Rotherham Biodiversity Action Plan 2012
Inland Rock and Brownfield Habitat Action Plan

Contents

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List of habitats included

National Priority Habitats
- Inland rock outcrop and scree habitats
- Open mosaic habitats on previously developed land

Local Priority Habitats
- Mixed habitats and structural mosaics

Habitat Descriptions

This habitat action plan is concerned with the vegetative habitats that occur on or result from inland rock and brownfield conditions and the faunal communities they support, particularly invertebrates. Bare ground and rock are important elements of semi-natural habitats as they provide features that certain species find essential or important at some stage of their lifecycle. Bare ground also enables us to consider natural processes and vegetation succession that are difficult to find elsewhere. This action plan is not concerned with the comparative significance of geological conditions or morphological features in their own right; these are considered in the work of the Rotherham Geodiversity Partnership. Coastal cliff and ledge habitats are excluded from this plan as they form part of the maritime cliffs and slopes priority habitat and are not found in Rotherham.

Inland Rock and Scree Habitats

Natural rock exposures support a wide range of communities. Screes are typically dominated by *Cryptogramma crispa* and other ferns, lichens and bryophytes. On cliff ledges, tall herbs such as *Sedum rosea* and *Angelica sylvestris* are generally abundant. Chasmophytic vegetation (in rock crevices) is usually dominated by ferns such as *Asplenium viride* and small herbs such as *Thymus polytrichus* and *Saxifraga* spp. Bryophytes and lichens also occur in crevices but are able to flourish on the open rock surfaces where there is a lack of competition from vascular plants. Component habitats of the UKBAP Priority Habitat – Inland rock outcrop & scree habitats include:

Calcareous rocky slope

This type of vegetation is found where plants grow out of crevices and cracks in calcareous rocks, often in somewhat shaded or sheltered situations such as gullies or overhangs, or among the crevices of boulder scree. Ferns and mosses are the most prominent plant constituents. Depending on the situation, the vegetation may range from being quite sparse to quite dense, but it is usually fragmented and limited in extent. It can occur over a wide range of altitudes.

Calcareous scree

The vegetation is normally sparse and fragmented, but may thicken up in places, and is dominated by herbs, ferns, mosses and lichens. Calcareous screes and boulder fields may occur over a wide range of altitudes. It is developed on broken rocks and boulders of various sizes rather than fissures in solid rock. The Natura type 'Calcareous and calcschist screes of the montane to alpine levels' is usually represented by partially vegetated scree or rubble from calcareous rocks. Ferns and grasses are the most prominent elements of the vegetation accompanied by lesser amounts of herbs and mosses. It normally occurs where there is some protection from grazing but it is also vulnerable to invasion by trees and shrubs. Limestone fern (*Gymnocarpium robertianum*) does not tolerate dense shade and is likely to disappear if a closed woodland or scrub canopy develops.

Siliceous rocky slope

This is found where plants grow from crevices and cracks in siliceous rocks, often in somewhat shaded or sheltered situations such as gullies or overhangs. Ferns and mosses are the most prominent plant constituents. Depending on the situation, the vegetation may vary in density, but it is usually fragmented and limited in extent. It can occur over a wide range of altitudes.

Many rock habitats, especially cliff faces, rock ledges, gorges and boulder fields are inaccessible to grazing animals and are unmanaged. Others are more accessible, such as fine screes and gently sloping rock outcrops, where accessible grazing may keep the vegetation in check. The inaccessibility of rock habitats

to grazing animals, especially of rock ledges, provides a refuge for many vascular plants that are sensitive to grazing, including numerous local and rare species.

The botanically rich rock habitats support a number of notable invertebrate species. Key groups include beetles such as *Leistus montanus* and *Nebria nivalis*, Diptera such as species of *Tipula* spp, *Thricops* spp and *Helina vicina*, and spiders such as *Pardosa trailli*. Several key species of birds use inland cliffs for nesting, notably the raptors peregrine and golden eagle, and raven.

The habitat encompasses the following NVC types:
U16 *Luzula sylvatica – Vaccinium myrtillus* tall-herb community
U17 *Luzula sylvatica – Geum rivale* tall-herb community
U18 *Cryptogramma crispa – Athyrium distentifolium* snow-bed community
U21 *Cryptogramma crispa – Deschampsia flexuosa* community
OV38 *Gymnocarpium robertianum – Arrhenatherum elatius* community
OV39 *Asplenium trichomanes – Asplenium ruta-muraria* community
OV40 *Asplenium viride – Cystopteris fragilis* community

In Rotherham rock and scree habitats are represented in both the Coal Measures and Magnesian Limestone character areas. They include natural rock outcrops as well as disused quarries - with some of the disused quarries associated with existing natural outcrops, or, in some cases, areas that would have been natural outcrops before the quarries were developed. Sandstone outcrops are fairly widespread on the Coal Measures, though natural outcrops are rare, and biodiversity interest is likely to slowly increase as a consequence of improved air quality. As with all the acid prone habitats, the use of calcareous aggregates in the vicinity and upslope from these sites is likely to damage these areas. Natural rock outcrops and disused quarries are widespread on the Magnesian Limestone, with great variability in the ecological diversity associated with these habitats.

Open Mosaic Habitats on Previously Developed Land[1]
These are generally primary successions, and as such are unusual in the British landscape, especially the lowlands. The vegetation can have similarities to early/pioneer communities (particularly grasslands) on more 'natural' substrates but, due to the edaphic conditions (factors inherent in the soil rather than climatic factors), the habitat can often persist (remaining relatively stable) for decades without active management (intervention). Stands of vegetation commonly comprise small patches and may vary over relatively small areas, reflecting small-scale variation in substrate and topography.

Plant assemblages are unusual, selected by propagule supply as well as site conditions (Ash *et al*. (1991) for several waste types, Shaw (1994) on Pulverized Fuel Ash (PFA)). The habitat supports a range of notable vascular plant, moss and lichen species. These often include species declining in the wider countryside such as *Ophrys apifera*, *Gymnadenia conopsea* (alkaline wastes), *Epipactis youngiana* (acid waste), *Osmunda regalis* (acid sandstone quarries), *Peltigera rufescens* (lime waste, PFA), *Cladonia pocillum* (calcareous wastes), *Diploschistes muscorum* (PFA) and a UK BAP priority liverwort, *Petalophyllum ralfsii* (PFA). Exotic plant species, which are well adapted to the prevailing environmental conditions, are a characteristic component of associated plant assemblages.

Invertebrate faunas can be species-rich and include many uncommon species (Eyre *et al*., 2002, 2004). Between 12% and 15% of all nationally-rare and nationally-scarce insects are recorded from brownfield sites, which will include many post-industrial examples (Gibson, 1998; Jones, 2002). Exotic plants provide for an extended flowering season and, with the floristic and structural diversity of the habitat mosaic, contribute to the value of the habitat for invertebrates (see Bodsworth *et al*., 2005).

Some areas are important for birds that are primarily associated with previously developed or brownfield land such as Little ringed plover (in 1984 97% of Little ringed plover nests in England were in 'man-made' habitats), as well as more widespread, but UK BAP priority species, including skylark and grey partridge. The habitat provides secure breeding and feeding areas commonly absent from land under agricultural management.

Heterogeneity within the habitat mosaic reflects chemical and physical modification by former development or previous industrial processes, including the exposure of underlying substrates and the tipping of wastes

[1] Description text taken from UK Biodiversity Action Plan; Priority Habitat Descriptions. BRIG (ed. Ant Maddock) 2008

and spoils. Features such as ditches, other exposures, spoil mounds and even the relicts of built structures provide topographical heterogeneity at the macro- and micro-scale. Sealed surfaces and compaction add further variation and contribute to the modified hydrology of such habitats resulting in areas of impeded and accelerated drainage. Stochastic, or random, factors also have a significant influence in shaping the habitat.

Edaphic conditions for this habitat are severely limiting on plant growth. Examples are substrates with extreme pH, whether alkaline (e.g. chemical wastes) or acid (e.g. colliery spoils); deficiency of nitrogen (PFA), or available phosphate (highly calcareous Leblanc waste, blast furnace slag and calcareous quarry spoil); or water-deficient (dry gravel and sand pits). Other typical situations where such conditions arise include disused quarries, former railway sidings, extraction pits and landfill sites.

The habitat is concentrated in urban, urban fringe and large-scale former industrial landscapes, especially in the lowlands, though more isolated examples can be found on previously developed land in more remote rural areas.

The main source of evidence for this definition (above) and identification criteria (below) came from a Defra research project, Riding et al. (2009). Their proposed definition was very slightly amended by the inter-agency working group, in consultation with Defra and some members of their project steering group.

Nationally open mosaic habitat sites may qualify as BAP priority habitat because they fulfil the criteria given below. The detailed explanatory notes are provided in appendix three. Further work will be needed to identify local sites that meet the criteria.

Each of these criteria must be met:

	Criterion
1.	The area of open mosaic habitat is at least 0.25ha in size.
2.	Known history of disturbance at the site or evidence that soil has been removed or severely modified by previous use(s) of the site. Extraneous materials/substrates such as industrial spoil may have been added.
3.	The site contains some vegetation. This will comprise early successional communities consisting mainly of stress-tolerant species (e.g. indicative of low nutrient status or drought). Early successional communities are composed of (a) annuals, or (b) mosses/liverworts, or (c) lichens, or (d) ruderals, or (e) inundation species, or (f) open grassland, or (g) flower-rich grassland, or (h) heathland.
4.	The site contains un-vegetated, loose bare substrate and pools may be present.
5.	The site shows spatial variation, forming a mosaic of one or more of the early successional communities (a)–(h) above (criterion 3) plus bare substrate, within 0.25ha.

Mixed Habitats and Structural Mosaics

Many habitats occur in mosaics and contain structural variation in the vegetation. Sites may comprise habitats that are individually or collectively of conservation value, but do not necessarily satisfy specific habitat or designation guidelines. Sites may also support highly varied structure between different habitats or within the same habitat, and this can provide a range of niches that are valuable for invertebrate groups. These sites can make an important contribution to the local biodiversity value of an area.

A site supporting varied structural features is likely to support a more diverse invertebrate fauna than a site with homogeneous vegetation. Structural complexity is generally a function of vegetation architecture, although it may also reflect substrate diversity. Complex vegetation architecture may be as a result of different species growing together, for example where small sedges, species of spike rush, species of rush and mosses form a close mosaic in some types of fen and water margin vegetation. In most standing water habitats the vast majority of macro-invertebrate biomass is associated with richly vegetated shallow water margins.

Mixed habitat and structural mosaics may occur in a variety of semi-natural and artificial situations including post-industrial sites on for example the following land types:

a) Railway cinder beds/tracks
b) Quarries
c) Sewage works
d) Derelict land
e) Spoil tips and landfill sites

Features indicating high structural diversity

- Dead wood (wet and shady situations)
- Dead wood (dry and open situations)
- Old coppice stools
- Woodland rides
- Pollards
- Sap runs on trees
- River shingle
- Loose hard substrates (e.g. rubble, brick, stone)
- Springs, seepages or pools
- Temporary pools
- Ditches
- Scattered scrub
- Varied sward heights from short open turf
- Seasonally damp/wet areas
- Earthworks
- South facing slopes (sun-warmed rock provides good habitat for certain specific invertebrates, such as miner bees, and also for reptiles)
- Steep slopes on banks
- Hummocky ground in old disused quarries
- Water margins (marginal mud, silt or sand)
- Coarse tussocky grassland

In many cases the animals and plants that appear on post-industrial sites are characteristic of early-successional vegetation communities but over time the vegetation can be expected to succeed to more permanent communities such as grassland, underscrub and/or scrub and woodland. However, in some cases these successional processes may be very slow due to a combination of the extreme physical conditions imposed by the substrates and/or the activities of grazing animals such as sheep, deer and rabbits. Post-industrial sites often become quite floristically and faunally diverse within a relatively short time. Plant communities commonly include a range of typical grassland species together with pioneer and ruderal plant species. Orchid species can sometimes become a significant feature.

The combination of different habitat types in close proximity to each other and the gradation from one habitat to another often provides a much higher diversity of niches for a wealth of plants and animals than other sites that may be dominated by one particular habitat. These sites are particularly valuable for species that utilise more than one habitat type throughout the day and night for feeding, roosting and protection. The juxtaposition of some of these habitats can also be important for the survival of particular animal species that require two or more habitats at different times during their life cycle such as amphibians and a range of invertebrates.

Current Status

Inland rock outcrop and scree habitats are widespread in upland areas of the UK, with more limited occurrence in the lowlands. Acidic rock and scree are especially widespread, whereas calcareous communities are restricted by the underlying geology, and good stands of tall-herb vegetation also tend to be restricted by heavy grazing.

The national habitat action plan provides the following estimates of extent (ha) of inland rock outcrop and scree habitats in the UK*:

Country	Calcareous slopes	Siliceous slopes	Calcareous scree	Siliceous scree	Tall-herb
Scotland	150-250	35,000-40,000	100-200	50,000-70,000	150-250
Wales	<100	<1,000	<100	3,000	45-50
England	100-500	1,000-1,500	300-500	3,000-3,500	30-40
N Ireland	present	present	present	present	15
UK	300-900	37,000-43,000	500-800	50,000-80,000	240-350

*All figures are estimates based on expert opinion and vegetation surveys undertaken by the different agencies

In 2008 Natural England reported that by area, 73% of SSSI inland rock is in favourable or recovering condition. Of this, 28% (2,004 ha) is in favourable condition and 45% (3,265 ha) is recovering.

In 2006, there were an estimated 62,700 ha of previously developed land in the UK of which an estimated 34,900 ha (55%) were vacant or derelict.

Locally available mapping does not enable any useful estimate of the extent of these habitats in Rotherham. Expert knowledge should inform ongoing botanical survey and monitoring work to be used to map and measure priority habitat presence, particularly on key sites.

Key Factors and Influences

The following are considered to be the key issues affecting Rotherham's brownfield resource; they are not in any order of priority:

- Importing inappropriate materials, e.g. limestone in Coal Measures area
- Overly engineered restoration and landscaping schemes
- Quarrying and extraction activities (where good practice protection and mitigation measures are not incorporated)
- 'Landscaping' of quarried land and the use of gravel pits and quarries for landfill, which has destroyed some of the available habitat.
- Damage to fragile vegetation and soils leading to erosion, as well as disturbance to animals, due to recreational use including mountaineering, mountain bikes, walkers and rock climbers.
- Some of these vegetation types, particularly those with arctic-alpine species, are represented at the edge of their range in the UK and so could be indicators of or sensitive to the early effects of climate change.
- The habitats usually occur in association with other more widespread habitats and so by default are managed in the same way and this usually includes grazing levels which are too high for the communities to sustain.
- Unsuitable grazing management, especially overgrazing, which is the main cause of unfavourable condition on upland sites.
- Lack of suitable management, leading to development of scrub and woodland at the expense of open, species-rich vegetation.
- Invasion of domineering 'alien' botanical species, e.g. Japanese knotweed or Himalayan balsam out-competing native vegetation and significantly increasing maintenance costs.
- Redevelopment, which is targeted on 'brownfield' land, such as quarries, including housing, industrial and commercial use, and landfill.

- ‘Reclamation’ of bare ground and early successional habitats as amenity green space, typically involving re-grading of landforms, burial of existing substrates beneath imported fertile soils, sowing of amenity grass mixtures, and planting of shrubs and trees.

Associated Habitats and Species

The list provided in Appendix One contains England Priority species that are associated with grassland habitats and highlights those that have been recorded in Rotherham. The list has been prepared by the Biodiversity Integration Groups, established to bring together habitat and associated species interests at an England level as part of Natural England led research.

Key Sites of Good Quality

The Rotherham Local Wildlife Site system includes selection criteria for mixed habitats and structural mosaics but it has not yet been possible to undertake the detailed assessment needed to identify sites of quality.

There are two Earth Heritage Sites of Special Scientific Interest (SSSI) in Rotherham, Wood Lee Common in Maltby and Bradgate Brickworks. There are 26 designated Regionally Important Geological Sites (RIGS) in Rotherham and a further 28 candidate sites have been identified but have not yet assessed. These sites are noted for their geological, rather than biodiversity, interest but there is the potential for any developing habitats at these sites to fall within the scope of this plan.

Until further survey and assessment work is undertaken it is not possible to state the extent or quality of inland rock, scree or open mosaic habitats in Rotherham.

Sites of Concern

Of the two Earth Heritage SSSI, both are currently recorded by Natural England as ‘Unfavourable Declining’ due to the heritage features being obscured by vegetation; tipping and scree build up, damage by fire and inappropriate scrub control. However, as noted above the monitoring relates to the geological interest of the sites and not any biodiversity value. As noted above further survey and assessment work is needed to fully understand the presence and state of these habitats and sites in Rotherham.

Specific Action for Key Associated Species

The list provided in Appendix One contains England Priority species that are associated with a range of brownfield habitats (BIG) and highlights which of these have been recorded in Rotherham.

Appendix Two includes a list from the UK Open Mosaic Habitat HAP of vascular plant species considered to be characteristic of the habitat where it occurs in the north of England.

For the vast majority of priority habitats the delivery of habitat management will benefit most of the species associated with the habitat. However, for brownfield sites the individual circumstances of a sites creation and history will often create a unique mosaic of conditions and species assemblage each requiring different management actions to support their conservation. As more knowledge is collected about key sites it will be necessary to identify specific management actions to support the assemblages found.

Scale of Potential Biodiversity Action

This action plan aims to protect the biodiversity interest of inland rock and open mosaic sites; in these situations vegetation can be slow to develop and, as such, can be sensitive to disturbance. Management is needed to reduce pressures on these habitats and to allow them to endure and spread. This would not only improve the habitat extent and condition, but could also increase the population sizes of a number of rare species.

Inland rock outcrops and quarry faces can be slow to develop vegetation and the successional process will be as interesting as the resulting habitats. The nature of these sites, often with steep and inaccessible elements, can make practical management difficult. Action on existing inland rock sites may be restricted to removing fast growing, pernicious vegetation, e.g. bracken and ivy, which may damage or inhibit more sensitive vegetation and may also have a negative impact on the geological interest of such sites. Invasive species such as Japanese knotweed and Himalayan balsam also need monitoring and eradicating where possible.

Brownfield and post industrial sites will develop vegetative and faunal communities dependent on their individual site characteristics and their local environment; the associated species lists reflect typical or common situations that may result in these habitat types. The unique successional processes that occur on each site are as interesting and valuable as the resulting habitat mosaics and species supported. Furthermore, brownfield sites are often temporary in nature and may be allocated for future development. Species found on brownfield sites often reflect unique circumstances and may be early colonisers or have a temporary presence during a particular development stage. Species presence may be supported by the continual creation of new areas of open or disturbed ground; sites that are left undisturbed may eventually succeed to more mature grassland or woodland habitats which can be managed to support the species groups present.

Limited opportunities exist to enhance early open mosaic habitats; low intervention is the key factor to enable habitat development; the key actions to protect the biodiversity interest of these sites is to ensure a continued supply of new sites, ideally in close proximity to known sites, and to prevent destruction of establishing vegetation.

Where sites are temporary in nature future development should incorporate measures to retain some element of open mosaic and bare ground habitat; this could form part of a new landscape scheme or be a distinct feature such as a low intensity green roof.

The development of restoration schemes for quarries, colliery tips, landfill sites and development plans for brownfield land should incorporate the retention of elements of the natural rock outcrops, structural faces and bare ground, open mosaic habitats. Additional features, such as ponds, wetlands, scrapes, stones walls and gabion structures should be added to these schemes as they can significantly expand the ability of a site to support invertebrate, bird, reptile and amphibian species as well as increasing the habitat diversity.

Objectives and Targets

The England Biodiversity Strategy 2011 includes the priority to establish more coherent and resilient ecological networks on land that safeguard ecosystem services for the benefit of wildlife and people. The Yorkshire and Humber Biodiversity Strategy contains the following objective under the theme of improving functional habitat networks and enhancing the wider environment:

- Strategic Objective 11: Promote management of wildlife sites which will maintain and enhance heterogeneity and diversity at all scales (so that a range of features and diversity of vegetation structure is encouraged).

It also contains the following objectives under the Minerals Sector:

- Develop regional guidance for strategic planning of mineral extraction after use to maximise biodiversity restoration potential, focusing effort on areas with high concentrations of minerals extraction.
- Maximise opportunities presented by mineral abstraction to contribute towards strategic, large-scale habitat creation ensuring linkages between minerals extraction and wider initiatives through Local Development Frameworks and local partnerships.
- Secure long-term management of restored sites through available mechanisms such as planning conditions and agreements, Landfill Tax Credit Scheme, Aggregates Levy Sustainability Fund (ALSF) and Environmental Stewardship.
- Encourage best practice for biodiversity in mineral abstraction and after use including the development of supplementary planning documents within Minerals Frameworks, the development of resources such as the Nature After Minerals Programme and use of accreditation schemes such as the e.g. ISO14000 series Environmental Management Systems, Eco-Management Audit Scheme (EMAS) and the Wildlife Trusts Biodiversity Benchmark as well as the production of Biodiversity Action Plans.

Focus on the delivery of the above objectives should maximise opportunities to protect, create and enhance rock, scree and open mosaic habitats.

In order to support the delivery of national and regional objectives and targets the following are the proposed objectives for the Rotherham Brownfield Habitat Action Plan:

<u>Conserve the existing inland rock and open mosaic resource by:</u>

- Review what is known about the extent and quality of these habitats in Rotherham and identify resources to fill any knowledge gaps
- Identifying existing sites for long-term protection and new sites to replace those known to be temporary
- Achieve favourable condition of habitats generating on designated sites (SSSI & RIGS)
- Undertake an appropriate level of open habitat management on sites that are in the control of Rotherham BAP partner organisations
- Assess where and what targeted species conservation is required over and above general habitat management
- Provide support and advice to other landowners to encourage suitable management action at sites not in BAP partner control

<u>Expand the existing inland rock and open mosaic resource by:</u>

- Identifying new areas for open habitat creation via natural succession; these can be permanent or temporary but should result in an overall increase in habitat of priority quality by 2025
- Incorporate these habitats and natural successional processes in all restoration plans developed for quarry, colliery and landfill sites
- Provision of buffer zones around existing good quality sites to reduce pressure and to allow these habitats to colonise and expand naturally
- Agree a process by which new temporary sites made available through development can be allowed to vegetate naturally between development phases
- Create and maintain small areas of bare ground and early successional vegetation on nature reserves and local wildlife sites; ensuring this is included as an objective or action in site specific management plans
- Include the retention of bare ground and early successional vegetation within landscaping and maintenance schemes on development sites

<u>Connect the inland rock and open mosaic resource by:</u>

- Prioritise the creation and expansion of bare ground and brownfield sites where they can link to, or provide stepping stones between, existing sites
- Agree long-term management actions for sites that will ensure that elements of bare ground and open mosaic habitat are always present and are not necessarily allowed to completely succeed to grassland or woodland habitats

Promote the special interest of the inland rock and open mosaic resource by:

- Providing a rolling programme of habitat monitoring within accessible sites
- Producing and sharing management plans that have biodiversity action as a key principle
- Identify mixed habitat and structural mosaic sites that meet Local Wildlife Site selection criteria
- Ensure that inland rock and open mosaic habitats and sites are fully recognised within development plans and spatial decision making.

Rotherham Biodiversity Forum, and other partners, will prepare a prioritised programme of action that will guide delivery across Rotherham over the plan period, i.e. to 2020.

Appendix One - List of England Priority Species that are associated with Brownfield Land (showing recorded presence in Rotherham)

Scientific name	Common name	Classification	Brownfield	RMBC
Geastrum corollinum	Weathered Earthstar	fungus	gardens	
Geastrum elegans	Elegant Earthstar	fungus	gardens; waste grounds	
Lecidea inops	Copper Lecidea	Lichen	old mine workings, spoil heaps	
Porina sudetica	a lichen	lichen	quarry, old mining sites	
Stereocaulon delisei	a lichen	lichen	quarry, old mining sites	
Stereocaulon symphycheilum	a lichen	lichen	quarry, old mining sites	
Bryum knowltonii	Knowlton`s Thread-moss	bryophyte	sand quarries; gravel pits	
Cephaloziella baumgartneri	Chalk Threadwort	bryophyte	disused quarries	
Cephaloziella calyculata	Entire Threadwort	bryophyte	metalicious sites	
Cephaloziella integerrima	Lobed Threadwort	bryophyte	mine waste, quarry	
Cephaloziella nicholsonii	Greater Copperwort	bryophyte	copper enrichment	
Didymodon glaucus	Glaucous Beard-moss	bryophyte	chalk pit	
Ditrichum cornubicum	Cornish Path Moss	bryophyte	on old copper-mine spoil	
Ditrichum plumbicola	Lead-moss	bryophyte	on old lead-mine spoil	
Grimmia crinita	Hedgehog Grimmia	bryophyte	buildings, concrete	
Lophozia capitata	Large-celled Flapwort	bryophyte	quarry sites	
Marsupella profunda	Western Rustwort	bryophyte	on boulders and waste	
Scopelophila cataractae	Tongue-leaf Copper-moss	bryophyte	copper sites on mines	
Southbya nigrella	Blackwort	bryophyte	disused quarries, spoil	
Tortula cernua	Flamingo moss	bryophyte	spoil associated with old lime quarries and kilns	Yes
Tortula vahliana	Chalk Screw-moss	bryophyte	bare chalk	
Chara canescens	Bearded Stonewort	stonewort	clay and gravel pits	
Bombus humilis	Brown-banded Carder-bee	bee	brownfield sites, quarries	
Bombus muscorum	Moss Carder-bee	bee	brownfield sites, quarries	Yes
Bombus ruderarius	Red-shanked Carder-bee	bee	brownfield sites, quarries	Yes
Bombus ruderatus	Large Garden Bumblebee	bee	brownfield sites, quarries	
Bombus sylvarum	Shrill Carder Bee	bee	brownfield sites, quarries	
Eucera longicornis	Long-horned Mining Bee	bee	brownfield sites	
Brachinus sclopeta	Streaked Bombardier Beetle	beetle	brownfield sites	
Carabus monilis	Necklace Ground Beetle	beetle	open uncultivated areas, waste ground	
Cicindela sylvatica	Heath Tiger Beetle	beetle	old quarries	
Lucanus cervus	Stag Beetle	beetle	big trees in urban areas; gardens	
Meloe rugosus	Rugged Oil-beetle	beetle	quarries and aggregate sites	
Ophonus puncticollis	a downy-back ground beetle	beetle	chalk pits	
Ophonus stictus	Oolite Downy-back	beetle	limestone quarries	
Aricia artaxerxes	Northern Brown Argus	butterfly	disused quarries (limestone and chalk)	
Coenonympha pamphilus	Small Heath	butterfly	road verges; disused quarries; waste ground	Yes
Cupido minimus	Small Blue	butterfly	quarries, gravel pits, road embankments, disused railway lines	Yes

Erynnis tages	Dingy Skipper	butterfly	old quarries, gravel pits, spoil heaps, railway cuttings, sidings and embankments, rubbish tips	Yes
Hipparchia semele	Grayling	butterfly	old mine workings, old quarries, other earthworks and derelict industrial land	Yes
Lasiommata megera	Wall	butterfly	disused quarries; railway embankments; derelict land; gardens	Yes
Leptidea sinapis	Wood White	butterfly	disused railways and quarries	Yes
Plebejus argus	Silver-studded Blue	butterfly	old quarries including sand, chalk and limestone, railway embankments	Yes
Pyrgus malvae	Grizzled Skipper	butterfly	quarries, gravel pits, spoil heaps, railway cuttings, sidings and embankments, rubbish tips	Yes
Austropotamobius pallipes	White-clawed Crayfish	crustacean	flooded aggregate sites, sand and gravel pits	Yes
Dorycera graminum	Phoenix Fly	fly	brownfield sites, quarries	
Thyridanthrax fenestratus	Mottled Bee-fly	fly	sand and garvel pits	
Heliophobus reticulata	Bordered Gothic	moth	quarries, railway cuttings, brownfield sites	Yes
Idaea ochrata subsp. cantiata	Bright Wave	moth	coastal brownfield	
Lampronia capitella	Currant-shoot Borer	Moth	gardens; waste grounds	
Nemophora fasciella	Horehound Long-horn Moth	moth	quarries, rough ground, landfill sites, road verges	
Scotopteryx bipunctaria	Chalk Carpet	moth	quarries, chalk and limestone embankments	
Shargacucullia lychnitis	Striped Lychnis	moth	road verges; disturbed waste grounds	
Tyta luctuosa	Four-Spotted Moth	moth	quarries, active or disused railways, road verges, ditches and other disturbed ground	
Nothophantes horridus	a money spider	spider	limestone quarries	
Sitticus distinguendus	a jumping spider	spider	brownfield	
Cerceris quadricincta	a weevil-hunting wasp	wasp	sand and garvel pits	
Cerceris quinquefasciata	a weevil-hunting wasp	wasp	sand and garvel pits	
Odynerus melanocephalus	Black-headed Mason Wasp	wasp	brick pits and extraction sites	
Adonis annua	Pheasants-eye	vascular plant	chalk quarries	Yes
Arabis glabra	Tower Mustard	vascular plant	waste ground	Yes
Campanula rapunculus	Rampion Bellflower	vascular plant	quarries, railway lines; waste land	Yes
Carum carvi	Caraway	vascular plant	waste land, roadsides	
Chenopodium urbicum	Upright Goosefoot	vascular plant	waste ground	Yes
Clinopodium acinos	Basil Thyme	vascular plant	quarries, waste ground, gravel pits, railway lines	Yes
Dactylorhiza viride	Frog Orchid	vascular plant	chalk quarries	
Dianthus armeria	Deptford Pink	vascular plant	waste land, roadsides	
Euphrasia anglica	Glandular Eyebright	vascular plant	disused quarries	
Filago pyramidata	Broad-leaved Cudweed	vascular plant	chalk quarries, spoil	
Fumaria purpurea	Purple Ramping-fumitory	vascular plant	waste ground; gardens	
Galeopsis angustifolia	Red Hemp-nettle	vascular plant	quarries, waste ground	Yes
Herminium monorchis	Musk Orchid	vascular plant	limestone quarries, spoil heaps	
Minuartia hybrida	Fine-leaved Sandwort	vascular plant	quarries and walls	Yes
Ophrys insectifera	Fly Orchid	vascular plant	chalk pits, spoil heaps	Yes
Orchis anthropophora	Man Orchid	vascular plant	old chalk pits, limestone	

			quarries	
Pilularia globulifera	Pillwort	vascular plant	gravel extraction	Yes
Potamogeton compressus	Grass-wrack Pondweed	vascular plant	flooded mineral workings	
Pulsatilla vulgaris	Pasqueflower	vascular plant	old quarries	Yes
Valerianella rimosa	Broad-Fruited Corn Salad	vascular plant	quarries, spoil-tips, disturbed ground	
Bufo bufo	Common Toad	amphibian	brownfield - in and near large ponds; gardens	Yes
Triturus cristatus	Great Crested Newt	amphibian	mineral extraction sites; disused quarries; garden and urban areas; railway lines	Yes
Alauda arvensis arvensis	Sky Lark	bird	brownfield - throughout	Yes
Emberiza schoeniclus	Reed Bunting	bird	flooded gravel, brick pits	Yes
Larus argentatus argenteus	Herring Gull	bird	urban rooftops for nesting; gravel pits and reservoirs for roosting	Yes
Lullula arborea arborea	Wood Lark	bird	disused quarries; gravel pits	Yes
Muscicapa striata striata	Spotted Flycatcher	bird	scrubby areas, woodland, gardens, church yards	Yes
Parus montanus kleinschimdti	Willow Tit	bird	flooded gravel pits	
Passer domesticus domesticus	House Sparrow	bird	scrubby areas with weedy grassland, gardens	Yes
Prunella modularis occidentalis	Dunnock (Hedge Accentor)	bird	gardens; gravel pits with scrub	Yes
Pyrrhula pyrrhula pileata	Bullfinch	bird	scrubby areas and gardens	Yes
Sturnus vulgaris vulgaris	Starling	bird	scrubby areas and gardens	Yes
Turdus philomelos clarkei	Song Thrush	bird	scrubby areas and gardens	Yes
Vanellus vanellus	Lapwing	bird	airfields, gravel pits, sewage works	Yes
Barbastella barbastellus	Barbastelle Bat	Mammal	Buildings; underground sites	
Erinaceus europaeus	Hedgehog	Mammal	suburban areas - gardens, parks, amenity grasslands; waste grounds	Yes
Lutra lutra	Otter	Mammal	wet brownfields; flooded gravel, brick pits	Yes
Micromys minutus	Harvest Mouse	Mammal	road verges; waste ground	Yes
Nyctalus noctula	Noctule	Mammal	buildings	Yes
Pipistrellus pygmaeus	Soprano Pipistrelle	Mammal	buildings; urban areas	Yes
Plecotus auritus	Brown Long-eared bat	Mammal	buildings, caves and mines for roosting and large urban gardens and trees	Yes
Rhinolophus ferrumequinum	Greater Horseshoe Bat	mammal	Buildings; underground sites	
Rhinolophus hipposideros	Lesser Horseshoe Bat	Mammal	Buildings; underground sites	
Anguis fragilis	Slow-worm	reptile	disused quarries; railway embankments; road verges	Yes
Natrix natrix	Grass Snake	reptile	garden; parks; allotments; derelict sites (natural/semi-natural habitat nearby)	Yes
Vipera berus	Adder	reptile	disused quarries; railway embankments	Yes
Zootoca vivipara	Common Lizard	reptile	disused quarries; railway embankments; road verges	Yes

Appendix Two – UKBAP Open Mosaic Habitats on Previously Developed Land

(Criteria Explanatory Notes including characteristic vascular plant species for the north of England)

The criteria are for guidance but cannot cover all potential scenarios and an element of expert judgement is therefore needed. It is assumed that the user will be able to recognise plant communities and the key component species.

1. The minimum size refers to the potential open mosaic habitat (OMH), which might be a part of a larger site containing other habitats such as woodland or developed land.

2. Disturbance refers to that resulting from major historical industrial use or development.
   2.1 Extraneous materials refer to extensive additions of spoil rather than incidental dumping of litter, broken glass, etc.
   2.2 There might be evidence of heavy metal contamination but extensive stands of Calaminarian grasslands are specifically excluded as that is a distinct Priority Habitat.

3. Brief descriptions of the early successional communities:
   (a) Annual communities are those comprised mainly of stress tolerant ruderals, which are short in stature and suited to low nutrient availability. Typical examples would be *Arenaria serpyllifolia*, *Centaurium erythrea*, *Linum catharticum* or *Trifolium arvense*.
   (b) Moss/liverwort communities can contain both acrocarpous (i.e. usually unbranched, tufted) and pleurocarpous (usually branched, carpeted) mosses and are usually relatively open and less luxuriant than in more mature habitats, often with bare ground present in a fine-grained mosaic. They can occur in discrete patches or interspersed in other communities such as open grassland or heathland. Common species are usually present such as the mosses *Brachythecium rutabulum*, *Dicranum scoparium* or *Hypnum cupressiforme* and the liverworts *Lophocolea heterophylla* or *Ptilidium ciliare*.
   (c) Lichen communities are likely to occur in extensive patches or interspersed with other communities such as open grassland or heathland. Species with a range of growth forms might be present, for example foliose (leaf-like), crustose (crust) or fruticose (shrubby and branched).
   (d) Ruderal communities are those composed mainly of taller annuals, biennials or short-lived perennials and typical of slightly more nutrient-rich, or less disturbed conditions than the annual communities. Typical examples would be *Daucus carota*, *Linaria vulgaris*, *Medicago lupulina* or *Reseda luteola*.
   (e) Inundation communities are comprised of species suited to periodic, often seasonal flooding. Vegetation is usually interspersed with bare areas of mud which can have a caked surface during dry periods and can result in annuals establishing. Typical species would be *Alopecurus geniculatus*, *Juncus bufonius*, *Persicaria maculosa* or *Ranunculus flammula*.
   (f) Open grassland is comprised mainly of perennial, stress-tolerant species of short stature with patches of bare ground at very fine-grained scale and often with a significant number of annual species or lichens in the sward. Typical species would be *Festuca ovina*, *Hypochaeris radicata*, *Pilosella officinarum* or *Rumex acetosella*.
   (g) Flower-rich grassland is a more typical, mature community with fewer gaps and characterised by more robust mesotrophic forbs such as *Centaurea nigra*, *Lotus corniculatus*, *Ranunculus acris* or *Trifolium pratense*.
   (h) Heathland communities are composed mainly of dwarf shrubs, often interspersed or in mosaics with graminoids, bryophytes or lichens. On OMH they tend to have a more open structure with less plant litter and other organic matter build up on the substrate than in more typical heathlands. Typical species include *Calluna vulgaris*, *Deschampsia flexuosa*, *Festuca ovina* or *Nardus stricta*.

   3.1 Annex 1 shows species of vascular plant known to be associated with, but not confined to, the habitat in certain areas and/or substrates.
   3.2 Other plant species associated with the particular edaphic conditions might also be present, for example ericaceous species on acidic sites. Species composition will also vary with geographic location and site age.
   3.3 One of the principal reasons for the habitat being a priority is its importance for invertebrates. Many have very precise requirements for habitat 'niches' within their landscape. As well as areas

of bare ground and food plants, these may be for sheltered places at various times of the year, or for rough vegetation or cover at others. At any particular site, features such as scrub may be essential to maintain the invertebrate value of the main habitat. Therefore, scattered scrub (up to 10–15% cover) may be present and adds to the conservation value of the site. Other communities or habitats might also be present (e.g. reed swamp, open water), but early successional communities should comprise the majority of the area.

4. 'Loose bare' substrate is intended to separate substrate potentially colonisable by plants from large expanses of sealed surface (concrete, tarmac, etc) where vegetation could only establish if it is broken up or heavily weathered.
   4.1 Bare substrate can occur at a range of spatial scales, from unvegetated patches easily seen from a distance, to small, open spaces between individual plants within a community. On some substrates, for example coal spoil, the patches of bare ground may be 10cm across or less. A site with a wide variety of patch sizes could also qualify.
   4.2 Bare substrate also implies absence of organic matter accumulation.

5. A mosaic is defined as an area where a range of contiguous plant community types occur in transition with one another, usually with ecotone habitat gradients and repeated occurrences of each community, and often at a small scale.
   5.1 The mosaic could comprise either:
   - a mixture of one of the habitats (a)–(c) or (e)–(h) plus bare ground together forming a mosaic;
   - a mixture of two or more of the habitats (a)–(h) in a mosaic, with adjacent bare ground;
   - a mixture of two or more of the habitats (a)–(h) plus bare ground together forming a mosaic.

   5.2 Continuous blocks of a closed plant community greater than 0.25 ha would be classified as a habitat other than OMH, although those containing very fine-grained mosaics might qualify.

Annex 1: characteristic vascular plant species for the north of England

Species	**Common Name**	**Species**	**Common Name**
*Artemisia vulgaris**	Mugwort	*Melilotus altissimus**	Tall Melilot
*Aster novi-belgii**	Confused Michaelmas-daisy	*Melilotus officinalis**	Ribbed Melilot
Blackstonia perfoliata	Yellow-wort	*Nardus stricta*	Mat-grass
Centaurea nigra	Common Knapweed	*Odontites vernus*	Red Bartsia
Centaurium erythraea	Common Centaury	*Oenothera spp.**	Evening Primrose
Cerastium fontanum	Common Mouse-ear	*Ophrys apifera*	Bee Orchid
*Cichorium intybus**	Chicory	*Picris echioides**	Bristly Oxtongue
*Conium maculatum**	Hemlock	*Picris hieracioides*	Hawkweed Oxtongue
Crepis biennis	Rough Hawk's-beard	*Plantago lanceolata*	Ribwort Plantain
Crepis capillaris	Smooth Hawk's-beard	*Reseda lutea*	Wild Mignonette
Dactylorhiza praetermissa	Southern Marsh-orchid	*Reseda luteola**	Weld
*Daucus carota ssp. sativus**	Carrot	*Saponaria officinalis**	Soapwort
Deschampsia flexuosa	Wavy Hair-grass	*Senecio squalidus**	Oxford Ragwort
Echium vulgare	Viper's-bugloss	*Silene vulgaris*	Bladder Campion
Equisetum arvense	Field Horsetail	*Tragopogon pratensis*	Goat's-beard
Erigeron acer	Blue Fleabane	*Trifolium arvense*	Hare's-foot Clover
Euphrasia spp.	Eyebright	*Trifolium campestre*	Hop Trefoil
Hieracium sabaudum	Autumn Hawkweed	*Trifolium dubium*	Lesser Trefoil
Hypericum perforatum	Perforate St John's-wort	*Trifolium hybridum**	Alsike Clover
Hypochaeris radicata	Cat's-ear	*Trifolium medium*	Zigzag Clover
Juncus inflexus	Hard Rush	*Trifolium pratense*	Red Clover
*Linaria purpurea**	Purple Toadflax	*Trisetum flavescens*	Yellow Oat-grass
*Linaria repens**	Pale Toadflax	*Tussilago farfara*	Colt's-foot
Linaria vulgaris	Common Toadflax	*Vicia cracca*	Tufted Vetch
Linum catharticum	Fairy Flax	*Vicia hirsuta*	Hairy Tare
Matricaria matricarioides	Pineapple Weed		
Medicago lupulina	Black Medick		

*introduced species of lower biodiversity value but still characteristic of OMH sites.

Notes: