

Scottish Natural Heritage

Constructed tracks in the Scottish Uplands

2nd Edition

June 2013

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Acknowledgements

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Land Use Consultants
March 2005

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Scottish Natural Heritage
June 2013



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Scottish Natural Heritage
Dualchas Nàdair na h-Alba

All of nature for all of Scotland
Nàdar air fad airson Alba air fad



Section 1

Introduction

1.1 Introduction

Landscape and visual Biodiversity and Geodiversity Access and Recreation



1.1.1 INTRODUCTION

Recent years have seen an increase in the demand for new tracks in the Scottish uplands. Some of this demand comes from traditional activities such as farming or estate management. Additional demands are associated with the development of wind farms, hydro schemes and telecommunications infrastructure, including mobile phone networks. As coniferous forests mature so additional tracks are required to move harvested timber.

The uplands are a sensitive and valued part of Scotland's natural heritage. Careful location, design, construction and maintenance of tracks can reduce the magnitude of impacts on the natural heritage. There are, however, many locations where a new track would result in unacceptable impacts. In such situations, construction of a track is inappropriate and it will be necessary to adopt alternative approaches.

1.1.2 TRACKS AND THE NATURAL HERITAGE

Some tracks are relatively small, designed for use by four wheel drive vehicles or even quad bikes. All other things being equal, these tracks can be more easily fitted into the upland landscape. Those associated with forestry harvesting and wind farms tend to be constructed to a higher specification, capable of accommodating heavy vehicles and with shallower gradients, gentler curves and wider running tracks.

Upland habitats and landscapes are often sensitive to change and slow to repair. Many contain lochs, watercourses and wetlands which need to be protected from adverse impacts. Their peaty soils also hold significant amounts of stored carbon which needs to be safeguarded. Upland landscapes are also highly valued both for their intrinsic character and for the wild land qualities that they provide. Tracks can have a major impact on these qualities, introducing significant new features into otherwise 'natural' landscapes and affecting fragile upland plants, animals, landforms and soils. They also have the potential to alter drainage patterns, potentially resulting in serious erosion and loss of stored carbon, the generation of surplus peat and damage to the water environment.

Tracks can create access and recreation benefits, providing new routes for walkers, cyclists and horse riders. While this has the potential to open up new opportunities, it can also create new, often unforeseen pressures by increasing the number of people using previously unvisited areas.

This good practice guide aims to increase understanding and awareness of the natural heritage impacts of track construction, management and use. By encouraging careful site investigation and scheme design, it aims to reduce the impacts of tracks on the natural heritage of the Scottish uplands. This is tempered with the knowledge that even the best design and construction methods cannot overcome the most significant impacts. In some situations a new track is likely to result in an unacceptable level of impact, such that alternative approaches should be explored.

Where impacts are unacceptable and no alternatives exist, a proposed track should not be constructed.



1.1.3 HOW TO USE THIS GUIDANCE

This guidance provides a step by step guide to the process of assessing the need for a track. It considers strategic design and location issues, detailed design and construction and maintenance of the finished track.

The guidance also includes:

- a section covering the restoration or enhancement of existing tracks
- a description of the legislative and planning context, including the range of consents and licences that may be required for track construction in the Scottish uplands.

Section 1.1.4 provides a more detailed breakdown of the topics covered in each section of the guidance.

Constructed tracks related to developments such as wind farms, hydro schemes, telecommunications, forestry and estate management can place considerable pressure on landscapes and habitats in the Scottish uplands. This guidance draws out key issues relating to constructed tracks, covering:

- route planning
- landscape and visual impacts
- biodiversity impacts

- engineering requirements
- cut and fill
- borrow pits
- reinstatement and restoration.

This guidance addresses natural heritage interests (landscape, biodiversity, geodiversity, access and recreation), but does not provide comprehensive coverage of issues relating to the historic environment. *Historic Environment Scotland* may be able to provide additional advice on the effect of upland tracks on the historic environment. The principles embedded in this guidance apply to the construction of tracks in the uplands and lowlands, across a range of different uses such as forestry, agriculture, estate management, hydro-generation and wind farms. Each section highlights wind farm track construction which generally accounts for a significant amount of the track construction in the uplands and thus offers great potential benefits from employing good practice.

1.1.4 STRUCTURE OF THE GUIDANCE

Section 1 – Introduction:

- *Landscape and visual effects*
- *Biodiversity and geodiversity effects*
- *Recreational effects*

Section 2 – Is a track needed? :

- *Need and alternatives*
- *The ‘do nothing’ option*
- *Checklist*

Section 3 – Strategic design:

- *The design process*
- *Engineering parameters*
- *Tracks and the natural heritage*
- *Landscape and visual effects*
- *Biodiversity*
- *Geodiversity*
- *Access and recreation*
- *Climate*
- *Checklist*

Section 4 – Detailed design:

- *Detailed alignment and scheme design*
- *Construction types*
- *Sourcing material*
- *Drainage*
- *Design for recreation*
- *Consents and licences*
- *Construction*
- *Checklist*

Section 5 – Track maintenance:

- *Planned maintenance*
- *Monitoring*
- *Materials*

- *Drainage*
- *Limiting vehicular access*
- *Repairing surface defects*
- *Monitoring biodiversity and geodiversity*
- *Checklist*

Section 6 – Track enhancement and restoration:

- *The need for enhancement and restoration*
- *Tracks in lower and flatter areas*
- *Tracks on steeper slopes*
- *Tracks in higher areas*
- *Track removal*
- *Biodiversity and geodiversity*

Section 7 – Planning & Legislation:

- *The need for consents*
- *Planning consent*
- *Borrow pits*
- *Development plan policies*
- *Environmental impact Assessment*
- *Nature conservation sites and protected species*
- *Historic environment*
- *Planning conditions and agreements*

Glossary

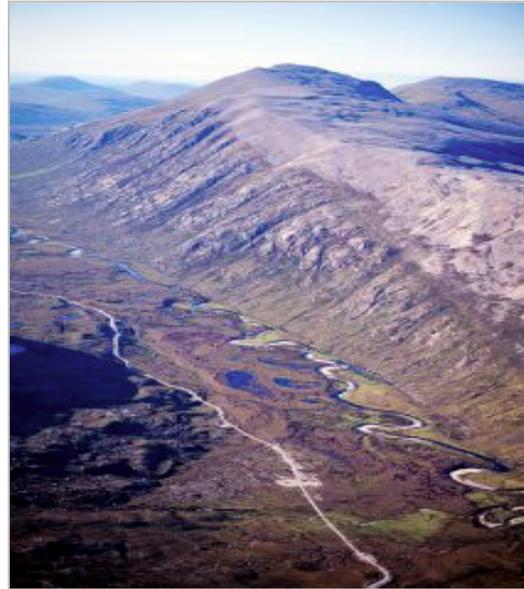
Consultees

Bibliography and references

1.2. Overview of landscape and visual impacts of tracks in the Scottish uplands

Tracks can have a significant influence on the way in which people experience the Scottish uplands.

Tracks can be prominent features in the upland landscape, detracting from wild land qualities



1.2.1 LANDSCAPE EFFECTS

At a simple level, tracks can introduce linear, clearly constructed elements into landscapes that may otherwise be characterised by remoteness and *wild land*¹ qualities reflecting the absence of man-made structures. It is these special qualities that underpin many people's appreciation of the uplands. By introducing reference points tracks can introduce scale into an otherwise open and expansive landscape.

The scale of impact may also be influenced by a track's location. Historic tracks usually reflect natural topography, following the line of least resistance between two points. They often run along the edge of the floodplain, linking farmsteads, fields or shielings. Modern 'bulldozed' tracks can ignore many of the constraints presented by the topography following alignments high up the hillside, providing access to, for example, hilltop wind farms or telecommunications infrastructure. Such tracks do not appear to fit easily within the structure of the landscape.

1.2.2 VISUAL EFFECTS

Upland tracks can be prominent features that are visible over a considerable distance. Factors that may influence the degree of visibility include the track's alignment in relation to key viewpoints, the colour of the surface material relative to the surrounding landscape, the treatment of areas of cut and fill (including the success of revegetation and the presence of notches or terraces on the skyline), the use of culverts or bridges, any seasonal effects such as the retention of snow in track cuttings and any effects on surrounding patterns of drainage. Good design in landscape terms can also be good in terms of engineering and cost depending on the situation and circumstances.

Landscape and visual effects are considered in more detail in [Section 3](#).

¹ [Mapping Scotland's wildness and wild land](#) (SNH webpage and mapped resources)

1.3 Overview of biodiversity and geodiversity impacts of tracks in the Scottish uplands

Tracks can have a variety of direct and indirect effects on biodiversity and geodiversity.



Pine Marten



Ling

1.3.1 BIODIVERSITY EFFECTS

Track construction will cause direct impacts from the loss of vegetation, fauna and soil along the construction corridor. While careful siting of tracks and cutting, storage and reuse of vegetation and soil will help minimise the extent of such impacts, some losses are inevitable. Upland habitats are often fragile and slow to regenerate so these effects may be of some significance, particularly where the species and habitats involved are uncommon or rare. Any unvegetated areas are likely to be subject to erosion and possibly landslip, resulting in elevated silt levels in water bodies which can affect aquatic species while deposition of material can affect vegetation.

Some of the most significant effects on biodiversity can result from changes in hydrology, where altered quality or patterns of run-off can affect a range of habitats and species. For example, the use of cuttings can have the effect of locally lowering the water table. This can affect vegetation, including wetlands and trees, in areas alongside the track. Tracks can also impound or divert water flow, potentially resulting in water-logging on one side of the track and drying on the other. This is a particular risk where tracks are constructed over peat, e.g. floating tracks. Compression of the peat under the weight of the track can impede the downslope movement of water, significantly affecting the health of vegetation growth on either side of the track. Detailed guidance for [Floating Roads on Peat](#) has been produced by SNH and FCS.

The construction of tracks and the installation of other infrastructure (e.g. cables or pipes) associated with developments such as wind farms and small scale hydro schemes can be especially difficult where extensive areas of deep peat, steep slopes and rock outcrops occur, and particularly where such physically challenging features are combined with a wet climate. Options for mitigation and techniques for successful post-construction restoration are limited and there can be significant and long term adverse impacts on moorland habitats and landscapes. This can be a major constraint on developments where such areas are designated, especially where wild land qualities are recognised as characteristic features (e.g. in West Sutherland, Wester Ross and Lochaber).

In these areas particular attention needs to be given to adequate assessment of ground conditions (peat/rock depth) prior to project design and the use of techniques that minimise any disruption to

vegetation, soils and drainage patterns. The use of low impact equipment, as well as the use of experienced contractors and a commitment to extended periods of post construction restoration are essential.

While effects on fauna are likely to be less direct, track construction can result in the loss of shelters, nests, foraging areas and the water environment. This can have an impact on species such as ground nesting birds, otter, water vole, badger, wildcat, fish, aquatic invertebrates and plants. Increases in vehicle movements can result in an increase in animal accident mortality rates, particularly after dark. Increases in numbers of walkers, cyclists or horse riders can cause greater disturbance for species such as deer, capercaillie and birds of prey.

Biodiversity effects are considered in more detail in [Section 3](#).

1.3.2 GEODIVERSITY EFFECTS



Schist outcrop on Ben Lawers



Patterns created by solifluction and wind shaped vegetation

The uplands of Scotland contain a wide range of significant Earth heritage interests. These include ancient rocks, fossils and minerals, which all record the geological history of Scotland; more recent landforms shaped by a long and complex history of pre-glacial weathering and erosion; ice age glaciations; soils and river and slope landforms that have evolved since the end of the last glaciation; and modern river, slope and soil processes. Track construction can result in damage to such features, particularly where extensive areas of cut and fill are required to negotiate changes in gradient or elevation.

Upland soils, which include many internationally rare alpine and sub-alpine soils and their associated mountain plant communities, are an important part of upland geodiversity, and a very fragile, non-renewable one. The cold climate of the uplands impedes most of the soil formation factors (vegetation, decomposition and weathering), the soils are often very shallow (a few centimetres deep) and unstable. Track construction and use can have very significant direct and indirect effects on soil over a wide area.

Carbon-rich soils i.e. peat and peaty gleys (of bogs, fens, flushes and heaths), are common features of the Scottish uplands and are sensitive to erosion and structural damage. This can lead to significant loss of soil carbon and to other environmental impacts, for example, sediment runoff into water bodies.

Hydrological changes triggered by track construction or watercourse crossings, including increased sediment loads in runoff and changes in water run-off volume or velocity, may adversely affect watercourse morphology (fluvial geomorphology). This can increase erosion or deposition. Blanketing of channel beds by sediment can lead to habitat changes and ultimately to morphological changes in rivers and floodplains as a result of increased peak flows and/or decreased base-flows. Such morphological changes may include the isolation of meanders, channel infilling and increased sedimentation.

Further effects may result from material sourced for track construction, either from on or offsite. The creation of borrow pits or the use of off-site quarries can have implications for earth science interests. At a more detailed level, the use of imported aggregate material with a different chemical composition may have implications for the local environment (for example stimulating a chemical reaction between alkaline limestone aggregate and the local acidic peat). Use of imported aggregate may also be detrimental to Earth heritage interests by confusing the geological record. There may, however, be situations where the construction of associated borrow pits can allow the exposure of important stratigraphic and geological structures.

Geodiversity effects are considered in more detail in [Section 3](#).

1.4 Overview of recreational impacts of tracks in the Scottish uplands

Tracks can have positive and negative effects on recreation in the Scottish uplands.



Tracks can act as a focus for recreational access to the uplands

1.4.1 RECREATION EFFECTS

Tracks provide easier access to previously remote areas for walkers, mountain-bikers, hill runners and horse riders. The tendency for tracks to hold snow during the winter can also make them attractive for cross-country skiing. The extent to which these opportunities are realised depends on the extent to which tracks provide access to points of interest and whether they connect with other tracks or paths to provide circular routes. The provision of way-marking, signage, pedestrian gates and areas for car parking can also help. Careful track design can help address or avoid any conflicts between land management and access. It can also help direct recreational activity away from sensitive habitats or soils.

The presence of tracks, or increases in the numbers of people using an area, can undermine the remoteness and wild land qualities that attract many people to the Scottish uplands. Furthermore, new tracks can create additional recreation pressures on previously unvisited areas. This is particularly true where a track ends abruptly, or where it links into an existing path or track that passes through a sensitive area.

Access and recreation issues are considered in more detail in [Section 3](#).

Section 2

Questioning the need for tracks and exploring alternatives

2.1 Questioning the need for tracks and exploring alternatives

Need and alternatives The 'do nothing' option



The natural heritage of the uplands is one of our most important and valued assets

2.1.1 INTRODUCTION

While the larger part of this guidance aims to promote good practice in the design, construction and management of upland tracks, the sensitivity of the upland environment means it is important that the need for new tracks is clearly justified and that potential alternatives are explored fully. This section of the guidance, therefore, explores alternative approaches that may avoid the need for new tracks or at least reduce the length or specification that is required. It concludes that there may be some situations where the natural heritage is so sensitive and the potential impacts so significant, that tracks should not be constructed.

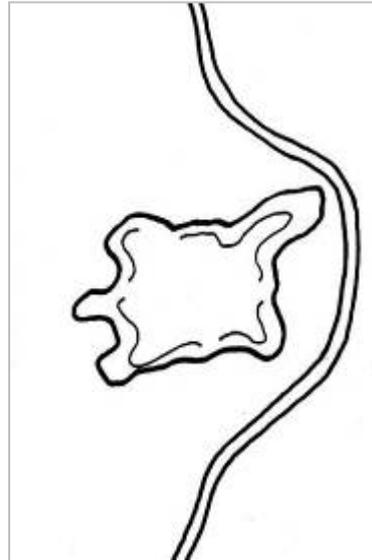
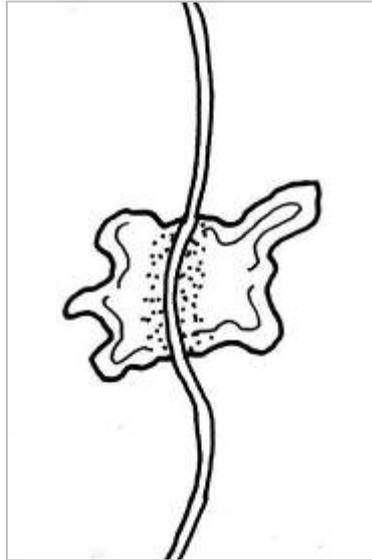
2.1.2 NEED AND ALTERNATIVES

The natural heritage of the Scottish uplands represents one of our most important and most valued environmental assets. Wherever possible, impacts on this asset should be avoided. Tracks should only be constructed where absolutely required, where there is no better alternative, and where the natural heritage impacts can be minimised. Given the nature of potential effects on the landscape, biodiversity and geodiversity of the Scottish uplands, and the effects on people's enjoyment of the countryside, there is a strong case for questioning the need for a track and exploring whether alternative options are viable.

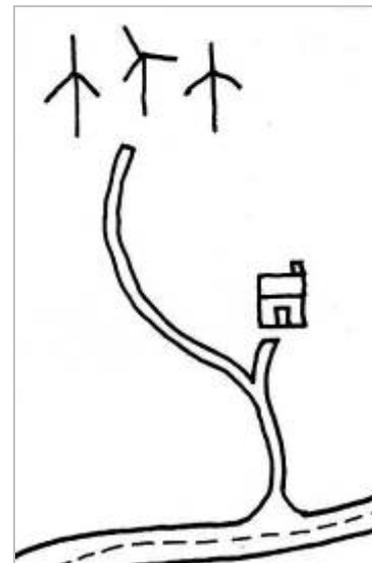
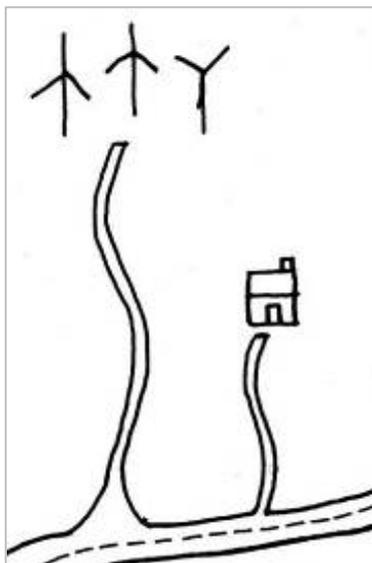
The consideration of alternatives should include both the track and the development it is designed to serve. It is, therefore, important that the need for, location and construction issues of a track are considered in detail early in the process of developing a proposal. If its location is fixed at an early stage, there will be relatively few options to reduce the impacts of the track. Failing to identify and address the impacts associated with track construction and use, has the potential to place larger projects in jeopardy.

2.1.3 CONSIDER ALTERNATIVES

In many cases, potential impacts can be addressed by realigning a proposed track to avoid the most sensitive habitats and Earth heritage features or areas where a new track would result in unacceptable levels of impact. Consequently it is important to try to avoid such impacts and to ensure that relevant detailed surveys such as for peat depth, habitats and species are carried out prior to finalising the siting and construction detail of a track.



The simplest way of reducing impact is to avoid sensitive areas altogether



Impacts can sometimes be reduced by sharing an existing track

Alternatives might include:

- Making shared use of an existing track for some or all of the route.
- Relocating the activity.
- Securing access from a different direction or location.
- Reducing the specification of the track, for example by using smaller vehicles or by restricting use during the winter, periods of poorer weather or when ground conditions are poor.
- Use of boats, helicopters or all-terrain vehicles. The practicality of such options will depend on the location of the track and the type and level of use that is anticipated.

- Aligning the track to fit the landscape and sensitive features, for example by avoiding impacts rather than compensating for them.

The early identification of sensitive habitats and species, Earth heritage features and landscapes is critical in such situations, emphasising the importance of thorough site investigation before the design of the scheme becomes fixed (*see Section 3*).

Many upland tracks are associated with proposed developments such as wind farms, telecommunications masts or hydro schemes. It is important that such tracks are designed and assessed as part of the overall scheme rather than being considered as less important secondary developments. Where the proposed track is judged likely to result in significant natural heritage impacts, the overall scheme should be reviewed to determine whether the effects could be minimised by taking access from another direction, or whether an alternative location could meet operational needs (e.g. providing the required coverage of mobile phone reception) with fewer impacts.

For tracks providing access to existing activities such as forestry harvesting, there will be fewer opportunities to vary the location of the development to reduce natural heritage impacts. In some cases it may be possible to provide access from another direction or to make shared use of an existing track (perhaps with limited upgrading to meet the needs of the proposed activity). Other alternatives might include transporting timber from remote forests by water (on lochs and sea lochs) or by using smaller vehicles.

Tracks for other purposes such as game and/or stock management will not require to be so highly engineered.

All this emphasises the importance of considering carefully the potential effects of track construction and use from the outset of a project, even where access might not be required for a number of decades.

2.1.4 HIGH IMPACTS, NO ALTERNATIVES – THE ‘DO NOTHING’ OPTION



In the most sensitive areas the need for a track may be outweighed by the potential impacts on the natural heritage

In some cases, there may be limited opportunities to modify a proposed track to avoid significant natural heritage impacts. There may also be situations where technical solutions such as the use of floating tracks over peatland areas are either judged to be insufficiently reliable or likely to result in significant impacts in their own right.

In cases where the magnitude of impact is very high and no alternatives exist, the scheme should not be implemented.

Pursuing development in such circumstances could result in very significant permanent damage to an important and valued part of Scotland's natural heritage.

Checklist

The following checklist sets out a series of questions which should be used to ensure that natural heritage issues have been fully considered in deciding whether a track is required and whether alternative approaches might be appropriate:

- Is a new track required?
- Can the management needs be achieved in a different way?
- What are the likely natural heritage impacts of a new track?
- Has the proposed route of the track been adequately surveyed to determine the nature of these impacts?
- Can these impacts be reduced by re-routeing the track, changing its specification or restricting the way in which it is used?
- Is it possible to improve an existing track rather than build a new one?
- In the case of tracks that form part of a wider development, can the impacts be reduced by modifying the overall scheme?
- If adverse impacts can't be avoided can they be appropriately mitigated?
- Are the natural heritage impacts so significant that a track should not be constructed?

Section 3

Strategic track design and the natural heritage

3.1 Strategic track design and the natural heritage

*The design process
Engineering parameters
Tracks and the natural heritage
Landscape and visual effects
Biodiversity
Geodiversity
Access and recreation
Climate*

3.1.1 INTRODUCTION

This section of the guidance describes the factors that should be taken into account in developing the outline design for upland tracks. It provides an overview of strategic engineering and construction issues before considering how strategic decisions about the location and design of tracks should take account of landscape, biodiversity, geodiversity and recreational effects.

Detailed design and construction issues are considered in [Section 4](#).

3.1.2 NATURAL HERITAGE AND THE DESIGN PROCESS

Good track design will include the following steps:

- Identification of natural heritage interests and likely impacts of track construction and use on these interests.
- Avoidance of natural heritage impacts, wherever possible.
- Mitigation of natural heritage impacts that cannot be avoided.
- Compensation for natural heritage impacts that cannot be mitigated.
- Enhancement of natural heritage, access and recreational benefits.

It is very important that the design process is based on good information about the area in question. An understanding of habitats and species, Earth heritage interests, landscape and visual qualities, and patterns of recreation activity is essential to ensure that the proposed track minimises adverse impacts on the sensitive upland environment. Similarly, to calculate accurately the volume of surplus soils, construction material and whether there is the need for borrow pits or off-site sourcing, a thorough understanding of ground conditions and local topography is essential. Peat depths, soil, design and construction issues, and underlying material should be taken into account.

While some published information is likely to be available, additional survey work is also likely to be required to provide a comprehensive and up to date picture of the area that could be affected by a new track. An informed approach will help ensure that these factors are reflected in track design from the outset, helping to avoid or reduce more serious effects later in the process.

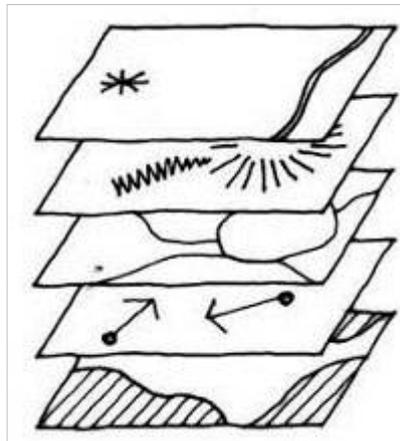
Information about the existing environment should be brought together as 'layers' which can be used together to consider different alignments.

Typical layers of information could include:²

- operational criteria (typically the points at which the track will start and end)
- engineering constraints (gradients, unsuitable ground, peat depths, potential sources of material, etc.)
- areas with high biodiversity sensitivity
- areas with high geodiversity sensitivity
- areas with high landscape sensitivity
- watercourses, lochs and wetlands
- existing water abstractions for private or public water supplies
- key viewpoints
- seasonal issues or requirements
- flood risk.

These layers of information can be analysed together to find the route that has the lowest impacts on the natural heritage. They can also be used to explore potential locations for any borrow pits that might be required. This approach allows the effects of alternative routes to be considered ‘in the round’.

Assembling different layers of information will help find the route that has the lowest impacts on natural heritage interests, whilst meeting the track’s operational aims.



3.1.3 LIAISONS, LICENCES AND CONSENTS

The need for planning permission or other types of consent to construct a track (in planning terms ‘private ways’) in the Scottish uplands depends on its purpose and location. Some tracks (for example those within National Scenic Areas, Sites of Special Scientific Interest and Natura sites) may require planning permission, whereas others may require ‘prior approval’ from the planning authority. Other kinds of consent may also be required, for example any engineering works in the vicinity of the water environment will need to comply with the [Water Environment \(Controlled Activities\) \(Scotland\) Regulations 2011](#).

² [Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste and Developments on Peatland: Site Surveys and Best Practice; SEPA’s wind farm guidance has useful information for assessing waterbodies, and existing abstractions](#)

Prior to the formation, or alteration of agricultural or forestry private ways, the developer must submit prior notification to the relevant planning authority (PA) for a decision on whether prior approval is needed before development can begin. Separate arrangements apply to development related to private ways for any other purposes, including sporting and recreational use. [Planning Circular 2/2015 Consolidated Circular on Non-Domestic Permitted Development Rights \(Annex F\)](#) provides guidance on prior notification and approval requirements in relation to agricultural and forestry private ways.

Where a [Natura](#) site is affected by a track proposal the planning authority will carry out a Habitats Regulations Appraisal, which may include an assessment of the implications of the proposal for the site in view of that site's conservation objectives (an Appropriate Assessment). In making the assessment the planning authority must consult SNH and take into account any advice received. The planning authority will approve the operation only if the assessment shows that the operation will not adversely affect the integrity of the site.

For [Sites of Special Scientific Interest](#) a list of operations requiring consent forms part of the notification. If a land manager wishes to carry out any of the listed operations (which may include the construction of tracks) they must obtain consent from SNH, unless an exemption from the need for consent applies. See Section 7 for more detail on planning and consents.

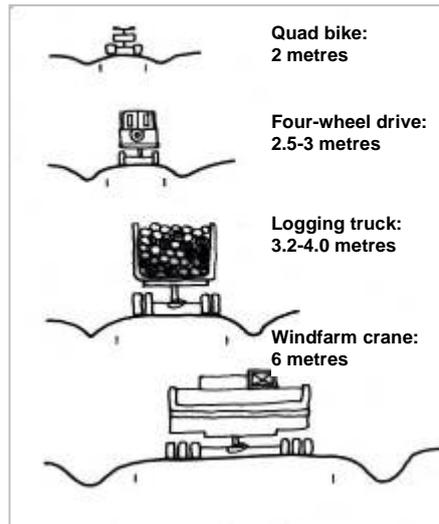
3.2 Engineering



3.2.1 ENGINEERING PARAMETERS

The function of the track and the characteristics of the least manoeuvrable vehicle will dictate the width of the track, the maximum gradient and the minimum corner radii. Larger and heavier vehicles will normally require wider tracks, shallower gradients and wider corners. These factors can have a significant bearing on the route that a track can take.

Width



The width will relate to the type of vehicle using the track

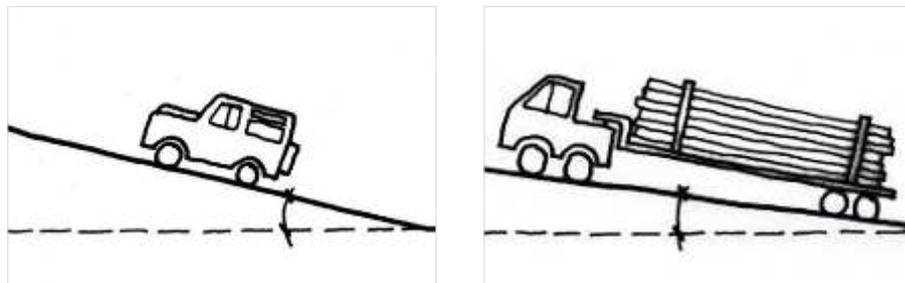
The aim will normally be to minimise a track's running width since this will help reduce the impact on surrounding habitats and Earth heritage interests and make it easier to fit into the landscape. The wider the track, the more substantial will be the earthworks required to negotiate steep slopes, gullies and river crossings. The track however must be wide enough to accommodate the largest vehicle that is likely to use it. Too narrow a track will result in damage to vegetation and other features.

Widths are likely to range from as little as 2m for quad bike tracks up to around 6m for some wind farm tracks.

Gradient

The maximum gradient will also depend upon the vehicles that are being used, together with the nature of the material used to surface the track. The steeper the maximum gradient, the less necessary will be cuttings and embankments. Steep sections must be planned with care, however, particularly where they are associated with corners.

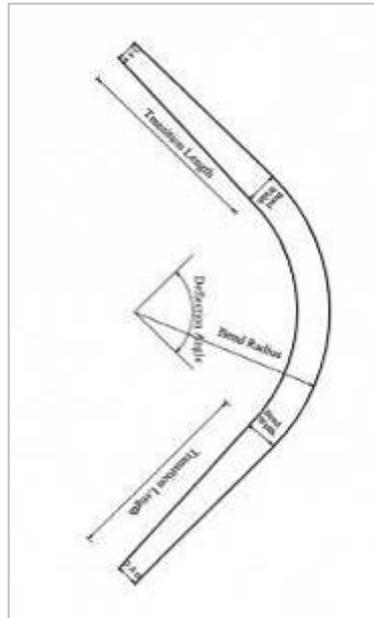
Tracks designed to accommodate light four wheel vehicles should normally have a maximum gradient of 14% or 1 in 7. For wind farm tracks, and tracks that will be used for timber extraction, the maximum gradient should be between 8% and 10% (1 in 12 to 1 in 10) with short lengths (less than 200m) at 12.5% (1 in 8) provided the average gradient of the track as a whole does not exceed 10% (1 in 10).



Maximum gradients will relate to the type of vehicle using the track

The choice of surface material will also have an influence on gradients. The smoother and rounder the material that is used, the lower the gradient that is possible since particles rotate between the wheels and road surface, reducing grip and creating ruts as the material migrates downhill. Sharper or bound material such as crushed rock tends to lock together to provide a more stable and resilient surface. The use of weathered material should be avoided as this does not interlock well.

Tracks should not normally have gradients of less than 2.5% (1 in 40) to permit efficient drainage of the surface.



Bend widening

Corner radii and turning circles

Tracks designed to carry large vehicles require longer corner radii and turning circles than those for quad bikes or four wheel drive vehicles. Forestry Commission guidance for [forest road construction](#)³ recommends the following radii and road widths.

Outside Radius	Minimum Widths For Maximum Angle Of Deflection (°)				Transition Straight Length	Maximum Gradient on Outside Radius
	15	45	90	180		
	Running surface width					
m	m	m	m	m	m	%
90	3.4	3.4	3.4	3.4	-	10
60	3.4	3.8	4.0	4.0	20	8
45	3.4	4.0	4.5	4.5	20	7
30*	3.4	4.4	5.0	5.1	25	6.5
25		4.6	5.1	5.3	30	5
20		4.9	5.6	5.9	30	4.5
15			6.3	7.0	40	4
10**				10.0	40	5 on diagonal

* Preferred minimum radius
 ** Absolute minimum hairpin

³ [Forestry Commission FCE information page for Roads](#)

3.3 Windfarms



Wind farms require track access to each turbine for construction and maintenance

3.3.1 CUT AND FILL

Most tracks will require areas of cut and fill to negotiate changes in level, steeper slopes, gullies and terraces. The more varied the landform and the higher the specification of the track, the more cuttings and embankments will be required to cope with changes in level. From an engineering perspective, the aim should be to achieve a balance between the cut and fill so that it is unnecessary either to import additional fill material, or dispose of surplus spoil/peat on or off site. Site survey during the design of an upland track should determine the suitability and volume of material likely to be generated on site, and thus the requirement for material to be imported or won from local borrow pits. 'Waste' could be generated as a result of track construction. Guidance is available from [Scottish Renewables](#) *et al.* on developments relating to management of waste, especially in relation to peat.⁴

3.3.2 TRACK ROUTING

Wind farm tracks have multiple end points, as every turbine must be accessed. There are, however, many different ways of getting to each turbine. The best solution will use the shortest track length while taking into consideration ecological, hydrological and landform constraints. There may also be landscape and visibility issues for different route options.

It should be remembered that the shortest distance on undulating ground may not be the optimum alignment in landscape and visual terms, and in avoiding sensitive habitats, where meanders may fit better.

⁴ [Scottish Renewables information on developments on peat and how to manage surplus peat](#)
[Developments on Peatland: Site Surveys and Best Practice](#)

3.4 Tracks and the natural heritage

The rest of this section considers the information on the natural heritage that should be analysed and reflected in the strategic design process.

It is divided into the following sections:

- *landscape and visual effects*
- *biodiversity*
- *geodiversity*
- *access and recreation*
- *climate effects*

3.5 Landscape and visual effects



3.5.1 SCOTLAND'S UPLAND LANDSCAPES

Scotland's upland landscapes together comprise one of the nation's most valued natural heritage assets. Though there are great differences between the often jagged and incised mountain ranges of the Western Highlands, the rounded massif of the Cairngorms, the gentler summits of the Southern Uplands and the smaller hill ranges such as the Pentlands, Campsies or Ochils, all of these areas share a number of key characteristics. These include:

- a landscape of mountains, plateaux, hills and ridges, dissected by glacially enlarged glens and straths, often containing burns, rivers and lochs
- a generally simple pattern of land cover comprising moorland, grassland, broadleaf and coniferous woodland and commercial forestry
- availability of shelter from prevailing winds (allowing the growth of woodland or settlements), or the influence of Earth heritage features
- comparatively few signs of human settlement, often limited to estate buildings, shielings, walls and fences, together with isolated bothies, ruins and tracks
- extensive, often open views along glens, from summits and across plateaux

These characteristics combine to create the general impression of slowly changing, remote and unsettled landscapes. For many people, both residents and visitors, these 'wild land' characteristics underpin the special appeal of much of the Scottish uplands. The character of these areas is reflected in their popularity for [recreation](#).

Some of our more rugged landscapes are designated as National Scenic Areas, for example the Assynt and Coigach ranges, and the mountains of Wester Ross. Uplands are central to the special qualities of Scotland's two National Parks while other upland areas are encompassed within Areas of Great Landscape Value or similar local landscape designations. It is therefore important that changes affecting such areas are designed and assessed to minimise the potential impact on this important resource.



Significant adverse landscape and visual impacts can result from the introduction of a built feature into an otherwise apparently natural landscape. Good design in landscape terms can also benefit engineering design and cost-effectiveness. The scale of the impact is influenced by a number of factors including:

Track alignment

- the extent to which the alignment of the track reflects the overall pattern of the landscape, for example the broad sweep of a ridgeline, or the finer grain landscape of a moraine field
- the extent to which the alignment of the track adheres to conventional patterns of development, for example running along the valley floor, linking farmsteads or passing through bealachs.

Cut and fill

- the scale and treatment of cut faces and areas of fill, together with structures such as bridges, culverts and fences.

The way the track is experienced

- the relationship between the new track and key viewpoints such as public roads, paths and hill summits.

3.5.2 UNDERSTANDING LANDSCAPE CHARACTER

Where it is proposed to construct a new track the first task will be to develop an understanding of the character of the landscape.

As a starting point, SNH's suite of [Landscape Character Assessments](#) provides comprehensive coverage across Scotland. These documents include a description of the physical evolution of the landscape and the history of settlement and land use. They also break Scotland down into a series of 'landscape character types' representing variations in geology, landform, land cover and settlement. These descriptions will provide an overview of the characteristics that are important in contributing to the landscape of the area in question. They may also provide guidance on managing change in the landscape.

The SNH Landscape Character Assessments were prepared at a fairly broad scale and may not identify key variations in landscape character at a more local level. Using the published information as a starting point, it will normally be necessary to undertake a more detailed survey of the area that would be affected by the proposed track. This will help identify key landscape characteristics that should be reflected in the alignment and design of the track. It will also help

identify key views which could be affected by the track and may suggest ways in which such impacts could be avoided or minimised.



The presence of a track in an otherwise apparently undisturbed landscape can result in adverse landscape and visual impacts

Landscape and visual impact assessment will normally be carried out by a landscape architect or landscape planner. Guidance on undertaking landscape character assessment is provided in *Landscape Character Assessment Guidance (2002)*. Methods of analysing landscape and visual impacts are provided in *Guidelines for Landscape and Visual Impact Assessment* (2nd Ed 2002) published by the Landscape Institute and the Institute of Environmental Management and Assessment. These guidelines are being reviewed and updated in 2012/13.

Liaison with *Historic Environment Scotland* is also recommended and a *Historic Landuse Assessment* should be made.

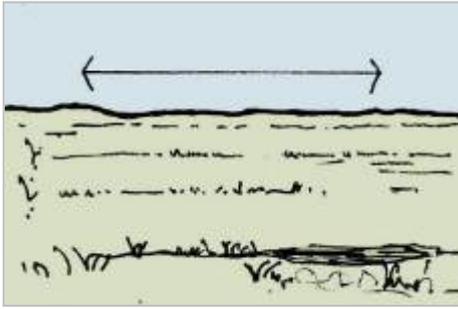
3.5.3 LANDSCAPE TYPES

It is important that key landscape characteristics are used to inform the alignment and design of the track. The following sections describe some of the types of landscape that are most commonly found in the Scottish uplands. Each description highlights the key characteristics and provides broad guidance on how tracks might most effectively be 'fitted' into the landscape. This is not an exhaustive description of landscape types but is intended to provide an overview of the way in which landscape issues should be reflected in the design process. In addition to this there will also be biodiversity and geodiversity sensitivities to consider.

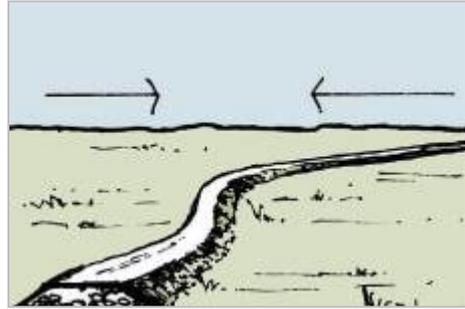
Flat landforms



This type of landscape is found in areas of plateau, sweeping *moorland* or flat peatland such as in Caithness and Rannoch Moor. These are often poorly draining and include areas of peat. Views tend to be long, open and extensive. The experience is generally one of exposure and openness.



Simple and open landscape with no visual focus



A raised track will create focus and may be a prominent feature



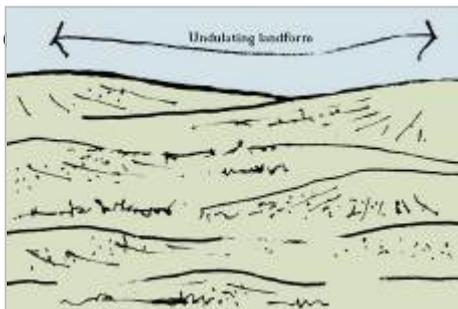
A sinuous route, flush with the surrounding ground level will reflect the open character of the landform

The simplicity of this type of landscape means there are few linear features to provide a cue for decisions about the alignment of a proposed track. Any new linear feature will introduce strong visual lines, dividing the landscape and introducing a sense of scale. Track design should avoid overly fussy or intricate alignments that would conflict with the expansive scale and form of the landscape. Where it is necessary to avoid areas of deep peat or poorer drainage, large and simple curves should be used.

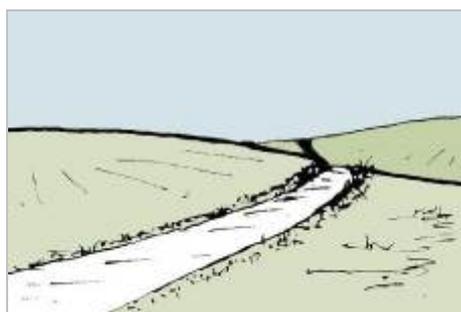
Poor drainage in these kinds of landscapes might suggest a design that raises the track above the

surrounding ground level. This would have the effect of imposing the track on the landscape. Shadows could further emphasise its presence. In such circumstances, gentle side slopes will help reduce the prominence of the track structure, but care will be needed to balance the benefits of gentle gradients with any additional land take which results.

Undulating landform



Prominent cuttings will be needed to maintain a straight & level route



A sinuous and undulating route will allow the track to fit the contours of the landscape

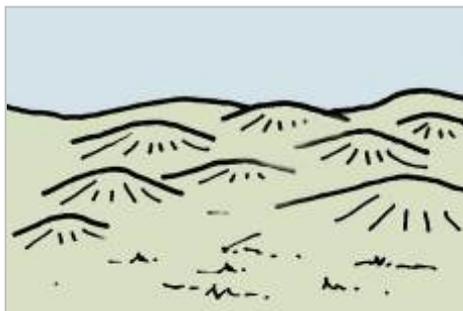
This landscape is typical of many areas of *moorland*, with its broad and open areas with gently convex slopes overlapping to give the impression of an undulating landform. While the slopes provide a degree of enclosure, there is a lack of features to provide orientation or an indication of scale. At a broader scale, the landscape is predominantly open in character. The undulating landform gives rise to variations in ground conditions, with drier areas of slightly higher ground interspersed with burns and areas of bog. This type of area can include the subtly undulating landscapes of peaty moorland found in many upland areas including Caithness and Lewis.

Given the lack of engineering constraints in this type of landscape (except those associated with

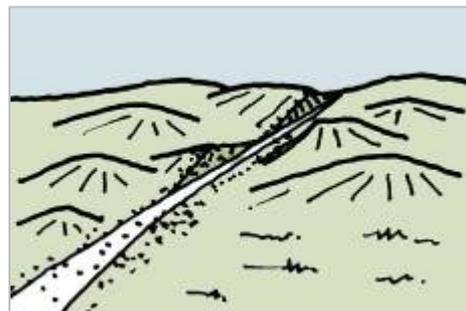
areas of deep peat and sensitive wetlands), the natural inclination might be to select a relatively straight alignment, particularly since this would result in a shorter and less costly track. This would, however, require localised sections of cut and fill as the track negotiated areas of higher and lower ground. The effect will be to superimpose a straight, clearly constructed feature onto an otherwise varied and organic landform. The areas of cut and fill will contrast with natural hill slopes and will draw attention to the track.

A more sensitive solution would involve routeing the track around areas of locally higher ground. It will still be necessary to avoid the lowest and wettest ground, but it should be possible to identify an alignment that also avoids the highest and most prominent areas. This will result in a more comfortable fit of the track into the undulating landscape. It will also reduce the need for cut and fill while the interlocking hill slopes will provide a degree of screening. The design of the track should ensure that bridging solutions or bottomless culverts are provided for existing burns and watercourses and that water is not impounded behind the track structure.

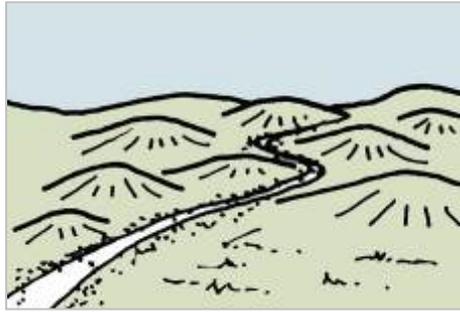
Hummocky landform



A chaotic landscape of glacial hills



As well as needing sections of cutting, a straight route will contrast with the hummocky landform, increasing landscape and visual impacts



Routeing the track around the hummocks will fit the landscape better and will be visually less prominent

This type of landform is typically associated with areas of glacial deposition in upland glens. It comprises a complex landscape of distinct, sometimes conical hummocks. Vegetation may vary with relatively minor differences in altitude, orientation and drainage. These hills are usually relatively small, but can easily contain local views and can provide an obstacle to direct movement. Taken together, these low hills create a complex, repeating texture within the upland landscape.

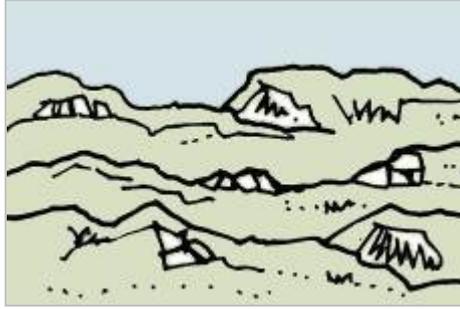
Selection of the shortest route through such a landscape would require significant amounts of cut and fill, and would have a significant impact on the character of this distinctive upland landscape. A straight track would appear as an obvious and incongruent feature in this fine grained and varied landform. Cuttings would draw further attention to the track structure. The first objective should be to determine whether the track can successfully be aligned to avoid areas of hummocky terrain. Where this proves impractical, the aim should be to identify an alignment which avoids an overly complex route, on the one hand, but responds to the repetitive nature of the hummock landform on the other.

As far as possible, the track should follow the natural geometry of the hummocks. The requirement for cut and fill should be minimised, though this will be influenced by the size of the track that is required and the complexity of the landform. Where they are required, cut faces and areas of fill should be graded to blend into the local pattern of slopes. Sufficient drainage should be provided to accommodate burns and watercourses and to prevent impoundment of water between hummocks.

This kind of landscape is of considerable interest to glacial geomorphologists.

Rocky landform

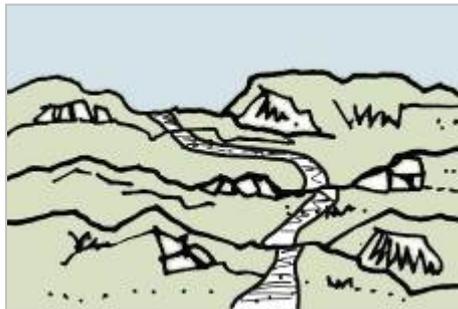




Rock outcrops and scree dominate this upland landscape



Following a direct route will require cutting and rock exposures. The straightness of the route is likely to conflict with the chaotic nature of this landscape



Where ground conditions allow tracks should pass around rock outcrops and should avoid the need for cuttings and additional exposure

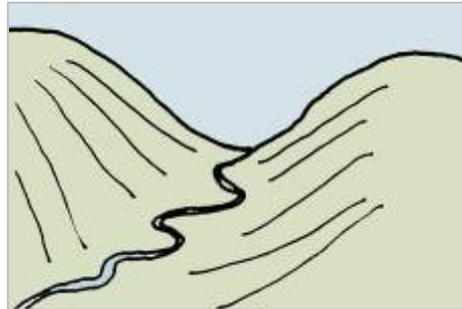
This is a common landscape, particularly in the Highlands where a steeply undulating landform is punctuated with rocky outcrops and crags. Exposed rock often contrasts with surrounding vegetation and creates a complex and rough landscape. Outcrops will often appear random, in both their size and their location. While these kinds of landscape are more usually typical of higher areas visited by stalkers, hill walkers and climbers, they are also found in higher parts of some upland glens and in some *plateau areas*.

While paths can often negotiate these complex landscapes by following tortuous routes involving many sharp changes in direction, it can be more difficult to accommodate a track. Alternatives should be considered wherever possible. Assuming that it is not practicable to avoid this type of landscape altogether, the aim should be to identify an alignment that makes maximum use of the easier ground between rock outcrops. While the creation of additional rock cuttings might appear a straightforward solution, the unweathered rock will usually contrast with neighbouring outcrops.

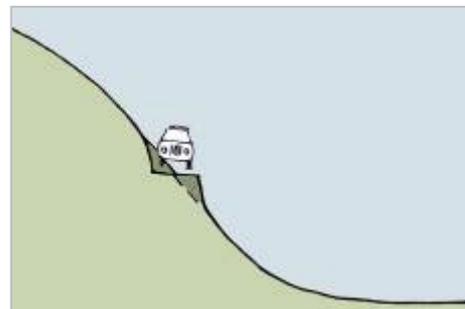
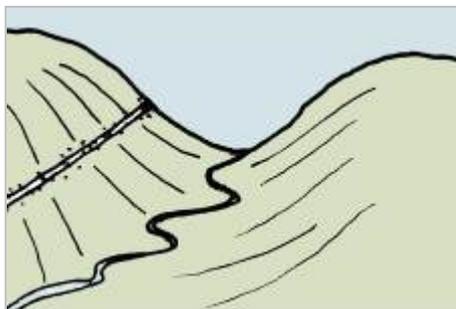
Narrow V-shaped valley



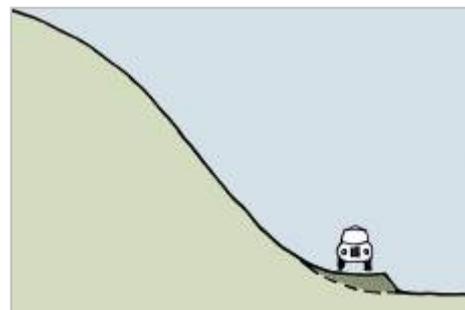
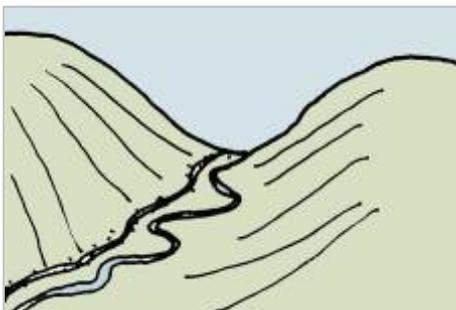
The uplands include many distinctive, comparatively narrow, steep-sided valleys. Enclosed by neighbouring uplands, these valleys are often relatively intimate in character. Views are framed within the valley and the eye tends to be drawn down the slopes to the valley floor and along the valley to the *bealach** at its head, where visible. Rivers and burns serve to emphasise the valley, providing a focus and linear movement. Most valleys have a pattern of vegetation similar to that of surrounding uplands, though they may include areas of grassland, native woodlands or individual trees. Smaller upland valleys tend to be un-settled though many accommodated historic communication routes or stalkers' paths giving access to higher ground.



Steep valley slopes with a river or burn located where they meet



A track part way up the hill will interrupt the flow of the slope, will require extensive cut and fill, and will be prominent as a result



A route through the base of the valley will appear to fit more comfortably

The aim should be to locate the track as close to existing linear features such as the valley floor or river corridor. [Note: if working within a river corridor, SEPA guidance for working near watercourses should be followed.⁵] This will appear a more natural location than part way up the valley slope where a track can appear as a more obvious imposition on the landscape and can interrupt the hill slope. Achieving this aim can be particularly difficult in narrower valleys since it is also important not to impinge too closely on water bodies. In such situations, the aim should be to locate the track within the lower third or quarter of the valley slope, on the harder, drier ground.

⁵ [SEPA guidance for working near watercourses includes WAT-SG-25 on Good Practice guide for River Crossings and WAT-SG-29 on Construction Methods](#)

* a pass or area of slightly lower ground between two hills or mountains

These lower slopes will normally (though not always) be more gentle than those at higher elevations, reducing the need for extensive areas of upslope cut and downslope fill to accommodate the track. A gently curving route will appear more natural than a straight line. Where possible, the track should pass (approaching at an angle) over the lowest part of any bealach at the head of the valley.

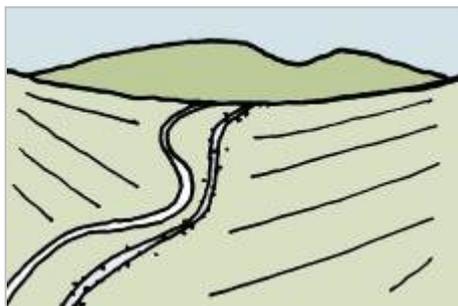
Broad U-shaped valley



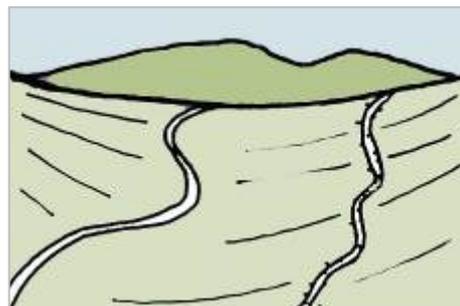
Mirroring a strongly meandering river course will create an overly complex route



A simpler alignment helps maintain the focus of the valley



A simple river form is less prominent and it is easy for a track to compete for attention



A route that parallels the river course will reinforce rather than compete

Wide, comparatively open U-shaped valleys were formed during successive periods of glaciation and are found throughout the Scottish uplands. These are often larger scale landscapes, including a broad valley floor and sweeping valley slopes. Such valleys often accommodate meandering rivers, lochs and areas of wetland. Some glens may have isolated farmsteads, lodges or bothies. Many more have historic sites such as abandoned settlements and field systems. Valleys are

often of importance for recreation, including routes through the uplands or providing access to neighbouring hills.

Broad, U-shaped valleys have a relatively subtle definition of side slopes and valley floor. This means that features such as tracks need to be carefully routed to ensure the most comfortable landscape fit. As a general rule, tracks should normally be located at the break of slope, marking the approximate junction of the valley floor with the valley slopes. This will help ensure that the track is not affected by flood events and will maintain the visual integrity of the floodplain. It will also help avoid sensitive wetland habitats.

Track alignment and form should also consider the course of rivers and burns. In the case of a strongly meandering river, there is a risk that, by adopting a similarly curving route, a track could compete visually with the natural river form. In this case, a simpler, gently curving alignment at some distance from the river will help maintain the focus of the valley. In the case of a simpler river morphology, a closer reflection of the watercourse in the track alignment may be more appropriate.

Track alignment should also be informed by the pattern and location of existing settlement within the glen in question. While it is important to ensure that a track does not affect areas of historic importance, the landscape impacts will be reduced if it is integrated with other 'man-made' elements such as field systems or estate buildings.

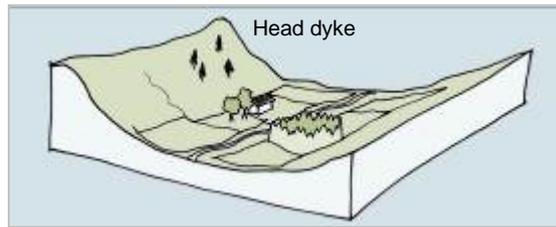
The sides of broad, U-shaped valleys are commonly found to be weathered (probably resulting from release of pressure as the ice sheets melted, and the subsequent weathering of joints). These weathered areas may be particularly sensitive to erosion and instability.

Broad strath or open glen

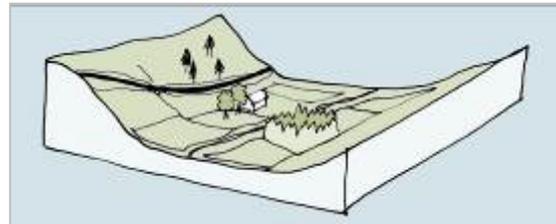


These are shallow, often flat bottomed valleys that can provide a transition between the lowlands and uplands. Many are comparatively well settled and provide corridors for road and rail communication. Valley floors and lower slopes tend to be managed for agriculture with settlement concentrated along the break of slope on drier ground. Vegetation may include coniferous and broadleaf woodland, together with grass and heather moorland. Views tend to be orientated along the valley or from higher ground over the strath.

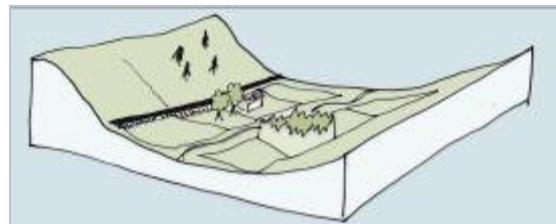
Fields tend to dominate the flatter and more fertile strath floor. Existing tracks often run along the edge of the floodplain, following the break of slope which is often emphasised by the presence of a 'head dyke'. In addition to following drier ground, such tracks link settlements and provide continuous access to farmland. This kind of alignment means that tracks fit the landscape relatively comfortably. New tracks should aim to reflect this pattern, but should take care not to breach historic features such as the head dyke, and to avoid impacts upon the floodplain.



Many straths include farmland, woods and farmsteads, lodges or bothies



A route on the open hillside will be prominent and will conflict with the historic pattern of settlement



A route along the edge of the fields will sit more comfortably in the landscape

Hill slopes



Hill slopes are a recurring element in the upland landscape. They take a wide variety of forms, with different angles, lengths and orientations. Many show the effects of glaciation, with concave lower slopes running into convex upper slopes. The influence of underlying geology is usually evident in the form of terraces or rock outcrops. Gullies and side glens often dissect the slopes. The pattern of vegetation can also have an influence on the appearance of upland slopes. Native woodland, grassland and moorland can accentuate changes in elevation, gradient and local variations in landform. Coniferous forestry can obscure the finer detail of the hill slope. Lighting conditions vary considerably with orientation and time of day. In full sunshine, hill slopes can appear vivid and detailed. When they are in shade the darkness can create a sense of depth within the landscape.

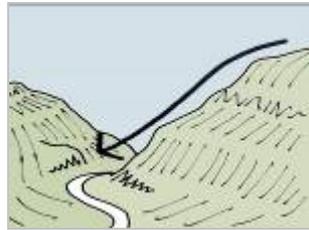
The steepness of the slope has an influence on the way that people 'read' the landscape. Steeper gradients have greater 'visual force', creating a sense of drama and drawing the eye down or up the slope more rapidly. Gentler slopes are, by contrast, less dramatic.



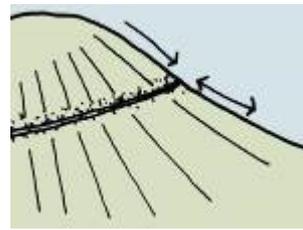
Many hills have concave lower slopes running into convex upper slopes



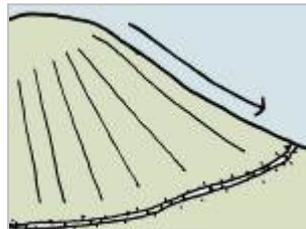
Gentler slopes have less visual force



Steeper slopes have more visual force



A track higher on the slope interrupts the visual flow and is prominent as a result



A route at the foot of the slope will be less prominent and will sit more comfortably in the landscape

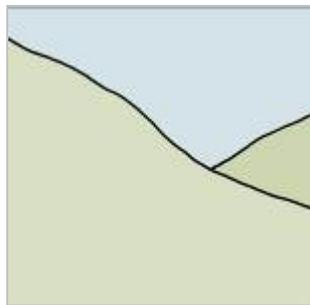
Given the simplicity of the landform, and the tendency for natural features such as vegetation and woodland to reflect and emphasise the pattern of the slope, a key challenge is to find ways of locating tracks that do not weaken slopes' key characteristics. There is a risk, for example, that a track part way up a hill slope interrupts the visual flow of the slope, effectively dissecting the slope. Any such track will also be prominent in this landscape.

Wherever possible, tracks should avoid cutting directly across the gradient of the slope since this will draw attention to the track and compromise the scale and visual flow of the slope. Where such routes are unavoidable, the alignment should be designed to follow the break of slope as far as possible, and to make use of features such as terraces or shelves. Following the break of slope will create a more logical and balanced landscape with the minimum disruption to the profile of the slope. Areas of scree and boulders should, wherever possible, be avoided, since it will be difficult to 'fit' the track visually into the chaotic structure of the landscape.

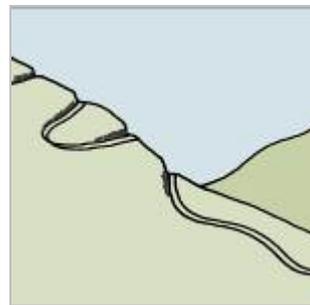
Ridgelines



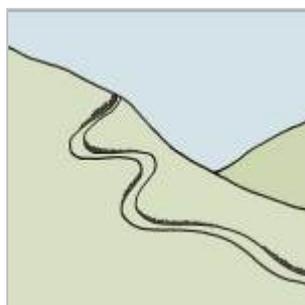
Ridges are a common component of many upland landscapes, linking summits and plateau areas with glens and straths. Ridges are often prominent features, visible as well defined skylines or back-dropped slopes. They are usually quite exposed, experiencing more extreme wind, rain and snow and less vegetation cover than more sheltered valley locations below. However, their prominence means they are often favoured as locations for telecommunications infrastructure. They may also provide the easiest route between the glen and the hill top and may facilitate recreation access to higher ground, or may be favoured as a route to provide access to a wind farm.



Ridges often form strong lines in the upland landscape



A track that follows the crest of the ridge, although only partly visible, will be prominent



Avoiding the ridge's crest as far as possible will help minimise the track's impact

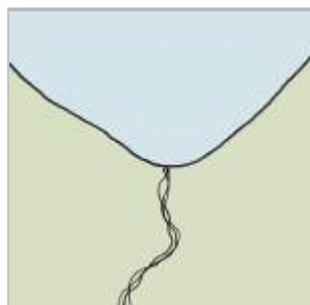
It is almost inevitable that locating tracks along ridgelines will result in a comparatively high level of landscape and visual impact. It can, however, be reduced by ensuring that the track is located off the most prominent central spine of the ridge, closer to the upper break of slope. The precise alignment should be designed to minimise visibility from key viewpoints, including those on lower ground, on neighbouring hillsides and from above. The design of the track and associated drainage should aim to keep areas of cut and fill (a cross section and longitudinally) to an absolute minimum since these are likely to be very visible and are likely to be subject to snow retention during the winter and early spring.

Bealachs

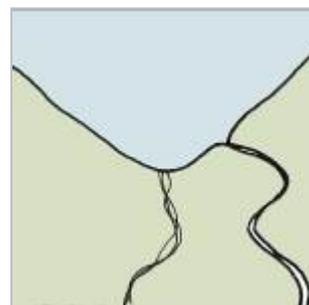


Bealachs (or cols) are passes or areas of slightly lower ground between two hills or mountains. These often form watersheds between different river catchments. The skyline may have a distinctive, sometimes symmetrical form at the head of upland glens. Frequently bealachs accommodate paths and other routes through the uplands, or provide access to the hills themselves. While bealachs often appear as the most rational or 'natural' route for a track, the use of cuttings can create particularly prominent 'notches' on the skyline.

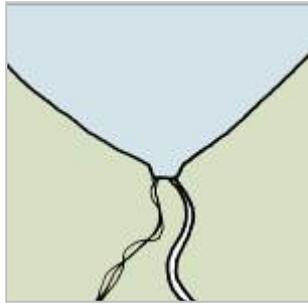
The design of tracks should aim to reflect the symmetrical character of the bealach landform. This applies both to tracks running through the bealach (to and from neighbouring areas of lower ground) or across the bealach (to and from neighbouring areas of higher ground). The use of cuttings and areas of fill should be minimised since these are likely to be very visible on the skyline. The alignment of the track and the construction method may need to respond to the frequent occurrence of deep peat in bealach areas, as well as the need to maintain water flows, and water quality, at key watershed locations.



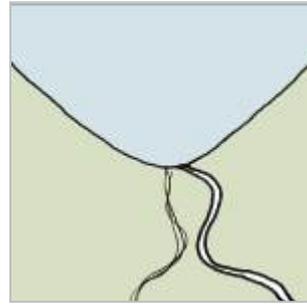
Bealachs provide a point of visual focus in the upland landscape



An alignment on the slopes above the bealach weakens the natural focus of the landscape



Passing over the bealach in cutting will create a notch in the skyline which may be very prominent



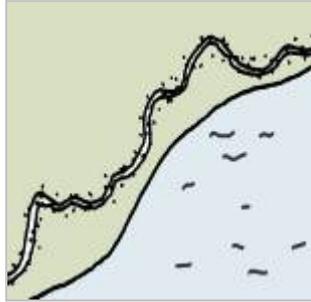
A track should approach at a gentle angle and should pass the bealach without the need for a cutting

Water - land edge

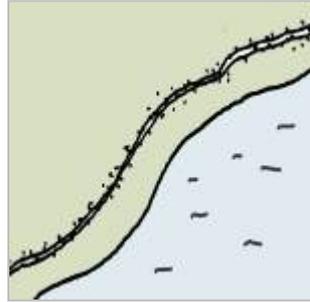


The boundary between the land and water can be one of the most prominent physical lines in the upland landscape. This is particularly the case where hills and mountains neighbour lochs or the sea. The complexity and character of the water: land edge varies considerably. In the case of many firths and inland lochs, the comparatively sheltered shoreline is simple and smooth. This contrasts with the exposed, rocky and indented shoreline that characterises many sections of open coast. Many sea coasts are characterised by raised beaches and cliff lines resulting from post-glacial changes in sea level.

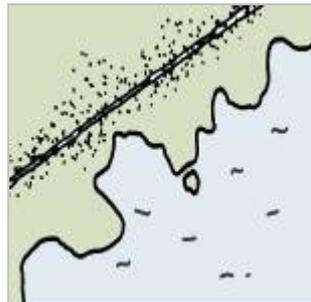
Track design should aim to reflect the overall character of the coast, though the availability of land for construction is also likely to be a determining factor in many situations. Where the shoreline is relatively simple, this should be complemented by a simple and straightforward track alignment. Where the shoreline is more complex and intricate, track design should aim to strike a balance between a very simple route (which would contrast with the natural character of the shore) and an overly complex alignment (which would be costly and impractical). In such cases, track alignment should aim to represent a partial simplification of the coastal topography. Raised beach platforms can provide a suitable setting for track routeing.



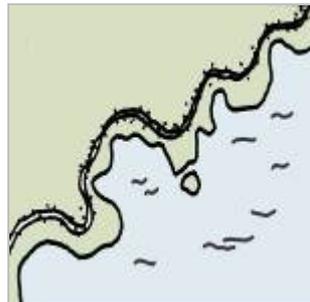
A complex route will normally contrast with a more simple coastal landscape



The track's alignment should echo the simplicity of the coastline



A straight alignment will contrast with a complex coast of bays and headlands



The track's alignment should represent a simplification of the coastline

Track design should, as far as possible, reflect the existing topography, making minimum use of cuttings and embankments. Minimising impacts upon water bodies and ensuring an appropriate buffer to them is likely to be of particular importance. It will of course be important to ensure that other natural and cultural heritage interests are fully considered in the design process.

Coniferous forest

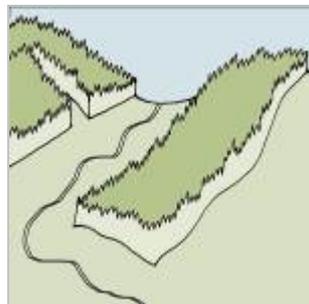


The twentieth century saw the establishment of significant areas of coniferous forestry in many parts of the Scottish uplands. Many of these are comparatively uniform in appearance, due to the use of single species and an even age structure. Allied to the use of geometric forestry edges, these older forests are often unsympathetic to their landscape setting. The earlier emphasis on timber production has been broadened to reflect a wider range of objectives, including recreation and biodiversity. This habitat can be associated with many of the foregoing landscape types.

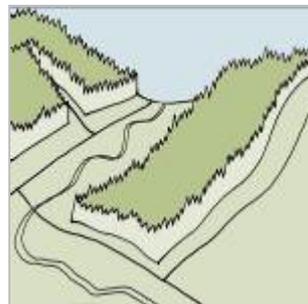
Considerable guidance now exists on ways of designing forests to fit more sensitively within the landscape. Many areas of forestry are now reaching maturity, creating demand for new tracks (to allow access for harvesting machinery and the export of timber) but also opportunities to restructure the forestry to reduce landscape impacts and enhance biodiversity and recreation benefits.

Given the transitory nature of forestry (albeit on a long cycle), tracks should not be designed to match with the geometry of woodland blocks or edges. It is important that new forestry tracks are designed to reflect the character and topography of the underlying landscape. While forestry may provide temporary screening, this is likely to be removed when the timber is harvested, potentially increasing the level of landscape and visual impact. This is a particular concern given the scale of many forestry tracks and the need for stockpiling, loading, passing and turning areas.

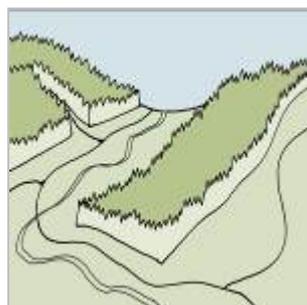
It is essential that the need for tracks, and ways in which they can be fitted into the upland landscape, are taken into account from the outset, rather than being left to when the timber is harvested. Where track construction would result in significant environmental effects, and where it is likely that other extraction methods (such as the use of chutes or helicopters) are uneconomic or impractical, this should be a key factor determining whether a forestry scheme is implemented.



Coniferous forestry can take the form of geometric blocks



Following the boundaries of the forestry rather than the form of the landscape can create a geometric network of tracks



Fitting tracks to reflect the underlying landscape will have lower impacts in the long term

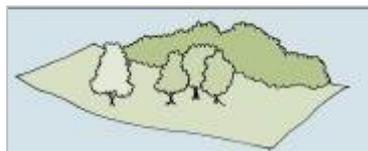
Native woodland



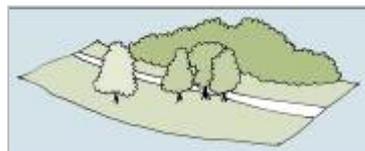
Native broadleaf and coniferous woodland is an important component of many upland landscapes. A range of policies and initiatives now favours the expansion of native woodlands in many parts of the Scottish uplands so it is likely that wooded landscapes will become more common in the future. This habitat can be associated with any of the foregoing landscape types.

Native woodlands have a subtle structure which can comprise comparatively dense stands or areas of more open woodland. Different species and ages create a diversity of texture, colour and structure or pattern. Such woodlands tend to be located in topography that provides a degree of shelter from prevailing winds, favouring glens, incised valleys, lower ground and at the foot of slopes. In many cases such woodland serves to emphasise the character and structure of the landscape.

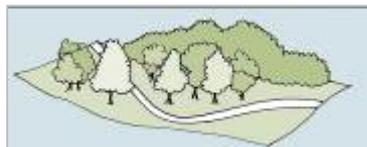
Native woodlands are often sensitive, both from landscape and biodiversity perspectives. The need for tracks in such areas should be considered carefully and alternative options explored fully. Where the need for a track is unavoidable, design and management will be critical in ensuring that new, straight lines are not imposed on a form of the woodland that has an otherwise natural appearance. This is particularly relevant where tracks are constructed alongside an area of woodland, or where existing features such as deer fences provide an apparently logical reference point.



Many native woodlands include individual trees and groups



Tracks should avoid running close to individual trees or cutting trees off from the main area of woodland



A curving route, together with new planting, will help fit the track into the wooded landscape and improve the experience of the track user

It is important that tracks reflect the underlying landform, responding to variations in topography in the same way as the woodland cover itself. Ideally, it would be possible to accommodate a gently curving track through open areas within the woodland, thereby using the natural woodland form to fit the track into the landscape and provide a measure of screening. It will be necessary to provide an adequate buffer between the track (and any drainage structures) and existing trees to avoid damaging root structures or altering the local water regime. It may be appropriate to include some new woodland planting in areas alongside the track.

Heather or grass dominated moorland



Much of the Scottish uplands comprise extensive areas of heather or grass dominated moorland. While these tend to be open landscapes with few scale references, the low blanket of vegetation often reflects an underlying grain in the landscape, with variations in species and colours in response to changes in drainage or soil conditions. Thin soils and harsh climatic conditions mean that vegetation regenerates slowly and damage may take many decades to repair. Some sites may never recover from damage. This habitat can be associated with any of the foregoing landscape types.

There are often few opportunities to provide effective screening in these open landscapes. The construction of tracks can introduce scale to the landscape and can detract from its wild land qualities. This is a particular concern given the time it takes for natural regeneration of habitats that have been severely disturbed, such as areas of cutting and embankment.

Given the sensitivity and prominence of these areas, and the difficulty in achieving successful screening, the need for tracks in such areas should be considered fully and alternatives explored carefully. Where the need for a track is unavoidable, priority should be given to an alignment that minimises the need for extensive areas of cut and fill. These will prove difficult to screen and successful revegetation may be difficult to achieve, particularly in more exposed locations. Wherever possible, the material for track surfacing should be chosen to minimise the contrast with the prevailing vegetation.

Visual effects

As well as the effects on landscape character, proposed tracks should also be considered in terms of their visual impact on key viewpoints. It is the combination of the effect on landscape character, and the nature and extent of the visibility, that will determine the overall landscape and visual impact. The aim of the visibility analysis should be to identify relevant viewpoints and to consider how visible the new track would be from each.



The most important viewpoints will be different for each area, but could include:

- settlement/residences
- recreational areas
- tracks, paths and trails;
- public roads
- hill tops, summits, local viewpoints or other natural or cultural points of interest.

Visibility analysis can be undertaken in a number of ways. It is increasingly common to undertake a GIS based analysis using digital contour data. This approach involves a computer constructing a three dimensional model of the area through which the proposed track runs. Key viewpoints and the proposed track route can be plotted onto this model and, taking each viewpoint in turn, the computer is able to calculate Zones of Theoretical Visibility (ZTV)⁶ indicating which sections of track would be visible from which locations. This has the benefit of allowing the visibility of alternative routes to be compared.

It is also possible to undertake much more limited analysis manually by analysing Ordnance Survey maps, and, where there is a limited number of viewpoints, undertaking field survey to 'ground truth' the results. Surveyors walking a proposed route wearing high-visibility jackets can be observed from a viewpoint to identify the extent of intervisibility.

Having analysed the extent of intervisibility for each viewpoint, it will be necessary to consider the implications for the view in question.

Taking into account the scale of the track, and the distance from the viewer:

- To what extent will the track be a visible feature in the landscape?
- Can the extent of visual impact be reduced by selecting an alternative alignment?
- Is there scope for mitigation measures, for example earth modelling or, in lower areas, native woodland planting, to reduce the visual impact?

⁶Further detail on ZTV can be found in [Visual Representation of Wind Farms \(SNH 2014\)](#).

3.5.4 WIND FARMS - LANDSCAPE AND VISUAL EFFECTS



Wind farm tracks must be considered as part of the Landscape and Visual Impact Assessment (LVIA) of the wind farm as a whole. However there is a tendency to judge the impacts of tracks on the basis of visibility over the same distances as the wind farm, using viewpoints that are not always suitable for assessing the potential impact of the access tracks which are often erroneously considered to be a minor part of the scheme.

As tracks can account for a significant element of the environmental impact of the wind farm it is important to consider them at a local scale. Particular attention should be given to conditions along the potential track route, using additional viewpoints to assess the impact of the track alone and to inform route selection and detailed design.

Wind farms are generally sited on high ground, and the tracks cross lowland, transitional, slopes and upland settings including plateaux and ridgelines. The tracks may therefore need different design solutions to reflect the local conditions of different sections of the track. Tracks that require a higher specification due to the nature of the development they serve cannot so easily fit with the natural topography as smaller tracks can. Instead they can cut across the landscape with large scale cuttings and embankments that are highly visible and insensitive to the local character of the landscape.

The Highland Council document [Construction Environmental Management Process for Large Scale Projects](#) sets out a robust Project Environmental Management Process (PEMP) for large scale construction projects, including those incorporating tracks. The procedure and stages outlined ensure that necessary mitigation measures identified and agreed at early stages of a project for the safeguarding of the environment are taken through to implementation with the involvement of all parties at the relevant stages.

3.6 Biodiversity



3.6.1. BIODIVERSITY

Most construction impacts on biodiversity can be mitigated through careful track design.

A four step process should be used to ensure this:

identify > avoid > reduce > compensate



Mountain Pansy



Sphagnum moss



Devil's bit scabious

Identifying important aspects of biodiversity

Gathering as much biological information about the potential route of a track is the first step in the process. This might include:

- The location of statutory sites designated for nature conservation purposes, such as Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs), Special Areas of Conservation (SACs) or Ramsar sites. This information is normally available from [Scottish Natural Heritage](https://www.scotland.gov.uk/topics/nature/scottish-natural-heritage).
- The location of non-statutory sites designated for nature conservation, such as local wildlife sites, Ancient Woodland or Regionally Important Geological Sites (RIGs). This information is usually available from the relevant Local Authority.
- The location of legally protected species. This information is sometimes available from the [National Biodiversity Network \(NBN\)](https://www.gov.uk/national-biodiversity-network), Biological Record Centres, local wildlife organisations or the relevant Local Authority, although new dedicated survey data are likely to be required.

- The significance of the distance between the location of these species and their places of shelter from the proposed track will vary from species to species, but this can range from 30m for a badger sett to up to 1000m for a golden eagle nest.
- The type and extent of habitats and species along the proposed track route, including those on the [Scottish Biodiversity List](#). This information may be available from estate maps, local wildlife organisations or the relevant Local Authority, although it is likely that up to date dedicated survey data will be required using a national standard technique, such as National Vegetation Classification (NVC) and Breeding Bird Survey. Surveys need to be of a type and standard that allows identification of, and quantifies, UKBAP, Annex 1 habitats, and groundwater dependent terrestrial ecosystems (GWDTE), as these are the ones that will normally be considered in assessments. Surveys need to take account of habitats, species and hydrology. A corridor 100m wide either side of the proposed track is sufficient for most habitat interests. However the width will vary according to the certainty of the route and the nature of the interest.

The more recent the data, the more robust the planning process will be.

Avoiding important aspects of biodiversity

The primary goal for biodiversity of fitting a track into the landscape is to ‘design out’ potentially significant impacts.

This has two aspects:

- avoiding features perceived to have high ecological value
- avoiding features that are less resistant to disturbance or that are less resilient.



Club Moss



Sundew



Bell heather

Valuing habitats and species

Valuing those habitats and species likely to be affected by a development (known as ‘ecological receptors’) allows the most valuable biodiversity features to be avoided. A summary of one approach to valuing ecological receptors in Scotland can be found in Table 1. The table shows how ecological value can be assessed using a combination of statutory measures (legally protected sites and species) and non-statutory but widely accepted measures, such as the presence of notable habitats and species listed on the [Scottish Biodiversity List](#) or [UK BAP](#) priorities list.⁷

⁷ Further information on valuing nature and ecosystems:

http://www.environment.scotland.gov.uk/our_environment/society/benefits_from_nature.aspx
<http://www.biodiversityscotland.gov.uk/biodiversity/important/>

Table 1: An approach to valuing ecological receptors in Scotland

Level of value	Examples
Highest	<ul style="list-style-type: none"> • A site subject to <i>international designation</i> (SPA, SAC, Ramsar site) • A <i>nationally designated site</i> (SSSI, NNR) • <i>European Protected Species</i> (i.e. species listed on Schedules 2 & 4 of the Habitats Regulations) • Badgers • Bird species listed on Annex 1 of the <i>Birds Directive and/or Schedule 1 of the Wildlife & Countryside Act 1981 (as amended)</i> • Animal or plant species listed in Schedule 5 or 8 of the <i>Wildlife & Countryside Act 1981 (as amended)</i> • A viable area of a habitat type listed in Annex 1 of the Habitats Directive • Any regularly occurring population of an internationally important species, i.e. those listed in Annex II or V of the <i>Habitats Directive</i> • A viable area of a <i>UKBAP</i> Priority Habitat • A regularly occurring population of a UKBAP Priority species • Viable areas of key habitat identified in local BAPs • Local Nature Reserves (LNR) and non-statutory Local Nature Conservation Sites (LNCS) (e.g. SINC or RIGS) • Watercourses, lochs and wetlands • Ancient and semi-natural woodland • Commonplace and widespread habitats, e.g. poor semi-improved grassland, coniferous plantation.
Lowest	<ul style="list-style-type: none"> • Habitats of little or no ecological value, e.g. amenity grassland or hard standing



Cloudberry



Butterwort



Adder

The primary biodiversity aim in locating a track is to avoid having an effect on features that have high ecological value. Table 1 shows that this may refer to sites, habitats or species which have particular protection under UK or European legislation, but use should also be made of Local Biodiversity Action Plans (LBAPs) and the *Scottish Biodiversity List* (which includes UKBAP priorities) to identify what is considered to be important at a more local level. Where it is not possible to avoid affecting sites or species with statutory protection, consents and/or licences are likely to be required. [Section 7](#) provides further information on obtaining consents and licences.

Many upland habitats of high ecological value, such as blanket bog, are also areas which present certain construction difficulties, and it is possible that preferential avoidance of these areas will also be made on engineering grounds.

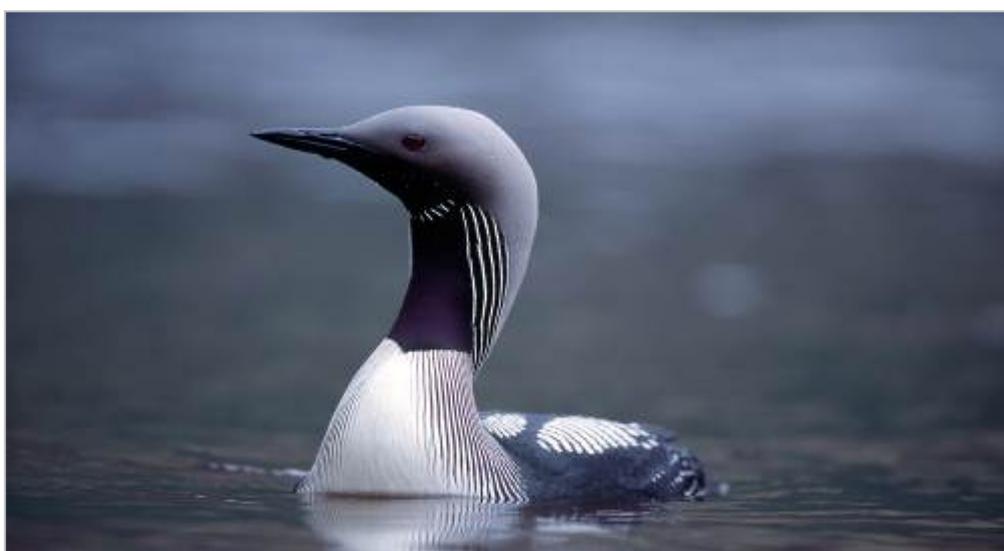
The disturbance and displacement of animal species during the construction and use of a track is much more likely than direct animal mortalities. Some species can easily move away from sources of disturbance or are able to tolerate noise (e.g. otters) or the presence of people. However, other species are much more vulnerable to disturbance especially during their breeding

season.

Breeding birds are often highly sensitive to disturbance, and for some species, such as golden eagle, which return to the same nest site year after year, these impacts can be long-lasting. These species may be put off from breeding again in that location if the new track is visible from the nest site. This could therefore include nesting sites that are some distance from the track location.

Advice can be sought from Scottish Natural Heritage or RSPB as to whether this is a likely prospect for a proposed track, and these organisations may also be able to provide advice regarding possible mitigation for these impacts (*see also page 60*).

As a general rule, 30–100m buffer zones are required around the shelters used by *badger* and *otter*, varying from case to case. There is no formal guidance regarding critical distances from the nest sites of birds of particular conservation importance, but approximate distances up to which species may be vulnerable to disturbance are provided in Table 2. SNH will be able to provide specialist advice on these matters if required.⁸



Black-throated Diver

Table 2: Approximate critical disturbance distances for selected bird species of conservation concern

	Red-throated Diver	Black-throated Diver	Golden Eagle	Sea Eagle	Peregrine	Red Kite	Osprey	Common Scoter	Black Grouse	Black Grouse Lek
Critical disturbance distance (m)	500-750	500-750	750-1000	500-750	500-750	150-300	500-750	300-500	100-150	500-750

** Figures taken from 'A review of disturbance distances in selected bird species' Ruddock, M. & Whitfield, D.P. (2007) (see footnote)*

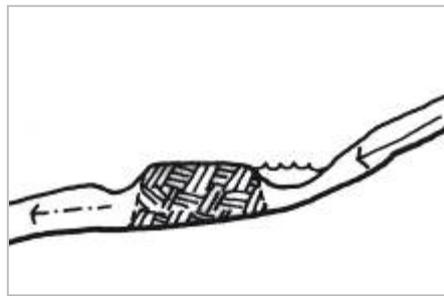
Minimising the impact magnitude

As well as avoiding particularly sensitive aspects of biodiversity, the potential impact on habitats and species can be minimised by ensuring that the track does not fragment the ecological resource or create a barrier to the movement of animals. Dividing up a habitat patch into smaller fragments can alter the way in which that particular habitat functions. Where possible, tracks should follow the natural edge of habitat patches.

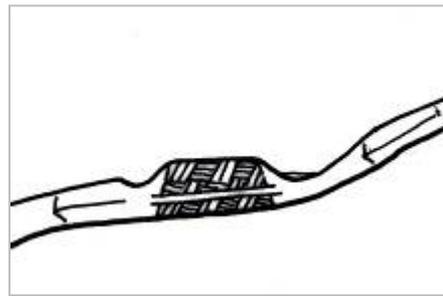
⁸ [A review of disturbance distances in selected bird species](#)

Tracks can have a significant impact on animals if they divide a population, or if they separate a given population from its feeding or foraging area. For example, although a track may be carefully placed to be beyond the 30m disturbance buffer around a badger sett, if it falls between main subsidiary setts also used by the badgers, there may still be significant disturbance impacts. The location of crossing points likely to be used by mammal species such as otter, badger or deer can be identified at an early stage, and reflective road-side markers can be used to try to minimise road mortality rates. Hazard warning signs could be provided.

Many upland habitats are maintained by particular patterns of through drainage, which can be interrupted by the construction of a track. Tracks can also create new patterns of through drainage which disrupt the natural processes. For example track drains can create preferential pathways which drain natural wetland areas. Track design should ensure that construction does not affect groundwater flow or result in the drying or flooding of habitats, or localised soil erosion caused by sheet wash from newly created 'hard' surfaces and corresponding sedimentation of adjacent areas.



Poor track design can interrupt drainage causing flooding uphill and drought conditions downhill



Blending the slopes into the natural profile of the hill will reduce the visual impact but could increase the extent of habitat disturbance

Care must also be taken not to destroy plant root systems, especially for trees where roots can extend a considerable distance from the above-ground vegetation, both just below the surface and at depth. Excavations can also disturb the burrows or hibernation sites of certain animals, including reptiles and mammals. For some species, such as *badger*, tunnel networks can extend for many metres beyond an entrance point, thus highlighting the importance of robust survey data prior to track construction.

Protecting soil quality, and hence soil biodiversity, is also an important consideration. Construction activities can result in soil contamination from construction materials, oils and fuels which can significantly affect soil micro-organisms; and compaction affecting soil porosity, hydrology and stability ([see pages 111-113](#)).

Habitat types

Specific habitat types or mosaics of habitats will present particular potential constraints to upland track design and construction, due to the plants, animals and soils present. Although not intended to be exhaustive, the following provides some guidance as to the likely issues that will be faced when planning tracks in different habitat types. The main sensitive biodiversity features in each situation are also summarised in [Table 3](#).

A number of habitats are highlighted as being listed on Annex 1 of the EC *Habitats Directive*. These are habitats that have particularly high nature conservation importance within a European context. The most valuable areas of these habitats are protected as SACs, but even outwith Natura sites, conservation of Annex 1 habitats should be an important consideration when designing track routes. A number of upland habitats are also listed as priority habitats in the UK Biodiversity Action Plan (*UK BAP*). Conservation of UK BAP Priority Habitats should also be taken into account when designing track routes.

Heathland



Heathland habitats tend to be those dominated by heather and other ericaceous dwarf shrub species, on soil with less than 0.5m depth of peat. When vegetation is removed these soils are particularly prone to erosion. Heathland habitats can form complex mosaics with other broad habitat types including grasslands and wetlands.

Heathland is found in a range of landscapes where there is a shallow peaty substrate. It typically occurs above the line of enclosed farmland, stretching up to the climatic tree line. This includes gently sloping hillsides, plateaux and ridges, as well as valley bottoms, and sometimes coastal fringes. It tends to be a sheep- or deer-grazed habitat, often used for grouse shooting or deer-stalking.

Most types of heathland, scree and plant communities which form around long-lying snowbeds are classified under the EC Habitats Directive as 'Annex 1' habitats.

Upland heathland is also listed as a UK BAP Priority Habitat. UK BAP Priority Habitats are those for which the UK either has an international obligation for conservation; are at risk due to rarity or decline; are functionally critical for a wider habitat mosaic, or which support UKBAP Priority Species. Species-rich areas of the globally rare **Scottish Liverwort Heath** for which Scotland has particular international responsibility should be avoided. This is because the habitat is highly sensitive to disturbance, has poor capacity to recover, and is of very restricted distribution. The conservation of both UK BAP and Annex 1 habitats should be a priority when designing track routes

There is also a large number of animal species associated with heathland whose presence should be considered. Those with national or European protection include reptiles, badger, wildcat and breeding birds (many moorland birds are ground nesting). Mountain hare is also found in these habitats, which although lacking in statutory protection, is listed as a UKBAP Priority species.

The relatively shallow peat depths associated with heathland habitats means that most tracks will be built using 'cut and fill'. This construction technique can result in a high degree of peripheral habitat disturbance and it is important to ensure that vegetated turfs, peat and other soils that are removed during the construction work are properly stored and reinstated wherever possible.

Wetlands including bogs, springs and flushes

Upland wetland habitats include blanket bog, raised bog, intermediate bogs, pools, springs, flushes and fens, and other GWDTEs.



Blanket bogs are largely restricted in their European distribution to the UK and Ireland. Their rarity means that they are classified as an Annex 1 Habitat, and are also listed as a **Priority Habitat** on the UK BAP. They generally occur on peat which is at least 0.5m in depth, and often very much more, and receive their water input purely from rainfall. These bogs are known as 'ombrotrophic' mires, and are found on hill top plateaux, saddles and watersheds. The ground is often level or only moderately sloping, and there may be eroded peat gullies and peat 'haggs'.

Areas of peat that are fed by runoff from surrounding areas as well as by rainfall are termed 'minerotrophic' and form fens. They are usually found on valley floors and valley-side terraces.

These wetland types are particularly sensitive to damage from track construction. Even tracks outwith the wetland area may cause damage if the movement of water to or from the wetland is affected. It is therefore particularly important to identify areas of wetland which could be affected by a proposed track.

Wetlands are important areas for a number of upland birds, and can provide habitat for water vole populations and otter (particularly on watersheds), and a range of other species including invertebrates and **bryophytes**. Drier areas may also be used by reptiles.

The deep peat and hydrological patterns which are normally associated with these wetland types present particular construction hurdles. Although the presumption should be to avoid disturbing these habitats at all, this is not always practicable. **'Floating roads'** are usually used in deep peat areas, but it should be understood that this method of construction can significantly alter habitat drainage regimes. Adequate provision must be made for maintaining through-drainage to avoid drying or flooding of habitats adjacent to the track. It is important to maintain hydrological connectivity between both sides of the track in order to avoid impacts on GWDTEs and other wetlands, and this is particularly important where a track runs across a slope.

Grasslands

Grassland areas in the uplands are often thought of as species-poor and ecologically uninteresting areas. However, where grazing is well managed, or where grasslands form intricate mosaics with other habitat types, they can provide valuable habitat for a range of species.

Improved and semi-improved grassland areas are usually found within enclosed farmland. The unimproved grasslands occur outside these enclosed areas, and are usually sheep, deer and/or rabbit grazed. They might be on valley sides, bottoms or hilltops, as well as within woodlands and can often have a very distinctive 'tussocky' appearance.



Upland grasslands in calcareous areas are both an Annex 1 Habitat and listed in the UK BAP as a Priority Habitat, *Upland calcareous grassland*. These grasslands can support a range of species including reptiles, breeding birds, wildcat and badger, and of which a number are nationally or internationally protected.

Many of the issues with heathland habitats also apply to track construction in grassland areas. Indeed, *heathland and grassland* often form intricate mosaics with each other in the uplands and cannot always be differentiated. Cut and fill is likely to be the primary construction technique here, and as grassy turfs can provide good seed sources for track edge restoration, excavated material must be properly stored.

Woodlands



Upland native woodland in Scotland currently covers a fraction of its original extent. Broadleaf woodlands remain in steep-sided river valleys, out of reach of grazing sheep and deer. There may also be wet woodlands on valley floors. Caledonian forests, Western acidic oak woodland, Bog woodland and Juniper on heath or calcareous grasslands are *Annex 1 habitat* types, and Native pine woodlands, Upland mixed ashwoods, Upland oakwood, Upland birchwoods and Wet woodland are all *UK BAP Priority Habitats*. These woodlands are often rich in bryophytes and lichens, as are Atlantic hazelwoods, and are particularly important for breeding birds, as well as providing habitat for bats, red squirrel, wildcat, pine marten and badger, all of which have national

or European protection. Licences are required for works which may affect many of these species. Native woodlands can support undisturbed soil profiles – a valuable feature that is rare in the UK.

Tracks within woodland areas are likely to involve a range of construction techniques. It may be necessary to use a sinuous track line to avoid felling trees particularly those of landscape or biodiversity importance and to avoid impacting on their root systems. Woodland ground flora habitats are often long established and may not be well adapted to disturbance. Care must therefore be taken to limit the zone of construction activities, and retain turf and soils for post-construction restoration.

Streams, rivers and lochs



Scotland's lochs, lochans, streams and rivers often have extremely high water quality, and maintaining the quality and quantity of water in these habitats is important for a range of animal, plant and invertebrate species. This includes mammals such as otter and water vole; fish; river jelly lichen; and many bird species of international or national conservation importance such as black-throated and red-throated divers, and common scoter. Important fish species spawn in the lower reaches of upland streams and rivers, (e.g. lamprey and salmon). Scotland's upland streams and rivers are also of global importance for their populations of freshwater pearl mussel.

Track construction should avoid direct impacts on water bodies, and indirect impacts associated with siltation and contaminated run-off must be avoided or well controlled. The location of tracks well away from both standing and flowing waters will minimise many of the potential issues surrounding these habitats. However, this is not always practicable for streams and rivers; careful consideration must be made of each stream crossing location,⁹ the appropriate method of engineering the crossing, and the need for protected species mitigation ([see page 99](#)).

Most of the species listed in the sections above are subject to statutory protection and licences are likely to be required for any proposal that is likely to affect them. See [Section 7](#) for advice on licences.

⁹ [Engineering in the Water Environment Good Practice Guide: Construction of River Crossings \(SEPA 2010\)](#)
[SEPA Pollution Prevention Guidelines](#)

Table 3: Checklist of some potentially sensitive biodiversity features

Broad habitat Type	Sensitive habitat	Sensitive species
Heathland	<i>Annex 1 Habitats:</i> Most types of heath, montane scree and snowbed communities <i>UK BAP Habitats:</i> Upland heathland, Mountain heaths and willow scrub	<i>Wildcat</i> – EPS, UKBAP <i>Badger</i> – Protection of Badgers Act 1992 <i>Breeding birds</i> - Wildlife & Countryside Act 1981(as amended)*; some UKBAP Reptiles - limited protection under W&C Act 1981*; some UKBAP Mountain hare - UKBAP Bryophytes and lichens - Schedule 8 of W&C Act 1981*; some UKBAP Invertebrates – some on Sch. 5 W&C Act 1981*
Wetlands	<i>Annex 1 Habitats:</i> Blanket bog, Raised bog, some types of fen <i>UK BAP Habitats:</i> Blanket bog, (Lowland) Raised bog, Upland flushes, fens and swamps	<i>Otter</i> – EPS, UKBAP Breeding birds -W&C Act 1981*; some UKBAP <i>Water vole</i> - Sch 5 W&C Act 1981*; UKBAP Reptiles - limited protection under W&C Act 1981*; some UKBAP
Grasslands	<i>Annex 1 Habitats:</i> Upland calcareous grasslands <i>UK BAP Habitats:</i> Upland calcareous grassland	Badger - Protection of Badgers Act 1992 Breeding birds - W&C Act 1981*; some UKBAP Reptiles - limited protection under W&C Act 1981*; some UKBAP
Woodlands and trees	<i>Annex 1 Habitats:</i> Caledonian forests, bog woodland, juniper woodlands, western oakwoods <i>UK BAP Habitats:</i> Native pine woodlands, Upland birchwoods, Upland mixed ashwood, Upland oakwood, Wet woodland	<i>Bats</i> – EPS; some are UKBAP Wildcat - EPS, UKBAP Breeding birds - W&C Act 1981*; some UKBAP Badger - Protection of Badgers Act 1992 <i>Red squirrel</i> - Sch 5 W&C Act 1981*; UKBAP <i>Pine marten</i> - Sch 5 W&C Act 1981*; some protection Conservation Regs UKBAP Bryophytes, lichens, fungi – some are on Sch 8 of W&C Act 1981*
Lochs, streams and rivers	<i>Annex 1 Habitats:</i> Oligotrophic to mesotrophic standing waters, Natural dystrophic lakes and ponds <i>UKBAP Habitats:</i> Eutrophic standing waters, Oligotrophic & dystrophic lakes, Mesotrophic lakes, Rivers, Ponds	Breeding birds Otter Water vole <i>Freshwater pearl mussel</i> Fish Bryophytes, lichens
Other	<i>Annex 1 habitats:-</i> Limestone pavement <i>UKBAP Habitats:-</i> Limestone pavement, Inland rock outcrop and scree habitats	Bryophytes, lichens Breeding birds Mountain hare

These are examples of some of the **main** species and habitats which may be affected by developments in these particular broad habitats, and this list should not be considered definitive.

Full list of [Annex 1 habitats](#), Full list of [UKBAP Priority habitats](#), [European Protected Species](#), [Wildlife and Countryside Act species](#), [UKBAP Priority species](#).

If the presence of an Annex 1 Habitat, or a protected species or waterbody is suspected along the potential route of a track, it would be prudent to seek specialist nature conservation advice and assess the need for a licence to carry out any aspects of the work.

Reducing impacts and compensation

It is not always possible to avoid sensitive features completely when designing tracks. Opportunities to minimise, mitigate and compensate for unavoidable adverse impacts should be investigated.

Reduction of impacts refers to on-site strategies designed to reduce the impacts of track construction and use on biodiversity features. This could include redesigning the track route to minimise the impacts, restoring the habitat at the track edges, or timing the works to avoid times of day (or year) when species or habitats are most vulnerable to disturbance (for example, when ground conditions are wet, or when animal species are breeding). Where there are protected species present, there may be a legal obligation to provide such measures.

Compensation refers to measures taken to off-set or compensate for significant adverse impacts. This might not be in the same location as the proposed track, and therefore avoiding or reducing impacts should always be the first priority. Compensation measures might include habitat creation or restoration.

Note: In cases where a proposed development might affect a Natura site, the requirements of the [Habitats Regulations](#) apply. In such cases, SNH uses particular definitions of the terms “mitigation” and “compensatory measures” which would supersede the uses of these terms in this Guide.

Summary

In summary, the avoidance strategy should entail:

- identifying routes that avoid sensitive and valuable habitats
- identifying routes that avoid sensitive species
- identifying routes that do not fragment the ecological resource
- where avoidance is not possible, reduce impacts, mitigate and compensate.

3.6.2. WINDFARMS - BIODIVERSITY IMPACTS¹⁰



In the planning stages of a wind farm development proposal tracks should be routed to avoid areas of valued ecological resource, such as blanket bog, whenever possible. Where it is proposed that

¹⁰ [Good practice during windfarm construction SNH et al, 2015](#)

tracks will cross areas of peat, it is important that appropriate surveys (of vegetation, hydrology and peat) are undertaken to determine their capacity to support excavated or *floating tracks*. In particularly deep, wet peat, 'floating' tracks have been known to sink, with serious consequences for the ecology, hydrology, construction costs, stability and carrying capacity of the track. It is therefore extremely important to avoid deep peat wherever possible.

Brash and branches can be used as an alternative to geotextiles as a base layer in some circumstances. They are considerably cheaper to use, and may be available on site if there are forestry operations nearby.

3.7 Geodiversity



3.7.1 GEODIVERSITY

Most construction impacts on geodiversity can be mitigated through careful track design, and a four-step process (similar to the mitigation hierarchy used for biodiversity) should be used to ensure this:

identify > avoid > reduce > compensate

Identifying important aspects of geodiversity

Gathering relevant information about the geodiversity of the potential route of the track is the first step in the process. This might include:

- The locations of nationally important sites designated for their Earth heritage interest. Sites of national or international importance for their Earth heritage (or Earth science) features in Britain are identified as Geological Conservation Review (GCR) sites and the majority of these are now afforded statutory protection as Sites of Special Scientific Interest (SSSIs). Information on the locations of GCR sites is available as a dataset from the [Natural Spaces](#) page of the SNH website. European and UNESCO geoparks are also areas designated for the national and international importance of their geodiversity.
- The locations of sites of local Earth heritage importance. In a number of areas of Scotland, sites of local Earth heritage importance have been designated as Local Geodiversity Sites (LGS) (or formerly as Regionally Important Geological/Geomorphological Sites (RIGS)). Information on these will normally be available from a local geodiversity group or a Local Authority (SNH will normally be able to advise on contacts for local geodiversity groups).
- The location of any rare or important soils. There is no special designation for the protection of soil in Scotland¹¹ and soils are not recognised as such as features for statutory protection in SSSIs. However, soils of conservation value will frequently occur within SSSIs. Their importance lies in their high ecological value, rarity, long-standing land use, the distinctive vegetation they support or the naturalness of the soil profile. Montane soils, peat and calcareous or magnesian soils are among the most valued in Scotland. These valued soils may be located by interpreting soil maps in the context of other features protected for geodiversity and biodiversity. Further advice can be sought from SNH.¹²

¹¹ [Scottish Soil Framework \(2009\)](#)

¹² [Scotland's soils web page](#)

Care must be taken that activities outside the boundaries of Earth heritage sites do not affect the features of interest. For example, work upstream of a site notified for its 'fluvial geomorphology' (river landforms and processes) may affect the site downstream by, for example, changing sediment load or altering water flow; and work downstream of a site may also have an effect if it disrupts water flow by, for example, temporary or permanent damming of the river.

Avoiding important aspects of geodiversity

Where it is not possible to avoid affecting sites with statutory protection, consents are likely to be required. [Section 7](#) provides further information on obtaining consents. When fitting a track into the landscape the primary goal for geodiversity is to 'design out' potentially significant impacts. This has two aspects:

- avoiding areas perceived to have high Earth heritage value, such as nationally or locally designated sites
- ensuring activities outside these areas do not have adverse effects on the high value Earth heritage features.

Reducing impacts and compensation for Earth heritage sites

If Earth heritage sites, and areas where work is likely to affect these sites, cannot be avoided, then options for reducing and compensating for adverse impacts should be considered. General guidance on reducing and compensating for different types of Earth heritage sites is given below; however, it is stressed that every site is unique and individual guidance should be sought in each case.

As soils are not a designated feature, assessing best practice¹³ for reducing and compensating for impacts on soil resources will rely on different approaches from those used for other components of geodiversity.

The resistance and resilience of soils can be intricately linked to biodiversity support. It is important to maintain the functionality of soil to support biodiversity as well as the integrity of the soil.

Damage to soil can be irreversible (no resilience) when soil is lost during the construction phase of a track (buried under the track or removed). Whereas upland soils generally have a low resistance to physical damage, they can have a better resistance and resilience to chemical changes particularly where a range of biological processes exists to mediate the impacts.

Resistance and resilience of Earth heritage features

All Earth heritage features are, by nature, irreplaceable with the exception of some 'active' geomorphological features, such as river meanders, which are still forming under present-day conditions. This means that the majority of Earth heritage features have no resilience to disturbance – they cannot re-form or 'bounce back' if they are damaged.

The 'resistance' or 'robustness' of Earth heritage features – which may be described as: the level of any potentially damaging operation that can be sustained without significant reduction in the value of the Earth heritage interest – is variable and dependent on individual site type and circumstances. However, some indication of 'robustness' is given by the Joint Nature Conservation Committee's Earth Science Conservation Classification (ESCC) divisions. The ESCC divides Earth heritage sites into three basic types which help to indicate the strategy and priorities that should be adopted for conservation purposes. These three site types are known as 'integrity sites', 'finite sites' and 'exposure sites'.

¹³ [Construction Code of Practice for Sustainable use of soils on Construction sites \(Defra, 2009\)](#)
[Calculating Carbon Savings from wind farms on Scottish peatlands \(Scottish Government, 2008 and 2011\)](#)
[Guidance on developments on peatland - Site surveys \(Scottish Government, 2011\)](#)

'Integrity sites'

'Integrity sites' are sites where inappropriate interference with one part of the site may damage or destroy the integrity of the entire site.

Active process geomorphological sites include all active river (fluvial geomorphology) and all active coastal sites. In these sites the whole active process system may be disrupted by interference in part of the site. Within upland areas, fluvial geomorphology sites may vary in size from a short section to several kilometres of river. To conserve the Earth heritage value of these sites, track construction should avoid the sites, and careful assessment should be made of impacts on the Earth heritage features from work carried out within the river catchment. If avoidance is not possible, measures to reduce impacts should be implemented.



Active process: "Wandering gravel bed rivers" like the River Feshie can cause problems for upland tracks, washing them away. Bank protection or gravel extraction in one part of these dynamic fast flowing sites can inadvertently cause a chain of river readjustments downstream.

Appropriate impact reduction measures will be strongly site dependent and may influence track routing and construction, construction methods and timing. Compensation will not be possible at these sites as the 'natural' aspect of the active process cannot be artificially recreated.

Some active process sites may be resilient; for example, if disturbed, some river landforms such as gravel bars may be able to re-form if sediment supply and discharge are maintained. Others, however, may be termed 'sensitive', where a fundamental, irreversible change results from a particular disturbance (e.g. the deflation and loss of soil following disturbance of the surface vegetation).

Static (inactive) geomorphological sites are landscapes created by processes that are no longer active, e.g. moraines and eskers formed by glaciers and glacial meltwater during the Ice Age or terraces and palaeochannels formed by rivers with different sediment loads and discharges in the past. By nature, they are entirely non-reproducible and irreplaceable. At these sites, the spatial and topographic relationships between individual landforms are frequently important (site integrity) and may be lost if part of the site is damaged or fragmented. These sites are often very large, covering many square kilometres. To conserve the Earth heritage value of static geomorphological sites, track construction should aim to avoid them. Where this is not possible, however, as is likely to be the case for some large sites, impact reduction measures should be implemented.



Static (inactive) integrity sites are often large, like the 'Loch Lomond Stadial Hummocky Moraines' of the Valley of a Thousand Hills in Torridon, and the relationship between individual landforms is an important part of the geodiversity interest of these sites.

Appropriate impact reduction measures will be strongly site dependent and may influence track routing and construction, construction methods and timing. In general, routes that are sympathetic to the *landscape character* avoid fragmenting key landforms and avoid cuttings or other ground levelling or earth movements will be most acceptable. Where cuttings are unavoidable, a cutting that leaves the original landform geometry discernible to the untrained eye is more acceptable than one where the original landform geometry is obscured. In some cases, a section cut through a glacial landform which reveals the internal structure and make-up of the landform may enhance the Earth heritage interest of the site. However, any benefits from newly exposed sections must be weighed against the corresponding loss caused by removal of part of the landform.

In the case of track construction, compensation will not be possible for static geomorphological sites.

Cave and karst systems, formed in limestone, are classed as integrity sites as they contain components of both 'active processes' (e.g. water flow affecting the formation of stalactites) and inactive interests (e.g. topography of karst and cave layout indicative of past water flow). In upland Scotland, karst sites are relatively rare and small in size and should be avoided during track construction, both by routing tracks away from them and by avoiding trampling and storage of any materials within the karst site. Disruption of drainage in and around both karst and cave sites should also be avoided. For cave sites it is important to be aware of the underground extent of the caves and the extent of the cave drainage catchment. The surface area above caves, as well as the wider drainage catchment, should ideally be avoided, but where this is not possible, or in areas where the extent of the caves is uncertain, impact reduction measures should be implemented.

Appropriate impact reduction measures will be strongly site dependent but will include maintaining drainage systems unmodified (including both discharge and sediment inputs), avoiding cave entrances and areas where the overburden 'roof' of the cave is thought to be thin, and ensuring any imported material matches local material in chemical properties such as pH, as changes in groundwater chemistry may dramatically affect the karst and cave features. Impact reduction measures may also influence track construction, construction methods and timing. Compensation measures will not be possible at these sites.

'Finite sites'

'Finite sites' are sites that contain a finite amount of the resource which forms the interest feature. 'Finite' may be loosely defined as the entire known resource being contained within the site, or a unique national/international example of a feature which is of limited extent.

Finite mineral, fossil or other geological sites, mine dumps. The majority of fossil (palaeontology)

and mineral sites are 'finite' sites, the fossil or mineral bearing body, be it bedrock or a loose deposit such as a mine dump, is of very limited extent, and is often entirely contained within the site.

These sites are usually relatively small and the main aim in track construction should be to avoid them. Where it is impossible to avoid such a site, impact reduction measures are likely to be limited but may include minimising the 'footprint' of the track on the ground (e.g. by raising it on stilts or piers) and avoiding rock exposures or areas of mine/quarry waste. It is highly unlikely that compensation will be possible at these sites.



Finite sites are often relatively small areas like this mine spoil site at Wanlockhead, Leadhills. They may be rock outcrop, soft sediment exposures, landforms or mine dumps. Track construction should aim to avoid these sites.

The 'other' geological sites referred to in this category may be of a variety of types and may vary greatly in size, for example a small area of solidified lava of unusual composition, or rock formed from a type of sediment which was only deposited in one small lake are likely to be small areas, whereas the remains of a volcanic plug showing unique features may cover a relatively large area. For larger finite sites, it may be harder to route tracks to avoid the site, but it is likely to be more feasible to route tracks through the site avoiding rock outcrops (see also guidance for Landscape & visual effects: [rocky landform](#)).

Finite underground mine and tunnel sites. Some finite geological sites occur in mines or tunnels. Track construction may have a detrimental effect on Earth heritage interests in underground mines and tunnels if it alters the drainage regime significantly or causes tunnel instability or collapse. Track routes should aim to avoid areas where underground workings are of Earth heritage interest. Where avoidance is not possible, a thorough survey of the impacts of the track (including hydrological impacts) should be carried out (this may also be advisable on the grounds of health and safety). Impact reduction will depend strongly on individual site circumstances, and it is unlikely that compensation measures will be possible.

Buried interest sites. Examples of Earth heritage sites where the interest is buried include unique bedrock where the only known occurrence is below ground, and sites where pollen buried in peat layers contains information on past environments. Buried sites are usually relatively small and the key to the interest is that the feature is accessible through excavation. Therefore, tracks should avoid routes through buried interest sites. If avoidance is not possible, then impact reduction measures may include raising the track on stilts or piers so that the buried interest can still be accessed beneath the track. While tracks running near to buried interest sites may assist with access for excavation, enhancement of the site interest associated with tracks that are routed through buried interest sites is highly unlikely. Compensation measures will not be possible for buried interest sites.

‘Exposure sites’

‘Exposure sites’, which may also be termed ‘Extensive sites’, are Earth heritage sites where a rock type, or glacial deposit, is exposed which occurs in a relatively uniform way over an extensive area, usually as surface exposure, and below vegetation and soil, and also below glacial deposits in the case of rock. Therefore, removal of material within the site should uncover more material of the same type. Additionally there are likely to be other areas where some or all sections of the rock or glacial deposit of interest are found. The designated site is often simply the best exposed example.



Rock outcrop in exposure sites may be discontinuous and scattered over a wide area. Visibility of rock outcrop is important and attempts should be made not to obscure it. Exposing new areas may be beneficial. This inland outcrop exposure site is at Badcall in Scourie Coast SSSI.

Exposure sites are numerically the most common type of Earth heritage site and may include exposures in disused and active quarries, cuttings and pits; exposures in coastal and river cliffs; foreshore exposures; mines and tunnels; inland outcrops and stream sections.

Exposure sites in the uplands of Scotland can vary hugely in size from a small section of rock outcrop to areas incorporating whole mountains. Track routes should avoid exposure sites where possible; however, where this is not possible, impact reduction measures can be taken. Impact reduction measures in exposure sites will be site specific, but may include routing tracks to avoid exposures of rock/glacial deposits and to avoid isolating small exposures from adjacent geological exposure areas. Generally routes that follow contours, and avoid cuttings and ground levelling measures which obscure geological exposures, will be more acceptable than those which do not. However, cuttings that increase the area of rock or glacial deposits exposed may enhance the Earth heritage interest of the site. Compensation for loss of exposures in ‘Exposure sites’ may be possible in some cases and would involve measures such as mechanically creating new exposures at an appropriate location elsewhere.

Summary

In summary, the strategy adopted when planning upland tracks to avoid detrimental effects on geodiversity should entail:

- identifying routes which avoid areas of high Earth heritage value
- identifying routes which do not fragment the Earth heritage interests
- identifying routes, and construction methods which will not damage nearby Earth heritage features
- where avoidance is not possible, reduce impacts and compensate where feasible.

3.8 Access and recreation



3.8.1 ACCESS AND RECREATION IN THE SCOTTISH UPLANDS

The Scottish uplands accommodate a wide range of recreation activities, many of which contribute to people's understanding and enjoyment of the natural heritage as well as making an important contribution to the economy and public health. Such activities include walking, horse riding, mountaineering, mountain-biking, hill running, cross-country skiing as well as bird watching. The potential recreation role of upland tracks has been confirmed by the [Land Reform \(Scotland\) Act, 2003](#) which has created a new right of responsible access to most parts of the countryside for all including walkers, cyclists and horse riders.

Upland tracks have the potential to result in a range of positive and negative impacts on recreation. New tracks can improve access for walkers, cyclists and horse riders, perhaps allowing people to reach previously inaccessible hills or areas. This may be of particular benefit for people who are less confident or able to journey into such areas over rough terrain, for example those with a disability. If integrated with existing path networks and provided with appropriate way marking, gates and other facilities, the use of such tracks could contribute to an area's recreation resource, and potentially to the local economy. Evidence from a number of promoted path networks has demonstrated their role in attracting and retaining visitors.

Conversely where a track undermines an area's wild land qualities, it may affect the very qualities that visitors come to experience and enjoy. This is likely to be a particular concern where the improved accessibility increases the number of people using a particular area, or produces a change in the nature of recreation activity (perhaps from walking or bird-watching to mountain-biking). Without careful planning, recreational use of tracks can also result in unforeseen problems. This is particularly likely where the track ends and walkers, cyclists and riders create new 'desire lines', resulting in erosion and other problems. There may be a need to create new paths¹⁴ or to link into existing routes to avoid these problems, especially where there is an obvious desire line between the proposed track and a point of interest such as a summit, viewpoint or waterfall. The same may be true where people might be expected to cut across country to reach another path or track in order to create a circular walk.

¹⁴ Guidance on construction and management of paths in the uplands: [Upland path work \(SNH\)](#); [Upland path management \(SNH\)](#)



New tracks sometimes parallel long established paths. Without careful design and signage to encourage continued use, it is possible that historic paths could fall out of use and could become overgrown and, over time, unusable.

Unless addressed during the design stage, it is also possible for recreation activity to conflict with land management operations. Good design should avoid this and could also identify ways of addressing long standing problems.

Planning for access and recreation

The first step in considering access and recreation issues should be to examine existing recreation provision and activity within the area. This should include:

- An analysis of the supply of access routes within the area. This may include *rights of way*, permissive routes, *long distance paths*, *local path networks* and existing tracks. Information on these routes will normally be held by the local authority or national park authority.
- An analysis of existing patterns of recreation activity in the area, and consideration of ways that this might change (qualitatively and quantitatively) following construction of a new track.



This analysis should help identify areas where increases in recreation activity could create problems for land management, or where it could affect the existing pattern of recreation. It should also identify areas served by the track where an increase in activity could result in erosion, habitat or species disturbance.

These findings should be reflected in the design of the track. Modifications might, for example, include:

- routing to avoid areas where sensitive habitats and/or species could be damaged or disturbed by recreation activity or areas where recreation activity could compromise land management activities
- creation or management of upland paths served by a track, particularly where these contribute to a circular route or give access to a summit or other point of visitor interest
- integration with local path networks, national and core path networks as appropriate.



In addition to planning for recreational use of the track itself, it is important to consider where people will go when they leave the track. Planning or monitoring may identify the need for a new path in order to prevent erosion or damage to sensitive upland habitats.

Many access authorities (local authorities and National Parks) have prepared outdoor access strategies and employ access officers who may be able to provide advice on managing access. Guidance on more detailed aspects of recreation planning and management (including signage, etc.) is contained in [Section 4](#).

In the planning system there is now more emphasis on consulting with local user groups when planning upland path networks in relation to wind farms, often leading to access strategies for larger individual developments. There is the potential for wind farm tracks to link to or open up views and access to features of interest. However this needs to be balanced against the potential negative effects which they can have on the recreational experience.

3.9 Climate effects



3.9.1. CLIMATE EFFECTS

The design and maintenance of upland tracks should take climatic factors into account. Scotland has a predominantly cold and wet temperate climate although there are significant regional variations within this overall pattern with western areas having generally milder and wetter conditions than those in the east. Mean temperatures fall, and rainfall increases, with elevation.

At the time of writing the latest information on projections in UK climate change come from UK Climate Projections 2009 (UKCP09). [Adaptation Scotland](#) provides a useful [Scottish Compendium of UKCP09 Climate Change Projections](#).

The SNH publication [Climate Change and Nature in Scotland](#) provides a summary of the key climate change trends for Scotland as projected in UKCP09.¹⁵ These are:

- Warmer, drier summers
- Milder, wetter autumns and winters
- Increase in extreme weather events including summer heat waves, droughts, and extreme precipitation events
- Rate of sea-level rise and sea surface temperature to increase around Scotland's coast.

Consideration should also be given to minimising the greenhouse gas emissions associated with track construction, to avoid compounding climate change trends.

The implications of climate and climate change for track construction are that:

- More extreme rainfall events may result in a higher risk of erosion where vegetation is damaged or broken. It also has implications for the design of bridges, ditches and culverts and other drainage structures.
- Rainfall has a significant influence on the design of tracks, both in terms of the need to ensure efficient drainage of the track surface and the need to manage run-off from surrounding areas.

¹⁵ [Climate Change and Nature in Scotland \(SNH, 2012\)](#)
[Scotland's Climate Change Adaptation Framework \(Scottish Government, 2009\)](#)
[Adaptation Scotland Compendium of Climate Change information](#)
[Adaptation Scotland Future Climate](#)
[Land Use Strategy for Scotland \(Scottish Government, 2011\)](#)

- Drainage ditches, culverts and bridges must have capacity to deal with high flows since it is during such events that there is the greatest risk of erosion, potentially causing damage to the track and neighbouring areas.¹⁶
- Cold weather can also affect tracks. Low temperatures are likely to result in freeze–thaw action affecting the track surface and areas of exposed rock or soil (for example where cut faces remain unvegetated). This can damage the surface of the track and can dislodge material from cuttings, accelerating erosion and creating a potential hazard for vehicles using the track.
- The use of road salt in freezing conditions should be avoided due to the damage it can cause to adjacent vegetation and through wash-off into nearby water bodies.

Cuttings are likely to fill with snow drifts that make tracks impassable to most vehicles. Snow in such situations can last longer than in surrounding areas, and will need to be cleared by machine where year-round access is required. On the other hand, snow trapped along upland tracks can provide a recreation resource for cross-country skiers.

¹⁶ [Paths and Climate Change \(SNH, 2011\)](#) – relates to paths but the implications will also apply to tracks at all scales.

Checklist

The following checklist sets out a series of questions which should be used to ensure that natural heritage issues have been fully represented in the strategic design of upland tracks:

1. Has the need for licences and consents been identified and applied for in advance of works?
2. Has the local planning authority, and Scottish Natural Heritage, Historic Environment Scotland and the Scottish Environment Protection Agency, as required, been contacted to discuss the proposed track?
3. How will the track be used?
 - What are the design requirements in terms of width, load bearing capacity, maximum gradient and minimum radii?
4. What types of landscape will be affected by the track?
 - Have the characteristics of the landscape been reflected in the choice of alignment?
5. What habitats and species will be affected by the track?
 - Has the alignment been chosen to avoid or minimise the loss of or disturbance to important habitats and species?
 - Have appropriate habitat mitigation or compensation measures been included in the scheme?
6. What Earth heritage features will be affected by the track?
 - Has the alignment been designed to minimise the impact on important Earth heritage features?
7. What is the current pattern of recreation activity in the area affected by the track?
 - Has the alignment been chosen to minimise the impact on existing recreation?
 - Have opportunities to facilitate recreational use of the track been identified?
8. Have current and possible future climatic conditions been considered in the design of the track?

Section 4

Detailed track design and construction

4.1 Detailed track design and construction

Detailed alignment and scheme design
Construction type
Sourcing materials
Drainage
Design for recreation
Consents and licences
Construction

4.1.1 INTRODUCTION

Section 3 highlighted the importance of basing decisions on good information about the host environment in order to identify, avoid or mitigate natural heritage impacts of tracks.

This section considers finer grain issues that should be encompassed in the process of detailed design and construction of tracks at all scales. Accepting that the broad alignment of the track has now been fixed, it includes the following steps:

- detailed alignment to avoid areas or features of particular local or wider sensitivity i.e. habitats, species, water environment, landscape, or geodiversity features
- selection of track type and construction type appropriate to ground conditions, and landscape features, on different sections of the route
- identification of areas and volume of cut and fill, defining the need for borrow pits (on or off-site), imported material and/or the disposal of material, including waste management implications
- identification and design of track drainage
- identification of additional access and recreation links and management
- identification of necessary planning consents and other licences or consents which need to be secured before construction begins
- best practice in construction techniques for sustainable and sensitive track design and maintenance
- revegetation of areas of cut and fill, borrow pits and areas of bare soil
- identification of mixed usage options and management requirements post construction.

The principles embedded in the detail of this section apply to the construction of tracks in the uplands across a range of different uses such as forestry, agriculture, estate management, hydro-generation and wind farms. Each section highlights wind farm track construction as these can account for much of the track construction in the uplands and thus offer the greatest potential benefits from employing good practice.

4.1.2 DETAILED ALIGNMENT AND SCHEME DESIGN

While the broad alignment of the track will already have been decided through the process described in the previous section, detailed design process provides an opportunity to ensure that the detailed routing of the track minimises impacts on the natural heritage. The influence of landscape, biodiversity, geodiversity and recreation and access interests, together with the influence of operational need, is therefore described in the following pages.

4.1.3 OPERATIONAL NEEDS

The detailed design will of course need to respond to the operational needs of the activity served by the track. In all but the most lightly used tracks, it will be important to include passing places and areas where vehicles can turn. These will help prevent over-run and damage to neighbouring vegetation or other parts of the track structure.

The frequency of passing places will depend on the level of use of the track, sight lines and road geometry. Passing places should be capable of accommodating the largest vehicles likely to use the track. On most tracks, passing places should be 3m wide and between 12 and 15m long. On tracks designed to carry 44 tonne trucks, passing places may be 4m wide and 33m long. It may be that small borrow pits provide opportunities for passing and turning areas.

4.2 Landscape and visual effects



Katrine Woods

4.2.1 LANDSCAPE

A key aim should be to reflect the local landscape character in the alignment of the track. Wherever possible, local features such as river meanders, terraces, gullies and woodlands should be reflected in the detailed routeing of the track. They should also be provided with sufficient buffers or setback to retain their integrity and setting. The track should not compete for attention with significant local features such as rock outcrops or waterfalls or cultural features, ruined farmsteads, shielings, etc. There may be opportunities to provide appropriate forms of planting along the lower parts of a track where this helps tie it into an existing wooded landscape.

In more open and extensive landscapes, such as those associated with plateau moorlands, minor changes in alignment are unlikely to result in significant reductions in landscape and visual impact, ([see pages 28-48](#)).

4.3 Biodiversity and geodiversity



4.3.1 BIODIVERSITY AND GEODIVERSITY

The broad alignment of the track should have been selected to avoid or minimise impacts on sensitive habitats, species and Earth heritage features. The detailed design stage provides an opportunity to ensure that finer grain biodiversity and geodiversity issues are accommodated in the track's routing and construction. Key issues to consider at this stage will include:

- avoidance of more sensitive habitats, species and Earth heritage features, wherever possible
- minimisation of habitat fragmentation, species isolation, fragmentation of Earth heritage features, and compaction and erosion of soil
- identification of areas where particular management, construction practices or monitoring procedures will be required
- the suitability of different track construction methods, including the drainage measures, to reflect local habitats, species and Earth heritage features
- identification of sensitive habitats, species and Earth heritage features where specific management, construction and monitoring measures are required
- identification of areas for further habitat management or enhancement.

More detailed survey may be required at this stage, particularly in areas where track construction could have a significant effect on habitats, species or Earth heritage features. Where protected species are unexpectedly encountered, SNH should be contacted for advice immediately.

See also [upland soils](#).

4.4 Recreation access

4.4.1 ACCESS AND RECREATION

Decisions about the detailed alignment of the track may also be informed by consideration of its potential recreation use. There may, for example, be opportunities to link the track into existing paths or tracks to develop an access network or circular route. There may also be potential to include a small parking area close to the start of a track so that people do not park on road verges or access points. Equally, there may be benefits in routeing a track so it avoids locations where recreation activity could come into conflict with other activities, such as the frequent movement of estate vehicles, livestock or forestry machinery.

4.5 Wind farms

4.5.1 WIND FARMS – ENGINEERING REQUIREMENTS

Construction of wind farms requires access for heavy and long loads, which determine the carrying capacity, corner radii, running width and maximum gradient of a track.

Wind farm construction tracks need to be strong enough to bear the weight of large construction cranes. These weigh up to 200 tonnes, but are delivered in parts, which have a maximum travelling weight of approximately 72 tonnes.

A 200 tonne crane has no limit to its turning circle, as the treads can be opposed so that the crane turns on the spot. The corner radii, therefore, are determined by the large, long delivery lorries.

The running width of wind farm construction tracks needs to be sufficient for the large vehicles used. This is typically 6–7m wide.

The maximum gradient should be 8-10% (1 in 12 to 1 in 10) with the potential for short lengths (less than 200m) at 12.5% (1 in 8).

Drainage is of high specification, with side ditches and culverts along with a cambered surface with cross-fall. Surface cross-drains are not used as they are unsuitable for the heavy use of the tracks.

Given the scale of wind farms and the turbines that are currently used, it is unlikely that tracks of lower specification (i.e. lower bearing capacity or width) will be suitable to meet the needs of construction. However, it may be possible to import some of the larger or more awkward structures onto the site in parts, reducing the requirements of the tracks. Best practice is now for the largest cranes to be assembled on site, thereby avoiding the need to construct maximum capacity tracks throughout. The cranes are, however, generally driven between turbines, rather than being dismantled between them.

Other guidance:

- [*Good Practice during wind farm construction*](#) (SNH et al, 2015)
- [*Floating roads on peat*](#) (SNH and FCE, 2010)
- [*Developments on peatland - Site surveys*](#) (Scottish Government, 2011)
- [*Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste*](#) (Scottish Renewables, 2012)
- [*Forests and water guidelines*](#) (FCS, 2011)

4.6 Construction types



A combination of cut tracks and floating tracks is used to negotiate varying ground conditions at the Novar wind farm

4.6.1 CONSTRUCTION TYPES

The detailed design process should include the type of track that will be constructed. This will reflect the proposed use of the track and the nature of the ground conditions.

A series of detailed site investigations should be undertaken to determine the characteristics of the ground conditions including the depth and nature of any peat and topsoil and the nature of the underlying subsoils and subgrades. This information will influence the choice of alignment and the design and construction of the track itself. These early site investigations should also be used to identify local sources of construction material.

The structural design of the track will also be influenced by the nature of local ground conditions (the subgrade). The load bearing capacity of the subgrade will influence the depth of track sub-base and any surface that is required. On softer ground geogrids or geosynthetic membranes or a layer of brash (tree branches and thinnings) can be used to reduce the depth of the sub-base that is required. In areas of peat, it may be possible to use a '*floating track*' ([see page 85](#)), though many wetter areas, and areas of deep peat, should be avoided altogether. An experienced civil or geotechnical engineer should be consulted to provide advice on the influence of local ground conditions on the structural design of the track.

Ideally the material for use in the track base should be a good quality granular material preferably with less than 15% silt content. The material should be placed and compacted in layers not exceeding 200mm thick. The degree of quality of compaction will depend on the moisture content of the material being placed.

Where a geotextile membrane is to be used above the subgrade/formation, it should be installed in accordance with the manufacturer's instructions.

From the economics of the project, it may be more appropriate to use locally won materials. These may have slightly higher silt/clay content and therefore be more moisture susceptible. These materials can be used but, due to their susceptibility to moisture, may require additional measures and time before they can be covered with subsequent road layers.

The road surfacing finish should where possible comprise between 100 and 150mm of crushed rock. Alternatively a well graded sand and gravel can be used but this surfacing material may be more prone to potholes and rutting and may therefore require more maintenance. A depth of

surface finishing of between 75 and 100mm is likely to shorten the overall life of the track and may be prone to a higher maintenance regime.

There are a number of options for the construction technique that allows the track structure to be tailored to local ground conditions. For this reason it is likely that different techniques will be required at different points along a typical route.

The following pages describe the techniques for:

- cut tracks
- surface tracks
- floating tracks.

These descriptions include typical cross-sections and a summary of the advantages and disadvantages of each technique.

Cut tracks

Cut tracks are constructed by excavating very weak overburden down to rock or a suitable, solid substrate and then building the track up again using solid fill. This type of track usually has a solid construction and is capable of taking very heavy loads.

Cut tracks are, however, most disruptive of ground conditions, particularly hydrology and subsurface drainage. Effective drainage is therefore required to ensure that the downslope areas are not subject to erosion and do not dry out. Depending on the quality of design, construction and revegetation, cut tracks can result in landscape and visual impacts, for example where there are areas of exposed cut or fill, or where notches are visible on the skyline.

Figure 1 shows a cross-section of a cut track on a gentle slope. Figure 2 shows a cross-section of a cut track on a steeper slope. Table 4 summarises the engineering and natural heritage advantages and disadvantages of cut tracks.

Figure 1: Cut track on a gentle slope

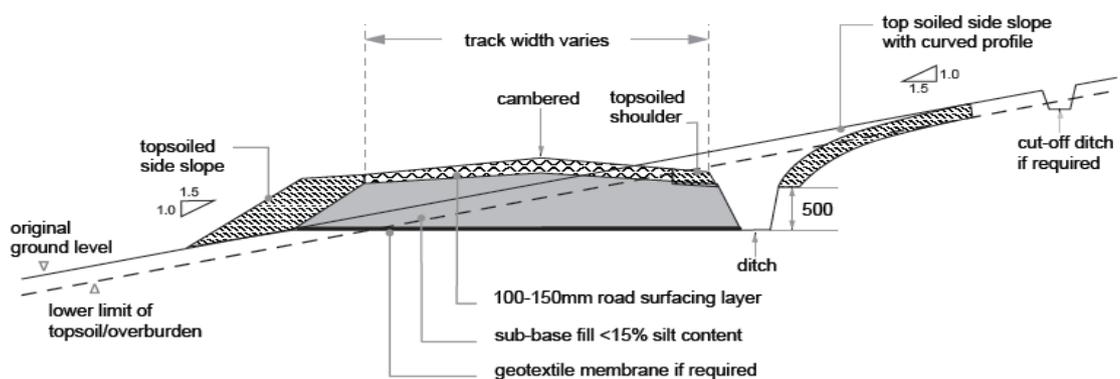


Figure 2: Cut track on a steeper slope

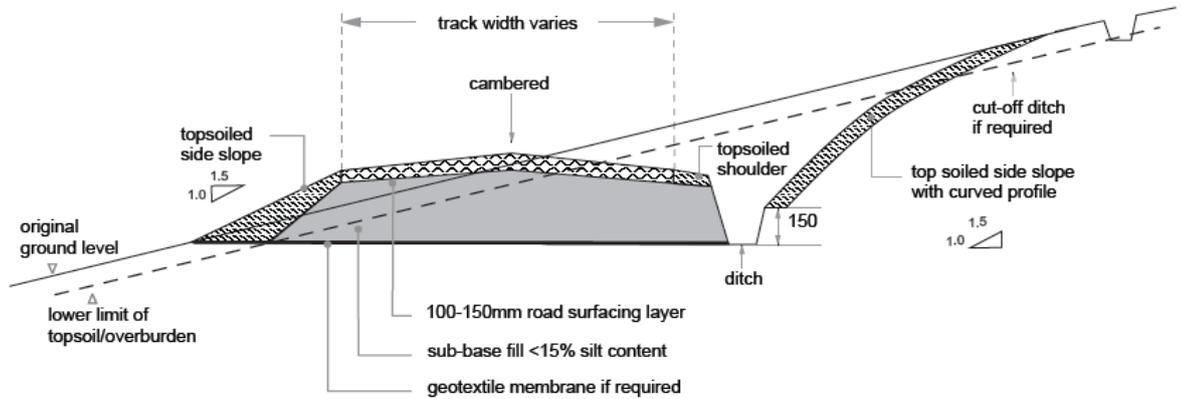


Table 4: Advantages and disadvantages of cut tracks

	Advantages	Disadvantages
Engineering	<ul style="list-style-type: none"> • Solid construction, capable of taking heavy loads 	<ul style="list-style-type: none"> • Need to identify an appropriate re-use for surplus soil and peat • Will it be easy to restore? • Requires a large amount of material on 'fill' • Often requires extensive drainage works • Potential landslip issues
Landscape		<ul style="list-style-type: none"> • Sections of cutting and embankment can be very extensive • Track can be very visible in the landscape
Biodiversity	<ul style="list-style-type: none"> • Creates a source of soils and turfs for track-edge restoration • Drainage can be controlled through planned installation of drains, bridges and culverts 	<ul style="list-style-type: none"> • Direct loss of habitat • Direct disturbance or impediment to species e.g. fish, water vole • Can result in large scale disturbance and fragmentation of habitats • If track edge restoration is poorly executed drainage can be badly affected¹⁷
Geodiversity	<ul style="list-style-type: none"> • Earth heritage impacts and opportunities can be pre-assessed • Creates a locally compatible source of fill for track construction • Drainage and siltation can be controlled through planned installation of culverts 	<ul style="list-style-type: none"> • Direct impacts on Earth heritage interest if not planned, managed and constructed properly • Potential for large scale destruction of Earth heritage interest • Fragmentation of Earth heritage interest • Potential for obscuring large sections of Earth heritage interest

¹⁷ *Good practice during windfarm construction (Scottish Renewables et al, 2013)*
Developments on peatland: guidance on the assessment of peat volumes, reuse of excavated peat and the minimisation of waste (Scottish Renewables and SEPA, 2012)

Surface tracks

Surface tracks are constructed on the existing ground surface, directly on top of the existing vegetation, and are generally relatively thin structures, i.e. <1m thick overall. Surface tracks normally incorporate a proprietary geosynthetic or mattress of forest residue material when crossing areas of soft or weak ground. These are laid along the route of the track to provide additional structural strength whilst reducing the depth of the sub-base that is required to carry a given load. Typical geosynthetics include:

- Finely woven or unwoven geotextiles. These types of geotextiles can be used to reduce the movement of silt up through the structure of the track, but are not particularly strong. Their main property is that of a separation layer between the subgrade and the clean road aggregate.
- Higher strength geotextile materials. These are normally used below tracks with high embankments that require a reinforcing effect for stability. Their use is normally restricted to high volume public roads.
- Welded or extruded geogrids. Geogrids interlock with the road aggregates of the track to form a mechanically stabilised layer that helps the track to distribute its loads over a wider area. Geogrids can be particularly useful in tracks crossing areas of deep peat with 'floating tracks'.

Geosynthetic materials can be used as single layer, or in combination, depending on the track design, e.g. a geogrid can be used on top of an unwoven geotextile over weak and wet ground to give separation and load distribution. Forest brush (tree branches and thinnings) can also be used as a layer.

Geotextiles can be used to construct a temporary track, such as a temporary access to a borrow pit, or to an area of woodland during management or felling. In this case the geotextile is laid directly onto the vegetation and the temporary road constructed on top. When the need for the track is over, the track can be carefully removed and the geotextile taken up to leave the ground below undamaged.

Figure 3 shows a cross-section of a surface track constructed over soft ground. Table 5 summarises the engineering and natural heritage advantages and disadvantages of surface tracks.

Figure 3: Surface track with geosynthetic on soft ground

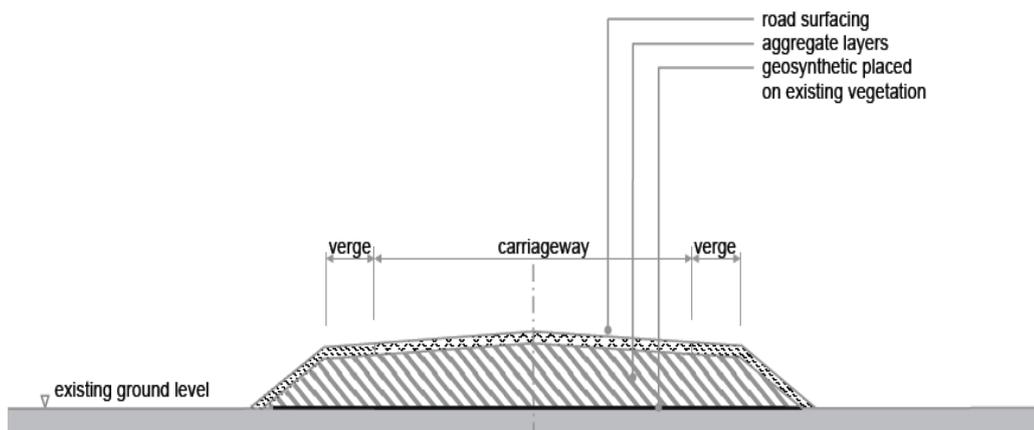


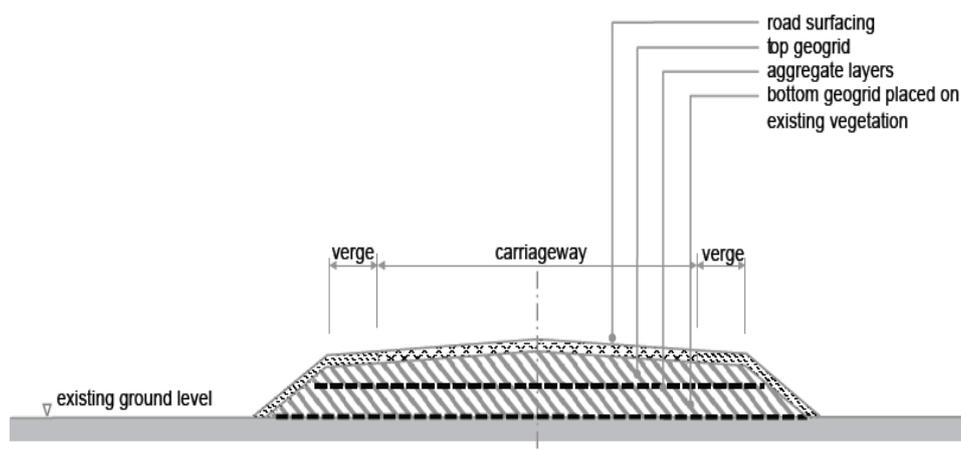
Table 5: Advantages and disadvantages of surface tracks

	Advantages	Disadvantages
Engineering	<ul style="list-style-type: none"> • Can reduce the required track sub-base depth on a like-for-like basis • Can facilitate temporary access 	<ul style="list-style-type: none"> • Weak material left in place below the track • Settlement can still happen in the weak soil below
Landscape	<ul style="list-style-type: none"> • Avoidance of landscape and visual impacts associated with cuttings and embankments • Landscape and visual impacts limited to the track running surface 	<ul style="list-style-type: none"> • If track is raised it may create a prominent linear feature • Steep, rocky edges are hard to revegetate
Biodiversity	<ul style="list-style-type: none"> • Less disturbance of habitats along the route of the track • Soils remain intact • Through drainage can be facilitated 	<ul style="list-style-type: none"> • Direct loss and fragmentation of habitat • Can result in large scale disturbance and fragmentation of habitats • Hydrology can be disrupted
Geodiversity	<ul style="list-style-type: none"> • Comparatively few direct Earth heritage impacts 	<ul style="list-style-type: none"> • Requires construction material sourced elsewhere on or off site • Potential for obscuring large sections of Earth heritage features • Soil sealing and loss under the track • Risk of compaction and poor drainage under tracks on more organic soils

Floating tracks¹⁸

As already mentioned 'floating tracks' can be particularly useful in crossing areas of deeper peat, as in upland wind farms, where excavated methods of track construction are deemed to be impractical or undesirable. However it is best to avoid deep peat altogether if at all possible. Floating tracks avoid the need to excavate the peat and refill the excavations with imported rock. They are constructed on the existing ground surface normally with one or two layers of geogrids interlocked with crushed rock aggregates to build up a strong mechanically stabilised layer. Guidance on the construction of *floating roads on peat* is available on the ROADDEX website.

Figure 4: Floating track on deep peat



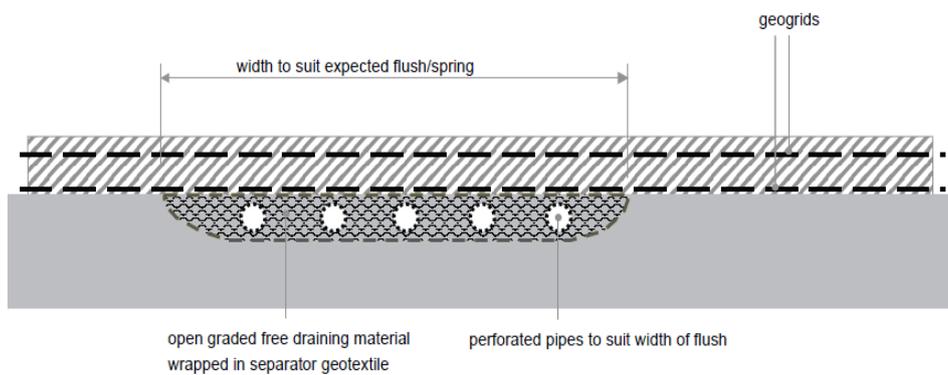
Any track crossing peat has the effect of compressing the underlying peat and causing settlement. While this in turn increases the strength of the peat it can also cause associated drainage and alignment problems. Given the sensitivity of upland peat habitats, these effects can be of

¹⁸ *Floating roads on peat (SNH and FCS, 2010)*

considerable concern. Drainage through or under a floating track should therefore be carefully considered to prevent the structure acting as a dam, impounding water on the uphill side and causing drought on the downhill side. Regular maintenance inspections should be carried out on the finished track to monitor the operation of such drainage.

Settlement in a floating track can be estimated using modern techniques, but the calculations involved should only be carried out by an experienced geotechnical engineer. The amount of settlement will be dependent on a range of parameters, and if underestimated can result in the track becoming distorted or settling unevenly. This can reduce the load carrying capability of the track and may require additional material to be added in rectification. This new material may in turn accelerate consolidation and settlement in the peat below and compound any problems of poor drainage. Construction of the track should therefore allow for continued drainage across the line of the track even under compaction and settlement. This may be achieved through the sub-base (by using coarse granular material) or by constructing drains through the peat at regular points along the length of the track.

Figure 5: Piped crossing at a spring or flush



Floating tracks have been generally restricted to crossing slopes of less than 5% (approx. 3°). Where the ground is steeper than this some form of retaining structure may be required on the downslope side. It may be sensible to use a combination of cut tracks on sloping ground and floating tracks on the flatter and wetter areas.

Floating tracks are not universally suitable, however. In areas of particularly wet peat it will be difficult if not impossible to achieve a floating track without very significant effects on the hydrology of the area and therefore on local habitats, and risking track failure. Tracks should avoid such areas altogether.

Figure 6: Shows a cross-section of a floating track crossing a slope

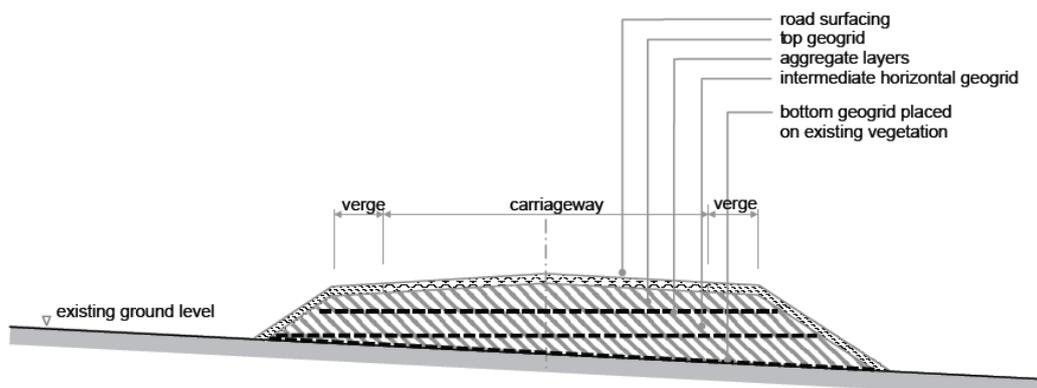


Table 6 summarises the engineering and natural heritage advantages and disadvantages of floating tracks.

Table 6: Advantages and disadvantages of floating tracks

	Advantages	Disadvantages
Engineering	<ul style="list-style-type: none"> • Can provide access across areas of deep peat 	<ul style="list-style-type: none"> • Not suitable in areas of wetter peat • Not suitable in more steeply sloping areas • Subject to compaction and settlement, creating uneven running surface • Load bearing capacity may be compromised • Point loading from large stationary vehicles can cause subsidence • Compaction makes installation of culverts problematic but can be obviated by good construction techniques.
Landscape	<ul style="list-style-type: none"> • Avoidance of landscape and visual impacts associated with cuttings and embankments • Landscape and visual impacts limited to the track running surface 	<ul style="list-style-type: none"> • Local visual impact where track has subsided or failed
Biodiversity	<ul style="list-style-type: none"> • Comparatively limited habitat disturbance • Some through drainage of deep peat habitats can often (although not always) be maintained 	<ul style="list-style-type: none"> • Direct habitat loss • Fragmentation of habitat but peat soil can remain largely intact • Tracks often sink down to bedrock, displacing peat • Often results in upslope ponding of water as through drainage rarely unimpeded • Does not create soils and turfs for track-edge restoration
Geodiversity	<ul style="list-style-type: none"> • Less disturbance of sensitive materials; peat soil can remain largely intact • Some through drainage of deep peat habitats can often (although not always) be maintained 	<ul style="list-style-type: none"> • Requires construction material sourced elsewhere on or offsite • Potential for obscuring large sections of Earth heritage interest



Floating tracks can be vulnerable as a result of settlement, compaction and erosion

Causeway or displacement construction method

It is not recommended that any track section be constructed using a causeway or peat displacement method. Consideration of this option suggests that the site is either most suited to construction of a floating track, or is too wet for any form of track.

Causeway/displacement construction involves disturbance over a wider corridor than most other construction methods. This not only has ecological impacts over a wider area but also leaves significant uncertainty over the longer-term consequences for track stability and the effects on water movement through the track structure.

4.7 Sourcing materials



4.7.1 SOURCING MATERIALS

The sourcing of material to be used in the construction of a track is a key issue to be considered from the outset. Scotland has a wide range of rock types, many of which are reflected in landforms, soils and vegetation types. In many parts of Scotland the bedrock is overlain with a layer of glacial clays, sands and gravels. The materials derived from these rocks and deposits vary in terms of their colour, erosion resistance, stability, angle of repose and load bearing capacity. Variations in their chemical properties can have an impact on soil and habitat quality (for example as a result of the addition of alkaline or acidic material, heavy metals, or nutrient enrichment). It is also important to assess whether material sourced remotely or on site could be regarded as waste within the legal definition of the term and subject to waste regulations.¹⁹

It is vital that key decisions about the alignment and design of the track are set in the context of information about the sourcing of construction material. During the construction of tracks and excavation of borrow pits appropriate consideration should be given to the Code of Practice for the sustainable use of soils on construction sites²⁰ which covers operations such as stripping, stockpiling and handling of soil and peat. Further guidance on handling and storage of peat soils is available in Good Practice During Wind farm Construction.²¹

Factors to consider in sourcing materials include:

- siltation and run-off especially from finer materials
- re-use of materials on site where appropriate
- engineering requirements
- suitability of local material
- balance of cut and fill along the length of the track
- potential need for borrow pits

¹⁹ [Developments on Peatland: Guidance on assessment of peat volumes and the minimisation of waste \(Scottish Renewables/SEPA 2012\); Guidance on waste](#)

²⁰ [Construction Code of Practice for the Sustainable Use of Soils on Construction Sites \(Defra, 2009\)](#)

²¹ [Good Practice During Windfarm Construction \(SNH et al, 2015\)](#)

- potential need to import material
- availability of material for restoration and future maintenance.

These issues are discussed in turn in the following paragraphs.

Engineering requirements



Material used for track construction must be suitable for the level of expected use and the availability of local deposits

From an engineering perspective, it is important that the choice of materials reflects local ground conditions and the use to which the track is to be put. Ideally, the material used in the track sub-base should normally comprise a good quality granular material preferably with less than 15% silt content. It is possible to use materials with a higher silt or clay content (to allow, for example, the use of locally won material in preference to the import of crushed rock onto the site), but they will be more susceptible to moisture and may extend the construction period, since the sub-base must be dry before it can be completed so this needs to be planned in at the early stages of determining track location and type.

Thorough site survey is required at an early stage in order to determine ground conditions, the construction method that is likely to be most appropriate, and the volume of material that needs to be sourced either on or offsite. Investigations may include the use of trial pits to determine the depth of surface deposits and the nature of the underlying rock, supplemented by the use of probes.

The depth of the sub-base will be determined by local ground conditions and the construction method. Depending on the load bearing capacity of the existing ground (subgrade), the track sub-base may range between 150mm and 750mm in depth ([see page 80](#)). The use of a geosynthetic membrane can reduce the depth of material that is required and should be installed in accordance with the manufacturer's instructions.

Material used to surface the track should normally comprise crushed rock. This will provide the most resilient surface and will normally require the lowest levels of maintenance. Alternatively, well graded sand and gravel can be used, but this will be more prone to potholing, rutting, and washing off, potentially leading to siltation of adjacent watercourses, and will therefore require more frequent maintenance. This may be an option where use of the track is relatively low, but could be more demanding where larger numbers of vehicles or heavier vehicles use the track.

Rock types

In Scotland the types of rock available and suitable for track construction range from limestone and sandstone to granite and marble. The latter rock types (i.e. igneous and metamorphic rocks) are more predominant in the north and north-east of Scotland whilst sandstones and limestones are more common in central and southern Scotland.

Some of these rock types, but not all, are suitable after crushing for use on track construction particularly in the upper 100–150mm 'running' surface. However, the strength of different types of rock varies widely. Some can quickly degrade or breakdown under the weight of vehicles. Expert geotechnical advice should be sought where the suitability of a given material is uncertain.

There are extensive deposits of sands and gravels throughout Scotland. Sands and gravels are suitable in track construction as a 'capping layer' to the natural underlying clays and silty sands, and also as a general road fill. Crushed gravel and sands can be used for the top running surface but are not as durable as crushed rock as the gravel surfaces tend to pothole more easily leading to a higher level of required maintenance.

When sourcing rock, sands or gravels, it should be borne in mind that these are non-renewable resources and their extraction may have a permanent impact on the Earth heritage interests of the area.

Local materials

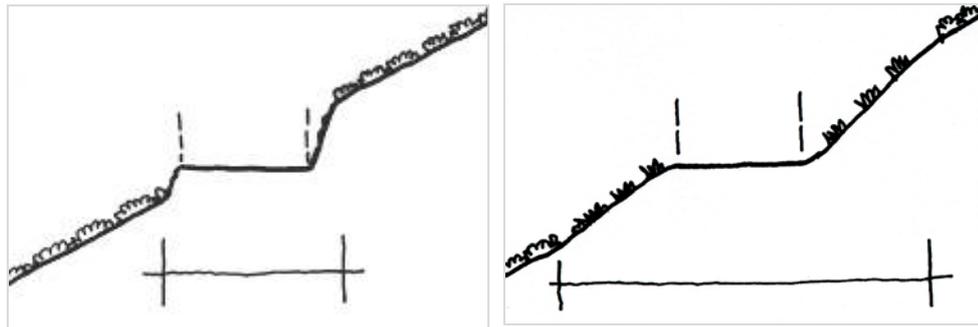


The use of imported material can raise significant sustainability and economic issues

Having determined the engineering requirements, the next step will be to consider the suitability of local material for construction of the track sub-base and surface. There is considerable variation in the characteristics of rocks across Scotland, and in their suitability for track construction.

While it might be assumed that locally sourced material is preferable from a natural heritage perspective, newly won rock can sometimes have a very different appearance from weathered rock. In the case of lighter or more strongly coloured rock, this can increase the landscape and visual impact of the rock. Therefore it may sometimes be preferable to use an alternative source of surfacing material where this reduces the contrast between the track and surrounding vegetation or rock, and is chemically inert or similar to the local rock.

Cut and fill



On steeper cross-slopes, a narrow corridor will result in prominent cut & fill slopes

Blending the slopes into the natural profile of the hill will reduce the visual impact but could increase the extent of habitat disturbance

A key design aim should be to minimise the amount of cut and fill along the length of a track. The more extensive the areas of cutting, or the lengths of embankment, the less the track structure will appear to fit the landscape, and the greater the landscape and visual impacts will be as a result. Impacts on Earth heritage interests and drainage are also likely to be increased, for example, if poorly restored cut banks erode or extend upslope over time.

A further aim should be to strike a balance between the material derived from areas of cutting and that used to create sections of embankment. Much will depend on the nature and location of material excavated from cuttings. While in some cases rock can be crushed and used to build the sub-base or even the track surface, the material will often only be suited to use as subsoil along the slopes on either side of the track. The detailed design should determine the volume of material that can be re-used on site and the requirement for re-use elsewhere – either to restore borrow pits along the track or transport offsite.

There are important waste management implications of measures to deal with surplus peat as set out within SEPA's [Regulatory Position Statement - Developments on Peat](#). Landscaping with surplus peat (or soil) may not be of ecological benefit and consequently a waste management exemption may not apply. In addition disposal of significant depth of peat would be considered landfilled waste, and this again may not be consentable under SEPA's regulatory regimes. Experience has shown that peat used as cover can suffer from significant drying and oxidation, and that peat redeposited at depth can lose structure and create a hazard when the stability of the material deteriorates. This creates a risk to people who may enter such areas or through the possibility of peat slide.

It is therefore essential that the scope for minimising the extraction of peat is explored and alternative options identified that minimise risk in terms of carbon release, human health and environmental impact. The volume of excess material and the disposal solution will have cost implications and depending on where the disposal takes place, there may also be natural heritage effects.²²

While track design should normally aim to confine the area affected by the track to as narrow a corridor as possible, there may be some benefit in widening the corridor where this allows engineered slopes to be blended into the surrounding landform. A narrow corridor may require steep cut and embankment slopes which would contrast with surrounding areas of hillside and could prove difficult to revegetate successfully.

By grading out the areas of cut and fill it will be possible to blend them into surrounding slopes, achieve more successful revegetation and reduce the risk of erosion. This will significantly improve the appearance of the track, though could result in more extensive areas of habitat disturbance.

²² [SEPA information on Surplus Peat Management](#)

Any proposals for the re-use of peat on road shoulders should follow the best practice guidance in page 27 of *Floating Roads on Peat*, and *Good Practice During Windfarm Construction*. Any landscaping or road batters should be limited to the areas of ground already disturbed.

4.8 Wind farms

4.8.1 WIND FARMS – CUT AND FILL



Regrading the slopes above and below a new track can help blend it into the hill slope. This will, however, increase the area affected during track construction.

Tracks for large vehicles, with wide running widths, and gentle gradients, necessitate large scale earthworks, and where tracks cross steep slopes and gullies, cuttings and embankments become exaggerated. This leads to tracks that are less sympathetic to the landscape.

It may be possible to use excess material extracted from cut sections of track to ameliorate the gradient of slopes either side of track sections, or to build up the downside slopes to a little above the track level to reduce the visibility of the track in the wider landscape.

Any proposals for the re-use of peat on road shoulders should follow the best practice guidance in page 27 of [Floating Roads on Peat](#), and [Good Practice During Windfarm Construction](#). Any landscaping or road batters should be limited to the areas of ground already disturbed.

Ameliorating the cut or filled slopes either side of a track such that they are shallow gradients allows reinstated turfs to establish better by reducing the tendency to slump. This creates a wide construction corridor, but the better established vegetation will make the disturbance less visible overall.²³

Borrow pits

While some suitable material may be derived from cuttings constructed along the track, it is likely that borrow pits will be required to supply material for the sub-base and surface.

Track design should consider the need for borrow pits to provide material for track construction. Like tracks, borrow pits can result in a range of natural heritage impacts, including the direct loss of habitats and soil, landscape and visual effects and modifications to the local hydrology. It is important, therefore, that the number, size and location of any borrow pits, together with proposals for restoration, are considered from the outset and that proposed borrow pit locations are shown in planning application plans and visualisations.

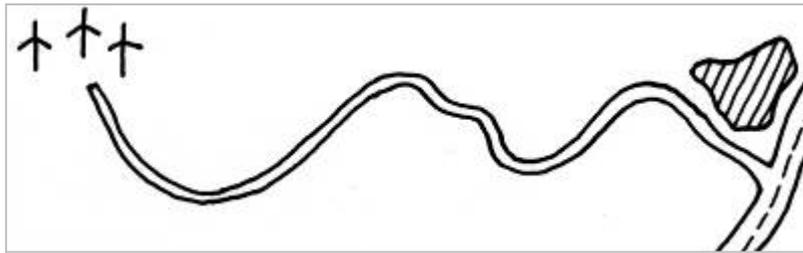
In some cases it may be preferable to have fewer, larger borrow pits, particularly where they can be sited in less sensitive and less prominent locations. This consideration may particularly apply in areas of thick till, where a single larger borrow pit will provide access to relatively greater volumes

²³ [Good Practice During Windfarm Construction](#) discusses verge re-instatement.

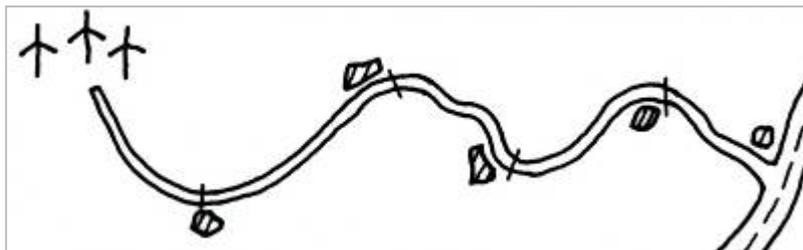
of bedrock than will a larger number of smaller pits. In areas of thick glacial till (generally a mix of clay and coarse pebbles, cobbles and even boulders), usable rock will be at some depth. In other cases, it may be best to have a larger number of small borrow pits.

Accurate and detailed pre-construction survey will be required in order to quantify the volume of material that will be required and to consider the size, number and location of borrow pits along the route of the track. This requires information on the depth of material along the route and the type of construction that will be used (for example whether geosynthetics will be employed to reduce the depth of the track sub-base).

Careful consideration should be given to removal and storage of turf, topsoil and sub-soil from borrow pits. These should be used for on-site restoration wherever possible once excavation is complete.²⁴



A single large borrow pit may be preferable if it is in a less prominent and less sensitive location



A larger number of small borrow pits can help reduce the scale of impact in any one place. It may also be possible to build them into the track as passing places or turning areas.

The selection of sites for borrow pits should consider the scale of the excavation, its visibility across the surrounding area and its likely impacts on the natural heritage. These impacts may include changes in hydrology; damage to sensitive ecosystems, both at the site's location and also further downhill/ downstream; and damage to Earth heritage interests including soils, bedrock, glacial landforms and glacial deposits.

The planned after-use of the borrow pit should also be considered, since this may influence the borrow pit location. Borrow pits can be incorporated in track design to provide turning areas or passing places. They can also be incorporated within the track corridor, for example accommodating the turning circle for vehicles on the hairpin bends that may be required on steeper slopes.

Consideration should be given to the careful removal and **storage of turf**, topsoil and subsoil from the borrow pit. These should be used to restore the site once excavation is complete. Where excavation has revealed features of geodiversity interest, it may be appropriate to retain these as exposed conservation faces. Where infill and restoration of borrow pits is appropriate, material that is not suitable for use in track construction may be suitable. Such disposal will require careful and sensitive rehabilitation of the material and associated vegetation.

²⁴ [Construction Code of Practice for the Sustainable Use of Soils on Construction Sites \(Defra, 2009\)](#)
[SEPA Regulatory Position Statement – Developments on Peat \(SEPA, 2010\)](#)
[Guidance on the Assessment of Peat Volumes, Reuse of Excavated Peat and Minimisation of Waste](#)

Borrow pits for the construction or maintenance of tracks are likely to require planning consent ([see Section 7](#)). It is vital, therefore, that detailed survey work is undertaken during the design of the track in order to identify how many borrow pits will be required, what size they need to be and where they will be located.

The material for wind farm tracks is commonly locally won stone from borrow pits on site, although for locations where borrow pits are not possible, imported stone is used. It is important that the quantity and quality of stone required is assessed accurately to obtain sufficient material of a suitable nature to construct the track. Pre-construction survey work should be carried out to ensure that potential borrow pits have adequate stone in sufficient quantity for track construction.

Importing material

Depending on the volume of material likely to be required to construct the track and the suitability and supply of local material, there may be a need to use material sourced elsewhere.

The use of such materials raises a number of issues that should be considered carefully:

- It is possible that the chemical composition of imported material may react with that of the host environment. This may happen, for example, where alkaline material (such as crushed limestone) is used in an otherwise acidic environment (such as a peatland). The chemical properties of imported rock may also modify the weathering and erosion of local material and may influence the chemistry of water flowing into local rivers and other habitats. This can have a significant impact on surrounding habitats, species, water bodies, and Earth heritage interests such as soils.
- Imported material may confuse the geological record, potentially reducing the value of a site for the study of geological history.
- It should be recognised that the winning of suitable aggregates off site can itself raise natural heritage concerns. This is particularly so where it creates pressure for new quarries or the reopening of former quarries.
- The movement of material will result in a range of transport impacts, ranging from noise, vibration and danger for local communities, to energy consumption and CO₂ emissions.
- The colour of imported material could have a visual impact – it could stand out in the landscape but see also [Local materials section](#).

Maintenance

Whether or not material for track construction is sourced on or off site, consideration should be given to future maintenance. It is likely that additional material will be required to undertake repairs to the sub-base and, in particular, to the track surface. Using the same source of material will help ensure that the appearance of the track is maintained.

[Section 5](#) covers maintenance issues in more detail.

4.9 Drainage



4.9.1 DRAINAGE

Drainage is an essential component of track design and construction. Without effective drainage, a track can significantly alter the area's hydrology, impeding flows or acting as a channel in its own right. While this can damage the structure of the track itself, the effects on surrounding areas can be even more serious, particularly where run-off results in erosion or the loss of water-sensitive habitats. Run-off from the track itself, or from surrounding land during track construction and use, may result in increased sediment load in water bodies which could affect sensitive features such as salmon spawning redds or freshwater pearl mussels. Increased sediment load also affects fluvial geomorphological processes and may affect the location and extent of bank erosion and flooding. Temporary and partial damming of watercourses during construction may also have flood risk impacts.

The [Scottish Environment Protection Agency](#) (SEPA) provides information on requirements under [The Water Environment \(Controlled Activities\) Regulations \(2011\)](#) and a number of [Pollution Prevention Guidelines](#) (PPGs) with good practice principles when working near water bodies.

Engineering works in and around rivers and streams are regulated under the Water Environment (Controlled Activities) (Scotland) Regulations 2011. Authorisation for many such works is required from SEPA and guidance is available in the '[CAR Practical Guide](#)' available on the SEPA website, alongside guidance on good practice.

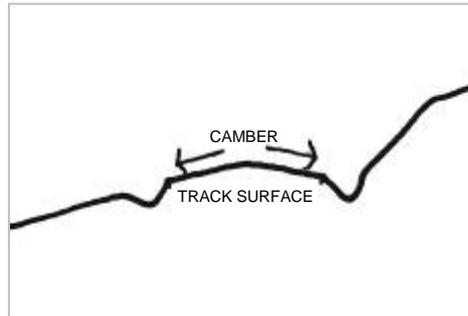
The following pages describe a range of measures that can be used to ensure efficient track drainage and to maintain drainage patterns throughout the track corridor. Their advantages and disadvantages are summarised in [Table 7](#). Further information on engineering activities in the water environment is available from SEPA.²⁵

Cambers and cross-falls

While some tracks use a cross-fall to drain water across the entire width of a track to a single drainage ditch, some constructed tracks are tending to return to a model based on a camber with ditches on either side of the track. A cambered approach achieves a more efficient pattern of drainage with a minimum amount of flow over the surface of the track itself. While regular maintenance is required to maintain the profile, there may be opportunities to re-vegetate the centre of the track, helping to reduce its landscape and visual impact, and impact on the habitat. In free-draining soils cambered tracks often only need a ditch at the up-slope side and sometimes

²⁵ [Engineering activities in the water environment](#)

not at all.



A camber drains water to both sides of the track. It requires two drains and for the profile to be maintained. It allows rapid drainage of the surface.

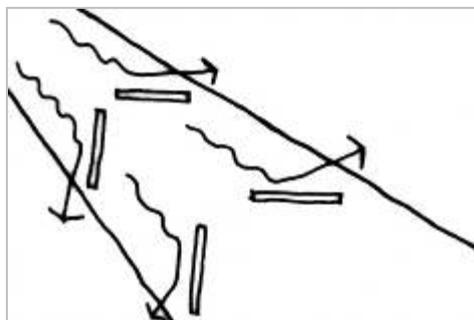
Water breaks



Timber beams set into the track surface divert water to ditches on either side

Water breaks, comprising timber or metal channels laid across the width of the track and orientated down slope, may be used where gradients are likely to result in water flowing down the surface of the track, rather than directly to the sides. Water breaks can interrupt such flows and carry run-off to a drainage ditch on the downhill side of the track.

However, water breaks are not generally seen as a practical method for track drainage as frequent maintenance is required to prevent blockage and erosion; they are vulnerable to damage by vehicles; and are vulnerable to erosion on the upslope side in flood conditions.



Water breaks prevent water flowing downhill along the course of the track

Ditches

Ditches are used to manage run-off from the track surface and to maintain surface and groundwater flows across the line of the track. Tracks using a cross-fall will normally have one ditch, located on the up-slope. Cambered tracks will normally have ditches on either side.

Pre-earthworks drainage for major track development requires installation of cut-off/diversion ditches ahead of the main earthworks. They are installed on the high-side boundary of areas which will be affected by access track earthwork operations.²⁶

- Ditches usually connect with culverts to carry water under or through the structure of the track to link into soak-aways.
- A smooth base to the ditch will permit a steady flow of water, minimising the risk of erosion and siltation.
- Gradients should be steep enough to allow efficient drainage, but not so steep as to create erosion.
- Ditches should be sufficiently large to cope with the highest flows since this is the time when the risk of erosion is greatest. There may be a need for check dams in the ditch to slow the water velocity.
- Ditches may be cut 'u' or 'v' shaped depending on the substrate. There is a trend towards wider, shallower, sometimes vegetated ditches for drainage. These are appropriate for use in many track construction situations. However depending on the soils in the local area the profile of the ditch can vary.

Bridges and Culverts²⁷

Engineering activities such as culverts, bridges, watercourse diversions, bank modifications and dams should be avoided unless there is no practicable alternative. Where a watercourse crossing cannot be avoided, bridging solutions, or bottomless or arched culverts, which do not affect the bed and banks of the watercourse, should be used. Further guidance on the design and implementation of crossings can be found in SEPA's Engineering in the Water Environment Good Practice Guide on construction of River Crossings.

In all situations the use of bridges or bottomless culverts rather than pipe or box culverts should be the initial consideration as culverts have the potential to cause problems for fish and other wildlife, and to block and cause drainage issues. SEPA has a presumption against the use of culverts. Crossing watercourses (including culverting) is a controlled activity under The Water Environment (Controlled Activities)(Scotland) Regulations 2011²⁸ and requires authorisation from SEPA.

Where watercourse crossings have to be used they should be placed at locations where streams or natural drainage channels cross the track route.

Watercourse crossings should be designed to accommodate flood flows. If there are any nearby risk receptors to the watercourse crossing then it may need to be designed to accommodate a 1 in 200 year flow. Further guidance on this should be sought from the local authority and SEPA. The size and design of culverts will be influenced by the depth of the track sub-base, and although it may be feasible to use two or more, smaller diameter culverts where sub-base depth is limited, it is preferable not to as these will be at greater risk of blockage than a single, larger pipe.

²⁶ [Good practice during windfarm construction](#)

²⁷ [Engineering in the water environment: good practice guide – River crossings \(SEPA 2010\)](#)
[Culverting of watercourses – position statement \(SEPA 2006\)](#)

[Engineering activities in the water environment](#)

²⁸ [The Water Environment \(Controlled Activities\)\(Scotland\) Regulations 2011](#)



Stone facing can help culverts blend into the surrounding landscape. Culvert pipes should, however be set back into the stonework to minimise their visual prominence. Culverts should be sunk into the bed of the channel to allow access by fish and other species, and not left 'perched' as in this example. It is preferable to use a single larger pipe since this will carry more water and will be less prone to blockage.



Larger culverts are likely to be required where river flows (or anticipated flood flows) are high. There should be an adequate depth of material over culverts. For forestry extraction tracks this is normally between 750mm and 1000mm.

Where migratory fish are involved a bridge should always be the first choice as culverts can more easily obstruct the passage of fish, e.g. lampreys, salmon and brown trout which have differing migration needs, and other fauna e.g. otters and water voles. Culverts should be designed to permit the passage of fish and other species and consequently need to be part buried in the bed of the watercourse so there is no 'step' up to them and the culvert contains bed material along its length.

Culverting a natural stream prevents any further channel change at that point. Where a stream has a history of channel migration a bridge over the whole area of possible channel change would be preferable.

Culverts require a minimum internal gradient of 1% (1 in 100). Corrugated or rough surfaces inside culverts will trap silt and contribute to the stream ecosystem and allow safe through passage of aquatic fauna.

Depending on the management of water on the downstream side of the culvert, in some situations it may be appropriate to use a large stone or other feature to interrupt the flow of water. This will help dissipate its energy and help prevent problems of erosion. However this is not always suitable in watercourses with fish species as it can make it more difficult for fish to safely enter and exit the culvert.



Culverts and silt traps require maintenance to ensure they continue to function properly. Blocked culverts can damage the track structure and result in flooding or erosion problems in surrounding areas.

Figure 7: Cross section showing culvert, silt trap and apron

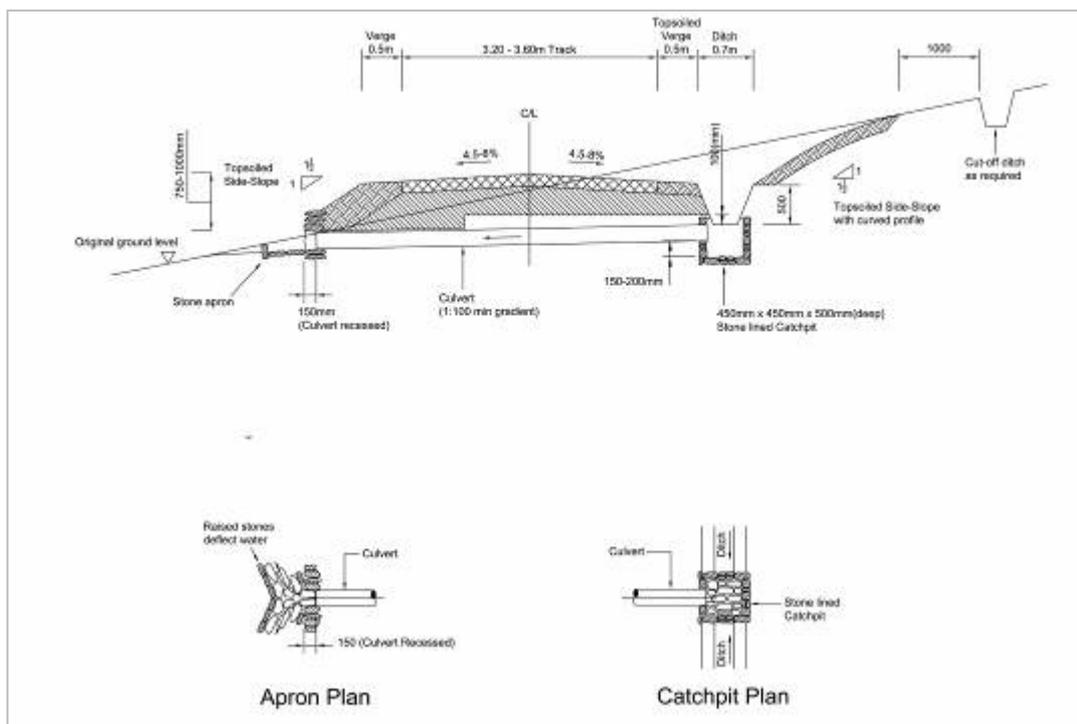
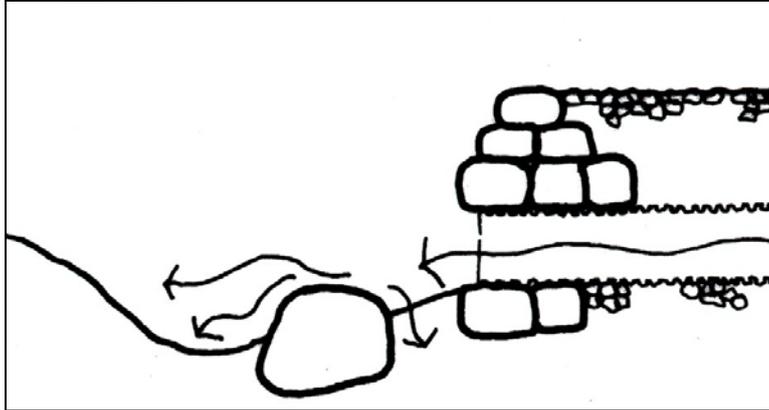


Figure 7 shows a typical cross-section incorporating a culvert and silt trap. It includes details of a stone apron to dissipate energy where water emerges from the culvert, and a catch-pit which is used to trap silt and direct water into the culvert. External faces of culverts should be designed to fit sensitively in the surrounding landscape. Regular maintenance is required to ensure that culverts are not blocked by stones, silt or vegetation. Where less frequent maintenance is likely, or where a build-up of silt or vegetation is considered advantageous from a biodiversity perspective (for example permitting species to move through the culverts), it is appropriate to use oversized culverts.



Careful design is required where water emerges from a culvert to avoid erosion affecting the hill slope or even the structure of the track itself. Here a block of stone dissipates the energy of the water although care must be taken in using such features where migratory fish use the water body.

Silt traps and soak-aways

Increased silt levels in watercourses can result in significant natural heritage impacts ([see pages 115-116](#)). Where run-off from the track itself or from surrounding land is likely to be high in silt, silt traps should be constructed at regular intervals. Silt traps should be located at points where the water enters a culvert or joins a natural watercourse. However, construction water should not be discharged directly to a natural watercourse without being treated or approval from SEPA. In addition silt traps should not be put into any sort of natural channel, even a burn which may have been diverted to accommodate a track.

Silt traps comprise a pit that is constructed below the level of the incoming ditch and outgoing culvert. As water enters the silt trap it will slow, allowing material held in suspension to settle out to its base. Silt traps will only work where the pit is long enough to allow settlement and they must be maintained regularly otherwise they will not function correctly.

Where appropriate the silt trap and culvert may be stone faced to help the feature blend into the surrounding landscape and minimise longer term maintenance requirements.

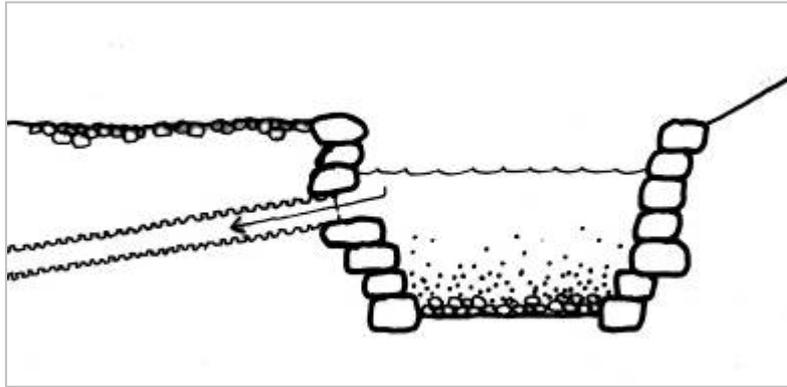
Where flows are likely to be low, surface water run-off can be directed to soak-aways. Soak-aways work in a similar way to silt traps but have no outfall to a watercourse and rely on infiltration of water into the underlying ground. They should not be placed close to a natural watercourse.²⁹

Swales and attenuation ponds should also be considered for use at appropriate locations in the drainage and water management associated with track construction. The principles of [SuDS](#) should be applied.

²⁹ [CIRIA publication C648 Control of Water Pollution from Linear Construction Projects, Technical Guidance, 2006](#)

Local topography

Local topography will have a significant influence on the design of the drainage system used for the track. If the area is wet and flat, frequent culverts and side ditches on both sides may be needed. If the area is steeply sloping, the ditches may need to cope with fast flowing water, but culverts may not need to be so frequent. Steep ditches are likely to erode more quickly, though vegetation can be used to slow the flow of water. In steep areas particular attention must be paid to the culvert outlet. High flows below the culvert outlet can initiate gully heads which cut upslope, eventually undermining the culvert and even the track itself. Good culvert design will include features to reduce this risk ([see page 101](#)).³⁰



Water flows from the trackside ditch into the silt trap. As it slows, suspended material settles to the bottom of the pit before the water passes through the culvert.

³⁰ [Engineering in the water environment: good practice guide – River crossings \(SEPA 2010\)](#)
[Culverting of watercourses – position statement \(SEPA 2006\)](#)
[Engineering activities in the water environment](#)

Table 7: The advantages and disadvantages of different drainage techniques

Drainage feature	Advantages	Disadvantages
Cross-fall	<ul style="list-style-type: none"> Water on surface of track deflected laterally across track Only one drainage ditch required which should be at the uphill side of track 	<ul style="list-style-type: none"> Can increase erosion of track surface
Camber	<ul style="list-style-type: none"> Water on surface of track drained to each edge, minimising flows across the track surface Can allow re-vegetation along track centre line 	<ul style="list-style-type: none"> Drainage ditches may be required on both sides of the track, (though sometimes only on up-slope) Reprofiling required to maintain drainage pattern
Water breaks/bars	<ul style="list-style-type: none"> Diverts water off track surface 	<ul style="list-style-type: none"> Frequent maintenance required to prevent blockage and erosion Vulnerable to damage by vehicles Vulnerable to erosion on the upslope side in flood conditions, especially where outer edge is raised above track level Timber or metal features may appear out of place in the upland landscape
Ditches	<ul style="list-style-type: none"> Divert surface and groundwater from upslope away from track surface Wider, shallower, and vegetated ditches have biodiversity and landscape benefits 	<ul style="list-style-type: none"> Require regular culverts or water breaks Require flat bases to allow steady flow of water Require cut slopes beside track to be larger to accommodate ditch depth and width Angle is critical – if too steep will erode, if too shallow or too long will fail to drain under flood conditions Require tapered sides to avoid scour and collapse
Bridges	<ul style="list-style-type: none"> Can maintain the integrity of the river channel Allows the free passage of fish, otter, water vole, etc. Protect stream crossings from vehicular impact and increases in silt loading downstream 	<ul style="list-style-type: none"> Use of concrete could be harmful to fish Can be a prominent and engineered feature in the upland landscape
Culverts	<ul style="list-style-type: none"> Divert water under track preventing damage to track surface or structure Divert water without change in running surface Protect stream crossings from vehicular impact and increases in silt loading downstream Plastic culverts prevent need for concrete which can be harmful to fish Specially designed mammal culverts for water vole and otter can be used where appropriate 	<ul style="list-style-type: none"> Require sufficient depth and gradient to drain across track Require anti-erosion measures at outflow to prevent damage to the track and surrounding areas Require regular maintenance to avoid blockages Poorly designed culverts can impede fish migration and passage of other species Culverts reduce the quality of stream habitats
Silt traps	<ul style="list-style-type: none"> Allow water to slow down and deposit suspended material Reduce likelihood of blockages in ditches and culverts Can be used to slow water flow along long sections of steep ditch if downslope edge is built up enough to divert some water into adjacent culvert 	<ul style="list-style-type: none"> Require regular clearing of deposited material Inappropriate in natural watercourses

4.10 Access and recreation



4.10.1 DESIGN FOR RECREATION

The strategic design stage (described in [Section 3](#)) will have identified ways in which the routing of the track can strike a balance between impacting upon existing patterns of recreation and providing a new recreation resource linked into other paths and tracks. The detailed design stage provides an opportunity to maximise the track's recreation potential but also to ensure that measures are in place to manage any pressures or problems created by recreation activity in areas along and adjacent to the track.

The strategic design stage should have identified the kinds of recreation activity that may be attracted or accommodated by the track. This is likely to vary considerably according to the location of the track and the area served by it. Types of user may range from family groups, walkers, climbers, mountain bikers and horse riders, to more specialist interests such as kayakers or cross-country skiers. Tracks also have the potential to provide important all-abilities access to remoter parts of the Scottish uplands.

These different types of user have different requirements and expectations. While it will normally be sensible to ensure there is somewhere to park cars near the start of a track, where it is likely that horse riders will use the track, the parking area should have space for horseboxes and trailers. All-ability access and family access may require relatively frequent signage and way marking, together with easily negotiated gates. Climbers and hill walkers are likely to require a lower level of provision.

Maps, signage and way marking can provide an effective management tool, helping to ensure that recreation activity is concentrated in areas where habitats are sufficiently robust and where such activity does not conflict with land management. The detailed design stage should also consider the extent to which people will use the track to access other areas, and the management issues that may arise as a result. There may be a need to place simple way markers at key points along the track or at its end in order to direct visitors to other routes or points of interest. There may also be opportunities to create new links off the track, connecting with other paths or tracks, or providing access to particular hills or other points of interest.

Particularly careful consideration is required at the end of the track. While some users will be happy to retrace their steps along the track, others may want to gain access to particular hills, continue through the uplands or link to another path or track to form a circular route. Where habitats are fragile and the ground frequently wet, even moderate levels of unmanaged activity can result in erosion and damage. This can affect biodiversity and geodiversity (directly and indirectly), result in landscape impacts and affect land management. In such circumstances it will be

necessary to explore appropriate management responses, including the creation of new upland paths³¹, or the use of signage to encourage people into more resilient areas.



Track design should reflect the likely recreational use



Information in the form of signage and way-marking will help realise the recreational potential of upland tracks as well as providing a management tool

In many cases it will prove difficult to anticipate accurately the type and level of use, and the impacts in terms of disturbance, trampling or erosion. There may therefore be a need for monitoring (for example using a combination of automatic counters and site inspections) to measure the level of use and the appropriate response. Liaison with local authority and national park authority access officers and neighbouring estates will help to develop an integrated and co-ordinated approach.

4.10.2 CONSENTS AND LICENCES



It is essential that the necessary consents and licences have been secured before construction begins. It is good practice to liaise with the local planning authority, Scottish Natural Heritage, Historic Environment Scotland and the Scottish Environment Protection Agency once the need for a track has been identified and as the outline and detailed designs develop. In addition to helping to identify any issues that might later constrain the proposal, this kind of liaison will help to identify the consents that need to be in place for the development to proceed.

³¹ [Upland path construction and management manuals](#)

Planning consents

Consent will be required for most forms of proposed track if the track forms part of development that does not have 'permitted development rights' (either because it is not included within the [General Permitted Development \(Scotland\) Order 1992](#), or because these rights have been removed). [Annex F of Circular 2/2015, Consolidated Circular on Non-domestic Permitted Development Rights](#) provides further detail on permitted development rights for tracks, and the prior notification and prior approval process.

Other consents and regulations



Consent may be required where tracks have the potential to affect the historic environment

Consent will also be required from Historic Environment Scotland or the local planning authority where the proposed track affects a [Scheduled Ancient Monument](#)³² or a listed building or structure. Historic Environment Scotland must also be consulted by the local planning authority regarding any proposals that involve or might affect historic gardens and designed landscapes that are included in the Inventory of Gardens and Designed Landscapes (see also [Section 7](#) of this guidance).

As consents and licences need to be in place prior to works commencing it is important that sufficient time is planned in to apply for, and await receipt of, these. For example under The Water Environment (Controlled Activities)(Scotland) Regulations (2011) and The Construction (Design and Management) Regulations 2015³³ time needs to be included for consents for notifiable projects – many track construction works would constitute a [notifiable project](#).

³² [Historic Environment Scotland Scheduled Ancient Monuments](#)

³³ [The Water Environment \(Controlled Activities\) \(Scotland\) Regulations 2011](#)
[The Construction \(Design and Management\) Regulations 2015](#)

4.11 Biodiversity and geodiversity



4.11.1 BIODIVERSITY AND GEODIVERSITY CONSENTS

In addition to the possible need to obtain planning consent, consent from Scottish Natural Heritage is normally required for activities that are likely to damage the protected natural features of an SSSI.

Work which is likely to affect the following species may also require a licence from [Scottish Natural Heritage](#):

- bats (all species)
- otter
- wildcat
- badger
- red squirrel
- pine marten
- water vole
- breeding birds
- capercaillie leks (breeding displays).

Licences are not guaranteed to be granted, even if the track has planning permission. If there is insufficient evidence to show that impacts on the affected ecological receptor have been minimised and there are viable alternatives to the proposals, then the licence application may be refused.

[See Section 7](#) of this guidance for further information on licences for works affecting protected species.

4.11.2 CONSTRUCTION

Timing the works

Good track construction will take into consideration the different times of day or season when ecological receptors are more susceptible to disturbance.³⁴

For some species, there are specific legal requirements for this for example, it is illegal to disturb a nesting bird, its nest or its eggs, and therefore it is often recommended to avoid any vegetation clearance during the breeding bird season (March to August inclusive, although some species do breed before this time and some continue later into the autumn).

Most species are particularly vulnerable during their breeding season or during hibernation when visible signs of their presence may be difficult to find.

Fish are particularly susceptible to the effects of siltation and other water pollution events during spawning and fry periods and therefore in-stream works should be avoided during these times. The spawning and incubation period for salmon and trout is typically October into May, but other fish species have different spawning times. For example, lamprey spawning and incubation occurs between March and August, the months depending on the species. Arctic charr are also now known to make spawning migrations into burns. Some local areas experience variations in spawning outwith the usual periods noted above. If there is any doubt about when spawnings take place in the area affected by track construction local [Rivers and Fisheries Trusts](#), or the freshwater research section of [Marine Scotland Science](#) can be contacted for further information. It is important to note that at any given time of year there will always be one or another life stage of these species in our rivers, streams and sometimes lochs.³⁵

Other species have distinctive diurnal patterns of activity which determine when they are most vulnerable. Otter, for example, are most likely to be active at dawn and dusk. Bats, and bird species that are active during twilight hours, will be sensitive to the use of flood lighting which is often used to enable construction works to be continued during the hours of darkness.

Marking out the route

The route of the track should be marked out on the ground well ahead of the construction activity. This will allow for advance checks for unforeseen sensitive species, habitats or Earth heritage interests along the route, as well as verification of the pre-assessed impacts.

Opportunities for minor changes in the alignment of the track to avoid small-scale or unforeseen sensitive receptors should be taken at this stage wherever possible. Where protected species are unexpectedly encountered SNH should be contacted for advice immediately.

This stage should also include the definition of the most sensitive sections of the track's route (e.g. water crossings, peat bogs, landscape features) and the establishment of management zones where specific mitigation measures and construction techniques are required to minimise impacts during the construction phase.

Construction should avoid periods of wet weather (when soils are particularly susceptible to compaction and when there is an increased risk of run-off carrying unacceptable levels of sediment) and very dry weather (when there is a high risk of turfs and soils drying out).

Early execution of mitigation options

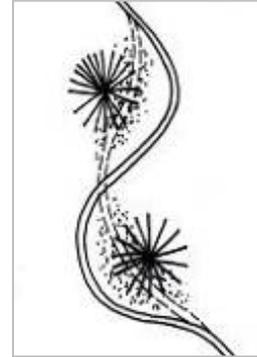
It is best practice to have in place ecological mitigation options, identified as necessary or potentially necessary during the track planning stages, before any construction works begin. This

³⁴ [Good Practice During Windfarm Construction \(SNH et al, 2015\)](#) – has useful information on seasonal considerations which could apply to track construction

[The Biodiversity Scotland Nature's Calendar](#) provides information survey or sensitive periods for a variety of species

³⁵ [SNH Freshwater Fish webpages](#)
[Forests and Water Guidelines \(Forestry Commission, 2011\)](#)

includes precautionary measures such as the ready supply of appropriate silt-trapping measures, as well as the legally required mitigation for protected species.



The detailed routing of the track should be kept away from trees to avoid damaging root systems

'Restore as you go'

Track-edge habitat restoration will be the primary mitigation factor during the construction phase. Restoration should be carried out in tandem with construction rather than being left until the end. Track-edge turfs and topsoil/peat should be stored suitably close to the track, and replaced up to the batter edges as soon as possible. This ensures that the track-edge soil or peat does not become exhausted through drying, or eroded by wind and rain. In periods of particularly dry weather, it may be necessary to water turfs, soil and peat to increase the longevity of the seed bank. The potential for this should be assessed when choosing a location in which to store these materials.³⁶

There is a preference for the use of *in situ* materials (turf, topsoil) in the restoration of track-edge habitats wherever possible. The advantages of this include:

- cheaper than importing soil and seeds
- ensures use of local seeds/seed bank, and therefore conservation of local genetic diversity
- conserves the local soil fauna
- avoids the introduction of alien or invasive species through external seed mixes or turf
- provides an immediate source of vegetation cover, reducing the risk of erosion
- ensures recolonisation of species in keeping with the local landscape.

However, there are also some disadvantages, including:

- the success of the restoration is often dependent on the skill of those responsible for the turf replacement; adequate training must be provided
- colonisation can often be slow, and before the surfaces are properly vegetated they are vulnerable to erosion.

Therefore, a combination of *in situ* material recycling and reseeding may be necessary. Reseeding should, however, be considered a last resort. If necessary, there should be preferential use made of locally harvested seed because, in the same way as turf replacement, it ensures the use of species of native provenance, and conservation of local genetic diversity.

³⁶ **Good Practice During Windfarm Construction (SNH et al, 2015)**

The re-use of soils and peat should be limited to the areas already disturbed by the track construction and not placed on undisturbed vegetation.

The level of success of restored and revegetated areas should be monitored and any problems addressed promptly.

Construction methods – excavated tracks



Construction should normally proceed uphill. Working from the most recently completed section of track will help minimise the area affected by construction

As a general rule, track construction should proceed uphill so that drainage can be managed effectively. Due to Scottish climatic conditions and the nature of subsoils, it is important to keep the track subgrade or formation as dry as possible. This is best achieved by constructing the side and cut-off ditches first, with SEPA approvals in place, and ensuring that these discharge to a suitably buffered watercourse. This will direct surface water away from the sub-base, reducing the risk of water-logging and erosion. No machinery should enter a natural watercourse without authorisation under The Water Environment (Controlled Activities)(Scotland) Regulations 2011 (CAR).

In all cases, precautions should be taken to minimise silts and fine sand being carried into surrounding waterbodies since this is likely to have significant impacts on fragile upland aquatic habitats, could affect the geomorphology of water bodies, and could also affect domestic water supplies. Silt traps should therefore be installed in drainage ditches before the ditch outlet. While purpose-built booms can be used, alternatives, including sandbags or straw bales, can also be used to create temporary weirs. Buffer zones should be used to allow material to be deposited before it is carried into a water body.

Once the side and cut-off drains have been formed, construction of the road sub-base can commence. On completion of the sub-base, the final layers of surfacing are placed and the uphill and downhill slopes are covered with topsoil and turfs as necessary. Progressive construction will minimise the size of the area that is disturbed. Wherever possible, machinery should work off the section of track most recently completed. Recycling of turfs and topsoil from newly excavated sections to the sides of the most recently completed section of track will help minimise damage and loss.

Soil and turf storage

While the aim should be to recycle turfs and topsoil quickly, there may be a need for short term storage while construction proceeds. Soils should be stored to a maximum depth of 1m, on geotextile matting. Subsoil and topsoil should be kept separate. Soils should be kept damp to prevent them drying out and should be stored for a maximum of 12 months. Turfs should be

stored in a single layer and again should be watered to prevent them drying and the vegetation dying.³⁷

The location of any temporary storage areas need to be considered including where they will be located and how they avoid any watercourses, GWDTEs or other sensitive areas. In addition details of how the storage areas will be constructed, what types of soils and peat will be stored and the peat maintained fit for re-use should be considered. This information may also be of interest to geotechnical engineers assessing the peat stability proposals. Note that any soils or peat stored for greater than 3 years (or where storage prior to disposal is for more than 1 year) is likely to require a permit under The Landfill (Scotland) Regulations 2003.

Construction equipment

The choice of construction equipment will reflect the size of the track and the extent of any cut and fill that is required. At one end of the scale, it may be possible to make use of equipment more commonly used in path construction. This may include powered wheelbarrows and climbing diggers. Larger tracks will require heavier earth moving equipment including tracked or wheeled excavators, dump trucks and vibrating rollers or plates. Where slopes are steep, an excavator with four independently controlled wheels or legs (which allow the machine to 'climb' the hillside) can be used. Given the importance of keeping the construction corridor as narrow as possible, and the benefit of working off the most recently completed section of track, machinery with long arms is likely to be particularly useful.

³⁷ [SEPA Regulatory Position Statement – Developments on Peat \(SEPA, 2010\)](#)
[Construction Code of Practice for the Sustainable Use of Soils on Construction Sites \(Defra, 2009\)](#)

4.12 Biodiversity and geodiversity

4.12.1 CONSTRUCTION IMPACTS ON UPLAND SOILS

Upland soils are an important resource contributing to geodiversity, biodiversity and a range of natural processes including drainage and buffering. Such soils are also very fragile, however, and given the timescales over which they have been formed, should be regarded as a non-renewable resource.

Track design, construction and use should aim to minimise the impact on soils. The following points should therefore be taken into account:

- Soil compaction can result from the use of construction equipment or in areas used for the storage of materials.
- Soils can be seriously damaged by run-off, erosion and deposition.
- Disturbance of natural soil profiles should be minimised. Where it is inevitable, special care should be taken to restore it as closely as possible to the original profile. Soil moved during construction should be stored and re-used on site wherever possible. Turf should be replaced to avoid leaving bare surfaces which are prone to erosion.
- Care should be taken to avoid contamination resulting from the use of imported materials, or even heavy metal rich materials if they are present onsite.
- Care should also be taken to avoid changing nutrient levels in the soil. Use of material from different substrates or soils can alter nutrient levels along the route of the track and in adjoining areas.
- Good pre-construction survey work will inform understanding of the soil qualities and assist in minimising construction and storage impacts on soils.

4.13 Engineering

4.13.1 THE EFFECTS OF SILTATION

Upland tracks can lead to increased silt levels in water bodies. While the greatest risks of excessive siltation occur during construction, they also reflect the materials used (particularly in the surface of the track) and the level of use (particularly during poor weather).

The [Scottish Environment Protection Agency \(SEPA\)](#) should be contacted for guidance and information on legislative requirements relating to The Water Environment (Controlled Activities) (Scotland) Regulations 2011.³⁸ Useful guidance on this can be found in SEPA's 'CAR Practical Guide'.

High levels of sediment load can have a number of significant effects on water bodies including:

Physical impacts

Fine sediment can affect the stream channel by:

- altering the substrate composition, clogging channel bed interstices and reducing habitat space for small fish and invertebrates
- causing marginal changes to the in-stream channel morphology and general habitat availability
- reducing the permeability of the bed material.

High suspended sediment concentrations can also affect water resources by:

- damaging turbines in hydroelectric plants, and increasing requirements for water treatment procedures
- reducing reservoir and diversion dam storage capacity.

Chemical impacts

High sediment levels can reduce the amount of dissolved oxygen with impacts on the quality of freshwater habitats. Erosion which generates high sediment loads in watercourses will also move nutrients and carbon from terrestrial to freshwater habitats and may lead to acidification and eutrophication of water bodies.

Biological impacts

Increases in sediment loading can:

- reduce light levels within the water body resulting in a reduction in plant growth, with potential knock-on effects for other species higher in the food chain
- damage leaf surfaces as a result of abrasion and smothering
- adversely affect invertebrate populations; serious siltation can kill invertebrate populations e.g. freshwater pearl mussel
- interfere with the behaviour, feeding and growth of fish species; serious siltation will simply kill fish rather than merely interfere with them
- increase the susceptibility of fish to disease, and may cause damage to gills by abrasion and clogging

³⁸ [The Water Environment \(Controlled Activities\) \(Scotland\) Regulations 2011](#)

- increase surface water temperature and lead to thermal stratification, not only a problem in rivers, but also for downstream reservoirs and lakes.

4.13.2 CONTROLLING SILTATION



Straw bales can be used as a temporary silt control measure during construction



Temporary silt protection is particularly important where tracks cross watercourses



Where there is a risk of significant levels of siltation the use of specialist equipment may be appropriate

Photographs reproduced with kind permission of AMEC and ScottishPower.

Siltation issues can easily be dealt with using a range of techniques, depending on anticipated silt loadings and the volume of run-off.

Straw bales are cheap and easily obtainable. To be most effective when used in ditches straw bales should be wrapped in geotextile and pinned in place, with a covering of stones. They can be used to protect specific features along the construction route, such as water bodies. Bales can be placed in interceptor ditches to create a 'weir' effect that slows down the water movement, which encourages larger silt particles to settle out. However, bales require regular maintenance and

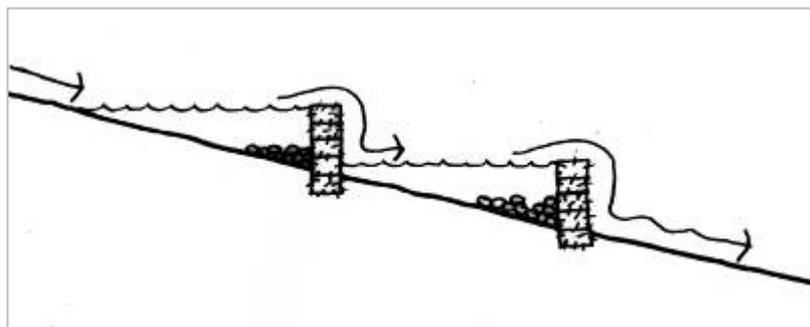
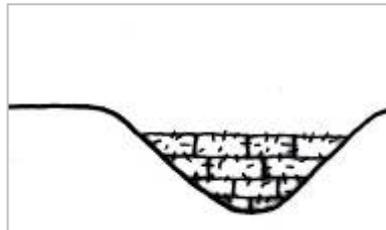
changing to prevent clogging and disintegration.³⁹

Where heavier silt loads are anticipated, or where there are particularly sensitive ecological features that require protection, commercially available silt fencing can be used. These products consist of a permeable membrane, and are partially buried in the substrate. They often have loops for easy fixing to supportive stakes, and markers to show the depth of silt which can be accommodated by the fencing before clearance is required. Silt fencing is usually washable and can be re-used.

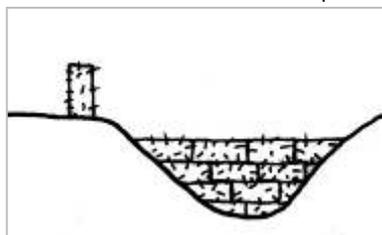
The pumping of excavations and trenches can often lead to heavy silt loadings. Settlement lagoons can be constructed to allow sediment to settle out prior to discharge, although due consideration must be given to the potential habitat loss associated with this. Commercially available silt removal equipment is widely available and can be hired or purchased as necessary. It should be noted that the discharge from some of this equipment is not always completely clean and may still require attenuation.

As with all forms of mitigation, these siltation control measures are only as effective as the quality of their installation and regularity of maintenance. Adequate provision for this must therefore be made.

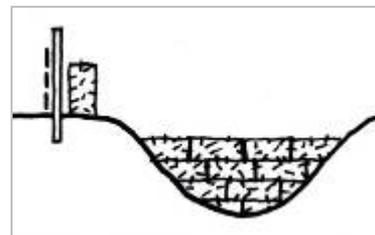
The **Scottish Environment Protection Agency** (SEPA) should be consulted in relation to the control of run-off and silt. Technical guidance on the Control of Water Pollution from Linear Construction Projects is available from **CIRIA**.⁴⁰



Straw bales or sandbags can be used to build weirs that allow suspended sediment to settle out



Straw bales can also be used to provide a barrier between construction activity and watercourses



A permeable membrane can be used in conjunction with bales where heavier silt loads are anticipated

³⁹ [Good Practice During Windfarm Construction \(SNH et al, 2015\).](#)

⁴⁰ [Control of Water Pollution from Linear Construction Sites \(CIRIA, 2006\)](#)

Revegetation

Thin soils and harsh climatic conditions mean that upland habitats are often very slow to regenerate naturally. Many tracks that were constructed during the second half of the twentieth century using bulldozers have left raw scars which remain unvegetated some 40 years later. Such scars increase the landscape and visual impact of the track. They are also susceptible to erosion, making natural regeneration even more difficult.

Given the fragility of upland vegetation, careful stripping, handling and revegetation of turf is essential.

The success of vegetation re-establishment can be increased by carrying out track construction and habitat restoration in short sections, rather than building the entire track and revegetating edges at the end of the process. Rapid reinstatement techniques involve building sections of track up to 500m in length and using freshly lifted turfs to revegetate the margins of the most recently completed section of track. This minimises the storage time and handling of turfs and avoids the cost of undertaking a separate operation.



This former track on the Glenfeshie Estate has been carefully revegetated with soil and turfs

The success of this approach to reinstatement will depend on the skills of machinery operators in lifting, moving and placing turfs. Generally, the larger and deeper the section of turf, the more likely it is to survive the trauma of replanting. The higher and more exposed the location, the longer it will take for the vegetation to become fully established. Furthermore, more gentle slopes are easier to revegetate whilst turfs are subject to slumping and erosion on steeper slopes. The timing of construction activity should be chosen to coincide with optimum soil moisture conditions to reduce the risk of structural damage. Peat in particular should not be allowed to dry out. Soil compaction resulting from the use of machinery should be avoided.

At lower altitude seeding may be used to supplement natural regeneration or turving with preferential use made of locally harvested seed.

As a general principle planning and site investigation should seek to minimise the amount of materials excavated and stripped. Excavated materials and stripped turf should be stored and

managed appropriately, and restoration should take place as soon as possible.

Turf stored for longer than 3 years is likely to be classed as waste material and would require licensing under waste regulations.

Information on revegetation and habitat restoration can be found in [Upland Pathwork construction standards](#).



Without careful revegetation of cut slopes erosion will create prominent scars affecting adjoining habitats and affecting water quality

Borrow pit restoration

There should be a presumption that borrow pits will be fully reinstated at the end of the construction period. However, if an important Earth heritage interest is uncovered during excavation the presumption in favour of full reinstatement should be reviewed. There will inevitably be insufficient material to fully re-profile the borrow pit to the original landform, therefore alternative restoration objectives for the borrow pit should be explored. For example, where the topography, geology, ecology and landscape character are suitable, creation of a wetland habitat and water body may be an appropriate alternative.

When reinstating borrow pits using peat, its use for re-profiling must be in keeping with the environmental reinstatement objectives set down at the outset of the project. Guidance is available from [SEPA](#). As a general guide it is considered by SEPA and SNH that a depth of 0.5 – 1.5m of peat plus up to 50cm of turf (i.e. a total depth of up to 2m) would be appropriate for habitat restoration/creation, subject to site specific conditions e.g. topography, setting (landscape and ecological), water table depth and so on. It is considered that a depth greater than 2m would not have added ecological benefit over what will be achieved with a lesser depth. Therefore, a depth of greater than 2m is likely to be classed as waste by SEPA and so may require waste licensing.

Full reinstatement of borrow pits would usually include:

- regrading of the landform, in particular the back wall of the pit
- refill of material, often with excess material from other parts of the works (NOTE: extreme care must be taken when using peat)
- reinstatement of vegetation, usually through replacement of removed and stored turfs, though excess turfs from other parts of the works can also be used where the vegetation is appropriate.

As noted above, borrow pits may uncover features of Earth heritage interest and it may be appropriate to leave these exposed as conservation faces. In some cases, partial reinstatement can leave the rock face exposed as a crag habitat. It may also be appropriate to leave some rock

exposed in areas where rock outcrops are a characteristic landscape feature.

Table 8: Summary of the advantages and disadvantages of different reinstatement techniques.

Reinstatement technique	Advantages	Problems
Turfs	<ul style="list-style-type: none"> • Re-uses turfs removed during track construction • Reinstated vegetation of same type as surrounding vegetation, with local species • Rapid recreation of habitats possible • Rapid relaying of turfs can promote quicker recovery 	<ul style="list-style-type: none"> • Storage location needs to be carefully selected to prevent excess damage to underlying habitats, prevent peat slippage and silty runoff to water bodies • Turfs require careful storage including watering to avoid them drying out • Turfs cannot be stored in high piles, but require large areas for storage • Delay in returving can result in failure of turfs and erosion
Seeding	<ul style="list-style-type: none"> • Rapid vegetation cover as grasses become established quicker than heather • Rapid establishment and stabilisation of soils 	<ul style="list-style-type: none"> • Introduction of non-local species • Visual intrusion of bright green swards along tracks • Attractive to deer and sheep for grazing, which may lead to excessive trampling of disturbed track edges
Heather shoots	<ul style="list-style-type: none"> • Rapid introduction of heather seed 	<ul style="list-style-type: none"> • Source of heather shoots bearing seed capsules required
Heather seeds	<ul style="list-style-type: none"> • Introduction of heather rather than grass 	<ul style="list-style-type: none"> • Source of heather seeds required, • Slow to germinate
Natural regeneration	<ul style="list-style-type: none"> • Local species colonise area 	<ul style="list-style-type: none"> • Slow, particularly at high altitude • Erosion may occur before soil/peat can be stabilised by plants

Checklist

The following checklist sets out a series of questions which should be used to ensure that natural heritage issues have been fully considered in the detailed design and construction of upland tracks.

Detailed alignment, scheme design and construction types:

- Has the detailed alignment of the track been designed to avoid sensitive natural heritage areas or features?
- What type of track construction will be used in different sections of its route?
- Has the work been timed to minimise the impact on habitats and species?

Sourcing materials:

- Has sufficiently detailed site survey been carried out to determine the nature of ground conditions along the track route and the implications for construction methods and the requirement for borrow pits or the use of imported material?
- Has the number, location and size of any on-site borrow pits been identified?
- How will the borrow pits be treated when mineral extraction is complete?
- Will borrow pits be fully or partially restored using stripped and stored soil and turfs or will they be incorporated into the scheme design to provide passing or turning areas?
- Have the natural heritage implications associated with the use of imported materials been explored fully?
- Is it appropriate to use 'lower specification', locally available materials even though this may require more frequent maintenance?

Drainage:

- Will proposals for drainage maintain existing patterns of ground and surface water flows?
- Will drainage be capable of handling anticipated storm flows?
- Will the design of the track avoid additional erosion and deposition affecting the track or adjoining areas?
- Will surface water run-off from the track be managed to prevent erosion of the track surface and structure?
- Are adequate measures in place to minimise silt loading and subsequent deposition during construction and use of the track?
- Have culverts, silt traps, bridges and other structures been designed to minimise the likely impact on the landscape?
- Have culverts been designed to ensure that they do not act as barriers to the movements of species such as fish?

Recreational usage:

- Has the likely type and level of recreational use of the track been reflected in its detailed alignment, the provision of gates, signage and waymarking, and in the creation of links to other tracks or paths?
- Is monitoring required to determine the level of recreation activity?

Consents and licences:

- Are the necessary consents and licences in place before construction starts?
- Is there a requirement to secure additional consents to cover the borrow pits?

Construction:

- Have mitigation measures been planned into the construction process?
- Have sensitive sections been identified and construction and monitoring methods determined?
- Will progressive construction techniques be used to minimise disturbance and maximise the potential for successful vegetation re-establishment?

Section 5

Track Maintenance

5.1 Detailed track design and construction

Planned maintenance
Monitoring materials
Drainage
Limiting vehicular access
Repairing surface defects
Monitoring biodiversity and geodiversity

5.1.1 INTRODUCTION



The harsh climatic conditions of the uplands mean that regular maintenance is essential to prevent the deterioration of the track

Previous sections have described how careful planning, routing and construction of tracks can help minimise the impact on natural heritage interests. Ensuring that tracks are properly monitored and maintained is equally important in identifying and addressing issues before they damage the structure of the track or create problems such as erosion, water-logging or silt loading in neighbouring water bodies.

This section therefore describes a number of issues that need to be considered with respect to the maintenance of upland tracks.

5.1.2 PLANNED MAINTENANCE

Effective track maintenance is essential to maintain the quality and integrity of the track and to prevent damage caused by impeded drainage, erosion and vehicle over-runs.

Regular inspections and prompt responses are essential since in the harsh environment of the uplands relatively small problems can quickly develop to affect the track and areas around it. Good maintenance is of course important to protect investment in the track.

It is important that the likely revenue implications of regular monitoring and maintenance are accounted for in annual budgets so that maintenance work can be carried out when needed.



5.1.3 MONITORING

Monitoring will be required at regular intervals to identify problems as they arise and to avoid the need for more serious intervention later on. Monitoring will only be effective if it is backed by appropriate action to address identified problems.

Monitoring is likely to be of particular importance during the first few years following track construction. This will help ensure that relocated turfs and other vegetation (for example in drains) are establishing and regenerating properly. It will also highlight any erosion problems associated with structures such as ditches, culverts and the track surface itself.

5.1.4 MATERIALS

The material selected for the track, and in particular the running surface, will influence the type of maintenance required. Loose material on the track surface will become scattered by vehicle wheels, and is therefore generally unsuitable as a finished surface. Bound material on the surface provides a better and longer lasting surface. Material that creates an interlocking, bound surface, such as crushed rock, provides a robust surface which is less prone to forming ruts and potholes that catch water. The maintenance implications of different materials should therefore be taken into account from the outset. Where there is good environmental or economic justification for using less suitable surfacing material, this should be reflected in a commitment to more frequent inspections, monitoring and maintenance.

The location and availability of materials for track maintenance should be identified at the planning stage to ensure maintained areas appear complementary in colour and texture to the original track sections. Where the original material was won locally, it may be appropriate to retain one borrow pit to supply maintenance operations. This should be selected taking into account the relative landscape, biodiversity and geodiversity impacts of retaining different borrow pits.

5.1.5 DRAINAGE

Drainage systems require regular maintenance to ensure uninterrupted flow of water, and to remove blockages such as wood, leaves or silt. Silt traps reduce the need for clearing culverts by reducing the amount of silt entering the culvert, but will themselves require regular clearance. Larger diameter culverts and silt traps require less frequent clearance.

5.1.6 LIMITING VEHICULAR ACCESS

The need for track maintenance can sometimes be reduced by limiting vehicular access in particularly adverse weather conditions where it is considered likely to result in track erosion. This is particularly relevant for tracks surfaced with finer grain material where use during especially wet or cold weather could accelerate the process of erosion. Vehicles should not be allowed access when frost is coming out of the ground and before the track thaws, dries and settles. An alternative would be to limit use of the track to vehicles with low pressure tyres.

5.1.7 REPAIRING SURFACE DEFECTS

Fine grade surface materials can be re-profiled using a combination of scraping and rolling. This method maintains a smooth surface but does not allow the colonisation of vegetation between wheel tracks which can be beneficial in softening the visual impact of the track.

When repairing defects, such as potholes and ruts, simply placing extra surfacing material into the pothole and rolling will not provide an effective and long lasting repair since the new material will not lock into the surrounding road surface. A more effective repair would involve cutting out the track surface around the pothole/defect to a distance of some 500–600mm beyond the pothole and to a minimum depth of 75mm. This ‘pocket’ should then be infilled with suitable surfacing material which has to be compacted using a vibrating roller/plate depending on the size of the surfacing repair. It is essential that the track’s camber/cross-fall is maintained. Wherever possible the material used for the repair should match the existing track surface in colour and texture.

5.2 Biodiversity and geodiversity

5.2.1 MONITORING EFFECTS ON BIODIVERSITY AND GEODIVERSITY

Monitoring is particularly important during and following track construction in order to identify and address any effects on habitats, species and Earth heritage interests.

Monitoring habitat restoration

Where there has been track-side habitat restoration, the success of the revegetation should be monitored to identify locations or particular aspects which need intervention. This will identify locations where recolonisation is slow or has failed, and what species need particular attention within the restoration. It may also identify other habitat-related problems, such as locations where there has been excessive soil/peat erosion or where drainage provision has failed.

The results of monitoring should be used as triggers for further track or habitat management where necessary.

Monitoring protected species

Where tracks have been constructed in locations known to support protected species, monitoring of the response of those species following the completion of the construction phase, and during track operation, will provide an indication of the extent of species resilience to the disturbance. Such monitoring may be a requirement of a licence granted to permit works which may affect a protected species. Again, the results of monitoring should be used where necessary as triggers for further track or habitat management.

Maintaining bridges and culverts

Particular attention should be paid to the timing of maintenance activities on bridges and culverts. Culverts should be kept clear of debris to enable them to function efficiently, and this should also include mammal culverts. Mammals need to be able to see a reasonable amount of daylight through a culvert to feel safe enough to use it. Culverts should only be cleaned during periods of dry weather, and timed to avoid impacts on spawning fish, and fry, which will depend on the species involved ([see 4.11.2](#)).

Monitoring geodiversity interests

Monitoring should also include geodiversity interests along the length of the track. Depending on the area in question, this might include:

- the stability and condition of Earth heritage features
- the condition of exposed 'conservation faces' and the presence of encroaching vegetation, instability or erosion
- the condition of downstream features, particularly if the track has resulted in changes in the area's drainage
- particular attention should be paid to the maintenance of culverts and silt traps where sedimentation from culverts has the potential to damage or destroy Earth heritage sites; likewise, the potential for uphill erosion from culverts must be carefully monitored if such uphill erosion would damage or destroy Earth heritage features.

Checklist

The following checklist sets out a series of questions which should be used to check that natural heritage issues are fully considered in the monitoring and maintenance of upland tracks:

- Has the track been designed to reflect the needs of ongoing monitoring and maintenance?
- Has the monitoring and maintenance programme been designed to pick up teething problems and issues of vegetation re-establishment during the first year or so of the track's life?
- Has the need for regular and ongoing maintenance been built into annual budgets?
- Has a stock of material been secured for future maintenance, or has a borrow pit been retained to supply future maintenance?
- Are monitoring and maintenance measures in place to ensure the future operation of the drainage system?
- Are measures in place to prevent vehicular damage during poor weather?
- Has monitoring been put in place to determine the effects on any protected species, vulnerable habitats or Earth heritage interests that are present?
- Have potential management responses been identified to deal with possible effects?

Section 6

Track enhancement and restoration

6.1 Track enhancement and restoration

- The need for enhancement and restoration
- Tracks in lower and flatter areas
- Tracks on steeper slopes
- Tracks in higher areas
- Track removal
- Biodiversity and geodiversity

6.1.1 INTRODUCTION

Previous sections of the guidance have concentrated on the design, construction and maintenance of new tracks.

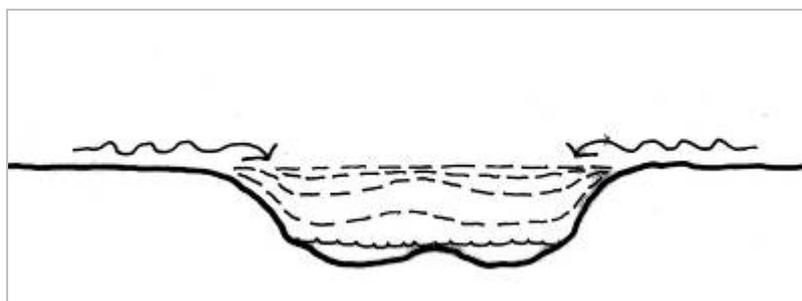
This section focuses on ways of reducing the natural heritage impacts of existing tracks that were poorly constructed or have been inadequately maintained. It examines ways of enhancing different types of existing tracks before considering the potential to remove tracks altogether. See also [Revegetation](#).

6.1.2 THE NEED FOR ENHANCEMENT AND RESTORATION

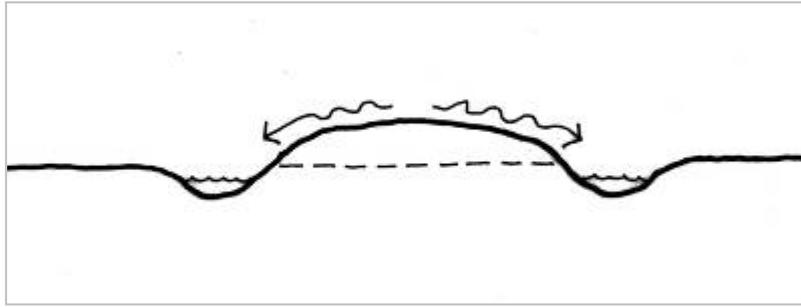
The 1960s saw a significant expansion of upland tracks in Scotland. Many of these tracks were constructed using angled bulldozers and paid little or no attention to issues of landscape, nature conservation or drainage. Some led rapidly to problems of erosion as burns were diverted onto new courses, sometimes creating erosion scars on the hillside and depositing large amounts of material further down the hillside. Others led to instability and landslips, particularly where the tracks were bulldozed across steeper gradients. In other instances tracks were bulldozed straight up the hill slope, creating a new channel for drainage and erosion.

Even where such immediate effects did not occur, the use of bulldozers tended to create highly visible scars where machines cut into the hill slope and excavated material was deposited downslope to create a running platform. The fragile and exposed nature of many upland areas meant that many of the areas of cut and fill remain as unvegetated scars some four decades after they were created. Even in lower areas, tracks were often sited with relatively little concern about the effect on neighbouring trees or habitats.

There is a growing number of examples of poorly constructed tracks now being improved to address many of these problems. While there are obvious environmental and recreation benefits associated with such initiatives, there are also likely to be advantages for land management, for example by allowing easier access across an estate at different times of year. There are also a few examples of tracks being removed or downgraded to footpaths, helping to restore the wild land character of the uplands.



Erosion means that tracks may sink below surrounding ground level and will quickly become water-logged



Restoring a cambered profile with ditches on either side will ensure water is carried away from the track surface

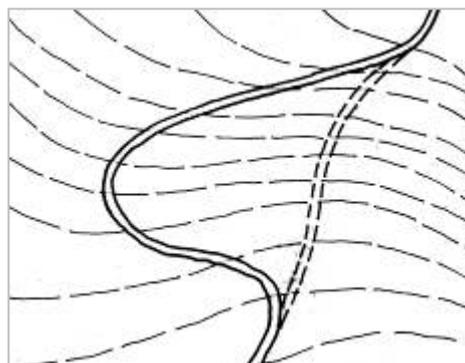
The following paragraphs describe ways of enhancing poorly constructed or maintained tracks. It draws on the experience of the Glenfeshie and Mar Lodge estates in the Cairngorms.

6.1.3 IMPROVING TRACKS IN LOWER AND FLATTER AREAS



Restored camber and ditch on the Glenfeshie Estate

In lower and flatter areas, many poorly constructed or maintained tracks have been subject to erosion, meaning they have gradually sunk below the surrounding ground level, exacerbating the effects of poor drainage. Such tracks should be re-profiled to create a gently cambered running track with shallow drainage ditches on either side. While the surface of the track itself will usually comprise crushed rock, the entire track and the parallel ditches should be reseeded using a combination of local native species to match the surrounding vegetation. There may be special circumstances where other species and/or techniques may be used e.g. faster growing, more robust grasses to act as a nurse crop. Vegetation will gradually colonise the surface as well as the ditches and slopes along the track, reducing the landscape and visual impact.



Steep tracks should be realigned to benefit from gentler slopes

6.1.4 IMPROVING TRACKS ON STEEPER SLOPES



A realigned track on the Glenfeshie Estate replacing a section that climbed steeply up the hillside and was subject to erosion

Different techniques are required where tracks have been bulldozed up steeper slopes and where gradients are too steep, creating erosion and visual scarring. In such locations, the track should be re-routed to take a more sinuous route that effectively zigzags up the hill-slope. This reduces gradients and allows surface water to be drained away from the track at regular intervals.

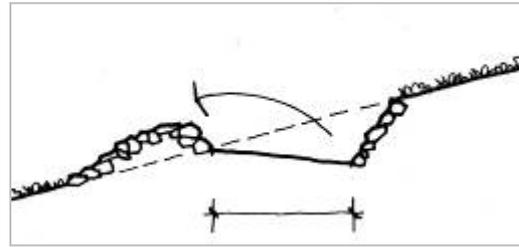
The profile to be adopted for new sections of track should comprise gentle uphill cut slopes (revegetated with turfs removed from the new track alignment), upslope drainage ditches, a gently cambered running surface and a revegetated downslope fill. The redundant section of the track should be revegetated using large turfs from the new track and immediate neighbouring areas (illustrated in the photograph in section on [Revegetation](#)).



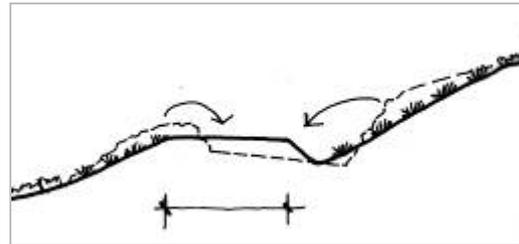
Bulldozed tracks can still have poorly revegetated cut slopes after 40 years. Without enhancement they may never heal.

6.1.5 IMPROVING TRACKS IN HIGHER AREAS

In higher areas, the priority should be to address the impact of bulldozed tracks across the open hillside. In addition to creating a harsh visual scar, these tracks can result in significant erosion problems with deep gullies and large amounts of materials being carried downhill. While it may be impractical to remove these tracks altogether, careful regrading of the uphill 'cut', the creation of a drainage ditch, the use of a cambered surface and regraded downhill 'fills', together with the careful recycling of turfs to vegetate the previously bare cut and fill areas, can significantly reduce the visual impact of these tracks and improve their operational use.



Many bulldozed tracks simply created a running platform with no revegetation of cut slopes



Restoration involves grading out of cut slopes and the recycling of turfs to revegetate the cut slopes

6.1.6 TRACK REMOVAL

It will not always be possible to mitigate the environmental impacts of, or restore, a track that has been constructed in the wrong place. In some circumstances the sensitivity of the landscape or the difficulty in tackling issues of erosion may suggest that tracks should be downgraded or even removed altogether. In such situations it will be necessary to weigh up the operational benefits of maintaining vehicular access with the continued environmental effects of retaining and maintaining a track. However, when contemplating the removal of a track, careful consideration should be given to the relative impacts of restoration, enhancement and maintenance. The desirable solution may not always be the most sustainable.

On its Mar Lodge Estate in the Cairngorms, the National Trust for Scotland (NTS) has undertaken a project to restore a number of the upland tracks that were created for estate management purposes by previous owners of the estate. This has been assisted by funding from the European Regional Development Fund and Scottish Natural Heritage. The NTS has regraded ground along the former tracks to blend and merge with the surrounding topography, and revegetated with heather and turfs from the surrounding area. A narrow path is being retained, providing managed access for visitors to the estate.

6.2 Biodiversity and geodiversity

6.2.1 BIODIVERSITY AND GEODIVERSITY

Constructed tracks will generally have a long-term purpose e.g. for forestry, estate management, wind farms. Once the principal access requirements of the track no longer apply there should be a general presumption that the track should be restored to the original habitat, unless other uses such as established recreational access can justify its retention.

That said, if a track has been in place for a substantial period of time (e.g. >10 years), the track edges are likely to have become softened and 'naturalised', and animal species will be well habituated to its presence. Depending on its construction method, the surrounding habitat types and the amount of post-decommissioning access, it is likely that there would already be some degree of natural recolonisation of the track surface.

In these circumstances, and with an established need for continued use, retention or partial restoration of the track may be valid.

Work on the Mar Lodge Estate has established that major tracks can be completely restored (effectively removed) or restored to retain a path, albeit with fairly intensive resource input.

Track restoration should consider the potential to restore Earth heritage features where possible. This might include, for example, the re-establishment of natural river or stream courses where they have been culverted.

If the original track construction exposed important Earth heritage interests these should be reflected in the restoration scheme. The softening and naturalisation described above could obscure newly exposed Earth heritage elements. Competing interests may therefore need to be handled carefully and sensitively, perhaps by maintaining only the best examples of Earth heritage elements and allowing the remainder to be revegetated and naturalised.

Section 7

Planning and legislation

7.1 Planning and Legislation

The need for consents
Planning consents
Borrow pits
Development plan policies
Environmental impact assessment
Nature conservation sites and protected species
Historic environment
Planning conditions and agreements

7.1.1 INTRODUCTION

This part of the guidance sets out the legislative and planning background to track construction in Scotland. This guidance can only give a broad outline and context of the law and should not be taken as interpreting statute.

7.1.2 THE NEED FOR CONSENTS

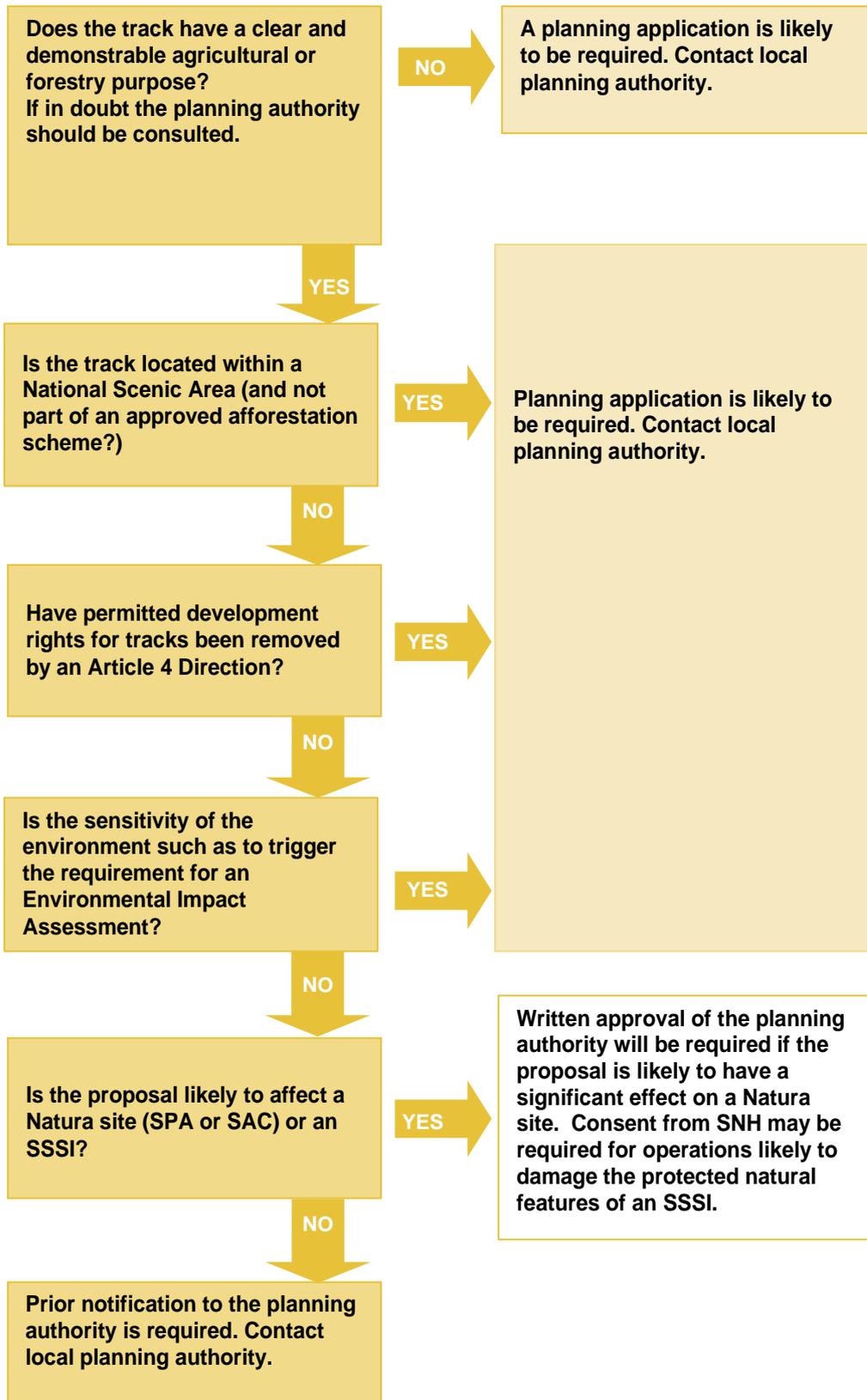
Track construction is an engineering operation and therefore falls within the definition of 'development' requiring planning permission as set out in the [Town and Country Planning \(Scotland\) Act 1997](#). Some tracks fall under the [The Town and Country Planning \(General Permitted Development\) \(Scotland\) Amendment \(No. 2\) Order 2014](#). Forestry and agricultural tracks are subject to a prior notification process. Others, as a result of their use or locations, will require planning consent.

Other kinds of permission may also be required, such as authorisation under the [Water Environment \(Controlled Activities\) \(Scotland\) Regulations 2011](#), and, depending on the sensitivity of the environment affected, an environmental impact assessment may be required.

This section provides guidance on the factors that will determine where planning permission or other consents are required. It is recommended, however, that more detailed advice should be sought at an early stage from the relevant planning authority and from agencies such as Scottish Natural Heritage and Historic Environment Scotland.

Whilst each track must be considered in its own right, the following flow diagram aims to provide an overview of the factors that may determine whether planning permission is required.

7.1.3 OVERVIEW OF THE NEED FOR CONSENTS AND LICENCES



7.1.4 PLANNING CONSENTS

Under the *Town and Country Planning (Scotland) Act 1997* and the *Town and Country Planning (General Permitted Development) (Scotland) Order 1992* a number of forms of development are granted planning permission without the need for a planning application. The construction of certain types of private way, including upland tracks, may qualify for this 'permitted development', but require the submission of a prior notification to the Local Planning Authority. Planning authorities (including National Park Authorities) will assess prior notification applications for tracks and will determine if prior approval is required.

General permitted development rights for agricultural and forestry private ways are set out in the Town and Country Planning (General Permitted Development)(Scotland) Amendment (No.2) Order 2014.

In addition Annex F of *Circular 2/2015 Consolidated Circular on Non-domestic Permitted Development Rights* provides detail of permitted development rights, and the prior notification and approval requirements in relation to agricultural and forestry tracks (private ways). Individual planning authorities may provide their own guidance on permitted development rights for private ways. An example is The Highland Council *Permitted Development Rights Guidance for Agricultural and Forestry Private Ways (Interim)*.

It should be noted however that permitted development rights are removed in certain circumstances.

The Town and Country Planning (Restriction of Permitted Development) (National Scenic Areas) (Scotland) Direction 1987 removes permitted development rights for agricultural tracks and for forestry tracks unless the latter form part of an approved afforestation scheme.⁴¹

The Conservation (Natural Habitats, &c.) Regulations 1994 as amended removes permitted development rights where an appropriate assessment concludes that a track would have an adverse effect on the integrity of a Natura site (SAC and SPA).

The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 in conjunction with Article 3(8) of the GPDO removes permitted development rights for tracks requiring Environmental Impact Assessment (except for forestry roads and tracks).

All other tracks require express planning consent from the planning authority and therefore require a planning application. Planning authorities will be able to provide advice relating to specific proposals.

Permitted development rights may also be removed by the use of Article 4 Directions applying to a specific type of development within a defined geographic area. Where this occurs, developers are required to apply for planning consent to the local planning authority. Article 4 Directions may be made by planning authorities or Scottish Ministers (who must approve such Directions in any case). The aim of Article 4 Directions is to provide a means of stricter control within sensitive environments.

Planning authorities will be able to provide advice relating to specific proposals.

Whether permitted development rights apply or not many tracks are likely to require authorisation under CAR and CDM regulations.

⁴¹ *Additional Controls on PDR with specific reference to roads and ways*

7.1.5 BORROW PITS

Forestry Commission Scotland can provide advice on what consents or permissions may be required for quarries or borrow pits on land used for forestry.

Excavation operations on agricultural land requisite for the purposes of agriculture within that agricultural unit also have permitted development rights. Other borrow pits must be covered by the consent for the development in question (e.g. a wind farm), meaning that the location and scale of the borrow pits will need to be clear in the planning application. Where the need for, or location of, borrow pits is identified after the submission of the main track proposal, as is the case in some wind farms, then separate planning consent will have to be sought. Such borrow pits are likely to be granted temporary planning consent only, with a condition requiring reinstatement upon expiry.

7.1.6 DEVELOPMENT PLAN POLICIES

Strategic or local development plans are prepared by local planning authorities and National Park Authorities and set out the framework of land use policies for a particular area. Development plans are often accompanied by supplementary guidance. While some plans and supplementary guidance will include specific policies relating to the development of tracks, many others will include policies designed to protect designated or sensitive areas, together with policies relating to specific types of development such as wind farms or telecommunications.

Section 25 of the Town and Country Planning (Scotland) Act 1997 makes it clear that development plans should normally carry the greatest weight when a planning authority decides whether a planning application should be granted consent. Strategic and local development plan policies should be examined at an early stage in the development of proposals for tracks and, where appropriate, discussions held with planning officers prior to the submission of a planning application or prior notification.

7.1.7 ENVIRONMENTAL IMPACT ASSESSMENT

Under the terms of the *Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011* some developments require an Environmental Impact Assessment (EIA) to be undertaken. A planning authority must not grant planning permission in such cases unless they have first taken the environmental information into consideration, and they must state in their decision that they have done so.

Projects for the creation or construction of tracks may be subject to Environmental Impact Assessment. This will depend on the location and nature of the proposed track, the length or area affected and whether it is likely to have a significant effect on the environment.

A constructed or engineered track will have to be considered in terms of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011. The Regulations list, in Schedule 2, the types of projects and thresholds which allow for a case by case assessment of likely significant effects on the environment. The construction of a road is a *Schedule 2* development and so must be screened for the need for EIA if it is to be located within a 'sensitive area' or the area of works exceeds 1 ha. 'Sensitive areas' include SSSI, Natura sites, National Scenic Areas and National Parks. Otherwise where the area of works exceeds 1ha the sensitivity of the location and the need for EIA must be considered against the selection criteria set out in Schedule 3 of the Regulations. These include wetlands, and mountain and forest areas in terms of their capacity to absorb the development.

Paragraph 48 of Circular 3/2011 also states that local landscape and biodiversity designations may be relevant for screening proposals for locational sensitivity. EIA will be required where there is a likely significant effect on the environment.

Forest roads may also require consent under the *Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999*. For the purposes of the Forestry EIA regulations a

forestry road is described as: the formation, alteration or maintenance of private ways on land used (or to be used) for forestry purposes. This includes roads within a forest or leading to one.

Tracks in an agricultural unit which have been created gradually through continual use (i.e. are non-constructed/engineered such as ATV tracks on rough ground), may be subject to the [Environmental Impact Assessment \(Agriculture\) \(Scotland\) Regulations 2006](#). These will require to be assessed on a case by case basis and may be likely to trigger consideration in terms of EIA where they form part of a broader agricultural restructuring project and/or are likely to have a significant effect.

[Paragraph 72 of Circular 3/2011](#) notes that, where the local planning authority's opinion is that an EIA is required under the Regulations, permitted development rights are withdrawn and a planning application must be submitted. Planning authorities will be able to provide advice relating to specific proposals.

7.1.8 NATURE CONSERVATION SITES AND PROTECTED SPECIES

Existing measures provide protection for nationally and internationally important nature conservation sites. Natura sites (Special Protection Areas and Special Areas of Conservation, along with potential SPA and SAC sites) are subject to protection under the [Conservation \(Natural Habitats &c.\) Regulations 1994 \(as amended\)](#) to ensure compliance with the requirements of the Habitats Directive.

If an operation which otherwise benefits from permitted development rights is likely to have a significant effect on a Natura site and is not directly connected with agreed Natura 2000 management arrangements, the person proposing the operation must apply to the planning authority for approval (in effect, permitted development rights are suspended). SNH can provide advice to the person proposing the operation on whether a significant effect is likely or not.

Following receipt of an application for written approval, the planning authority will carry out a Habitats Regulations Appraisal, which may include an assessment of the implications of the proposal for the site in view of that site's conservation objectives (an Appropriate Assessment). In making the assessment the planning authority must consult SNH and take into account any advice received. The planning authority will approve the operation only if the assessment shows that the operation will not adversely affect the integrity of the site. If the assessment concludes that it is not possible to ascertain that there would not be an adverse effect on the integrity of a site, permitted development rights are withdrawn and an express planning application will be required.

For Sites of Special Scientific Interest (both biological and geological) a list of operations requiring consent forms part of the notification. If a land manager wishes to carry out any of the listed operations (which may include the construction of tracks) they must obtain consent from SNH, unless an exemption from the need for consent applies.⁴² One of these exemptions is if the operation is being carried out with planning permission. If a Public Body proposes to carry out an operation likely to damage the protected natural features of an SSSI they must apply for consent from SNH for these operations, whether or not the operation is listed as an operation requiring consent. This requirement on public bodies includes proposals outwith the boundary of an SSSI but which are likely to damage the protected natural features of an SSSI. Again there is an exemption from the need for public bodies to apply to SNH for consent if the operation is being carried out with planning permission.

Many nationally and internationally important geodiversity sites are protected by SSSI status, though some are not. Earth heritage SSSIs are subject to the same controls as those listed above.

Track construction may also affect species that are protected under domestic or international legislation (the Wildlife and Countryside Act 1981, as amended, the EC Habitats Directive, the

⁴² More information on exemptions can be found in [SNH Sites of Scientific Interest booklet](#)

Habitats Regulations, the EC Wild Birds Directive and the Protection of Badgers Act 1992). A number of animal species found in the Scottish uplands, including pine marten, red squirrel, badger, water vole, wildcat and freshwater pearl mussel, are protected under one or more of the above pieces of legislation.

For most species this protection extends to places used for shelter, protection and/or breeding. Several species, including otter, wildcat and bats are given strict protection under the Habitats Regulations. These species, known as European Protected Species (EPS), are protected from deliberate or reckless disturbance. Over and above this their breeding sites and resting places are protected from all types of damage or destruction whether or not deliberate or reckless.

All species of wild birds (including their eggs) are protected and it is an offence to intentionally or recklessly damage, destroy or otherwise interfere with the nest of any wild bird while it is in use. It is also an offence to obstruct or prevent any wild bird from using a nest. Certain wild birds listed in Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) are given additional protection. It is an offence to intentionally or recklessly disturb a bird listed on Schedule 1 while it is building a nest or while it is in, on or near a nest containing eggs or young. It is also an offence to disturb dependant young of Schedule 1 birds.

Birds listed on Schedule 1A are protected from intentional or reckless harassment. It is also an offence to intentionally or recklessly take, damage, destroy or otherwise interfere with any nest habitually used by a wild bird listed on Schedule A1 of this Act.⁴³

Work affecting species protected under this legislation, such as otters, water voles and badgers, may require a licence from SNH in order for the works to be legally carried out. Under the Wildlife and Countryside Act (as amended) it is not possible to licence works, including track construction, affecting wild birds that would otherwise be an offence. The full text of the legislation should be consulted to determine the precise level of protection afforded to each species. Further guidance and advice on protected species can be obtained from SNH.⁴⁴

The Nature Conservation (Scotland) Act 2004 states that all public bodies have a legal duty to further the conservation of biodiversity in the course of carrying out their functions, and in doing so, such organisations must have due regard to the 1992 Rio Convention on Biological Diversity and to the Scottish Biodiversity Strategy.

⁴³ [Wildlife and Countryside Act 1981 \(as amended\), Habitats Directive and Regulations](#)
⁴⁴ [SNH Species Licensing web page](#)

7.1.9 HISTORIC ENVIRONMENT

Tracks can have an adverse effect on many of the cultural elements evident in the Scottish landscape. Remains of former settlements and field systems are more common in the glens, while historic communication routes often cross higher land. These can make a significant contribution to the landscape character, but they are also of value in their own right. In planning a new track, it is important to make contact with the local authority archaeologist and Historic Environment Scotland, who can advise on the relative significance of historic and archaeological features and the impact of proposals on them. Consent must always be sought in advance of any works on protected sites. Information on the location of protected sites can be found at www.PASTMAP.org.uk.

A range of measures is designed to protect important elements of the historic environment. **Scheduled Ancient Monuments** are considered to be of national importance and are subject to statutory protection. Any works that will lead to damage, demolition or destruction of the monument, any works of repair or removal of a monument, or making alteration or additions, and any flooding or tipping operations, can only be carried out with prior written permission from the Scottish Ministers (called Scheduled Monument Consent). This is separate from any planning consents that are required for development of the track in question. Individual structures such as bridges may be listed, again reflecting national importance. Where construction of tracks has the potential to affect listed structures, it will be necessary to obtain listed building consent from the local planning authority. Planning authorities may use Article 4 Directions to remove certain permitted development rights for listed structures.

Many of the most important historic gardens and designed landscapes are included in the Inventory of Gardens and Designed Landscapes. Inventory sites are subject to consultation requirements, under **the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013**, which mean that local planning authorities must consult **Historic Environment Scotland**, regarding any proposal that involves, or may affect, **Inventory** sites.

7.1.10 PLANNING CONDITIONS AND AGREEMENTS

Where tracks are granted planning consent as part of a development with a fixed lifetime, planning conditions may require the reinstatement or restoration of some or all of the tracks on decommissioning. They may also be used in relation to other aspects of track construction including monitoring and habitat management.

Planning authorities may also enter into planning obligations with developers under Section 75 of the Town and Country Planning (Scotland) Act 1997 (as amended by the Planning etc. (Scotland) Act 2006). Such legal agreements can be used to govern issues such as habitat management, monitoring, maintenance and the lodging of financial bonds to cover the costs of future restoration. These kinds of measures are most commonly applied to schemes such as wind farms and telecommunications infrastructure. **Circular 3/2012** on Planning Obligations should be referred to for further information.

Glossary

Biodiversity	The variety of life in all its forms, levels and combinations. Includes ecosystem diversity, species diversity and genetic diversity. “ <i>Biological diversity - or biodiversity - is a term we use to describe the variety of life on Earth.</i> (Convention on Biological Diversity)“
Borrow pit	An excavation dug to provide material (borrow) for use as fill at another location
Brash	Tree branches from forestry thinnings and harvesting
Calcareous soil	Alkaline soils derived from limestone or similar rocks
CAR	<i>The Water Environment (Controlled Activities)(Scotland) Regulations 2011</i> , more commonly known as the Controlled Activity Regulations or CAR. Regulate discharges, disposal to land, abstractions, impoundments and engineering works affecting the water environment.
CBR	California Bearing Ratio. A measure of the load bearing capacity of subgrade
CDM	<i>Construction (Design and Management) Regulations 2015</i> – HSE information for clients, designers, workers and contractors
CIRIA	<i>Construction Industry Research and Information Association</i>
Compensation	Measures taken to off-set or compensate for significant adverse impacts which cannot be avoided or further reduced
Cross-fall	A constant slope across the width of a track, resulting in drainage to one side
Culvert	A drain or channel (pipe or concrete), can be open channels or totally enclosed; used to allow water flow under the structure of a road, track etc
Cut and fill	An operation where the material excavated and removed from one location is used as fill material at another location.
Earth heritage	The inheritance of rocks, minerals, fossils, landforms, unconsolidated deposits, soils and current geomorphological processes and the evidence they provide for the history of the Earth
EIA	<i>Environmental Impact Assessment</i>
EPS	<i>European Protected Species</i>
Eutrophication	The enrichment of natural waters with plant nutrients, which results in change including the increased production of algae and other aquatic plants, affecting the quality of the water and the balance of organisms present within it. Reductions in oxygen levels can have a significant impact on aquatic animals
GPDO	<i>The Town and Country Planning (General Permitted Development) (Scotland) Amendment (No.2) Order 2014</i> (Reviewed for private ways in 2014) and <i>The Town and Country Planning (General Permitted Development) (Scotland) Order 1992</i> and <i>Circular 2/2015 - Consolidated Circular on Non-Domestic Permitted Development Rights</i>

Geodiversity	Geodiversity is the variety of rocks, minerals, fossils, landforms, sediments and soils together with the natural processes which form and alter them.
Intervisibility	The extent to which a given point, structure or feature is visible from surrounding areas and viewpoints
JNCC	The Joint Nature Conservation Committee
Landscape character	The pattern that arises from particular combinations of different components of the environment. These components are both natural (influences of geology, soils, climate, flora and fauna) and cultural (historical and current impact of land use, settlement, enclosure and other human interventions)
Landscape & visual impact assessment (LVIA)	An established method of judging the landscape and visual effects of a proposed development or other land use change
LBS	Local Biodiversity Site
LGS	Local Geodiversity Site
LNCS	Local Nature Conservation Site
LNR	Local Nature Reserve
Mitigation	Measures taken to avoid, reduce or remedy adverse impacts of a development
NNR	National Nature Reserve
NSA	National Scenic Area
NTS	National Trust for Scotland
RIGS	Regionally Important Geological Site
RSPB	Royal Society for the Protection of Birds
Running width	That part of the track surface used by vehicles
SAC	Special Area of Conservation
SCM	Site condition monitoring – a procedure used by SNH to monitor the condition of the notified features in designated sites
Silt trap	A feature designed to remove silt from flowing water; commonly used in conjunction with watercourse crossings.
SINC	Site of Importance for Nature Conservation
SNCI	Site of Nature Conservation Interest
SNH	Scottish Natural Heritage
SOAC	<i>Scottish Outdoor Access Code</i>
Solifluction	The slow downslope movement of the soil associated with freezing and thawing and the melting of ice lenses. Solifluction has produced terraces, lobes and sheets of debris on many Scottish mountains.
SPA	Special Protection Area
SRDP	<i>Scottish Rural Development Programme</i>
SSSI	Site of Special Scientific Interest

Sub-base	Layers of material used to build up the structure of the track, but excluding the surface layer
Subgrade	Ground beneath the track
Subsoil	Lower part of the soil profile which consists mainly of mineral matter from weathered substrate and a few substances transported from the topsoil
Substrate	Soil's parental material, underlying drift or solid geology
SWT	Scottish Wildlife Trust
Topsoil	Upper part of the soil profile, rich in organic matter and usually darker in colour than subsoils. This is where most roots, plants and animal life are found
Turf	Upper part of the topsoil, forming a dense mat of living roots and decayed vegetation
UKBAP	United Kingdom Biodiversity Action Plan
ZVI	Zone of Visual Impact

Consultees

The following organisations were consulted during the preparation of this guidance:

Consultees for 2013 Second edition:

Cairngorms National Park Authority
Forestry Commission Scotland (FCS)
Loch Lomond & The Trossachs National Park Authority
Mountaineering Council of Scotland (MCoS)
Scottish Environment Protection Agency (SEPA)
Scotland's Moorland Forum
Scottish Renewables Forum
Scottish Government Planning & Architecture Division
Scottish Land and Estates
SNH specialist advisers

Original consultees for first edition:

Airtricity
Angus District Council
Argyll & Bute Council
Association for the Protection of Rural Scotland
Cairngorms National Park Authority
Dumfries and Galloway Council
Forestry Commission Scotland
Halcrow
Loch Lomond and the Trossachs National Park Authority
McLarty Contractors
Mott MacDonald
Mountaineering Council of Scotland
National Trust for Scotland
Pentland Hills Regional Park
Perth and Kinross Council
Ramblers Association Scotland
Renewable Energy Systems
Royal Fine Arts Commission for Scotland
Scottish Environment Protection Agency
Scottish Rural Property and Business Association
Scottish Power
The Highland Council
The John Muir Trust
The Scottish Rights of Way and Access Society (Scotways)

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General technical guidance:

Peat landslide hazard and risk assessments: Best practice guide for proposed electricity generation developments 2007, Scottish Government
Developments on Peatland: Site surveys 2011, Scottish Government
CIRIA Culvert Design and Operation Guide
CIRIA guidance on Controlling water pollution from linear construction projects
UKFS Guidelines on Forests and Soil 2011, Forestry Commission
A Guide to Hydro Power Construction Best Practice 2015, Scottish Government, SNH, SEPA, Scottish Renewables

SEPA technical guidance on:

Engineering activities in the water environment: Good practice guide – River Crossings, 2010; and Position statement on the culverting of watercourses, 2006
Flood risk management and assessment
Regulatory position statement – Developments on peat, 2010
Renewable energy developments advice

SNH guidance on:

Good Practice During Windfarm Construction 2015
Hydroelectric Schemes and the Natural Heritage 2010
Information note 318 on Soil: <http://www.snh.gov.uk/docs/A602512.pdf>
Paths and Climate Change – An investigation into the potential implications of climate change on the planning, design, construction and management of paths in Scotland (SNH Commissioned Report 436, 2011)

Other guidance:

Scottish Soil Framework 2009
Land Use Strategy for Scotland (esp. proposal 9 relating to soil carbon)
Scottish Government 2010 discussion paper - Management of carbon rich soils
Habitat translocation best practice guide 2003 Highways Agency and CIRIA
Construction Code of Practice for the Sustainable Use of soils on construction sites 2009 Defra
Scottish Outdoor Access Code
Upland path management
Upland path work
The UK Biodiversity Action Plan (UKBAP)
Landscape Character Assessment, Guidance for England and Scotland. 2002 Countryside Agency and Scottish Natural Heritage
Historic Environment Scotland – online inventory of Gardens and designed Landscapes
Guidelines for Landscape and Visual Assessment, 2002 Institute of Environmental Assessment/ the Landscape Institute
Handbook for Phase 1 habitat survey – a technique for environmental audit, 2010 Joint Nature Conservation Committee
Scottish Biodiversity Strategy, 2004 and 2013
Landscape Character of Scotland series, 1995-2005 Scottish Natural Heritage
National Scenic Areas: Development management

Legislation and Regulations:

The Water Environment (Controlled Activities) (Scotland) Regulations 2011
The Construction (Design and Management) Regulations 2015
Town and Country Planning (Environmental Impact Assessment)(Scotland) Regulations 2011
Environmental Impact Assessment (Forestry) (Scotland) Regulations. 1999
Environmental Impact Assessment (Agriculture)(Scotland) Regulations 2006
Land Reform (Scotland) Act, 2003
Nature Conservation (Scotland) Act, 2004
Protection of Badgers Act. 1992
The Conservation (Natural Habitats, &c.) Regulations. 1994 (as amended in Scotland)
Town and Country Planning (Scotland) Act. 1997
Town and Country Planning (General Permitted Development) (Scotland) Order 1992 (as amended)
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EC Directive on the Conservation of Wild Birds 1979 (79/409/EEC).
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Circular 3/2011: The Town and Country Planning (Environmental Impact Assessment)(Scotland) Regulations 2011, Scottish Government
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Circular 4/98 The Use of Conditions in Planning Permissions, 1998 Scottish Executive