUE

Quercus robur V 9
Crataegus monogyna V 4
Hedera helix IV 6
Galium aparine III 4
Geranium robertianum III 3
Rubus fruticosus agg. III 7
Arrhenatherum elatius II 4
Brachypodium sylvaticum II 4
Fraxinus excelsior II 4
Holcus lanatus II 5
Polypodium vulgare II 3
Tamus communis II 2
Urtica dioica II 4

MAP VEGETATION
UNIT UNIT

25 W21 Crataegus monogyna - Hedera helix scrub
Hedera helix - Urtica dioica sub-community

Tree height (m) 0-4
Shrub/bracken height (m) 1-5
Herb height (cm) 20-100
Tree cover (%) 0-80
Shrub cover (%) 30-100
Herb cover (%) 60
Cryptogam cover (%) 10

Bare surface (%) -
pH 6.1-7.2
Mean species per quadrat 13.3

FREQ- DOMIN
UENCY VALUE

Crataegus monogyna IV 5
Geranium robertianum IV 3
Hedera helix IV 6
Rubus fruticosus agg. IV 7
Urtica dioica III 4
Quercus robur III 4
Silene dioica II 3
Fraxinus excelsior II 4
Prunus spinosa II 4
Phyllitis scolopendrium II 3
Rosa pimpinellifolia II 3
Solanum dulcamara II 4
Tamus communis II 3
Acer pseudoplatanus II 3
Brachypodium sylvaticum II 4
Epilobium montanum II 2
Galium aparine II 4

MAP VEGETATION
UNIT UNIT

26 W22 *Prunus spinosa* - *Rubus fruticosus* agg. scrub
No clear NVC sub-community

Tree height (m) -
Shrub/bracken height (m) 2-5
Herb height (cm) 30
Tree cover (%) -
Shrub cover (%) 60-100
Herb cover (%) 5-80
Cryptogam cover (%) 10-40

Bare surface (%) -
pH 7.4
Mean species per quadrat 12.6

FREQ- DOMIN
UENCY VALUE

<i>Prunus spinosa</i>	V	8
<i>Eurynchium praelongum</i>	IV	6
<i>Urtica dioica</i>	IV	3
<i>Crataegus monogyna</i>	III	5
<i>Dactylis glomerata</i>	III	3
<i>Rosa pimpinellifolia</i>	III	5
<i>Rubus fruticosus</i> agg.	III	4
<i>Festuca rubra</i>	II	4
<i>Geranium robertianum</i>	II	3
<i>Glechoma hederacea</i>	II	4
<i>Hedera helix</i>	II	9
<i>Quercus robur</i>	II	4
<i>Sambucus nigra</i>	II	6
<i>Silene dioica</i>	II	3
<i>Arrhenatherum elatius</i>	II	2
<i>Athyrium filix-femina</i>	II	1
<i>Brachypodium sylvaticum</i>	II	3
<i>Carex arenaria</i>	II	3
<i>Dryopteris filix-mas</i>	II	4
<i>Epilobium montanum</i>	II	2
<i>Fraxinus excelsior</i>	II	4
<i>Galium verum</i>	II	4
<i>Phyllitis scolopendrium</i>	II	4
<i>Plantago lanceolata</i>	II	3
<i>Pteridium aquilinum</i>	II	4
<i>Rubus caesius</i>	II	4
<i>Senecio jacobaea</i>	II	2
<i>Stachys sylvatica</i>	II	3
<i>Tamus communis</i>	II	1

MAP VEGETATION
UNIT UNIT

27 W23 *Ulex europaeus* - *Rubus fruticosus* agg. scrub
No clear NVC sub-community

Tree height (m) -
Shrub/bracken height (m) 1-3
Herb height (cm) 20-100
Tree cover (%) -
Shrub cover (%) 40-90
Herb cover (%) 40-80
Cryptogam cover (%) 0-10

Bare surface (%) -
pH 5.9-6.8
Mean species per quadrat 12.6

FREQ- DOMIN
UENCY VALUE

<i>Ulex europaeus</i>	V	8
<i>Holcus lanatus</i>	IV	4
<i>Rubus fruticosus</i> agg.	IV	6
<i>Arrhenatherum elatius</i>	III	5
<i>Festuca rubra</i>	III	4
<i>Dactylis glomerata</i>	III	4
<i>Galium aparine</i>	II	3
<i>Pteridium aquilinum</i>	II	5
<i>Rosa pimpinellifolia</i>	II	5
<i>iubus caesius</i>	II	6
<i>Urtica dioica</i>	II	3
<i>Agrostis stolonifera</i>	II	2
<i>Carex arenaria</i>	II	3
<i>Poa pratensis</i>	II	3
<i>Solanum dulcamara</i>	II	3
<i>Eurynchium praelongum</i>	II	4
<i>Agrostis capillaris</i>	II	6
<i>Anthoxanthum odoratum</i>	II	3
<i>Crataegus monogyna</i>	II	5
<i>Plantago lanceolata</i>	II	3

MAP VEGETATION
UNIT UNIT

28 W24 *Rubus fruticosus* agg. - *Holcus lanatus*
underscrub
No clear NVC sub-community

Tree height (m) -
Shrub/bracken height (m) 1-3
Herb height (cm) 30
Tree cover (%) -
Shrub cover (%) 60
Herb cover (%) 60
Cryptogam cover (%) 10

Bare surface (%) -
pH 6.3-6.9
Mean species per quadrat 12.1

FREQ- DOMIN
UENCY VALUE

<i>Rubus fruticosus</i>	IV	6
<i>Arrhenatherum elatius</i>	IV	4
<i>Festuca rubra</i>	IV	4
<i>Holcus lanatus</i>	III	4
<i>Eurynchium praelongum</i>	III	4
<i>Solanum dulcamara</i>	III	3
<i>Dactylis glomerata</i>	III	3
<i>Galium aparine</i>	III	3
<i>Rosa pimpinellifolia</i>	III	5
<i>Ulex europaeus</i>	III	8
<i>Carex arenaria</i>	II	4
<i>Crataegus monogyna</i>	II	5
<i>Agrostis stolonifera</i>	II	2
<i>Populus tremula</i>	II	6
<i>Urtica dioica</i>	II	4
<i>Hedera helix</i>	II	6
<i>Rumex crispus</i>	II	1
<i>Sonchus asper</i>	II	2

MAP VEGETATION
UNIT UNIT

31 X6 *Pinus nigra/sylvestris* woodland

Tree height (m) 10-18
Shrub/bracken height (m) 1-4
Herb height (cm) 30
Tree cover (%) 40-80
Shrub cover (%) 5-100
Herb cover (%) 10-30
Cryptogam cover (%) -

Bare surface (%) -
pH 5.6-6.4
Mean species per quadrat 12.0

FREQ- DOMIN
UENCY VALUE

Pinus nigra/sylvestris V 7
Crataegus monogyna IV 4
Dryopteris filix-mas IV 4
Geranium robertianum IV 4
Rubus caesius III 4
Rubus fruticosus agg. III 7
Epilobium angustifolium II 3
Rosa pimpinellifolia II 3
Solanum dulcamara II 4
Hedera helix II 9
Phyllitis scolopendrium II 4
Silene dioica II 3
Urtica dioica II 5
Prunus spinosa II 1

MAP VEGETATION
UNIT UNIT

30 X5 *Alnus glutinosa* slack woodland

Tree height (m) 2-12
Shrub/bracken height (m) 1-3
Herb height (cm) 30-50
Tree cover (%) 70-100
Shrub cover (%) 0-40
Herb cover (%) 50
Cryptogam cover (%) 20

Bare surface (%) -
pH 5.9-6.5
Mean species per quadrat 11.7

FREQ- DOMIN
UENCY VALUE

Iris pseudacorus IV 5
Rubus fruticosus agg. IV 5
Galium palustre IV 3
Alnus glutinosa IV 9
Salix cinerea III 7
Solanum dulcamara III 4
Calliergon cuspidatum III 6
Phragmites australis II 3
Oenanthe crocata II 4
Holcus lanatus II 4
Lycopus europaeus II 3
Agrostis stolonifera II 3
Berula erecta II 2
Carex remota II 4
Filipendula ulmaria II 3
Geranium robertianum II 4

MAP VEGETATION
UNIT UNIT

32 X7 *Acer pseudoplatanus* woodland

Tree height (m) 4-16
Shrub/bracken height (m) 0-6
Herb height (cm) 20-40
Tree cover (%) 60-95
Shrub cover (%) 0-50
Herb cover (%) 20-50
Cryptogam cover (%) 10

Bare surface (%) -
pH 6.3
Mean species per quadrat 12.0

FREQ- DOMIN
UENCY VALUE

Acer pseudoplatanus V 9
Rubus fruticosus IV 4
Hyacinthoides non-scripta III 3
Geranium robertianum III 3
Hedera helix III 6
Arum maculatum II 1
Crataegus monogyna II 3
Glechoma hederacea II 4
Pteridium aquilinum II 2
Rubus caesius II 4
Silene dioica II 2
Brachythecium rutabulum II 4

ANNEX 6

TARGET NOTES

PEMBREY COAST

These are marked on the site map sheet(s) as TNn. Numbers 1-19 are extracted and abbreviated from Pembrey Forest Conservation Plan, together with their map references. The numbering system differs from the conservation plan. Large lengths of track and ride are recognised in the conservation plan as of interest. They are distinguished on the Pembrey Coast vegetation maps and details can be found in the conservation plan.

- 1 380044 Patches of *Pyrola rotundifolia*.
- 2 377041 Slack remnant beside ride with *Ophioglossum vulgatum*, *Dactylorhiza majalis praetermissa*, *D. fuchsii*, *Listera ovata*.
- 3 374040 Large slack with open water at eastern end (*Baldellia ranunculoides* and *Chara hispida* reported).
- 4 370036 Slack of great interest: *Anacamptis pyramidalis*, *Dactylorhiza majalis praetermissa*, *Orchis morio*, *Ophrys apifera*, *Epipactis palustris*, *Spiranthes spiralis*, *Ophioglossum vulgatum*, *Botrychium lunaria*, *Pyrola rotundifolia*, *Salix triandra*. All in an alder-sallow carr within SSSI boundary. The map reference is probably incorrect - is it 367044 (as marked)?
- 5 378034 Single specimen of *Rosa tomentosa*.
- 6 377033 Single specimen of *Rosa stylosa*.
- 7 376028 *Ophioglossum vulgatum* in ditch, decreasing due to shading.
- 8 386031 Slack remnant with *Pyrola minor* and *Dactylorhiza majalis praetermissa*.
- 9 399023 Small patch of *Geranium pyrenaicum*.
- 10 391018 Ride junction with *Pyrola minor*, *Dactylorhiza fuchsii*, *D. majalis praetermissa*, *Listera ovata*.
- 11 383018 Small patch of *Pyrola minor*.
- 12 388014 Large (20m x 10m) patch of *Pyrola minor* and a few *Dactylorhiza majalis praetermissa*.

- 13 387014 Patch of *Rubia peregrina*.
- 14 396010 Slack remnant with *Dactylorhiza majalis praetermissa*.
- 15 400011 Overgrown pond with willows, damp slack and alder scrub.
- 16 401009 *Anacamptis pyramidalis* and *Briza media* in glade.
- 17 408014 Roadside edge with *Verbascum virgatum*.
- 18 420014 Patches of *Geranium sanguineum*.
- 19 417018 Large patch of *Lathyrus sylvestris*.
- 20 Dune front eroding to expose *Hippophae rhamnoides* suckers and roots (good nodules visible).
- 21 Ruins of old observation building.
- 22 Recent site of small fire.
- 23 Many old bomb craters with little succession evidence.
- 24 Target area - adjoining swamp-slack depression (15-20) badly cut up by cannon shot.
- 25 Area cleared of *Hippophae rhamnoides* in 1985. Regeneration in drier turf (8-21) but good turf regrowth in wetter (8-14) sward.
- 26 Good grazing contrast either side of fence on saltmarsh - dune transition. No stock grazing to west.
- 27 Recently-constructed car park (without NCC approval). Not on air photos - approximate position marked.
- 28 Rubble dumped at end of track.
- 29 Scattered individuals of *Silene conica*.
- 30 *Leymus arenarius* tussock on dune ridge.
- 31 Trailbike tracks dissect dunes but erosion not severe. *Silene conica* reported in area and may be related to bike disturbance.

ANNEX 7

QUADRAT DATA (COMPUTER FORMAT)

Full tabulation of all quadrat data as sample-species tables is too costly in terms of space. A reduced version of the data in NVC format for use in the VESPAN2 package is given here. A copy of this data aggregated for all sites has been supplied to the NCC Nominated Officer on floppy diskette. For readers with access to VESPAN2 it is thus possible to obtain the data and display individual quadrats in full format.

The species characteristics of vegetation types are presented in great detail in Annex 5 (apart from infrequent species), based on data from all sites. Particular characteristics of this site are emphasised under descriptions of vegetation types in Annex 3. Quadrat membership of vegetation types is listed in Annex 4. This organisation of information should satisfy most readers.

170 9 0 10 0 11 30 13 0 14 0 15 30 16 0 22 70 116 6 268 1
 170 1184 2
 171 9 0 10 0 11 10 13 0 14 0 15 30 16 0 22 70 116 6 194 3
 171 385 2 549 1 565 3 913 11239 31243 2
 172 9 0 10 0 11 10 13 0 14 0 15 10 16 0 22 90 116 3 159 7
 172 217 3 268 2 427 1 565 31143 11184 41225 31239 22801 2
 173 9 0 10 0 11 60 13 0 14 0 15 50 16 60 22 20 116 3 194 3
 173 381 2 385 3 565 31239 31272 11501 8
 174 9 0 10 0 11 50 13 0 14 0 15 50 16 80 22 10 116 2 159 7
 174 194 3 371 1 381 3 384 2 678 3 913 11239 51501 9
 175 9 0 10 0 11 70 13 0 14 0 15 70 16 60 22 20 159 8 194 3
 175 381 3 419 1 706 11239 31272 11501 8
 176 9 0 10 0 11 25 13 0 14 0 15 25 16 0 22 75 116 5 217 1
 176 1184 51243 12801 1
 177 9 0 10 0 11 50 13 0 14 0 15 30 16 0 22 70 116 4 159 6
 177 565 5
 178 9 0 10 0 11 30 13 0 14 0 15 25 16 0 22 75 122 5 159 5
 178 304 3 381 4 565 3 678 1 706 2 769 2 913 4 958 31225 51243 2
 178 1273 41434 4
 179 9 0 10 0 11 5 13 0 14 0 15100 16 0 22 0 122 8 316 3
 179 322 2 355 2 375 3 732 4 769 3 911 3 972 5 975 31043 21143 1
 179 1156 31272 3
 180 9 0 10 0 11 5 13 0 14 0 15 95 16 0 22 5 122 7 316 2
 180 322 2 355 2 373 2 375 4 636 5 690 3 732 4 734 2 855 2 911 4
 180 972 5 975 31043 51143 11189 3
 181 9 0 10 0 11 30 13 0 14 0 15 30 16 0 22 70 116 5 217 4
 181 218 3 427 2 576 42801 4
 182 9 0 10 0 11 30 13 0 14 0 15 20 16 0 22 80 116 4 217 2
 182 218 2 576 5 650 5 941 31184 1
 183 9 0 10 0 11 30 13 0 14 0 15 30 16 0 22 70 116 5 217 1
 183 218 2 576 5 650 4 975 1
 184 9 0 10 0 11 10 13 0 14 0 15 40 16 0 22 60 116 4 217 1
 184 576 6 778 4 972 3 975 31156 21184 11272 31285 11303 12801 1
 185 9 0 10 0 11 60 13 0 14 0 15 70 16 20 22 30 122 3 159 5
 185 304 3 381 3 576 6 706 3 769 2 913 31239 41510 51519 32023 5
 185 1501 4
 186 9 0 10 0 11 30 13 0 14 0 15 40 16 0 22 60 117 3 122 6
 186 304 3 576 3 972 22256 3
 187 9 0 10 0 11 30 13 0 14 0 15 80 16 0 22 20 117 8 122 3
 187 217 1 218 4 576 3 778 2 972 11303 12801 1
 188 9 0 10 0 11 10 13 0 14 0 15 30 16 0 22 70 116 2 122 5
 188 159 2 576 3 778 5 972 41156 31303 2
 189 9 0 10 0 11 10 13 0 14 0 15 70 16 0 22 30 122 4 159 2
 189 217 1 576 7 682 5 778 4 972 41156 3
 190 9 0 10 2 11 20 13 0 14 80 15 30 16 30 22 70 122 6 159 3
 190 381 3 485 4 678 9 988 31015 21143 31225 51239 51268 31272 3
 190 1677 6
 191 9 0 10 3 11 60 13 0 14 70 15 80 16 50 22 20 122 5 460 3
 191 605 3 678 91136 51143 31272 31368 71519 72749 2
 192 9 0 10 1 11 20 13 0 14 5 15 30 16 70 22 30 125 3 159 4
 192 194 3 381 3 549 3 678 3 769 3 958 31136 51225 31239 31510 5
 192 2023 82381 3
 193 9 0 10 0 11 30 13 0 14 0 15 20 16 40 22 50 159 5 194 2
 193 381 2 576 4 613 2 769 2 972 41225 21501 22377 22381 9
 194 9 0 10 0 11 50 13 0 14 0 15100 16 0 22 0 122 5 217 1
 194 316 7 576 6 636 5 720 4 732 5 734 5 778 2 780 3 911 4 972 5
 194 1189 3
 195 9 0 10 0 11 20 13 0 14 0 15 20 16 60 22 20 125 3 153 7

195 159 4 194 3 304 2 323 3 373 3 381 3 680 4 706 2 769 31136 5
 195 1169 71225 31239 41268 61501 41562 72023 42381 62486 4
 196 9 4 10 0 11 30 13 90 14 0 15 20 16 4 22 80 605 21136 5
 196 1519 3
 197 9 0 10 4 11100 13 0 14 50 15 80 16 30 22 0 605 4 678 8
 197 1187 51268 31368 91519 51677 51766 42003 32749 3
 198 9 0 10 3 11150 13 0 14100 15 70 16 0 22 0 909 3 441 7
 198 465 3 522 2 605 4 678 7 680 3 962 21015 11136 71139 21368 5
 199 9 0 10 0 11 10 13 0 14 0 15100 16 20 22 0 122 5 241 2
 199 304 2 316 2 323 5 384 2 531 4 539 3 568 5 576 5 678 1 680 4
 199 722 3 769 4 800 5 855 2 988 21043 31059 51080 31081 31136 2
 199 1343 31349 31350 31546 31562 51914 42828 1
 200 9 0 10 0 11 20 13 0 14 0 15100 16 20 22 0 122 4 304 2
 200 316 4 336 5 531 4 609 5 855 4 988 21043 91081 21139 11349 4
 201 9 0 10 0 11 50 13 0 14 0 15 60 16 40 22 30 197 3 304 3
 201 373 4 381 3 459 1 543 1 680 2 706 3 913 2 958 31015 11136 5
 201 1225 51239 31273 31432 31434 31510 61562 42023 52377 32486 4
 202 9 0 10 1 11 15 13 0 14 20 15100 16 30 22 0 122 4 153 5
 202 241 2 304 3 316 3 323 4 336 3 531 3 539 4 568 3 583 5 609 3
 202 680 4 690 4 715 4 800 5 813 4 855 2 911 3 988 31043 31156 2
 202 1169 21223 31350 41571 62828 2
 203 9 0 10 0 11 30 13 0 14 0 15 80 16 80 22 0 122 4 336 5
 203 509 4 690 5 732 6 734 4 855 1 911 21043 61089 11213 41353 1
 203 1654 9
 204 9 0 10 0 11120 13 0 14 0 15 80 16 20 22 0 118 4 122 5
 204 336 4 690 4 732 6 734 4 831 4 911 2 961 41043 51213 41654 5
 205 9 0 10 1 11 20 13 0 14 40 15 50 16 40 22 0 122 5 304 3
 205 316 3 336 3 539 3 609 3 636 3 690 4 732 6 734 4 769 1 855 3
 205 911 41043 41089 11169 51179 71349 41571 41654 6
 206 9 0 10 0 11 40 13 0 14 0 15 60 16 20 22 30 122 4 125 3
 206 159 5 174 6 194 3 381 3 385 2 555 1 706 4 913 3 958 31100 3
 206 1225 41239 31434 42023 5
 207 9 0 10 0 11 60 13 0 14 0 15 25 16 0 22 75 122 5 159 4
 207 194 3 381 3 565 5 706 4 913 3 958 31225 41239 21434 4
 208 9 0 10 0 11 60 13 0 14 0 15 40 16 0 22 60 122 5 159 7
 208 565 5 913 21239 2
 209 9 0 10 1 11 15 13 0 14 15 15 80 16 70 22 0 122 4 295 1
 209 304 3 336 2 531 3 539 4 609 3 690 9 715 2 732 4 734 4 769 3
 209 855 3 911 31043 51136 11169 41179 41189 21223 21349 51350 4
 209 1654 8
 210 9 0 10 3 11 30 13 0 14 90 15 30 16 0 22 0 153 9 340 4
 210 909 1 546 3 609 3 680 3 690 4 715 5 917 2 961 31095 31136 4
 210 1169 51268 3
 211 9 0 10 2 11 30 13 0 14 30 15 90 16 10 22 0 304 8 415 2
 211 522 2 605 4 678 6 680 4 988 31136 31268 31432 21677 4
 212 9 0 10 1 11 60 13 0 14 5 15 70 16 20 22 0 125 2 304 3
 212 362 1 576 5 678 4 680 4 701 3 706 2 800 41015 51136 41240 1
 212 1272 11638 52167 4
 213 9 8 10 0 11 10 13100 14 0 15 30 16 10 22 0 122 3 153 10
 213 295 3 323 3 583 2 630 4 680 3 690 41136 31169 41268 31659 4
 214 9 0 10 1 11 30 13 0 14 40 15 60 16 20 22 0 122 4 160 3
 214 418 3 460 4 576 5 587 2 609 3 678 5 680 5 690 6 802 5 813 2
 214 823 21059 31136 31169 41179 71272 21349 41677 52828 3
 215 9 0 10 2 11 40 13 0 14 40 15100 16 40 22 0 159 3 160 3
 215 197 4 283 2 304 3 419 1 576 7 613 3 678 5 680 6 800 31136 4
 215 1239 32982 1
 216 9 0 10 0 11 15 13 0 14 0 15100 16 30 22 0 122 4 241 3
 216 304 3 316 2 323 4 373 3 384 2 576 5 680 4 800 4 813 3 911 4

216 914 4 917 41059 31081 41239 31349 41350 41546 31562 61571 5
 216 1914 42256 32828 1
 217 9 0 10 0 11 60 13 0 14 0 15 90 16 70 22 0 122 7 316 3
 217 636 2 720 4 732 5 734 6 813 2 911 31043 61143 11654 7
 218 9 0 10 0 11 10 13 0 14 0 15 90 16 0 22 30 122 8 316 5
 218 690 3 732 3 911 31043 51143 2
 219 9 0 10 0 11 40 13 0 14 0 15 70 16 20 22 20 316 3 336 4
 219 636 5 720 5 732 5 911 31043 51143 21213 51353 21654 5
 220 9 0 10 0 11 60 13 0 14 0 15 70 16 70 22 0 122 4 509 5
 220 732 2 911 21043 31143 21213 71216 41654 8
 221 9 0 10 0 11 60 13 0 14 0 15 90 16 70 22 0 122 5 323 2
 221 336 3 680 3 690 4 720 5 734 7 813 4 855 4 911 31043 51139 3
 221 1143 21654 8
 222 9 0 10 0 11 40 13 0 14 0 15 70 16 70 22 0 304 3 323 3
 222 680 3 690 3 720 4 734 6 823 1 855 4 911 3 917 21043 41059 3
 222 1069 51081 31143 21179 51381 31445 71654 52828 3
 223 9 0 10 0 11 40 13 0 14 0 15 70 16100 22 0 167 3 445 1
 223 558 4 609 3 680 3 734 7 758 3 802 4 855 4 911 21069 61169 4
 223 1179 41381 31445 102828 2
 224 9 0 10 0 11 60 13 0 14 0 15 90 16 0 22 10 122 5 316 3
 224 576 6 636 5 720 4 732 5 734 7 780 5 911 41189 4
 225 9 0 10 0 11 20 13 0 14 0 15 70 16 70 22 0 159 4 160 2
 225 174 3 197 3 304 3 373 3 419 1 576 8 613 5 680 3 800 5 807 3
 225 913 3 965 3 973 31015 31127 51273 11562 8 447 2
 226 9 0 10 0 11 10 13 0 14 0 15 50 16 90 22 0 159 4 174 5
 226 304 3 576 5 613 6 706 3 769 2 807 3 913 2 965 41127 41239 2
 226 1273 11562 9 447 3
 227 9 0 10 0 11 20 13 0 14 0 15 70 16 80 22 0 159 3 160 1
 227 174 4 304 3 576 8 613 5 674 1 678 1 680 4 706 2 769 1 800 5
 227 807 3 973 31127 31638 51562 82381 42982 1 447 3
 228 9 0 10 0 11 30 13 0 14 0 15100 16 30 22 0 159 2 160 1
 228 304 3 576 7 674 1 678 4 706 3 807 2 913 3 914 6 965 21015 3
 228 1127 81239 11273 11562 5
 229 9 0 10 0 11 25 13 0 14 0 15100 16 30 22 0 122 3 171 3
 229 230 2 251 3 323 5 371 2 384 3 460 4 568 3 576 6 680 4 706 2
 229 722 3 802 5 973 5 988 41043 41059 41081 31106 41179 51239 1
 229 1343 21349 51350 41445 61546 41571 32256 32828 3
 230 9 0 10 0 11 25 13 0 14 0 15100 16 0 22 0 122 4 171 4
 230 323 6 460 4 509 4 576 5 636 4 680 4 722 3 802 4 813 4 988 4
 230 1043 61081 31189 21349 31350 61354 21546 31571 62256 3
 231 9 0 10 0 11 30 13 0 14 0 15 70 16 0 22 0 122 7 217 2
 231 322 4 509 4 576 6 680 3 732 5 911 2 975 31189 21213 51353 3
 232 9 6 10 0 11 40 13 70 14 0 15 90 16 0 22 0 122 5 323 4
 232 522 2 576 4 680 51136 81169 8
 233 9 0 10 0 11 50 13 0 14 0 15100 16 0 22 0 122 5 171 4
 233 304 4 323 3 576 7 680 6 730 4 802 3 988 31043 6
 234 9 0 10 0 11 50 13 0 14 0 15100 16 0 22 0 122 5 217 4
 234 316 3 336 4 509 4 576 6 911 21213 5
 235 9 0 10 1 11100 13 0 14 50 15 30 16100 22 0 418 3 583 2
 235 813 21043 31069 51136 51179 81305 51445 91914 5
 236 9 0 10 0 11 90 13 0 14 0 15100 16 0 22 0 197 6 371 4
 236 576 4 680 4 758 4 802 4 973 21136 81270 31349 41396 3
 237 9 0 10 1 11 30 13 0 14 4 15 70 16 30 22 0 174 3 415 5
 237 445 3 576 6 680 8 800 2 913 3 973 21136 61268 21562 5
 238 9 0 10 1 11 20 16 30 22 0 122 5 323 4 418 1 445 1 531 4
 238 539 4 572 3 576 3 690 7 800 4 855 3 911 21043 31081 41089 3
 238 1136 21179 71349 31350 31546 31571 31654 42256 32828 2
 239 9 0 10 0 11 80 13 0 14 0 15 50 16 60 22 0 122 4 323 3

239 531 3 539 4 572 2 576 4 583 6 680 3 690 6 734 3 911 21069 4
 239 1081 31179 71445 82828 1
 240 9 4 10 0 11 50 13100 14 0 15 60 16 0 22 0 153 7 281 4
 240 583 2 715 21136 81169 7
 241 9 0 10 1 11 80 13 0 14 30 15 60 16 90 22 0 333 5 539 3
 241 680 2 690 6 715 3 720 4 734 5 855 21081 11136 21179 61445 9
 241 2828 2
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 244 1445 9
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 245 295 2 340 3 583 2 609 3 715 6 823 3 876 31089 21169 61179 2
 245 1268 51445 72416 42586 4
 246 9 0 10 0 11 20 13 0 14 0 15100 16 5 22 0 160 3 304 4
 246 323 5 576 6 680 5 800 6 965 2 988 31081 21106 41127 61239 2
 246 1272 11677 41695 32828 32982 3
 247 9 0 10 0 11100 13 0 14 0 15 90 16 0 22 10 122 5 159 7
 247 678 4 914 71127 41239 4
 248 9 0 10 0 11 80 13 0 14 0 15 90 16 0 22 10 159 6 174 3
 248 304 3 678 5 680 5 706 3 769 2 988 31127 81239 12982 3
 249 9 0 10 2 11 40 13 0 14 85 15 60 16 0 22 10 304 5 459 3
 249 605 4 678 9 680 41127 71268 21272 31677 3
 250 9 0 10 1 11 30 13 0 14 20 15 60 16 50 22 30 125 3 159 5
 250 174 5 194 3 304 3 373 2 381 3 576 4 678 5 706 3 769 3 913 3
 250 965 41127 51239 31432 31434 31510 72023 42920 5 447 3
 251 9 0 10 1 11 20 13 0 14 20 15 70 16 20 22 30 125 3 304 3
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 252 1069 51081 41089 31179 61445 61654 82828 3
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 253 304 3 323 3 418 1 465 3 558 2 576 8 583 3 678 4 680 4
 253 690 3 802 5 917 3 973 41043 31069 21106 21127 51179 81349 3
 253 1766 102828 1
 254 9 0 10 1 11 40 13 0 14 5 15 95 16 80 22 0 171 4 384 2
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 254 1189 21272 11305 21381 21638 41562 8
 255 9 0 10 1 11 40 13 0 14 20 15 80 16 30 22 0 122 3 163 3
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 255 831 2 911 31043 31069 51081 31089 31179 51445 62828 1
 256 9 0 10 0 11 80 13 0 14 0 15 70 16 0 22 30 122 5 336 5
 256 509 5 572 2 609 2 636 3 715 5 732 5 734 4 813 2 831 3 855 4
 256 911 21043 31069 4
 257 9 0 10 1 11 30 13 0 14 20 15100 16 0 22 0 122 4 163 3
 257 167 1 304 3 323 4 333 3 572 5 576 5 609 2 680 4 734 5 758 3
 257 802 3 813 3 831 1 973 41069 41081 31143 11223 31239 21272 4
 257 1363 5
 258 9 0 10 1 11 40 13 0 14 70 15 30 16 5 22 0 118 6 167 2
 258 304 5 323 3 340 2 415 3 465 3 576 4 680 5 715 3 758 3 813 3
 258 831 3 911 5 973 3 988 31127 51268 41363 81677 42707 3
 259 9 0 10 0 11 30 13 0 14 0 15100 16 20 22 0 159 3 171 5
 259 304 3 323 3 384 2 576 6 613 4 680 5 813 3 914 5 965 3 973 4
 259 988 31139 31638 51562 52381 32707 32982 1
 260 9 0 10 0 11 50 13 0 14 0 15100 16 5 22 0 117 5 122 5

260	217	1 316	3 576	8 720	5 734	5 813	3 911	4 988	31143	21677	4
261	9	0 10	0 11 40	13	0 14	0 15100	16 30	22	0 159	5 174	1
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262	283	4 576	8 988	31143	1						
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263	539	4 576	8 680	4 734	4 802	3 973	51043	31059	41069	31081	4
263	1179	41305	31349	41445	61571	42256	32707	3			
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264	609	3 690	5 722	3 855	51089	41179	21213	41216	21362	21654	6
264	2730	9									
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265	546	5 609	3 690	3 722	4 855	41089	31136	21179	71362	51445	7
265	1654	62730	5								
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266	855	31213	41216	51362	52730	10					
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267	369	3 381	3 678	5 706	3 769	3 913	4 958	31225	41239	31273	3
267	1434	32023	8								
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271	159	4 185	2 304	3 373	3 381	3 549	2 678	5 680	3 913	3 958	3
271	1015	21127	61225	31239	41273	31485	52023	7			

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268 385 3 678 1 706 2 913 31225 31239 21434 3

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271 159 4 185 2 304 3 373 3 381 3 549 2 678 5 680 3 913 3 958 3

271 1015 21127 61225 31239 41273 31485 52023 7

272 9 0 10 1 11 20 13 0 14 70 15 40 16 60 22 0 105 2 160 1
 272 197 3 445 5 465 3 475 4 532 3 576 4 680 3 973 31123 41127 6
 272 1139 11179 81239 31272 21519 61677 41914 6
 273 9 0 10 30 11 30 13 1 14 15 15 80 16 0 22 0 104 3 123 4
 273 160 1 304 3 465 2 475 1 532 2 576 7 613 4 656 3 680 5 706 2
 273 914 3 973 31123 51127 51273 1
 274 9 0 10 3 11100 13 0 14 85 15 70 16 5 22 0 532 2 605 3
 274 637 4 678 9 680 31368 81677 52982 3
 275 9 0 10 1 11 25 13 0 14 30 15 60 16 70 22 0 123 5 160 1
 275 174 3 304 3 576 7 613 4 656 4 706 3 914 3 973 31123 61127 4
 275 1940 8
 276 9 0 10 1 11 60 13 0 14 5 15100 16 0 22 0 123 4 171 4
 276 197 5 371 4 384 2 465 3 532 4 572 2 576 4 661 2 680 4 758 3
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 277 9 0 10 30 11 30 13 1 14 5 15100 16 0 22 0 104 2 123 4
 277 159 3 171 4 174 2 304 3 465 3 475 4 532 2 576 8 613 3 656 4
 277 914 3 973 31123 41127 62982 3
 278 9 0 10 1 11 30 13 0 14 30 15100 16 5 22 0 104 2 171 4
 278 197 3 304 3 371 1 445 1 475 3 532 3 576 5 613 3 656 5 661 2
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 280 171 5 174 3 251 3 304 3 384 2 465 3 475 3 532 3 576 6 613 3
 280 656 4 914 3 965 3 973 4 988 31056 21123 51127 51139 11333 2
 280 1396 31914 8
 281 9 0 10 1 11 30 13 0 14 5 15100 16 20 22 0 123 5 171 5
 281 304 3 324 2 532 3 576 8 613 3 656 5 680 4 758 3 988 31050 5
 281 1056 21123 41127 51139 11339 21396 2
 282 9 0 10 1 11 20 13 0 14 20 15100 16 20 22 0 123 5 171 4
 282 251 4 304 3 371 2 475 3 576 8 613 2 656 5 661 2 680 3 914 3
 282 973 3 988 31081 21127 61179 51914 52707 3
 283 9 0 10 2 11 30 13 0 14 70 15 60 16 5 22 0 160 1 197 5
 283 465 5 576 5 605 2 680 31127 61349 31363 81677 4
 284 9 0 10 2 11 40 13 0 14 40 15 60 16 40 22 0 197 5 445 5
 284 465 3 532 2 605 3 680 61123 31127 61139 11268 31363 71368 6
 284 1519 51677 6
 285 9 0 10 0 11 80 13 0 14 0 15100 16 0 22 0 197 5 371 4
 285 465 4 532 3 576 7 661 4 680 5 758 5 783 0 802 4 973 31043 5
 285 1056 31081 41127 51139 31143 21677 82707 2
 286 9 0 10 1 11 50 13 0 14 90 15 15 16 60 22 0 323 2 526 3
 286 532 2 558 4 605 2 758 3 831 4 855 31127 41179 9
 287 9 0 10 4 11100 13 0 14 75 15 80 16 0 22 0 160 3 197 5
 287 532 5 661 5 678 2 680 41127 61139 31169 91254 3
 288 9 0 10 2 11 50 13 0 14 40 15 90 16 0 22 0 104 3 197 5
 288 251 2 371 4 384 2 465 4 532 3 576 7 613 2 661 4 678 6 680 5
 288 973 31056 21081 31127 61139 31179 52828 3
 289 9 0 10 1 11 40 13 0 14 20 15 90 16 0 22 0 159 3 160 3
 289 174 3 283 3 465 2 475 4 656 4 706 2 965 4 973 31100 31123 5
 289 1127 51239 2
 290 9 0 10 0 11 40 13 0 14 0 15 30 16 0 22 0 117 5 217 5
 290 218 21143 12801 4
 291 9 0 10 0 11 50 13 0 14 0 15 60 16 0 22 0 117 8 217 3
 292 9 0 10 1 11 20 13 0 14 5 15 70 16 80 22 0 159 3 171 4
 292 174 4 304 3 465 2 555 2 576 6 613 3 656 4 706 2 965 4 973 4
 292 988 31015 21123 41127 31333 31638 31562 61897 31914 82366 4
 292 2367 32381 4 447 3

293 9 0 10 1 11 15 13 0 14 15 15 70 16 5 22 10 159 3 171 4
 293 174 5 304 3 576 4 613 3 656 3 706 3 769 1 914 3 965 4 973 4
 293 988 31100 31106 31123 51127 51225 21333 71562 42377 4 447 3
 294 9 0 10 1 11 30 13 0 14 70 15 60 16 20 22 0 171 3 304 2
 294 475 1 576 7 656 21123 81127 61914 5
 295 9 0 10 1 11 20 13 0 14 4 15 50 16 70 22 0 159 3 171 4
 295 174 1 576 6 613 5 656 5 706 1 914 21123 21638 31562 42366 5
 295 2381 8 447 2
 296 9 0 10 2 11 30 13 0 14 70 15 40 16 0 22 0 122 2 197 4
 296 324 3 415 2 576 5 605 3 630 2 680 41123 51136 51179 31273 2
 296 1363 81368 3
 297 9 0 10 2 11 30 13 0 14 80 15 40 16 0 22 0 122 2 197 3
 297 445 5 465 4 576 4 605 3 680 41123 51136 51268 11363 9
 298 9 0 10 2 11 40 13 0 14 70 15 50 16 0 22 0 122 3 197 2
 298 576 4 605 2 680 31123 61136 61268 21313 21363 81368 3
 299 9 0 10 3 11 50 13 0 14 70 15 80 16 0 22 0 122 2 197 4
 299 445 6 465 3 576 2 652 6 680 31123 61136 61193 51363 81368 4
 300 9 8 10 0 11 30 13 90 14 0 15 50 16 0 22 0 197 4 215 1
 300 445 5 630 3 652 8 798 3 990 31078 101123 11139 31368 42936 4
 301 9 0 10 5 11 40 13 0 14 90 15 50 16 10 22 0 197 4 215 2
 301 445 9 605 2 630 3 652 4 990 21078 11123 31136 51268 31363 5
 301 1368 41677 42936 5
 302 9 0 10 2 11 30 13 0 14 90 15 80 16 30 22 0 197 2 215 4
 302 304 3 445 8 465 3 576 4 652 91078 11123 41313 11363 51677 6
 302 2707 32794 12936 6
 303 9 0 10 0 11 20 13 0 14 0 15 50 16 50 22 10 117 4 122 7
 303 195 4 576 4 650 2 778 4 780 1 972 51156 32256 7
 304 9 0 10 0 11 30 13 0 14 0 15 90 16 0 22 10 117 5 122 6
 304 195 3 576 8 650 1 778 2 975 2
 305 9 0 10 0 11 30 13 0 14 0 15 90 16 0 22 10 117 5 195 4
 305 322 5 576 8 712 1 778 5 975 2
 306 9 0 10 0 11 50 13 0 14 0 15 60 16 30 22 20 122 6 159 5
 306 555 1 576 6 778 5 972 4 975 31100 11156 31225 22256 6
 307 9 0 10 0 11 40 13 0 14 0 15 40 16 0 22 60 116 6 159 5
 307 555 1 565 2 706 1 913 11100 11239 21243 11272 52982 1
 308 9 0 10 0 11 30 13 0 14 0 15 50 16 0 22 0 116 3 122 3
 308 159 3 217 4 555 1 565 1 576 3 682 3 769 2 972 4 975 21100 1
 308 1184 21225 21239 22801 6
 309 9 0 10 0 11 50 13 0 14 0 15 60 16 0 22 40 122 5 159 7
 309 555 5 706 31239 11434 22982 1
 310 9 0 10 0 11 30 13 0 14 0 15 90 16 30 22 10 159 5 174 6
 310 194 3 381 3 555 2 576 6 661 2 706 3 913 2 958 31100 31127 1
 310 1239 31434 31501 41677 52982 4
 311 9 0 10 0 11 40 13 0 14 0 15 20 16 0 22 80 116 5 122 3
 311 682 21184 11355 4
 312 9 0 10 0 11 25 13 0 14 0 15 40 16 4 22 60 116 3 217 5
 312 218 3 268 11239 51272 31501 42801 4
 313 9 0 10 0 11 25 13 0 14 0 15 40 16 0 22 60 116 7 210 2
 313 636 2 650 21068 31273 31303 2
 314 9 0 10 0 11 20 13 0 14 0 15 30 16 80 22 20 159 5 174 4
 314 194 3 197 3 381 3 419 1 680 2 706 4 913 3 958 31239 21432 3
 314 1501 91562 4
 315 9 0 10 0 11 60 13 0 14 0 15100 16 20 22 0 159 8 174 5
 315 185 2 543 3 576 6 656 4 680 4 706 2 711 2 913 2 965 31015 1
 315 1136 11239 21677 52982 3
 316 9 0 10 0 11 20 13 0 14 0 15 95 16 10 22 1 159 4 160 1
 316 174 3 373 4 381 2 384 2 576 8 613 5 656 4 706 11015 51136 4
 316 1432 21562 41677 41562 42377 32486 4

317	9	0	10	6	11100	13	0	14100	15	40	16	30	22	0	500	1	605	4
317	652	4	678	7	990	31015	31187	81268	41368	61519	51677	51766	4					
318	9	0	10	0	11	50	13	0	14	0	15	80	16	40	22	0	159	5
318	174	5	373	4	576	8	656	5	706	3	958	2	965	4	988	31015	31136	2
318	1225	41501	41510	41562	31562	62377	32486	3	447	3								
319	9	0	10	0	11	50	13	0	14	0	15	80	16	30	22	0	122	3
319	174	3	576	8	656	5	680	5	706	2	783	1	913	2	914	5	965	2
319	1015	21136	61239	21501	52486	32982	3											
320	9	0	10	6	11	40	13	0	14100	15	60	16	30	22	0	500	4	605
320	652	4	678	5	962	11015	31187	91268	31368	61519	51677	6						
321	9	0	10	3	11100	13	0	14	60	15	90	16	20	22	0	122	4	160
321	419	1	459	1	482	1	576	4	605	2	661	1	678	8	680	81123	51136	5
321	1268	51368	61519	41677	52416	22749	2											
322	9	0	10	0	11	25	13	0	14	0	15	99	16	20	22	1	159	4
322	174	3	304	2	373	3	381	2	384	2	555	1	576	8	613	5	656	4
322	783	2	914	4	965	4	988	3	995	11127	41225	31239	21273	21562	4			
322	2377	41501	5															
323	9	0	10	0	11	30	13	0	14	0	15	99	16	20	22	1	116	1
323	122	4	159	4	195	4	576	9	778	2	972	31156	22377	22807	5			
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324	195	4	576	9	778	31139	1											
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326	159	4	160	1	304	2	576	8	613	2	656	5	680	4	914	2	988	31123
326	1136	71677	41914	6														
327	9	0	10	0	11	40	13	0	14	0	15100	16	4	22	0	117	5	122
327	322	2	576	10	780	11353	12807	3										
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328	576	9	732	5	734	2	780	5	961	41353	3							
329	9	0	10	0	11	40	13	0	14	0	15100	16	0	22	0	117	5	122
329	316	5	322	2	576	9	732	2	961	51353	2							
330	9	0	10	0	11	30	13	0	14	0	15	90	16	20	22	0	117	5
330	304	3	576	9	961	3	973	1	988	31136	51562	51914	52377	3				
331	9	0	10	0	11	40	13	0	14	0	15100	16	0	22	0	117	4	122
331	217	1	304	2	322	4	576	9	734	5	778	2	911	4	961	5		
332	9	0	10	0	11100	13	0	14	0	15100	16	0	22	0	117	8	217	3
332	961	7																
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334	9	0	10	0	11100	13	0	14	0	15100	16	0	22	0	117	8	217	4
334	734	61213	8															
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337	9	0	10	0	11	30	13	0	14	0	15100	16	0	22	0	117	4	122
337	316	5	322	3	576	8	734	4	911	31213	31272	3						
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338	576	6	680	3	734	7	911	31143	2									
339	9	0	10	7	11100	13	0	14	80	15	70	16	20	22	0	630	4	678
339	1187	81268	51298	51313	21368	71677	52416	32749	3									
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341	914	31136	71349	21677	31914	32828	1											
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342	1273	21562	31677	52982	3													
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343	174	4	194	2	381	2	391	2	576	6	656	4	706	4	965	2	988	31015	2
343	1239	41273	21519	41562	41677	52982	4												
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344	174	8	381	3	576	5	913	4	958	31239	1	447	1						
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345	630	3	637	5	990	41187	71268	21368	71677	62416	42586	32749	3						
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346	1368	31677	92936	8															
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347	465	5	522	2	576	8	605	3	613	4	637	2	656	3	661	1	680	3	973
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 349 415 2 445 1 532 3 572 4 583 5 609 4 680 3 730 4 758 3 802 4
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 349 2732 5
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 351 2794 1
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 633 9 12 10 6 11 30 13 50 14 60 15 15 16100 22 0 304 3 391 4
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 639 2920 5
 640 9 16 10 2 11 30 13 40 14 30 15 30 16100 22 0 159 1 171 2
 640 304 4 445 1 500 3 587 2 678 6 680 2 800 21015 31127 51136 3
 640 1422 21766 102920 73333 3

AREAS OF VEGETATION TYPES

The table below lists the area (in hectares) of vegetation types at this site(s). Results are based on weighing on a balance accurate to 10mg - small categories may not be fully accurate. PF= Pembrey Forest, PCP= Pembrey Country Park, PB= Pembrey Burrows (non-SSSI and SSSI sectors).

Map Unit	NVC or non-NVC Unit	TYWYN SSSI	PF/PCP/non-SSSI PB	PB SSSI	TOTAL PEMBREY COAST
1	X1	0.96	-	0.96	1.92
2	SD4	1.60	3.21	9.73	14.54
3	SD6a	1.60	-	12.88	13.48
4	SD6d	12.05	3.85	7.69	23.59
5	SD6e	1.28	-	1.92	3.2
6	SD7c	-	33.34	32.05	65.39
7	SD7d	23.08	10.26	-	33.26
8	SD8	21.45	29.44	22.44	73.33
9	SD9	0.38	1.28	1.28	2.94
10	SD12	-	-	-	-
11	H11	-	-	-	-
12	SD14c-SD15a/b	13.24	0.38	-	13.62
13	SD15c	13.14	1.92	-	15.06
14	SD16a/b-SD16c/d	28.78	2.31	4.49	35.58
15	SD17	0.64	1.28	-	0.92
16	SM18b	1.28*	-	-	1.28*
17	SM24	4.53*	-	23.40*	27.93*
18	S4a	-	0.64	-	0.64
19	S4d-S21b	-	-	8.97	8.97
20	S12b	0.64	-	-	0.64
21	SD18a	19.85	25.00	2.56	47.41
22	SD18b	9.61	42.95	5.13	57.69
23	W1	18.91	1.92	-	20.83
24	W10c	-	0.51	0.51	1.02
25	W21a	-	-	-	-
26	W22	-	2.56	0.96	3.52
27	W23	-	0.64	0.96	1.60
28	W24	-	2.56	-	2.56
29	W25	-	-	-	-
30	X2	15.49	2.56	-	18.05
31	X3	-	966.67	0.38	967.05
32	X4	-	1.28	0.38	1.66
1-11 (strand/ grassland/heath)		62.40	81.38	88.95	232.73
12-15 (slacks)		55.80	5.89	4.49	64.26
16-20 (saltmarsh* and swamp)		6.45	0.64	32.37	41.38
21-32 (scrub and woodland)		63.86	1046.65	10.88	1121.39
Golf fairways/greens			26.92	1.28	28.20
MG1			43.59		43.59
MG2			37.18		37.18
Disturbed				1.28	1.28
Total		188.51	1242.25	139.25	1570.01
(* = not all included)					

ANNEX 9

SITE BIBLIOGRAPHY

- Bridges, M. (1987) Classic Landforms of the Gower Coast. Geographical Association, Sheffield.
- Currie, F.A. (1987) Pembrey Forest Conservation Plan 1987-92. Forestry Commission (Brechfa Forest District).
- Nature Conservancy Council (1983) Development at Pembrey: Nature conservation assessment and ecological/physiographical appraisal. Internal report, Oxwich Reserve Centre.

VEGETATION MAPPING AND VEGETATION UNITS FOR 1989 SOUTH WALES DUNE SURVEY

STRAND, DUNE AND TRANSITIONS

- | a | b |
|----|--|
| 1 | X1 <i>Dry foredune/saltmarsh/strandline transition community</i> |
| 2 | SD4 <i>Elymus farctus</i> foredune community |
| 3 | SD6a <i>Ammophila arenaria</i> mobile dune community
<i>Elymus farctus</i> sub-community |
| 4 | SD6d <i>Ammophila arenaria</i> mobile dune community
Typical sub-community |
| 5 | SD6e <i>Ammophila arenaria</i> mobile dune community
<i>Festuca rubra</i> sub-community |
| 6 | SD7c <i>Ammophila arenaria</i> - <i>Festuca rubra</i> semi-fixed dune community
<i>Ononis repens</i> sub-community |
| 7 | SD7d <i>Ammophila arenaria</i> - <i>Festuca rubra</i> semi-fixed dune community
<i>Tortula ruralis</i> ssp. <i>ruraliformis</i> sub-community |
| 8 | SD8 <i>Festuca rubra</i> - <i>Galium verum</i> fixed dune community
No clear NVC sub-community |
| 9 | SD9 <i>Ammophila arenaria</i> - <i>Arrhenatherum elatius</i> dune grassland
No clear NVC sub-community |
| 10 | SD12 <i>Carex arenaria</i> - <i>Festuca ovina</i> - <i>Agrostis capillaris</i> grassland
No clear NVC sub-community |
| 11 | H11 <i>Calluna vulgaris</i> - <i>Carex arenaria</i> heath |

a = mapping unit b = vegetation unit
X = Major non-NVC category or transitional type

MAPPING AND VEGETATION UNITS FOR 1989 SOUTH WALES DUNE SURVEY

SLACK, SALTMARSH AND SWAMP

a	b	
12	SD14c	<i>Salix repens</i> - <i>Campyllum stellatum</i> dune slack <i>Bryum pseudotriquetrum</i> - <i>Aneura pinguis</i> sub-community
12	SD15a/b	<i>Salix repens</i> - <i>Calliargon cuspidatum</i> dune slack <i>Carex nigra</i> sub-community (a) <i>Equisetum variegatum</i> sub-community (b)
13	SD15c	<i>Salix repens</i> - <i>Calliargon cuspidatum</i> dune slack <i>Carex flacca</i> - <i>Pulicaria dysenterica</i> sub-community
14	SD16a/b	<i>Salix repens</i> - <i>Holcus lanatus</i> dune slack <i>Ononis repens</i> sub-community (a) <i>Rubus caesius</i> sub-community (b)
14	SD16c/d	<i>Salix repens</i> - <i>Holcus lanatus</i> dune slack <i>Prunella vulgaris</i> - <i>Equisetum variegatum</i> sub-community (c) <i>Agrostis stolonifera</i> sub-community (d)
15	SD17	<i>Potentilla anserina</i> - <i>Carex nigra</i> dune slack No clear NVC sub-community
16	SM18b	<i>Juncus maritimus</i> saltmarsh <i>Oenothera lachenalii</i> sub-community
17	SM24	<i>Elymus pycnanthus</i> saltmarsh
18	S4a	<i>Phragmites australis</i> swamp and reed-beds <i>Phragmites australis</i> sub-community
19	S4d	<i>Phragmites australis</i> swamp and reed-beds <i>Atriplex hastata</i> sub-community
19	S21b	<i>Scirpus maritimus</i> swamp <i>Atriplex hastata</i> sub-community
20	S12b	<i>Typha latifolia</i> swamp <i>Mentha aquatica</i> sub-community

a = mapping unit b = vegetation unit
X = Non-NVC category or transitional type

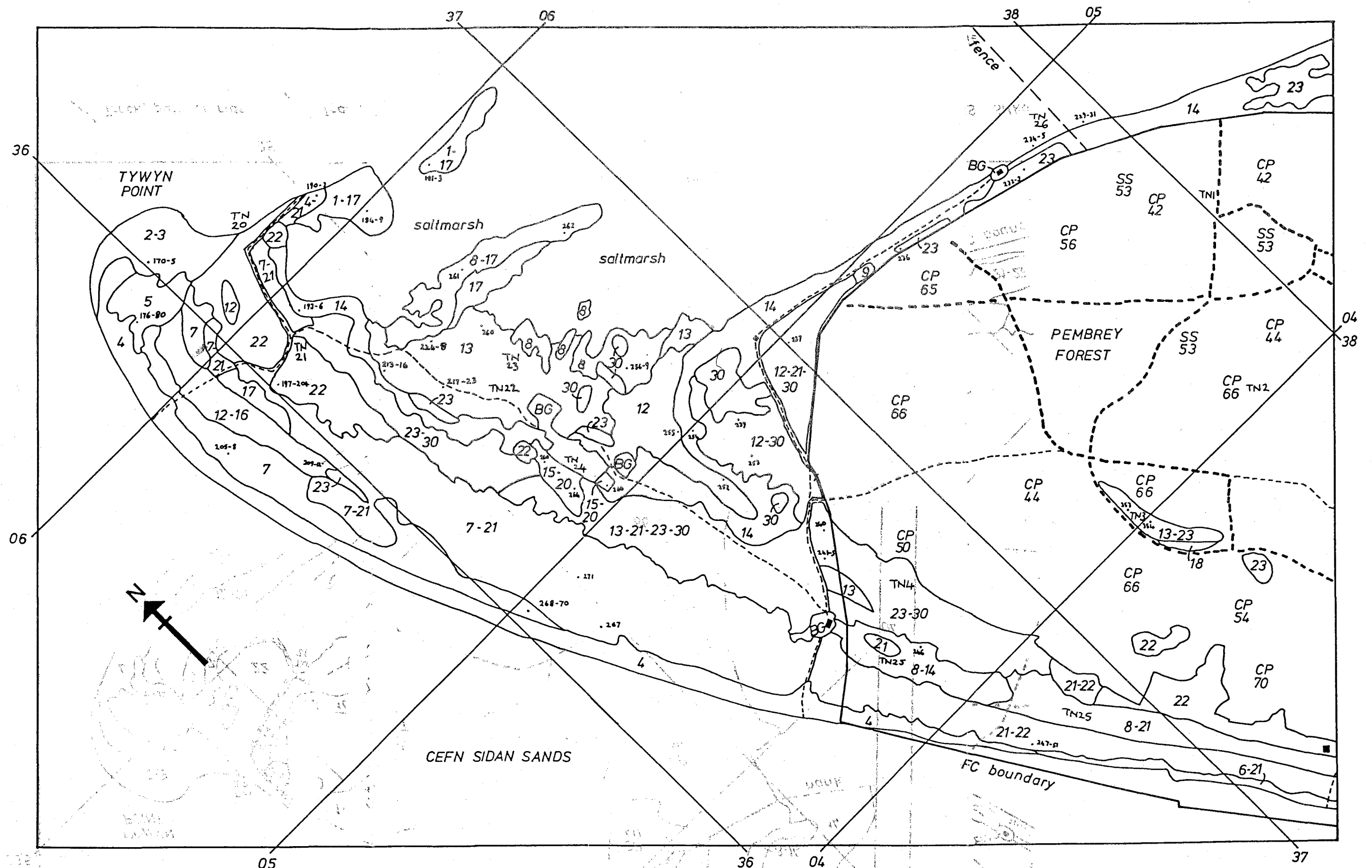
MAPPING AND VEGETATION UNITS FOR 1989 SOUTH WALES JUNE SURVEY

WOODLAND AND SCRUB

a	b	
21	SD18a	<i>Hippophae rhamnoides</i> scrub <i>Festuca rubra</i> sub-community
22	SD18b	<i>Hippophae rhamnoides</i> scrub <i>Urtica dioica</i> - <i>Arrhenatherum elatius</i> sub-community
23	W1	<i>Salix cinerea</i> - <i>Galium palustre</i> woodland
24	W10c	<i>Quercus robur</i> - <i>Pteridium aquilinum</i> - <i>Rubus fruticosus</i> agg. woodland <i>Hedera helix</i> sub-community
25	W21	<i>Crataegus monogyna</i> - <i>Hedera helix</i> scrub <i>Hedera helix</i> - <i>Urtica dioica</i> sub-community
26	W22	<i>Prunus spinosa</i> - <i>Rubus fruticosus</i> agg. scrub No clear NVC sub-community
27	W23	<i>Ulex europaeus</i> - <i>Rubus fruticosus</i> agg. scrub No clear NVC sub-community
28	W24	<i>Rubus fruticosus</i> agg. - <i>Holcus lanatus</i> underscrub No clear NVC sub-community
29	W25	<i>Pteridium aquilinum</i> - <i>Rubus fruticosus</i> agg. underscrub No clear NVC sub-community
30	X2	<i>Alnus glutinosa</i> slack woodland
31	X3	<i>Pinus nigra/sylvestris</i> woodland
32	X4	<i>Acer pseudoplatanus</i> woodland

a = mapping unit b = vegetation unit
X = Non-NVC category or transitional type

Pembrey Coast 1



--- Track, path or ride - - - Track or ride of conservation interest BG Bare ground CP Corsican Pine SS Sitka Spruce ■ Building

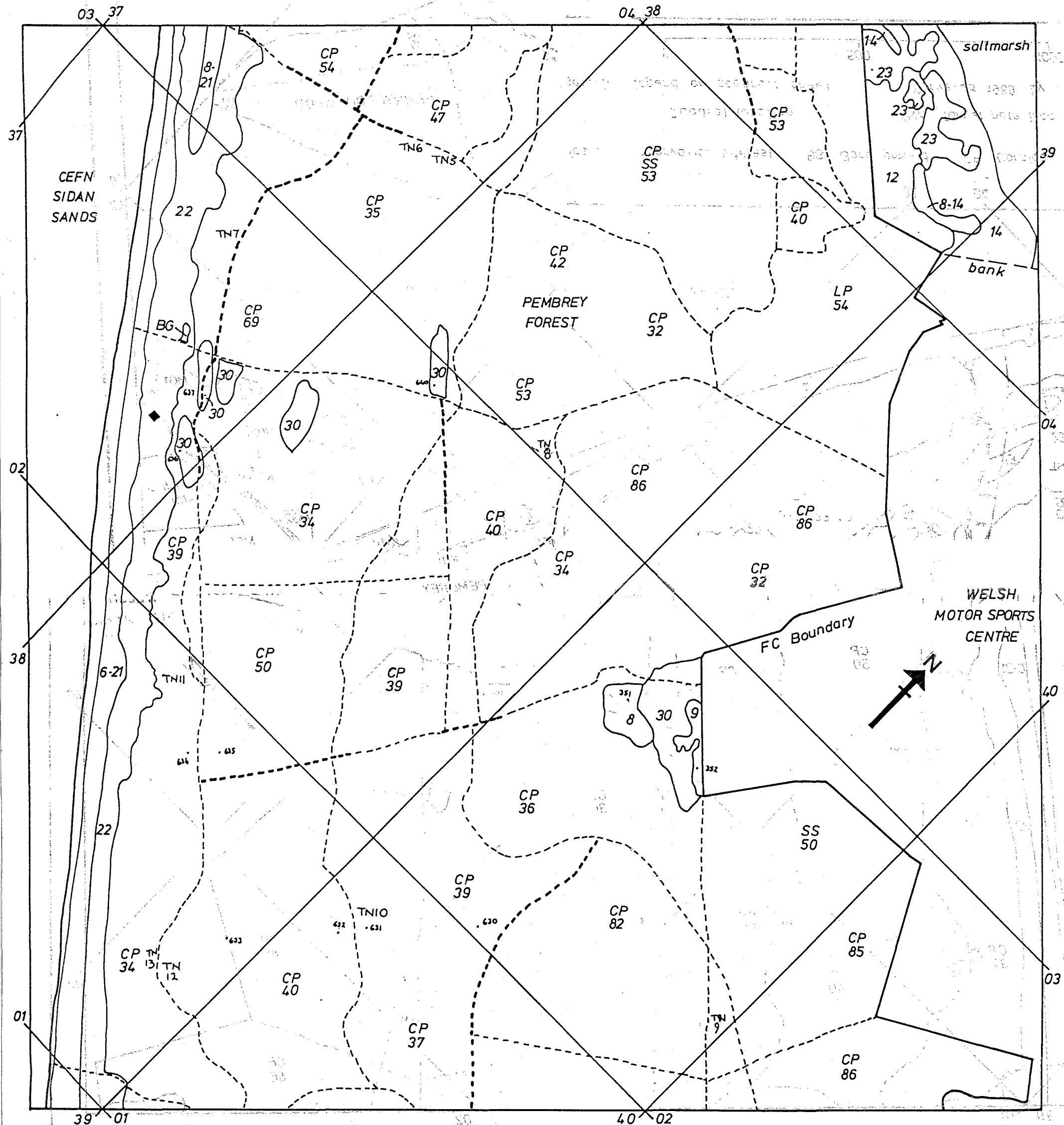
.n Quadrat location
Vegetation legend on separate sheet

T.Nn Target note location

Surveyed 1989 by T.C.D. Dargie

0 500 1000 metres

Pembrey Coast 2



CP Corsican Pine
 LP Lodgepole Pine
 SS Sitka Spruce

Track, path or ride
 " of conservation interest

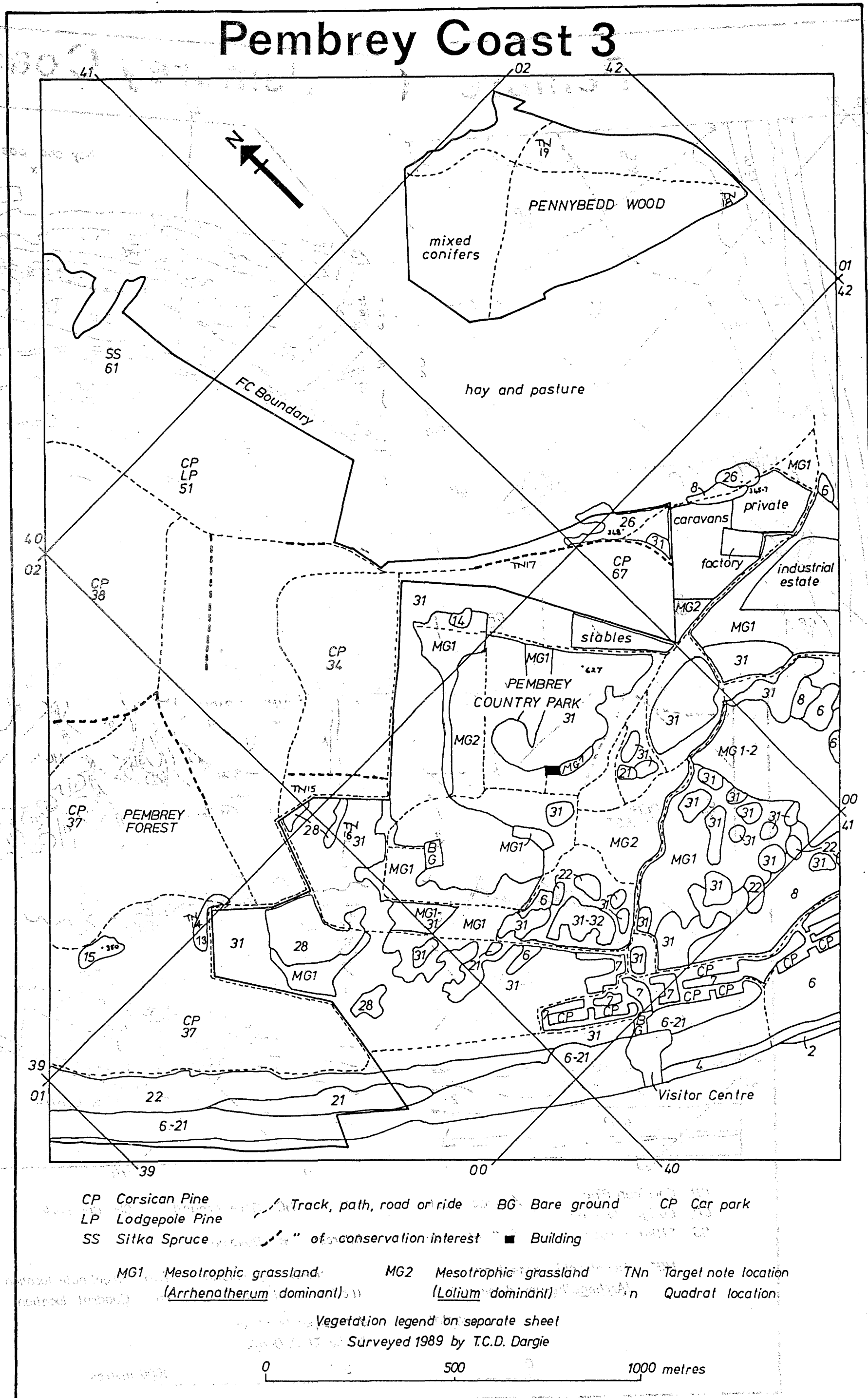
Vegetation legend on separate sheet

BG Bare ground
 ■ Building
 TNN Target note location
 ■ Quadrat location

Surveyed 1989 by T.C.D. Dargie

0 500 1000 metres

Pembrey Coast 3



CP Corsican Pine
LP Lodgepole Pine
SS Sitka Spruce

Track, path, road or ride

BG Bare ground

CP Car park

" of conservation interest

Building

MG1 Mesotrophic grassland
(*Arrhenatherum* dominant)

MG2 Mesotrophic grassland
(*Lolium* dominant)

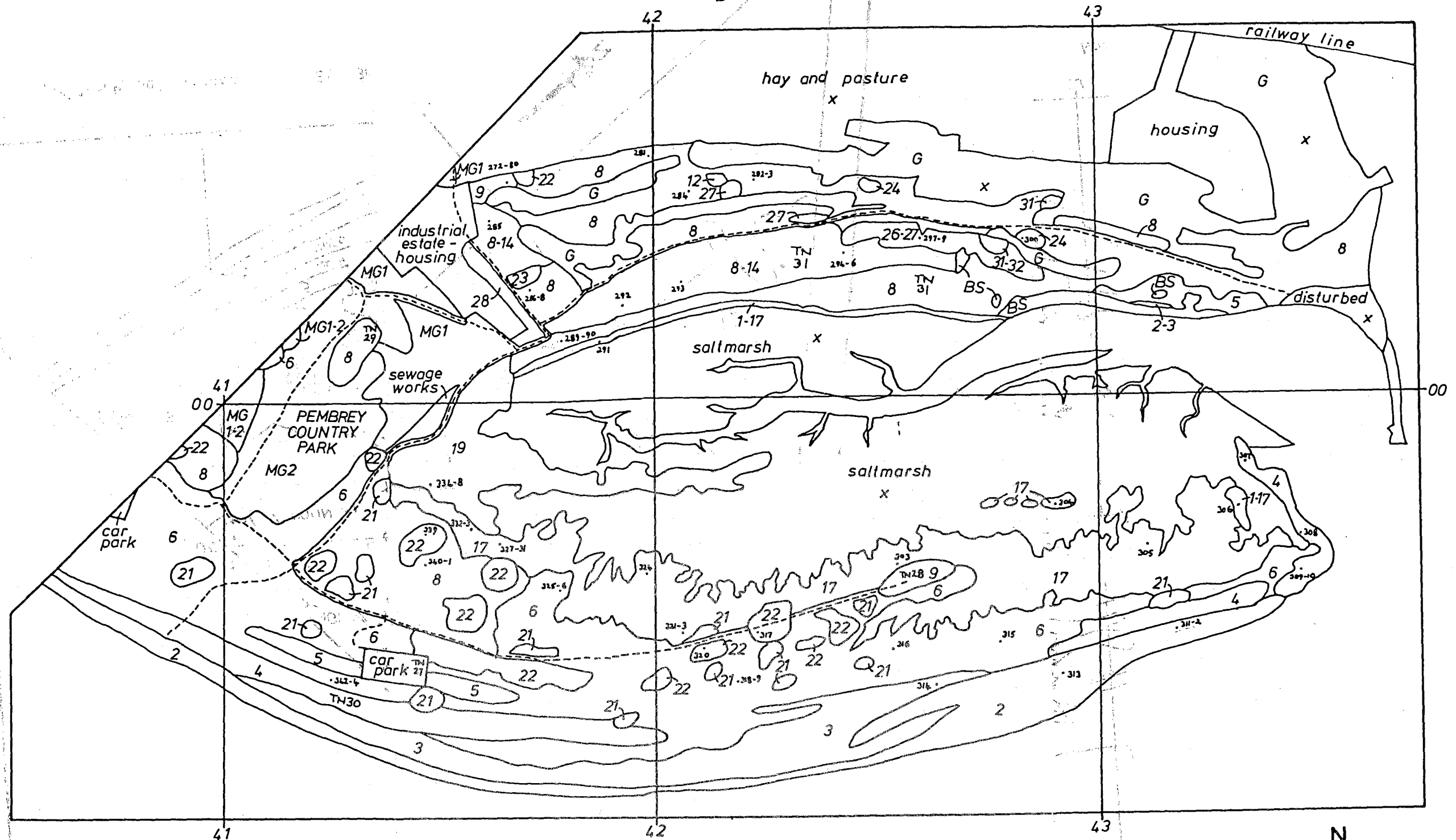
TNn Target note location
n Quadrat location

Vegetation legend on separate sheet

Surveyed 1989 by T.C.D. Dargie

0 500 1000 metres

Pembrey Coast 4



Track, path or road

BS Bare sand

n Quadrat location

TNN Target note location

x Not surveyed

MG1 Mesotrophic grassland
(*Arrhenatherum* dominant)

MG2 Mesotrophic grassland
(*Lolium* dominant)

Vegetation legend on separate sheet

Surveyed 1989 by T.C.D. Dargie

0 500 1000 metres

