Common Standards Monitoring Guidance

for

Vegetated Coastal Shingle Habitats

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Contents

Introduction

1.1 Origin

Shingle coasts form in wave dominated locations where suitably sized material is available. In Britain 'shingle' is applied to pebbles larger in diameter than sand (>2mm) but smaller than boulders (<200mm).
The origin of coastal shingle varies according to location. In southern England much is composed of flint eroded out of chalk cliffs, as well as shingle deposits of Ice Age origin from the sea bed reworked by wave action and redeposited by longshore drift. In northern and western Britain, shingle may derive from deposits transported to the coast by rivers or glacial outwash.

Vegetated shingle occurs on deposits of shingle lying at or above mean high-water spring tides. Species first to colonise are tolerant of periodic displacement or overtopping by high tides and storms, giving a characteristic vegetation consisting of annuals or short-lived perennials tolerant of occasional saltwater inundation. Level or gently-sloping, high-level mobile beaches, with limited human disturbance, support the best examples of this vegetation. Although shingle deposits are extensive, much is too dynamic for drift line vegetation to persist. On smaller sites, annual vegetation may exist in one location in one year but not another, and even the largest sites support less than 10 ha of this habitat. More permanent ridges are formed by storm waves: several beaches may be piled against each other and form extensive structures. Ecological variation in this habitat type depends on stability, the amount of fine material accumulating between pebbles, climatic conditions, width of the foreshore, and past management of the site. The ridges and lows formed also influence the vegetation patterns, resulting in characteristic zonations of vegetated and bare shingle.

1.2 Extent

Shingle is a globally restricted habitat type. There are 19,000 km of shoreline with an important shingle component in Great Britain and around 3,500 km of pure shingle (Sneddon and Randall, 1993). England has an estimated total area of 5343 ha of vegetated shingle, Scotland 700 ha, Wales 110 ha and N. Ireland 50 ha. The largest and most significant shingle structures are found in north-east Scotland and in south and south-east England. There are only a few extensive examples of perennial vegetation of stony banks in Europe, and the UK hosts a significant proportion of the European resource of this habitat. Shingle structures are thus of geomorphological as well as ecological interest.

1.3 Threats

Much vegetated shingle has been lost to agriculture, housing developments, industrial plants, defence infrastructure and even housing (e.g. Dungeness, Orfordness, Spey Bay) which has destroyed vegetation and ridge morphology. Exploitation presents a greater threat. Shingle structures have been regarded as a convenient source of aggregates, and have been subject to varying degrees of extraction, resulting in severe alteration of morphology and vegetation (e.g. Dungeness and Spey Bay) or almost total destruction of major parts of the feature (e.g. Rye Harbour).

A more continued threat is posed by the management of shingle structures for coastal defence, including beach recycling (artificial redistribution of material). Climate change and sea level rise will exacerbate this problem. In some cases beach recycling is undertaken without a detected negative impact: at Hurst Spit (Hants) material is transported by net drift from west to east and then deposited on a series of inshore submerged banks just to the west of the Isle of Wight. The local authorities (New Forest District Council) take shingle from this natural sink (the Shingles Bank) and recycle it to the foreshore.

Shingle vegetation is fragile and trampling caused by access on foot, and particularly by vehicles, has damaged many sites. The causes include military use, vehicle access to beaches by fishermen, and tourism.

Water abstraction from the groundwater system can cause drought stress on the vegetation.

2 Definitions

2.1 Types of formations

Shingle coasts can comprise several different landform types:

1. Fringing beach
These are narrow strips of shingle, usually in contact with the land behind. They usually occur along the foot of sedimentary cliffs such as chalk in southern Britain, but may also occur in front of coastal dunes or salt-marsh cliffs. Examples are Porlock (Somerset), Claymoddie (Dumfries and Galloway) and Llanddulas (Clwyd).

The northern end of Chesil (Futurecoast, Defra 2002).

2. Spit
Shingle spits in general grow out from the coast where there is an abrupt change in direction of the coastline. Spits may display recurved hooks at their distal ends, such as the distal end of Scolt Head (Norfolk), Aber Dysinni (Gwynedd) and Whiteness Head (Highland). Hurst Spit (Hampshire) is another good example where the coast turns into the Solent.

The distal end of Scolt Head (Norfolk) showing recurved spits (Futurecoast, Defra 2002).

Hurst Spit (Hants) looking towards Milford-on-Sea (Futurecoast, Defra 2002).

3. Bar/Barrier
This is geomorphologically similar to a spit but crosses an estuary mouth or bay and ultimately encloses a freshwater or brackish lagoon, such as Slapton Sands (Devon), Cemlyn Bay (Anglesey) and Chesil (Dorset), which encloses a very large lagoon.

4. Barrier island
An offshore barrier island is formed where a large mass of shingle has been deposited offshore and which may act as a skeleton for a sand dune system. Examples are Scolt Head (Norfolk) or Culbin Bar (Highland).

5. Cuspate foreland

When shingle is piled against an existing spit, fringing beach or series of relict storm ridges, it can form large structures, even kilometres wide. Dungeness (Kent) is a good example, along with Rhunahaorine (Kintyre).

2.2 Descriptions of United Kingdom vegetated shingle

In the UK vegetated shingle includes two habitat types on Annex I of the Habitats Directive, namely H1210 *Annual vegetation of drift lines* and H1220 *Perennial vegetation of stony banks.* It also includes the following NVC types as described in Rodwell (2000), although Rodwell admits that 'coverage of shingle features around the coast (is) less (than) adequate and ….we did not incorporate developing surveys of Dungeness by Dr Brian Ferry and of very many shingle beaches around the coasts of England and Wales by Pippa Sneddon working with Dr Roland Randall. Probably at least one further community could be added to our account from these surveys.'

NVC	Community name	Distribution	Habitats Directive Annex I
SD1	*Rumex crispus–Glaucium flavum* shingle community	E, NI (Mournes Coast)	1220 Perennial vegetation of stony banks
SD2	*Cakile maritima–Honkenya peploides* strandline community	E, NI (Mournes Coast and Strangford Lough)	1210 Annual vegetation of drift lines
SD3	*Matricaria maritima–Galium aparine* strandline community	E, NI (common)	1210 Annual vegetation of drift lines
MC6	*Atriplex prostrata – Beta vulgaris* ssp. *maritima* sea-bird cliff community		1210 Annual vegetation of drift lines

Rodwell (2000) recognises two assemblages, dominated by ephemeral, nitrogen-loving herbs which make a brief fragmentary appearance during the growing season on shingle along the driftline where organic debris has accumulated. On warmer, southern coasts the *Honckenya peploides-Cakile maritima* strandline community (SD2) is present. Towards northern Britain the *Matricaria* (*Tripleurospermum*) *maritima-Galium aparine* strandline community (SD3) replaces this. These vegetation types are regarded as pioneer communities that are overwhelmed by storm conditions and re-establish periodically as conditions become suitable.

In the UK, the Annex I type *Annual vegetation of drift lines* is not always easy to classify using the NVC. It consists, as outlined above, of driftline vegetation on stony substrates and other coarse clastic sediments and can include the SD2 and SD3 NVC types. Forms of MC6 *Atriplex prostrata – Beta vulgaris* ssp. *maritima* sea-bird cliff community and other vegetation types not described in the NVC (e.g. monospecific stands of *Atriplex* spp.) may also occur. Drift-lines on sandy shores are usually assessed as sand dune communities (see 2110 *Embryonic shifting dunes*), rather than this Annex I type. However, where drift line vegetation develops on other coarse clastic sediments, such as shell-banks (cheniers), it can be considered as part of the *Annual vegetation of drift lines.*

If the beach is stable for more than 3 years, short lived perennials can establish (e.g. *Glaucium flavum,* or *Beta maritima*). Other communities on stable shingle include grasslands where *Arrhenatherum elatius, Festuca rubra* or *Agrostis stolonifera* are dominant with lichens or mosses. These communities are superseded by wet or dry heaths and scrub communities. The NVC only describes part of the pioneer phase of perennial shingle vegetation, namely SD1 *Rumex crispus – Glaucium flavum* shingle community, which is an important component of the *Perennial vegetation of stony banks* Annex I habitat type at some sites, but a wide range of other vegetation types are also included.

Sneddon & Randall (1993) provide a comprehensive classification system for shingle vegetation types, some of which have equivalents in the NVC (see Table 1 below). Further details of shingle vegetation development and floristics can be found in section 11.

Table 1. Major divisions of the shingle vegetation classification.

Divisions are listed in order broadly from the most landward to the most seaward vegetation types (from Sneddon and Randall, 1993)

1. Scrub communities	la. *Prunus spinosa* communities lb. *Rubus fruticosus* communities lc. *Ulex europaeus* communities	
2. Heath communities	2a. Wet heaths 2b. Dry heaths	2b.i. *Pteridium aquilinum* 2b.ii. *Calluna vulgaris* communities 2b.iii Moss-rich communities
3. Grassland communities	3a. Saltmarsh-influenced grasslands 3b. *Agrostis stolonifera* grasslands 3c. *Arrhenatherum elatius* grasslands 3d. *Festuca rubra* grasslands 3e. Mixed grasslands 3f. Sandy grasslands	
4. Mature grassland communities	4a. Mature grasslands	4a.i. Mature grasslands - *Festuca rubra* 4a.ii. Mature grasslands - *Dicranum scoparium* 4a.iii. Mature grasslands - *Arrhenatherum elatius*
	4b. Less mature grasslands	4b.i. Less mature grasslands pure shingle 4b.ii. Less mature grassland saltmarsh influence
5. Secondary pioneer communities		
6. Pioneer communities	6a. *Honkenya peploides* dominated communities 6b. *Senecio viscosus* dominated communities 6c. *Beta vulgaris maritima* dominated communities 6d. *Raphanus maritimus* dominated communities 6e. Herb-dominated pioneer communities 6f. *Silene maritima* dominated pioneer communities	

2.3 Regional variations in shingle distribution

The *Rumex crispus-Glaucium flavum* community (SD1) is essentially a southern British community, found only as far north as the Firth of Forth. Shingle species that are primarily south-eastern include *Lathyrus japonicus, Suaeda vera, Lactuca saligna, Beta vulgaris maritima, Crambe maritima, Glaucium flavum* and *Rumex rupestris*.

The SD3 *Matricaria maritima-Galium aparine* strandline community is confined to Scotland and sheltered shores of the west. *Mertensia maritima* and *Cochlearia officinalis* ssp. *scotica* are northern species, occurring in Scotland, Northern Ireland and (in the case of *Mertensia maritima*) North Wales (Preston *et al.*, 2002).

3 Dynamics

Waves determine the position of the sediment on the beach. Shingle features are rarely stable in the long term. Deposits may be reworked in front of the shore or moved in parallel to it by longshore drift, before being thrown up onto the shore by storm waves. Many structures exhibit continuous morphological change causing landward and longshore reworking of a finite sediment volume. Ridges lying parallel to the shoreline tend to be rolled over towards the land by storm events. This natural landward movement of shingle banks is likely to be accelerated by sea level rise and increased storminess caused by climate change. Such movement has a knock-on effect on low-lying habitats behind the shingle. A fundamental aim of shingle conservation is to facilitate natural mobility.

The health and ongoing development of this habitat depends on a continuing supply of shingle. This may occur sporadically as a response to storm events rather than continuously. Sediment supply is frequently lacking, owing to interruption of coastal processes by coast defence structures, offshore aggregate extraction or artificial redistribution of material within the site (beach recharge). Attempts to rectify the situation by mechanical reprofiling are likely to fail in the long term as these do not address the lack of new material.

4 Attributes and targets

A series of broad habitat attributes have been defined that should normally be part of the conservation objectives or the management plan for all sites where vegetated shingle is an interest feature (Table 2).

There should normally be at least one target specified for each of the attributes. The targets set out here are for guidance only. They should be interpreted in terms of local knowledge of the site, its history and its surroundings. When a target is not applicable to a particular site it should be ignored, but a record of why the decision was taken should be made.

For vegetated shingle the mandatory (*) attributes are

- *habitat extent*
- *physical structure: functionality and sediment supply*
- *vegetation structure: zonation of vegetation*
- *vegetation composition: characteristic species* (for each vegetation zone)
- *negative indicators* (negative indicator species and signs of disturbance)

The presence of notable species (vascular plants or invertebrate fauna) which are not qualifying features in their own right, or other site specific features, is considered to be a discretionary attribute (indicators of local distinctiveness). It will not be appropriate to use these ‘quality indicators’ on every vegetated shingle site, but **where they are part of the reason for notification of the feature they should form an integral (mandatory)** part of the condition assessment.

Guidance is given in the following sections as to what needs to be considered for the above attributes to supplement Table 2 and, where appropriate, some examples are provided of the sorts of targets that should be set.

5 Recommended visiting period and frequency of visits.

The suggested visiting period is April to August, although annuals (e.g. *Arenaria serpyllifolia*) will flower earlier and perennials (e.g. *Crambe maritima*) later, and where driftline annuals are more abundant this will need to be taken into account.

6 Method of assessment

6.1 Data collation

The assessment should be applied to the reporting unit, which may be an SSSI site unit or SAC, although for practical purposes it may be sensible to divide a large or complex site into sub-units.

Prior to going out in the field, existing information on the site should be collated. Aerial photographs are particularly useful. Some NVC information should be available for most sites. Sneddon and Randall carried out a comprehensive survey in 1993 but other information may exist for individual sites. The use of the oblique aerial photographs in the Defra Futurecoast CD-ROM also provide an important record to allow familiarization with difficult to access sites and to help place the feature in the context of the coastal environment.

The guidance should be read prior to the field visit and the assessment forms need to be tailored to suit the particular site. If contractors are used, consultation with local conservation agency staff is essential for selecting routes and stopping places.

6.2 Assessing habitat extent

Habitat extent should be assessed using any previous information available, preferably aerial photographs. If none is available this first reporting round must form the baseline. The source of the baseline must be clearly identified - aerial photography should include source, date (at least month and year) and scale. Field trials have shown that failure to provide some of this information may mean change will not be able to be assessed.

7 Field survey

7.1 Structured walk

We recommend that the vegetation composition, negative indicators etc. of the two principal vegetated shingle 'zones' (annual vegetation of driftlines and perennial vegetation of stony banks) be assessed using a **structured walk** (e.g. a W shaped walk) with at least 10 stops within each assessment unit (block, management unit etc.) to avoid excessively variable results. The number of stops should be enough to allow the assessor to have an overview of the site and judge the condition of the feature. To avoid subjectivity in selecting stops and to ensure that as wide an area as possible is covered, general routes with stops should be pre-selected by consulting maps or aerial photographs before the field visit. This also allows the number of stops per unit area to be determined more consistently. The **exact** stopping locations will be recorded in the field using GPS if possible. If contractors are using the guidance, consultation with local staff on route selection and stopping points is **mandatory**.

At each stop, the appropriate attributes (e.g. percentage cover and/or presence of relevant species) should be assessed within approximate 4 m^2 sampling units. There is no need to measure cover values precisely – simple visual estimates will suffice. It should not take very long (no more than 5 minutes) to record all the relevant attributes at each stop.

The recommended methods of selecting the number and location of the stops are not intended to have statistical value, and the final condition of the interest feature is not simply the average of the condition of each stop. On the contrary, each stop should successively contribute to the assessor's overview of the state of the site. The following is a quantitative definition of frequency, intended to assist with the assessment of several of the shingle attributes. This is a version of the well-known DAFOR scale, which has been adapted to the particular characteristics of vegetated shingle:

- **Dominant:** the species appears at most (>60%) stops and it covers more than 50% of each sampling unit.

- **Abundant:** species occurs regularly throughout a stand, at most (>60%) stops and its cover is less than 50% of each sampling unit.
- **Frequent:** species recorded from 41-60% of stops.
- **Occasional:** species recorded from 21-40% of stops.
- **Rare:** species recorded from up to 1-20% of stops.

7.2 Transects – for assessing zonation

Having completed the rapid assessments for the quality of the main vegetated shingle 'zones' it should then be relatively straightforward to do the one or more **transects** required to assess the width of the shingle zones. If there is no prior data on the width of these habitats for the site, this assessment can form a crude baseline.

The routes followed for the structured walk and the start and finish points of the transects should be marked on a map. Ideally these should be traced over aerial photos of the site using GIS, to enable comparisons to be made on future visits. Permanent markers could be used to aid orientation in this respect. Comparisons could be made using set bearings from a given permanent marker – the owner/occupier could be asked not to destroy or remove particular makers (pill boxes etc) that could be used, although loss due to erosion will have to be accepted. Some landmarks may already be used as permanent markers for surveys by local authorities, the Environment Agency or universities.

Photographs are essential to the condition assessment and should be taken as an accompanying record wherever possible. These should be archived with the assessment file. In some countries photography is a mandatory part of the condition assessment.

There are several new technologies being trialed to aid the condition assessment process These include CASI (Compact Airborne Spectrographic Imager) and LIDAR (Light Detection and Ranging) which may be available from organisations such as the Environment Agency and can be useful tools for assessing zonation as well as extent.

8 Habitat Extent

Extent of the vegetated shingle is a fundamental attribute to be assessed in determining condition of the vegetated shingle feature. The target is no decrease in extent from the established baseline with the caveat 'subject to natural change'. There is a need to ensure that natural processes govern the system, and that the geomorphological 'health' of the feature is considered. However, the extent of the vegetation may be subject to periodic and seasonal variation, as natural processes re-distribute shingle sediments and change sediment composition.

Extent of the driftline may be particularly difficult to assess, as the community can vary enormously from year to year. The sparse nature of the vegetation and its seasonal appearance makes it difficult to detect on aerial photographs, but remote sensing images may be available. Driftlines on essentially sandy beaches are assessed within the sequence of sand dune communities.

9 Functionality and sediment supply

The aim is to distinguish anthropogenic from natural processes and to identify the anthropogenic processes that may be causing the feature to move away from favourable condition.

Shingle deposits are dynamic and will adjust and respond to climatic changes (such as a rise in sea level) or local changes in wind and wave energy in an attempt to reach 'geomorphological equilibrium', which may include landward transgression. If this response is constrained by anthropogenic constructions such as fixed sea defences or infrastructures, natural habitat migration is prevented ('coastal squeeze'). The ensuing loss of extent would fail the extent attribute, as the feature is prevented reaching a natural geomorphological equilibrium. However, if landward migration is prevented by a feature such as higher ground, we would consider condition to be favourable for the extent attribute, as the shingle deposits are free to respond and reach a natural geomorphological equilibrium. The shingle structure might breach in response to ambient and storm effects, which would constitute 'roll over' - literally over landward habitat types including saltmarsh or sand dune.

The amount of offshore sediment available will also determine response of the system to such changes. There are other activities which may affect sediment supply, such as dredging.

10 Zonation of vegetation

The aim of this assessment is to detect negative trends arising from anthropogenic influences which are causing a long term decline in the habitat. One indicator of this is change in the natural zonation of the habitats. Changes should be interpreted with great care given the dynamic nature of the vegetated shingle feature and in particular the driftline.

Vegetated shingle can usually be broken down into annual vegetation of driftlines and perennial vegetation of stony banks; however the NVC only describes part of the pioneer phase of perennial shingle vegetation, namely SD1 *Rumex crispus – Glaucium flavum* shingle community. If your site has other communities, such as grassland, heathland or scrub these will need to be included in the overall assessment of zonation at the site (see Table 1).

11 Vegetation composition: characteristic species

11.1 Development and floristics of shingle vegetation

The development of shingle vegetation is dependent on stability and then water availability, which is primarily controlled by the proportion and size of the fine fraction material of the matrix under 2mm in diameter. The matrix is usually composed of sand, silt or organic matter. The fine fraction is critical at germination and seedling stages, since without it enough moisture may not be present for growth to be initiated or to continue. The presence of finer particles of sand or detritus is essential for the development of the extensive absorptive roots most shingle plants need to thrive.

Scott (1963) recognised three foreshore stability classes, based on the length of time over which the shingle is undisturbed by environmental factors. Where natural disturbance from environmental factors is very frequent, plants will be unable to grow. Where the shingle beach is stable from spring to autumn it can support summer annuals (e.g. *Atriplex* spp. or *Galium aparine*). This can include NVC types SD2 *Honkenya peploides – Cakile maritima* strandline community and SD3 *Matricaria maritima – Galium aparine* strandline community on stony substrates. The presence of the yellow horned-poppy *Glaucium flavum* and the rare sea-kale *Crambe maritima* and sea pea *Lathyrus japonicus*, all species that can tolerate periodic movement, is significant. Where there is a higher proportion of sand the communities may grade into the embryonic dune community, SD4 with *Elymus farctus* (*Elytrigia juncea*).

If the beach is stable for more than 3 years, short-lived perennials can establish (e.g. *Glaucium flavum, Rumex crispus, Beta maritima, Silene vulgaris* ssp. *maritima*). The NVC only describes part of the pioneer phase of perennial shingle vegetation, namely SD1 *Rumex crispus – Glaucium flavum* shingle community. This is the characteristic pioneer vegetation of maritime shingle around the coast of the warmer south of Britain. *Rumex crispus* is a constant component of this community, *Glaucium*

flavum, *Crambe maritima* and other nitrogen-loving species such as *Senecio jacobaea* or *Cirsium vulgare*. *Lathyrus japonicus* are typical on south-eastern formations.

On more stable shingle above this zone, where sea spray is blown over the shingle, plant communities with a high frequency of salt-tolerant species such as thrift *Armeria maritima* and sea campion *Silene vulgaris* ssp. *maritima* occur. These may exist in a matrix with abundant lichens. These formations can progress to grasslands where *Arrhenatherum elatius*, *Festuca rubra* or *Agrostis stolonifera* are dominant and which are rich in herbs such as *Galium verum*, *Silene maritima*, *Vicia sativa*, *Lotus corniculatus* or *Centaurea nigra.* Where there is a greater saline influence, *Plantago maritima* may be common, or *Ammophila arenaria* or *Carex arenaria* where there is greater sandy influence. More mature *Festuca rubra* or *Arrhenatherum elatius* grasslands support large communities of lichens such as *Cladonia* spp. and mosses such as *Dicranum scoparium*, *Ceratodon purpureus* or *Hypnum cupressiforme*.

The greater expanse and stability on the largest and most stable structures results in a more complex development of vegetation over time. The sequence of vegetation may include long-lived perennials such as broom *Cytisus scoparius*, gorse *Ulex europaeus*, and blackthorn *Prunus spinosa*. Heath vegetation with heather *Calluna vulgaris* and/or crowberry *Empetrum nigrum* can also occur, particularly in the north. The sequence of plant communities is influenced by natural cycles of degeneration and regeneration of the shrub vegetation that occurs on some of the oldest ridges. Sneddon and Randall (1993) gave a comprehensive description of stable shingle vegetation (see Table 1).

11.2 Setting targets for positive indicators

Indicative guidance on targets is given in Table 2 for NVC types SD1, SD2 and SD3 and related vegetation. Lists of species should be tailored to individual sites to reflect the variability of shingle, as indicated above. For other vegetation types on shingle, targets should be set with reference to other relevant guidance sections, whilst taking into account the distinctive characteristics of the shingle habitat. For example mature grasslands (Sneddon and Randall, 1994) corresponding largely to NVC U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland are covered by the CSM monitoring guidance for lowland grassland habitats (dry acid grasslands). For dwarf-shrub heaths on shingle the lowland heathland guidance may be used. The guidance for sand dune and saltmarsh may also be useful in some instances. The agency coastal habitat specialists can provide further guidance.

12 Transitions to other terrestrial or wetland habitats

A variety of terrestrial habitat types, such as heathland, grasslands etc. may be part of the vegetated shingle feature. However, transitions to other habitats such as saltmarsh, sand dune or M28 *Iris pseudacorus – Filipendula ulmaria* mire may be present. Targets should be set according to the scientific citation, local distinctiveness or the management plan. This is included in table 2 under the attribute Indicators of local distinctiveness.

13 Indicators of negative trends: plant species

There is a wide potential variation in the vegetation on more stable shingle banks, and invasion by many undesirable species is possible. Possible species occurring could be *Cirsium vulgare*, *Senecio jacobaea* or *Pteridium aquilinum*; even gorse *Ulex europaeus* can become a problem if the proportion becomes too high (e.g. over 10 % at Ballyquintin Point in County Down), although this would need to be assessed on a site-by site basis. *Lupinus arboreus*, *Centranthus ruber* and *Tamarix gallica* are other introduced species on vegetated shingle.

Where there are mature grasslands (Sneddon and Randall, 1994) corresponding largely to NVC U1 *Festuca ovina-Agrostis capillaris-Rumex acetosella* grassland, the CSM monitoring guidance for lowland grassland habitats (dry acid grasslands) gives detailed advice on negative indicator species

(agricultural weeds, rank grasses, scrub) which can be used to guide the setting of targets. Care should be taken with using *Arrhenatherum elatius* as a negative indicator as it forms part of the succession on many shingle sites. Detailed guidance on mire communities e.g. M23 *Juncus effusus – Galium palustre* pasture is also included.

Where there are heath communities on shingle the CSM Monitoring guidance for lowland heathland should guide setting targets for indicators of negative trends both for vegetation composition (i.e. species) or other indicators e.g. overgrazing.

14 Other negative indicators:

In addition to observations on negative indicator species, other negative indicators should be noted such as:

- signs of disturbance
- vehicle damage or trampling at vulnerable locations (tracks, access points).

Targets for this can be found in the generic table.

15 Indicators of local distinctiveness

Quality indicators are features of a shingle site that make it 'special' but which are not covered by the attributes already described. They should be apparent from the SSSI citations or past surveys. This is a discretionary attribute in that it may not be applicable to every site; but where local distinctiveness has contributed to the selection of a site for shingle it should be mandatory. The target(s) should be tailored to each site. Quality indicators may include the following:

- notable species which are not notified features in their own right (e.g. lichens, vascular plants, invertebrates)
- structural attributes
- associations between vegetated shingle and other habitats, e.g. mosaics of vegetation types, transitions to heath or freshwater reedbed.

Coastal vegetated shingle can be of high conservation interest for invertebrates, the best faunas occur in the largest shingle expanses with the most varied structure and vegetation. The most appropriate rule for management of coastal shingle is to leave it alone, and anthropogenic disturbance of shingle should be avoided.

16 Recording forms for use in the field

The agencies will supply separate field recording forms that fit within the objectives detailed in this guidance.

It is advisable to record as much information as resources and time allow, in a consistent manner during different visits, and to keep all the records in a file. This will provide a history of the condition of the site in relation to management. Mark the route of your 'W' walk and your transects on a map and take photographs, especially of the more dynamic parts of the habitat.

The tables provided are for guidance only. Lists of species should be produced on a site-specific basis, and the assessment should be carried out based on the particular conservation objectives tables or management plans.

17 Generic attributes table

Table 2. UK guidance on conservation objectives for monitoring designated sites

Interest feature: Shingle

Includes the following NVC types. The NVC does not cover the whole range of shingle vegetation, only the pioneer phases have a specific NVC classification: SD1, SD2, SD3, MC6. A full list of NVC equivalents is provided in the Coastal Vegetated Shingle Structures of Great Britain (Sneddon and Randall 1993) and this includes pioneer, lichen/moss communities, heathland, grassland, wetland and scrub.

Annex I habitats:
Annual vegetation of drift lines (H1210) which includes the following NVC types: SD2 *Cakile maritima–Honkenya peploides* strandline community and the SD3 *Matricaria maritima-Galium aparine* strandline community. MC6 *Atriplex prostrata – Beta vulgaris* ssp. *maritima* sea-bird cliff community may also be present and other vegetation types not described in the NVC, e.g. monospecific stands of *Atriplex* spp.
Perennial vegetation of stony banks (H1220) which includes the NVC type SD1 *Rumex crispus-Glaucium flavum* shingle community and a wide range of other vegetation types (see section 2).

Transitions: including saltmarsh communities (e.g. SM13, SM28) brackish mire (M28), swamp communities (e.g. S4, S5, S19, S20, S21), grassland (e.g. MG1, MG11) heathland (e.g. H1, H11)

Phase I category: H3 Shingle/gravel above high-tide mark

Reporting category: Supralittoral sediment

All attributes are mandatory unless indicated by * (one failure among mandatory attributes = unfavourable condition)

Attribute	Targets	Method of assessment	Comments
Habitat extent	No decrease in extent from the established baseline subject to natural change **(see text on habitat extent, section 8)**	A baseline map should be prepared to show the distribution of shingle vegetation, using aerial photography or existing NVC survey data Aerial photography/other remote sensing can help with assessing shingle structure and perennial vegetation, but may not pick up driftline vegetation.	Extent may be subject to periodic and seasonal variation, and will need to be assessed over a period of time Natural processes may result in re-distribution of shingle sediments and changes in sediment composition. Such changes are usually acceptable.

Attribute	Targets	Method of assessment	Comments
Physical structure: functionality and sediment supply	No increase in linear constraints to mobility in active foreshore zone e.g. introduced structures, or active shingle management such as beach recycling for coastal defence	Aerial photographs can be used combined with information gathered from the site visit	An important aspect of this habitat is the ability to respond to natural coastal processes, which may result in changes in extent and distribution of the substrate that can subsequently be colonised by pioneer species. Ensure that natural processes govern system
Vegetation structure: zonation of vegetation	Maintain the range of vegetation zones and transitions typical of the site	Transects extending from beach to stable vegetated shingle can be used to estimate the width of the driftline and perennial vegetation zones at points described by GPS and marked on a map.	Individual sites will have different patterns of vegetation types depending on site size, history, substrate and patterns of human use. Perennial vegetation of the shingle feature may include grassland, heathland and scrub depending on the exact nature of the site.
Vegetation composition: positive indicators	Maintain frequency of characteristic species of the vegetated shingle zones (see Box 1 below) as follows **annual vegetation of drift lines (strandline)**: At least one listed species frequent and another occasional **perennial vegetation of stony banks (SD1):** At least two listed species abundant and two frequent Lists to be tailored to each site. For other vegetation types appropriate targets should be set with reference to relevant guidance sections e.g. Lowland grassland, lowland heath, sand dune (see section 11)	Visual assessment using structured walk	Because of the variability of shingle habitats it is not feasible to give comprehensive guidance. Species and targets should be set for key vegetation units on a site-specific basis, taking account of the specific conditions and vegetation characteristics. Where appropriate, targets should be based on related habitat guidance. See section 11 for further comments.

Attribute	Targets	Method of assessment	Comments
Vegetation composition: negative indicators	Target should be set to register high or increasing frequency/cover as unfavourable for species not typically associated with communities that define the feature (i.e. undesirable 'weed' species, species uncharacteristic of typical shingle communities or non-native invasive species). For vegetation types such as dry acid grasslands and dwarf-shrub heath on shingle, appropriate targets should be set with reference to relevant guidance sections e.g. Lowland grassland, lowland heath (see section 13)	Aerial photographs, together with visual assessment of cover, using structured walk	Negative species will include non-native species (e.g. *Lupinus arboreus*, *Centranthus ruber*, *Tamarix gallica*), invasive species indicative of changes in nutrient status (e.g. *Senecio jacobaea*, *Cirsium vulgare*) and species not characteristic of typical communities (e.g. *Pteridium aquilinum*).
Other negative indicators: signs of disturbance	No loss of vegetated substrate within the habitat as a result of anthropogenic activities	Visual assessment of disturbance such as vehicle damage or trampling at vulnerable locations (tracks, access points) during site visit	Where recycling schemes have been consented these should comply with conditions of the licence. It is possible that despite licence conditions damage to the has site occurred, which needs to be considered at licence renewal
Indicators of local distinctiveness* **(including notable species and transitions to other terrestrial or wetland habitats)** *If part of the reason for the notification of the site these are a mandatory attribute	Targets to be set to maintain distinctive elements at current extent/levels and/or in current locations, e.g. to maintain existing populations of notable species or transitions between habitats. Targets for the transition areas should be set according to the scientific citation, local distinctiveness or the management plan.	The presence of indicators of local distinctiveness to be confirmed during visit at appropriate season (list species, add DAFOR score, mark locations on map(s) in file. List to be tailored to each site	This attribute is intended to cover any site-specific aspects of this habitat feature (forming part of the reason for notification) which are not adequately covered by the previous attributes , or by separate guidance e.g. for notified species features. A variety of terrestrial habitat types, such as heathland, grasslands etc. may be part of the vegetated shingle feature. However, transitions to other habitats such as saltmarsh, sand dune, M28 *Iris pseudacorus* mire or other wetland types may be present (see Table 1).

Box 1. Typical spp. for vegetated shingle zones (see also Sneddon & Randall 1993)

Annual vegetation of drift lines	Perennial vegetation of stony banks
Honckenya peploides, Cakile maritima, Atriplex prostrata, A. glabriuscula, A. laciniata, Salsola kali, Galium aparine, Matricaria maritima, Polygonum oxyspermum.	*Rumex crispus, Crambe maritima, Glaucium flavum, Silene uniflora, Beta vulgaris maritima, Lathyrus japonicus, Picris echioides*

18 Bibliography

English Nature. 1999. *Overview of coastal sand dunes, saltmarsh and vegetated shingle by Natural Area* . English Nature Research Report 317. Peterborough.

English Nature. 1999. National specialist guidance for conservation objectives. Volume 1 Annex I habitats and Earth Heritage features. Internal report (with updates in August 2000)

European Commission DGXI. 1996. *Interpretation manual of European Union Habitats: version EUR 15.* Brussels, European Commission

Ferry, B., Lodge, B., & Waters, S. 1990. *Dungeness: A vegetation survey of a shingle beach.* Research & survey in nature conservation, no. 26. Nature Conservancy Council, Peterborough.

Jackson, D.L., & McLeod, C.R. 2000 *Handbook on the UK status of EC Habitats Directive interest features: provisional data on the UK distribution and extent of Annex I habitats and the UK distribution and population size of Annex II species*. Joint Nature Conservation Committee Report No.312. Peterborough.

JNCC 2000. A comprehensive list of possible and candidate Special Areas of Conservation in England, including proposals for new sites and amendments to existing sites. Formal advice to Government 25 July 2000. JNCC/English Nature, Peterborough

McLeod, CR, Yeo, M, Brown, AE, Burn, AJ, Hopkins, JJ, & Way, SF (eds.) (2004) *The Habitats Directive: selection of Special Areas of Conservation in the UK*. 2nd edn. Joint Nature Conservation Committee, Peterborough. www.jncc.gov.uk/SACselection

Nature Conservancy Council 1989. *Guidelines for selection of biological SSSIs* Nature Conservancy Council. Peterborough.

Parkinson, N. & King, A. (1999) Monitoring guidelines and conservation objectives for Earth heritage SSSI. English Nature internal report. English Nature, Peterborough.

Preston, C.D., Pearman, D.A. & Dines, T.D. (eds.). 2002. *New atlas of the British and Irish flora.* Oxford University Press.

Robertson, H., Bingham, J. & Slater, I. 2000. *Monitoring the condition of lowland grassland SSSI. I English Nature's rapid assessment method*. English Nature Research Report 315. Peterborough.

Rodwell, J.S., ,Dring, J.C., Averis, A.B.G., Proctor, M.C.F., Malloch, A.J.C., Schaminee, J.H.J, & Dargie, T.C.D. 2000. *Review of coverage of the National Vegetation Classification*. Joint Nature Conservation Committee Report No. 302. Peterborough.

Rodwell , J.S. 2000. *British plant communities. Volume 5: maritime communities and vegetation of open habitats. Cambridge,* Cambridge University Press.

Scott, G.A.M. (1963) The ecology of shingle beach plants. *Journal of Ecology,* **51**, 733-742.

Sneddon, P., & Randall, R.E. 1993. *Coastal vegetated shingle structures of Great Britain: Main report.* Joint Nature Conservation Committee, Peterborough.

Sneddon, P., & Randall, R.E. 1993. *Coastal vegetated shingle structures of Great Britain: Appendix 1 - Wales; Appendix 2 -Scotland; Appendix 3 - England.* Joint Nature Conservation Committee, Peterborough.

UK Biodiversity Group 1999. *Tranche 2 Action plans Volume V maritime species and habitats.* UJKBG/English Nature, Peterborough