

A baseline vegetation and National Vegetation Classification survey of the rewilding area at Hen Hill Estate

Graeme Lyons

October 2020



Fig. 1. The NVC community OV4 appearing again after the last harvest.

0 - Summary

The Ken Hill Estate plan to rewild a large area of 423.3 ha of their Estate from 2019 and 2020. The summer of 2019 was the last crop for much of this area and as such the 2019 survey season was an exciting opportunity to collect baseline data before any changes were made to the site.

The aim of the survey was to create a robust baseline for assessing change over the coming years, using comprehensive vegetation mapping. Additionally, any rare and scarce vascular plants were also mapped, their distribution and abundance can also be used to assess change. The level of detail in the NVC map will also be reduced to a more basic habitat map, that will also be of value to the Estate as it will provide spatial information on habitats that is more digestible at full scale.

Some 48 NVC communities were recorded, rising to over 80 when all sub and intermediate communities were also counted. The Ken Hill rewilding area is a very complex site with a wealth of different vegetation types found. Overall, the site is approximately 45% woodland, 15% scrub, 12% grassland and 37% arable. Heathland accounts for only 0.45% of the site, around a tenth of a hectare.

It is inevitable that large blocks of arable communities will diminish in extent in favour of grassland communities but it is not inevitable that the species that comprise them will disappear, only time will tell if species such as Corn Marigold will continue to thrive in the rewilding landscape and it may well be pigs that provide vital early successional habitat. Careful monitoring is needed and if a decline in rare and scarce species is observed then a rethink will be needed and some mechanical intervention in these instances should not be seen as a failure of rewilding. Conversely, grassland species are likely to do much better, especially if some kind of pulse-grazing is used. The Plain, which is overgrown with Wavy Hair-grass, is likely to move towards something less species poor and Heather could well increase.

An area in the grassy field 'Ragged Arse' that could not be fit to any NVC community was especially important. Dominated by Smooth Cat's-ear, with Annual Knawel and Night-flowering Catchfly also present (all three of which have conservation status), this patch was quite unusual. It may be a lens of habitat that for some reason escaped enrichment in the rest of the field.

Overall, the woodlands are unlikely to change greatly, a reduction in Bramble under the canopy is unlikely due to the extent of the resource and the wealth of other options available to livestock. Some mowing of Bramble around the areas cleared near the Plain in conjunction with grazing for a few years would be of benefit to kick start the process of moving this towards grassland.

The Arable Plant Index for the rewilding area alone in 2019 was classed as Internationally Significant with 105 points scored for the rewilding area in 2019 alone. Red-tipped Cudweed could not be found in 2019 but if these historic records were counted the index rises to 113. Additional records of arable plants on the 'regenerative agriculture' part of the Estate made by Natural England bring the total for the whole Estate to 117 in 2019 (90 is required for International Significance). A detailed arable plant survey of the regenerative agriculture part of the Estate is suggested to understand more about how this is changing in relation to the rewilding area.

Some 16 species with conservation status were recorded and where possible these have been mapped and a brief species account provided.

1 - Introduction

The Ken Hill Estate plan to rewild a large area of 423.3 ha of their Estate from 2019 and 2020. The summer of 2019 was the last crop for much of this area and as such the 2019 survey season was an exciting opportunity to collect baseline data before any changes were made to the site.

The author was commissioned to carry out a wide range of surveys in 2019, including this NVC survey.

The aim of the survey was to create a robust baseline for assessing change over the coming years, using comprehensive vegetation mapping. Additionally, any rare and scarce vascular plants were also mapped, their distribution and abundance can also be used to assess change. The level of detail in the NVC map will also be reduced to a more basic habitat map, that will also be of value to the Estate as it will provide spatial information on habitats that is more digestible at full scale.

The NVC base map can be used for a wide range of spatial analyses beyond what is included here and can be provided to other projects with spatial elements to enhance their value.

2 - Methodologies

2.1 - NVC mapping

Mapping took the form of a general walk over, rather than detailed quadrat analysis between June and October. The site was far too big to collect lots of samples from lots of different habitat types. Grey-scaled, A3 aerial photos were printed out and communities mapped on top of these in the field. An attempt was made to walk all areas of the site. The survey took approximately nine days in the field.

Where no clear fit was found, NVC communities were described using 'KH' for Ken Hill and a number. Some crops could not be assigned to any particular community, such as Lucerne and Phacelia and were simply named as such.

The NVC map was extremely complex, so a second layer was created at the same time being a 'basic habitat' map. This map was even more basic than say a Phase 1 survey (all grassland was mapped simply as grassland). It does give the reader a sense of the proportions of the basic habitats present, such as the relative proportions of grassland, scrub and woodland, which are key factors in rewilding projects and could help frame any 'limits of acceptable change' the Estate might have.

2.2 - Mapping of key species

All plants with conservation status were mapped to 10 m squares, using a handheld GPS where possible. This data was then transferred into the author's Recorder 6 database to eight figure accuracy. This allowed for distribution maps at the 10 x 10 m level to be generated.

The following species were mapped in detail (these maps are attached in the appendix).

- Stinking Chamomile
- Corn Marigold
- Gold-of-pleasure
- Dwarf Spurge
- Rye Brome
- Prickly Poppy
- Hoary Mullein
- Shepherd's Cress
- Hoary Cinquefoil
- Hound's-tongue
- Night-flowering Catchfly
- Annual Knawel

2.3 - Casual recording of other vascular plants

Heather was also mapped when it was found (away from the main area of heathland on the Plain).

2.4 - Arable plants index

Plantlife's Arable Plant Index was used. Each qualifying score has its own index depending on how rare or scarce it is. The sum of these indices is therefore the score for the site.

3 - Results

3.1 - NVC communities

3.1.2 - Grassland communities

MG1 - False Oat-grass *Arrhenatherum elatius* grassland

Almost all of the set aside margins can best be described as some form of MG1 grassland. The more enriched areas become dominated by Nettle (MG1b), the less frequently managed areas become dominated by bramble (MG1/W24) and the less-enriched areas where more management occurs have a wealth of Knapweed (MG1e) and in these cases can even drift towards MG6 in places.

MG1b - Nettle *Urtica dioica* sub-community

This community is often dominant in margins that are adjacent to woodland or underneath or near large hedgerow trees.

MG1e - Knapweed *Centaurea nigra* - sub-community

MG1 but with a wealth of Knapweed and occasionally other flowering plants. Mainly found on the richer arable margins.

MG6 - Perennial Rye-grass *Lolium perenne* - Crested Dog's-tail *Cynosurus cristatus*

This is the basic semi-improved grassland that is most typical of grazed pasture throughout the UK. It has usually experienced some level of input historically and is significantly different to the richer MG5 hay meadow community that will have had minimal input over the years (MG5 was not recorded at Ken Hill).

MG6b - Sweet Vernal Grass *Anthoxanthum odoratum* sub-community

This is the more acidic variant of MG6 drifting towards U1 grassland.

MG6c - Yellow Oat-grass *Tristemon flavescens* sub-community

This is perhaps the closest community to chalk-grassland found on the site. The grassland here was extremely rich with several species recorded here that were not recorded anywhere else, such as Common Broomrape. Although no CG (chalk grassland) communities were recorded on the site, this is a step towards them away from MG communities. It was only found in the unnamed grassy field to the extreme east of the site adjacent to the main road.

MG7 - Perennial Rye-grass grassland

This is typically caused by extreme levels of input and grazing, they typically occur on dairy farms etc. Here it was represented by a tiny slither of habitat towards the extreme south west of the site, its origins not clear.

MG10 - Yorkshire-fog *Holcus lanatus* - Soft Rush *Juncus effusus* rush-pasture

Recorded only in the fields to the north west of the site which at the time of writing were not ground-truthed. This is the typical rush-pasture where damper MG6 becomes dominated by common rushes and is often the fate of poorly-managed wet grassland. Here it seems to exist in small patches in a mosaic.

MG11 - Tall Fescue *Festuca arundinacea* grassland

Recorded in one field only at the extreme west of the site to the west of 'the Sink'. This is typically a species-poor community dominated the coarse grass that often has some weak saline influence.

Acid grassland communities

U1 - Sheep's Fescue *Festuca ovina* - Common Bent *Agrostis capillaris* - Sheep's Sorrel *Rumex acetosella* acid grassland

This is typically the grazed version of U2 but a similar effect can also be had by trampling on tracks etc. It is generally richer, being much shorter with a more varied sward and a greater amount of bare ground. Lower plants tend to do well here too. It is likely to increase in extent. Most of the tracks around the Plain are of this type. It is significantly better for invertebrates than large blocks of U2 as the short sward and bare ground allow heat to penetrate into the sand/soil.

U2 - Wavy Hair-grass *Deschampsia flexuosa* acid grassland

Typically dominates in areas that are unmanaged/ungrazed. Dominated by Wavy Hair-grass, most of the Plain is this community where it has not been grazed for decades, the sward has become very spongy, somewhere between tussocks and thatch. Large grazing herbivores should break this up to give way to more diverse communities. Closer to the house, the sward becomes dominated by Red Fescue but is still likely to be U2. It is therefore expected that some of this community will give way to U1 with the application of grazing.

U20 - Bracken *Pteridium aquilinum*

Typically, single species stands of Bracken are listed as U20, they were classed as 'tall herb' in the basic habitat map.

3.1.2 - Heathland communities

H9 - Heather *Calluna vulgaris* & Wavy Hair-grass *Deschampsia flexuosa*

H9c - Species-poor community

The heathland on the Plain is best described as this community. Recent scrapes on the Plain would probably come out closer to H9d - Heath Bedstraw *Galium saxatile* community but these exist in such small proportions they were not thought worth mapping separately. Creation of more of this community through grazing would however be a sign of success for the project. Continued scraping would also benefit a wide range of plants and invertebrates and should be continued, the benefits of this are great and the author does not believe that waiting for such habitat to be created by livestock is ideal. It may not happen in this area and it may not happen quickly enough, by continuing to create a few small scrapes a year or every other year, will ensure that some species can continue as the management transitions.

3.1.3 - Open communities

The variety of soils and crops present means there is a wide range of arable NVC communities present at Ken Hill. It is inevitable that many of these communities will change and disappear from the site with the removal of agricultural practices but it may well be possible to maintain many of the scarcer plants of these communities with some complimentary sympathetic management if they appear to be disappearing entirely from the site. It will be exciting to see the effects of rooting pigs on light sandy soils as this could generate the desired conditions.

Due to the varied soils of Ken Hill, the number of OV communities is considerably more detailed and involved than any other NVC the author has carried out. They are also very fluid in nature and it is not always clear which community is present.

OV3 - Common Poppy *Papaver rhoeas* - Field Pansy *Viola arvensis* community

Bur Chervil, Prickly Poppy, Venus's Looking-glass were all recorded in this area. The breeding Woodlark were regularly found to be in this area and could well have been breeding in this community. This rich community is rich because it has escaped fertiliser and it is vital that if the bulb growing continues for a year or two that no fertiliser is placed on these soils. It transitions to other communities, such as OV7 which is much less interesting, when fertiliser is applied. Enrichment and disturbance to this community causes it to pass to something more like OV7/OV25 where it becomes overwhelmingly dominated by Prickly Sow-thistle and (to a lesser extent), Groundsel.

Found only in the bulb/bluebell field to the very south east of the field 'Beach Road'.

OV4 - Corn Marigold *Glebionis segetum* - Corn Spurrey *Spergula arvensis* community

Limited on the site to two or three areas, easily seen by the presence of Corn Marigold itself. The main areas being to the north of the site at 'Lamsey Lane' shown in figure 2 below and a late summer flush to the south of the site in 'Hill Field' shown in figure 3. The large bright golden flowers of Corn Marigold make this community instantly recognisable.



Fig. 2. OV4 to the north of Lamsey Lane in early summer.



Fig. 3. OV4 towards the south of the site in Hill Field after harvest.

OV7 - Common Field Speedwell *Veronica persica* - Grey Field Speedwell *Veronica polita*

Much of the area dominated by Fat Hen and Scentless Mayweed is best described as this community. It is particularly dominant in areas planted with Spring Barley and also in areas with Oil-seed Rape.

OV8 - Common Field Speedwell *Veronica persica* - Black-grass *Alopecurus myosuroides*

This community dominates in areas which were predominantly planted with Winter Wheat. Species diversity is lower here due to the Winter Wheat receiving more herbicide than other crops because Winter Wheat has such a problem with Black-grass caused by the earlier sowing.

OV9 - Scentless Mayweed *Tripleurospermum inodorum* - Chickweed *Stellaria media* community

This community seems to be most dominant under Oilseed Rape crops.

OV11 - Annual Meadow-grass *Poa annua* - Field Woundwort *Stachys arvensis* community

Scattered in several places around the site, Field Woundwort being the key species here but this can be a rich community where Corn Spurrey can be locally dominated and other

scarce arable plants, such as Dwarf Spurge, Gold-of-pleasure and Sharp-leaved Fluellen can also be present. It is typically found on sandy fields that have had limited nutrient enrichment. It is most obvious to the north of 'Poplars' to the east and around the southern margin of Marsh Breck between the game cover crop and the set aside margin.

OV13 - Chickweed *Stellaria media* - Shepherd's-purse *Capsella bursa-pastoris* community

This is one of the more enriched arable communities and was mainly found in areas where fertiliser had been deposited historically, such as to the north of 'Potato Close'.

OV14 - Small Nettle *Urtica urens* - Henbit Dead-nettle *Lamium amplexicaule* community

This community really only dominated one field to the south of the site, being 'Warren'. Small Nettle is the overwhelming dominant species here and is present across most of the field while Henbit Dead-nettle persisted mainly in more open areas

OV15 - Scarlet Pimpernel *Anagallis arvensis* - Common Field Speedwell *Veronica persica*

Key species in this community are the two fluellens (at Ken Hill, only Sharp-leaved Fluellen was recorded) and also Dwarf Spurge. Recorded towards the north of the site in field 'Fryatts Pit'.

OV16 - Common Poppy *Papaver rhoeas* - Night-flowering Catchfly *Silene noctiflora*

Found in one area in an Oilseed Rape field to the north of the site, being the south west end of 'Collage Field'. As Night-flowering Catchfly is now a scarce species, this is an uncommon community but is ecologically not especially distinct here. The soils in this area being unremarkable and most of the other species being present were coarser arable weeds. The two other locations where much less Night-flowering Catchfly were present (Ragged Arse and the south of Beach Road - see appendices for distribution maps of the scarcer species) were much more significant communities.

OV19 - Annual Meadow-grass *Poa annua* - Scentless Mayweed *Tripleurospermum inodorum*

Found in the entrances to several fields towards the south of the site.

The following four OV NVC communities were listed as 'tall herb' communities rather than arable and are much more likely to persist on site and are typically much duller botanically and of less value.

OV24 - Nettle *Urtica dioica* - Cleavers *Galium aparine*

Typically, single species stands of this nutrient indicating tall herb are listed as OV24. It can indicate the historic placement of cut material or some other accumulation of nutrients, such as livestock defecating repeatedly under trees or regular dumping of arisings etc.

OV25 - Nettle *Urtica dioica* - Creeping Thistle *Cirsium arvense* community

Very similar to above but with varying amounts of Creeping Thistle than can become completely dominant.

OV26 - Great Willowherb

Typically, single species stands of this tall herb are listed as this community. A sign of enrichment but also damp conditions, usually in or on the edges of ditches.

OV27 - Rosebay Willowherb

A single patch of this community is found at the north western end of the Plain. It is possible that historically cut material from the Plain was placed here. It can also indicate the presence of a fire.

3.1.4 - and dune communities

SD10 - Sand Sedge *Carex arenaria* dune community

Here Sand Sedge is overwhelmingly dominant, the rhizomes are given away by lines of regimented shoots growing up through the sand. Found only on the small heath to the very south of the site. Although listed in the 'sand dune' communities, it is probably better thought of as part of the heathland mosaic.

3.1.5 - Woodland communities

W1 - Grey Willow *Salix cinerea* - Marsh Bedstraw *Galium palustre* carr

Mainly found to the very west of the site around the small reedbed just north of Marsh Beck.

W4 - Downy Birch *Betula pubescens* - Purple Moor-grass *Molinia caerulea* woodland

A single area of wet birch woodland lies immediately to the east of the small reedbed. This community is a poor fit and in hindsight, it is perhaps better mapped as the sub-community W6e (this being the Downy Birch sub-community of Alder carr).

W6a - Alder *Alnus glutinosa* - Nettle *Urtica dioica* woodland - typical sub-community

Very limited in extent with a small slither being found along a ditch to the west and a larger area of mature woodland in the isolated wood to the south west. It is possible that if Lesser Spotted Woodpecker were breeding on site, this could be where to look. Despite being a small wood, it is very dense and they could easily be present here without often being detected.

W8 - Ash *Fraxinus excelsior* - Field Maple *Acer campestre* - Dog's Mercury *Mercurialis perennis* woodland

This is the base-rich version of W10 and begins to dominate towards the north west and east of the site. Increasingly Sycamore can dominate and at times can completely replace the Ash component in this type of woodland.

W10 - Pedunculate Oak *Quercus robur* - Bracken *Pteridium aquilinum* - Bramble *Rubus fruticosus* agg. woodland

Much of the woodland has been mapped as W10, even the woodland that has been planted with various conifers. This is based on the ground flora, soil and understorey. Where more acidic species are present in the ground flora, this community passes toward the more

acidic W16 (Wavy Hair-grass being a key species here). W10 is best described as English oak woodland, much of hazel, chestnut coppice, bluebell woodland falls into this category.

W14 - Beech *Fagus sylvatica* - Bramble *Rubus fruticosus* agg. woodland

This is neutral Beech woodland, found on the west facing part of the southern end of Ken Hill Wood. Here, Beech becomes the overwhelming dominant in the canopy. There are base-rich and acidic versions of this community but the neutral one was a much better fit. Some of the Beeches here are among the largest trees in Ken Hill Wood.

W16 - Oak spp. *Quercus* spp. Birch spp. *Betula* spp. - Wavy Hair-grass *Deschampsia flexuosa* woodland

This more acidic version of W10 was mainly found to the south of the site and immediately around the edge of the Plain. It is not entirely clear that the large block to the south is as extensive as mapped but it is an indicator that this community is present to the south of Ken Hill Wood and it is thought that if future heathland creation were to be made, this could possibly be a place to do it, depending on the soil profile.

W21 - Hawthorn *Crataegus monogyna* - Ivy *Hedera helix* Hawthorn scrub

This is the basic Hawthorn scrub which is the most common hedgerow type around the site, much of the scrub expected to develop away from very clayey or acidic areas will likely be this (after it has passed through the low Bramble stage).

W22 - Blackthorn - *Prunus spinosa* - Bramble *Rubus fruticosus* agg. scrub

This is the well-known Blackthorn scrub, typically dominated by the one plant forming very dense scrub, usually along hedgerows. It is not as common at Ken Hill as W21 Hawthorn scrub as it tends to do better on clayey soils.

W23 - Gorse *Ulex europaeus* - Bramble *Rubus fruticosus* agg. scrub

Areas dominated by Gorse are best described as this community and it is typically found on more acidic areas.

W24 - Bramble agg. *Rubus fruticosus* agg. - Yorkshire Fog *Holcus lanatus* Scrub

This is the low Bramble scrub that dominates on the sides of tracks and in grassland where grazing or management is reduced or removed. Many grassland communities that are starting to scrub over have been assigned as an intermediate community (such as MG1/W24).

3.1.6 - Swamp and aquatic communities

The swamp NVC 'communities' are typically single-species stands of one plant and as such are not really very helpful in terms of understanding vegetation communities.

S4 - Common Reed *Phragmites australis* reedbed

This is the well-known reedbed community, overwhelmingly dominated by Common Reed.

S7 - Lesser Pond Sedge *Carex acutiformis* swamp

Small amounts of this community were found to the south west of the site along ditch edges and around the western edge of the field to the west of 'The Sink'.

S12 - Reedmace *Typha latifolia* swamp

Found only as narrow strips along ditches in this survey. Mainly to the south west of the site.

S20 - Grey Bulrush *Schoenoplectus tabernaemontani* swamp

A tiny amount found in a ditch to the south west of the site. Like the following community, this plant typically grows in brackish conditions.

S21 - Sea Club-rush *Scirpus maritimus* swamp

Single species stands of this usually brackish tolerant plant were found around the pond in the centre of the northern wood, showing that there is some element of saline influence here.

A16 - Common Water-starwort *Callitriche stagnalis* community

The small farm ponds, surrounded by woodland and scrub, best fit this species-poor aquatic community dominated by Water Star-wort species.

3.1.7 - NVC communities written for this survey

KH1 - Smooth Cat's-ear *Hypochaeris glabra* - Annual Knawel *Scleranthus annuus* acid-grassland

Found in the field to the north of the wood known as 'Ragged Arse' only. Smooth Cat's-ear was overwhelmingly dominant. Annual Knawel only occasional. Hare's-foot Clover was abundant and Night-flowering Catchfly recorded only once. Silver Hair-grass was also noted here. Quite an unusual and very distinct community that stands out from the rest of the field (MG6) clearly on aerial photographs. Perhaps the closest NVC to this was SD19 but that did not feel like a good fit.

This is probably the most important 'NVC' community on the site, housing a suite of rare plants and being very unique in its nature.



Fig.4. The community called KH1 in summer. The pappuses here are those of Smooth Cat's-ear growing at an incredible density. The author has never encountered this plant in more than a few individuals at a time so it was incredible to see it as the dominant species.

KH2 - Wild Clary *Salvia verbenaca* - Knotted Clover *Trifolium striatum* - Ribwort Plantain - *Plantago lanceolata* acid-grassland

Perhaps closest to the Breckland sub-community U1c, this rich and sandy community was present along the old railway line and a few other places south of Hill Field to the very south of the site. It was particularly rich in invertebrates and a number of species, such as *Alydus calcaratus* were found here.

KH3 -Broom *Cystisus scoparius* - Biting Stonecrop *Sedum acer* scrub

Almost certainly a later successional version of KH2 above. Dominated by Broom but seemingly with large areas of bare sand caused by rabbits, resulting in patches of Biting Stonecrop.

KH4 - Common Stork's-bill *Erodium cicutarium* on loose sand community

This community is overwhelmingly dominated by storksbill on very loose sand. It is here that the Breckland Leatherbug can be found and was the most exciting community for invertebrates. Structurally, it is perhaps most close to OV3 but lacks the diverse assemblage of that community. It could well be intermediate between OV3 and U1c.



Fig. 5. Dense patches of Common Stork's-bill on loose sandy soil were listed as KH4.

KH5 - Bristly Ox-tongue *Helminthotheca echioides* - Hoary Willowherb *Epilobium parviflorum* - Common Cudweed *Filago vulgaris*

Found to the west of the site at the north end of 'Marsh Breck', a particularly rich mix of ruderals (dominated by Bristly Ox-tongue and Hoary Willowherb) and arable weeds (such as Corn Spurrey and Common Cudweed). Probably closest to OV19 but not a good match as this had far more diversity and some species associated with low nutrients and lighter soils.

3.2 - NVC maps

With some 48 different NVC communities and over 80 sub-communities in total, it was very difficult to find colours and cross-hatching for all of them at once. This has been attempted and the reader is encouraged to load up the shapefile and investigate the map further digitally if there are any problems discerning the polygons. An overall view and several close-up views around the site (including the Plain and the small 'southern heath') have been included. To make things more clear, similar maps have been produced using the basic habitat for each polygon, which is considerably easier to read but lacks any ecological detail.

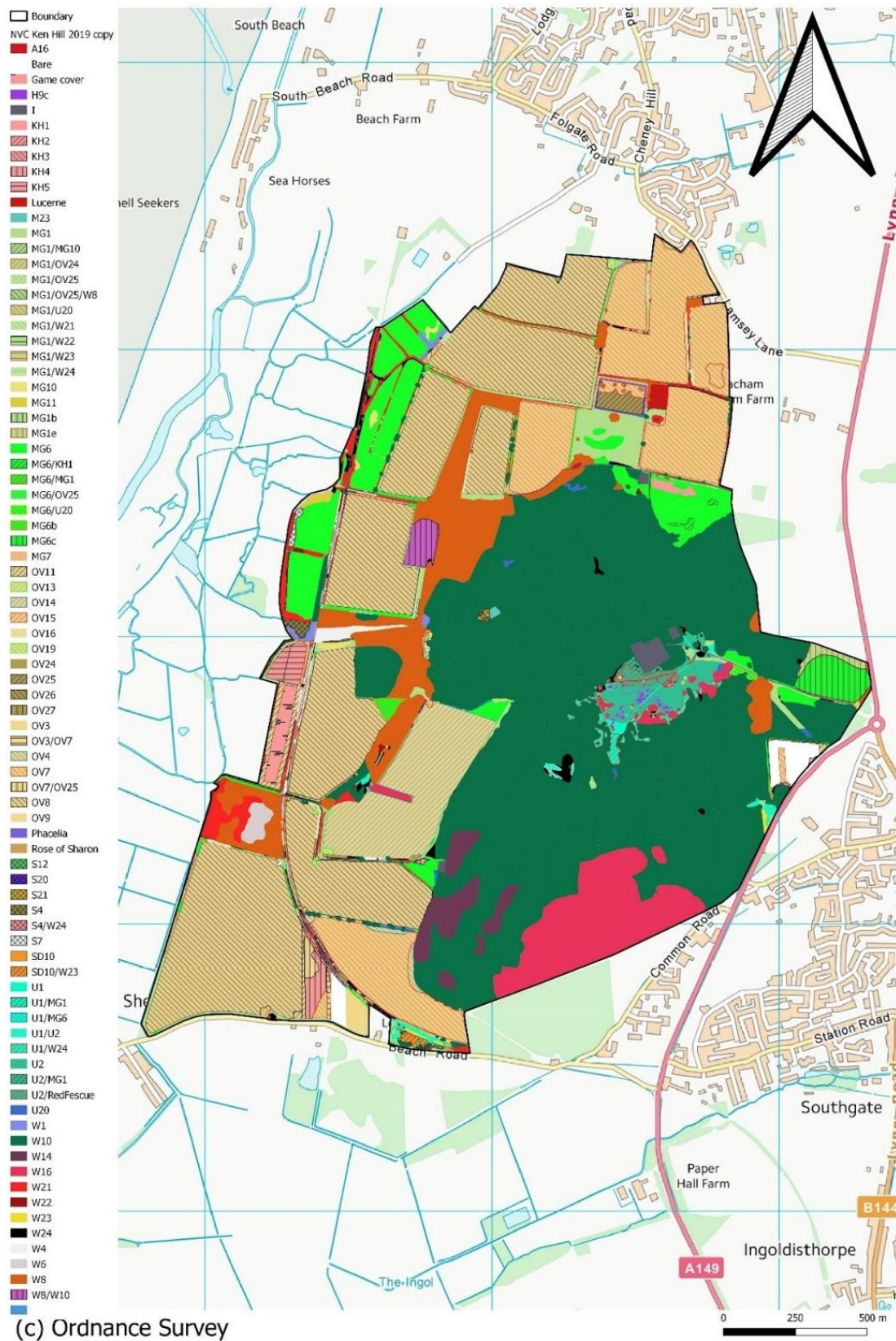


Fig. 6. NVC overview.

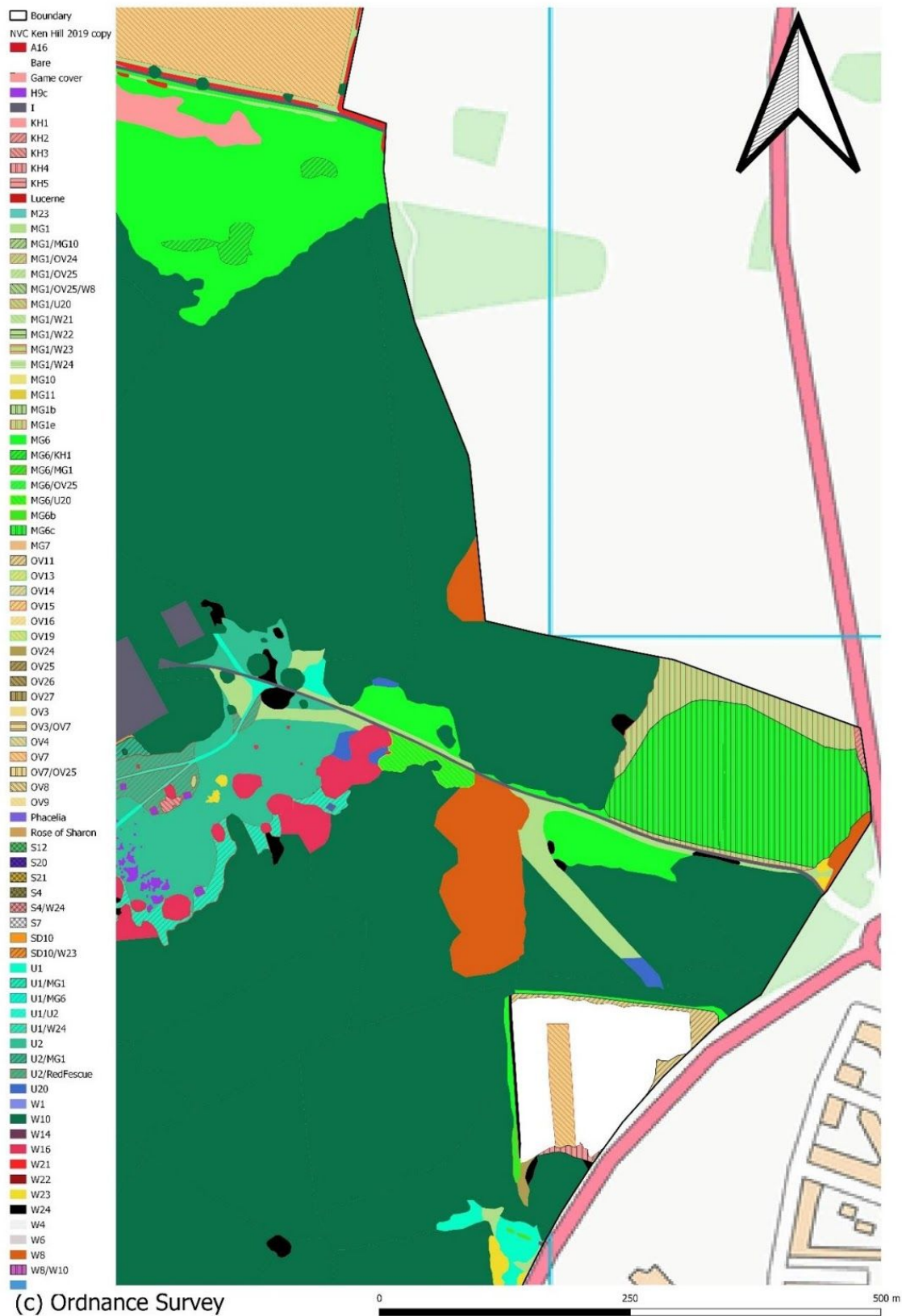


Fig. 7. NVC east.

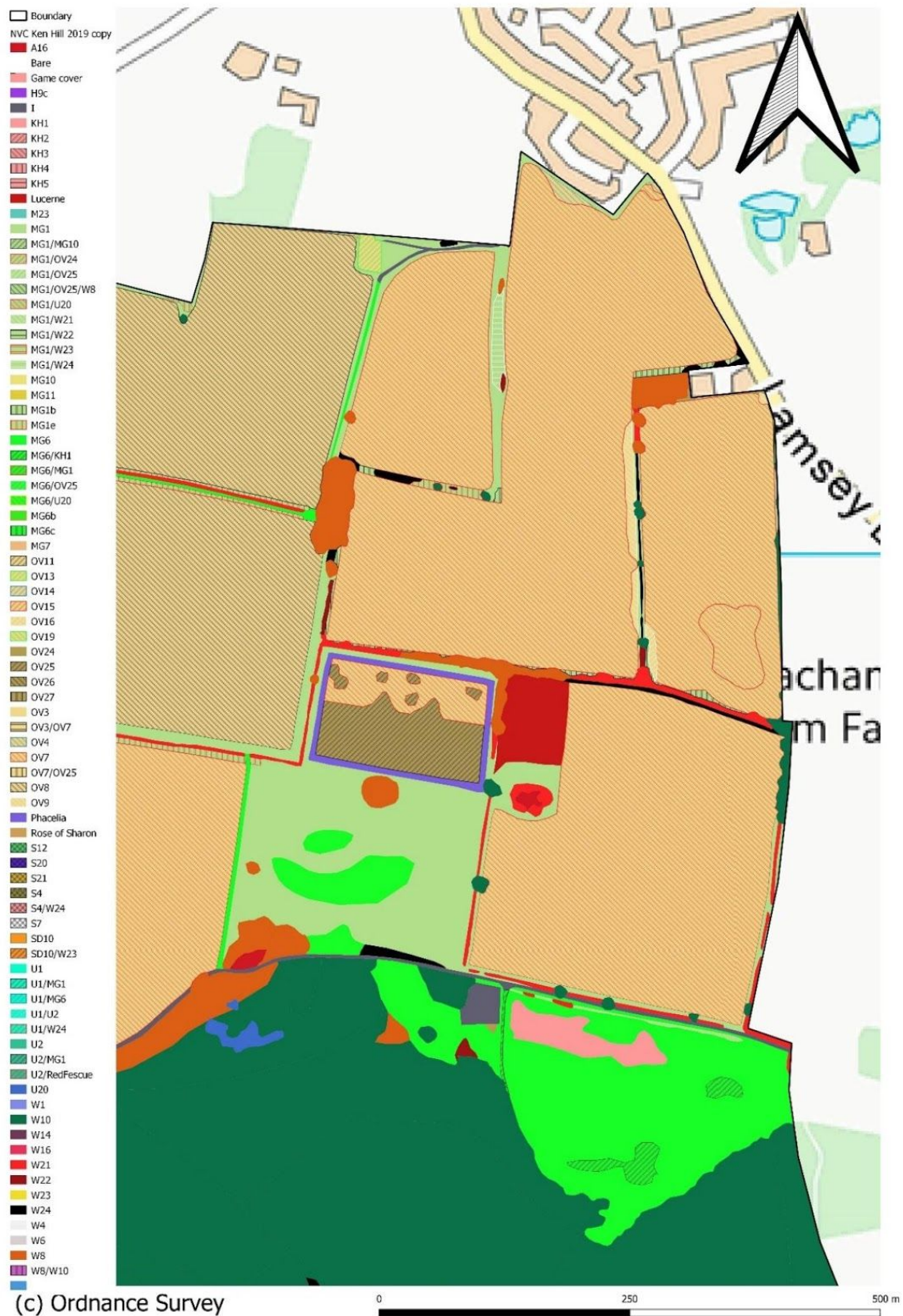


Fig. 8. NVC north east.

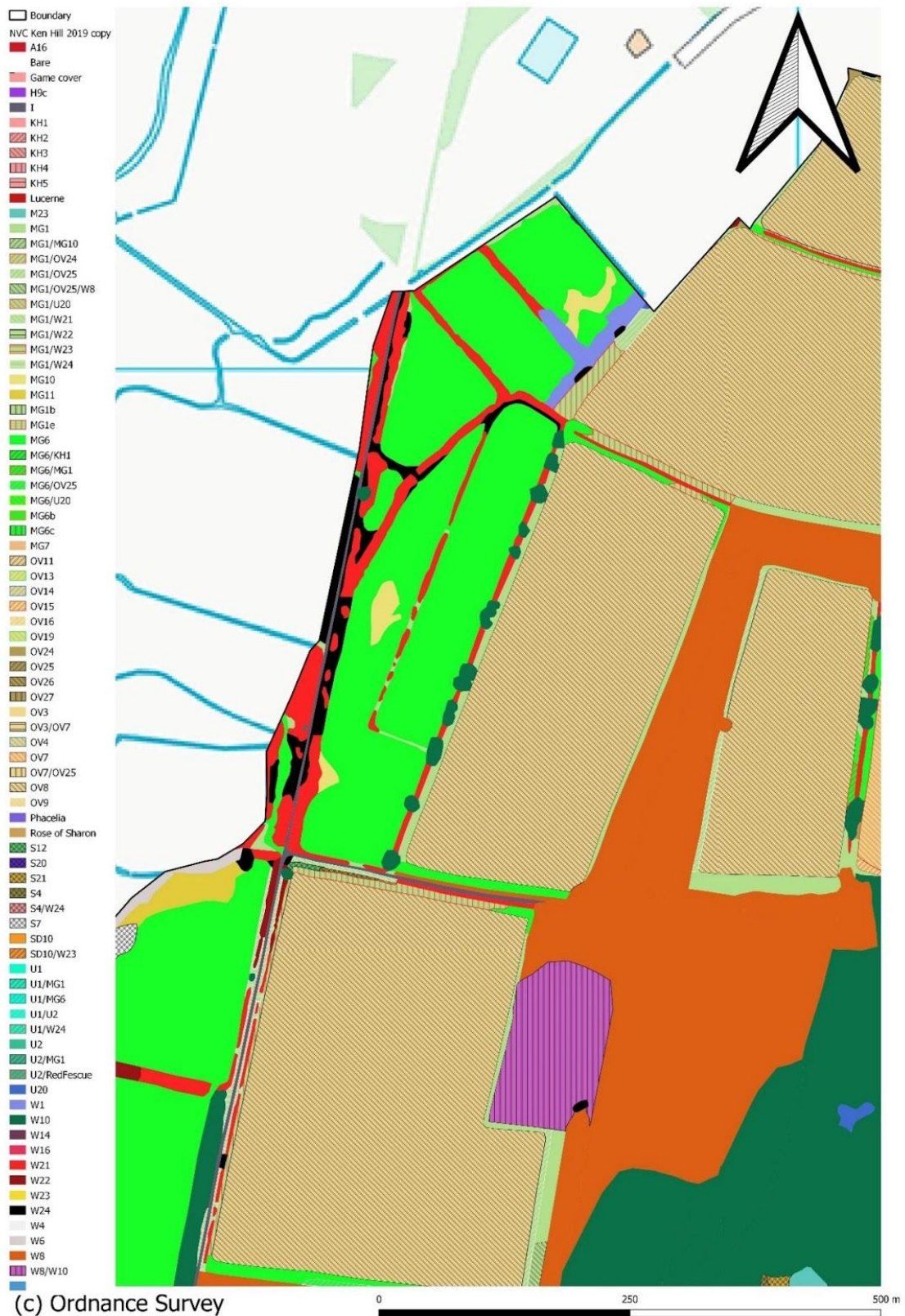


Fig. 9. NVC north west.

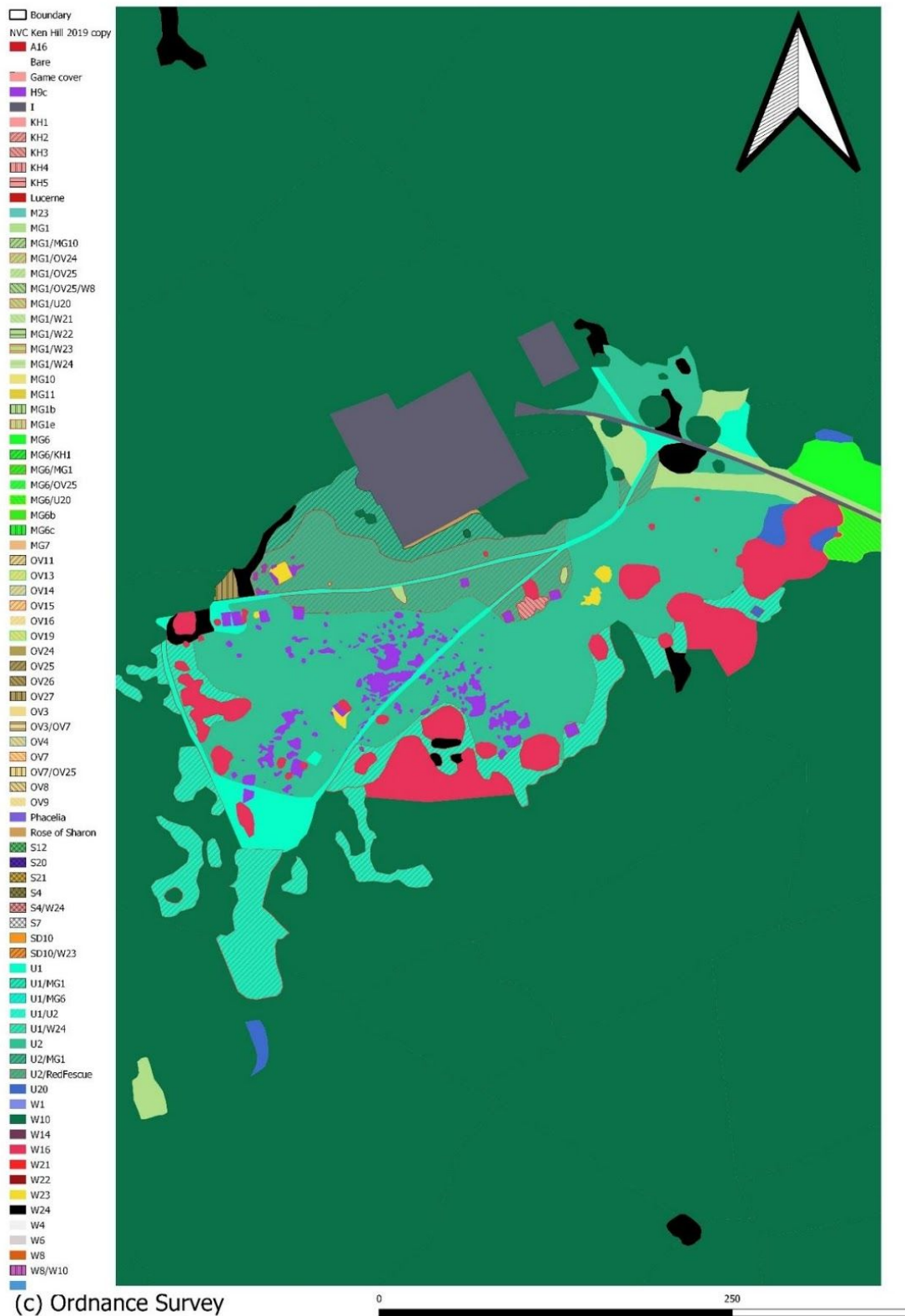


Fig.10. NVC The Plain.

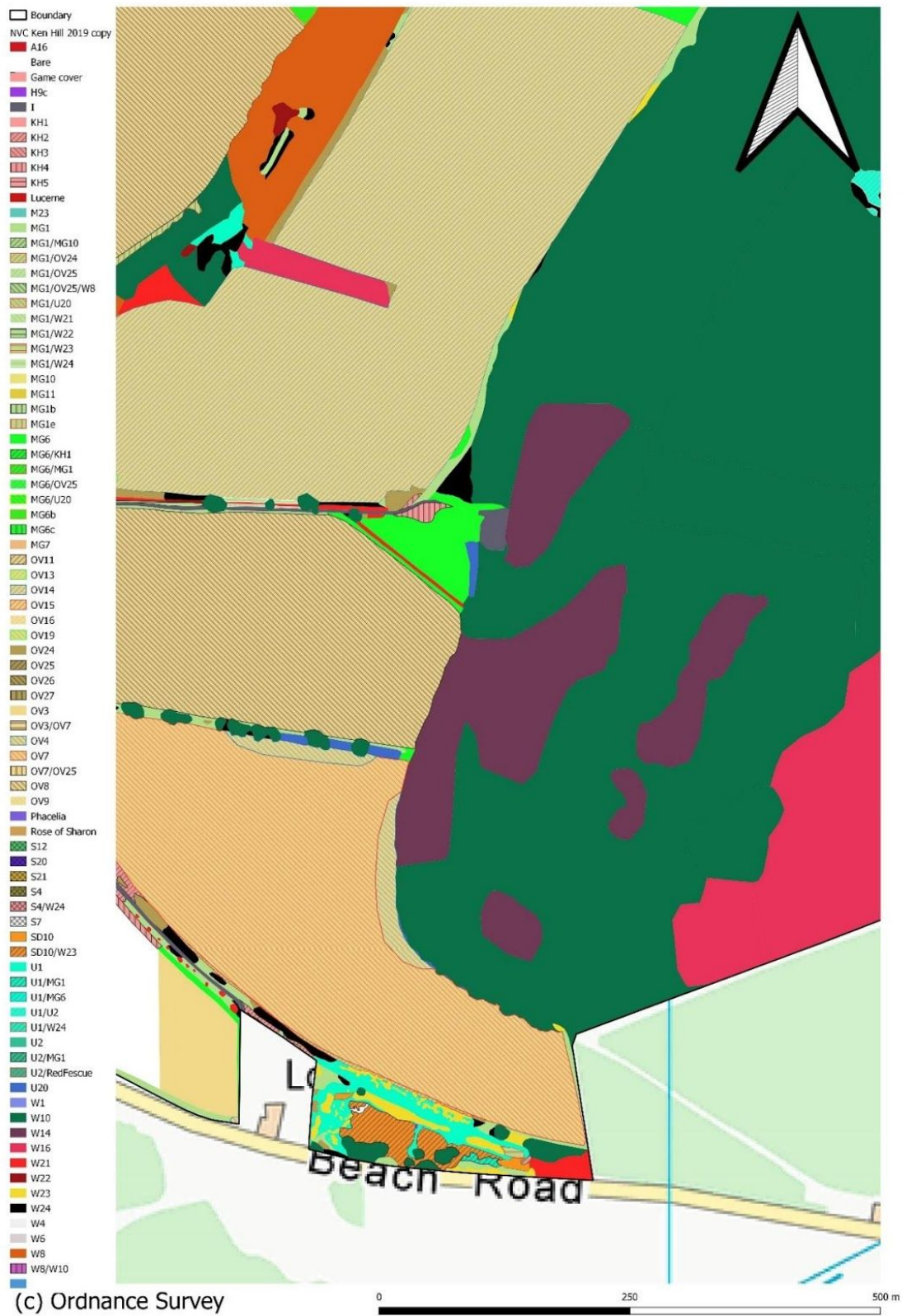


Fig.11. NVC south.

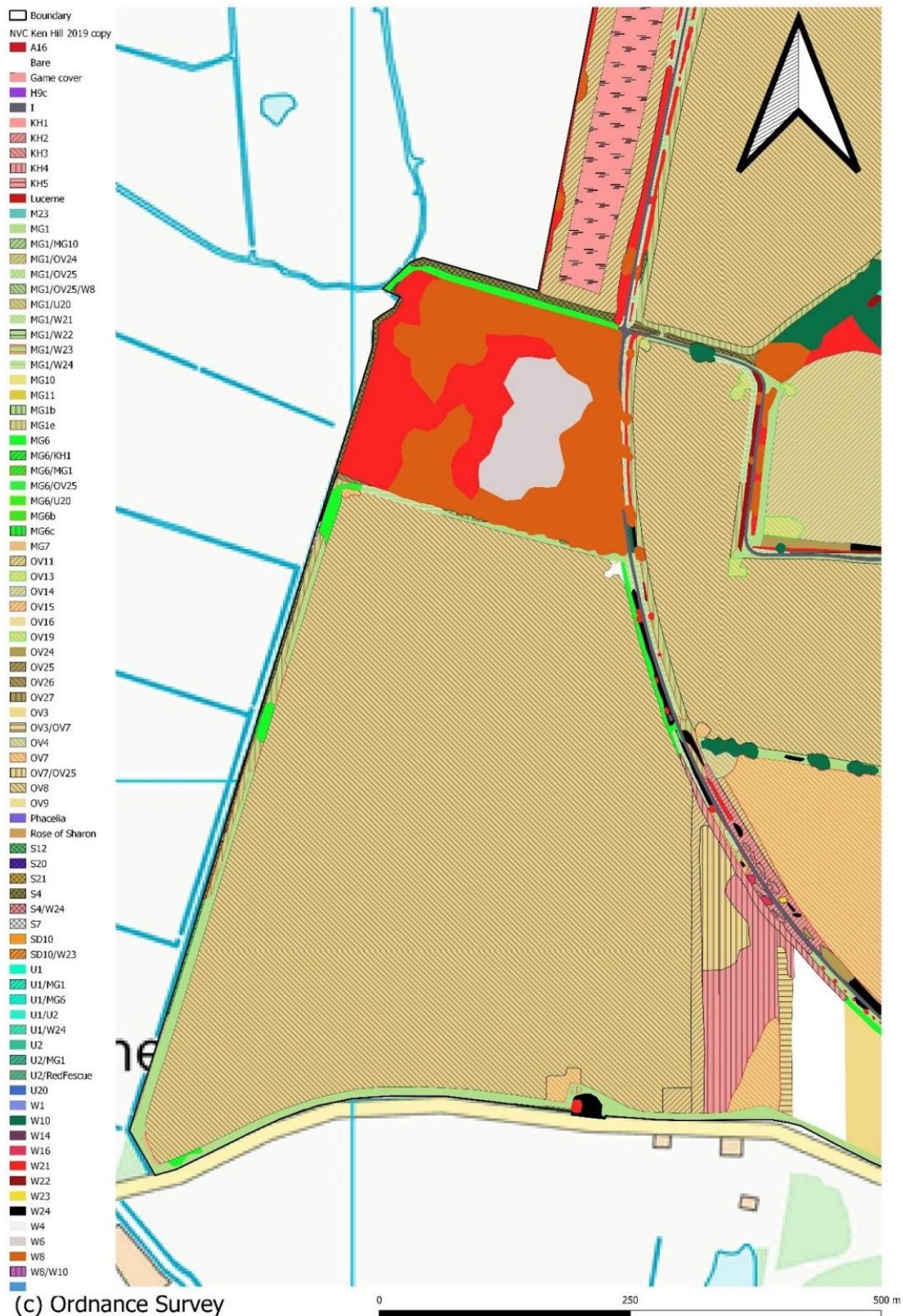


Fig.12. NVC south east.

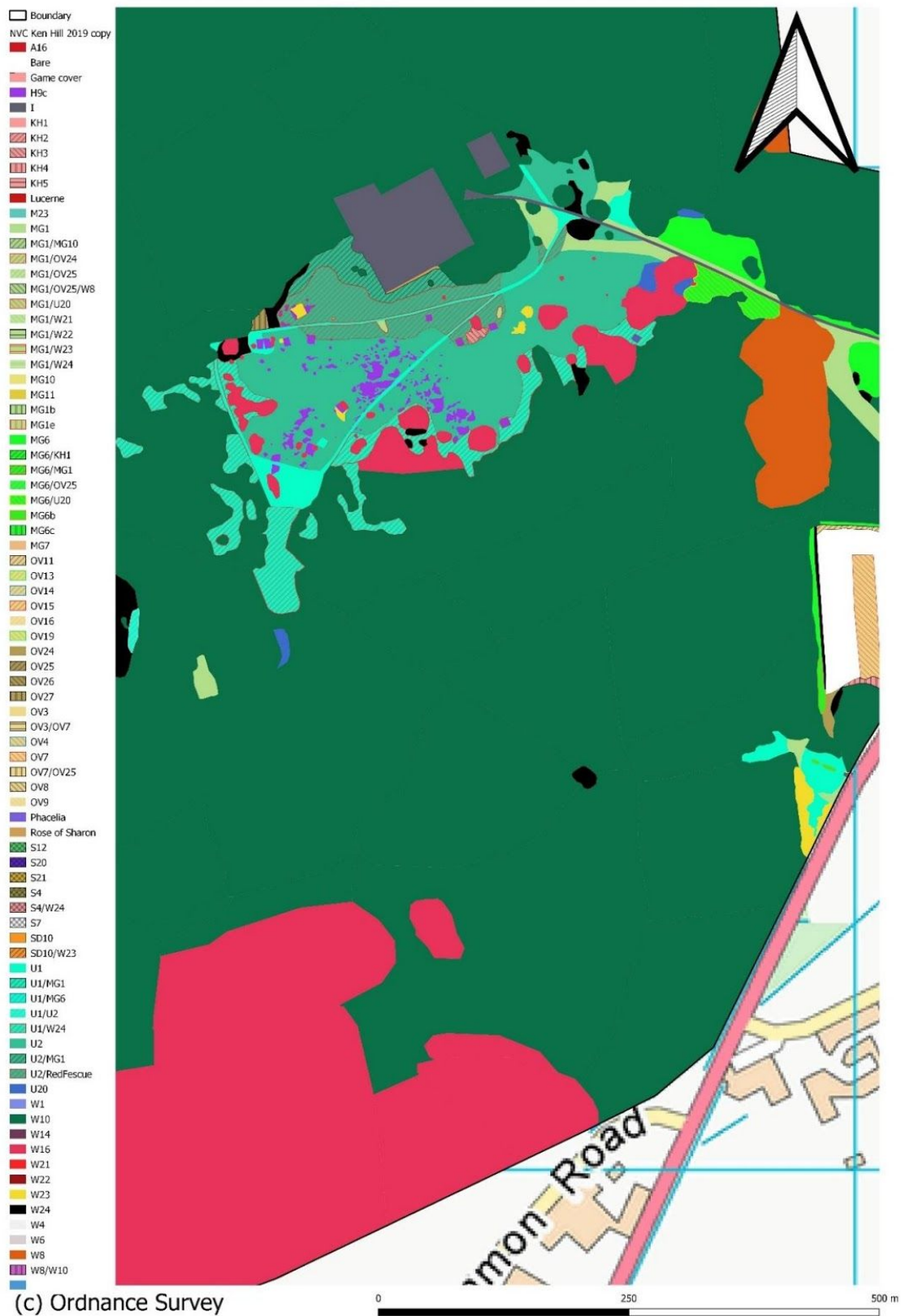


Fig. 13. NVC south.

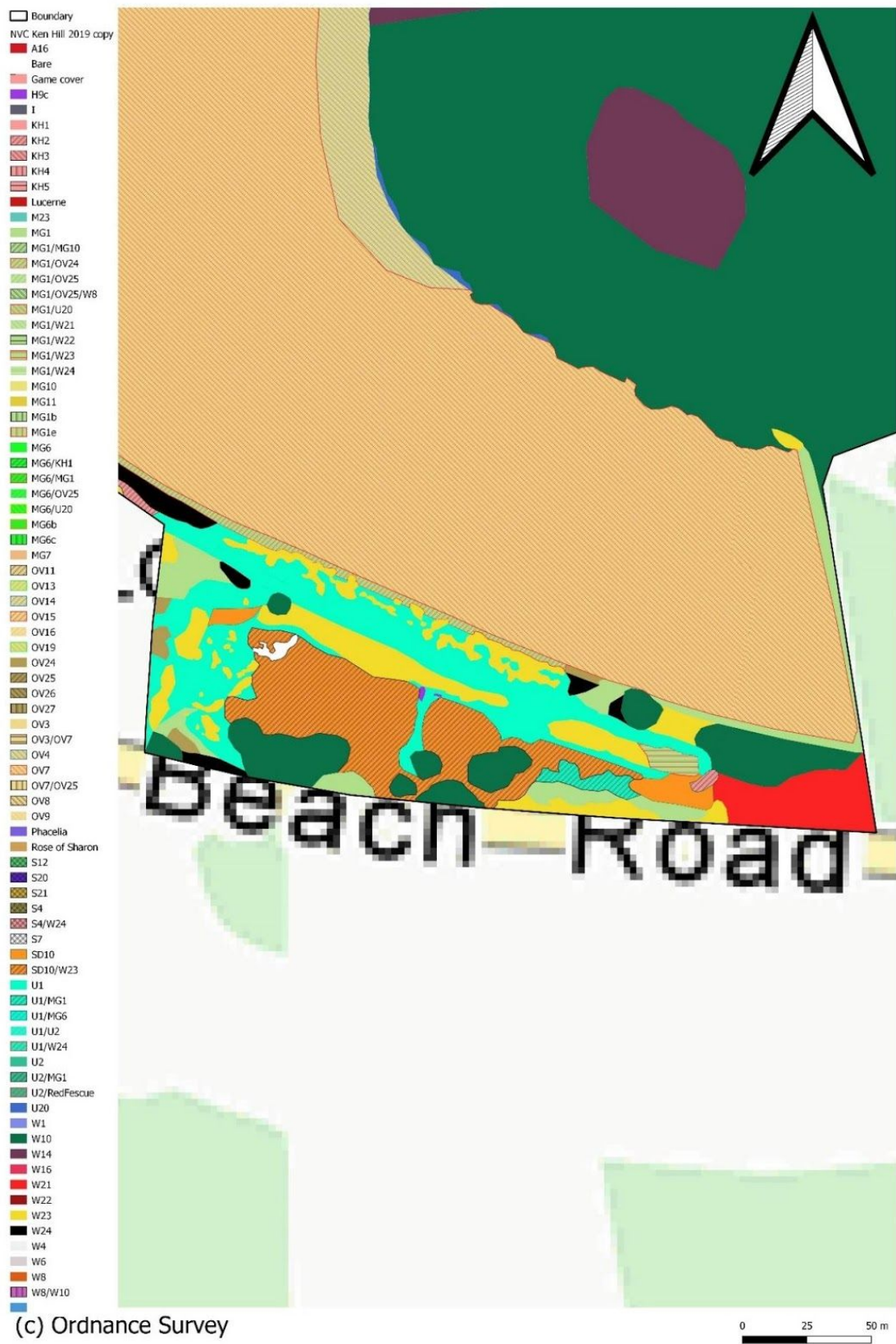


Fig. 14. NVC south heath



Fig. 15. NVC west

3.3 - Basic habitat maps

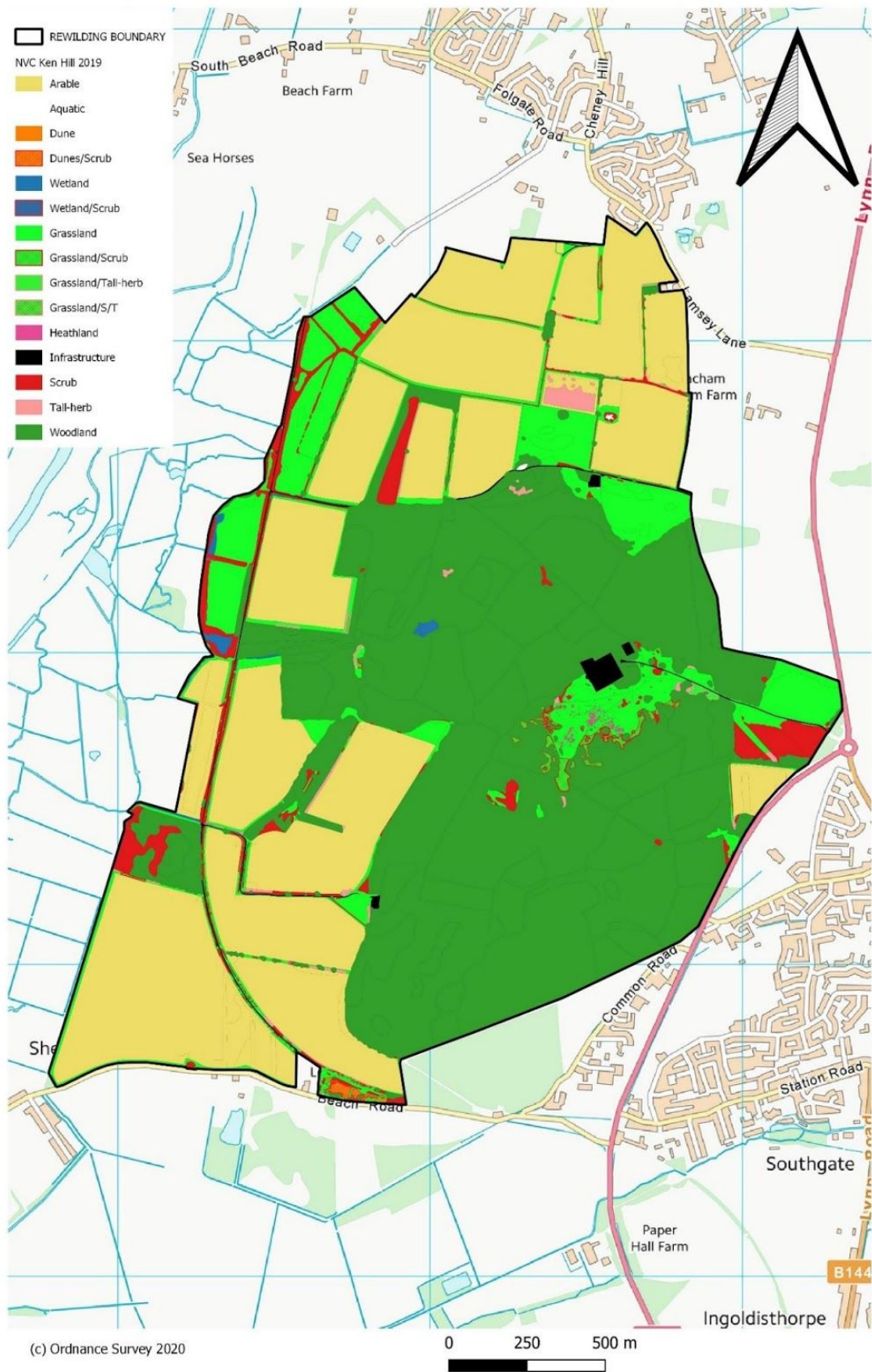


Fig.16. Broad habitat overview

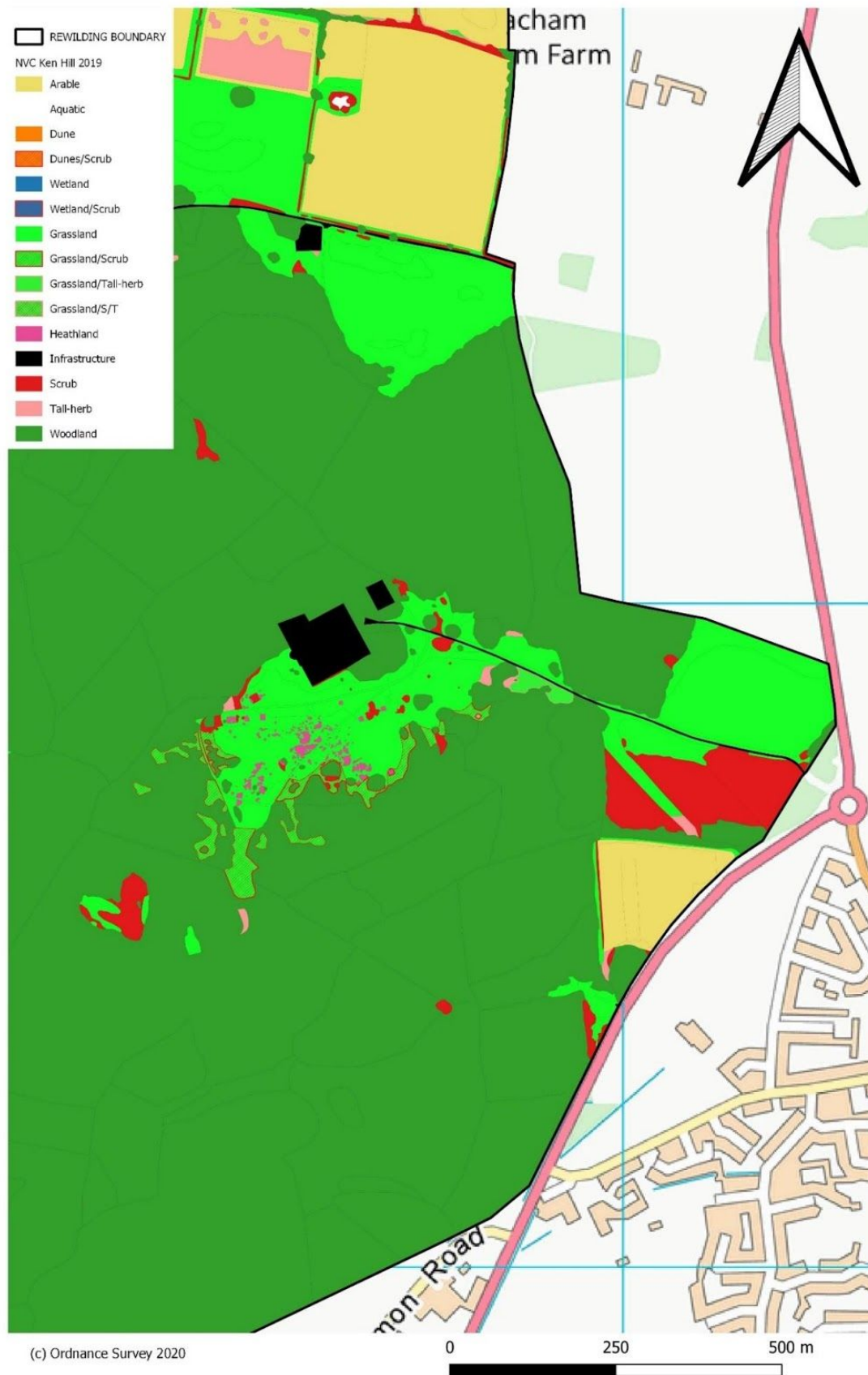


Fig. 17. Broad habitat south east

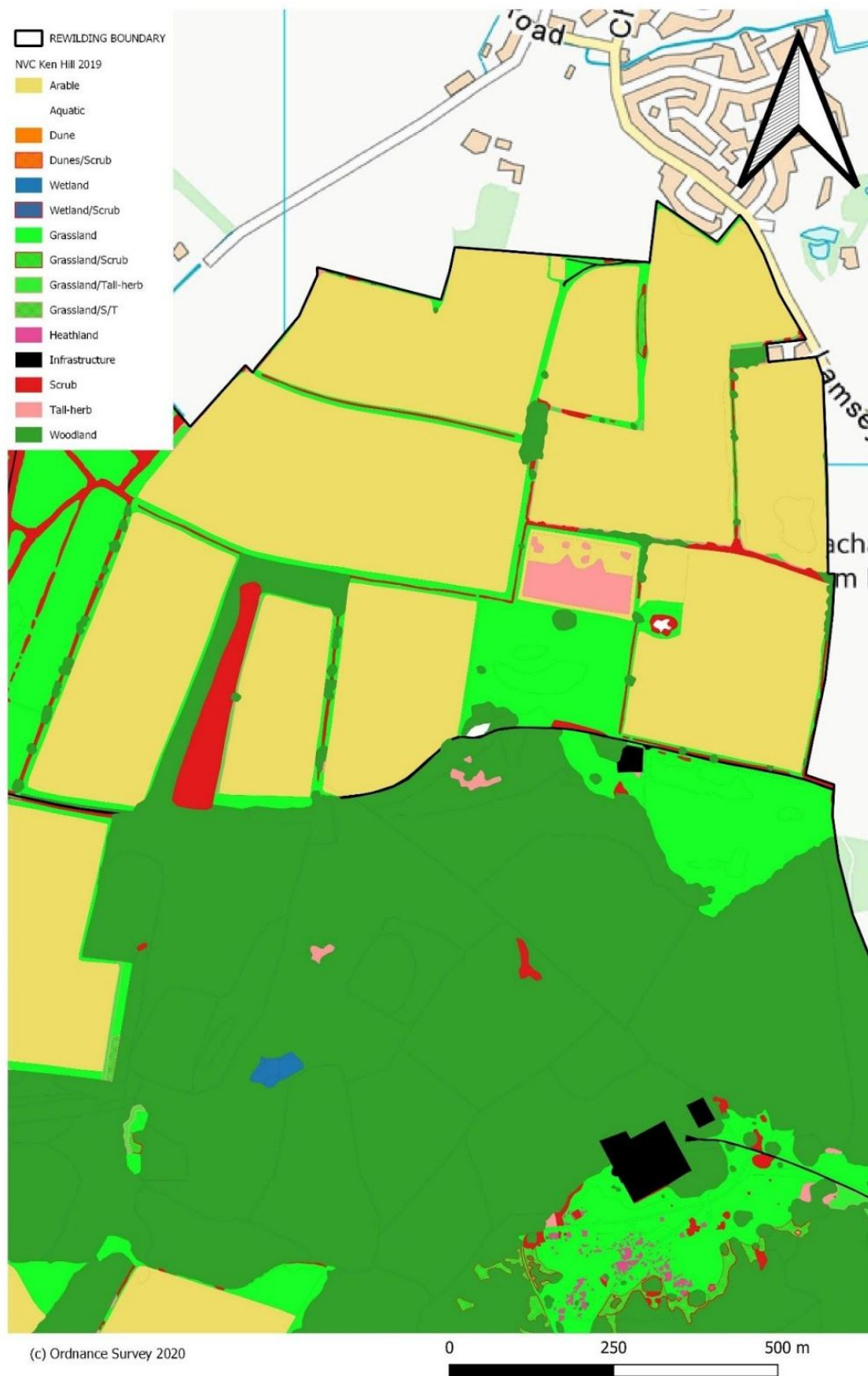


Fig. 18. Broad habitat north.



Fig. 19. Broad habitat west



Fig. 20. Broad habitat south heath.

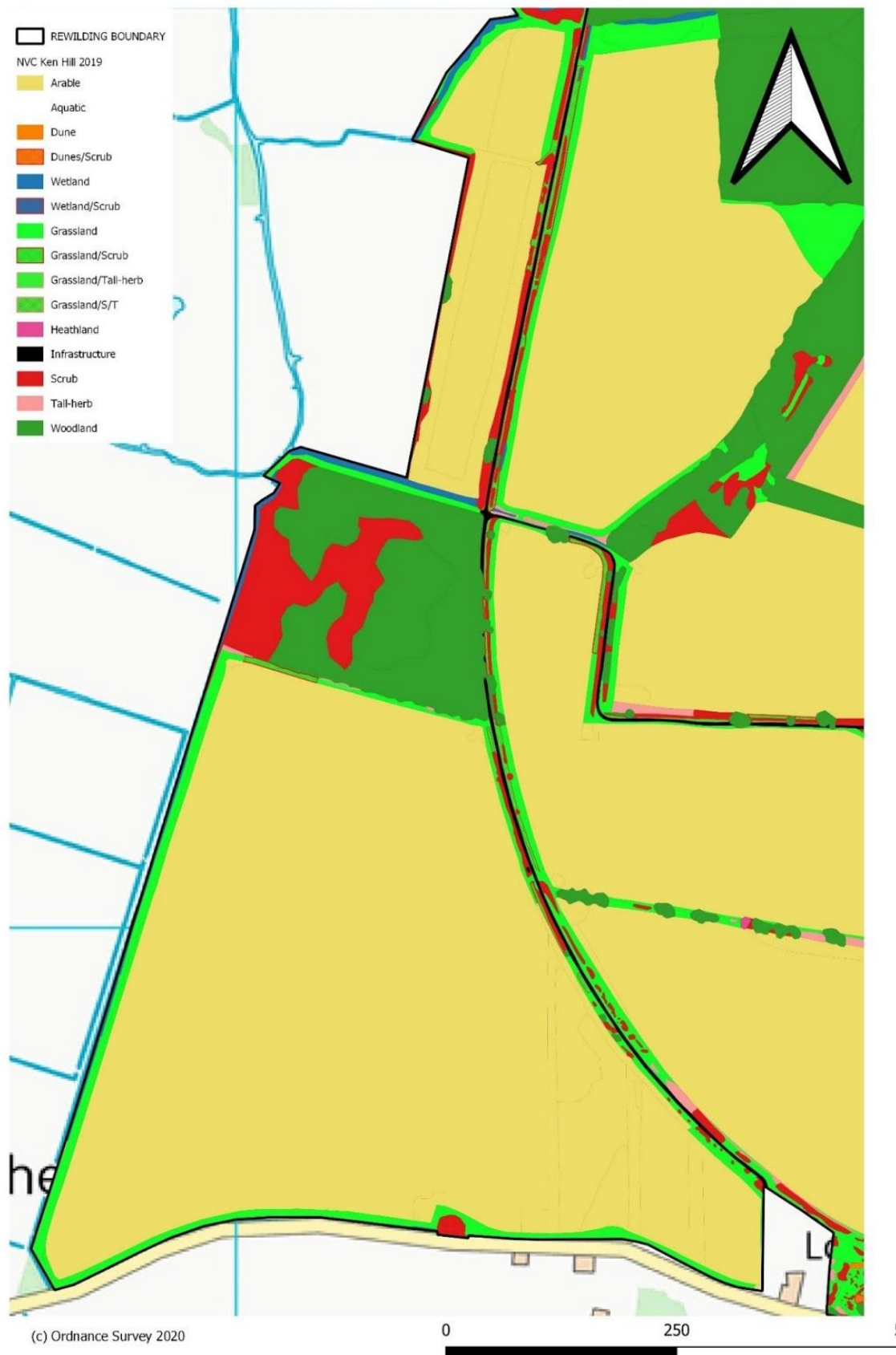


Fig. 21. Broad habitat south east.

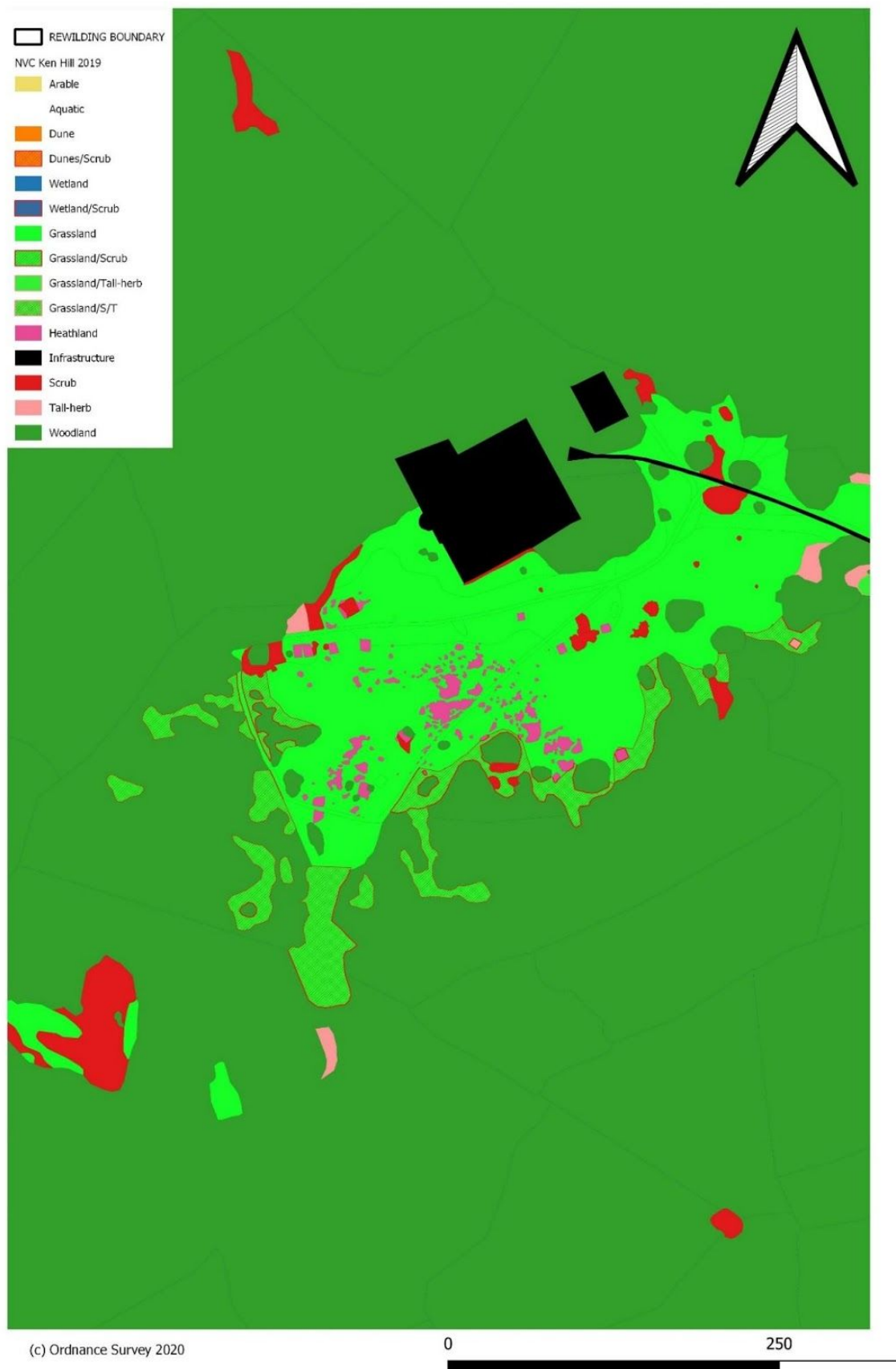


Fig. 22. Broad habitat the Plain.

3.4 - Systematic breakdown of NVC communities

Tab. 1. Total area of each NVC communities by hectare.

NVC community	Broad NVC community	Area
A16	Aquatic	0.08
Bare	Arable	2.60
Game cover	Arable	1.59
H9c	Heathland	0.36
I	Infrastructure	2.94
KH1	Acid grassland	0.43
KH2	Acid grassland	0.33
KH3	Scrub	0.06
KH4	Arable	1.34
KH5	Arable	1.39
Lucerne	Arable	0.56
M23	Wetland	0.11
MG1	Neutral grassland	10.4
MG1/MG10	Neutral grassland	0.10
MG1/OV24	Neutral grassland	0.09
MG1/OV25	Neutral grassland	0.32
MG1/OV25/W8	Neutral grassland	0.08
MG1/U20	Neutral grassland	0.06
MG1/W21	Neutral grassland	0.06
MG1/W22	Neutral grassland	0.03
MG1/W23	Neutral grassland	0.02
MG1/W24	Neutral grassland	0.96
MG10	Neutral grassland	0.55
MG11	Neutral grassland	0.30
MG1b	Neutral grassland	0.20
MG1e	Neutral grassland	3.17
MG6	Neutral grassland	21.6
MG6/KH1	Neutral grassland	0.24
MG6/MG1	Neutral grassland	0.05
MG6/OV25	Neutral grassland	0.05
MG6/U20	Neutral grassland	0.21
MG6b	Neutral grassland	0.52
MG6c	Neutral grassland	2.99
MG7	Neutral grassland	0.01
OV11	Arable	1.94
OV13	Arable	0.08
OV14	Arable	15.8
OV15	Arable	0.03
OV16	Arable	0.03
OV19	Arable	0.15
OV24	Tall herb	0.47
OV25	Tall herb	1.07

OV26	Tall herb	0.06
OV27	Tall herb	0.03
OV3	Arable	0.93
OV3/OV7	Arable	0.21
OV4	Arable	0.64
OV7	Arable	40.3
OV7/OV25	Arable	0.46
OV8	Arable	88.9
OV9	Arable	0.17
Phacelia	Arable	0.33
Rose of Sharon	Scrub	0.01
S12	Wetland	0.08
S20	Wetland	0.00
S21	Wetland	0.09
S4	Wetland	0.99
S4/W24	Wetland	0.03
S7	Wetland	0.21
SD10	Sand Dune	0.04
SD10/W23	Sand Dune	0.36
U1	Acid grassland	1.41
U1/MG1	Acid grassland	0.02
U1/MG6	Acid grassland	0.04
U1/U2	Acid grassland	0.19
U1/W24	Acid grassland	1.44
U2	Acid grassland	3.57
U2/MG1	Acid grassland	0.32
U2/RedFescue	Acid grassland	0.95
U20	Tall herb	0.49
W1	Woodland	0.68
W10	Woodland	146.1
W14	Woodland	5.09
W16	Woodland	18.00
W21	Scrub	6.50
W22	Scrub	0.37
W23	Scrub	0.55
W24	Scrub	2.67
W4	Woodland	0.83
W6	Woodland	1.13
W8	Woodland	24.2
W8/W10	Woodland	1.51
TOTAL		423.3

3.5 - Systematic breakdown of basic habitats by hectare

Tab. 2. Total area of each basic habitat by hectare and by percentage.

Broad habitat	Area	Area	Percentage
Arable	157.4	157.4	37.2
Aquatic	0.08	0.08	0.02
Bare	0.0041	0.0041	0.00
Dune	0.05	0.41	0.10
Dune/Scrub	0.36		
Wetland	1.49	1.52	0.36
Wetland/Scrub	0.031		
Grassland	47.2	50.7	12.0
Grassland/Scrub	2.51		
Grassland/Tall herb	0.92		
Grassland/Tall herb/Scrub	0.08		
Heathland	0.37	0.37	0.09
Infrastructure	2.94	2.94	0.69
Scrub	14.9	14.9	3.53
Tall herb	2.12	2.12	0.50
Woodland	192.8	192.8	45.5
TOTAL	423.3	423.3	100 percent

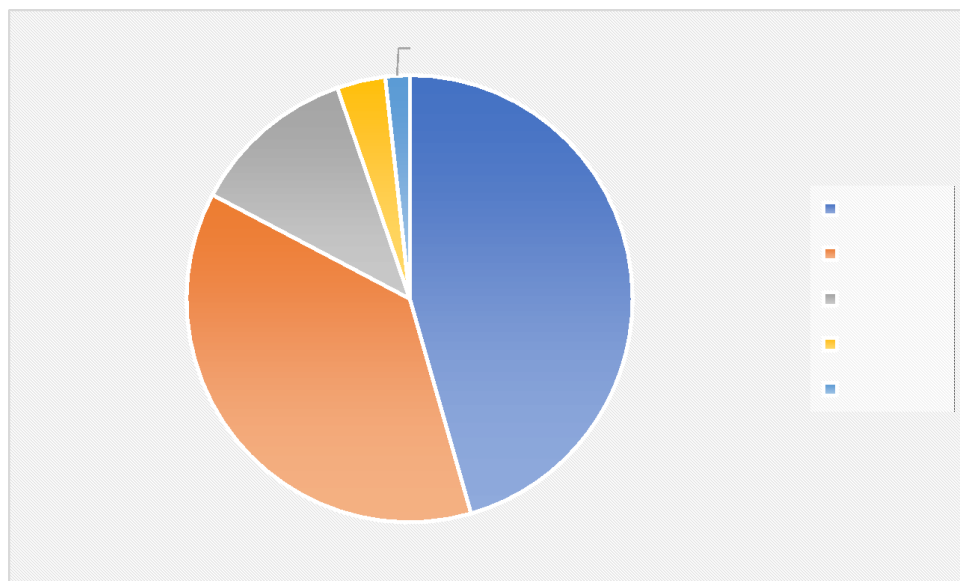


Fig. 23. Breakdown of the major habitats in the rewilding area.

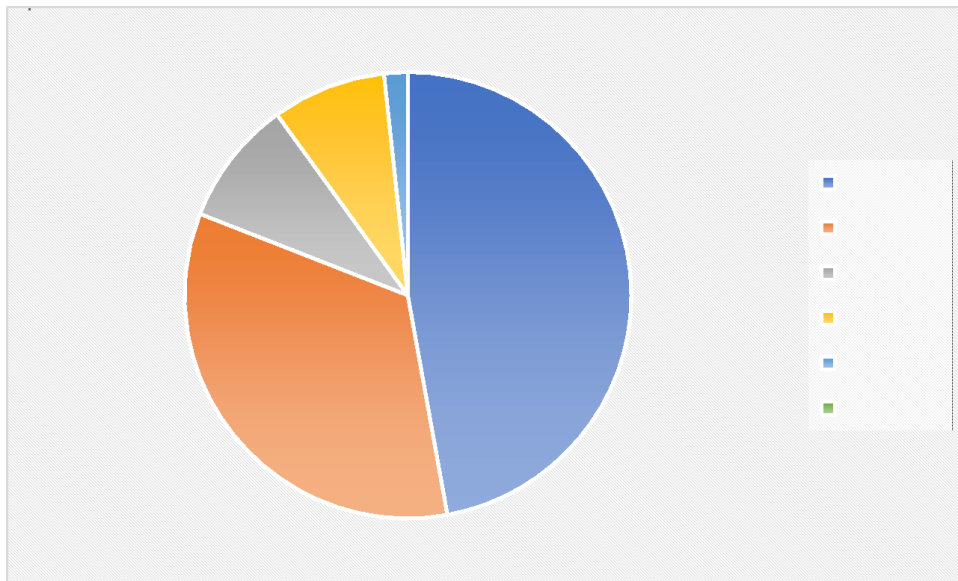


Fig.24. 'Other' from figure 23 above.

3.6 - Mapping of key species

For the base map, the colour-coding from the NVC map was removed so that the plant records (recorded to the nearest 10m grid reference) could easily be seen. The maps are contained in the appendix.

Stinking Chamomile (*Anthemis cotula*) - IUCN Red List, Vulnerable {Plant Life Score: 7}

The main area this species was present was at the extreme north of the site to the east of 'Lamsey Lane', which had Oilseed Rape in at the time. A lesser amount was found in a winter wheat field to the west of the site around the eastern edge of 'the Sink'.



Fig. 25. A dense patch of Stinking Chamomile in Lamsey Lane.

Corn Marigold (*Glebionis segetum*) - IUCN Red List, Vulnerable - {Plant Life Score: 7}



Fig. 26. Corn Marigold to the north of Lamsey Lane.

The distribution of Corn Marigold follows broadly the distribution of the NVC community OV4.

Gold-of-pleasure (*Camelina sativa*) - Nationally Scarce {Plant Life Score: 7}

Only one plant of this species was recorded, by which time it was already in fruit. It was spotted on the edge of a game cover plot (between the cover and the margin) towards the south of Marsh Breck.

It is not entirely clear if this is a wild plant as there is some evidence that this species can be introduced via seed mixes, such as the game cover mix used in this area. However, it was thought best to include it until stronger evidence was found to prove otherwise.



Fig. 27. The single fruiting Gold-of-pleasure found in the margin of Marsh Breck.

Scattered around the site in arable margins but never in large amounts. The main focus of this was in the north end of 'Dunston West' and along the eastern edge of 'Siberia'.



Fig. 28. The diminutive Dwarf Spurge.

**Rye Brome (*Bromus secalinus*) - IUCN Red List, Near Threatened & Nationally Scarce
{Plant Life Score:7}**

A fairly large patch of this scarce grass was recorded in only one field to the south of the site next to the old railway line. This was confirmed by the county recorder, Richard Carter. It was found in the south east corner of 'Beach Road', between the bulb fields and the beet crop.



Fig. 29. Old heads of Rye Brome.

Prickly Poppy (*Papaver argemone*) - IUCN Red List, Vulnerable {Plant Life Score:7}

Found only in the southernmost field where it was present in the field centre and along the track, thinly scattered through the crop of bulbs. It seemed to be tied to the NVC community OV3 on the site.



Fig. 30. The striking Prickly Poppy in flower.

Hoary Mullein (*Verbascum pulverulentum*) - Nationally Scarce {not an arable plant}



Fig. 31. Hoary Mullein is scattered around the site, two plants along the old railway to the south but with most plants in the more base-rich grassland to the east of the site by the main road. This is a locally common roadside plant in Norfolk and would not be expected disappear in the change in management.

Shepherd's Cress (*Teesdalia nudicaulis*) - IUCN Red List, Near Threatened - {not an arable plant}

Found only on the Plain, this plant was clinging on in the scrapes where it didn't have to compete with dense Wavy Hair-grass and on top of tussocks which had been grazed by Rabbits. It is therefore expected to do well with a sympathetic grazing regime.



Fig. 31. The early flowering Shepherd's-cress found on the Plain.

The small scrapes on the heath are well worth continuing with if something similar is not created by the livestock.

Hoary Cinquefoil (*Potentilla argentea*) - IUCN Red List, Near Threatened - {not an arable plant}



Fig. 32. Hoary Cinquefoil.

Recorded only in one small area of the Plain along the track. Another poor competitor that could do well with grazing on the Plain. It is not an uncommon plant in East Anglia.

Hound's-tongue (*Cynoglossum officinale*) - IUCN Red List, Near Threatened - {not an arable plant}

A single plant of this fairly common species was found to the very south of the site along the Beach Road.

Night-flowering Catchfly (*Silene noctiflora*) - IUCN Red List, Vulnerable - {Plant Life Score: 7}

Found in three areas widely scattered around the site. Its own NVC community to the north (a patch of OV16 in the south east corner of Collage Lane). A single plant in the area of KH1 in Ragged Arse and several plants at the very south of the site along the Beach Road in 'Beach Road' field.



Fig. 33. The striking yellow and pink flowers of Night-flowering Catchfly.

Smooth Cat's-ear (*Hypochaeris glabra*) - IUCN Red List, Vulnerable - {Plant Life Score 7}



Fig. 34. Smooth Cat's-ear closes up tightly when the sun goes in.

Found in one large area labelled KH1 in Ragged Arse, this is Catchfly likely to do well as long as the sward is kept short enough. However, if the sward is kept short all year round, year after year, then many other species will decline, showing the level of balancing required with grazing.

Annual Knawel - (*Scleranthus annuus*) - IUCN Red List Endangered and Section 41 species - {Plant Life Score: 8}



Fig. 35. Annual Knawel past its best by midsummer.

The highest scoring arable plant of the survey was also found in the area listed as KH1 in Ragged Arse. Richard Carter also spotted this plant to the south, perhaps somewhere along the railway line, but the records were not available at the time of writing.

The following three species with conservation status were not mapped in detail as they were too numerous to do so with any degree of accuracy.

- Common Cudweed, Near Threatened, 6
- Field Woundwort, Near Threatened, 6
- Corn Spurrey, Vulnerable, 7

3.7 - Arable Plant Index

Tab. 3. List of the scarcer plants at Ken Hill, there arable plant indices and whether they were found in grassland, arable or both. That is specifically where they were found at Ken Hill during the survey and does not necessarily mean they are only found in that habitat.

Species	Index	Arable or grassland
Smooth Cat's-ear	7	Grassland only
Annual Knawel	8	Grassland only
Common Cudweed	6	Abundant in both habitats
Corn Spurrey	7	Mainly in arable but in short bare grasslands too
Field Woundwort	6	Scattered around the site in arable scenarios
Night-flowering Catchfly	7	Recorded in both, although mainly in arable
Hound's-tongue	N/A	Recorded in the arable only BUT this plant does very well in disturbed grassland
Stinking Chamomile	7	Widespread but all records in arable places
Dwarf Spurge	6	Arable only but found east of main road too.
Corn Marigold	7	Widespread but all records in arable places
Prickly Poppy	7	Only found in one field to the south where Bluebells are grown
Bur Chervil	3	Mainly in the Bluebell field to the south
Rye Brome	7	One field to the south
Corn Mint	1	Mainly in one arable field to the west but does grow well in grassy places too
Bugloss	1	Scattered in both
Sharp-leaved Fluellen	2	Occasional but only in arable areas
Henbit Dead-nettle	1	Arable areas only
Black-grass	2	Arable areas, mainly in Winter Wheat crop
Small-flowered Cranesbill	2	Arable and grassy areas
Common Stork's-bill	1	Arable and grassy areas
Dwarf Mallow	2	Arable and grassy areas
Smooth Tare	2	Arable and grassy areas
Wild Radish	1	Mainly arable
Field Madder	1	Frequent in both
Flixweed	3	Arable only
Gold-of-pleasure	5	One arable field only
Black Mustard	2	Arable only
Green Field Speedwell	1	Arable only
Grey Field Speedwell	2	Arable only
Slender Parsley-pert	1	Both

Common Broomrape	2	Grassland only
Hoary Cinquefoil	N/A	Grassland only
Shepherd's-cress	N/A	Grassland only
Hoary Mullein	N/A	Grassland and verges only

An arable plant index of 105 means that the site is internationally significant for arable plants, on whatever soil type it is assessed. Rising to 113 if the historic records of Red-tipped Cudweed (that were not found in 2020 either by the author or Richard Carter).

Red-tipped Cudweed could reappear and an effort to search for it in late summer should be made from time to time. Additionally, Small-flowered Catchfly is present just a few metres from the site, to the south of the Beach Road and this could eventually be found on the southern part of the rewilding area, although it seems unlikely as this has not happened yet. If suitable swards are produced in the project, it may be worth considering a simple introduction from the adjacent site as the plant appeared abundant there in 2020.

Tab. 4. Additional records from 'regenerative agriculture' part of Estate in 2019.

Additional arable plant species recorded on the 'regenerative agriculture' portion of the Estate but not in the rewilding area by Natural England staff in 2019.

Species	Index	Arable only?
Narrow-fruited Cornsalad	8	Most likely arable only
Rough Poppy	3	Most likely arable only
Small Toadflax	1	Most likely arable only

The additional 12 points brings the total Estate to 117 (125 if historic records are counted). This is an incredibly high score but according to NE and Plantlife is not unheard of in this part of Norfolk It does however reflect the Estate's importance for this group of plants. A more thorough arable plant survey of the 'regenerative agriculture' part of the Estate is suggested.

4 - Conclusion

With nearly 50 NVC communities present, the site is exceptionally complex. The site is clearly internationally significant for its arable plant assemblage and beyond this has a number of other vascular plant species that have conservation status on the more acidic soils. Both of these assemblages are mainly associated with the light, sandy soils that are found scattered throughout the site. Although it is likely that some losses from the former suite of species, those associated with arable landscapes, are likely to occur, there are opportunities for bare ground creation through livestock manipulation (pulse grazing) and possibly through rootling of pigs. This is however, difficult to predict and there is no guarantee they will graze or rootle in these areas.

The second assemblage, those species associated with acid-grassland and heathland, are likely to thrive in the new regime as coarse grasses will be grazed allowing for more germination space of poor competitors.

5 - Discussion and habitat management recommendations

Many of the 'OV' NVC communities are likely to disappear from the rewilding area with the removal of agriculture. Whether the plants that exist only in these communities in the rewilding area can persist will depend on the nuance and flexibility of the grazing that is put in place. Having the same number of animals in the same compartment size is unlikely to create suitable space for these plants.

The plants that occur in the grassland and those that occur in both habitats are likely to continue to do well given a suitable grazing regime and it is hoped they will thrive and spread to field centres. Over time, a closed sward will likely push these species out and this could happen if there are not periods of greater activity in grazing or if the pig rooting is not adequate or in the right areas. It may be, given that many of these plant species are present to the east of the site in the 'regenerative agriculture' part of the Estate, that this is considered an acceptable loss.

Generating suitable bare ground through grazing is a fine balancing act. It's very hard to achieve in a large extensive grazing block with a similar density of animals year after year without simultaneously destroying anything that germinates in the bare ground they created. That is why a pulsed grazing plan is far more likely to work, with the pauses in grazing being as key to the desired effect as the periods of grazing themselves. Equally using something like mob grazing would also create the desired results and would also hugely benefit other taxa. If this is not possible then compartmentalising the site is an option, or moving the animals on from their favourite areas as they develop, on a regular basis. All these methods are in some way trying to emulate the predator/prey relationship that is now totally absent from the UK landscape.

If a decline in arable plants across the rewilding area is shown then some level of mechanical intervention should be investigated to create some bare ground of a suitable nature or adapt the grazing regime accordingly. As mentioned in the invertebrate survey, having the ability to vary grazing density across the site, both spatially and temporally, will be of great benefit to a wide range of flora and fauna.

Woodland

It may be worth cutting the bramble that is growing in the cleared area of pasture woodland for a few years to allow the livestock to browse the softer shoots that grow up. This may help push the sward under the trees here to something grassier. The dense carpet of bramble here is unlikely to change with grazing alone as it is now.

Heathland creation could be investigated to the extreme south of Ken Hill Wood.

Heathland

As mentioned above, small scale scraping is of great value and should be continued until is confirmed that the livestock have picked up the slack.

Acknowledgements

Many thanks to Richard Carter for accompanying me around the site one evening in summer 2019 and confirming the identify of Rye Brome. Thanks also to David Streeter for his help with some of the undescribed vegetation communities present. A huge thank you to everyone at the Estate for commissioning me to do the survey, especially for Dom Buscall's understanding on the late submission of this report. Also, a huge thank you to the Padwicks for putting me up throughout the survey season of 2019.

References and bibliography

Lyons, G. (2020) *A baseline vegetation structure and composition survey of the Ken Hill Estate rewilding area*. Unpublished report to Ken Hill Estate.

Rodwell, J. S. (1995) *British Plant Communities Volume 4 - Aquatic communities, swamps and tall-herb fens*.

Rodwell, J. S. (2000) *British Plant Communities Volume 5 - Maritime communities and vegetation of open habitats*. Cambridge University Press.

Rodwell, J. S. (2000) *British Plant Communities Volume 5 - Maritime communities and vegetation of open habitats*. Cambridge University Press.

Rodwell, J. S. (2000) *British Plant Communities Volume 5 - Maritime communities and vegetation of open habitats*. Cambridge University Press.

Rodwell, J. S. (2000) *British Plant Communities Volume 5 - Maritime communities and vegetation of open habitats*. Cambridge University Press.

Rose, F. (1989) *Colour Identification Guide to the Grasses, Sedges, Rushes and Ferns of the British Isles and north-western Europe*. Viking.

Stace, R. (2019) *New Flora of the British Isles - fourth edition*. Cambridge University Press.

Swan, E. (2020) *Arable plant survey*. Unpublished report from Natural England.

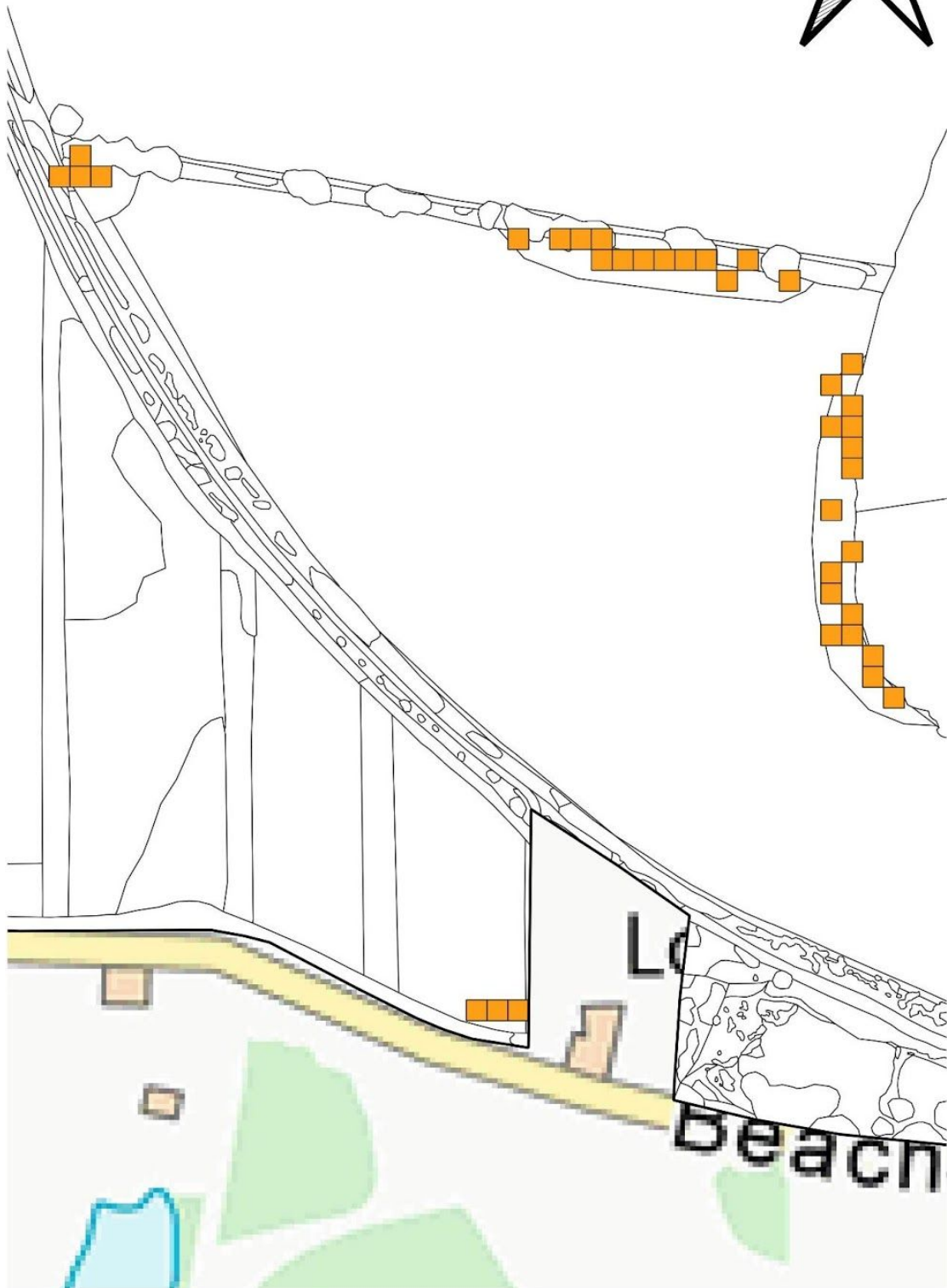
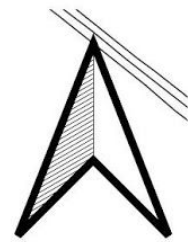
https://www.plantlife.org.uk/application/files/1315/1784/3682/Important_Arable_Plant_Areas_-_Outstanding_assemblages_B.pdf last accessed 24th October 2020.

Appendices

Appendix 1 - Rare and scarce species maps



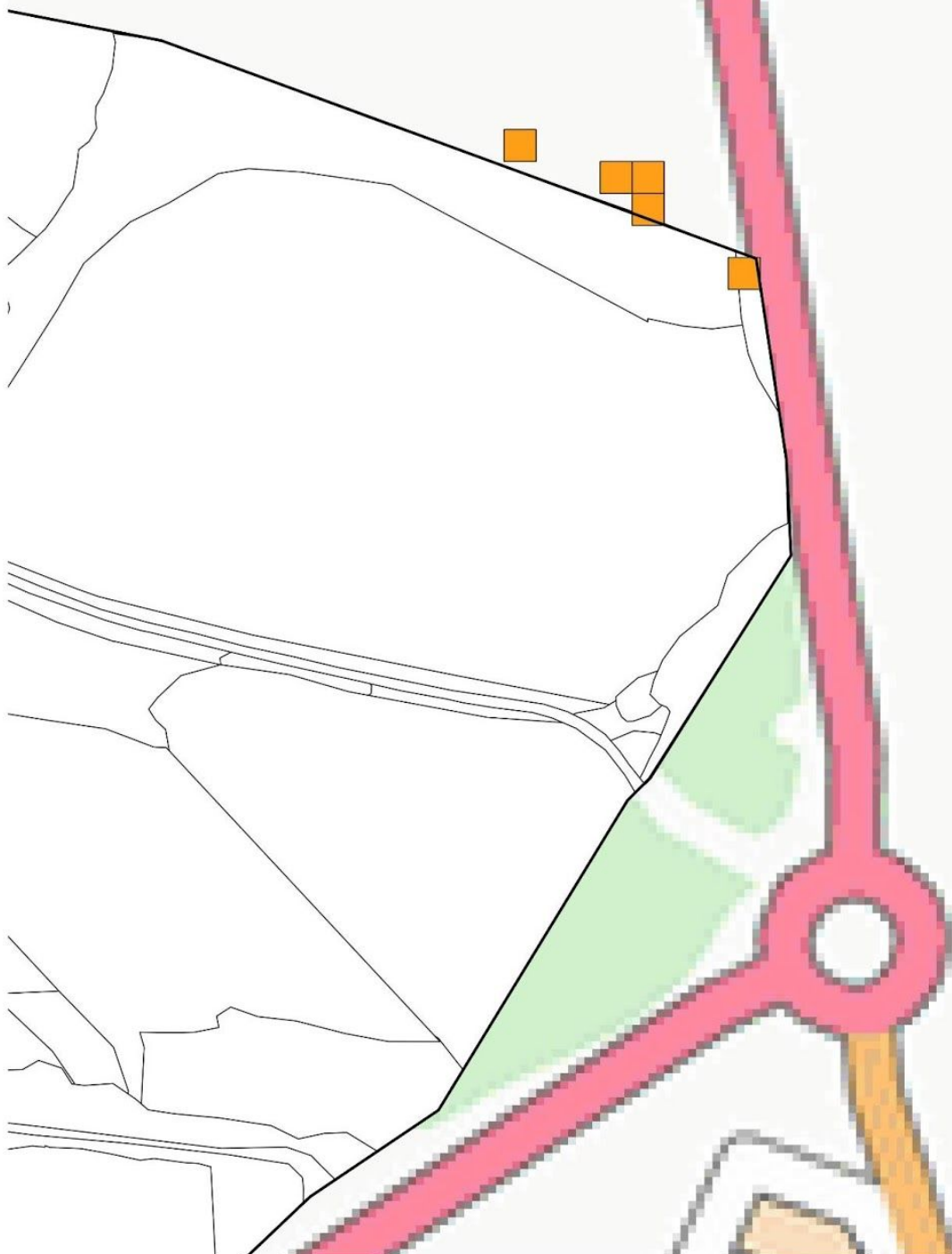
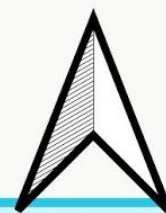
Corn Marigold - south



(c) Ordnance Survey 2020

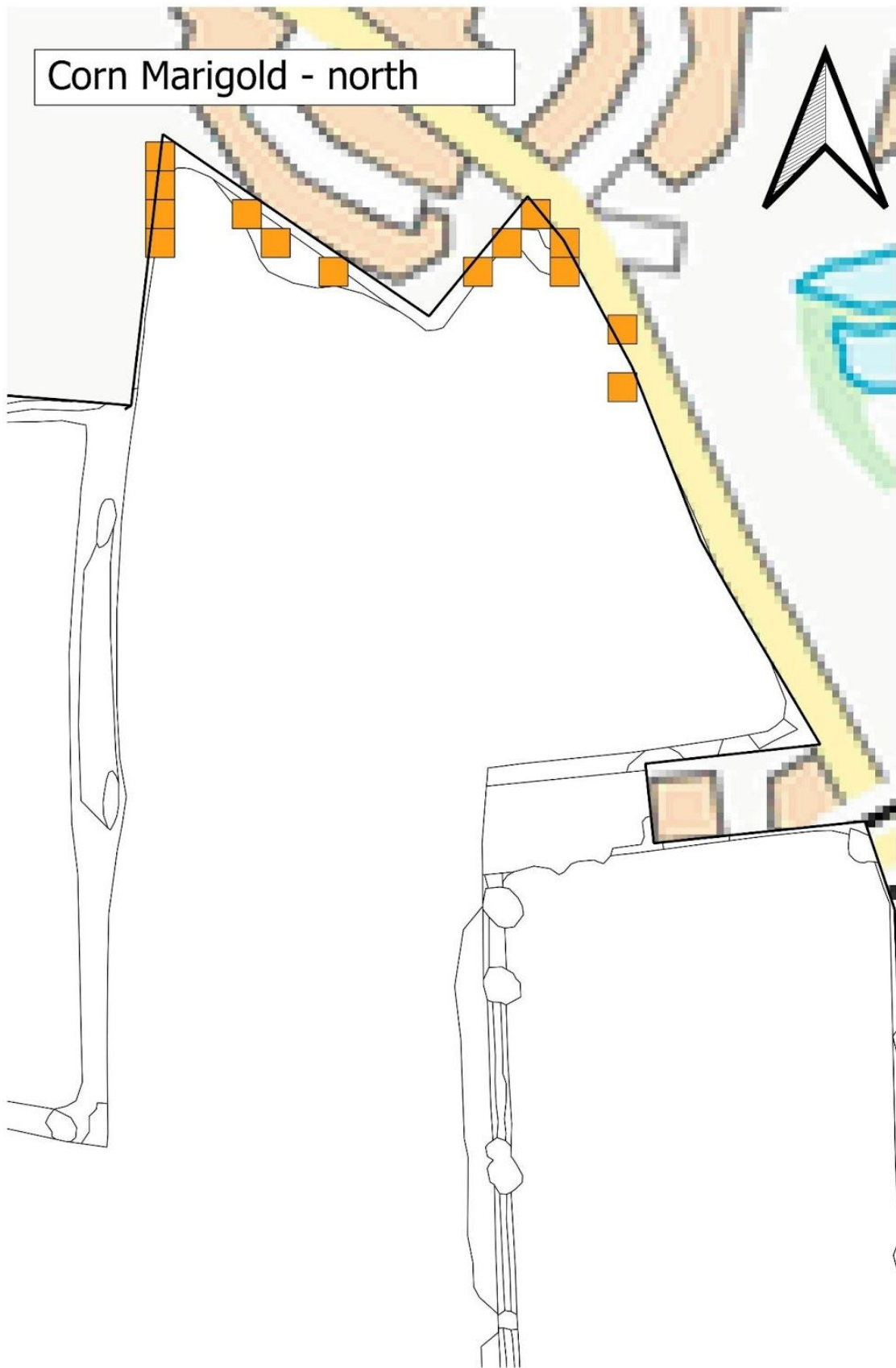
0 50 100 m

Corn Marigold - east



(c) Ordnance Survey 2020

0 50 100 m



(c) Ordnance Survey 2020

0 50 100 m



Dwarf Spurge - north



Dwarf Spurge - west

(c) Ordnance Survey 2020

0 50 100 m



Gold-of-pleasure

(c) Ordnance Survey 2020

0 50 100 m



(c) Ordnance Survey 2020

0 50 100 m

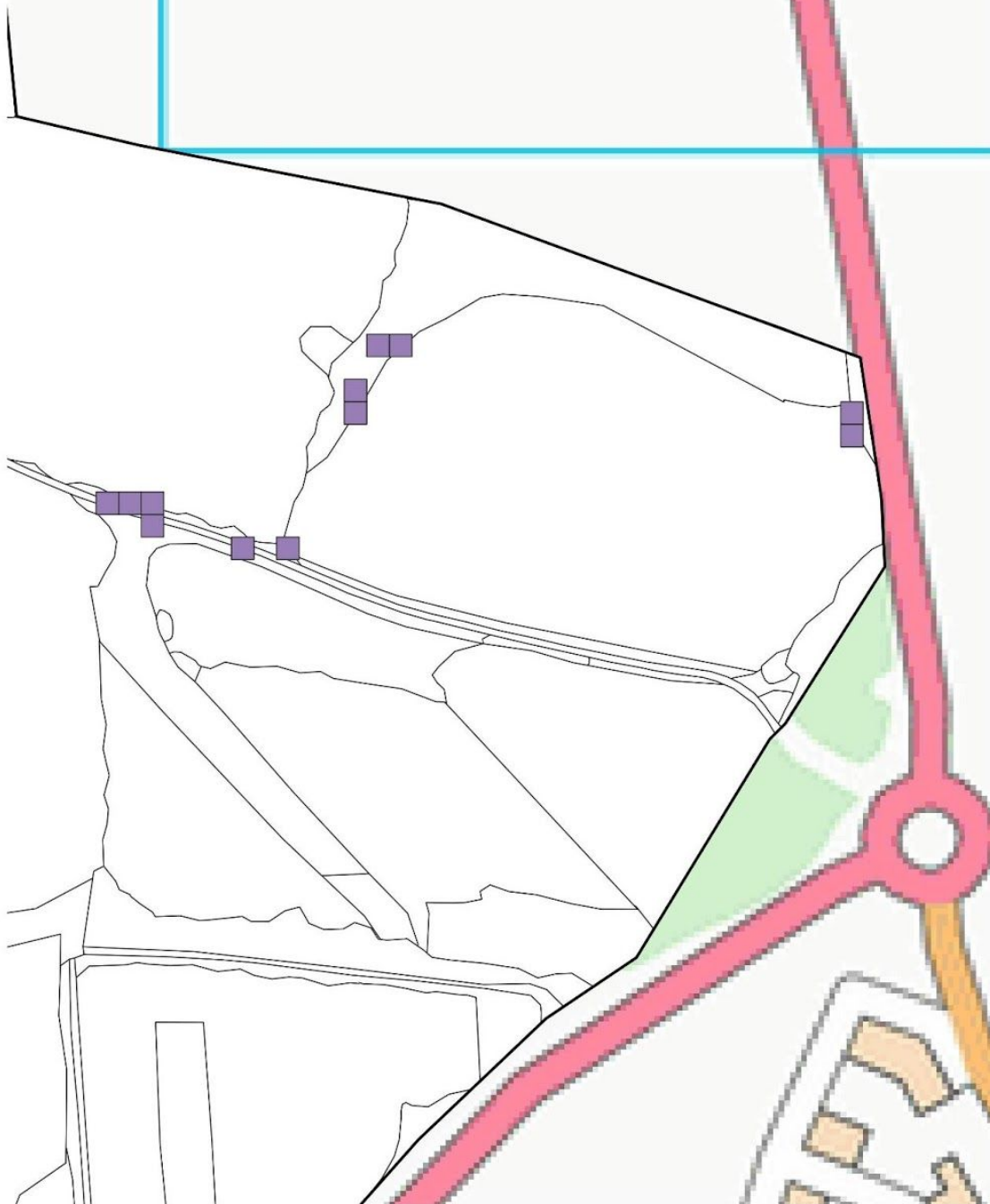
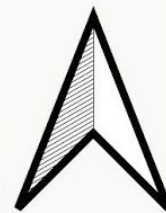
Hoary Cinquefoil



(c) Ordnance Survey 2020

0 50 100 m

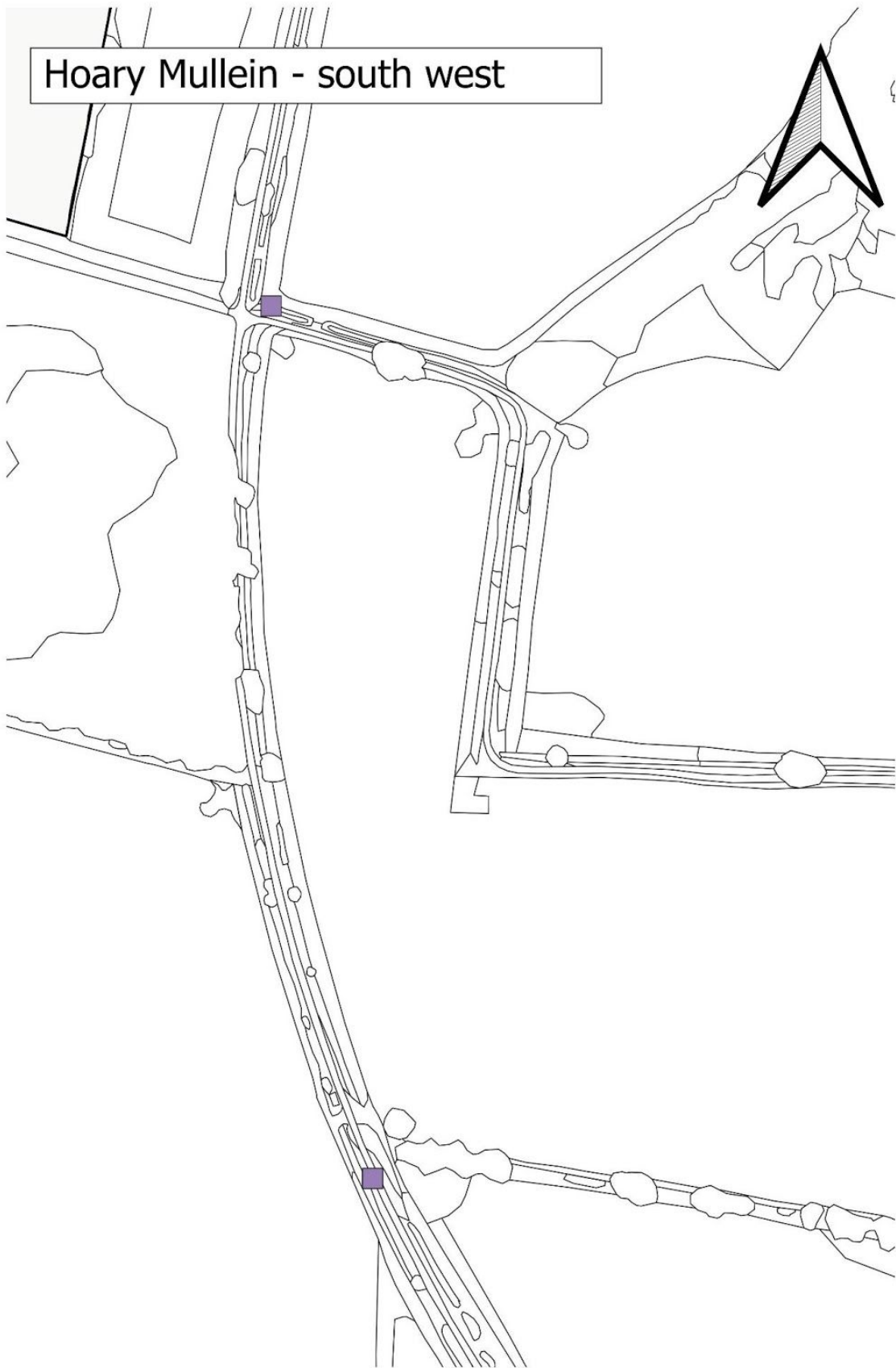
Hoary Mullein - east



(c) Ordnance Survey 2020

0 50 100 m

Hoary Mullein - south west



(c) Ordnance Survey 2020

0 50 100 m



(c) Ordnance Survey 2020

0 50 100 m

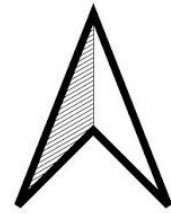
Night-flowering Catchfly - north



(c) Ordnance Survey 2020

0 50 100 m

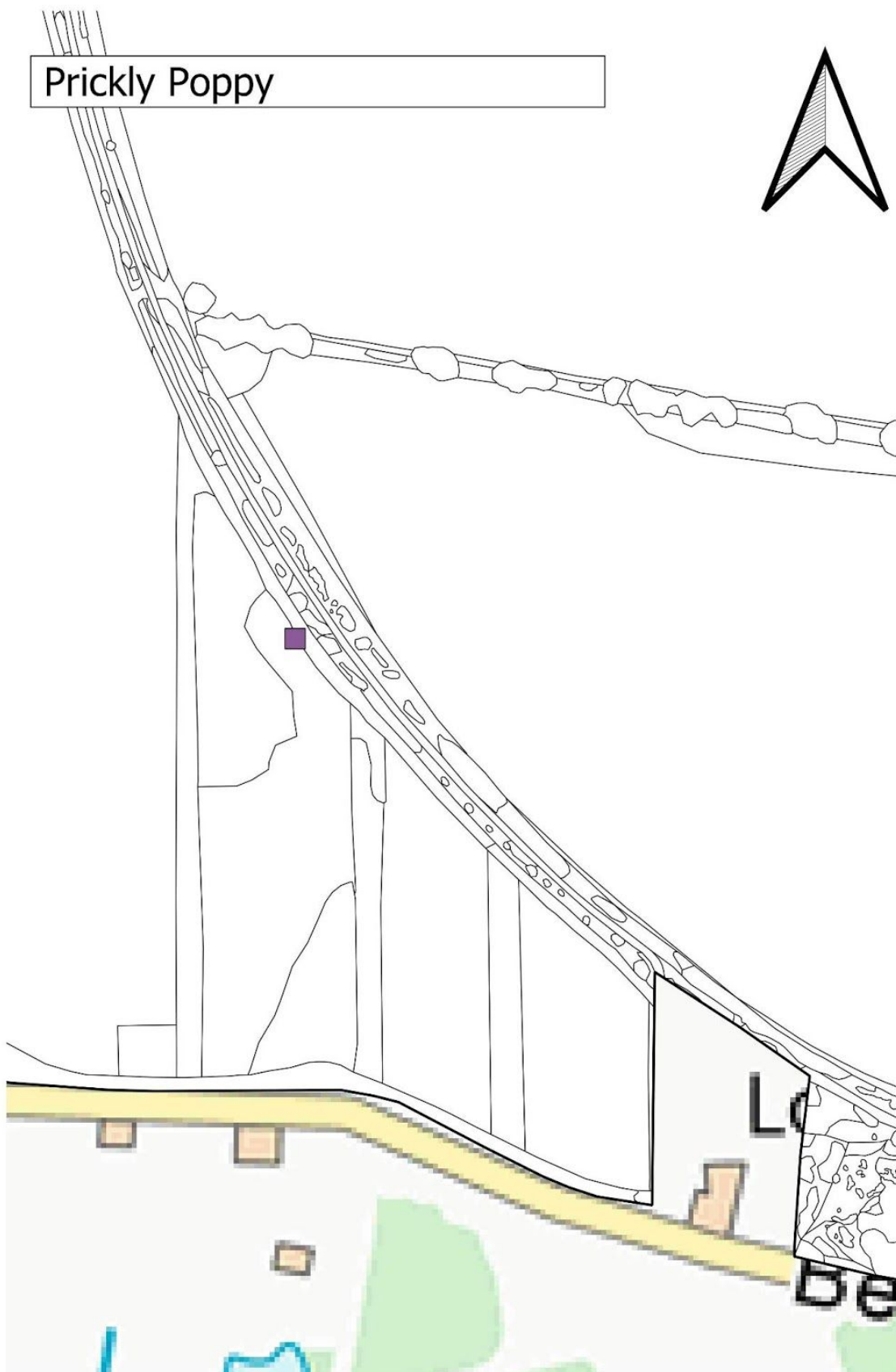
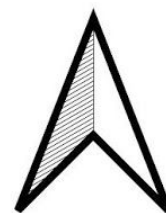
Night-flowering Catchfly - south



(c) Ordnance Survey 2020

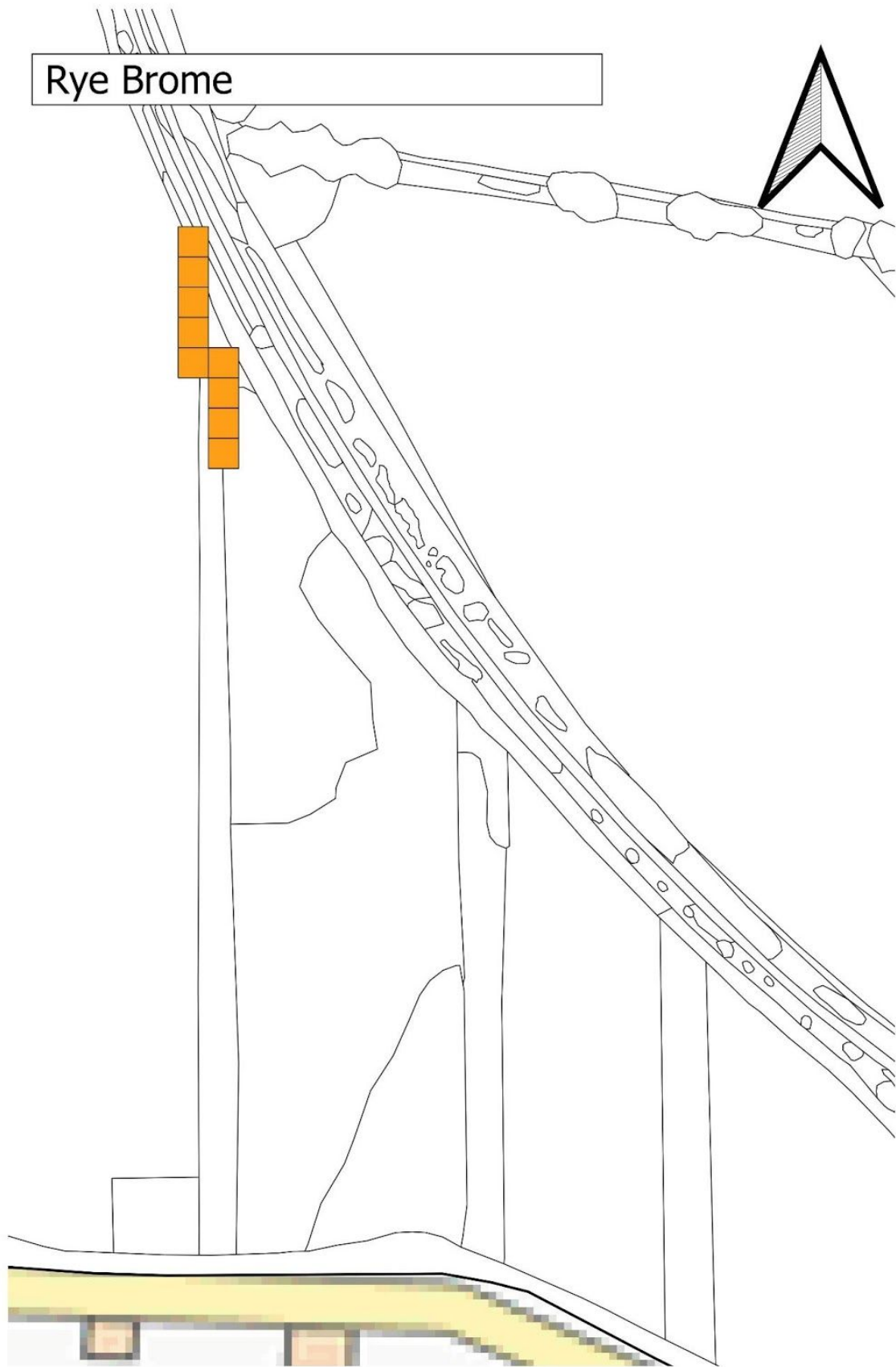
0 50 100 m

Prickly Poppy



(c) Ordnance Survey 2020

0 50 100 m



(c) Ordnance Survey 2020

0 50 100 m

Shepherd's-cress



(c) Ordnance Survey 2020

0 50 100 m



Stinking Chamomile - north



(c) Ordnance Survey 2020

0 50 100 m