

An Alternative Vision for the Matlock Wolds Site

Holistic Restoration

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Contents

Summary	2
Introduction	6
Issues and Conflicts with the Proposed Development	6
The Site	9
<i>The Site's Wildlife</i>	13
Improved Grassland	14
Species Rich Grassland	15
Wet Flush and Rush Pasture	16
Hedges	17
Birds	18
Bats	19
<i>The Sites Flood Risk</i>	19
The Alternative Proposal	21
<i>The Underpinning Science</i>	21
<i>The Alternative Site Design</i>	23
People First Regions	25
Parkland, Scrub Nooks and On	25
Contour Tree Strips	
Grasslands	26
Water	27
Nature First Regions	28
Hedges and Scrub	28
Grassland	28
Water	29
Conclusion	30
Site Species List and Scientific Names	30
References	34

Summary

The Wolds site is part of the Moorland Fringe of the Dark Peak National Character Area (NCA). In 2015 Natural England identified the following goals for this area;

- enhance moorland fringe habitats, to increase species-rich grasslands and scrub
- encourage the creation and expansion of a more ecologically connected patchwork of grasslands - unimproved pastures, rushy pastures and species-rich pastures and meadows

These goals sit within a larger vision for the Dark Peak which acknowledges the challenges this region faces in relation to 'the management of water and flooding' and the potential to 'increase the extent of native woodland, scrub and trees, and manage existing tree cover to provide a range of benefits including ... to store carbon (and) reduce run-off' (Natural England, 2015).

Sites such as the Wolds can play a tremendously important role in mitigating against both flooding and climate change due to their mature matrix of trees, hedges, wet grassland and flush.

The Wolds, and similar sites, are characterised by several highly valuable habitat types for wildlife including flushes (a Peak District Local Biodiversity Action Plan (BAP) Priority Habitat) that 'though small they have specialised flora and fauna and make a great contribution to the diversity of the overall moorland habitat' and 'species rich neutral pastures and hay fields (which) are rare but relatively species rich where they do occur ... Wet or marshy pastures can provide important feeding or breeding grounds for wading birds.' ([Natural](#) England, 2015).

The wildlife that the protected habitats of the Wolds support is no less important.

Of the bird species recorded dunnock, house martin, bullfinch and snipe are Amber listed while redwing, fieldfare, linnet, starling, song thrush, house sparrow, marsh tit and mistle thrush are Red listed.

Starling, linnet, house sparrow, song thrush and bullfinch are additionally included within NERC Act 1996 and redwing and fieldfare listed on Schedule 1 of the Wildlife and Countryside Act. Snipe are a Priority Species under the Peak District Local BAP and are also listed within Annex 1 of the Birds Directive 1979.

Additionally Amber listed reed buntings have been observed on multiple occasions as have red kites which, although Green listed within Britain, are 'Near Threatened' on the global IUCN Red List. Red listed hen harriers have also been observed on site with a representative from the RSPB suggesting that they may utilise the site as a stop off on migration routes to the coast.

In addition to the bird species recorded during the survey periods many other Red and Amber listed species have been recorded within 1km of the centre of the site (NBN atlas, 2021).

These include the Red listed lesser redpoll, willow tit, tree sparrow, grey wagtail, cuckoo, yellowhammer and skylark and Amber listed greylag goose, pink footed goose, meadow pipit, dunlin, redstart and willow warbler.

The site is frequented by many mammal species including common pipistrelle, noctule, brown long-eared and soprano pipistrelle bats. All bats are Priority Species under the Peak District Local BAP and listed in Annex IV of the Habitats Directive. Soprano pipistrelle, noctule and brown long-eared bats are additionally Species of Principle Importance under NERC Act 1996.

Other mammals have also been recorded on or around the site including brown hare and European hedgehog (NBN atlas, 2021), both are Priority Species under the UK Post-2010 Biodiversity Framework with hedgehogs additionally classified as 'vulnerable to extinction' by the IUCN Red List for British Mammals.

In addition to birds and mammals there are records of slow worms within 0.5 km of the centre of the site and common lizards within 1 km of the centre of the site (NBN atlas, 2021). On the 28/08/21 a common lizard was photographed and on the 21/03/21 a

common toad was photographed, both adjacent to the site. Slow worms, common lizards and common toads are all Priority Species under the UK Post-2010 Biodiversity Framework with populations of all three in decline due, in large part, to habitat loss.

The site is comprised of a mosaic of species rich grassland, mature hedgerow and wet flush habitats offering a wide array of niches for a number of invertebrates. As yet no survey has been carried out by the developer to assess invertebrate diversity on site despite the advice to 'survey for protected invertebrates if distribution and historical records suggest that they may be present' (Natural England, 2014). The National Biodiversity Network Atlas, recommended as the 'principle source of biological data' (Natural England, 2014) lists 315 species of insect alone recorded within 1km of the centre of the site including the white-letter hairstreak butterfly which is classed as endangered by the Joint Nature Conservation Committee due to a 50 to 79% population decline over the last 10 years (JNCC, 2010). The white-letter hairstreak is also a Priority Species under the UK Post-2010 Biodiversity Framework.

Planning permission can be refused if biological surveys;

- do not provide enough evidence to assess the likely negative effects on protected species. The lack of any invertebrate survey, despite records of endangered invertebrates in close proximity to the site, constitutes insufficient evidence to assess the likely negative effects of development on protected species.
- are carried out at the wrong time of year. The reptile survey carried out by the developer does not clearly meet these criteria. The time of year and time of day are both crucial when interpreting reptile surveys because, as ectotherms, reptiles are highly influenced by external temperatures. The only survey times recorded for the reptile survey submitted are for the 2015 survey year of which 6 of the 7 recordings are in a less than optimal month (Froglife, 2015). The photographic evidence of common lizard adjacent to the site suggests that these surveys have been ineffective in their attempts to detect reptile presence on site.

- are not up to date. The winter bird survey data which was compiled over a single season, the winter of 2016 to 2017, is arguably both insufficient to accurately estimate winter bird populations and out of date.

It is the authors opinion that insufficient evidence exists to accurately assess the level of likely impact upon protected species utilising the site and that planning permission should be declined unless such evidence can be provided in full.

Further to a lack of evidence that would allow a full appraisal of the impact of the development upon Protected Species, for a development to proceed that would disturb any species listed under Annex IV of the Habitats Directive which includes all bat species, the development has to be 'in the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment' (European Commission, 2007).

The impact of this development is likely, in the author's opinion, to contribute to both the likelihood and severity of future flooding of the properties to the south of the site, have a detrimental impact upon the global climate and negatively impact Protected Species. The authors consider the exacerbation of both flooding and climate change combined with inevitable habitat loss and its impacts upon already vulnerable species to stand in direct opposition to the interests of public health, public safety, public interest and beneficial consequences for the environment.

In light of this an alternative plan for the site is proposed that enhances its wildlife value, increases its ability to buffer against both floods and droughts, captures carbon dioxide and enhances the local area for far reaching public benefit.

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Introduction

Issues and Conflicts with the Proposed Development

The site is approximately 23.6 ha (58.3 acres) and developers are proposing the construction of over 400 houses as well as shops including a hair dressers, newsagent and fast food outlet on approximately 28 ha of the site. The remainder of the site is proposed to remain as open space allocated to gardens, parks, play areas, amenity and civic space (3.6 ha) as well as approximately 5.7ha retained as a proposed Countryside Park.

There are many and varied issues with the development that have been highlighted including issues around increased traffic movements and the potential danger this poses to pedestrians including children going to Highfields School, the difficulties in walking or cycling to the amenities within Matlock due to the distance and elevated position of the site above the snowline and the extended period of disruption that the construction will cause.

The development will also have a profound effect on the wildlife that currently lives within, and is reliant upon, the site and also that which inhabits the wider ecosystems of which the site is a part including areas that support protected species such as snipe, slow-worms and spotted flycatchers.

The development will also heavily impact how the site interacts with water including rain that drains onto it from higher ground and ground water that is pushed up through the site's complex underlying geology.

This report will focus on how the site interacts with local wildlife, including protected species, and how it interacts with water movements especially in relation to surface water flooding.



The site. Anonymous source.

When it comes to both wildlife and flooding impact the National Planning Policy Framework (NPPF) is very clear.

Where wildlife is concerned;

“Planning policies and decisions should contribute to and enhance the natural and local environment by:

- *a) protecting and enhancing valued landscapes, sites of biodiversity or geological value and soils (in a manner commensurate with their statutory status or identified quality in the development plan);*
- *b) recognising the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services – including the economic and other benefits of the best and most versatile agricultural land, and of trees and woodland;*
- *d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;“*

para 170 NPPF 2019

“To protect and enhance biodiversity and geodiversity, plans should:

- *a) Identify, map and safeguard components of local wildlife-rich habitats and wider ecological networks, including the hierarchy of international, national and locally designated sites of importance for biodiversity, wildlife corridors and stepping stones that connect them; and areas identified by national and local partnerships for habitat management, enhancement, restoration or creation; and*
- *b) promote the conservation, restoration and enhancement of priority habitats, ecological networks and the protection and recovery of priority species; and identify and pursue opportunities for securing measurable net gains for biodiversity.”*

para 174 NPPF

Where flooding is concerned;

“All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change. – so as to avoid, where possible, flood risk to people and property.”

para 157 NPPF

“When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere.”

para 163 NPPF

The guidance is clear on how both wildlife and flooding should be approached within the NPPF and this report will suggest an alternative use of the site in line with these objectives.

This report will propose the creation of a diverse, wild landscape that mitigates against flooding, produces good food, is integrated with outdoor recreation and education and contributes to and enhances the natural and local environment.

The creation of such a site would protect and enhance the unique character and charm of the Derbyshire Dales whilst safeguarding the site's endangered and protected wildlife and restoring its priority habitats. The protection of this site would also enhance the value of Matlock Moor and Matlock Forest local wildlife sites (LWS) by enhancing the network of habitats that stretch to the north of Matlock delivering on the aims of '*establishing coherent ecological networks that are more resilient to current and future pressures*'.

It also harnesses the site's potential for delivering ecosystem services especially in the form of flood mitigation and carbon sequestration. It provides opportunities for nature education, something that has been drawn into sharper focus recently with the proposal of a GCSE in Natural History, and nature connection linked to improving both the physical and mental health of people through lowering stress levels and raising self esteem (Mind, 2018).

The Site

The site sits high up in the landscape above the spa town of Matlock. It slopes from 247 m Above Ordnance Datum (AOD) in the north west corner to 210 m AOD in the south east. The larger area within which the site sits is on the fringe where the lowlands and uplands meet and is characterised by seasonally wet acid grassland most often used for grazing. Above the site the landscape is more characteristic of Dark Peak moorland with two notable local wildlife sites, Matlock Moor and Matlock Forest, embedded within a larger matrix of habitats.

A ridge of free draining, acidic sandy soil atop Chatsworth grit supports dry heath communities directly to the north of the site which freely sheds water onto the site itself. The site is mainly characterised by high clay, slow draining soils atop rocks of the Marsden formation which include impervious mudstone and siltstone. In general the site is gently sloped and roughly south facing with a valley crossing it running from the north west boundary towards the south east boundary. Below and to the south of the site is the town of Matlock which has experienced flooding in the past and surface flooding associated with runoff from the site.



The site in the landscape. Image by Wolds Action Group

The varied topography of the site and how this has interacted with past management has created three areas of different character - the valley slopes categorised as semi-improved/degraded species rich grassland, the wet flush and rush pasture in the valley bottom and the improved valley tops.

All three areas are generally well vegetated but the valley sides show areas of bare soil and slipped turf, evidence of poaching by cattle over wet months. The valley sides also have considerably shorter and sparser vegetation than either of the other areas showing obvious signs of overgrazing as recorded in Land at Gritstone Road and Pinewood Road, Matlock - Environmental Statement, Volume 1 (ES1).



The Matlock Wolds Now



Mature trees, including ash and oak, and mature hedges are dotted across the site with some especially mature and diverse grown out hedges marked 1 and 2 on the map (above). These hedges are magnificent wildlife habitats and something that has sadly disappeared from much of our countryside. Hedgerows are now classified as UK Biodiversity Action Plan (BAP) Priority Habitats with all hedgerows included, provided that they have at least 80% native woody vegetation which the hedgerows present within the site conform to (ES1).

The site is crossed by two main water ways associated with areas of flush, rush pasture and wet woodland, again something that has largely vanished from the wider countryside and also classed as BAP priority habitats. The areas of flush are punctuated by standing pools of water and steadily flowing shallow channels embedded within damp and boggy ground (ES1).

The site is prone to water logging as a result of its underlying geology and soils (discussed in more depth below) and parts of the site have been classified as at *'high risk of flooding from surface water'* by the Environment Agency. The properties to the south of the site are also classed as *'at a high risk of surface water flooding as they are on the overland flow route'* (Environment Agency, 2013).

The Site's Wildlife

The site is well embedded in the landscape and forms part of the habitat matrix which includes Matlock Moor and Matlock Forest LWS. The tree strip to the western boundary of the site, and the mature hedges and scrub running across the site, link it into larger sections of mature deciduous and mixed woodland including Hurker Wood and Goodwin's Wood. There are also areas of semi improved grassland and dry heath running up the ridge to the north and along the rides within the Forestry Commission plantation that form stepping stones of habitat to Matlock Moor and beyond. The larger area, of which this site is a part, is known to house nightjars, snipe, woodcock, curlew, cuckoos, spotted flycatchers, common lizard, slow worms and grass snakes (all of which are red or amber listed or BAP priority species). The site itself provides a buffer between the town of Matlock to the south and the valuable species and habitats found to the north.

Improved Grassland

These fields are dominated to different degrees by grasses including Yorkshire fog, perennial rye grass, crested dog's tail, meadow foxtail, creeping bent, sweet vernal grass and cock's foot with flowers including creeping and meadow buttercups, white and red clover, common mouse-ear, dandelion, ribwort plantain, cuckoo flower, spear thistle, daisy, common chickweed, lesser trefoil, yellow rattle and common sorrel with localised patches of creeping thistle, nettle and bird's foot trefoil (Botanical Species List, 2016 and 2020).

The fields to the far south of the site are also improved grassland but managed in a different way with tight grazing by horses and sheep resulting in similar species but with an abundance of white clover.

These fields are sufficiently diverse that restoration to species rich grassland is a strong possibility with appropriate grazing or mowing regimes (Magnificent Meadows, 2021).



Nectar rich field sward. Anonymous source

Species Rich Grassland

The northern facing valley slopes are similar to the improved grassland above them but with a higher density of herbs (BSL). The southern facing valley slopes support a much more diverse assemblage of plants including those more typically associated with unimproved grasslands. There are a wide range of grasses with most of the species from the improved grassland present and the addition of false oat grass, meadow fescue, red fescue and sheep's fescue along with field woodrush. There are also additional species of herb including pignut, bugle, germander speedwell, heath speedwell, harebell, common cat's ear, common vetch and bush vetch, common dog violet and barren strawberry. Foxgloves, tormentil, mouse ear hawkweed and hedge bedstraw run along the boundaries of the dry stone walls. The dry stone wall adjacent to the wet woodland adjoining the site in the north east corner perches atop a low bank on which mouse-ear hawkweed, barren strawberry, English bluebell, foxglove, greater stitchwort and wood sage grow.

The heavy grazing by cattle causes severe defoliation to herbs removing flower heads and limiting seed production which has knock on effects to pollinators and seed eating birds and small mammals. It is possible that if grazing were suspended on the site then a greater diversity of herbs would have presented themselves for survey.

Over 90% of species rich grasslands were lost during the 20th century (The Wildlife Trusts, 2021) making remaining areas, such as this, highly valuable for wildlife.



Species rich grassland. Anonymous source.

Wet Flush and Rush Pasture

The main valley bottom is dominated by wet flush and rush pasture fed by seepages to the north of the site and also from within the site itself. The steady flow of water supports soft rush, hard rush, Yorkshire fog, creeping bent, tufted-hair grass and reed sweet grass as well as herbs including cuckoo flower, common sorrel, wavy bittercress, greater willow herb, greater birds foot trefoil, marsh thistle, broadleaf dock and gypsywort (BSL).

Cattle grazing has damaged the wet flush habitats through defoliation, compaction, poaching and eutrophication caused by deposits of urine and faeces (ES1).



View across an area of wet flush. Anonymous source

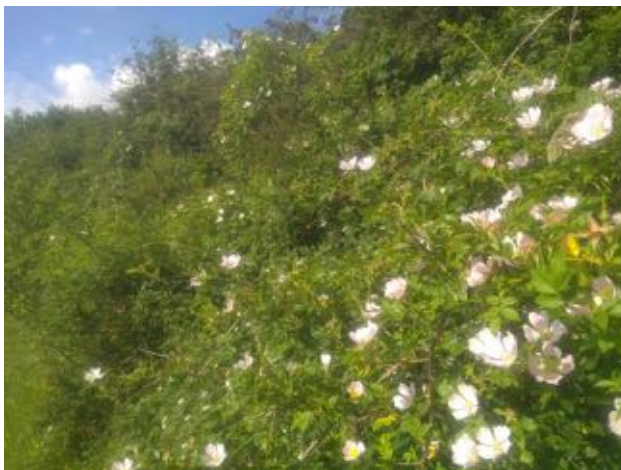
The diversity of grasses and herbs present throughout the site will support numerous insect species including moths and butterflies. For example cocksfoot alone is the larval food plant of the Essex skipper, large skipper, small skipper, meadow brown, ringlet and speckled wood butterflies all of which can be found locally. The herbs too support an array of butterflies

with common blue caterpillars feeding on bird's foot trefoil and white clover and green veined white and orange tip caterpillars feeding on cuckoo flower. Greater stitchwort is the food plant of the yellow underwing, marsh pug and plain clary moths and also provides much needed early nectar to a variety of pollinators. Other plants too, including the vetches, the trefoils, marsh thistles, foxgloves and clovers support a host of nectar and pollen seeking invertebrates. Creeping buttercup is a favourite of short tongued bees and germander speedwell of solitary bees while other insects such as hoverflies and soldier beetles prefer other plants including pignut. It is highly likely that the site supports a rich and diverse invertebrate fauna which as yet remains unstudied.

Hedges

Hedges provide a wealth of nectar and other resources for invertebrates including bees, butterflies and many other species with hawthorn, dog roses and brambles producing nectar and pollen as well safe nesting sites for many bird species.

Hedge 2, that runs along the eastern side of the valley, is mature with a thick base and an array of species including holly and hawthorn as well as elder, hazel and blackthorn with sprawling dog rose across much of it (ES1). Hedge 1, on the south western side of the valley, is similarly mature extending to 8m tall and 8m wide in some areas. The hedge is composed of holly, hawthorn, blackthorn, hazel, dog rose, elder and bramble. Below the hedges nestle male ferns, foxgloves, greater stitchwort and English bluebells along with ivy and nettles (ES1).



Diverse hedgerows supporting an array of species. Anonymous source.

The hedges offer an array of safe nesting sites adjacent to the invertebrate filled grasslands where many species of bird can successfully rear chicks. The hedges also offer overwintering sites for invertebrates and a steady stream of high energy food in the form of blackberries, elderberries, haws, sloes, hazel nuts, rosehips, ivy berries and holly berries for birds and small mammals over autumn and winter. Mistle thrush will hold a territory of a berry laden holly and guard it for the duration of winter and wood mice will shelter under the protection of hawthorn feeding on fallen haws. The small mammals and birds themselves are perfect food sources for sparrow hawks as well as kestrels and owls that visit the site and can be heard calling from adjacent woodlands (ES1).

Birds

Some of the birds that have been recorded in the Breeding Bird Survey, 2016, 2018 and 2020 include bullfinches which are amber listed and a BAP priority species. They feed on hedge buds over spring and then raise their young on the rich invertebrates on offer. Dunnocks, also amber listed, and red listed house sparrows and linnets move about the site feeding on invertebrates and seeds. Red listed song thrushes and starlings forage for snails and probe the soft flush for invertebrates on which to raise their young. Marsh tits have also been recorded on site, they are also red listed and feed on the high numbers of invertebrates and wild seeds.

A variety of other more common birds also make their home here including great tit, blue tit, chaffinch, chiffchaff, wren, long-tailed tit, jay, magpie, carrion crow, jackdaw, greater spotted woodpecker, blackbird, garden warbler, treecreeper, nuthatch, pied wagtail, greenfinch, goldfinch, collard dove, common whitethroat and lesser whitethroat. Other species including willow warbler, cuckoo, redpoll, meadow pipit and coal tit were recorded singing from the woodlands just to the north of the site and it's likely that they too benefit from the sites abundance.

Over winter the site becomes home to a different set of species that have been recorded in Wintering Bird Survey Results, November 2016 to February 2017. Snipe use the wet grassland for foraging and are not only amber listed but are listed in Annex 1 of The Birds Directive, 1979 and listed as a priority species in the Peak District local BAP. Redwings and fieldfares also arrive, coming to feed on the diverse array of berries that the mature

hedgerows provide as do mistle thrushes. Redwings, fieldfares and mistle thrushes are all red listed species. The more common birds including goldfinches also remain feeding on berries and seeds, including the seeds of ribwort plantain, that remain through most of the winter.

Bats

It's not just birds that are drawn to the resources offered by this site. There are numerous species of bat that come to harvest the rich invertebrate biomass available, often focusing foraging attention on the profusion of insects produced by the wet flush and rush pasture. Common pipistrelle and brown long eared bats roost around Matlock, some within 200m of the site to the south, and use the area as a foraging ground. Soprano pipistrelle, noctule and probably Daubenton's and Natterer's bats join them, focusing their attention along hedgerows and walls as well as above the wet flush (ES1). Common pipistrelle, among other species, also use the oak lined footpath along the western edge of the site as a commuting corridor between a likely roost to the south and feeding grounds to the north.

All bat species are priority species under the Peak District Local BAP and soprano pipistrelle, noctule and brown long-eared bat are listed as Species of Principle importance under the NERC Act 1996.

The Sites Flood Risk Potential

Above the site is a region of Chatsworth grit that functions as an aquifer holding a vast quantity of water within it. The majority of the site sits below this aquifer on top of rocks of the Marsden formation, complex formations of impervious mudstones and siltstones interbedded with porous sandstones. Where water moving through sandstone meets impervious mudstones and siltstones the water is likely to be forced to the surface as springs, seepages and flushes. It is very difficult to know exactly where the mudstones and siltstones lie in relation to the sandstones which makes predicting water movement on the site very difficult. The complexity of the underlying geology means that springs and flushes will shift over time and their likely movements are difficult to predict (Cheney, 2007).

Mudstones and siltstones also create impermeable formations below the soil surface which impede water infiltration and result in water logged soils above them.

The current management of the site exacerbates the problems surrounding surface water. A modern tractor exerts a pressure of around 12 psi on the ground while cattle, with their much smaller hooves, exert a pressure of around 25 psi when standing. This rises to 55 psi when they walk and can severely compact ground, especially wet or waterlogged ground, very quickly. The site is grazed relatively intensively for extended periods of time which results in soil compaction levels of between 700 to 830 psi on similar sites with average surface compaction levels of 560 psi. Above compaction levels of 300 psi plant roots struggle to penetrate soils and the ability of water to infiltrate into the ground diminishes rapidly. Rain falling onto compacted or waterlogged ground, underpinned by impervious rocks, struggles to infiltrate with rates of just over 1 cubic centimetre of water infiltrating per second recorded when water was held above the soil. On sloped sites such infiltration rates result in surface flows of water that, in this case, run off and down towards Matlock. These surface water flows are exacerbated by the high volume of water that drains down onto the site from the expanse of land to the north. In previous years this water has caused surface flooding on Amberdene, Bentley Close and Wellington Street, Matlock, and contributed to flooding of the Derbyshire County Council Chatsworth Hall site.



Flooding close to Cavendish Fields. 2017. Wolds Action Group.

The Alternative Proposal

The below proposal retains the many unique and appealing features of the site, enhances its wildlife value, reduces the likelihood of surface water flooding and creates a space for recreation, relaxation and education for local residents and visitors alike.

The Underpinning Science

This site represents a fragment of a bygone farming age. The fields are diverse, the hedges mature and the valley bottom is still wet flush. These habitats have all but vanished from the larger countryside but it is alongside these habitats that our wildlife co-evolved. Our wildlife populations are in free fall because these habitats are being systematically removed from our landscapes. In order to conserve and restore the populations of protected species, such as snipe, song thrushes, brown long eared bats and slow worms we need diverse mosaic landscapes. Landscapes where nectar and seed rich grasslands are in close proximity to mature trees and sprawling scrublands and where water is abundant. These landscapes also need to be large enough, and sufficiently connected to one another, that species can move about freely to replenish sub-populations and avoid long term localised extinctions. To maintain these landscape mosaics in the long run areas must evolve gradually as woodlands turn to wood pasture, grasslands to scrublands and wetlands to damp grassland, all kept moving by dynamic water and grazer pressure. Vast, joined up and self willed landscapes are at the core of British rewilding initiatives.

These very same landscape types also absorb significant quantities of carbon from the atmosphere (Rewilding Britain, 2019) and capture and store water (Rewilding Britain, 2020). The use of such landscapes to capture carbon is implemented under the banner of natural climate solutions (NCS) and their role in capturing water under natural flood management (NFM).

NFM techniques utilise vast mosaic landscapes creatively to find solutions to flooding, seeking to address the cause of flooding, not just deal with its effects. The shift of emphasis from building attenuation basins and flood defences that combat runoff to examining the land from which the water drains opens the door to far more creative and long term solutions to both flood and drought mitigation.

The potential of the hills to catch the rain that falls on them, slow it down and store it is vast. Healthy vegetated soils function as giant sponges absorbing water over rainy periods and releasing it steadily over dry periods. Plants aid water retention by intercepting and slowing incoming rain with their leaves and branches and increasing the surface roughness of soils which slows surface water flows. This gives water time to stand on soils while plant roots and soil life aid its infiltration by creating soft soils with networks of channels through which water can percolate.

Wetlands can also capture and hold phenomenal quantities of water. Their soils tend to be high in partially degraded organic matter and they support dense stands of plant growth, such as rushes, that absorb and slow water. A one acre wetland, only 30cm deep, can retain 1,250 cubic metres of water (Miller, 1992).

In short, NFM techniques rely on healthy and intact ecosystems to even out rainfall, absorbing water over very rainy periods and releasing it steadily over dry periods. As climate change progresses and rainfall gets ever more unpredictable these natural sponges offer us a good chance of mitigating against both floods and droughts. Crucially these ecosystems adapt and develop over time having no fixed upper limit of capacity, this makes them inherently more future proof than 'hard' infrastructure such as attenuation basins which tend to have solid caps on the quantity of water held.

NFM techniques rely upon alterations of site;

- **Vegetation** - Increased coverage of vegetation and increased levels of vegetation heterogeneity raise surface roughness and decrease surface water runoff speeds. Intensive grazing or mowing can have a very detrimental effect on an area's ability to slow water by removing much of the vegetation and creating a uniformly low sward.
- **Soil compaction** - Soil compaction results from heavy traffic on soils. It is decreased by plant roots, especially deep rooting species such as many tree species and soil life. Soil life, especially earthworms such as the vertically tunnelling black headed worm and the common earthworm, create channels through the soil that gently disturb it opening up its structure and aiding water infiltration. Diverse and healthy soil life

can only be supported by diverse and healthy plant life, the two being tightly interwoven.

- **Drainage** - Over the last 100 years we have drained away 90% of Britain's wetlands (Environment Agency, 2019). By encouraging drains to clog and wetlands to re-emerge we can start to retain some of the water that they once held and provide a diverse wildlife habitat in so doing. Wetlands can slow down water runoff increasing the lag time between the rainfall event and the water peak entering the river thereby lowering flood risk. They can also trap sediments and capture eroded soil which would otherwise contribute to flooding downstream.

NFM techniques therefore often focus on promoting vegetation and tree cover, enhancing soil structure through changes in management regimes and wetland creation to capture surface runoff (SEPA, 2015).

The Alternative Site Design

The Landscape Character of Derbyshire, 2014, details the landscape character type (LCT) of the Derbyshire Dales. Two of its primary aims are to '*conserve the pastoral character of the landscape*' and '*to restore unimproved permanent pasture*'. The LCT places an additional emphasis on the retention of landscape features such as dry stone walls and established hedgerows, all of which contribute to sense of place and the unique draw of the Derbyshire Dales.

This site design meets perfectly these criteria honouring our unique landscapes to preserve the identity of the Dales. The design incorporates various elements that each bring multiple benefits and is divided into two sections, the People First areas of the site which focus primarily on enhanced mental and physical health and education potential for local residents and the Wildlife First areas where wilding is promoted. The site as a whole captures water and mitigates against surface flooding. Across the whole site we also propose the rebuilding of dry stone walls and the laying or coppicing of hedges and scrub on a rotational basis to ensure their preservation into the future.



The Matlock Wolds Alternative Vision

- People first region
- Wildlife first region
- Hedge line
- Flush
- Prevents flooding

People First Regions

Parkland, Scrub Nooks and On Contour Tree Strips

The incorporation of more trees into the area reduces flood risk, benefits wildlife, absorbs carbon and creates space for people.

The impact of tree planting on water infiltration rates as well as runoff volumes has been demonstrated through various studies on test catchments. In the Pontbren stream catchment, North Powys, Wales infiltrations rates were up to 60 times higher under cross slope plantings of native woodlands compared to heavily grazed adjacent pasture (Carroll et al., 2004). Ten years later median infiltration rates were measured on the same site and were found to be up to 67 times greater in treed plots than grazed plots (Marshall et al., 2014). The volume of surface water runoff was also decreased by up to 78% below tree cover when compared to grazed plots and modelling by Nisbet and Thomas (2006) suggested that flood peaks could be reduced by 30% - 50% by planting up small catchments with trees due to enhanced hydraulic roughness and increased soil infiltration rates.

Approximately 7 acres of the site, currently grazed by cattle, would be planted up to native scrubland and tree strips running along contour. These tree strips could be expected to increase infiltration rates by up to 60 times. Full modelling of the water movements around site is beyond the scope of this report but this could result in an extra 26,000 litres of water sinking into the ground *per second* instead of contributing to surface water flows.

By establishing plantings of native trees, allowing volunteer individuals to succeed, and expanding upon areas of scrub more habitat can be provided for wildlife already present within the site. More nectar, pollen and berry rich scrublands will provide more food and nesting sites for invertebrates and birds and by establishing young native trees the site can guarantee a succession of mature trees for hole nesting woodpeckers, starlings and bats.

Grasslands

Herb rich grasslands are an important aspect of the current site.

By focusing tree planting on the steeper sections of the site, prone to water runoff, certain flatter regions become visible between them that lend themselves to restoration to herb rich grasslands. The water retention, species diversity and wildlife value of these areas can be enhanced by strategic management. On the steeper or more water logged areas of the site the sward can be allowed to grow up over summer with contoured buffer strips retained over winter, either in rotation or semi permanently. The buffer strips enhance surface roughness and lay down thatch to impede surface water flows. In addition the buffer strips provide over wintering habitats for species including bumble bees, offer seeds to many birds and provide year round hunting ground for owls.

Between the buffer strips, on less runoff prone ground, the grass could be allowed to grow up over summer before being cut for late season hay. This would allow a diverse, herb rich sward to develop that would support many species of invertebrates, birds and mammals including butterflies and moths which in turn would support bats. There is evidence that in temperate grasslands water infiltration is 1.6 times greater under long hay growth than short mown growth which would result in an increase of 28,920 litres of water every second infiltrating into soils across the site (assuming that around 3 acres are retained as open, mown paths and glades with unaffected infiltration rates).

Amidst this mosaic, along contours and across flatter areas, a network of paths could be mown for people to explore and enjoy, opening out into playing fields and glades protected by scrub. Jay Appleton's prospect refuge theory has guided much landscape design and centres around the suggestion that people like both open vistas and secure refuges within landscapes. The network of scrub creates alcoves in which people can relax or enjoy a picnic looking out across the more open areas of the site where families can play ball games or school children gather for outdoor activities. This connection to nature is vital for our mental health and becoming ever more acknowledged by both medical practitioners and schools (Mind, 2018).

Water

The focal point of the landscape would be a small lake created within the valley with one bank open to the public and the rest reserved for wildlife.

The lake would be embedded in the wet flush of the valley bottom and would swell and empty with rain events, buffering surface water flows throughout the year and aiding in avoiding flooding of adjacent properties.

The 3.4 acres of wet flush, if fully restored, expanded and enhanced by the addition of a series of scrapes, could hold approximately 4250 litres of additional water.

The lake would form another water store and could be sized to accommodate peak surface water flow rates. The wetland would primarily buffer extreme rain events and secondarily transpire and evaporate water.

The natural cycling of the lake, with exposed draw down zones over summer, could support a staggering quantity of invertebrate life providing the 3000 insects a day needed per pipistrelle bat. The array of dragonfly and damselfly species that already inhabit the site could be enhanced and their numbers increased by the addition of a larger body of water not to mention the food source that they, and other species, provide for wagtails and similar species. The lack of ponds in the area was suggested as a contributing factor towards the low numbers of amphibians found during survey periods (ES1). Amphibians are under significant pressure both nationally and globally and the creation of a lake embedded within a network of other water bodies and wet grassland could significantly improve numbers found on site, adding additional food for other species from diving beetle larvae to herons.

The lake would serve as the focal point and the link between the east and west areas of the site. A path, winding down through a scrub stabilised bank on either side, would open out onto a boardwalk across the lake boundary and adjoining wet flush. The boardwalk would function as both a safe and accessible path to the lake and a low bridge below which animals could move freely, ensuring that the path did not segregate one side of the flush from the other. Pond dipping platforms and bird hides would be placed strategically off this main board walk to provide an array of opportunities for nature connection and education.

Across the whole People First region of the site, taking into account 7 acres planted to trees, 40 acres allowed to grow up as hay to be cut or retained as a buffer strip and 3.4 acres restored as wet flush, an additional 54,920 litres of water could be infiltrated per second and an additional 4250 litres prevented from leaving the site.

Nature First Regions

The region preserved for wildlife is centred on the valley feature that runs from north west to south east across the site.

Hedges and Scrub

The hedges and scrub would be retained and sections laid on a rotational basis to ensure mature and thick hedges that increase water retention and wildlife habitat into the future. There are various young to semi mature trees and scrub patches appearing about the site from old dry stone walls and these would be retained where appropriate. Certain small areas would be allowed to mature within the valley feature to aid in water infiltration however there is a balance to be struck between water retention and the health of the species rich grassland that this area currently supports. This conflict can be alleviated to a certain extent by, instead of attempting to reduce surface water flows on the valley sides, the wet flush is restored to better deal with the runoff that does occur.

This allows an element of dynamism and self will into the evolution of the site whilst ensuring that one of its most important and valuable habitats is preserved and enhanced.

Grassland

The grassland, especially on the southern bank of the valley, is species rich but has been negatively impacted by current cattle management. In order to maximise vegetation cover and heterogeneity, and better steady surface water flows and support the maximum diversity of plant species, less intensive grazing would be beneficial ceasing when the site becomes excessively wet. By decreasing the stocking density and grazing with lighter weight rare breed cattle a dynamic mosaic of species rich pasture would be created whilst excessive scrub encroachment and poaching minimised.

Cattle dung, from heritage breeds fed on a diverse diet of herbs and grasses, is a vital resource in itself supporting vast numbers of dung flies, dung beetles and rove beetles all of which make excellent food for species such as bats, birds and badgers. There would be additional benefit in managing the cattle organically, or at least not treating the stock with avermectins, whilst on site. Avermetins kill a wide range of invertebrates including beneficial ones such as dung beetles and earthworms. From both a water infiltration perspective and a wildlife perspective this would be best avoided.

Water

The wet rush pasture that extends down the central valley could be restored by altering the grazing regime as above. This would lower inputs of urine and faeces and minimise poaching. Scrapes could be created down the valley with the largest of these forming the lake as described above and cattle strategically excluded from certain areas over certain seasons to build up a rich tapestry of habitats.

These scrapes, with associated shallow bunds on the downhill face would take up water during periods of high flow and relinquish it steadily during dry periods evening out water flow rate exiting the site.

These pools, some shallow and ephemeral and some deeper and more permanent, would provide a vital resource for wildlife including an array of invertebrates as well as amphibians and birds. By enhancing water pooling and potentially partially blocking strategic drains the wet flush and rush pasture could be expanded to provide more foraging grounds for many species including snipe, starlings and song thrushes.

There is a relatively high level of uncertainty in where water will appear and how it will move about the site in the future due to the complex geology that underpins the area. This allows a more self willed aspect of the site to express itself with people taking a backseat and watching as the site evolves over time.

People too could benefit from the expanded areas of wildlife habitat with hides positioned on high ground overlooking the wilding lands below. The reserve itself could be opened up as an educational resource periodically to give pupils or youth groups the opportunity to come and immerse themselves in the natural world and learn vital ecoliteracy skills.

Conclusion

The Wolds site houses a rich array of species, some of which are nationally threatened, and with sympathetic management and restoration the site could become a real asset to local conservation efforts. The management needed to allow this to happen is the very same that would enhance the site's ability to absorb and store water protecting local residents from surface flooding now and into the future. Beyond flood protection the site could become a lifeline, not just for wildlife but for people. During the ongoing COVID-19 pandemic the importance of nature to people's well being has become evident and the site could provide a space in which everyone could relax and move closer to nature. By opening its doors to school groups children's mental health could be enhanced in the short term and in the long term the site could foster within the next generation the ecoliteracy skills required to contribute to finding solutions to the climate crisis and ecological collapse.

Site Species List and Scientific Names

Bats

Common pipistrelle	<i>Pipistrellus pipistrellus</i>
Brown long eared	<i>Plecotus auritus</i>
Soprano pipistrelle	<i>Pipistrellus pygmaeus</i>
Noctule	<i>Nyctalus noctula</i>
Daubenton's	<i>Myotis daubentonii</i>
Natterer's	<i>Myotis nattereri</i>

Birds

Blackbird	<i>Turdus merula</i>
Blue tit	<i>Cyanistes caeruleus</i>
Bullfinch	<i>Pyrrhula pyrrhula</i>
Buzzard	<i>Buteo buteo</i>
Carrion crow	<i>Corvus corone</i>
Chaffinch	<i>Fringilla coelebs</i>
Chiffchaff	<i>Phylloscopus collybita</i>
Coal tit	<i>Periparus ater</i>
Collared dove	<i>Streptopelia decaocto</i>
Dunnock	<i>Prunella modularis</i>
Fieldfare	<i>Turdus pilaris</i>
Garden warbler	<i>Sylvia borin</i>
Goldfinch	<i>Carduelis carduelis</i>

Great tit
Greater spotted woodpecker
Greenfinch
House martin
House sparrow
Jackdaw
Jay
Lesser whitethroat
Linnet
Long-tailed tit
Magpie
Marsh tit
Mistle thrush
Nuthatch
Pied wagtail
Raven
Red kite
Redwing
Robin
Snipe
Song thrush
Sparrowhawk
Starling
Swallow
Treecreeper
Whitethroat
Woodpigeon
Wren

Parus major
Dendrocopos major
Carduelis chloris
Delichon urbicum
Passer domesticus
Corvus monedula
Garrulus glandarius
Sylvia curruca
Carduelis cannabina
Aegithalos caudatus
Pica pica
Poecile palustris
Turdus viscivorus
Sitta europaea
Motacilla alba
Corvus corax
Milvus milvus
Turdus iliacus
Erithacus rubecula
Gallinago gallinago
Turdus philomelos
Accipiter nisus
Sturnus vulgaris
Hirundo rustica
Certhia familiaris
Sylvia communis
Columba palumbus

Plants

Species Rich Grassland

Rough meadow grass
Sheep's fescue
Cock's foot
Red fescue
Meadow fescue
Annual meadow grass
Field woodrush
Yorkshire fog
Perennial rye grass

Poa trivialis
Festuca ovina
Dactylis glomerata
Festuca rubra
Festuca pratensis
Poa annua
Luzula campestris
Holcus lanatus
Lolium perenne

False-oat grass
 Sweet vernal grass
 Crested dog's tail
 Meadow foxtail
 Foxglove
 Tormentil
 Hedge bedstraw
 Mouse-ear hawkweed
 Daisy
 Red clover
 Common cat's ear
 Common ragwort
 Common mouse-ear
 Germander speedwell
 Creeping thistle
 Common vetch
 Bush vetch
 Broadleaf everlasting pea
 Heath speedwell
 Bird's foot trefoil
 Bugle
 Meadow buttercup
 Creeping buttercup
 Ribwort plantain
 Dandelion
 Common sorrel
 Cuckoo flower
 Soft rush
 Hard rush
 Marsh thistle
 Hogweed
 Pignut
 Harebell
 Soft rush
 Hard rush
 Creeping bent
 Tufted hair grass
 Greater willowherb
 Greater bird's foot trefoil
 Marsh thistle
 Wavy bittercress
 Cuckoo flower
 Yorkshire fog

Arrhenatherum elatius
Anthoxanthum odoratum
Cynosurus cristatus
Alopecurus pratensis
Digitalis purpurea
Potentilla erecta
Galium mollugo
Hieracium pilosella
Bellis perennis
Trifolium pratense
Hypochaeris radicata
Jacobaea vulgaris
Cerastium fontanum
Veronica chamaedrys
Cirsium arvense
Vicia sativa
Vicia sepium
Lathyrus latifolius
Veronica officinalis
Trifolium corniculatus
Ajuga reptans
Ranunculus acris
Ranunculus repens
Plantago lanceolata
Taraxacum officinale
Rumex acetosa
Cardamine pratensis
Juncus effusus
Juncus inflexus
Cirsium palustre
Heracleum sphondylium
Conopodium majus

Juncus effusus
Juncus inflexus
Agrostis stolonifera
Deschampsia cespitosa
Epilobium hirsutum
Lotus pedunculatus
Cirsium palustre
Cardamine flexuosa
Cardamine pratensis
Arrhenatherum elatius

Reed sweet grass
Broadleaved dock

Glyceria maxima
Rumex obtusifolius

Improved Grassland

Meadow foxtail
Sweet vernal grass
Perennial rye grass
Crested dog's tail
Creeping buttercup
White clover
Red clover
Ribwort plantain
Creeping thistle
Spear thistle
Cuckoo flower
Common mouse ear
Curled dock
Daisy
Lesser trefoil
Common sorrel
Yellow rattle
Common nettle
Bird's foot trefoil

Alopecurus pratensis
Anthoxanthum odoratum
Lolium perenne
Cynosurus cristatus
Ranunculus repens
Trifolium repens
Trifolium pratense
Plantago lanceolata
Cirsium arvense
Cirsium vulgare
Cardamine pratensis
Cerastium fontanum
Rumex crispus
Bellis perennis
Trifolium dubium
Rumex acetosa
Rhinanthus minor
Urtica dioica
Trifolium corniculatus

Wet Flush

Soft rush
Hard rush
Creeping bent
Tufted hair grass
Greater willowherb
Greater bird's foot trefoil
Marsh thistle
Wavy bittercress
Cuckoo flower
Yorkshire fog
Reed sweet grass
Broadleaved dock

Juncus effusus
Juncus inflexus
Agrostis stolonifera
Deschampsia cespitosa
Epilobium hirsutum
Lotus pedunculatus
Cirsium palustre
Cardamine flexuosa
Cardamine pratensis
Arrhenatherum elatius
Glyceria maxima
Rumex obtusifolius

Holly	<i>Ilex aquifolium</i>
Hawthorn	<i>Crataegus monogyna</i>
Blackthorn	<i>Prunus spinosa</i>
Hazel	<i>Corylus avellana</i>
Elder	<i>Sambucus nigra</i>
Oak	<i>Quercus robur</i>
Ash	<i>Fraxinus excelsior</i>
Rowan	<i>Sorbus aucuparia</i>
Bramble	<i>Rubus fruticosus</i>
Dog rose	<i>Rosa canina</i>

Appendix 7.3A. Botanical Species List, 2016 and 2020

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34

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